Carson River Watershed

Regional Floodplain Management Plan

Supplemental Update 2013

For questions or comments on this updated plan please contact the Carson Water Subconservancy District, 777 East William Street, Suite 110A, Carson City, NV 89701, 775.887.7450 or brenda@cwsd.org, or edjames@cwsd.org.

Thank you to members of the Carson River Coalition, the CRC's River Corridor Working Group, and County and Tribal staff for assisting with this document.

The Nevada Division of Environmental Protection Bureau of Water Quality Planning helped fund this supplemental update through the Clean Water Act 319 (h) program.

Carson River Watershed

Regional Floodplain Management Plan Supplemental Update 2013

All supplemental/revised material is in red.

Supplemental Update 2013 Introduction:

This document provides revisions and updates to the existing 2008 Carson River Watershed Regional Floodplain Management Plan (RFMP). The plan calls for an update/progress report to be completed at a minimum of five years. The revisions and updates in this document follow the Table of Contents of the original document to assist a reader in understanding the content. The update is also being completed to assist those counties that participate in FEMA's Community Rating System (CRS) program.

The general content of the document remains largely unchanged. The main changes in content are related progress on the Suggested Actions section. These are documented in Appendix H. Other updates and revisions provide more up-to-date information relating to emergency contacts, CRS information, and consistency with existing plans. Additional appendices have been added that provide additional detail/progress on suggested actions.

The next update will occur after the completion of the Mapping Activity Statements (MAS) and the model and maps have been adopted by CWSD and the Counties.

Table of Contents

Tables

Figures

Appendices

Abbreviations

RiskMAP Risk Mapping, Assessment and Planning

1.0 Introduction and Background

Table 1.0-2: Population Change from 2000 to 2010 and Projected Change to 2020

County	Population		Population Change 2000 to 2010		Projected Change** 2011 to 2020	
	2000	2010	Number	%	Increase	%
Alpine, CA*	1,113	1,175	62	5.6%0	0	0%
Douglas, NV	41,259	46,997	5,738	13.9%	-298	-0.06%
Carson City, NV	52,457	55,274	2,817	5.4%	-461	-0.08%
Lyon, NV	34,501	51,980	17,479	50.7%	7,333	13.98%
Storey, NV	3,399	4,010	611	18.0%	1,334	32.36%
Churchill, NV	23,982	24,877	895	3.7%	4,074	16.2%
Total	156,711	184,313	27,602	15%	10,781	5.8%

Sources: Nevada State Demographer 2010
* U.S. Census Bureau, 2010
**Nevada State Demographer 2012
Note: Population numbers represent the entire county not just the portions within the Carson River Watershed.

2.1 Federal Emergency Management Agency

CRS Activities

300 Public Information Activities
310 Elevation Certificates
320 Map Information
330 Outreach Projects
340 Hazard Disclosure
350 Flood Protection Information
360 Flood Protection Assistance
370 Flood Insurance Promotions

The current status of CRS classification for the counties within the Carson River Watershed is the following:

County	Classification
Alpine County –	not classified
Douglas County	6
Carson City	6
Lyon County	10*
Churchill County	10*
Storey County	8

*Participates in the NFIP but does not currently participate in the CRS program.

4.0 Flood Risk Reduction and Floodplain Protection Strategies

4.1.1 Floodplain Protection Mechanisms

Conservation Easements:

Conservation easements are legal agreements between property owners and another entity usually a land trust or a government body. The easement restricts land uses to allow for protection of an array of conservation values. The land remains in the property owner's possession and they can continue to use it, sell it, or pass it onto their family/heirs. (Land Trust Alliance website 2013)

Flexible in nature, conservation easements can be negotiated to limit development on all or a portion of the property. They do not necessarily provide for public access and often prefer the continuation of the existing land use, such as farming or other open space uses. The holder of the easement is responsible for ensuring the terms of the agreement are followed. (Land Trust Alliance website 2013)

Transfer of Development Rights (TDR) Programs:

According to the Center for Land Use Education, *"the Transfer of Development Rights (TDR) is a voluntary, incentive based program that allows landowners to sell development rights from their land to a developer or other interested party who then can use these rights to increase the density of development at another designated location."* (Miskowiak and Stoll 2006)

The landowner who sold the development right maintains ownership of the property and generally a conservation easement or other restrictive covenant is placed on the property to limit or prevent development. TDR programs are useful to protect land uses and land areas such as farmlands, open spaces, floodplains, habitat areas and/or places of historical significance. The program is an equitable market based program that protects natural/historical values while providing incentives to both the seller and the buyer.

Douglas County and Churchill County currently have TDR programs within the Carson River Watershed. Details on their programs can be found on their respective websites.

Local and Federal Land Protection Initiatives:

Carson City Question 18 Quality of Life Initiative:

In 1996 Carson City voters approved the Quality of Life Initiative that provided a ¼ cent sales tax increase to: acquire and maintain open space (40%), develop community park facilities and trails (40%), and maintain and operate the park facilities developed through Quality of Life Initiative (Q18) (20%). (CCPRMP 2006)

Carson City Open Space Plan:

The Open Space Plan, which is an element of the Carson City Master Plan, identifies resident surveys reflecting the number one priority as preserving open space in the river corridor and the importance of open space to public health and safety (watersheds, drainage ways, flooding). Since its inception, Carson City's Open Space program has significantly contributed to the protection of lands in the Carson River Corridor.

The Douglas County Conservation Act of 2013 (Introduced to congress, yet to be enacted):

If approved by Congress, this federal legislative act will allow for: (1) disposal of certain excess and difficult to manage federal lands, ensuring that the sales proceeds are used to acquire conservation easements in the floodplain from willing landowners in Douglas County; (2) transfer federally owned flood control management areas and important water resource infrastructure parcels to Douglas County; (3) transfer of important federally owned cultural sites to the Washoe Tribe; (4) dedication of the Burbank Canyons Wilderness Area while maintaining vehicular use of historic and existing roads; and (5) improved management of certain federally owned public recreation parcels. (Etchegoyhen 2013)

4.3 (Updated) Flood Data Information and Maintenance

FEMA's RiskMap Program

Federal Emergency Management Agency (FEMA) Risk MAP Charter 2011/2012 (Charter)

The Charter, the first to be signed in FEMA Region IX, formalizes the collaborative efforts regarding flood management between Carson Water Subconservancy District (CWSD), Alpine County in California, Douglas, Carson City, Lyon, and Churchill Counties in Nevada, FEMA Region IX (FEMA), U.S. Army Corps of Engineers (USACE), U.S. Geological Survey (USGS), U.S. Department of the Interior Bureau of Reclamation (USBR), National Flood Insurance Program (NFIP) Coordinator, State Hazard Mitigation Office, and other partners. The Charter outlines the process to identify, assess, communicate, and plan for flood risk within the Carson River Watershed (watershed). Storey County did not sign the Charter; however, they are participating in the meetings. The flood risk information provided will be used to enhance hazard mitigation plans, make informed decisions to improve resiliency after flooding, protect the beneficial functions of floodplains, and raise awareness about local flood risks.

The Charter:

- Details the long-term flood hazard mapping vision for the watershed;
- Describes the desired mapping, assessment, planning information, and planning products;
- Describes the assistance that CWSD and FEMA will provide;

- Summarizes local flooding concerns and indicates areas where floodplain changes are expected; and
- Describes the roles and responsibilities of the CWSD, FEMA, and other signatory partners.

Charter signatories are scheduled to meet annually, but may meet more frequently if needed. A copy of the Charter is located in Appendix J.

Risk MAP Discovery Process

The Risk MAP Discovery is a process where FEMA works closely with communities to better understand local flood risks. The Discovery process entailed working closely with communities within the Carson River Watershed to better understand the local flood risk, mitigation efforts, etc., and to spur watershed-wide discussions about increasing the area's resilience after flooding. The Discovery process identifies areas at risk for flooding and solutions for reducing that risk on a watershed-wide basis. Charter partners from the watershed met to review the information gathered to date on flooding history, risks, stormwater and floodplain management activities, and any gaps in the data. The Risk MAP Discovery process was completed by CWSD and its partners in 2012. A Discovery Report (December 2012) was developed that summarized the data collected for the watershed and identified priority restudy needs and mitigation projects (See Appendix K). This information is being used to update flood management and mitigation efforts on a watershed-wide basis.

4.3.2 Map Modernization Program

To address the need to update flood studies and maps FEMA has implemented the *Map Modernization Program*. This program is intended to reduce the age of flood maps, produce digital mapping for high priority areas, develop flood maps for many previously unmapped communities, and encourage states and communities to share the costs of flood mapping.

Cost-sharing is achieved through FEMA's Cooperating Technical Partner Program. The goal of this program is to incorporate local knowledge into the mapping process resulting in more accurate and representative information. In 2005, CWSD became a partner through this program. See Appendix G for a copy of the partner agreement.

4.3.4 Elevation Reference Mark Maintenance

Elevation reference marks (ERMs) are very important as they provide a ground elevation reference for surveyors to start from when they determine the elevation of a building, cross section, or topography for a site. To maintain consistency and accurate data the following items should be implemented:

1. ERMs should be permanent monuments, and the location and elevation of each ERM should be confirmed every three years to five years.

4.3.6 Unsteady State Model for the Carson River

Typical floodplain management tools include the use of a steady state backwater calculation program to establish a water surface elevation at flood stage. The most widely used program is the Hydrologic

Engineering Centers River Analysis System (HEC-RAS) program developed by the United States Army Corp of Engineers (USACE). The steady state module in HEC-RAS utilizes information from each cross section in the model to calculate the conveyance, energy, and ultimately the water surface elevation for the cross section.

- *Hydraulic Modeling and Floodplain Mapping Guidelines (See Appendix I):* The purpose of the Carson River *Hydraulic Modeling and Floodplain Mapping Guide* (Guide) is to provide criteria, standards, and modeling guidance for future hydrologic analysis, hydraulic modeling and flood hazard mapping studies on the Carson River within Lyon, Carson City, Douglas and Alpine counties. It provides a convenient source of technical information that is specifically tailored to the unique hydrologic and hydraulic characteristics of the Carson River watershed. Practitioners' use of the consistent set of criteria in this guide will result in uniform modeling practices throughout the watershed, across jurisdictional boundaries, and potentially reduce conflict between regulatory agencies and the land development community. The Guide only applies to the floodplains and floodways associated with main stem and the East and West forks of the Carson River. It is not intended to provide modeling direction for tributaries or alluvial fans associated with the Carson River.

  The Guide does not replace or supersede federal regulations set forth in 23 Code of Federal Regulations (CFR) Part 650, 44 CFR Part 60, or 44 CFR Part 65. It covers the types of models to be used, acceptable software, data requirements, data collection, terrain development, and surveying standards, specific direction on hydrologic and hydraulic modeling parameter selection, and prescribes floodplain delineation techniques. It does not cover rainfall-runoff simulation.

- *Model Update Protocols:*
  In order for the unsteady state model to be an effective tool in determining cumulative impacts to upstream and downstream users, a standard protocol for updating the model if new development occurs in the floodplain must be set up. This protocol will need to be agreed upon by each effected local jurisdiction.

4.7 Summary of Suggested Actions

Table 4.7-1 provides a summary of the suggested actions presented in this section. The table also includes suggested responsible parties and potential sources of funding for specific actions. Suggested Action Progress reports from each County and CWSD are located in Appendix H.

5.2 Monitoring and Revision

An annual report evaluating progress towards implementing the regional level suggested actions will be coordinated and prepared by CWSD for each County involved in the CRS program. These reports will be provided to the county floodplain administrators and other interested parties.

The floodplain management plan and suggested actions will be reviewed and updated on an as-needed basis, not to exceed a five-year time frame. CWSD will work with stakeholders, including the working group and local floodplain administrators, to achieve this. The Plan and updates will be distributed via email to all counties, agencies and other stakeholder groups to increase awareness and expand and strengthen the core group of individuals committed to carrying out the stated goals and suggested actions.

Success and improvements in the effectiveness of the suggested actions and the regional approach to floodplain management can be measured by factors such as: amount of floodplain protected and allowed to function naturally, reduction in flood damage using the information from the 1997 flood as our baseline, enhancement of sediment transport capabilities, improvement of water quality through implementation of best management practices and river restoration projects, and improved awareness of flooding issues and the need to protect our open floodplain by the general public.

5.3 Linking Regional Floodplain Management with Other Plans

This Plan is consistent with the following documents as pertaining to flooding and floodplain management.

Table 5.3-1: Linkage with Existing Government Plans

Applicable Plans	Date	Applicable Section(s)
State of Nevada		
Standard Multi-Hazard Mitigation Plan	Oct 2004	Pages 53 – 56
Nevada Model Floodplain Management Plan	Oct 2004	All sections
State of California		
Water Plan Update 2005	2005	Chapter 10 - Page 10.3, Box 10-1
Alpine County, California		
Floodplain Development Standards Code		16.08
Douglas County, Nevada		
Douglas County Master Plan 2011 Update	2011	ERC Goal 3 Policies 3.1 – 3.6, and ERC Actions 3.1 – 3.7
Carson City, Nevada		
Carson City Master Plan	Apr 2006	3.1a; 3.3d; 8-9 SR-SPA4.5; 8-9 SR-SPA6.1; 8-22 LR-SPA 3.1; 8-27 V&T SPA 3.1; A-5; B-19; B-27; 9-9 3.3d; 9-9 4.3a
Carson City Parks and Recreation Plan	2006	Section 6.6
Carson City Open Space Plan	2000	All sections
Carson River Master Plan	1996	Chapter 3
Lyon County, Nevada		
2010 Comprehensive Master Plan County-wide Component	Dec 2010	Chapter 3, Agriculture, Open Space, Hazardous and Environmentally Sensitive Land Options; Goal NR 6 – Policies NR 6.1 and NR 6.2. View www.lyon-county.org/document/Planning

Churchill County		
2010 Master Plan	2010	Chapter 3
Washoe Tribe of Nevada and California		
Integrated Resource Management Plan	2008	All sections
Multi Hazard Mitigation Plan	2009	Pages 89-100
Storey County		
Master Plan 1994	1994	All sections
Carson Water Subconservancy District		
Carson River Watershed Adaptive Stewardship Plan	2007	All sections

7.0 Emergency Response

Table 7.0-1: Emergency Response Contacts

Alpine County, California	
Emergency Response Officer: Robert Levy	(530)694-2231
Sandbag Materials Location:	Alpine County Road Department 50 Diamond Valley Road, Markleeville Contact Number: 530-694-2140
Carson City, Nevada	
Emergency Manager: Stacey Giomi	Contact Number: (775)887-2210x1014
Sandbag Materials Location: City Corporate Yard	3303 Butti Way Contact Number: 775.887.2355
Churchill County, Nevada	
Emergency Manager: Ron Juliff	155 N. Taylor St. Ste. 177, Fallon, NV 89406 Contact Numbers: (775)423-4188 (W), (775) 428-2521 (H)
Floodplain Manager: Michael Johnson (Planning Director) Cliff Van Woert (Building Official)	155 N. Taylor, Fallon, NV 89406 Contact Number: (775)423-7627 Contact Number: (775.428.0264
Sandbag Materials Location: County Road Department Yard	330 N. Broadway Contact Number: (775)423-4133
Douglas County, Nevada	
Emergency Communications Manager: Todd Carlini – East Fork Fire Chief	P.O. Box 218, Minden, NV 89423 Contact Number: (775) 782-6290
Floodplain Manager: Mimi Moss	Ph: (775) 782-6230
Sandbag Materials Locations:	All Fire Departments in County
Lyon County Nevada	
Emergency Manager: Jeff Page	27 S. Main Street, Yerington, NV 89447 Contact Number: (775) 463.6531 24-Hour Dispatch: 775 463-6620
Emergency Management Coordinator: Rob Loveberg	Contact Number: (775) 463-6592
Floodplain Manager: Rob Loveberg	Contact Number: (775) 463-6592

Sandbag Materials Locations: Dayton Utilities Yard, Lyon County Road Superintendent	34 Lakes Road, Dayton, NV 89403 Contact Number: (775) 246-6220 18 HWY 95A, Yerington, NV 89447 Contact Number (775) 463-6551
Storey County	
Emergency Manager: Joe Curtis	141 North "C" Street, Virginia City, NV 89440, (775) 847-0454
Floodplain Manager: Shannon Gardner	110 Toll Road, Virginia City, NV 89440, (775)847-0966
Community Development Director: Dean Haymore	110 Toll Road, Virginia City, NV 89440 (775) 847-0966
Public Works Director: Mike Nevin	100 Toll Road, Virginia City, NV 89440 (775)847-0966
Tribal Contacts	
Washoe Tribe of Nevada and California Washoe Environmental Protection Department/Emergency Management Coordinator: Lisa Christensen	(775) 265-8618
Fallon Paiute Shoshone Tribe Emergency Management Coordinator: Richard Black	(775) 423-0590 ext. #3

8.0 References

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The Nevada State Demographer, 2012 *Nevada County Population Projections 2012 to 2031 Based On The Last Estimate Year of 2011*, http://nvdemography.org/wp-content/uploads/2012/10/2012-Oct-1-Population-Projections.pdf.

Nevada Natural Resources Status Report. 2008. http://dcnr.nv.gov/nrp01/content.html.

NOAA National Weather Service, Advanced Hydrologic Prediction Service: Reno: Carson River near Carson City http://ahps2.wrh.noaa.gov.

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Summary and Future Steps:

This revision of the Regional Floodplain Management Plan focuses on the CRC's progress toward implementation of the suggested actions and the information/documentation associated with specific actions. The CRC's River Corridor Working Group is pursuing the following actions to further implement the plan:

- Watershed-wide floodplain education program
- Establishment of a specific process to identify "Fluvial Erosion Hazard Zones".
- Completion of the Mapping Area Statement #4 which will finalize the mapping and modeling of the FEMA floodplain, delineate a floodway, and provide a process for accessing cumulative impacts along the Carson River from Alpine County, CA to Lahontan Reservoir. If grant funding is received during the 2013, the grant also will fund a robust education and outreach program or effort regarding the modeling and mapping, and will look at providing consistent ordinances and mitigation measures throughout the watershed to assist with compliance and good neighbor policy implementation. Additionally, a model update protocol is critical to ensure that each new development is documented and a consistent approach to cumulative impact assessment is followed.
- An additional revision/update of the plan will occur once the MAS phases are finalized and the updated maps are adopted. Map changes and updates will occur at that time. These will include any misspellings, changes in the FEMA boundaries, floodway delineations, etc. A projected date for these revisions is 2016.

Appendices

A **Carson River Watershed Flood History Table**

B **Rapid Evaluation of the River System**

C **HDR White Paper – Review of Existing County Ordinances**

D **County Flood Zone Maps**

E **Public Workshops Feedback Summaries/Results**

F **County Adoption Documentation**

G **FEMA Cooperative Technical Partner Agreement**

H **County Progress Reports 2008-2013**

I **Hydraulic Modeling and Floodplain Mapping Guidelines**

J **Risk MAP Charter**

K **Risk MAP Discovery Report**

L **Floodplain Management Plan Update/Revision Process 2013**

Appendix G

FEMA Cooperative Technical Partner Agreement

Cooperating Technical Partners
Memorandum of Agreement

FEDERAL EMERGENCY MANAGEMENT AGENCY

and the

CARSON WATER SUBCONSERVANCY DISTRICT, NEVADA

AGREEMENT is made on *(date)* June 6, 2005, by these parties: Carson Water Subconservancy District and the Federal Emergency Management Agency (FEMA).

BECAUSE the National Flood Insurance Program (NFIP) established by the National Flood Insurance Act of 1968 has several purposes, the most significant being

- To better indemnify individuals from losses through the availability of flood insurance;
- To reduce future flood damages through community floodplain management regulations; and
- To reduce costs for disaster assistance and flood control.

BECAUSE a critical component of this program is the identification and mapping of the nation's floodplains to create a broad-based awareness of the flood hazard and to provide the data necessary for community floodplain management programs and to actuarially rate flood insurance;

BECAUSE the Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP) and is authorized by §1360 of the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4101), to establish and update flood-risk zone data in floodplain areas. Further, in the identification of flood-prone areas, FEMA is authorized to consult with, receive information from, and enter into agreements or other arrangements with the head of any State, regional, or local agency;

BECAUSE FEMA encourages strong Federal, State, regional, and local partnerships for the purposes of reducing flood losses and disaster assistance; and FEMA and its State, regional, and local partners have determined that it is advantageous to encourage and formalize greater cooperation in the flood hazard identification and mapping processes; and many communities and the agencies that serve them have developed considerable technical capabilities and resources that provide the opportunity to improve and expand the collection, development, and evaluation of flood hazard data; and

BECAUSE the Carson Water Subconservancy District has expressed a desire to perform certain functions in the flood hazard identification process and has provided evidence that it has sufficient technical capability and will dedicate the resources necessary to perform those functions.

NOW THEREFORE, it is mutually agreed that the parties enter into this agreement to work together to create and maintain accurate, up-to-date flood hazard data for the counties of Douglas, Carson City, Churchill and Lyon, Nevada and Alpine, California, subject to the terms and conditions recited below.

1. CONSULTATIONS

The parties shall collaborate on flood hazard identification activities and shall consult with each other to fully integrate each other's contributions into flood hazard identification efforts.

2. EVALUATION AND REPORTING

The parties shall annually review the partnership created by the agreement to determine and document the activities undertaken to maintain accurate flood hazard data.

3. RESOURCE COMMITMENT

The parties agree to commit the appropriate human, technical, and available financial resources sufficient to coordinate effectively with all entities impacted by flood hazard identification efforts to implement this agreement.

4. STANDARDS

Unless otherwise agreed to by the parties, all flood hazard identification activities will be accomplished in accordance with the standards documented in *Guidelines and Specifications for Flood Hazard Mapping Partners*, dated April 2003, and all subsequent revisions.

5. SPECIFIC INITIATIVES

When specific initiatives, projects, or activities are to be performed, they will be forward through and negotiated by the Carson Water Subconservancy District and shall be attached as negotiated Mapping Activity Statement (MAS) items. For this Memorandum of Agreement to go into effect, no MAS items are required.

6. TERM

The respective duties, responsibilities and commitments of the parties in this agreement shall begin on the date this Agreement is signed by the parties and may be periodically renewed, revised, or terminated at the option of any of the parties. The parties agree that a 60-day notice shall be given prior to the termination of this agreement.

THEREFORE, each party has caused this Agreement to be executed by its duly authorized representatives on the date mentioned above.

Carson Water Subconservancy, Authorized Representative* — Date: 4/21/2005

FEMA authorized representative — Date: 06/6/05

* The Carson Water Subconservancy District is composed of the following entities:

Carson City, Nevada
Churchill County, Nevada
Douglas County, Nevada
Lyon County, Nevada
Alpine County, California

Appendix H:

County Progress Reports 2008-2013

H1: Alpine County

H2: Douglas County

H3: Carson City

H4: Lyon County

H5: Churchill County

H6: Carson Water Subconservancy District

Progress Report
for the
Carson River Watershed Regional
Floodplain Management Plan Alpine
County
2008-2013

This summary shows the progress of Alpine County on each of the action items contained in the Plan.

Plan Element	Suggested Action	Status
SA-1	Adopt Living River approach to retain river system in a more natural state that allows the river to access its floodplain. Recognize that not all areas of the river system can be allowed to migrate freely due to special designation (i.e., Superfund area) and/or existing infrastructure.	Alpine County adopted the Regional Floodplain Management Plan which states the Living River approach as one of its main goals
SA-2	Adopt a good neighbor floodplain management policy that recognizes that actions by one property owner can impact adjacent and downstream property owners.	Alpine County adopted the Regional Floodplain Management Plan which states a good neighbor floodplain management as one of it policies
SA-3	Floodplain and flood hazards should be considered with open space program objectives when selecting acquisition targets and establishing management strategies for open spaces.	Alpine County does not have an open space program.
SA-4	Investigate areas where the implementation of stream zone buffers would provide multi-objective benefits for river system and downstream communities.	Topic discussed in CRC meetings but not acted on to date.
SA-5	Plan for and mitigate cumulative effects of watershed urbanization.	Topic discussed in CRC meetings. See SA – 14.
SA-6	Manage development in special flood hazard areas and other flood hazard areas (those known flood hazard areas not included on most current FIRMs) to provide public safety and protect the natural functions and benefits of floodplain lands.	Topic discussed in CRC meetings but not acted on to date.

Plan Element	Suggested Action	Status
SA-7	Retain lands that provide floodplain storage and maintain or restore connection of river with floodplain through land acquisition, conservation easements, local open space programs, TDR and PDR Programs, and other protection methods	Alpine County General Plan encourages protection of floodplains and riparian areas. Conservation subdivision density bonus available for projects that protect these type of lands as permanent open space. Alpine County is purchasing the site of the former USFS Markleeville Guard Station located in the floodplain of Markleeville Creek. Grant funds are being sought to restore the site to a more natural floodplain form and function.
SA-8	Encourage the incorporation of low impact development principles into sub-division development proposals for floodplain lands to decrease run-off and minimize loss of floodplain storage capacity.	No requirements for LID in Alpine County.
SA-9	Identify and promote options for landowner incentive programs, such as floodplain leasing program and conservation easements that provide compensation to landowners providing ecosystem services.	Topic discussed in CRC meetings but not acted on to date.
SA-10	Promote and utilize best management practices as a means of protecting riparian habitat.	Topic discussed in CRC meetings as possible landowner stock fencing and watering incentives.
SA-11	Implement or enhance county ordinances that include floodplain protection as a purpose, account for the loss of floodplain storage volume, and mitigate losses through a variety of methods.	Alpine County has not considered an enhanced floodplain ordinance.
SA-12	Investigate feasibility of implementing additional measures that go beyond minimum FEMA requirements	Topic discussed in CRC meetings. Alpine County has not considered any action.

Plan Element	Suggested Action	Status
SA-13	Develop model watershed floodplain management ordinance language that can be adopted by counties to provide watershed-wide consistency.	Topic discussed in CRC meetings but not acted on to date.
SA-14	Secure funding for and conduct watershed-wide unsteady state modeling to identify flood water storage requirements and to look at the cumulative effects of watershed development.	CWSD has secured funding from FEMA to model and map the river (MAS 1-3). MAS-4 funding request is pending.
SA-15	Support FEMA's Map Modernization Program and encourage FEMA to update FIRMs with current and future conditions. Significant verification of topography and other variables should be conducted prior to release of draft FIRMs.	This element is on going with FEMA. See SA -14
SA-16	CWSD continue to participate in FEMA's Cooperating Technical Partner Program.	CWSD continues to be a CTPP.
SA-17	Strive for up-to-date and consistent data collection and maintenance to include updating of flood studies where necessary and conduct studies for significant water courses and alluvial fan areas that have not been analyzed. This data should be used to update FEMA maps and fill data gaps. Complete delineation of the floodway throughout river system and incorporate into FIRMs.	Updated mapping on the West Fork Carson upstream from the state line to Woodfords will be completed as part of CWSD project to update FEMA mapping in the watershed.
SA-18	Flood studies and maps should be updated after significant flooding events.	Alpine County has not experienced a significant flood event during this period.
SA-19	Elevation Reference Marks (ERM) should be permanent monuments and updated on a regular basis.	None in Alpine County.
SA-20	ERMs should be in the same datum as base flood elevations on FIRMs or a datum that is readily convertible to FIRM datum. Move towards FEMA recommended NAVD 88 datum.	None in Alpine County.
SA-21	A master list of ERMs should be developed, maintained, and made available to interested parties.	None in Alpine County.

Plan Element	Suggested Action	Status
SA-22	Photo-Monitoring program (on-the-ground and aerial) should be developed and coordinated on a watershed level to document flooding and flood hazards in a consistent matter.	Topic discussed in CRC meetings. A list of picture points has been developed.
SA-23	Known and projected hazard areas including channel migration hazards should continue to be documented and updated information should be incorporated into planning processes.	Topic discussed in CRC meetings but not acted on to date.
SA-24	LiDAR and/or aerial photography (on a watershed level) should be conducted on a 5-year basis, or as needed, to provide updated information on channel movement and floodplain condition.	LiDAR surveys have been done. The latest survey was done in 2011.
SA-25	Establish building set-backs in flood hazard areas, where appropriate, to reduce severe hazards from channel migration.	Topic discussed in CRC meetings but not acted on to date.
SA-26	Channel cross-sectional surveys should be conducted and well documented to track long term changes in river channel.	Surveys has been done under contracts MAS-1,2 and 3.
SA-27	Identify unstable stream banks and areas with high potential for erosion.	
SA-28	Promote the use of non-structural, bio-engineering (soft-engineering utilizing natural materials) techniques in river restoration projects in combination with other proven methods.	The Markleeville Creek (Markleeville Guard Station) and Hope Valley restoration projects will incorporate bio-engineering.
SA-29	Update the 1996 Fluvial Geomorphic Assessment.	Topic discussed in CRC meetings but not acted on
SA-30	Develop watershed-wide outreach and education program about floodplain importance and flooding hazards.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers to aid in this element
SA-31	Brochures should be developed for distribution on a watershed level with consistent messages and information for the general public.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.

Plan Element	Suggested Action	Status
SA-32	CWSD website will provide information on the Regional Floodplain Management Plan and provide emergency contact information. Local governments and other entities can link to this website to increase distribution.	The information has been posted on the CWSD website.
SA-33	Annual Flood Awareness Week will be established with the objective of providing information about flooding and flood hazards to the general public.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.
SA-34	Special Events, River Work Days, and other outreach opportunities should be utilized to help raise awareness of flooding hazards and importance of floodplains.	Markleeville or Alpine Creek day is held annually in September.
SA-35	Investigate opportunities to remove existing restrictions, such as berms, to allow flood waters to access floodplain.	Topic discussed in CRC meetings but not acted on to date.
SA-36	Limit the use of future management measures such as dams, levees, and floodwalls.	Topic discussed in CRC meetings but not acted on to date.
SA-37	Design future bridges and roads to protect floodplain, accommodate and not restrict changing river course, and minimize back up of flood water.	Topic discussed in CRC meetings but not acted on to date.
SA-38	Investigate opportunities to enhance grade control structures	Topic discussed in CRC meetings but not acted on to date.

Progress Report
for
Carson River Watershed Regional
Floodplain Management Plan Douglas
County
2008-2013

This summary shows the progress of Douglas County on each of the action items contained in the Plan.

Plan Element	Suggested Action	Status
SA-1	Adopt Living River approach to retain river system in a more natural state that allows the river to access its floodplain. Recognize that not all areas of the river system can be allowed to migrate freely due to special designation (i.e., Superfund area) and/or existing infrastructure.	Douglas County adopted the Regional Floodplain Management Plan which includes the living river approach to protect the function and values of the natural floodplain.
SA-2	Adopt a good neighbor floodplain management policy that recognizes that actions by one property owner can impact adjacent and downstream property owners.	Adopted "Reasonable Use Drainage which states "Downstream properties shall not be unreasonable burdened with increased flow rates, negative impacts or unreasonable changes in manner of flow from upstream properties (DCDCIS 6.1.4) Also the County flood ordinance requires new development to demonstrate no adverse impact (20.50.100, 110, and 160).

Plan Element	Suggested Action	Status
SA-3	Floodplain and flood hazards should be considered with open space program objectives when selecting acquisition targets and establishing management strategies for open spaces.	Chapter 20.714 Division of Agricultural Land for Conservation Purposes addresses preservation of open space to protect floodplains from development, thereby maintaining a passive flood control, drainage, and ground water recharge system.
SA-4	Investigate areas where the implementation of stream zone buffers would provide multi-objective benefits for river system and downstream communities.	Continued discussion at CRC meetings.
SA-5	Plan for and mitigate cumulative effects of watershed urbanization.	Provided for in Floodplain Ordinance and Design Standards. Detention/Retention required for increased in flow due to development for 25 year design storm.
SA-6	Manage development in special flood hazard areas and other flood hazard areas (those known flood hazard areas not included on most current FIRMs) to provide public safety and protect the natural functions and benefits of floodplain lands.	Douglas County participates in the NFIP and regulates development in flood hazard areas per County Code Title 20.50.
SA-7	Retain lands that provide floodplain storage and maintain or restore connection of river with floodplain through land acquisition, conservation easements, local open space programs, TDR and PDR Programs, and other protection methods	Since 2001, the Douglas County TDR Program has preserved in excess of 2,000 acres of agricultural land within the primary floodplain.
SA-8	Encourage the incorporation of low impact development principles into sub-division development proposals for floodplain lands to decrease run-off and minimize loss of floodplain storage capacity.	DCDCIS Section 6.1.4.7 – Low Impact Design encourages Low Impact Design, but does not require it.

Plan Element	Suggested Action	Status
SA-9	Identify and promote options for landowner incentive programs, such as floodplain leasing program and conservation easements that provide compensation to landowners providing ecosystem services.	Continued discussion at CRC meetings.
SA-10	Promote and utilize best management practices as a means of protecting riparian habitat.	Not currently adopted.
SA-11	Implement or enhance county ordinances that include floodplain protection as a purpose, account for the loss of floodplain storage volume, and mitigate losses through a variety of methods.	Storage volume discussed, may be addressed during future updates of Title 20.50
SA-12	Investigate feasibility of implementing additional measures that go beyond minimum FEMA requirements	Title 20.50 currently allows 0.5' rise of floodplain which is more restrictive than FEMA 1'. The County also requires owners to build 1' above BFE.
SA-13	Develop model watershed floodplain management ordinance language that can be adopted by counties to provide watershed-wide consistency.	Continued discussion at CRC meetings.
SA-14	Secure funding for and conduct watershed-wide unsteady state modeling to identify flood water storage requirements and to look at the cumulative effects of watershed development.	CWSD has secured funding from FEMA to model the river. MAS-4 funding request is pending
SA-15	Support FEMA's Map Modernization Program and encourage FEMA to update FIRMs with current and future conditions. Significant verification of topography and other variables should be conducted prior to release of draft FIRMs.	The County is supportive of this.
SA-16	CWSD continue to participate in FEMA's Cooperating Technical Partner Program.	CWSD continues to be a CRPP.

Plan Element	Suggested Action	Status
SA-17	Strive for up-to-date and consistent data collection and maintenance to include updating of flood studies where necessary and conduct studies for significant water courses and alluvial fan areas that have not been analyzed. This data should be used to update FEMA maps and fill data gaps. Complete delineation of the floodway throughout river system and incorporate into FIRMs.	The County is currently remapping Johnson Lane, Sunrise, and Buckbrush washes. Buckeye Creek was remapped last year. CWSD is remapping the Carson River.
SA-18	Flood studies and maps should be updated after significant flooding events.	No significant flood events. Maps are being updated
SA-19	Elevation Reference Marks (ERM) should be permanent monuments and updated on a regular basis.	The County has no ERM.
SA-20	ERMs should be in the same datum as base flood elevations on FIRMs or a datum that is readily convertible to FIRM datum. Move towards FEMA recommended NAVD 88 datum.	The County has no ERM.
SA-21	A master list of ERMs should be developed, maintained, and made available to interested parties.	The County has no ERM.
SA-22	Photo-Monitoring program (on-the-ground and aerial) should be developed and coordinated on a watershed level to document flooding and flood hazards in a consistent matter.	This has not occurred.
SA-23	Known and projected hazard areas including channel migration hazards should continue to be documented and updated information should be incorporated into planning processes.	These areas of concern have not yet been identified.
SA-24	LiDAR and/or aerial photography (on a watershed level) should be conducted on a 5-year basis, or as needed, to provide updated information on channel movement and floodplain condition.	LiDAR has been completed within the last year by CWSD.
SA-25	Establish building set-backs in flood hazard areas, where appropriate, to reduce severe hazards from channel migration.	This item has been discussed, but no action has occurred.

Plan Element	Suggested Action	Status
SA-26	Channel cross-sectional surveys should be conducted and well documented to track long term changes in river channel.	Cross sectional surveys for Johnson Lane, Buckbrush Wash, Sunrise Wash, Buckeye Creek, and the Carson River have been completed within the last 2 years.
SA-27	Identify unstable stream banks and areas with high potential for erosion.	This has not been completed.
SA-28	Promote the use of non-structural, bio-engineering (soft-engineering utilizing natural materials) techniques in river restoration projects in combination with other proven methods.	This has not been completed.
SA-29	Update the 1996 Fluvial Geomorphic Assessment.	NA
SA-30	Develop watershed-wide outreach and education program about floodplain importance and flooding hazards.	Continued discussion at CRC meetings.
SA-31	Brochures should be developed for distribution on a watershed level with consistent messages and information for the general public.	These are available at the County Library.
SA-32	CWSD website will provide information on the Regional Floodplain Management Plan and provide emergency contact information. Local governments and other entities can link to this website to increase distribution.	This will be completed when the links are forwarded from CWSD to Douglas County.
SA-33	Annual Flood Awareness Week will be established with the objective of providing information about flooding and flood hazards to the general public.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.
SA-34	Special Events, River Work Days, and other outreach opportunities should be utilized to help raise awareness of flooding hazards and importance of floodplains.	This occurs with displays and information at the Library. Efforts include those by CWSD and the County.
SA-35	Investigate opportunities to remove existing restrictions, such as berms, to allow flood waters to access floodplain.	There are a very limited number of restrictions such as berms in the County.

Plan Element	Suggested Action	Status
SA-36	Limit the use of future management measures such as dams, levees, and floodwalls.	Flood Control is not anticipated to be achieved by these methods in Douglas County.
SA-37	Design future bridges and roads to protect floodplain, accommodate and not restrict changing river course, and minimize back up of flood water.	This is anticipated. Work has started to expand the culvert crossing on the Martin Slough and US395 to allow additional passing of floodwater.
SA-38	Investigate opportunities to enhance grade control structures	No action on this item.

Progress Report
of
Carson River Watershed Regional
Floodplain Management Plan Carson
City
2008-2013

This summary shows the progress of Carson City on each of the action items contained in the Plan.

Plan Element	Suggested Action	Status
SA-1	Adopt Living River approach to retain river system in a more natural state that allows the river to access its floodplain. Recognize that not all areas of the river system can be allowed to migrate freely due to special designation (i.e., Superfund area) and/or existing infrastructure.	The Carson City adopted the Regional Floodplain Management Plan which states the Living River approach as one of its main goals.
SA-2	Adopt a good neighbor floodplain management policy that recognizes that actions by one property owner can impact adjacent and downstream property owners.	The Carson City adopted the Regional Floodplain Management Plan which states a good neighbor floodplain management as one of its policies.
SA-3	Floodplain and flood hazards should be considered with open space program objectives when selecting acquisition targets and establishing management strategies for open spaces.	The Carson City's Open Space plan places high priority on purchase of floodplains lands.
SA-4	Investigate areas where the implementation of stream zone buffers would provide multi-objective benefits for river system and downstream communities.	Topic discussed in CRC meetings but not acted on to date.
SA-5	Plan for and mitigate cumulative effects of watershed urbanization.	Topic discussed in CRC meetings but not acted on to date.
SA-6	Manage development in special flood hazard areas and other flood hazard areas (those known flood hazard areas not included on most current FIRMs) to provide public safety and protect the natural functions and benefits of floodplain lands.	Topic discussed in CRC meetings but not acted on to date.

Plan Element	Suggested Action	Status
SA-7	Retain lands that provide floodplain storage and maintain or restore connection of river with floodplain through land acquisition, conservation easements, local open space programs, TDR and PDR Programs, and other protection methods	Carson City has acted on acquisition of floodplain as open space. Currently there is 4,192 acres of SFHA, 55% is open space or 2,288 acres.
SA-8	Encourage the incorporation of low impact development principles into sub-division development proposals for floodplain lands to decrease run-off and minimize loss of floodplain storage capacity.	Carson City code encourages LID but does not have specific requirements.
SA-9	Identify and promote options for landowner incentive programs, such as floodplain leasing program and conservation easements that provide compensation to landowners providing ecosystem services.	Topic discussed in CRC meetings but not acted on to date.
SA-10	Promote and utilize best management practices as a means of protecting riparian habitat.	Topic discussed in CRC meetings as possible landowner stock fencing and watering incentives.
SA-11	Implement or enhance county ordinances that include floodplain protection as a purpose, account for the loss of floodplain storage volume, and mitigate losses through a variety of methods.	The Carson City has 1 to 1 volume requirement in its flood protection ordinance 12.09.080 (9).
SA-12	Investigate feasibility of implementing additional measures that go beyond minimum FEMA requirements	Topic discussed in CRC meetings. Carson City has a 2ft above BFE requirement.
SA-13	Develop model watershed floodplain management ordinance language that can be adopted by counties to provide watershed-wide consistency.	Topic discussed in CRC meetings but not acted on to date.
SA-14	Secure funding for and conduct watershed-wide unsteady state modeling to identify flood water storage requirements and to look at the cumulative effects of watershed development.	CWSD has secured funding from FEMA to model the river. MAS-4 funding request is pending.

Plan Element	Suggested Action	Status
SA-15	Support FEMA's Map Modernization Program and encourage FEMA to update FIRMs with current and future conditions. Significant verification of topography and other variables should be conducted prior to release of draft FIRMs.	This element is on going with FEMA.
SA-16	CWSD continue to participate in FEMA's Cooperating Technical Partner Program.	CWSD continues to be a CTPP.
SA-17	Strive for up-to-date and consistent data collection and maintenance to include updating of flood studies where necessary and conduct studies for significant water courses and alluvial fan areas that have not been analyzed. This data should be used to update FEMA maps and fill data gaps. Complete delineation of the floodway throughout river system and incorporate into FIRMs.	CWSD has completed floodplain mapping of the river in the Dayton and Carson City areas. Mapping efforts are starting in Douglas County.
SA-18	Flood studies and maps should be updated after significant flooding events.	Carson City has not experienced a significant flood event during this period.
SA-19	Elevation Reference Marks (ERM) should be permanent monuments and updated on a regular basis.	Carson City has 99 ERMs throughout the city. Verification is scheduled every five years.
SA-20	ERMs should be in the same datum as base flood elevations on FIRMs or a datum that is readily convertible to FIRM datum. Move towards FEMA recommended NAVD 88 datum.	Carson City's ERM are in NAVD 88 datum.
SA-21	A master list of ERMs should be developed, maintained, and made available to interested parties.	Carson City's ERM are available through its website www.carsonsw.org
SA-22	Photo-Monitoring program (on-the-ground and aerial) should be developed and coordinated on a watershed level to document flooding and flood hazards in a consistent matter.	Topic discussed in CRC meetings. A list of picture points have been developed.

Plan Element	Suggested Action	Status
SA-23	Known and projected hazard areas including channel migration hazards should continue to be documented and updated information should be incorporated into planning processes.	Topic discussed in CRC meetings but not acted on to date.
SA-24	LiDAR and/or aerial photography (on a watershed level) should be conducted on a 5-year basis, or as needed, to provide updated information on channel movement and floodplain condition.	LiDAR surveys have been done. The latest survey was done in 2011.
SA-25	Establish building set-backs in flood hazard areas, where appropriate, to reduce severe hazards from channel migration.	Topic discussed in CRC meetings but not acted on to date.
SA-26	Channel cross-sectional surveys should be conducted and well documented to track long term changes in river channel.	Surveys has been done under contracts MAS-1, 2 and 3.
SA-27	Identify unstable stream banks and areas with high potential for erosion.	Topic discussed in CRC meetings but not acted on to date.
SA-28	Promote the use of non-structural, bio-engineering (soft-engineering utilizing natural materials) techniques in river restoration projects in combination with other proven methods.	Bio-engineering techniques are being used on river restoration projects being accomplished by the Conservation Distict and their partners.
SA-29	Update the 1996 Fluvial Geomorphic Assessment.	Topic discussed in CRC meetings but not acted onto date.
SA-30	Develop watershed-wide outreach and education program about floodplain importance and flooding hazards.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.
SA-31	Brochures should be developed for distribution on a watershed level with consistent messages and information for the general public.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.

Plan Element	Suggested Action	Status
SA-32	CWSD website will provide information on the Regional Floodplain Management Plan and provide emergency contact information. Local governments and other entities can link to this website to increase distribution.	The information has been posted on the CWSD website
SA-33	Annual Flood Awareness Week will be established with the objective of providing information about flooding and flood hazards to the general public.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.
SA-34	Special Events, River Work Days, and other outreach opportunities should be utilized to help raise awareness of flooding hazards and importance of floodplains.	Yearly events occurred, such as Carson River Days.
SA-35	Investigate opportunities to remove existing restrictions, such as berms, to allow flood waters to access floodplain.	Topic discussed in CRC meetings but not acted on to date.
SA-36	Limit the use of future management measures such as dams, levees, and floodwalls.	Topic discussed in CRC meetings but not acted on to date.
SA-37	Design future bridges and roads to protect floodplain, accommodate and not restrict changing river course, and minimize back up of flood water.	Topic discussed in CRC meetings but not acted on to date.
SA-38	Investigate opportunities to enhance grade control structures	Topic discussed in CRC meetings but not acted on to date.

Progress Report
for
Carson River Watershed Regional
Floodplain Management Plan Lyon
County
2008-2013

This summary shows the progress of Lyon County on each of the action items contained in the Plan.

Plan Element	Suggested Action	Status
SA-1	Adopt Living River approach to retain river system in a more natural state that allows the river to access its floodplain. Recognize that not all areas of the river system can be allowed to migrate freely due to special designation (i.e., Superfund area) and/or existing infrastructure.	Lyon County adopted the Regional Floodplain Management Plan which states the Living River approach as one of its main goals.
SA-2	Adopt a good neighbor floodplain management policy that recognizes that actions by one property owner can impact adjacent and downstream property owners.	Lyon County adopted the Regional Floodplain Management Plan which states a good neighbor floodplain management as one of its policies.
SA-3	Floodplain and flood hazards should be considered with open space program objectives when selecting acquisition targets and establishing management strategies for open spaces.	Lyon County's Comprehensive Master Plan places high priority on moving development density out of the floodplain; open space program to be developed in the future.
SA-4	Investigate areas where the implementation of stream zone buffers would provide multi-objective benefits for river system and downstream communities.	Topic discussed in CRC meetings but not acted on to date.
SA-5	Plan for and mitigate cumulative effects of watershed urbanization.	Topic discussed in CRC meetings but not acted on to date. See SA -14.

Plan Element	Suggested Action	Status
SA-6	Manage development in special flood hazard areas and other flood hazard areas (those known flood hazard areas not included on most current FIRMs) to provide public safety and protect the natural functions and benefits of floodplain lands.	Lyon County's Comprehensive Master Plan places high priority on moving development density out of the floodplain; incentive programs proposed for new development code.
SA-7	Retain lands that provide floodplain storage and maintain or restore connection of river with floodplain through land acquisition, conservation easements, local open space programs, TDR and PDR Programs, and other protection methods	Lyon County's Comprehensive Master Plan places high priority on moving development density out of the floodplain; incentive programs proposed for new development code.
SA-8	Encourage the incorporation of low impact development principles into sub-division development proposals for floodplain lands to decrease run-off and minimize loss of floodplain storage capacity.	Lyon County's draft Land Use and Development code encourages LID; specific requirements are to be developed.
SA-9	Identify and promote options for landowner incentive programs, such as floodplain leasing program and conservation easements that provide compensation to landowners providing ecosystem services.	Lyon County's Comprehensive Master Plan places high priority on moving development density out of the floodplain; incentive programs proposed for new development code.
SA-10	Promote and utilize best management practices as a means of protecting riparian habitat.	Topic discussed in CRC meetings as possible landowner stock fencing and watering incentives.
SA-11	Implement or enhance county ordinances that include floodplain protection as a purpose, account for the loss of floodplain storage volume, and mitigate losses through a variety of methods.	Lyon County to consider improvements to floodplain requirements in its draft Land Use and Development code.
SA-12	Investigate feasibility of implementing additional measures that go beyond minimum FEMA requirements	Topic discussed in CRC meetings. Lyon County has a 1ft above BFE requirement.

Plan Element	Suggested Action	Status
SA-13	Develop model watershed floodplain management ordinance language that can be adopted by counties to provide watershed-wide consistency.	Topic discussed in CRC meetings but not acted on to date.
SA-14	Secure funding for and conduct watershed-wide unsteady state modeling to identify flood water storage requirements and to look at the cumulative effects of watershed development.	CWSD has secured funding from FEMA to model the river MAS 1-3. MAS-4 funding request is pending.
SA-15	Support FEMA's Map Modernization Program and encourage FEMA to update FIRMs with current and future conditions. Significant verification of topography and other variables should be conducted prior to release of draft FIRMs.	This element is on-going with FEMA. Lyon County signed RiskMAP charter along with other local jurisdictions, federal and state agencies, and CWSD.
SA-16	CWSD continue to participate in FEMA's Cooperating Technical Partner Program.	CWSD continues to be a CTPP.
SA-17	Strive for up-to-date and consistent data collection and maintenance to include updating of flood studies where necessary and conduct studies for significant water courses and alluvial fan areas that have not been analyzed. This data should be used to update FEMA maps and fill data gaps. Complete delineation of the floodway throughout river system and incorporate into FIRMs.	CWSD has completed floodplain mapping of the river in the Dayton and Carson City areas. Mapping efforts are starting in Douglas County.
SA-18	Flood studies and maps should be updated after significant flooding events.	Lyon County has not experienced a significant flood event during this period.
SA-19	Elevation Reference Marks (ERM) should be permanent monuments and updated on a regular basis.	Lyon County has not initiated a program to provide ERMs.
SA-20	ERMs should be in the same datum as base flood elevations on FIRMs or a datum that is readily convertible to FIRM datum. Move towards FEMA recommended NAVD 88 datum.	Lyon County has not initiated a program to provide ERMs.
SA-21	A master list of ERMs should be developed, maintained, and made available to interested parties.	Lyon County has not initiated a program to provide ERMs.

Plan Element	Suggested Action	Status
SA-22	Photo-Monitoring program (on-the-ground and aerial) should be developed and coordinated on a watershed level to document flooding and flood hazards in a consistent matter.	Topic discussed in CRC meetings. A list of picture points have been developed.
SA-23	Known and projected hazard areas including channel migration hazards should continue to be documented and updated information should be incorporated into planning processes.	Topic discussed in CRC meetings but not acted on to date.
SA-24	LiDAR and/or aerial photography (on a watershed level) should be conducted on a 5-year basis, or as needed, to provide updated information on channel movement and floodplain condition.	LiDAR surveys have been done. The latest survey was done in 2011.
SA-25	Establish building set-backs in flood hazard areas, where appropriate, to reduce severe hazards from channel migration.	Topic discussed in CRC meetings but not acted on to date.
SA-26	Channel cross-sectional surveys should be conducted and well documented to track long term changes in river channel.	Surveys has been done under contracts MAS-1, 2 and 3.
SA-27	Identify unstable stream banks and areas with high potential for erosion.	Topic discussed in CRC meetings but not acted on to date.
SA-28	Promote the use of non-structural, bio-engineering (soft-engineering utilizing natural materials) techniques in river restoration projects in combination with other proven methods.	Topic discussed in CRC meetings but not acted on to date.
SA-29	Update the 1996 Fluvial Geomorphic Assessment.	Topic discussed in CRC meetings but not acted on to date.
SA-30	Develop watershed-wide outreach and education program about floodplain importance and flooding hazards.	Topic discussed in CRC meetings. A grant request has been submitted by UNCE to the Corps of Engineers to aid in this element.
SA-31	Brochures should be developed for distribution on a watershed level with consistent messages and information for the general public.	Topic discussed in CRC meetings. A grant request has been submitted by UNCE to the Corps of Engineers to aid in this element.

Plan Element	Suggested Action	Status
SA-32	CWSD website will provide information on the Regional Floodplain Management Plan and provide emergency contact information. Local governments and other entities can link to this website to increase distribution.	The information has been posted on the CWSD website.
SA-33	Annual Flood Awareness Week will be established with the objective of providing information about flooding and flood hazards to the general public.	Topic discussed in CRC meetings. A grant request has been submitted by UNCE to the Corps of Engineers to aid in this element.
SA-34	Special Events, River Work Days, and other outreach opportunities should be utilized to help raise awareness of flooding hazards and importance of floodplains.	Yearly events occur, such as the Carson River Festival at Ooddles of Noodles and Carson River Workdays.
SA-35	Investigate opportunities to remove existing restrictions, such as berms, to allow flood waters to access floodplain.	Topic discussed in CRC meetings but not acted on to date.
SA-36	Limit the use of future management measures such as dams, levees, and floodwalls.	Topic discussed in CRC meetings but not acted on to date.
SA-37	Design future bridges and roads to protect floodplain, accommodate and not restrict changing river course, and minimize back up of flood water.	Topic discussed in CRC meetings but not acted on to date.
SA-38	Investigate opportunities to enhance grade control structures.	Topic discussed in CRC meetings but not acted on to date.

Progress Report
of
Carson River Watershed Regional
Floodplain Management Plan Churchill
2008-2013

This summary shows the progress of Carson City on each of the action items contained in the Plan.

Plan Element	Suggested Action	Status
SA-1	Adopt Living River approach to retain river system in a more natural state that allows the river to access its floodplain. Recognize that not all areas of the river system can be allowed to migrate freely due to special designation (i.e., Superfund area) and/or existing infrastructure.	Churchill County adopted the Regional Floodplain Management Plan which states the Living River approach as one of its main goals.
SA-2	Adopt a good neighbor floodplain management policy that recognizes that actions by one property owner can impact adjacent and downstream property owners.	Churchill County adopted the Regional Floodplain Management Plan which states a good neighbor floodplain management as one of its policies.
SA-3	Floodplain and flood hazards should be considered with open space program objectives when selecting acquisition targets and establishing management strategies for open spaces.	Section 16.12.040.3 of Churchill County Code explains planned unit developments, a specialized kind of subdivision. The Planning Commission may allow up to five units per acre if the developer provides benefits to the community such as protection and access to the Carson River corridor or protection of agriculture through the Transfer of Development Rights program.

Plan Element	Suggested Action	Status
SA-4	Investigate areas where the implementation of stream zone buffers would provide multi-objective benefits for river system and downstream communities.	Topic discussed in CRC meetings but not acted on to date.
SA-5	Plan for and mitigate cumulative effects of watershed urbanization.	Regional efforts through CWSD are in process. See SA – 14.
SA-6	Manage development in special flood hazard areas and other flood hazard areas (those known flood hazard areas not included on most current FIRMs) to provide public safety and protect the natural functions and benefits of floodplain lands.	Topic discussed in CRC meetings but not acted on to date by Churchill County. ???
SA-7	Retain lands that provide floodplain storage and maintain or restore connection of river with floodplain through land acquisition, conservation easements, local open space programs, TDR and PDR Programs, and other protection methods	See SA - 3
SA-8	Encourage the incorporation of low impact development principles into sub-division development proposals for floodplain lands to decrease run-off and minimize loss of floodplain storage capacity.	No action to date by Churchill County. FPMP was adopted by Churchill County and calls for LID practices to be implemented.
SA-9	Identify and promote options for landowner incentive programs, such as floodplain leasing program and conservation easements that provide compensation to landowners providing ecosystem services.	See SA-3
SA-10	Promote and utilize best management practices as a means of protecting riparian habitat.	Topic discussed in CRC meetings as possible landowner stock fencing and watering incentives.
SA-11	Implement or enhance county ordinances that include floodplain protection as a purpose, account for the loss of floodplain storage volume, and mitigate losses through a variety of methods.	No action to date by Churchill County.

Plan Element	Suggested Action	Status
SA-12	Investigate feasibility of implementing additional measures that go beyond minimum FEMA requirements	Topic discussed in CRC meetings but not acted on by Churchill County to date.
SA-13	Develop model watershed floodplain management ordinance language that can be adopted by Counties to provide watershed-wide consistency.	Topic discussed in CRC meetings but not acted on to date.
SA-14	Secure funding for and conduct watershed-wide unsteady state modeling to identify flood water storage requirements and to look at the cumulative effects of watershed development.	CWSD has secured funding from FEMA to model the river MAS 1-4. MAS-4 funding request is pending.
SA-15	Support FEMA's Map Modernization Program and encourage FEMA to update FIRMs with current and future conditions. Significant verification of topography and other variables should be conducted prior to release of draft FIRMs.	This element is on going with FEMA.
SA-16	CWSD continue to participate in FEMA's Cooperating Technical Partner Program.	CWSD continues to be a CTPP.
SA-17	Strive for up-to-date and consistent data collection and maintenance to include updating of flood studies where necessary and conduct studies for significant water courses and alluvial fan areas that have not been analyzed. This data should be used to update FEMA maps and fill data gaps. Complete delineation of the floodway throughout river system and incorporate into FIRMs.	Churchill County completed a LIDAR study in 2013 in cooperation with Carson Water Subconservancy District, US Army Corps of Engineers, Bureau of Reclamation and US Fish & Wildlife Service. The study included the Newlands Project from Lahontan Dam downstream, including the Carson River. The purpose was to help determine potential flood risks from irrigation canals and the river and to enable developers to plan mitigation into their development.

Plan Element	Suggested Action	Status
SA-18	Flood studies and maps should be updated after significant flooding events.	Churchill County has not experienced a significant flood event since the initial plan adoption.
SA-19	Elevation Reference Marks (ERM) should be permanent monuments and updated on a regular basis.	?
SA-20	ERMs should be in the same datum as base flood elevations on FIRMs or a datum that is readily convertible to FIRM datum. Move towards FEMA recommended NAVD 88 datum.	?
SA-21	A master list of ERMs should be developed, maintained, and made available to interested parties.	Does Churchill have a master list?
SA-22	Photo-Monitoring program (on-the-ground and aerial) should be developed and coordinated on a watershed level to document flooding and flood hazards in a consistent matter.	Topic discussed in CRC meetings. A list of picture points has been developed.
SA-23	Known and projected hazard areas including channel migration hazards should continue to be documented and updated information should be incorporated into planning processes.	Topic discussed in CRC meetings but not acted on to date.
SA-24	LiDAR and/or aerial photography (on a watershed level) should be conducted on a 5-year basis, or as needed, to provide updated information on channel movement and floodplain condition.	See SA-17.
SA-25	Establish building set-backs in flood hazard areas, where appropriate, to reduce severe hazards from channel migration.	Topic discussed in CRC meetings but not acted on to date.
SA-26	Channel cross-sectional surveys should be conducted and well documented to track long term changes in river channel.	Surveys has been done under contracts MAS-1, 2 and 3.
SA-27	Identify unstable stream banks and areas with high potential for erosion.	Topic discussed in CRC meetings but not acted on to date.

Plan Element	Suggested Action	Status
SA-28	Promote the use of non-structural, bio-engineering (soft-engineering utilizing natural materials) techniques in river restoration projects in combination with other proven methods.	In February, 2013, a sediment removal and bank stabilization project at Bafford Lane was completed. It was a cooperative effort of Churchill County Planning Department, Churchill County Emergency Management, Churchill County Road Department, Churchill County Mosquito, Vector and Weed Control District, Lahontan Conservation District, Dayton Valley Conservation District and Truckee-Carson Irrigation District. The funding was provided by CWSD with in-kind match from the other agencies. Approximately 20,000 cubic yards of sediment was removed and the bank was stabilized using bioengineering techniques.
SA-29	Update the 1996 Fluvial Geomorphic Assessment.	Topic discussed in CRC meetings but not acted on as no funding available.
SA-30	Develop watershed-wide outreach and education program about floodplain importance and flooding hazards.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.
SA-31	Brochures should be developed for distribution on a watershed level with consistent messages and information for the general public.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.

Plan Element	Suggested Action	Status
SA-32	CWSD website will provide information on the Regional Floodplain Management Plan and provide emergency contact information. Local governments and other entities can link to this website to increase distribution.	The information has been posted on the CWSD website and is updated periodically.
SA-33	Annual Flood Awareness Week will be established with the objective of providing information about flooding and flood hazards to the general public.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element
SA-34	Special Events, River Work Days, and other outreach opportunities should be utilized to help raise awareness of flooding hazards and importance of floodplains.	Carson River Workday, sponsored by Lahontan Conservation District, is held annually in the spring. The location is the site of a conservation easement on the river. Beginning in January, Churchill County Emergency Management, other County personnel and the Sheriff meet with TCID frequently as the snow survey and water data becomes available. If it looks like there is a chance of flooding, the Sheriff sends a letter to landowners on the river to warn them and to remind them to take fences and debris out of the channel.
SA-35	Investigate opportunities to remove existing restrictions, such as berms, to allow flood waters to access floodplain.	Topic discussed in CRC meetings but not acted on to date.
SA-36	Limit the use of future management measures such as dams, levees, and floodwalls.	Topic discussed in CRC meetings but not acted on to date beyond the existing outreach brochures.

Plan Element	Suggested Action	Status
SA-37	Design future bridges and roads to protect floodplain, accommodate and not restrict changing river course, and minimize back up of flood water.	Topic discussed in CRC meetings but not acted on to date.
SA-38	Investigate opportunities to enhance grade control structures	Topic discussed in CRC meetings but not acted on to date.

Progress Report
for the
Carson River Watershed Regional
Floodplain Management Plan Carson
Water Subconservancy District
2008-2013

This summary shows the progress of Carson Water Subconservancy District on each of the action items contained in the Plan.

Plan Element	Suggested Action	Status
SA-1	Adopt Living River approach to retain river system in a more natural state that allows the river to access its floodplain. Recognize that not all areas of the river system can be allowed to migrate freely due to special designation (i.e., Superfund area) and/or existing infrastructure.	CWSD adopted the Regional Floodplain Management Plan which states the Living River approach as one of its main goals. CWSD continues to promote this approach to our Watershed Community.
SA-2	Adopt a good neighbor floodplain management policy that recognizes that actions by one property owner can impact adjacent and downstream property owners.	CWSD adopted the Regional Floodplain Management Plan which identifies a good neighbor floodplain management policy as one of its goals. CWSD continues to promote this approach to our Watershed Community.
SA-3	Floodplain and flood hazards should be considered with open space program objectives when selecting acquisition targets and establishing management strategies for open spaces.	CWSD supports the local jurisdictions, non-profits and landowners in protecting and managing floodplains and flood hazard areas. CWSD funding is often used to complete river restoration, habitat enhancement, bank stabilization, and/or flood hazard projects.

Plan Element	Suggested Action	Status
SA-4	Investigate areas where the implementation of stream zone buffers would provide multi-objective benefits for river system and downstream communities.	Topic discussed in CRC meetings but not acted on to date. Additional literature research may need to be conducted to determine an appropriate buffer zone size that would be beneficial.
SA-5	Plan for and mitigate cumulative effects of watershed urbanization.	CWSD received funding from FEMA to complete a floodplain model that when completed will help plan for cumulative impacts of development in the floodplain upstream of Lahontan Reservoir. CWSD is seeking funding for MAS #4 in 2013. This funding will complete the model and also investigate mitigation measures that will alleviate cumulative effects on a watershed scale. CWSD continue to involve the CRC in the planning and progress of the FEMA MAS projects.
SA-6	Manage development in special flood hazard areas and other flood hazard areas (those known flood hazard areas not included on most current FIRMs) to provide public safety and protect the natural functions and benefits of floodplain lands.	Topic discussed in CRC meetings but not acted on to date.
SA-7	Retain lands that provide floodplain storage and maintain or restore connection of river with floodplain through land acquisition, conservation easements, local open space programs, TDR and PDR Programs, and other protection methods	The RFMP and CWSD support those entities that can legally undertake this suggested action.
SA-8	Encourage the incorporation of low impact development (LID) principles into sub-division development proposals for floodplain lands to decrease run-off and minimize loss of floodplain storage capacity.	CWSD encourages the use of LID practices.

Plan Element	Suggested Action	Status
SA-9	Identify and promote options for landowner incentive programs, such as floodplain leasing program and conservation easements that provide compensation to landowners providing ecosystem services.	CWSD contracted to complete a Floodplain Ecosystem Services Valuation for the Carson Valley in 2010. The project findings indicated that it was not economically viable at this time to undertake a floodplain leasing program. Further research would need to be conducted to come up with creative economically viable solutions.
SA-10	Promote and utilize best management practices as a means of protecting riparian habitat.	Topic discussed in CRC meetings as possible landowner stock fencing and watering incentives.
SA-11	Implement or enhance county ordinances that include floodplain protection as a purpose, account for the loss of floodplain storage volume, and mitigate losses through a variety of methods.	CWSD may be assisting with development of enhanced ordinances and mitigation measures if the funding request pending for MAS 4 is approved in 2013.
SA-12	Investigate feasibility of implementing additional measures that go beyond minimum FEMA requirements	Topic discussed in CRC meetings. See SA -11.
SA-13	Develop model watershed floodplain management ordinance language that can be adopted by Counties to provide watershed-wide consistency.	Topic discussed in CRC meetings but not acted on to date. See SA – 11.
SA-14	Secure funding for and conduct watershed-wide unsteady state modeling to identify flood water storage requirements and to look at the cumulative effects of watershed development.	CWSD has secured funding from FEMA to model the river MAS 1, 2 & 3. MAS 4 funding request is pending.

Plan Element	Suggested Action	Status
SA-15	Support FEMA's Map Modernization Program and encourage FEMA to update FIRMs with current and future conditions. Significant verification of topography and other variables should be conducted prior to release of draft FIRMs.	This element is on-going with FEMA. CWSD has spearheaded a RiskMAP Charter for the watershed with signatories including the local counties, CWSD, FEMA, USACE, State of NV, USBR, TCID, and NOAA. The purpose of the agreement is to work collaboratively to identify, assess, communicate and plan for flood risk within the watershed. See Appendix J of 2013 Regional Floodplain Management Plan Update.
SA-16	CWSD continue to participate in FEMA's Cooperating Technical Partner Program.	CWSD continues to be a CTP.
SA-17	Strive for up-to-date and consistent data collection and maintenance to include updating of flood studies where necessary and conduct studies for significant water courses and alluvial fan areas that have not been analyzed. This data should be used to update FEMA maps and fill data gaps. Complete delineation of the floodway throughout river system and incorporate into FIRMs.	CWSD has completed floodplain mapping of the river in the Dayton and Carson City areas through MAS 1 & 2. Mapping efforts are starting in Douglas County under MAS 3, with MAS 4 pending funding.
SA-18	Flood studies and maps should be updated after significant flooding events.	No action to date.
SA-19	Elevation Reference Marks (ERM) should be permanent monuments and updated on a regular basis.	CWSD supports the Counties to mark and update their ERMs.
SA-20	ERMs should be in the same datum as base flood elevations on FIRMs or a datum that is readily convertible to FIRM datum. Move towards FEMA recommended NAVD 88 datum.	CWSD encourages all ERM throughout the watershed to be created or converted to NAVD 88 datum.

Plan Element	Suggested Action	Status
SA-21	A master list of ERMs should be developed, maintained, and made available to interested parties.	CWSD has become aware of a national data base through National Oceanic and Atmospheric Administration, http://www.ngs.noaa.gov/cgi-bin/ds_county.prl as well as a map explorer tool with additional data: http://www.ngs.noaa.gov/NGSDataExplorer/ . CWSD encourages local jurisdictions to refer to this site and maintain any changes or updates to their ERMs.
SA-22	Photo-Monitoring program (on-the-ground and aerial) should be developed and coordinated on a watershed level to document flooding and flood hazards in a consistent matter.	Topic discussed in CRC meetings. A list of picture points has been developed.
SA-23	Known and projected hazard areas including channel migration hazards should continue to be documented and updated information should be incorporated into planning processes.	Topic discussed in CRC meetings but not acted on to date.
SA-24	LiDAR and/or aerial photography (on a watershed level) should be conducted on a 5-year basis, or as needed, to provide updated information on channel movement and floodplain condition.	CWSD and NDEP funded a LiDAR survey of the Carson Valley in 2012. This survey data will be used to update the hydrologic model for the Carson Valley.
SA-25	Establish building set-backs in flood hazard areas, where appropriate, to reduce severe hazards from channel migration.	Topic discussed in CRC meetings but not acted on to date.
SA-26	Channel cross-sectional surveys should be conducted and well documented to track long term changes in river channel.	Surveys have been done under contracts for FEMA MAS-1, 2 and 3.
SA-27	Identify unstable stream banks and areas with high potential for erosion.	Topic discussed in CRC meetings but not acted on to date.

Plan Element	Suggested Action	Status
SA-28	Promote the use of non-structural, bio-engineering (soft-engineering utilizing natural materials) techniques in river restoration projects in combination with other proven methods.	Bio-engineering techniques are being used on river restoration projects being accomplished by the watershed Conservation Districts and their partners. CWSD helps fund many of these bank stabilization and river restoration projects.
SA-29	Update the 1996 Fluvial Geomorphic Assessment.	Topic discussed in CRC meetings but not acted onto date.
SA-30	Develop watershed-wide outreach and education program about floodplain importance and flooding hazards.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.
SA-31	Brochures should be developed for distribution on a watershed level with consistent messages and information for the general public.	Four brochures focused on floodplain issues have been created by UNCE with funding from CWSD and NDEP. UNCE Fact Sheets 09-20, 11-69, 11-70 and 12-06. These brochures are available at CWSD and are for public distribution. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.
SA-32	CWSD website will provide information on the Regional Floodplain Management Plan and provide emergency contact information. Local governments and other entities can link to this website to increase distribution.	The information has been posted on the CWSD website as is updated when changes occur.

Plan Element	Suggested Action	Status
SA-33	Annual Flood Awareness Week will be established with the objective of providing information about flooding and flood hazards to the general public.	Topic discussed in CRC meetings. A grant request has been submitted to Corps of Engineers in 2013 by UNCE to aid in this element.
SA-34	Special Events, River Work Days, and other outreach opportunities should be utilized to help raise awareness of flooding hazards and importance of floodplains.	CWSD and NDEP provide funding for the administration and implementation of annual events such as Carson River Work Days and the Carson River Festival.
SA-35	Investigate opportunities to remove existing restrictions, such as berms, to allow flood waters to access floodplain.	The Alpine Watershed Group and Alpine County are partnering to achieve floodplain restoration at Markleeville Creek. Additionally, the Hope Valley Meadow Restoration is in the design phase and implementation funding is being sought for both projects. Partners on this project include the AWG, the USFS, and American Rivers.
SA-36	Limit the use of future management measures such as dams, levees, and floodwalls.	CWSD encourages the Living River approach to floodplain management. Each County along the Carson River adopted the plan which specifically identifies the need to limit the use of these types of flood structures.
SA-37	Design future bridges and roads to protect floodplain, accommodate and not restrict changing river course, and minimize back up of flood water.	Topic discussed in CRC meetings but not acted on to date.
SA-38	Investigate opportunities to enhance grade control structures.	Topic discussed in CRC meetings but not acted on to date.

Appendix I:
Hydraulic Modeling and Floodplain Mapping Guidelines

Hydraulic Modeling and Floodplain Mapping Guidelines

Carson River, NV & CA

Date: October 2011

Prepared for:

Carson Water Subconservancy District

Funding Provided by:

Nevada Division of Environmental Protection

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

Project number: 137049

List of Acronyms

1-D	One-dimensional
2-D	Two-dimensional
ASPRS	American Society for Photogrammetry and Remote Sensing
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CRC	Carson River Coalition
CTP	Cooperating Technical Partners
CWSD	Carson Water Subconservancy District
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DTM	Digital Terrain Model
ESRI	Environmental Systems Research Institute
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
GIS	Geographic Information Systems
GPS	Global Positioning System
GUIDE	Guidelines and Specifications for Flood Hazard Mapping Partners
HEC-RAS	Hydrologic Engineering Centers River Analysis System
IMU	Inertial Measurement Unit
LiDAR	Light Detection and Ranging
LN	Break line format
Mr. SID	Multi-resolution seamless image database
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NDEP	Nevada Division of Environmental Protection
NFIP	National Flood Insurance Program
n	Manning's Roughness Coefficient
PT	Point line format
RMSE	Root mean square error
SA	Suggested Action
TIN	Triangulated Irregular Network
TSDN	Technical Support Data Notebook
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
WSELs	Water-surface elevations
WSP	Water Supply Paper

Table of Contents

List of Figures

List of Tables

Appendices

1 INTRODUCTION

> *"Flooding in the Carson River Watershed is a natural process that occurs on a regular basis. It is also one of the most devastating and costly natural events that our communities face. The Carson River is unique in that we have no flood control structures and have extremely limited upstream storage capability. However, we have the best flood control mechanisms available – open floodplain lands.*
>
> *The actions of one community have the potential to impact downstream communities, making flooding a watershed-wide challenge."*
>
> *-Carson River Watershed Regional Floodplain Management Plan*

These excerpts from the *Carson River Watershed Regional Floodplain Management Plan* (Plan) summarize the issues, concerns, and opportunities communities face along the Carson River. The Plan is a living document providing suggested actions and strategies for floodplain management within the Carson River watershed. All communities along the river have adopted this Plan to encourage the realization of the value and critical functions provided by floodplains for public safety and reduction of flood damage. Actions were developed to address the need for accurate data, reduction of negative impacts from existing infrastructure, and outreach and education.

In an effort to provide guidance for future floodplain mapping efforts along the Carson River, the Carson River Coalition (CRC), hosted by the Carson Water Subconservancy District (CWSD), organized a Hydraulics and Hydrology Committee in May 2010. This committee, made up of stakeholders and experts, met to provide guidance on modeling and flood mapping protocol for the Carson River. The committee discussed specific models and methodologies and chose a preferred set of models, procedures, specifications, and guidelines. Funded by the Nevada Division of Environmental Protection (NDEP), a modeling and mapping guide was chosen as a mechanism to summarize these preferences and provide a manual for the Carson River watershed.

This guide covers required modeling and mapping procedures for the Main Carson River and both East and West forks. The downstream extent shall be Lahontan Reservoir in Lyon County, Nevada. For the West Fork, the approximate upstream extent shall be Hope Valley, and for the East fork, Monitor Pass, both in Alpine County, California (Figure 1). This guide, and subsequent modeling/mapping, addresses several suggested actions (SAs) from the Plan:

- **SA-14:** Secure funding for and conduct watershed-wide unsteady-state state modeling to identify flood water storage requirements and to look at the cumulative effects of watershed development.
- **SA-15:** Support Federal Emergency Management Agency's (FEMA) Map Modernization Program and encourage FEMA to update Flood Insurance Rate Maps (FIRMs) with current and future conditions. Significant verification of topography and other variables should be conducted prior to release of draft FIRMs.
- **SA-16:** CWSD continue to participate in FEMA's Cooperating Technical Partner Program.
- **SA-17:** Strive for up-to-date and consistent data collection and maintenance to include updating of flood studies where necessary and conduct studies for significant water courses and alluvial fan areas that have not been analyzed. This data should be used to update FEMA maps and fill data gaps. Complete delineation of the floodway throughout river system and incorporate into FIRMs.
- **SA-18:** Flood studies and maps should be updated after significant flooding events.

The ultimate goal of this guide and modeling/mapping effort in the Carson River Watershed is to provide a consistent and complete tool to assess cumulative impacts of land use changes within the 0.2-percent chance (500-year) floodplain. There is also a strong desire among local stakeholders to use the modeling/mapping as a means for mitigating flood hazards to downstream communities, loss of riparian habitat and floodplain function, and degradation of water quality. Any proposed land use changes can be introduced to the model to evaluate cumulative impacts to floodplain extents, peak flow, peak flow timing, and flood volumes.

The CWSD, NDEP and participating communities require the procedures outlined in this guide, to the greatest extent practicable, accompanied by sound engineering judgment, for future floodplain modeling and/or mapping within the 0.2-percent (500- yr) floodplain extents along the Main Stem and East and West forks of the Carson River in the study areas outlined in Figure 1. This guide will also serve as a basis for any model/map revisions.

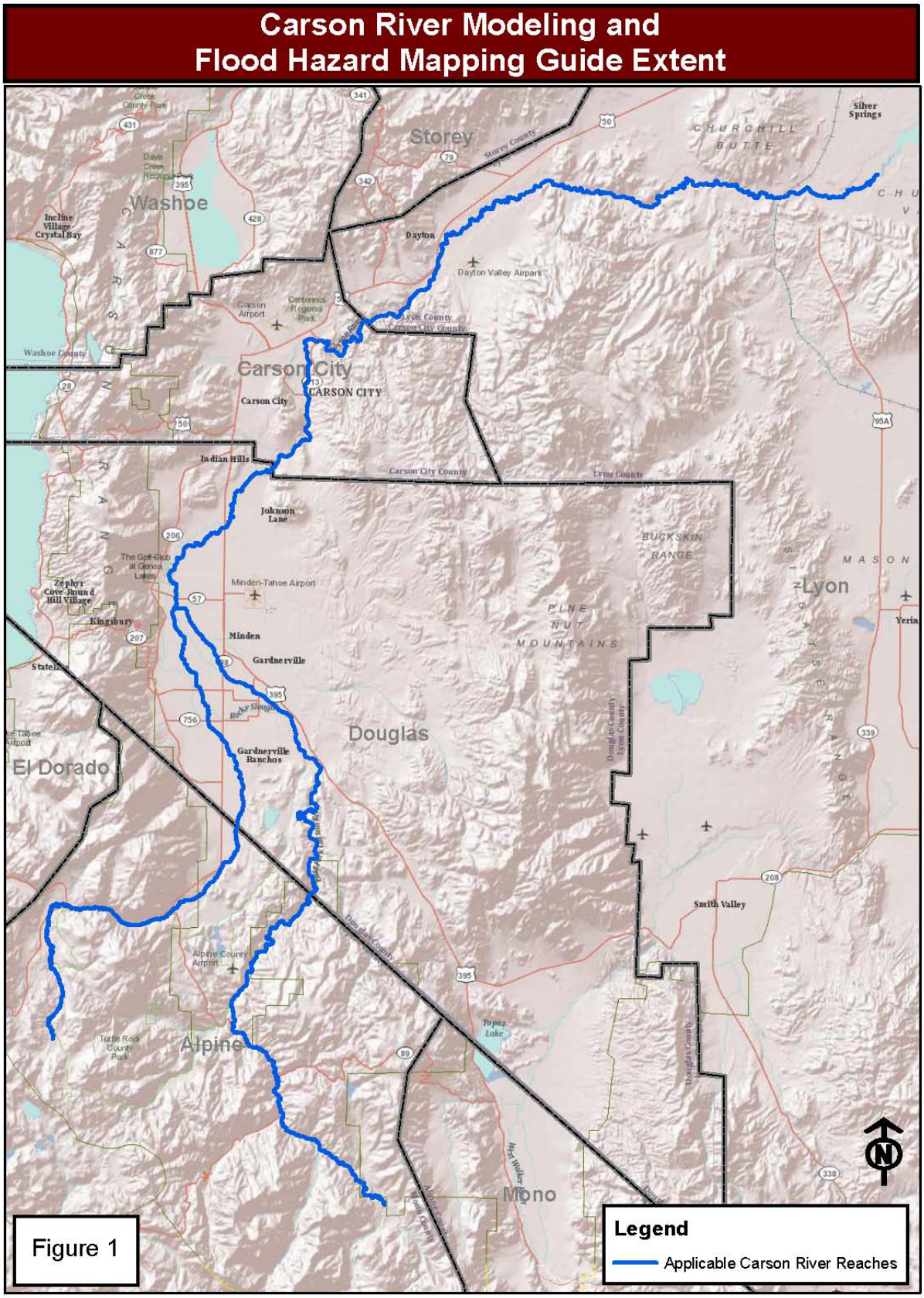

Figure 1: Study area map

2 PURPOSE AND SCOPE

The purpose of the Carson River *Hydraulic Modeling and Floodplain Mapping Guide* (Guide) is to provide criteria, standards, and modeling guidance for future hydrologic analysis, hydraulic modeling and flood hazard mapping studies on the Carson River within Lyon, Carson City, Douglas and Alpine counties. It provides a convenient source of technical information that is specifically tailored to the unique hydrologic and hydraulic characteristics of the Carson River watershed. Practitioners' use of the consistent set of criteria in this guide will result in uniform modeling practices throughout the watershed, across jurisdictional boundaries, and potentially reduce conflict between regulatory agencies and the land development community. It should be noted that this Guide only applies to the floodplains and floodways associated with main stem and the East and West forks of the Carson River. It is not intended to provide modeling direction for tributaries or alluvial fans associated with the Carson River. Topics not included in this Guide are to be conducted using best engineering judgment and local, state, and federal standards.

The Guide is not intended to replace or supersede federal regulations set forth in 23 Code of Federal Regulations (CFR) Part 650, 44 CFR Part 60, or 44 CFR Part 65. The Guide covers types of models to be used, acceptable software, data requirements, data collection, terrain development, and surveying standards, specific direction on hydrologic and hydraulic modeling parameter selection, and prescribes floodplain delineation techniques. This guide does not cover rainfall-runoff simulation.

3 CONCEPTUAL FRAMEWORK

The following section summarizes a variety of pertinent concepts relating to the technical portions of the Guide. A broad overview of hydrology, hydraulic modeling, and Geographic Information Systems (GIS) is presented to familiarize the reader with these concepts.

3.1 Hydrology

An accurate and useful hydraulic model is predicated on a sound hydrologic analysis for the study reach of interest. Generally, two different approaches can be used to represent the flow of water in a hydraulic model. These are known as steady-state flow and unsteady-state flow.

Steady-state flow assumes that depth, velocity, and discharge at a given location do not vary with time. A single flow value is assumed along the entire study reach. A common application of a steady-state flow evaluation is the use of peak discharges associated with flood events.

Unsteady-state flow assumes that discharge, as well as depth and velocity, can change over a given time period at a single location and throughout the study reach. This change in flow over time is often represented graphically by a hydrograph, with time on the *x* axis and discharge or flow on the *y* axis (Figure 2). Hydrographs for both the 1997 and 2006 floods on the Carson River at the United States Geological Survey (USGS) stream gage near Carson City are shown in Figure 2. It should be noted that although the length and magnitude of the two events shown in Figure 2 are quite different, the overall shape of the hydrograph curves is quite similar.

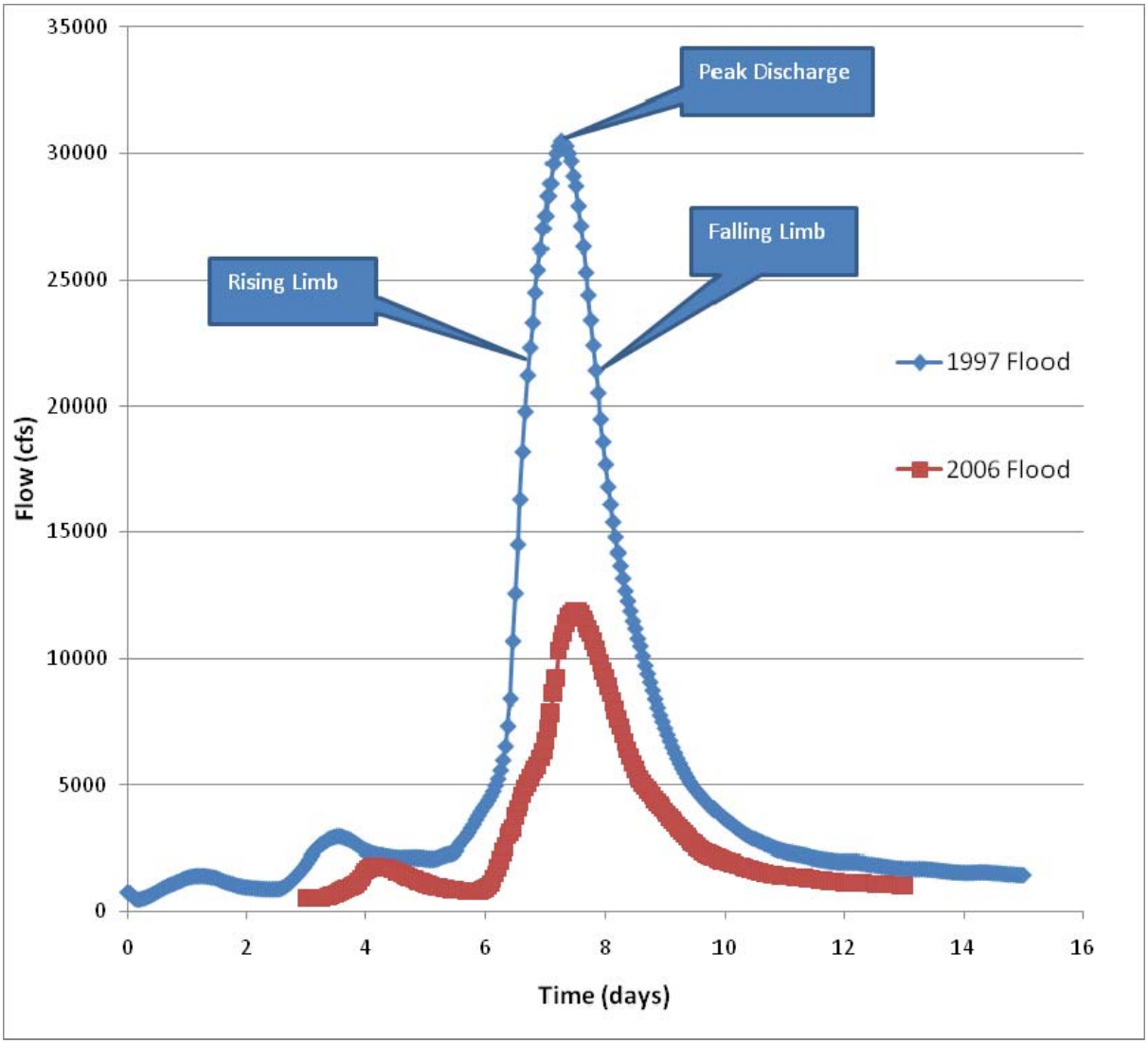

Figure 2: Example hydrographs from the *Carson River Near Carson City* USGS stream gage

The time period chosen often represents a specific storm event, extending from the time flow increases above normal baseflow until the storm peak has passed and flow returns to normal levels. The portion of the hydrograph with increasing discharge is known as the rising limb, while the section of decreasing discharge is called the falling limb. The highest point on the hydrograph curve indicates the peak discharge for the storm. The way that the watershed responds to precipitation determines the shape of the hydrograph. If runoff rapidly makes its way into the stream channel after the start of the storm, the rising limb will be quite steep, whereas a flatter sloping rising limb indicates that precipitation takes longer to arrive in the channel from the overbank regions. This explains why the two curves shown in Figure 2 have a similar shape, but different magnitudes. The area under the curve represents the volume of water associated with the storm event in question.

Both steady- and unsteady-state models have benefits, drawbacks and appropriate applications. Steady-state hydraulic models have the benefit of relative ease of setup and stability during analysis. However, they are not able to model the range of flows that occur during a storm event. Unsteady-state flow models are able to more accurately simulate the timing and volume of the flood event being modeled. In addition, an unsteady-state model is able to represent flow attenuation caused by storage of flood water in the channel and overbank areas. It is the desire of member agencies within the Carson Water

Subconservancy District to simulate the attenuation that occurs in the reaches where significant overbank storage exists. It is the desire of the member agencies to exercise a floodplain management strategy that considers both the hydrologic and hydraulic impacts of encroachments or modifications to the Carson River floodplain that would change these storage dynamics and result in downstream changes to the hydrograph.

3.2 USGS Streamflow Data

USGS operates and maintains streamgaging stations on rivers and streams throughout the world. These stream gages collect stage data, generally recording one stage value every 15 minutes. Stage is the height of the water-surface above a given stream gage datum. These data are available from USGS in numerous formats.

The raw 15-minute data, referred to as instantaneous data, are available through the USGS website (*http://waterdata.usgs.gov/nv/nwis/rt*). Specific data requests may be required to obtain instantaneous data prior to roughly 1990.

Mean daily flow data are also provided by USGS. These values represent an average of the recordings for a given 24-hour period. This averaging process tends to impact the instantaneous peak flow values that are reported, reducing the usefulness of this data set for statistical analyses in support of flood flow determinations.

Peak streamflow data represents the maximum instantaneous flow value that occurs during each water year. These data are not subject to averaging; therefore, they provide a better base for flood flow estimates. It should be noted that there may be gaps in peak flow measurements due to errors in measurement or damage to stream gages during extreme events. A minimum of 20 data points (water years) are recommended when performing statistical analyses on peak flow data.

As mentioned above, the automated stream gage digitally records stage, rather than directly recording discharge. Stage data are converted into discharge based on a stage-discharge rating curve, which is developed by taking direct discharge measurements in the river at various stage elevations over a period of many years. These discharge values are plotted against the related stage elevations to develop and approximate the rating curve for that stream gage location (Figure 3). During large flow events, care must be taken when attempting to extrapolate the rating curve beyond measured data points. It should also be noted that measurements of flow rate are performed with a variety of methods. Direct measurements have been performed using a flow meter or more recently with newer Doppler sounders. These types of measurements can be very accurate for the lower range of stages. At higher depths and velocities, these measurements can be more complex and less accurate. The data collected for these estimates includes the cross section at the location of the measurement (which is typically the same location over a period of time), velocity distribution, cross section area and estimated discharge. All of these data can be useful for model calibration.

Some of the methods used to estimate peak flow are based on indirect measurements. These measurements use the slope-area method after the event has occurred. This is done with cross section and high water mark surveys. The accuracy of these estimation techniques are highly dependent on the quality of the high water marks, which can often be difficult to accurately determine for a number of reasons, and upon estimation of roughness parameters for the reach in which the estimate is performed. If the indirect estimate is inaccurate, it can influence the rating curve fit to the data points and result in an inaccurate estimation of an event's peak, hydrograph shape and volume. Therefore, these data need to be reviewed for reasonableness when attempting to calibrate an unsteady flow model using gage data.

It is also important to understand data collection history. The location of the gage or the location for direct measurements may have changed over the history of the gaging station. This is also important to consider when using these data.

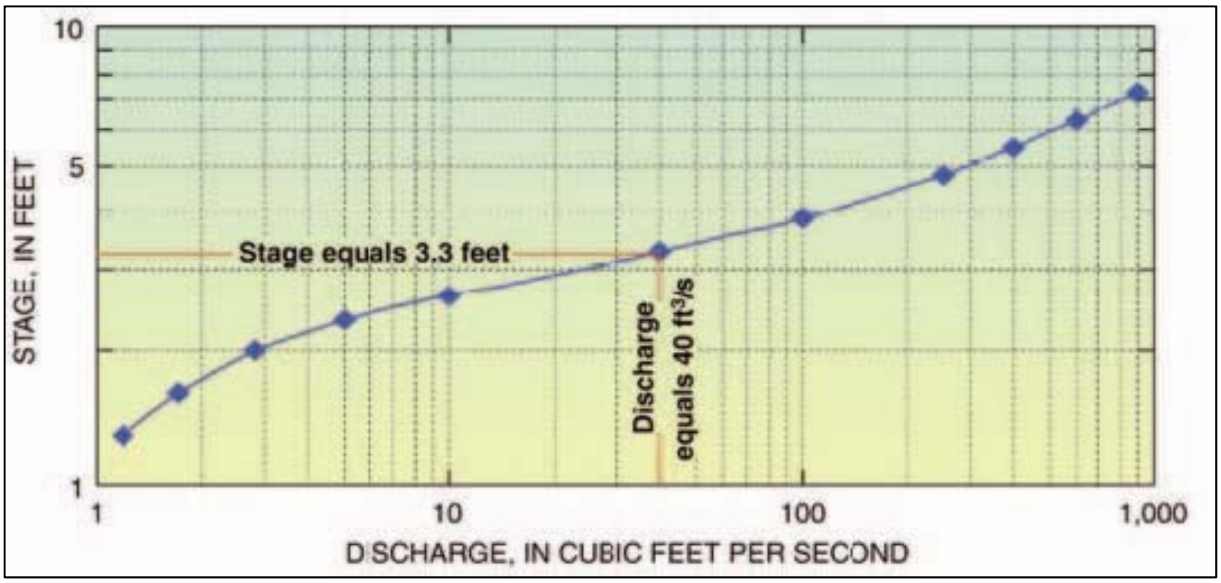

Figure 3: Example rating curve, after USGS, 2011

3.3 Hydraulic Modeling

Hydraulic models are used in many different settings to estimate water-surface elevations, flooding inundation limits, flow velocities, flow rates, and other hydraulic parameters. Models can be used to simulate irrigation systems and pipe networks as well as open channels and natural river systems. Numerous software programs have been developed for this purpose. Each software package has an appropriate use, depending on conditions and the type of data output desired. River systems, such as the Carson River, are generally evaluated using two types of models: one-dimensional (1-D) steady and unsteady flow models and/or two-dimensional (2-D) unsteady flow models.

3.3.1 One-dimensional Modeling

One-dimensional models use a simplifying assumption that hydraulic parameters, such as water-surface elevations, are represented by an average value across an entire cross section when estimating stage, velocity distribution and energy losses between cross sections (Figure 4). This assumption is essentially correct for river systems where flowpaths in the channel and the overbanks are well-defined, and overbank flooding is at the same water surface elevation as the main channel. Often, these models can simulate bifurcated flow using lateral structures and interconnected stream reaches or storage areas (unsteady models). One-dimensional models can be run in steady- or unsteady-state, depending on the physical setting and the purpose of the modeling effort.

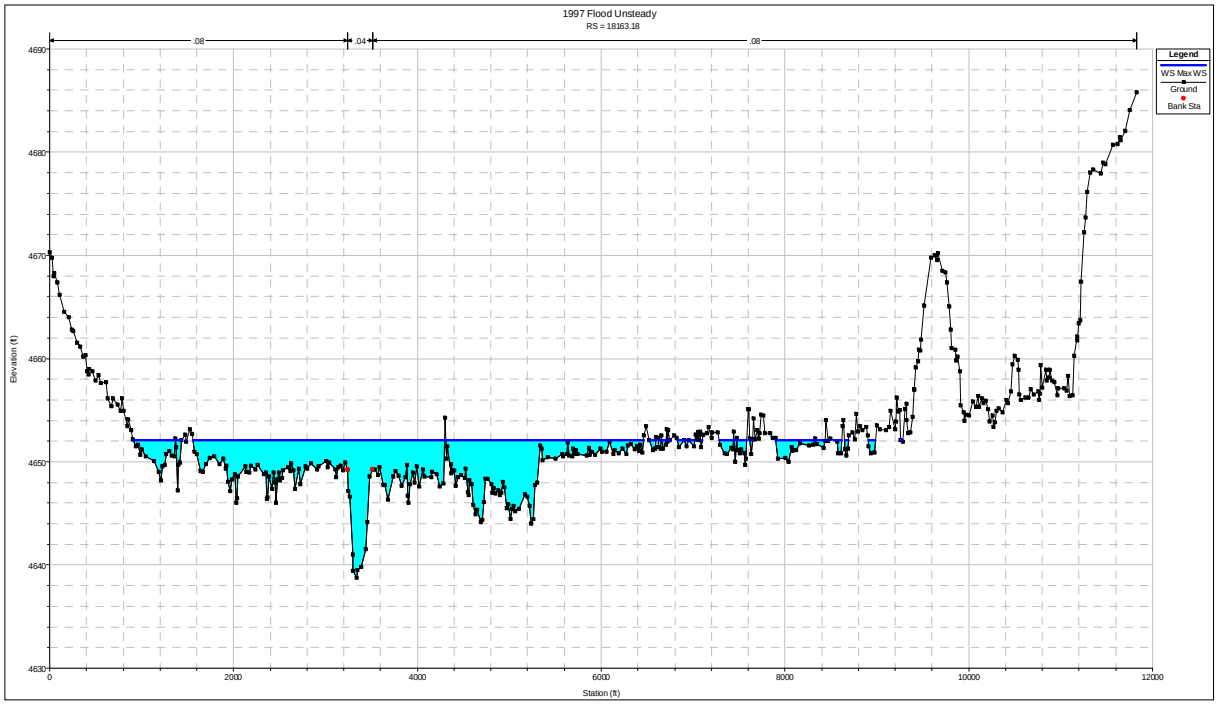

Figure 4: One-dimensional model cross section showing constant water-surface elevation

Unsteady–state flow 1-D models use a hydrograph as flow input. The full dynamic wave solution takes into account both conservation of mass and conservation of momentum. This unsteady-state analysis allows the model to account for both temporal and spatial changes in flow conditions within the system. The advantages to this system are that changes in flood wave timing, volume, and peak flows can be evaluated along a study reach. This makes 1-D unsteady-state modeling a valuable tool to evaluate downstream impacts of changes in the Carson River floodplain.

3.3.2 Two-dimensional Modeling

In generalized terms, 2-D models operate on a grid- or mesh-based routing scheme with a single water-surface elevation applied to each gridded section. Hydraulic parameters are calculated for each cell and compared to adjacent cells to route water through the grid network. Two-dimensional models are typically run with a hydrograph as input and are computationally more complex than 1-D models.

A common 2-D application is for analysis over complex topography (e.g., alluvial fans) where flow frequently bifurcates or converges while traversing through a watershed. Volume conservation is an important part of 2-D modeling. Like most 1-D models, most 2-D models also employ a rigid boundary assumption.

An example of 2-D modeling for an alluvial fan in the arid southwest is depicted in Figure 5. Using this tool, a visual impact analysis can be prepared for depths, velocities, and inundation limits within the study area. It should be noted, that this is simply an example of a 2-D application. Application of a rigid boundary assumption to an active alluvial fan is not a valid solution for this type of flooding hazard since it would not account for changes in geometry due to deposition, erosion or channel avulsions.

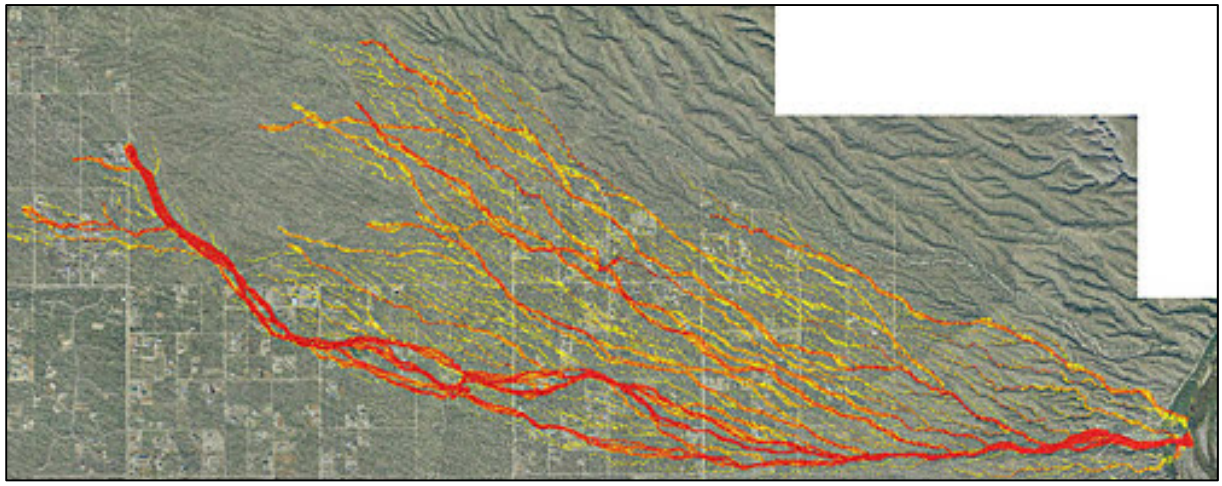

Figure 5: Example: Two-dimensional modeling for alluvial fan

3.4 Geographic Information Systems (GIS)

GIS is a multi-faceted tool that promotes use and development of spatially referenced data, data storage, and visual representation of the data across many disciplines. Distinct advantages of using the GIS platform for model development are the ability to reduce the effort and increase the accuracy associated with pre- and post-processing the results from hydraulic models. Many forms of spatial data can be used in the data processing allowing a more efficient and verifiable means of representing spatially variable data (land use, roughness, topography, flow patterns, etc.). For water resource professionals, GIS has become an integral tool in the day-to-day operations for investigating and solving problems. GIS aids in the development of graphical products for visual review with corresponding tabular attribute tables that containing the source data. An example of cross sectional data displayed in GIS with the source attribute data are shown in Figure 6.

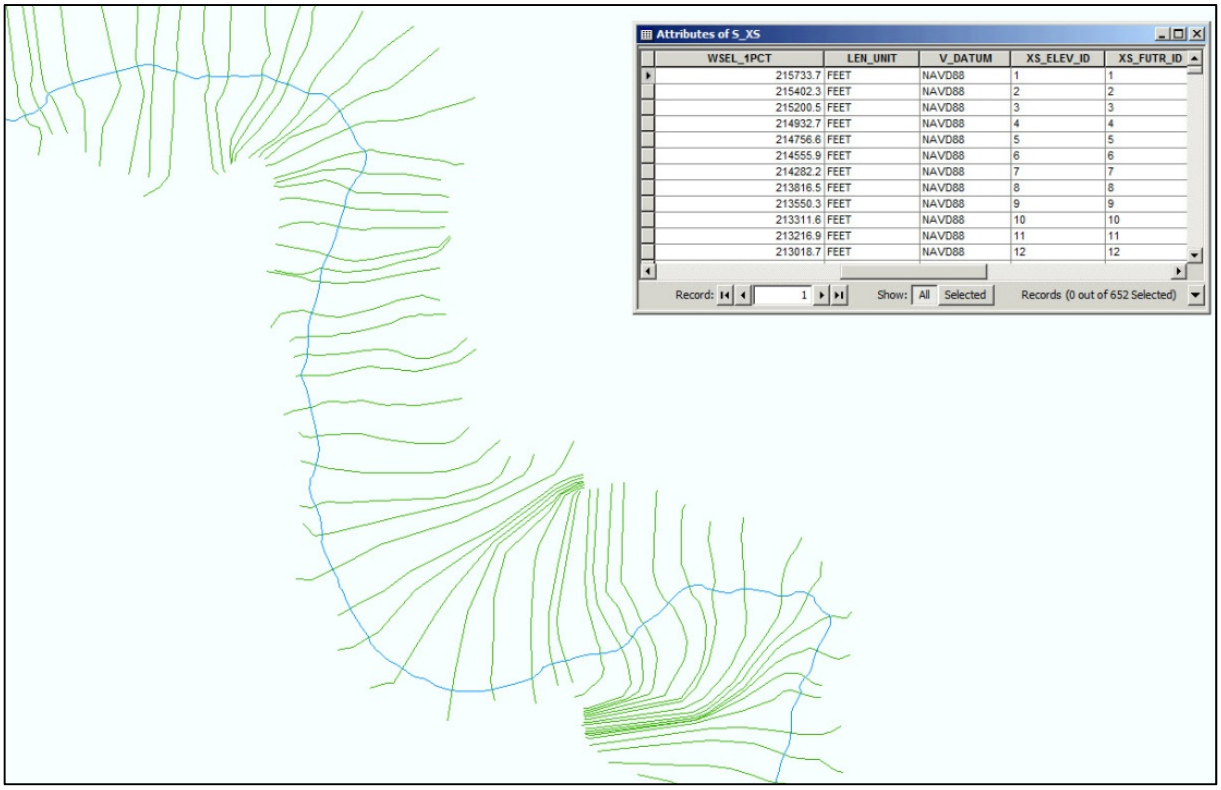

Figure 6: Example GIS visual and tabular product

Within the GIS software platform, various extensions and tools are available to aid in the collection and extraction data for hydraulic and hydrologic analysis. Examples are the HEC-GeoHMS and HEC-GeoRAS tools developed by Environmental Systems Research Institute (ESRI) for the U.S. Army Corps of Engineers (USACE). Through the use of GIS, floodplain boundaries can be developed and displayed from water-surface elevations (WSELs) from a hydraulic model. GIS also has the capability to develop terrain/surface models from raw topographic data to support the extraction of geo-referenced hydraulic model geometry. Figure 7 is an example of a digital floodplain modeling output overlaid on a digital terrain.

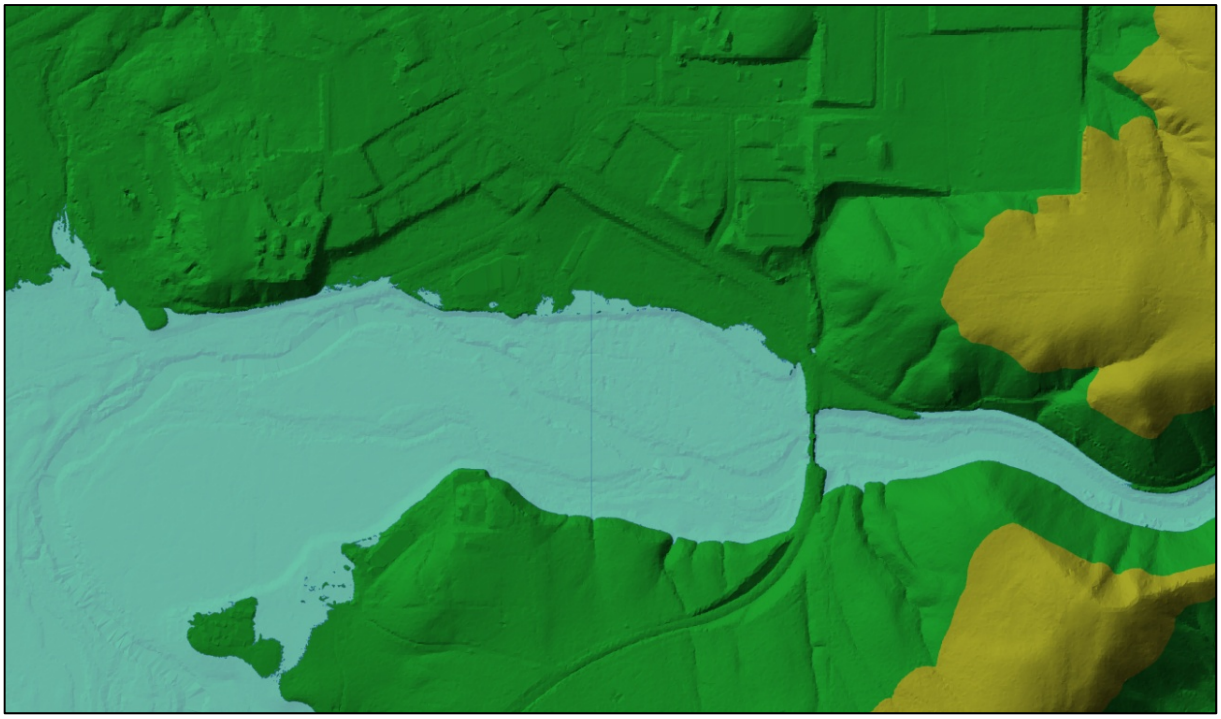

Figure 7: Example GIS digital floodplain on terrain surface

GIS has the capability to provide aesthetically pleasing and technically sound map products that support data development, alternative analysis, stakeholder reviews, FEMA deliverables, and public involvement. An example of work maps developed in GIS to display the results of a floodplain re-delineation study for FEMA is shown in Figure 8.

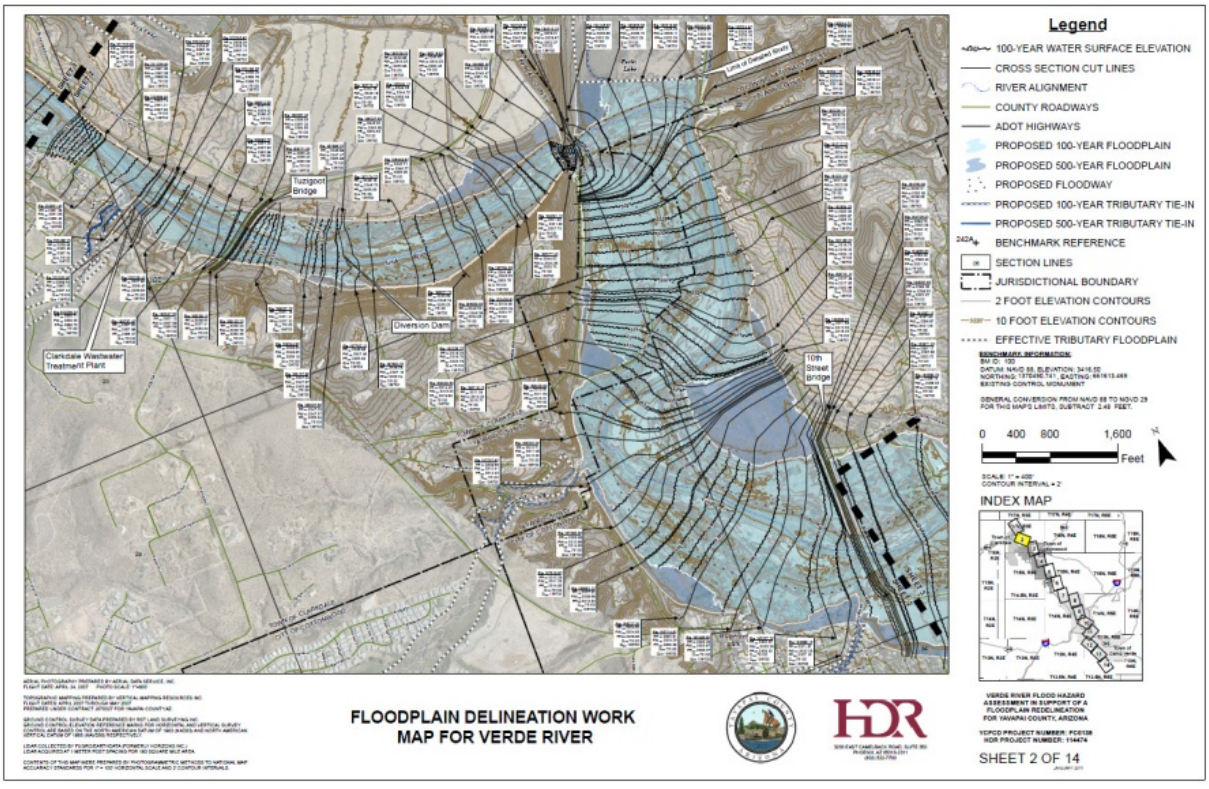

Figure 8: Example GIS floodplain re-delineation work map

3.5 Historic Flooding

The Carson River system periodically experiences flood events. Typically, these events occur during the winter season involving rain-on-snow. Three large floods have occurred since 1986. On February 19, 1986, a warm rainstorm resulted in a peak flow at the Carson River near Carson City stream gage of 13,200 cubic feet per second (cfs), while the Carson River Fort Churchill stream gage recorded a peak flow of 16,600 cfs. From December 30, 1996 to January 2, 1997, a series of warm rain storms produced rain on an unusually heavy snowpack, resulting in the largest flood on record. The Carson City stream gage peaked at 30,500 cfs, and the peak flow at the Fort Churchill stream gage was 22,300 cfs. Another warm storm occurring over December 30 and 31, 2005, resulted in a maximum flow of 11,900 cfs at the Carson City stream gage and a flood flow of 9,800 cfs at the Fort Churchill stream gage. The estimated recurrence intervals for these events are given in Table 1.

Table 1: Historic Floods on the Carson River

Date	Stream Gage Location	USGS Estimated Peak Flow (cfs)
February 1986	Carson River near Carson City	13,200
	Carson River near Fort Churchill	16,600
January 1997	Carson River near Carson City	30,500
	Carson River near Fort Churchill	22,800
January 2006	Carson River near Carson City	11,900
	Carson River near Fort Churchill	9,800

These events can be used as the basis of flow hydrographs for modeling efforts, as well as to calibrate models. As seen in Table 2, the recurrence interval of these flood events varies, depending on the location of the stream gage in question. Although the peak discharge of a certain event may not correspond to the statistically determined 1-percent chance (100-year) or 0.2-percent chance (500-year) flood flow, the shape of the flood hydrograph is very important for modeling the Carson River. The hydrograph shape represents the response of the watershed upstream of that point to a given storm.

It should be noted, that the reported estimates are determined with various methods with differing levels of confidence. Direct measurements are the most accurate form of measurement typically made by USGS. Direct measurements are performed using velocity meter or acoustic sounder. Unless unusual conditions exist at the time of measurement, USGS will typically rate these estimates as “good.” Another approach to making an estimate of peak flow is with the use of an indirect measurement. An indirect measurement is made days or weeks after the peak flow has receded. High water marks are field-identified and cross section surveys are performed for a series of cross sections in the vicinity of the high water marks. A slope area method calculation is performed to make the estimate. This slope-area calculation may be verified with a step-backwater analysis in some cases.

The accuracy of this type of estimate is dependant on many factors, such as:

- High Water Mark Data Quality – Obtaining reliable high water mark data is often difficult. Wave action, floating debris influences, superelevation on channel bends, degradation of high water marks from precipitation, presence of secondary high water marks that provide a false impression, etc., can make identification of accurate high water mark data difficult.
- Assignment of Accurate Roughness Values – Assignment of accurate roughness values may be a significant factor in some settings.
- Channel Changes – The cross section surveys are performed after the flooding event has receded. Channel bank erosion, channel bed erosion, channel bed aggradation and vegetation loss at the time of the survey may, or may not, be representative of the conditions that existed at the time of peak flow.

Anomalies in the Carson River estimates for the 1997 event have been noted and will require additional investigation to determine effective use of these data for calibrating the model.

4 TECHNICAL GUIDANCE

The following sections cover the technical guidance for floodplain modeling and mapping for the Carson River within the Study Reach defined in this guide (Figure 1). The use of the term “practitioner” referrers to any persons, agency or firm conducting floodplain modeling or mapping or updating floodplain models or maps for the Study Reach.

4.1 Hydrologic Analysis

For unsteady-state flow modeling, the practitioner shall use flow or stage hydrographs for model input and boundary conditions. Historic hydrographs extracted from the data listed in Table 2 shall be used for calibration efforts. Synthetic hydrographs for the flood recurrence interval of interest (i.e., 1- percent chance, 0.2-percent chance) shall be developed using a balanced hydrograph method described below.

It should be noted that CWSD has developed regional hydrographs for the Carson River System within the study area covered by this guide. The practitioner shall use these data to the extents practicable.

4.1.1 Hydrologic Data

USGS has installed numerous stream gages along the Carson River. A selection of those stream gages which provide useful flow data are listed in Table 2, along with the period of record of the instantaneous flow data, annual peak flow, and direct measurement data available for each stream gage. Other stream gage sites along the river have limited periods of record or do not collect stage and discharge information and are not included in this table.

4.1.1.1 Mixed Population Data

For the Carson River Watershed, floods typically occur in response to rain-on- snow events in the Sierra Nevada Mountain Range. These floods generally occur in the winter months (historical occurrence has been between November and March) and can differ from spring melt (April to June) or summer rainstorm events. The practitioner shall investigate the historic gage records to determine if a mixed flood population exists and whether analysis warrants separating winter and spring/summer events.

Table 2: Carson River USGS Stream Gages

Stream Gage ID #	Description	Instantaneous Flow Period of Record	Number of Records	Peak Stream Flow Period of Record	Number of Records	Field Measurements Period of Record	Number of Records
10309000	East Fork Carson River Near Gardnerville	10/1/1990 - 9/30/2009	551360	5/28/1890 - 5/20/2009	90	11/6/1938 - 12/30/2010	888
10309100	East Fork Carson River at Minden	3/12/1994 - 9/30/1998	140321	6/2/1975 - 3/24/1998	15	4/1/1974 - 2/22/1999	175
10310000	West Fork Carson River at Woodfords	10/1/1993 - 9/30/2009	545656	6/9/1890 - 5/3/2009	94	10/21/1938 - 12/27/2010	887
10310358	West Fork Carson River at Muller Lane near Minden	3/18/1994 - 9/30/1998	152195	3/11-1995 - 6/7/1998	4	3/14/1994 - 10/7/1998	45
10310407	Carson River near Genoa	10/1/2001 - 9/30/2009	258915	4/14/2002 - 5/4/2009	8	9/28/2001 - 12/27/2010	100
10311000	Carson River near Carson City	10/1/1989 - 9/30/2009	513242	5/12/1939 - 5/4/2009	71	8/21/1938 - 12/27/2010	916
10311400	Carson River at Deer Run Rd Near Carson City	10/1/1990 - 9/30/2009	513298	1/15/1980 - 5/4/2009	25	3/15/1979 - 1/26/2011	347
10311700	Carson River at Dayton	4/12/1994 - 9/30/2009	323517	5/12/1994 - 5/19/2008	10	4/11/1994 - 1/14/2011	168
10312000	Carson River Near Fort Churchill	4/2/1987 - 9/30/2009	517792	6/20/1911 - 5/5/2009	99	9/27/1957 - 1/19/2011	712

4.1.2 Hydrograph Development

For all hydraulic analysis conducted in the study area (Figure 1), a balanced hydrograph shall be developed using USGS stream gage data and the procedures outlined below. It is anticipated, however that balanced hydrographs will be developed by early 2012 at all stream gages for the study area and will be available from CWSD for use in hydraulic modeling.

4.1.2.1 Annual Maxima Flood Frequency Analysis

The practitioner shall develop an annual maxima flood frequency curve for the study reach of interest. For this analysis, only stream gages with 20 years of data (not necessarily continuous) or more shall be used. Instantaneous annual maxima stream flow values shall be collected for the specific reach of interest. These data shall be used to perform a Log Pearson Type III distribution using the statistical approach outlined in Water Resources Council Bulletin 17b. In general, station skew shall be used where practical. Any deviations from this shall be based on sound engineering judgment.

4.1.2.2 Flow Duration Frequency Analysis

The practitioner shall evaluate mean daily flow data to develop flow-duration-frequency relationships for the balanced hydrograph. Average daily stream flow values for the annual peak shall be used for the 1-day, 3-day, 5-day, 7-day, and if necessary, the 10-day averages to develop frequency curves for each duration. Water Resources Council Bulletin 17b shall be used for these analyses. These values shall be used in conjunction with an historic “pattern” hydrograph to develop a synthetic balanced hydrograph for the reach.

4.1.2.3 Balanced Hydrograph

Once evaluation of annual maxima and mean daily flow data is complete, the practitioner shall use these data points along with an historic “pattern” flood hydrograph, to construct a balanced hydrograph. The instantaneous peak flow estimate shall be straddled by the 1-day, 3-day, 5-day, 7-day, and 10-day peak values and to create a preliminary balanced hydrograph. Adjustments to the preliminary hydrograph shall be made to preserve volume and capture the shape, to the greatest extent possible, of the pattern hydrograph.

4.2 Data Collection and Data Development

The following section summarizes the types, form, and specifications for data collection and development to support hydraulic modeling and mapping.

4.2.1 Aerial Photography

Aerial photography provides significant value by providing the visual element of the study reach and its surrounding environment. The use of aerial photography is particularly important when preparing a product that displays spatially referenced information to an audience who may have limited knowledge of the site conditions.

To support project evaluations, the practitioner shall collect ortho-rectified aerial photography for the study reach as available. If aerial photography is to be collected specifically for a project, the following procedures shall be used:

- The mapping collection for perennial rivers shall, to the extent practicable, be coordinated to occur during the low flow periods with the least amount of shadow coverages, thus providing the largest amount of exposed ground.
- Aerial photography collection for detailed projects shall, at a minimum, use 1"=600' photo scale based on post-processed airborne Global Positioning System (GPS) and Inertial Measurement Unit (IMU) coordinates for the center of the photos.
- The aerial photography collected shall be completed in cooperation with the topographic mapping collection, to ensure that both products reflect a single collection reference point in time.
- The contents of the mapping shall be performed to support the National Map Accuracy Standards for 1" = 100' horizontal scale and 2' contour intervals for both flat terrain and detailed studies used to supersede existing delineation data.
- The photographs collected shall be provided in a tiled format, with an index grid, and sequential naming using either alpha or alpha-numeric combinations from left to right and upstream to downstream.
- Documentation prepared by the aerial collection company shall include a collection report that maps the flight patterns, indicates the date and time of collections, provides a digitally reference supported grid (preferred GIS format).
- The practitioner shall prepare the delivery request of aerial photography using the Mr. SID (multi-resolution seamless image database) format with a description of the software packages utilized to produce them. This format is preferred due to the losses wavelet compression capability which yields high compression ratios and significant reduction in file sizes without compromising the quality of the raster image.

If the aerial photography collection is being conducted in support of a FEMA-level quality deliverable, the *Guidelines and Specifications for Flood Hazard Mapping Partners* [April 2003] (GUIDE) shall be followed with respect to Appendix A: Guidance for Aerial Mapping and Surveying.

The following three examples are critical excerpts that shall be followed from the GUIDE:

1. Aerial photography shall be flown under the following conditions:
   - While the sun angle is above 30 degrees;
   - When there is no snow cover;
   - When the flooding sources are in the main channels; and
   - When leaves are off the trees.
2. The assigned practitioner shall perform aerial surveys under the direct supervision of a registered land surveyor or American Society for Photogrammetry and Remote Sensing (ASPRS)-certified photogrammetrist, consistent with state regulations.
3. The practitioner shall abide by the requirements set forth with the GUIDE for vertical root mean square error (RMSE) standards in section A.8.6.1. Additionally, the practitioner shall abide by the requirements set forth with the GUIDE for pre-project and post-project deliverables in sections A.8.7.1 and A.8.7.2 respectively.

Figure 9 is an example of a gridded aerial photography deliverable within a geodatabase format to support a project coverage area.

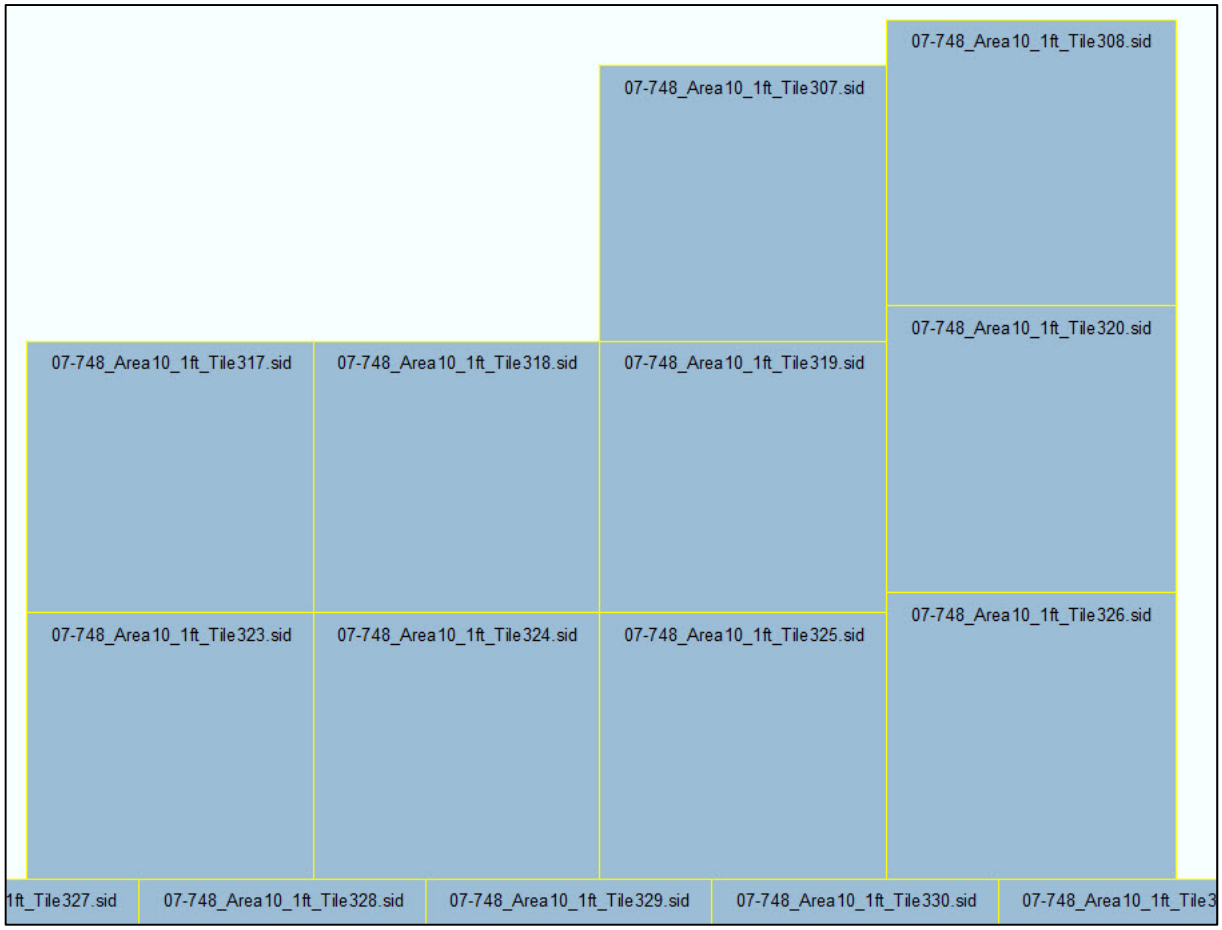

Figure 9: Example of a gridded aerial photography database deliverable

4.2.2 Terrain Data

Topographic data may be readily available for a study reach. In the event that a project is located in a remote area that does not have detailed topographic mapping, coarser data may be available from USGS for reference and use within the GIS platform.

The practitioner shall conduct an evaluation to determine sources of topographic coverage and coverage extents for the study reach. The practitioner shall use the most current topographic data meeting FEMA's GUIDE, Appendix A. The data collected shall be in either point (PT) and break line (LN) format or Dense Light Detection and Ranging (LiDAR) (LAS or ASCII XYZ). Both products have unique variables for resolution, accuracy, and point spacing which affect the net size of the product produced.

A Digital Elevation Model (DEM), Digital Terrain Model (DTM), or Triangulated Irregular Network (TIN) may be used if supporting documentation or source files accompany them and the surface meets National Map Accuracy Standards.

The product of a terrain survey after post processing by the practitioner often represents the "bare earth" equivalent which omits certain elements that are necessary to support the definition of a detailed study. The practitioner is required to collect survey data for missing terrain data. Typical survey data to be collected, described in more detail below, include the following:

- **Supplemental Survey Data:** Areas within the study limits where the topography has changed since the original aerial/terrestrial data collection.
- **Bathymetric Data:** Areas below water on the date that aerial survey was collected.
- **Hydraulic Structures Data:** Any hydraulic structures such as bridges, culverts and inline structures that affect hydraulic grade line for which as built information is absent or questionable.

4.2.2.1 Supplemental Survey Data

In many cases, the best available terrain data may be several years old. Changes in topography, such as new development or infrastructure, lateral migration of stream channels, and development of point bars/islands, may not be represented. The practitioner shall update these areas of topographic change since the date of original collection and integrate into original data. The practitioner shall perform the survey collection of XYZ data, using calibrated survey grade equipment that meets industry and FEMA standards at the time of collection.

In the event that topographic data meeting FEMA GUIDE standards does not exist, the practitioner shall collect new topographic data. Data collection shall use survey ground control methods for both horizontal and vertical survey based on the North American Datum of 1983 (NAD83) and the North American Vertical Datum of 1988 (NAVD88) respectively. Collection shall follow the FEMA GUIDE standards.

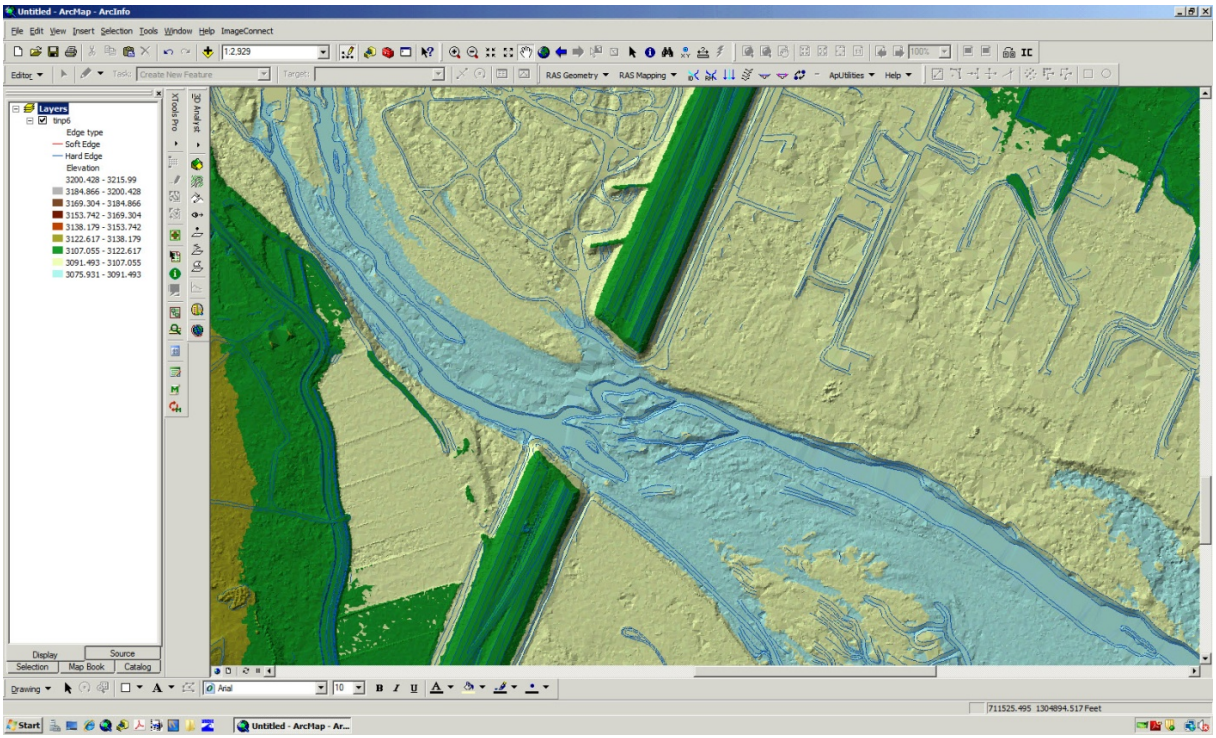

Figure 10: Example bare earth surface terrain missing bridge data

4.2.2.2 Bathymetric Data

In most instances, additional survey may be necessary to collect underwater channel geometry or "bathymetric" information. The practitioner shall collect information in support of the project need(s) as directed by a qualified water resource specialist, whom shall identify the location and frequency of cross sections. These collections are also subject to industry standards and those set forth by FEMA's GUIDE. In general, cross sections shall be collected to capture changes in channel grade, such as pools and riffles. Additionally, cross sections shall be collected at areas of channel expansion and contraction.

4.2.2.3 Hydraulic Structures Data

Hydraulic structures, such as bridges, culverts or inline dams, are often removed from LiDAR collection for the development of the equivalent "bare earth" or ground coverage file. Depending on the availability, as-built data for hydraulic structures may be available from local municipalities or transportation authorities. As-built plans have the potential to provide a cost effective mechanism for obtaining data for modeling structures such as bridges, culverts, weirs, diversion structures, or dams.

In the event that adequate information from as-built documents is not available or conflicts with survey references, additional structure surveys will be necessary. Practitioners shall perform this survey collection of XYZ data, using calibrated survey grade equipment and methods that meet industry and FEMA standards at the time of collection to accurately capture the geometry of all hydraulic structures that may effect water-surface elevations for the study reach. For bridges, this may include high chord, low chord, guard rails, deck profiles, pier information, and/or abutments. For culverts, this may include inverts, crowns, culvert size and shape, wingwalls, sediment depths, and/ or deck profile. For inline dams, this typically includes a profile along the top of the structure.

4.2.2.4 Additional Data

Additional data that may be collected to support hydraulic modeling and flood hazard mapping includes but is not limited to the following:

- Land use
- Vegetation cover
- Roads, Highways, Interstates
- At-grade-crossings, culverts, bridges
- Dams, Levees, Lateral Weirs, Irrigation Diversion Structures
- Siphons, Pump Stations
- Emergency Spillways
- Storm Water Retention/Detention Facilities
- Structures Identification (Habitable and Ancillary)
- Assessors Parcel Data

4.3 Manning's Roughness Values

Developing an assessment of Manning's roughness values is an important part of any hydraulic modeling analysis. The Manning's n value assigns a roughness parameter that simulates resistance to flow within a hydraulic model. Best practices for determining the n values consist of aerial photo interpretation, field reconnaissance, review of effective studies, and review of agency literature or published requirements, and model calibrations (not discussed in this section). The practitioner shall review the best available data and identify local requirements which may govern the selection of roughness coefficients.

4.3.1 One Percent and Greater Flood Frequencies

Depending on the return frequency the practitioner is modeling and the type of hydraulic system being modeled, a combination of aerial and/or field reconnaissance methodologies can be employed to estimate Manning's roughness values. For the purposes of this guide and as outlined in FEMA's GUIDE, Manning's n values may be estimated using aerial photography with appropriate calculation methods (outlined below) for flood frequencies equal to or exceeding the 1-percent chance (100-year) flood. Although not required, an attempt must be made to incorporate field photos of channel and overbanks for use in Manning's n estimations.

4.3.2 Less Than One Percent Flood Frequencies

For all flood frequencies less than the 1-percent chance (100-year) flood, the practitioner shall conduct a physical field reconnaissance of the study reach or wash where access and conditions permit. During this investigation, digital photography shall be collected and documented for unique site characteristics affecting the Manning's roughness values. Locations of field photos shall be recorded on aerial maps.

The n value assessment of ephemeral washes versus perennial streams will greatly differ, due to the visibility of bed material. Visual inspections of perennial streams are limited to sand bars, areas of outcropping, or under water cross section investigations due to visual restrictions from the conveyance of water. Ephemeral washes are open, limited only by isolated discharge periods, and field reconnaissance in the form of walking the wash bottom can be performed.

Photographic documentation (described above) for an ephemeral washes is standard practice, however the use of a reference grid is highly recommended to provide a sense of relative size for the comparison of bed/channel form materials depicted. An example of an ephemeral wash n value inspection tool is depicted in Figure 11, using a 1foot by 1 foot PVC pipe grid, which internally holds a string grid of 1 inch by 1 inch grid:

Figure 11: Field reconnaissance inspection tool

Photographic documentation for a perennial stream is more complex and is most often conducted from the banks of the wash or river. Although the stream bottom cannot be seen in the photography, the embankments and overbank vegetation are captured to support the development of the corresponding roughness values.

The practitioner shall develop a presentation map or series of presentation maps depicting the field reconnaissance conducted. These maps shall include the location of photographic collection points as described above with project reference information.

The practitioner shall develop a photographic documentation log, which displays the photography collected, identifies the site or photo number and the date of collection. An example of a photograph log template documenting field investigation is shown in Figure 12 for a single point.

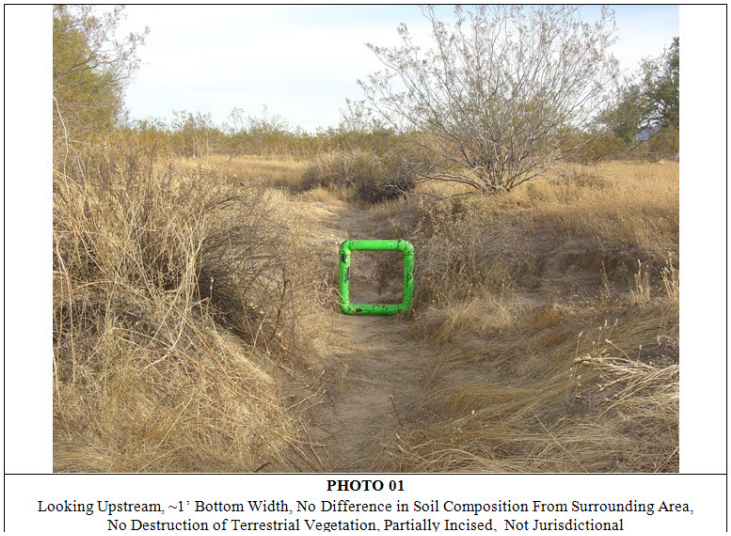

Figure 12: Example of field reconnaissance photo log at a single point

Using the photography log and the presentation maps for the field reconnaissance, the practitioner shall prepare calculations to compute the corresponding Manning's roughness coefficient, n value, based on the individual factors observed in the field.

Many textbooks and manuals have been written that describe the Manning's n value and the factors involved in the selection. Three publications often referenced for such guidance are Barnes (1967), Chow (1959), and Ree (1954). These publications may be used as appropriate to support Manning's n determinations.

The step-by-step procedures for developing the Manning's n value are detailed in USGS's Water-Supply Paper 2339 (WSP 2339), *Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Floodplains*. A simplified and brief description of the process is provided below. It should be noted that developing roughness values for floodplain can be quite different than the values used for channels. Additionally, seasonal variability for roughness coefficients may need to be considered, but is not detailed here-in.

Cowan (1956) developed a procedure for estimating the individual efforts of five factors that commonly occur to guide in the estimation of the n value for a channel. Cowan's equation for developing the n values indicates the following computation:

$$n = (n_b + n_1 + n_2 + n_3 + n_4) * m$$

Where:

n_b = a base value of n for a straight, uniform, smooth channel in natural materials
n_1 = a correction factor for the effect of surface irregularities
n_2 = a value of variations in shape and size of the channel cross section
n_3 = a value for obstructions
n_4 = a value for vegetation and flow conditions
m = a correction factor for meandering of the channel

The selection of a base n value for channel sections is based on the classification of a stable or sand channel. Stable channels remain relatively unchanged throughout most ranges of flow, while sand channels are assumed to have unlimited supply of sand with bed materials moving with relative ease to take on new bed form configurations. The roughness coefficients applied to a longitudinal reach, channel or floodplain are often located at sections of regular geometric shape or irregular shape for many naturally occurring channels.

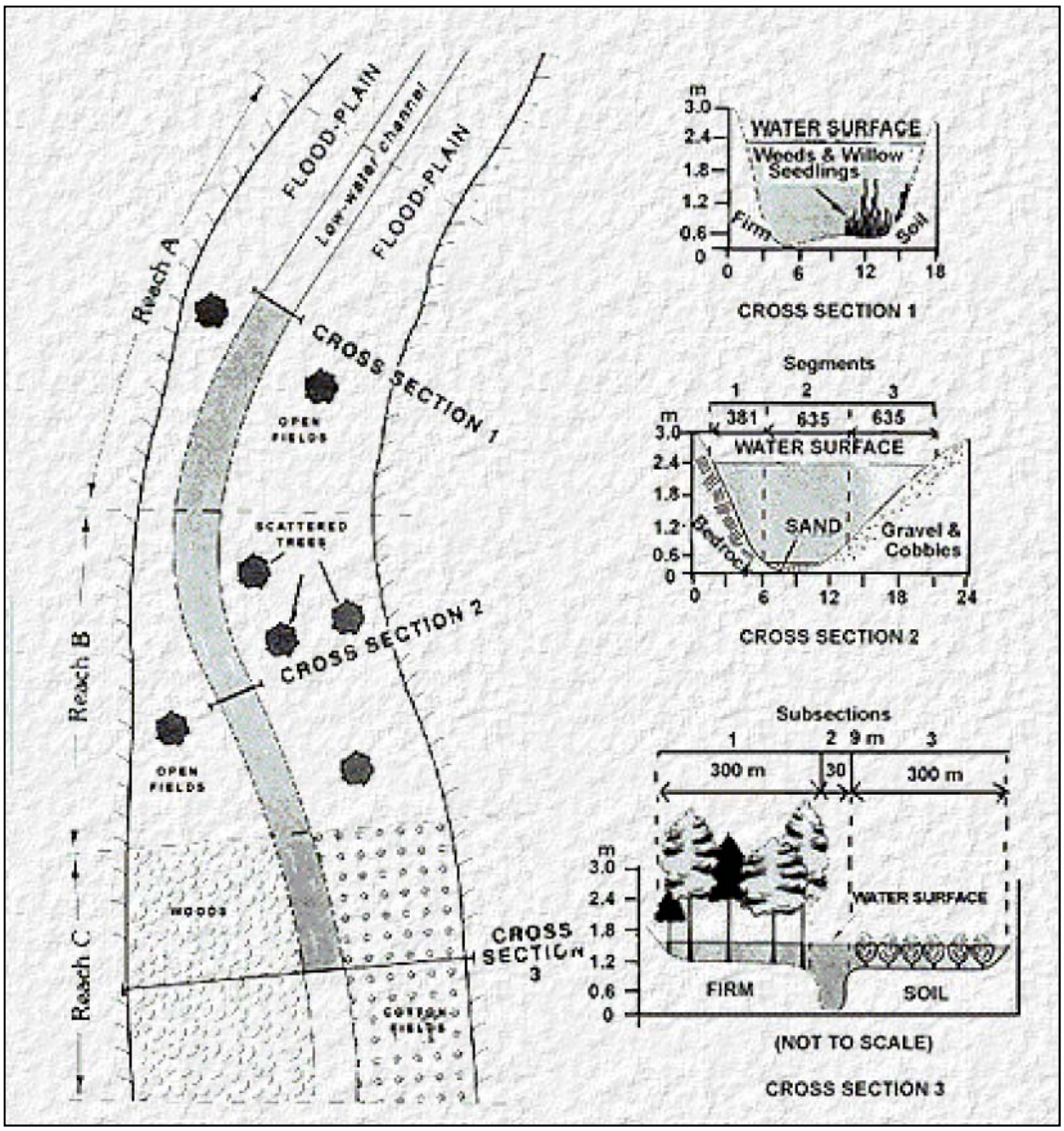

Figure 13: Graphic of floodplain subsections for Manning's n calculations (from WSP 2339)

Refer to Appendix A for suggested base Manning's n values dependant on channel bed materials.

Adjustment factors for the channel n values add increments of roughness to the base n value n_b for each condition which impacts the roughness. The following summarizes the adjustment factors for channel n values:

- Irregularity (n_1): A correction factor which accounts for the ratio of width to depth in eroded and scalloped banks. In some cases large adjustments are necessary if irregular banks contain project points into the stream.
- Variation in Channel Cross Section (n_2): A correction factor which accounts for the alternating of large and small cross sections, sharp bends, constrictions, and lateral shifts in the low-water channel bed.
- Obstruction (n3): A correction factor which accounts for both naturally occurring and man made obstructions within the channel and floodplain, assigned four levels of obstruction: negligible, minor, appreciable, and severe.
- Vegetation (n4): A correction factor which accounts for the affects of vegetation dependant on the depth of flow, percentage of wetted perimeter covered by vegetation, density, degree of vegetation flattening by high water, and vegetation alignment.
- Meandering (m): A correction factor dependant on the ratio of the total length of meandering in a channel to the straight length of a channel. Meandering is separated into three categories of minor, appreciable, and severe. This correction should only be considered when the flow is confined to the channel.

Table 1 in the WSP 2339 gives base n values, while Table 2 provides recommendations for the corresponding correction factors (n value adjustments) for n1 through n4 and m for channels. These values are separated by levels of impact and provide guidance with respect to the ranges of correction that may be applied.

The n value computed for channel roughness is determined by following the series of decision-based adjustments based on user review and application of corrections to the based n value. Similarly the n value computed for floodplains are subject to a base value which is adjusted to compensate for vegetation density in the floodplain through respective subsections.

A flow chart for procedures for assigning n values was developed within WSP 2339, which is referred to as Figure 21 in that document, providing guidance for the order of operations for both channel and floodplain roughness computations.

There are several references, guides, and technical white papers that a user can refer to for Manning's n values for typical channels. An extensive compilation of n values for channels (streams) and floodplains can be found in Chow's *Open-Channel Hydraulics* handbook (Chow, 1959). Excerpts to the most common channel values from this book have been included within the Hydrologic Engineering Centers River Analysis System (HEC-RAS) user's hydraulic reference manual to support the engineering community. In general, the bed value shall be in a range of 0.020 to 0.05 for an alluvial system in the silt to cobble range. Overbanks shall range from 0.030 to 0.20 depending on the naturally occurring vegetation and coverage materials, assuming no significant obstructions. Blocked obstructions and man made features may have an influence on the resulting overbank roughness coefficients.

An example of Manning's n value ranges and respective values within Table 3 is provided for reference:

Table 3: Example Manning's n Values for Floodplains and Channels

Type of Channel and Description	Minimum	Normal	Maximum
A. *Natural Streams*			
1. **Main Channels**			
a. Clean, straight, full, no rifts or deep pools	0.025	0.030	0.033
b. Same as above, but more stones and weeds	0.030	0.035	0.040
c. Clean, winding, some pools and shoals	0.033	0.040	0.045
d. Same as above, but some weeds and stones	0.035	0.045	0.050
e. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
f. Same as "d" but more stones	0.045	0.050	0.060
g. Sluggish reaches, weedy. deep pools	0.050	0.070	0.080
h. Very weedy reaches, deep pools, or floodways with heavy stands of timber and brush	0.070	0.100	0.150

4.4 Terrain Development

As an underlying support to the hydrologic and hydraulic modeling software packages, various types of digital terrain surfaces are used to extract model geometries. These surfaces shall be prepared from aerial survey data comprised of either digital point and break line files or mass points, such as Airborne LiDAR. Both of these data sets are commonly used. For the purposes of this Guide, the practitioner shall evaluate the opportunities for both products and their utility for the development of a single or multiple surfaces to support hydraulic modeling for the study area.

There are many software packages currently available for developing TIN or DTM from raw survey products. Both the TIN and/or DTM shall be developed from mass point files or point and break line data. Alternatively, raster or DEM data may be used for a terrain surface, however the resolution shall be small (1/2 foot square grid cell resolution) to prevent degradation and loss of quality from the source data.

The float file format is used within HEC-RAS Mapper to support post processing of HEC-RAS hydraulic model results. The float file format may be used with Mapper to support flood hazard delineation within the HEC-RAS system.

Surface models used for 2-D modeling differ based on software requirements. Data used to develop the surface model shall be in the form of "bare earth" LiDAR data (.LAS) or 3D ASCII data files (.TXT) or equivalent.

National Map Accuracy Standards for surface development and use with hydraulic modeling have been established by FEMA. The requirements for a standard TIN differ from that of a LiDAR product. The practitioner shall follow the FEMA GUIDE for mapping partners and the specific requirements of each products development and submittal criteria. Copies of all developmental information are to be provided in both electronic and hard copy for approval within a study.

Traditional photogrammetric surveys are subject to the requirements set forth by the FEMA GUIDE, specifically Appendix A, Section A.7. LiDAR surveys are subject to the requirements set forth by the FEMA GUIDE, specifically Appendix A, Section A.8 and the recent procedural memorandum No. 61 from FEMA, which addresses revised requirements for the topographic data prepared for use within a new flood hazard analysis for the Nation Flood Insurance Program (NFIP). As part of the best practices

for developing terrain data, it is essential to collect copies of the survey control data, flight report, and final sign and sealed survey report that clearly declares the contents of the submittal meet the FEMA standards discussed above. The resulting Root Mean Square Error (RMSE), both vertical and horizontal accuracies, scale, and resolutions must be declared for reference and comparison to the standards. The practitioner shall prepare finalized products with a licensed surveyor's certification, stating that products prepared comply with the FEMA GUIDE, Appendix A requirements.

In the event a single TIN surface file size is too large for utilization within the hydraulic or GIS software applications, the practitioner shall prepare mosaic TINs. Due to the potential for interpolation errors, an overlapping buffer is necessary to prevent errors during the data extraction process. A buffer zone equal to five percent of the tile size shall be incorporated around the adjoining tiles. Refer to FEMA GUIDE, Appendix A, Section A.4.4 for additional information related to the requirements for mosaic TINs.

The practitioner shall record the process used to develop the mosaicked TINs and provide the process results and a copy of the reference map in both electronic and hard copy. This documentation shall be maintained for use in the preparation of the final technical document delivery for FEMA.

4.5 Hydraulic Modeling

This section of this Guide covers hydraulic model selection and best practices for developing models. It addresses both 1-D and 2-D modeling. In general, the practitioner shall use both 1-D and 2-D models, as appropriate and unsteady-state flow inputs. Unsteady-state flow development is covered in Section 4.1 Hydrologic Analysis.

4.5.1 Model Selection

The selection of either 1-D or 2-D modeling shall be governed by the type of stream or overbank floodplain environment to be modeled.

4.5.1.1 One-dimensional

A 1-D model shall be used in areas where both the channel and overbank flow paths are either clearly defined or easily discernable from aerial photography and topographic data. Additionally, a 1-D model shall be used in situations where hydraulic structures, such as bridges, culverts and weirs need to be evaluated for their effects on hydraulic grade lines.

While there are numerous versions of hydraulic models available, HEC-RAS shall be used due to its accessibility as public domain software, computational framework, validation, forward compatibility with previous version of the software, continued support, unsteady-state modeling features, and the ability to interface successfully with supporting platforms such as AutoCAD and GIS.

The most current version of the software shall be used for modeling and can be downloaded directly from the USACE at the following website:

http://www.hec.usace.army.mil/software/hec-ras/hecras-download.html

4.5.1.2 Two-dimensional

A 2-D hydraulic model shall be used for complex unsteady-state flow environments with shallow dispersive flow which commonly bifurcates between channels, rills, or sections of undefined flow paths. As a general rule of thumb, the 2-D application is best suited when shallow flow paths traverse through the study area in a relatively random, dynamic matter, exchanging flow across multiple channels. Shallow overbanks floodplain areas and alluvial fans typically experience this type of flow behavior.

4.5.2 One-dimensional Hydraulic Model Development

The following section covers the best practices and specifications for developing a 1-D HEC-RAS model for the Carson River.

4.5.2.1 Cross Sections

Cross sections shall be oriented perpendicular to flow within the stream channels and overbank regions. This often results in section lines with one or more bends, to account for changes in flow direction across the channel and overbanks, as seen in Figure 14.

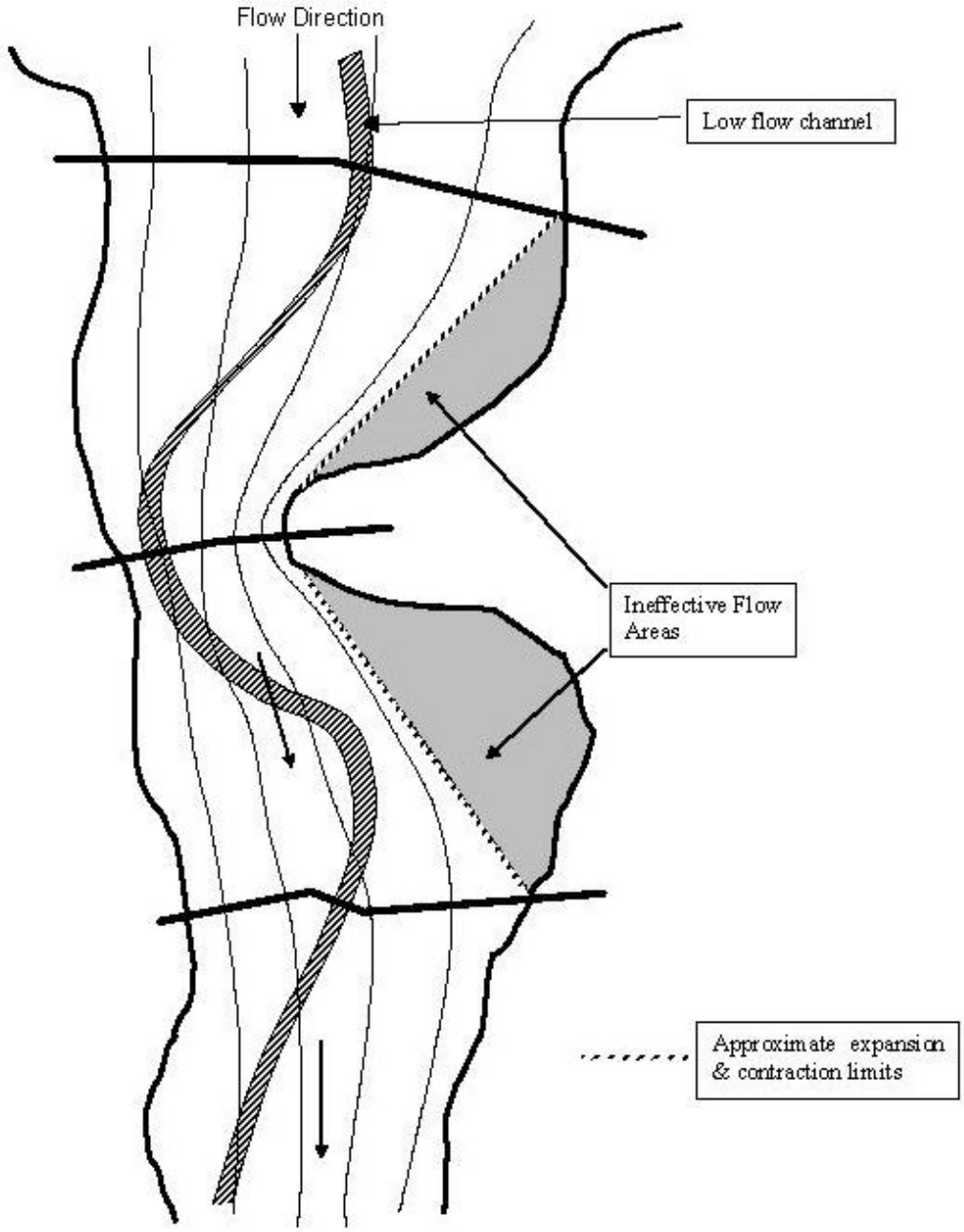

Figure 14: Cross section layout (after Arizona DWR, 2002)

Each section should be long enough to extend past the anticipated floodplain boundary of the event being modeled. The model assumes that cross section geometry remains roughly the same up and downstream for one half the distance to the next section. Therefore, sections need to be placed closely enough to represent large changes in the river system. Unsteady-state flow modeling requires sections be spaced more tightly, due to the model's sensitivity to changes in hydraulic parameters. Factors to be considered when determining cross section spacing include: significant flow contractions and expansions, pool/riffle sequences, changes in channel and floodplain roughness, and flow change locations. Sections should be placed as near as possible to surveyed cross sections to minimize usage of interpolated elevations.

4.5.2.2 Ineffective Flow

Portions of the river system which do not actively convey flow shall be accurately represented in the model. These are known as ineffective flow areas. Examples include eddies and slackwater areas behind large obstructions, as well as those areas above or below hydraulic structures where water is not being conveyed downstream. The ineffective flow areas option in HEC-RAS shall be used to render flow in these areas ineffective. Practitioners shall follow guidance outlined in the HEC-RAS Users Manual and Hydraulic Reference Guide.

Determination of ineffective flow areas in the vicinity of bridges and/or culverts depends on flow expansion (ER) and contraction (CR) ratios (Figure 15). This ratio represents the extent of ineffective flow along the channel per unit of length of ineffective flow across the channel. These factors are used to determine the distance above and below the structure that a portion of the flow is rendered ineffective. The practitioner shall follow guidance found in the USACE *HEC-RAS Hydraulic Reference Manual*. Examination of the specific structure and its placement in relation to the channel and floodplain, along with engineering judgment is also required when establishing ineffective flow areas. In many cases a 1:1 CR and 2:1 ER are used.

4.5.2.3 Hydraulic Structures

When modeling bridges and culverts, a minimum of four cross sections are required to represent the hydraulic performance of the structure and impact to water-surface elevations. Figure 15 is a schematic of the required sections from chapter 5 of the USACE *HEC-RAS Hydraulic Reference Manual.*

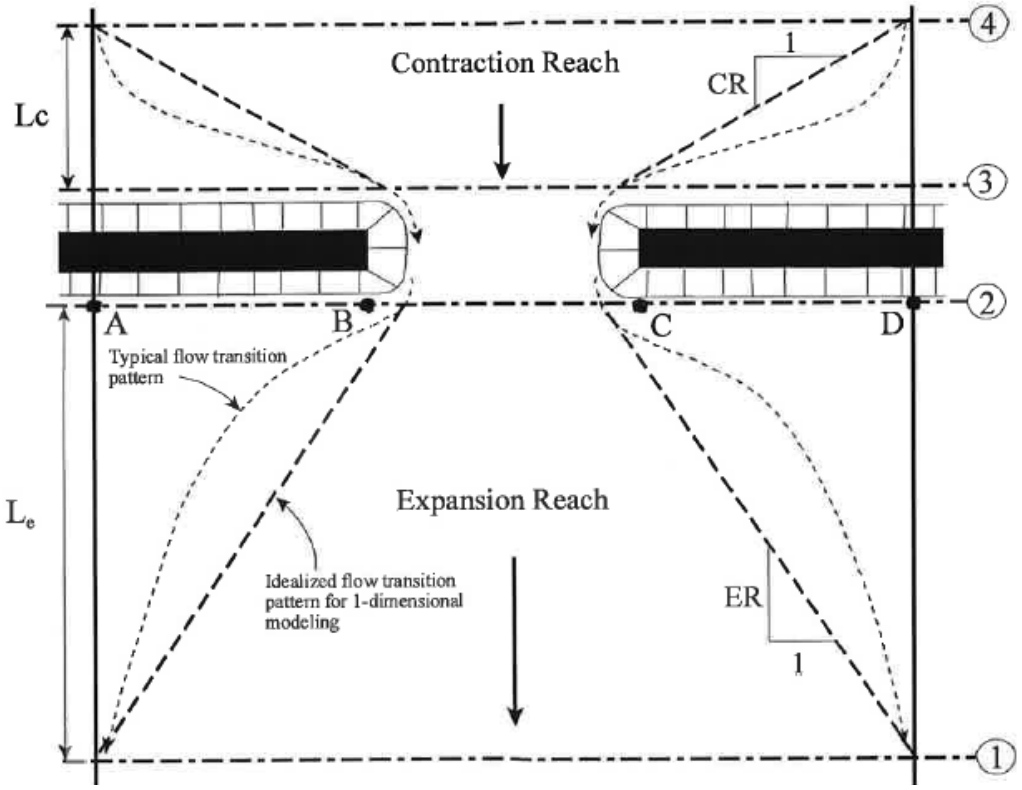

Figure 15: Cross section layout for modeling bridges (after USACE, 2010)

Cross sections 1 and 4 should be placed far enough up and downstream of the structure to be outside of the extent any flow expansion or contraction, as well as ineffective flow, caused by the structure. Cross sections 2 and 3 should be placed near the upstream and downstream faces of the structure, usually at the toe of the associated roadway embankment.

The shape, location, and dimensions of bridge piers must also be included in the model. For those bridges and culverts built on a skew, the skew angle must be calculated and entered into HEC-RAS to reduce the open area available for flow. The bridge high and low chord data must be determined and entered into the model. Survey data or as-built drawings should be used to determine the overtopping elevation of the bridge deck. If guard rails or fencing exists on the bridge, it may be appropriate to use the top of these features as the high chord elevation, depending on their ability to trap debris and/or impede flow. Any bridge abutments that block the open area of the bridge must be coded into the model as well.

When modeling culverts, entrance loss coefficients need to be selected that are appropriate to the structure in question. Table 6.3 of the USACE *HEC-RAS Hydraulic Reference Manual* provides guidance on values for various culvert configurations. The exit loss coefficient is commonly assumed to be 1.0.

At least one cross section is required to correctly model an inline weir placed in the channel. This section shall be placed upstream of the structure to allow the model to correctly calculate the impact of the weir on water-surface elevations.

4.5.2.4 Split Flow

In many stream systems bifurcated or split flow occurs when multiple channels with unique channel inverts and water-surface profiles form within a larger floodplain. In this situation, it is necessary to use a split flow approach to more accurately estimate independent hydraulic conditions in each channel. The modeler shall use a defined junction and separate stream reaches to represent the situation if conditions warrant. See Figure 16 for an example of a split flow situation, including an example cross section layout. The model performs an iterative calculation process to determine the magnitude of flow in each channel.

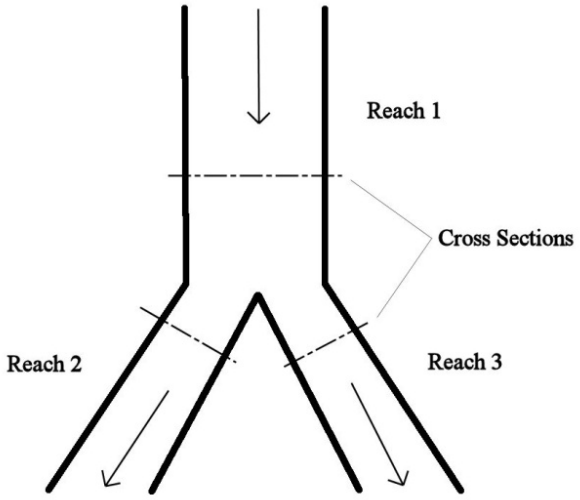

Figure 16: Split flow configuration

Another flow split situation occurs when water leaves the main channel along an extended length and enters another channel, a storage area or travels as overbank flow. In this situation, a lateral weir shall be used adjacent to the channel to more accurately represent this type of split. In this case, the lateral weir should be laid out along the high points of the anticipated overtopping section. It should be noted that in many cases flow will not only leave but reenter the main channel along this split reach. The modeler shall associate lateral weirs with the appropriate "losing" stream for a steady-state model. For unsteady-state flow models such as the Carson River the model can assess flow in both directions over the weir.

4.5.2.5 Weir Flow

Flow over lateral weirs and hydraulic structures is sensitive to the weir coefficient used. This coefficient represents both the form (broad-crested, rectangular, etc.) of the weir as well as the resistance to flow created by the roughness of the weir surface. Hence, a concrete floodwall would tend to have a higher weir coefficient, resulting in higher discharge, than a vegetated earthen levee. Appropriate weir coefficient values can be found in the USACE *HEC-RAS Hydraulic Reference Manual.* Lateral weirs shall be used at any point along the river where water "breaks out," or intermittently leaves and re-enters the channel.

4.5.2.6 Storage Areas

Storage areas shall be used to represent the overbank region in areas where velocities are low to zero and water-surface elevation is better approximated by volumetric calculations. Examples include offline ponds and detention basins. These areas should be connected to the main channel and/or adjacent

storage areas using lateral weirs placed the high points of the channel bank, and an elevation/storage curve or other representative function to represent the storage area.

4.5.3 Boundary Conditions

For 1-D, unsteady-state flow modeling on the Carson River, there are several boundary conditions that may be used at the modeler's discretion. The following discussion is a summary of the principal types of boundary conditions anticipated for the Carson River. In general, however the modeler shall use regional hydrology developed by CWSD for the purposes of modeling the Carson River. Updates may be available and the practitioner shall contact CWSD to obtain the most current hydrology for input to the model. For specific guidance on entering data and boundary conditions not covered in this Guide, refer to chapter 8 in the latest version of the *HEC-RAS River Analysis System Users Manual*.

4.5.3.1 Flow Hydrograph

As described in Section 5, a series of flow hydrographs have been developed at USGS stream gage locations for the Carson River within the area covered by this Guide. Hydraulic models shall use these hydrographs, where applicable as upstream or downstream boundary conditions. The most common use will be for upstream boundary conditions. In the event that the study reach begins or ends at a location not coincident with USGS stream gage locations, output hydrograph from adjacent models shall be used for boundary conditions.

4.5.3.2 Stage Hydrograph

Stage hydrographs are similar to flow hydrographs and may also be used as upstream or downstream boundary conditions. These data follow the same direction described above for flow hydrographs.

4.5.3.3 Internal Boundary Stage/Flow Hydrographs

It is possible to introduce an internal boundary condition in the model to force a stage or flow hydrograph at an area where values are known, such as a USGS stream gage. Modelers shall follow procedures outlined in the flow and stage hydrograph sections above.

4.5.3.4 Rating Curves

Rating curves are available through USGS, as described in Section 3.2, and may be used as a downstream boundary condition where appropriate. The primary application for the Carson River would be for calibration of known flood events. Rating curves may also be used for modeling theoretical events, where appropriate. For low gradient water-surface profiles the modeler shall use a rating curve only if it is far enough downstream from the study reach to prevent errors introduced by that rating curve.

4.5.3.5 Downstream Boundary Condition

Normal depth boundary conditions can be used as a downstream boundary condition. Friction slope shall be entered as the water-surface slope in the downstream vicinity of the reach. The boundary condition shall also be applied far enough downstream of the study reach to prevent errors introduced by the normal depth calculations. If a normal depth boundary condition is used as a downstream boundary condition, calibration efforts must be made to ensure that the computed rating matches observed measurements at gage locations, if available for the downstream reach of the model.

4.5.4 Model Calibration

To the extent practicable, HEC-RAS models for the Carson River shall be calibrated to known historic flood events using available high water marks, direct and indirect measurement data, historic event hydrographs and photographs showing flooding extents. Stage data shall be used at downstream and internal model boundaries. The flowing steps, taken from the *HEC-RAS Users Manual Version 4.1*, shall be generally followed for calibration:

1. Run a range of steady-state flow discharges and adjust Manning's n values so that model calibrates to rating curves at USGS stream gages and any known high water marks.
2. Review historic 15 minute flow data and select several flood events to use for unsteady-state calibration. These events shall encompass a wide range of flows (low to high and back to low). Table 1 provides a list of potential calibration events.
3. Adjust storage areas and lateral weirs to produce matches in flow hydrographs.
4. Adjust Manning's n values to produce matches in stage hydrographs.
5. Fine tune Manning's n values using vertical variation capabilities for low to high stages.
6. Verify calibration by running events not used in calibration.

For a complete discussion on calibration see chapter 8 in *HEC-RAS Users Manual Version 4.1*. Modeler shall also follow FEMA Guidelines and Specifications for Flood Hazard Mapping Partners Appendix C, Section C.3.3.4.

4.5.5 Floodway Development

When necessary, regulatory floodways shall be developed following standard modeling procedures outlined in chapter 10 of *HEC-RAS Users Manual Version 4.1* and Appendix C, section C.4 in FEMA's GUIDE.

Because modeling is being performed in unsteady-state flow for the Carson River, mapping partners must receive approval from the FEMA regional project officer and agreement from the communities involved before performing a floodway analysis. Practitioners shall also verify the allowable water-surface elevation rise due to floodway encroachment for all local municipalities covering the project reach. If no standard exists, the NFIP regulation of 1-foot maximum shall be used.

For unsteady-state 1-D modeling, floodways can only be determined using Method 1 as described in the *HEC-RAS Users Manual Version 4.1*. Modelers shall follow the recommended procedure from chapter 10 in *HEC-RAS User's Manual Version 4.1* as follows:

1. Begin with a 1-percent chance flood, calibrated unsteady-state flow plan.
2. Create a steady-state flow plan using the peak flows from the unsteady-state plan results.
3. Perform a steady-state flow encroachment, beginning with Method 4 equal conveyance.
4. Copy the 1-percent chance plan and rename to represent "new" encroached plan.
5. Adjust downstream boundary condition (i.e., hydrograph, rating curve) to reflect target water-surface elevation rise at all stages/flows.
6. Import steady-state flow plan encroachment stations into "new" unsteady-state encroached plan developed in step 4.
7. Run the unsteady-state model and check results against base 1-percent chance model described in step 1.
8. Adjust encroachments as necessary to achieve target water-surface elevation rise throughout the study reach.

4.5.6 Two-dimensional Hydraulic Model Development

The practitioner shall use FEMA-approved 2-D hydraulic models. Two-dimensional modeling guidelines and procedures shall be covered in future versions of this guide.

4.6 Floodplain and Floodway Mapping

Upon completion of the hydraulic modeling, the resulting water-surface elevations and water-surface extents can be exported to the AutoCAD and/or GIS software environment. Alternately, the hydraulic results can be used directly with HEC-RAS Mapper. Tools included within both software packages conduct an intersection between water-surface elevations extracted from HEC-RAS and the terrain surface, yielding a third representing flooding limits. The process is conducted for each return event, producing a group of floodplain and floodway limits. The practitioner shall select either method described above, document the process, and provide copies in support of the Technical Support Data Notebook (TSDN) deliverable.

The inundation limits reflected by the floodplain and floodway polygons produced by either method described above shall be reviewed by the practitioner. The results generated frequently contain small "pocket islands" that reflect an elevated feature which exists above the modeled water-surface elevation, but does not meet FEMA's requirements to be maintained as an island of zone X. In addition, the practitioner shall review the data for triangulated dangles on the perimeter of the data set, these appear in the form of triangular sections either dangling to the interior or exterior of the data set as a result of the interpolation between the surfaces. These dangles shall be removed and documented using the best engineering judgment for the study area.

In the event that multiple elevation surface files (mosaicked tiles) are used to support the post processing, the practitioner shall inspect the areas subject to overlap and manually refine the resulting floodplain and floodway line work with respect to the topographic data, reported water-surface elevations, and existing features. This process shall be documented and performed using the best engineering judgment in the areas of occurrence.

The final floodplain and floodway line work shall be compared by the practitioner against project contours to validate the resulting boundary. This entails a comparison of the hydraulic WSEL, floodplain line work location, and governing contours. The practitioner shall document the review process.

4.6.1 FEMA Standards

The floodplain and floodway products prepared from successful floodplain delineation and cleanup, shall be packaged for delivery by the practitioner, according to the FEMA GUIDE, Appendix L. Digital Flood Insurance Rate Maps (DFIRM) are digital versions of flood maps formatted following FEMA guidelines and specifications. DFIRMs allow communities to view flood insurance rate maps with digital media or through the internet.

Key features of the DFIRM data set that the practitioner shall address are coordination, standards, horizontal and vertical accuracies with controls, data structure, quality control, deliverable format, and metadata. Per FEMA, the DFIRM database specifications contain the following additional defined spatial and non-spatial data items and tables:

- Subbasins with links to discharges, storm data, and regression equations;
- Gages, including rain gages, stream gages, and coastal gages;
- Nodes with links to node discharge data and zipped hydrologic models;
- Profile base lines;
- Overbank flow paths;
- Additional cross section data, including links to a frequency (rating) table and the zipped hydraulic models;
- Additional coastal transect data, including links to the zipped coastal models;
- Primary frontal dunes;
- Modeled coastal shorelines;
- Outline of the studied area(s) with links to FEMA case information;
- Photographs, sketches, and similar documents linked to spatial features;
- Documentation for variable data that may be developed for the flood study/mapping project (e.g., topographic data, land use, soils, roughness);
- Zipped files containing general information on methodology (e.g., Technical Support Data Notebook defined in Appendix M of the GUIDE); and
- Zipped Flood Insurance Study (FIS) report components (e.g., FIS text, flood profiles, floodway data tables).

The practitioner shall comply with the DFIRM standards listed above and use the FEMA DFIRM database prototype to support the product development for the Carson River. The practitioner shall refer to the FEMA website directly to inquiry for changes or updates to requirements.

http://www.fema.gov/plan/prevent/fhm/dfm_dfhm.shtm

A copy of the DFIRM database prototype can be downloaded directly from FEMA at the following location:

http://www.fema.gov/library/viewRecord.do?id=3175

The practitioner shall prepare the digital DFIRM database using metadata per FEMA requirements listed in the GUIDE, Appendix L, Section L.6 and or L.8. The metadata examples for draft digital data identify the requirement of the following key components of product identification and information:

- Citation Information
- Project Description with Abstract and Purpose
- Time Period of Content
- Status
- Spatial Domain
- Keywords
- Place
- Access Constraints
- Use Constraints
- Point of Contact
- Native Data Set Environment
- Cross Reference
- Data Quality Information
- Spatial Data Organization Information
- Spatial Reference Information
- Entity and Attribute Information

- Distribution Information
- Metadata Reference Information

4.6.2 Work Map Components

The practitioner shall prepare topographic and aerial photographic work maps in support of the TSDN for submittal to FEMA. The practitioner shall develop an index map depicting the study area. The index map shall include project full name or title, agency project reference number, practitioner project number, study limit explanation, description of authority for study, communities/town/cities/or tribes participating within the study area, elevation reference mark or benchmark elevation control data, project title, north arrow, scale bar, survey and aerial photography collection methods and standards utilized. The date of production shall be included upon the final products (including the cover sheet).

The work maps shall be prepared in full size format (24”x36”) in portrait or landscape format and index, key legend, project full name or title, agency project reference number, practitioner project number, north arrow, scale bar, and a index map depicting the relative location for the panels focus with the study area.

The work maps shall be prepared using a standard engineering scale, selected using best engineering judgment for the display of data prepared in support of the study area. Examples of standard engineer scale are 1”=200’ for 1”=400’ for the viewport map scale. Additional FEMA requirements for mapping related products can be found in the GUIDE, Appendix M, Section M.2.1 through M.2.3.

The resulting work maps shall be signed by a registered professional engineer (within the state of study analysis) in support of the TSDN deliverable to FEMA. The practitioner shall prepare both electronic and hard copies for both the coversheet and work maps products.

5 MODEL STORAGE AND MANAGEMENT

CWSD is currently participating in the FEMA Cooperating Technical Partners (CTP) program. The goal of this program is for local communities, participating in NFIP, to take an active role in maintaining up-to-date flood hazard maps for their respective jurisdictions. CWSD shall act as the clearing house for any up-to-date hydraulic models for the Carson River intended to update flood hazard mapping through FEMA. CWSD will store and manage models to make certain that land use changes have been incorporated and impacts have been reviewed by stakeholders and respective interested municipalities. Copies of completed models will be distributed by CWSD to any parties interested in making land use changes. This Guide will serve as the basis for any changes to these models. Once changes have been made a new proposed condition version shall be delivered back to CWSD for updates to the database. Additionally, any updates to hydrologic data along the study areas covered in this Guide shall be submitted to CWSD for review and incorporation into the database.

Modeling additions or changes for the project area shall be documented based on FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners Appendix M: Guidance for Preparing and Maintaining Technical and Administrative Support Data.* Updates/additions to the model and associated reporting shall be archived at both the CWSD and FEMA as study reaches are completed.

6 REFERENCES

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Chow, V.T., 1959. *Open-channel Hydraulics*: New York, McGraw-Hill Book Co., p. 680.

Ree, W.O., and Crow, F.R., 1977, *Friction factors for vegetated waterways of small slope:* Agricultural Research Service, U.S. Department of Agriculture, ARS-S-151, p. 56.

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U.S. Geological Survey, 1982, *Guidelines for Determining Flood Flow Frequency*, Bulletin #17B of the Hydrology Subcommittee.

APPENDIX A: Manning's Roughness Tables from HEC-RAS Users Manual

Table 3.1
Manning's 'n' Values

Type of Channel and Description	Minimum	Normal	Maximum
A. *Natural Streams*			
1. **Main Channels**			
a. Clean, straight, full, no rifts or deep pools	0.025	0.030	0.033
b. Same as above, but more stones and weeds	0.030	0.035	0.040
c. Clean, winding, some pools and shoals	0.033	0.040	0.045
d. Same as above, but some weeds and stones	0.035	0.045	0.050
e. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
f. Same as "d" but more stones	0.045	0.050	0.060
g. Sluggish reaches, weedy. deep pools	0.050	0.070	0.080
h. Very weedy reaches, deep pools, or floodways with heavy stands of timber and brush	0.070	0.100	0.150
2. **Flood Plains**			
a. Pasture no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
2. Same as above, but heavy sprouts	0.050	0.060	0.080
3. Heavy stand of timber, few down trees, little undergrowth, flow below branches	0.080	0.100	0.120
4. Same as above, but with flow into branches	0.100	0.120	0.160
5. Dense willows, summer, straight	0.110	0.150	0.200
3. **Mountain Streams, no vegetation in channel, banks usually steep, with trees and brush on banks submerged**			
a. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
b. Bottom: cobbles with large boulders	0.040	0.050	0.070

Table 3.1 (Continued)
Manning's 'n' Values

Type of Channel and Description	Minimum	Normal	Maximum
B. *Lined or Built-Up Channels*			
1. **Concrete**			
a. Trowel finish	0.011	0.013	0.015
b. Float Finish	0.013	0.015	0.016
c. Finished, with gravel bottom	0.015	0.017	0.020
d. Unfinished	0.014	0.017	0.020
e. Gunite, good section	0.016	0.019	0.023
f. Gunite, wavy section	0.018	0.022	0.025
g. On good excavated rock	0.017	0.020	
h. On irregular excavated rock	0.022	0.027	
2. **Concrete bottom float finished with sides of**:			
a. Dressed stone in mortar	0.015	0.017	0.020
b. Random stone in mortar	0.017	0.020	0.024
c. Cement rubble masonry, plastered	0.016	0.020	0.024
d. Cement rubble masonry	0.020	0.025	0.030
e. Dry rubble on riprap	0.020	0.030	0.035
3. **Gravel bottom with sides of**:			
a. Formed concrete	0.017	0.020	0.025
b. Random stone in mortar	0.020	0.023	0.026
c. Dry rubble or riprap	0.023	0.033	0.036
4. **Brick**			
a. Glazed	0.011	0.013	0.015
b. In cement mortar	0.012	0.015	0.018
5. **Metal**			
a. Smooth steel surfaces	0.011	0.012	0.014
b. Corrugated metal	0.021	0.025	0.030
6. **Asphalt**			
a. Smooth	0.013	0.013	
b. Rough	0.016	0.016	
7. **Vegetal lining**	0.030		0.500

Table 3.1 (Continued)
Manning's 'n' Values

Type of Channel and Description	Minimum	Normal	Maximum
C. *Excavated or Dredged Channels*			
1. **Earth, straight and uniform**			
a. Clean, recently completed	0.016	0.018	0.020
b. Clean, after weathering	0.018	0.022	0.025
c. Gravel, uniform section, clean	0.022	0.025	0.030
d. With short grass, few weeds	0.022	0.027	0.033
2. **Earth, winding and sluggish**			
a. No vegetation	0.023	0.025	0.030
b. Grass, some weeds	0.025	0.030	0.033
c. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
d. Earth bottom and rubble side	0.028	0.030	0.035
e. Stony bottom and weedy banks	0.025	0.035	0.040
f. Cobble bottom and clean sides	0.030	0.040	0.050
3. **Dragline-excavated or dredged**			
a. No vegetation	0.025	0.028	0.033
b. Light brush on banks	0.035	0.050	0.060
4. **Rock cuts**			
a. Smooth and uniform	0.025	0.035	0.040
b. Jagged and irregular	0.035	0.040	0.050
5. **Channels not maintained, weeds and brush**			
a. Clean bottom, brush on sides	0.040	0.050	0.080
b. Same as above, highest stage of flow	0.045	0.070	0.110
c. Dense weeds, high as flow depth	0.050	0.080	0.120
d. Dense brush, high stage	0.080	0.100	0.140

Appendix J:
Risk MAP Charter

Risk MAP Charter for the Carson River Watershed

Purpose:
Working in a close collaborative effort, Carson Water Subconservancy District (CWSD), FEMA Region IX (FEMA), U.S. Army Corps of Engineers (USACE), U.S. Geological Survey (USGS), U.S. Department of the Interior Bureau of Reclamation (USBR), State NFIP Coordinator, State Hazard Mitigation Office, and other partners (as listed on page 5) will identify, assess, communicate, and plan for flood risk within the Carson River Watershed (watershed), which includes portions of Alpine County in California and Douglas, Carson City, Storey, Lyon, and Churchill Counties in Nevada. The flood risk information provided can be used to enhance hazard mitigation plans, make informed decisions to improve resilience after flooding, protect the beneficial functions of floodplains, and raise awareness about local flood risks.

This charter:

- Details the long-term flood hazard mapping vision for the watershed;
- Describes the desired mapping, assessment, planning information, and planning products;
- Describes the assistance that CWSD and FEMA will provide;
- Summarizes local flooding concerns and indicates areas where floodplain changes are expected; and
- Describes the roles and responsibilities of the CWSD, FEMA, and other signatory partners.

Watershed Vision:
In 2008, all counties along the Carson River adopted the "Carson River Watershed Floodplain Management Plan" (FPM Plan) that describes the long-term goals and objectives for floodplain management. These goals are based on identification and mapping of floodplains to create a broad-based awareness of flood hazards and provide the data necessary to support community floodplain management programs. The mapping program will provide many benefits to watershed communities, property owners, and citizens. These include:

- Increased public awareness and action to reduce risk to life and property;
- Ability to build upon flood hazard data and maps produced during the Flood Map Modernization (Map Mod) program;
- Assess present and future risk;
- Address gaps in flood hazard data to form a solid foundation for risk assessment and floodplain management and provide entities with information needed to mitigate flood-related risk;
- Protection of the natural and beneficial function of drainage-ways and floodplains, including trail corridors, parks, recreational areas, wildlife habitat, flood storage, and groundwater recharge; and,
- Encouraging "Good Neighbor Policies" throughout all communities within the watershed.

Mapping and Assessment:
The watershed experiences flooding incidents on an average of every five years. Types of flood hazards include riverine and alluvial fan flooding and debris flows. Major flood events are typically the result of rain-on-snow events. Flood storage in the upper watershed is limited and available storage is not regulated. Therefore, flood flows are not actively managed and large flows can occur downstream. The watershed contains areas of open floodplains that are continually under threat of change and development. The FPM Plan calls for the protection of the natural function of these floodplains, especially lands within Carson Valley, which provide the bulk of the flood storage for the entire watershed.

Based on previous studies, information obtained during community public meetings for the development of the FPM Plan, and discovery meetings for mapping activity statements, a Five-Year Master Mapping Plan was developed for the watershed. The plan identifies the sequence of work to be performed in order to meet the goals and objectives for floodplain mapping and associated assessments and is consistent with the community goals described in the FPM Plan.

Regulatory Products:
FEMA will provide Alpine, Douglas, Carson City, Lyon, and Churchill Counties with the following updated regulatory products to support floodplain management and flood insurance administration.

- **Flood Insurance Study (FIS) Report:** The FIS describes the county's flood history and provides technical information on the study.
- **Flood Insurance Rate Map (FIRM):** The FIRM identifies the county's flood hazard zones, base flood elevations, and floodway boundaries. This map is also used to determine where flood insurance may be required.

Flood Risk Products:
CWSD and partners will work closely with FEMA to produce the products listed below which identify locations and causes of flood hazard changes and quantify the risks associated with those changes. This will allow Alpine, Douglas, Carson City, Lyon, and Churchill Counties to use these updated data and products to make informed hazard mitigation, land use and development, and emergency management decisions.

- **Changes Since Last Flood Insurance Rate Map (FIRM):** Changes since the last FIRM identify areas where the floodplain, floodway, and/or flood zone designations have changed since the previous flood study. Engineering factors that may have contributed to any changes will also be identified.
- **Areas of Mitigation Interest:** Areas of mitigation interest identifies areas where conditions may contribute to the severity of the flood hazard and associated losses. These include areas with a history of flood claims, hydraulic or other structures that contribute to backwater impacts, and areas experiencing land use change or development.

FEMA Resources to Support Flood Mitigation Actions:
FEMA encourages floodplain management activities that exceed minimum requirements through programs such as the Community Rating System (CRS). The watershed currently has two CRS communities, Douglas County and Carson City. FEMA also offers Hazard Mitigation Assistance grant programs that fund eligible mitigation activities which reduce disaster losses and protect life and property from future disaster damage. Information on these programs will be provided, along with other related State, Federal, and association resources throughout the project.

Communication and Coordination:
FEMA, CWSD, and partners will work together to establish a consistent flow of information about project status, timelines, and next steps. In addition to regular status reports, CWSD will coordinate with the counties, cities, and other entities in the watershed. CWSD will establish a Flood Mapping Project Management Team (PMT) that will meet on a regular basis to ensure that the goals of this charter are implemented in a coordinated manner. The PMT includes representatives from all counties, cities, Federal, State, and other governmental entities throughout the watershed. CWSD is also the coordinating entity for the Carson River Coalition (CRC), a large watershed-wide stakeholder group. The CRC will be provided opportunities to review and comment on mapping programs and the implementation of the living river concept as described in the adopted Carson River Watershed Regional Floodplain Management Plan.

FEMA will work with Alpine, Douglas, Carson City, Lyon, and Churchill Counties to enhance their ability to communicate flood hazards and associated risk to people who live and work within the watershed.

Specific meetings for each phase of mapping include:

- **PMT Meetings**: These meetings will focus on setting project expectations, roles and responsibilities of the PMT, and on validating and gathering data.
- **Community Coordination Officer (CCO) Meeting/Open House**: Local officials will be provided with FIS and FIRM information and requirements for map adoption. Meetings will be closely followed by open house meetings where FEMA, CWSD, and local community officials will present project results to local citizens and explain the impact that the results will have on development, planning, and flood insurance.
- **Flood Study Review Meeting**: Local officials, State, Federal, Tribal, and non-governmental entities will be provided the opportunity to view and comment on drafts of the engineering analyses and flood risk data. This meeting may also include highlights of hazard mitigation planning and implementation of best management practices to reduce flood hazards in the watershed.

Roles and Responsibilities:
This Risk MAP Charter represents a good-faith effort by all parties to share data, communicate findings, and plan mitigation activities to protect the communities within the watershed from flood risk. It is not legally binding nor does it preclude a community from participating in the FIRM appeal process. The parties listed in the signature block

below agree to collaborate on flood hazard identification activities, risk analysis products, and will consult with each other to integrate contributions into flood hazard identification efforts. It is intended to provide a common "Good Neighbor" strategy to address flood hazards and increase resilience within the watershed.

FEMA and CWSD will provide local officials with regular updates on project status, the data and products described above, and outreach guidance to include local awareness of flood risk. These efforts will better enable local communities to take action to reduce risk, through the adoption of the maps, development or enhancement of mitigation plans, and increased communication with citizens to inform them of their risk and the steps that they can take to mitigate that risk.

Alpine, Douglas, Carson City, Lyon, and Churchill Counties, and other entities will provide input and updates throughout the study process to verify data and ensure that the information accurately represents their communities.

CWSD, FEMA, and local officials agree to communicate as needed over the course of each project outlined in the mapping program to review project milestones, outcomes, and impacts. CWSD and the PMT will meet at least twice a year to discuss, plan, and coordinate all mapping program projects.

If for any reason an entity who is a signatory to this document wishes to withdraw their participation from the Risk MAP Charter, they may do so at any time by submitting a written request to CWSD.

We, the undersigned, agree to work together to implement this Risk MAP Charter for the Carson River Watershed to the best of our abilities and within our legal authorities and delegations.

Chuck Roberts, Chairman
Carson Water Subconservancy District
Date Signed: 2/28/12

Sally Ziolkowski, Director
FEMA Region IX Mitigation Division
Date Signed: 2/13/2012

Alicia Kirchner, Chief
USACE Sacramento District,
Planning Division
Date Signed: 3-15-12

Kirk Davis, NFIP Coordinator Jason King, State Engineer
Nevada Division of Water Resources
Date Signed: 12/28/12

Elizabeth Ashby
Nevada Department of Public Safety
State Hazard Mitigation Office
Date Signed: 23 Feb 2012

Henry Skip Veatch, Chairman
Board of Supervisors
Alpine County, California
Date Signed: 2/21/2012

Lee Bonner, Chairman
Board of Commissioners
Douglas County, Nevada
Date Signed: 3/9/12

Bob Crowell, Mayor
Carson City, Nevada
Date Signed: 2/14/2012

Chuck Roberts, Chairman
Board of Commissioners
Lyon County, Nevada
Date Signed: 2/23/12

Norman Frey, Chairman
Board of Commissioners
Churchill County, Nevada
Date Signed: February 15, 2012

Kenneth Parr, Area Manager
U.S. Bureau of Reclamation
Lahontan Regional Office
Date Signed: 04/16/12

Ernest Schank, President of the Board of Directors, Truckee-Carson Irrigation District
Date Signed: 4/11/2012

Jon Mittelstadt, Meteorologist in Charge
National Oceanic & Atmospheric Administration
National Weather Service - Reno, NV
Date Signed: 4-26-2012

Appendix K:
Risk MAP Discovery Report

Discovery Report

Carson River Watershed, Watershed HUC 16050201, 16050202, 16050203

Alpine County, California
Douglas County, Nevada
Carson City, Nevada
Churchill County, Nevada
Lyon County, Nevada
Storey County, Nevada

Report Number 01
12/14/2012

R O Anderson

Carson River Watershed
Discovery Report

December 14, 2012

Prepared for:
CARSON WATER SUBCONSERVANCY DISTRICT
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Prepared By:
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Table of Contents

I. General Information

Within the Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) Program, the Discovery process is intended to initiate watershed-wide discussions about increasing resilience to flooding. FEMA partners with local and regional officials during Discovery to gather and validate available flood data, as well as to discuss flood history, catalog areas at risk for flood loss, examine development plans, review the adequacy of existing hazard data, assess mapping needs, and discuss community activities that relate to flood risk and solutions for reducing flood risk. The goal of Discovery is to determine which areas within a watershed require mapping, risk assessment, or mitigation planning assistance.

Because flood hazards change over time, the Discovery process provides an opportunity to review comprehensively the components and activities that contribute to flood risk. Local participation in Discovery will increase flood risk understanding and help identify proactive steps to protect communities from flood-related loss of life and property damage. Through Risk MAP, FEMA can provide information to improve risk communication and enhance local mitigation plans, resulting in decreased flood risk.

As part of the Discovery process, FEMA holds a Discovery Meeting to review the flood risk data that were collected, discuss the community's flooding history, development plan, flood risk concerns, stormwater and Special Flood Hazard Area (SFHA) management activities, and other daily operations that affect flood risk.

This report, along with the Discovery Maps, is intended to summarize the information gathered as part of the Discovery process for the Carson River Watershed (HUC 16050201, 16050202, and 16050203).

The Carson River watershed comprises approximately 3,965 square miles and includes portions of six counties and two states. These geographic units of the Carson River watershed are Alpine County, California, and Douglas, Lyon, Storey, Carson City, and Churchill Counties in Nevada. A small unpopulated portion of Pershing County is also located within the watershed, however this area has no direct tributaries to the Carson River and is not typically included for planning purposes.

Approximately 606 square miles of the watershed are located in Alpine County, California. This portion of the upper watershed is delineated into four sub-watersheds as follows:

1. Wolf Creek
2. East Fork Carson River
3. Markleeville Creek
4. West Fork Carson River

Major valleys within these sub-watersheds include Charity Valley, Pleasant Valley, Hope Valley, Diamond Valley, Wolf Creek Meadow, and Faith Valley.

Approximately 3,359 square miles of the watershed is located in Nevada. There are five hydrographic areas in the Nevada portion of the watershed:

1. Carson Valley (Minden, Gardnerville, Genoa – Douglas County)
2. Eagle Valley (Carson City)
3. Dayton Valley (Dayton, Virginia City – Lyon County)
4. Churchill Valley (Fallon – Churchill County)
5. Carson Desert (Fallon, Stillwater – Churchill County)

Geographic regions and subwatersheds are listed below and included on the Discovery Maps.

The U.S. Geological Survey defines the Carson River as three separate hydrologic units code (HUC) as follows:

16050201 Upper Carson
16050202 Middle Carson
16050203 Lower Carson

II. Watershed Stakeholder Coordination

Outreach to community officials and stakeholders was conducted as part of the Discovery process. In addition to the six counties within the Carson River Watershed, seven additional stakeholders were identified. These stakeholders are organizations in the form of associations and government agencies that are involved with the Carson River Watershed. A list of community and stakeholder contacts was gathered and kept current throughout the Discovery process. This list is included in the Appendix A to this document.

Communities and the identified stakeholders were contacted initially in March of 2012 to apprise appropriate individuals of the upcoming Discovery meetings. A Carson River Risk Mapping, Assessment, and Planning (MAP) Charter Discovery Group Meeting was held at the Carson Water Subconservancy's District Conference Room in Carson City on March 21, 2012 to provide background on the Discovery process. The group discussed watershed flood issues, identified gaps in data, and reviewed the current five-year mapping master plan during the meeting.

On May 8, 2012, the communities and stakeholders were sent a memorandum that identified the data to be collected. As responses were received, follow up telephone calls were made to clarify information or request missing data. Discussed during these conversations were mitigation plans, areas of flooding concern, and the availability of GIS data. On July 5, 2012, a subsequent request for information and data was forwarded to those communities that did not respond to the first request. During the month of July, follow up telephone calls were made to community officials. The draft Discovery Report and Discovery Maps were distributed to stakeholders on August 17, 2012 for review and comment in preparation of the Discovery meeting. Following the Discovery Meeting, stakeholders were given a period of time to provide comments for use in the compilation of the final Discovery Report and Maps.

III. Data Analysis

Several communities and stakeholders provided data during the Discovery process. These data were collected in several different formats, including CD's containing existing reports, paper and digital copies, emails, shapefile data, and hyperlinked locations to local and statewide data.

The data were recorded and reviewed to determine usefulness. A list of the data collected prior to the Discovery meeting, the deliverable or product in which the data are presented, and the source of the data is shown in Table 1.

This Data Analysis section is further divided into two subsections: the first subsection includes a list of data that can be used for Risk MAP products (regulatory and non-regulatory). The second subsection contains a listing of other data and information used by the project team to form a holistic understanding of Carson River Watershed.

Table 1: Data Collection for Carson River Watershed

Data Types	Deliverable/Product	Source
Community Assistance Visits	Community Fact Sheet	Nevada Division of Water Resource, Local Agencies
Community Rating System	Community Fact Sheet	FEMA's "Community Rating System Communities and Their Classes"
Demographics, Industry	Community Fact Sheet	US Census Bureau, QuickFacts and American FactFinder
Insurance Policies	Community Fact Sheet	FEMA Regional Office
Mitigation Plans Status	Community Fact Sheet	Nevada Department of Emergency Management, California Emergency Management Agency, Local Agencies
Mitigation Projects	Community Fact Sheet	Data.gov: FEMA Hazard Mitigation Program Summary
Repetitive Loss	Community Fact Sheet	Nevada Division of Water Resources, Local Agencies
Claims	Community Fact Sheet	Nevada Division of Water Resources, Local Agencies
Letter of Map Change (LOMCs)	Community Fact Sheet	FEMA, FIS
Declared Disasters	Community Fact Sheet	Nevada Division of Emergency Management
Hazards	Community Fact Sheet	Local Hazard Mitigation Plans, FEMA, Nevada Division of Water Resources, Nevada Division of Emergency

		Management
GIS Boundaries: Community, City, Town	Discovery Map Geodatabase	Douglas County GIS[1], Alpine County GIS, Churchill County GIS
Boundaries: County and State	Discovery Map Geodatabase	www.census.gov
Boundaries: Watersheds	Discovery Map Geodatabase	Nevada Division of Environmental Protection
Effective Flood Zones: Modernized SFHAs	Discovery Map Geodatabase	Douglas County GIS, Alpine County GIS, FEMA
Future or recent highway improvement, bridge, culvert, levee locations	Discovery Map Geodatabase	Douglas County GIS, Alpine County GIS, Churchill County GIS, FIS Levee Locations
Hydrography: California & Nevada	Discovery Map Geodatabase	Douglas County GIS, Alpine County GIS
Mitigation Projects: Recent, ongoing, planned, desired FEMA/OFA/local projects	Discovery Map Geodatabase	Developed based on community provided information, Local Hazard Mitigation Plans
Recently developed or planned high growth areas	Discovery Map Geodatabase	Douglas County GIS, Alpine County GIS, Churchill County GIS
Stream Gages	Discovery Map Geodatabase	US Geologic Survey
Study Needs: FEMA	Discovery Map Geodatabase	Developed based on community provided information
Study Needs: Recent, ongoing, planned, desired FEMA/OFA/local studies	Discovery Map Geodatabase	Developed based on community provided information
Topographic Availability	Discovery Map Geodatabase	LiDAR from Carson Water Subconservancy (2004), FEMA (2003), Churchill County (2011); Carson Valley (2012)
Transportation: Roads & Railroads	Discovery Map Geodatabase	Douglas County GIS, Alpine County GIS, Churchill County GIS

[1] Douglas County GIS provides geographic information system services for Carson City, Douglas County and Lyon County.

i. Data for Subsequent Flood Risk Products

1. Topographic Data

LiDAR acquisition for the Douglas County, Nevada, FEMA restudy (finally published in 2008) was performed by EarthData Aviation at the request of Horizons Inc. in a Navajo Chieftain aircraft (tail number N62912) equipped with an LH System ALS40 LiDAR system including an inertial measuring unit (IMU) and a dual frequency GPS receiver. Acquisition was accomplished on October 23rd and 24th, 2003. These data were post-processed to provide topographic mapping and are described in TSDN dated 2005. The existence of this dataset was not generally known by engineers working in Carson Valley. Instead, most flood hydraulic studies relied on data produced during 2004, as described below.

In 2004, a LiDAR topographic survey of the Carson River corridor, including Alpine County, Douglas County, Carson City, and Lyon County, was produced for Carson Water Subconservancy District (and others) by BAE Systems/Woolpert. The purpose of that survey was to develop topographic information for river restoration projects to be developed along the Carson River. Because the LiDAR dataset was not originally intended for floodplain analysis and delineation, the required QA/QC to comply with FEMA guidelines was not part of the original work. Therefore, in 2010, the LiDAR dataset was reviewed and field data collected to validate the topographic dataset according to FEMA guidelines for topographic data to be used for floodplain analyses[2].

Given the age of the 2004 LiDAR dataset, CWSD personnel, in cooperation with other stakeholders, decided that a new LiDAR topographic dataset is appropriate for Carson Valley floodplain mapping (and other uses). Planning and funding of the proposed LiDAR project was funded by NDEP and CWSD. The LiDAR data were gathered in late September 2012.

Churchill County commissioned a LiDAR topographic survey of the reach of Carson River downstream from Lahontan Dam to Fallon, Nevada. The purpose for these data is use in flood risk assessment and evaluation of the levee and canal systems. Churchill County Engineering and the U.S. Army Corps of Engineers are currently conducting analyses for Churchill County using the LiDAR information.

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[2] Thompson, D. B. and M. Bernard (2009). Validation of the 2004 BAE Systems LiDAR topopgraphy dataset for the Carson Valley portion of the dataset. Engineer's report, R.O. Anderson Engineering, P.O. Box 2229, Minden, NV 89423.

Thompson, D. B. and M. Bernard (2010). Validation of the 2004 BAE Systems LiDAR topopgraphy dataset for the Dayton Valley portion of the dataset. Engineer's report, R.O. Anderson Engineering, P.O. Box 2229, Minden, NV 89423.

ii. Other Data and Information

1. Mitigation Plans/Status, Mitigation Projects

Mitigation plans in Nevada are prepared by the counties for all the incorporated and unincorporated communities, and special districts within the county. Mitigation plans in California can be prepared individually by the counties, cities, and other special districts, or jointly as a regional plan. Hazard mitigation plans were obtained for five of the six counties. The status of each county's plan is as follows:

- Alpine County's hazard mitigation plan lapsed as of 2010.
- Carson City's plan is current with the next update due in April of 2016.
- Churchill County recently submitted their plan to FEMA for review.
- Douglas County's plan is current with the next update due in March of 2013.
- Lyon County is currently in the process of developing their hazard mitigation plan.
- Storey County's plan is current with the next update due in December of 2014.

Although invited to participate by each of the participating jurisdictions, involvement of members of the general public was relatively limited. A review of mitigation goals for each community revealed that while many of the plans noted the need to pursue flood mitigation projects, such as installing new flood facilities or updating storm drainage systems, only the Carson City and Alpine County plans identified specific mitigation projects and their locations.

2. National Flood Insurance Program Mapping Study Needs

i. Mapping Changes

Comparing the Letter of Map Change (LOMC) list from FEMA to the LOMC table in the effective Flood Insurance Study (FIS) identifies two completed Letters of Map Revision (LOMR) in Douglas County that have not been incorporated into the effective study. The first is along the Cottonwood Slough (12-09-1034P), and the second affects the Park Ditch and Pine Nut Creek (12-09-1513P).

FEMA is currently working on the Walker River Preliminary Map Revision (PMR), a new riverine engineering analysis along the Walker River for 14.5 miles of detailed study on 14 panels in Lyon County. The analysis will include modeling of sedimentation and dredging scenarios and the creation of depth grids.

ii. Coordinated Needs Management Strategy

The Coordinated Needs Management Strategy (CNMS) is an initiative to update the way FEMA organizes, stores, and analyses flood hazard mapping needs information for identifying and managing flood hazard mapping needs. The CNMS inventory contributes to the identification of risk in two important ways. The first is by indicating where the depiction of flood hazards on FIRMs has been validated through detailed assessment. The second is by showing which previously studied or unstudied floodplains inadequately represent flood hazards. In this way, CNMS leads to the improvement of flood hazard data. Currently, the Carson River Watershed has no requests identified in CNMS.

3. Socio-Economic Analysis

The US Census 2010 Quick Facts and the 2006–2010 American Community Survey were used for this research. Community Fact Sheets for each county are provided in the Appendix B. Populations within the watershed boundary exhibit substantial variations in reported demographics. For example, the rural communities such as Alpine County and Storey County contain only 1,102 and 3,896 people, respectively, in contrast to larger rural communities, such as Carson City with a population of about 55,300 people. The median age of individuals living in the watershed ranges from 39.0 to 47.0, with the majority of the counties having more than 15% of the population over 65 years old. The population of Carson River Watershed is made up primarily of Caucasians (over 75% in all the counties), American Indians (ranging from 1.8% to 21.8%), and persons of Hispanic or Latino origin (ranging from 6% to 21.3%). Median household income in the watershed ranges from a low of $48,433 to a high of $63,478 annually. Residents across the watershed worked primarily in the following industries:

- Educational services, and health care and social assistance,
- Arts, entertainment, recreation, accommodation and food services, and
- Retail trade and manufacturing.

Table 2: Socio-Economic Analysis

County	Population	Median Age	Median Household Income	Top Industry
Alpine County	1,102	40.9	$63,478	Educational services, and health care and social assistance
Carson City	55,274	41.1	$52,067	Educational services, and health care and social assistance
Churchill County	24,637	39.0	$51,597	Arts, entertainment, and recreation, and accommodation and food services
Douglas County	46,997	47.0	$60,721	Educational services, and health care and social assistance
Lyon County	51,871	39.9	$48,433	Retail trade
Storey County	3,896	46.4	$61,525	Manufacturing

4. Community Rating System

The Community Rating System (CRS) is a voluntary program created under the NFIP to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to SFHA management. Currently, only Carson City, Douglas County, and Storey County participate in the CRS program. Both Carson City and Douglas County provide educational materials regarding flood risks to their citizens.

5. Flood Control Structures

i. Levees

There are no levees identified in the USACE National Levee Database (NLD). However, there are several levees identified on FEMA's FIRM panels as listed below:

Table 3: Levees Identified on FEMA FIRM Panels

Community	Flood Source	FIRM Panel
Carson City	Combs Canyon Creek	32001C0083E
Carson City	Eagle Valley Creek/ Combs Canyon Creek	32001C0084E 32001C0092E
Carson City	H Tributary	32001C0092E 32001C0094E
Carson City	Kings Canyon Creek	32001C0111E 32001C0112E
Lyon County	Unnamed Wash at Silver Springs	32019C0211E 32019C0213E
Lyon County	Unnamed Wash at Silver Springs	32019C0214E 32019C0212E
Lyon County	Carson River	32019C0289E
Lyon County	Carson River	32019C0452E
Lyon County	Undetermined	32019C0452E

ii. Dams

Lahontan Dam and Reservoir was constructed by the Bureau of Reclamation in 1911-1915 as part of the Newlands Project to divert and store water from the Truckee River and Carson River basins to provide irrigation to lands near Fallon. It is located in Churchill County and is owned by the Bureau of Reclamation and operated by the Truckee-Carson Irrigation District. The dam also produces hydroelectric power. The total storage capacity of the Lahontan Reservoir is approximately 313,000 acre-feet to the top of the 20-inch high wooden flashboards on the spillways. The dam has a spillway elevation of 4,162.0 feet and a top of flashboard elevation of 4,163.67 (Lahontan Dam datum). The outlet works have a maximum discharge capacity of approximately 2250 cfs at a reservoir pool elevation of 4,162. The two spillways are uncontrolled and have a combined maximum capacity of approximately 66,000 cfs at a reservoir pool elevation near the crest of the dam (elevation 4174). The dam has a structural height of 162 feet and a crest length of 1,325 feet.

In Carson City there are two dams identified for flood control purposes. The Eagle Valley Golf Course Dam was constructed in 1984 and is located in northeast Carson City on the west course of the Eagle Valley Golf Course. The dam, which is owned and maintained by Carson City, is classified as a Medium size dam with a significant hazard rating by the Division of Water Resources. The dam is an earthen dam with up to 53 acre-feet of storage capacity. The

crest elevation of the dam is at 4,771 feet and the top width of the dam is approximately 15 feet.

The Shenandoah Detention Basin was constructed in 1999 and is located in Carson City on the east side of U.S. Highway 395 just north of Bonanza Drive. The reservoir is owned and operated by Carson City. The dam is an earthen dam with approximately 34 acre-feet of storage capacity.

Additionally, several small reservoirs exist in Alpine County; however, they are of insignificant capacity.

6. SFHA Management/Community Assistance Visits

Data collected from the Nevada Division of Water Resources, indicates that the most recent Community Assistance Visit (CAV) occurred on the following dates:

- *Alpine County* *No CAV performed*
- *Carson City* *July 21, 2011*
- *Churchill County* *September 28, 2011*
- *City of Fallon* *October 04, 2011*
- *Douglas County* *February 23, 2012*
- *Lyon County* *October 20, 2009*
- *City of Fernley* *October 29, 2009*
- *City of Yerington* *September 02, 2009*
- *Storey County* *September 06, 2007*

A CAV is a visit to the community by FEMA personnel or staff of a State agency on behalf of FEMA to provide technical assistance to the community and assure that the community is enforcing adequately its SFHA management regulations. Douglas County was the only jurisdiction among the stakeholders from which we received a copy of the CAV Report. No issues were identified during the CAV process and Douglas County was commended for doing an excellent job of administering its floodplain building requirements.

7. Regulatory Mapping

The most recent FIRM updates for the communities in the Carson River Watershed became effective as follows:

- *Carson City* *Revised Preliminary November 28, 2011*

  This revision included new detailed flood hazard information for Vicee Canyon Creek, Ash Canyon Creek, Kings Canyon Creek, and Kings Split in Carson City, Nevada.

- *Churchill County* *September 26, 2008*

  HDR Engineering Inc. was contracted by FEMA to complete a countywide DFIRM and FIS for Churchill County. This became effective on September 26, 2008. The

DFIRM process included digitizing floodplain boundaries from the effective paper FIRMs and fitting them to a digital database (DFIRM).

- *Douglas County* *January 20, 2010*

  During this revision, floodways were developed or revised for the confined reaches of Bobwhite Wash, Buckeye Creek, Calle Hermosa Wash, Calle de Asco Wash, and Juniper Road Wash. Alluvial fan floodplains were amended or/or extended for Buckbrush Wash, Sunrise Pass Wash, Johnson Lane Wash, Airport Wash, and Buckeye Creek.

- *Lyon County* *January 16, 2009*

  This revision incorporated the approximate analyses of "behind levee" flooding to indicate the extent of the "behind levee" floodplain.

- *Storey County* *January 16, 2009*

  This revision incorporated the approximate analyses of "behind levee" flooding to indicate the extent of the "behind levee" floodplain.

- *Alpine County* *No FIS; the entire County is currently mapped by FEMA as Zone D.*

8. Watershed Projects

i. Ongoing Projects

Carson City Freeway Project — Carson City is working with FEMA on mapping revisions associated with the new U.S. Highway 395 freeway and associated improvements. To date, more than half of the improvements are complete. When the freeway is complete, there will be changes to the timing and flowrate of floodwaters that reach the Carson River.

Churchill County LiDAR and Canal System Projects — Because of the Fernley canal breach, embankments associated with the extensive canal system in Churchill County are being reviewed by the Churchill County Engineer. Churchill County commissioned collection of a LiDAR topographic dataset of the valleys throughout the Fallon area. The U.S. Army Corps of Engineers (USACE) is currently modeling portions of Churchill County using the LiDAR dataset. Some of the structures are 80–90-years old, therefore the risk presented by the failure of these structures should be evaluated. In anticipation of another relatively wet year, the Lahontan Conservation District (LCD) performed debris removal from the Carson River in their district to improve channel capacity. Significant amounts of sediment near bridge crossings and other locations where flows are obstructed have been sources of flooding issues. Most of the bridges are located near commercial and residential areas, which are the highest risk areas. In 2011, Churchill County received a USACE grant to support sediment removal, which is currently in progress. Although Lahontan Dam is a significant structure, the principal concern is not dam failure, but insufficient channel capacity downstream from the structure if/when capacity of the reservoir is exceeded. Churchill County Engineering Department is examining alternatives for controlled release and diversion areas in the event of extreme flooding. When results from the USACE hydraulic modeling (based on the LiDAR topographic data) is complete, options for addressing river channel and canal capacity will be

evaluated. An example of problems with sediment accumulation is the bridge at Bafford Lane, which is 70% occluded. Furthermore, houses were built in proximity to river channel. Although the USACE hydraulic modeling and LiDAR topographic data are not in strict compliance to FEMA guidelines, the results should be useful for floodplain planning and management tasks. If a canal failure similar to the Fernley breach occurs, the damage and cost could be great because commercial and residential buildings are in risk areas which were not previously developed. The goal is completion of the project before January 31, 2013.

US Bureau of Reclamation (USBR) Safety of Dams Project — The USBR Safety of Dams project was scheduled to begin in April 2012. Models used to manage Lahontan Dam operations include the Riverware daily model. In 2011, the Riverware daily flow model was used to optimize storage in Lahontan Reservoir. The results were useful in avoiding downstream flooding during a normal snowmelt event. USBR developed a real-time hourly model for in projecting flow conditions during a forward five-day scenario, which would assist assessment of short-term flooding conditions.

Carson River Mapping and Modeling Project—Carson Water Subconservancy District (CWSD) is currently working on projects to revise floodplain mapping of the entire Carson River. Additional efforts comprise education of the CWSD board and stakeholders on the fundamentals of the modeling program and changes to the floodplain maps. Additionally, CWSD is involved in working with the Carson River Coalition (CRC) River Corridor working group which is serving as steering committee considering which projects to work on for the Floodplain Management Plan which was adopted by all the counties. It has identified the need to update LiDAR and land use maps for the entire watershed and is a coordinated effort.

R.O. Anderson and HDR personnel continue work on the Carson River mapping project. The flood mapping for FEMA Mapping Activity Statement (MAS) #1 and #2 will be completed in December 2012, which includes only Lyon County and Carson City. Funding has been received for MAS #3 which will encompass modeling of the Carson Valley. The next phase, MAS #4 will include mapping of the Carson Valley. The statistical analysis of records from U.S. Geological Survey (USGS) streamgage records of the Carson River watershed upstream from Lahontan Reservoir is in progress. USGS only has short-time interval hydrographs for a couple of major events; therefore, it would be valuable to also look at historic flood events.

State Route 88 Flood Mitigation Project — Douglas County has prepared a grant for the State Route 88 Flood Mitigation Project to be submitted under FEMA's Unified Hazard Mitigation Assistance Program pending federal funding this year.

Douglas County Community and Senior Center — Douglas County is moving forward with plans to build the new community and senior center in Carson Valley. The Pine Nut Pre-Disaster Mitigation Preliminary Map Revision (PMR) is turning into a Letter of Map Revision (LOMR) to include the Community Center.

Douglas County Martin Slough Path — Carson Valley Inn (CVI) has received approval from Douglas County for their Site Improvement Permit (SIP) #00675-02 for the North Parking

Lot and Bike Trail Improvements. The Bike Trail will follow a path along the Martin Slough which is in an AE and AE (floodway) so the project has obtained an approval from FEMA for a Conditional Letter of Map Revision (CLOMR). SIP 00675-02 was issued on October 9, 2012, with U.S. Army Corps of Engineers' approval, and construction commenced the beginning of November.

National Weather Service Forecasting — The National Weather Service is working on forecasting for floods and prevention of hazards to life and property. There are three forecast points along the Carson River (at Woodfords, near Gardnerville, and at Carson City), but they can put a forecast point at any USGS gage that has a lot of historical data. They may consider forecast points at Dayton, Fort Churchill, and somewhere below Lahontan in the future. The National Weather Service is trying to get flood inundation maps online for public access to be able to approximate areas and depth of water during flooding from minor flooding up to flood of record.

Truckee Carson Irrigation District Canal Maintenance — The Truckee Carson Irrigation District (TCID) has a contract with USBR to do operations and maintenance work on the canals, Lahontan Dam, and the Newlands Project in Fernley and Churchill County. TCID has equipment to perform the work, but no funding for the studies. TCID believes that the outcome of the Charter and Discovery Process will benefit TCID because of concerns with the canal and where water will go in flooding. This is the value of inundation maps and the Environmental Action Plans (EAP) they develop. TCID's contribution is to do the work if the county identifies structures which need to be replaced.

USGS Streamgaging Stations — USGS is responsible for the operation and management gauging stations, taking measurements every six weeks of low, average, and high flow. Prior to 1975, unit value of historical data begins to drop off because the information was collected on strip charts. The USGS is working with FEMA and NOAA to create a system-wide approach for data accumulation.

Flood History Database — The Nevada Division of Water Resources is participating in a pilot project with the US Army Corps of Engineers Silver Jackets to update the flood history database and link to weather forecasting data through ACOE. They are creating website links which could serve Carson River data through the USGS website.

Lyon County Floodplain — Lyon County is working with the Carson Water Subconservancy District (CWSD) to redefine the floodplain in the Dayton Valley area. CWSD has also provided funding for an analysis and feasibility flood study of Ramsey Canyon near Silver Springs. Flows from Ramsey Canyon pass through Silver Springs to Lahontan Reservoir. The modeling and studies are complete for Ramsey Canyon and the County is now working to submit a hydrology only LOMR to FEMA for approval.

Lyon County Hazard Mitigation Plan — Lyon County has contracted with a consultant to develop their local Hazard Mitigation Plan.

Markleeville Creek Floodplain Restoration Project — The Alpine Watershed Group has retained a consultant to complete the final restoration planning and design stages for the Markleeville Creek Floodplain Restoration. This includes community outreach, final restoration design, environmental analysis/documentation and project permitting. The goal of the restoration project is to re-establish the natural form and function of Markleeville Creek through the site of the former United States Forest Service (USFS) Guard Station.

American Rivers Floodplain Restoration in Hope Valley — Alpine Watershed Group (AWG) is leading this project on the West Fork of the Carson River between Hwy 88 and Blue Lakes Rd. on U.S. Forest Service (USFS) property. The project is being sponsored by American Rivers, USFS, AWG, and others. A consultant was hired to look at restoring portions of the river to allow it to reach its floodplain but not re-watering the entire meadow. The design phase will be complete soon. Alpine Watershed Group is seeking funding to complete additional projects and may be moving upstream into Faith and Charity Valleys.

ii. Completed Projects

Carson City Stormwater Mitigation Projects - Carson City completed improvements to alluvial fan stormwater mitigation systems. In 1986, a flood control dam was built in the west side subarea of Golf Course Creek B in order to alleviate damage from floods. In 1999, a flood control basin was built in the F Tributary just south of East Bonanza Drive. In 2002, basins within Silver Oak Golf Course were completed. In 2005, Vicee Retention Basin was completed. In 2007, the Eagle Valley Creek and the Timberline/Combs Canyon basins were completed.

Carson City Emergency Action Procedure – Carson City has prepared an emergency action procedure which shows locations where sandbags should be placed and pre-positioned.

Douglas County FEMA Map Challenge — After four years of contesting the data used by the Federal Emergency Management Agency (FEMA) to develop flood maps for the Carson Valley, it has been determined that the 2010 maps will remain as best available information.

Dayton Valley Bank Stabilization Projects – Dayton Valley Conservation and R.O. Anderson have completed over 30 different river restoration and bank stabilization projects in the past 14 years. A majority of the projects which were implemented were the result of property owners along the Carson River experiencing significant annual erosion of valuable agricultural lands and needing to find viable long-term methods to minimize erosion from annual stream flows.

9. Community Involvement

The CWSD is a unique multi-county, bi-state agency dedicated to establishing a balance between the needs of the communities within the Carson River Watershed and the function of the river system. The thirteen member Board of Directors consists of representatives from each of the five counties within the watershed plus two representatives from the agricultural community. In 2009, Storey County joined CWSD as a non-voting member. Granted no regulatory authority of its own, the CWSD's mission is to work within existing governmental frameworks to promote cooperative action for the watershed that crosses both agency and political boundaries. The CWSD strives to involve all counties and communities within the

watershed in the efforts to preserve the rich history and unique resources of the Carson River Watershed.

CWSD is a Cooperating Technical Partner with FEMA. FEMA has provided funding for flood-related activities on a regional basis. CWSD members have also signed a Risk Map Charter for the Carson River Watershed which will provide for a collaborative effort between local, State and Federal agencies to identify, assess, communicate, and plan for flood risk within the Carson River Watershed. The flood risk information provided can be used to enhance hazard mitigation plans, make informed decisions to improve resilience after flooding, protect beneficial functions of floodplains, and raise awareness about local flood risks.

10. Other Data

i. Floodplain Management Ordinances

All six of the counties within the Carson River Watershed have floodplain management ordinances.

ii. Capital Improvement Plans

Carson City and Douglas County both have Capital Improvement Plans (CIP). Carson City's CIP is currently being updated and includes channel restoration, sediment control, and other drainage improvement projects in the next 5 years. Douglas County's CIP for Fiscal Year 2012-2016 does not include any new storm water control projects.

IV. Discovery Meeting

The first Discovery Meeting was held for the Carson River Watershed on September 13, 2012. Representatives from U.S. Bureau of Reclamation, Nevada Division of Water Resources, Nevada Division of Emergency Management, Nevada Division of Environmental Protection, Carson Water Subconservancy District, Alpine County, Carson City, Douglas County, Churchill County, HDR Inc., R.O. Anderson Engineering, Inc., and FEMA Region IX attended the meeting. Sign in sheets and meeting notes from the meeting are provided in Appendix C.

Representatives from Carson Water Subconservancy District and R.O. Anderson Engineering, Inc. met separately with Lyon County, on October 5, 2012, who was unable to attend the Discovery meeting.

The second Discovery Meeting was held on October 31, 2012. Representatives were present from U.S. Geological Survey, U.S. Army Corps of Engineers, National Weather Service, Nevada Division of Water Resources, Nevada Division of Environmental Protection, Carson Water Subconservancy District, Alpine County, Carson City, Douglas County, Churchill County, Storey County, Truckee Carson Irrigation District, Town of Gardnerville, HDR Inc., R.O. Anderson Engineering, Inc., and FEMA Region IX attended the meeting. Sign in sheets and meeting notes from the meeting are provided in Appendix C.

V. Findings and Options

The Discovery process has identified several priority restudy needs as well as mitigation projects in the Carson River Watershed as listed below in Table 4. If funded and completed, these projects should be used to update the FIS and FIRM for the Carson River Watershed communities. In addition, FEMA's tool for tracking study accuracy, CNMS, should be updated to reflect these needs. A description of each project listed by County is provided in Appendix D. As discussed above, each project was ranked as a high, medium, or low priority by the stakeholders.

VI. References

Alpine County, *Alpine County Natural Hazard Mitigation Plan.*

Alpine County Website. Available at http://www.alpinecountyca.gov/.

Carson City Website. Available at http://www.carson.org/.

Carson City, November 2010. *Carson City Hazard Mitigation Plan.*

Carson City Public Works, January 2009. *Emergency Action Plan for Eagle Valley Golf Course Dam.*

Carson City Public Works, October 2006. *Emergency Action Plan Shenandoah Detention Basin.*

Carson Water Subconservancy District, 2008. *Carson River Watershed Regional Floodplain Management Plan.*

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Carson Water Subconservancy District Website. Available at www.cwsd.org/.

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Douglas County, Nevada, February 2009. *Douglas County Natural Hazard Disaster Mitigation Plan.*

Douglas County Website. Available at http://www.douglascountynv.gov/ .

Federal Emergency Management Agency, November 2011. *Flood Insurance Study, Carson City, Nevada.*

Federal Emergency Management Agency, January 2008. *Flood Insurance Study, Churchill County, Nevada.*

Federal Emergency Management Agency, January 2010. *Flood Insurance Study, Douglas County, Nevada.*

Federal Emergency Management Agency, January 2009. *Flood Insurance Study, Lyon County, Nevada.*

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Lyon County Website. Available at www.lyon-county.org/.

Storey County, Nevada, January 2010. *Storey County Hazard Mitigation Plan.*

U.S. Census Bureau. 2010. State & County QuickFacts. Available at http://quickfacts.census.gov/qfd/index.html. Accessed on June 7, 2012, July 10, 2012, July 11, 2012, and July 17, 2012.

U.S. Census Bureau. 2000. American FactFinder, Available at http://factfinder2.census.gov. Accessed on June 7, 2012, July 10, 2012, July 11, 2012, and July 17, 2012.

VII. Appendix and Tables

Appendix A — Stakeholder Contact Information

Appendix B — Community Fact Sheets

Appendix C — Discovery Meeting Sign-In Sheets & Meeting Notes

Appendix D — Recommended Watershed Projects

Appendix E — Stakeholders Comments of Draft Discovery Report and Map

Appendix F — Discovery Maps

Carson River Watershed Discovery Project

	Contact	*Title*	*Email*	*Phone*
Alpine County	Brian Peters		bpeters@alpinecountyca.gov	530-694-2140 x425
Carson City	Robb Fellows	Floodplain, CRS and NDPES Manager	RFellows@carson.org	775-283-7370
Churchill County	Milorad Misha Stojicevic	Capital Projects and Engineering Manager	mstojicevic@churchillcounty.org	775-423-2153
	Ron Juliff	Office of Emergency Management	ccem@phonewave.net	775-423-4188
	Eleanor Lockwood	Planning Director /Floodplain Manager	planning-director@churchillcounty.org	775-423-7627
	Preston Denny	GIS	planning-gis@churchillcounty.org	775-423-7627
DEM	Elizabeth Ashby	SHMO	eashby@dps.state.nv.us	775-687-0314
DWR	Kim Davis	State Floodplain Manager	kadavis@water.nv.gov	775-684-2884
Douglas County	Erik Nilssen	County Engineer	enilssen@co.douglas.nv.us	775-782-9063
	Barbra Resnik	Civil Engineer II	bresnik@co.douglas.nv.us	775-782-6234
FEMA	Eric Simmons	Region 9 Engineer	eric.simmons@dhs.gov	510-627-7029
HDR	Mitch Blum		mitchell.blum@hdrinc.com	
Lyon County	Rob Loveberg	Planning Director	rloveberg@lyon-county.org	775-463-6592
NOAA	Gary Barbato		gary.barbato@noaa.gov	775-673-8104
Storey County	Austin Osborne		aosborne@storeycounty.org	775-847-0966
TCID	Kate Rutan		kate@tcid.org	775-423-2141
USACE	Judy Soutiere		Judy.M.Soutiere@usace.army.mil	
USBR	Pat Fritchel Terri Edwards		pfritchel@usbr.gov tedwards@usbr.gov	775-884-8368
USGS	Steven Berris		snberris@usgs.gov	775-887-7693
Consultant with City of Fallon	Steve Endacott		sendacott@sci-nevada.com	775-423-1345 x 225

RIX Discovery 2012: Carson River Watershed
Fact Sheet: Alpine County, California

CID: 06003	**FIS/FIRM:** No FIS; the entire County is currently mapped by FEMA as Zone D.
LOMCs: None	**Last CAV/CAC Date:** None
Demographics: Population: 1,102 Median Age: 40.9 Elderly (65+): 9.9% Native: 95%	**Social Characteristics** Non-English Speakers: 2.7% High School + Education: 92.1% Bachelors + Education: 29.7%
Industrial Population in labor force: 64.9% Median Income: $63,478	**Top 5 Industries:** (1) Educational services, and health care and social assistance; (2) Public administration; (3) Arts, entertainment, and recreation, and accommodation and food services; (4) Professional, scientific, and management, and administrative and waste management services; and, (5) Other services, except public administration.
Insurance Total Policies: 116 Floodprone Policies: 0	 Zone X Policies: 0 Zone D Policies: 116
Mitigation Plans: *Alpine County Natural Hazard Mitigation Plan* Effective: 2004 Expires: Lapsed as of 2010	
Other Plans: *Alpine County General Plan* Effective: 2009 *Carson River Watershed Regional Floodplain Management Plan* Effective: 2008	

RIX Discovery 2012: Carson River Watershed

Fact Sheet: Carson City, Nevada

CID: 320001	**FIS/FIRM:** Effective Date: January 16, 2009 Level of Study: Detailed
LOMCs: 5	**Last CAV/CAC Date:** July 21, 2011
CRS Status	
Class: 6	SFHA Discount: 20%
Effective: October 1, 2009	Non-SFHA Discount: 10%
Demographics:	**Social Characteristics**
Population: 55,274	Non-English Speakers: 8.2%
Median Age: 41.1	High School + Education: 88%
Elderly (65+): 16.5%	Bachelors + Education: 21.6%
Native: 88.4%	
Industrial	**Top 5 Industries:** (1) Educational services, and health care and social assistance; (2) Public administration; (3) Arts, entertainment, and recreation, and accommodation and food services; (4) Retail trade; and, (5) Manufacturing.
Population in labor force: 64.7%	
Median Income: $52,067	
Presidentially-Declared Disasters	
Flood-related total: $3,099,910 (includes Carson Water Subconservancy District)	
Recent flood related: February 28; 1986, January 3, 1997; February 3, 2006	
Other hazards: August 27, 2004 – Waterfall Fire	
Insurance	
Total Policies: 638	Zone X Policies: 184
Floodprone Policies: 451	Zone D Policies: 3
Mitigation Projects and Other Grants	
Mitigation Projects: Eagle Valley Golf Course Basin, Shenandoah Basin, Silver Oak Golf Course Basins, Timberline/Combs Basins, Eagle Valley Creek Basins and Vicee Canyon Basin.	
Mitigation Plans:	
Carson City Hazard Mitigation Plan	
Effective: April 6, 2011	
Expires: April 6, 2016	
Other Plans: *Carson City Sand Bagging Plan*	*Community Wildfire Protection Plan*
Effective: 2010	Effective: August 2009
Carson River Watershed Regional Floodplain Management Plan	
Effective: 2008	

RIX Discovery 2012: Carson River Watershed
Fact Sheet: Churchill County, Nevada

CID: 320030, 320002	**FIS/FIRM:** Effective Date: September 26, 2008 Level of Study: Detailed
LOMCs: 0	**Last CAV/CAC Date:** September 28, 2011
CRS Status – Does Not Participate	
Demographics: Population: 24,637 Median Age: 39.0 Elderly (65+): 15.3% Native: 94.2%	**Social Characteristics** Non-English Speakers: 5.6% High School + Education: 87.7% Bachelors + Education: 18.2%
Industrial Population in labor force: 62.7% Median Income: $51,597	**Top 5 Industries:** (1) Arts, entertainment, and recreation, and accommodation and food services; (2) Educational services, and health care and social assistance; (3) Retail trade; (4) Public administration; and, (5) Professional, scientific, and management, and administrative and waste management services.
Presidentially-Declared Disasters Flood-related total: $30,149 Recent flood related: January 3, 1997 Other hazards: None	
Insurance	
Total Premiums: $82,809 Total Coverage: $40,351,900 Total Policies: 161 Floodprone Policies: 105	Zone X Policies: 56 Zone D Policies: 0 Rep Losses: 1 Zone Claims: 3
Mitigation Projects and Other Grants Mitigation Project: None	
Mitigation Plans: *Churchill County and City of Fallon Multi-Jurisdictional Hazard Mitigation Plan* Effective: Submitted to FEMA 2012	
Other Plans: *Churchill County Master Plan* Effective: 2010 *Carson River Watershed Regional Floodplain Management Plan* Effective: 2008 *Lahontan Dam Table Top Flood Exercise* Effective Date: 2009	*Carson River Geographic Response Plan* Effective: Unknown *Design, Estimating and Construction Review Truckee Canal Risk Assessment* Effective: 2008

RIX Discovery 2012: Carson River Watershed
Fact Sheet: Douglas County, Nevada

CID: 320008

FIS/FIRM: Effective Date: September 30, 1992
Level of Study: Detailed

LOMCs: 5

Last CAV/CAC Date: February 23, 2012

CRS Status

Class: 6
Effective: October 1, 2004

SFHA Discount: 20%
Non-SFHA Discount: 10%

Demographics:

Population: 46,997
Median Age: 47.0
Elderly (65+): 20.1%
Native: 94.1%

Social Characteristics

Non-English Speakers: 2.7%
High School + Education: 91.8%
Bachelors + Education: 23.2%

Industrial

Population in labor force: 61.5%
Median Income: $60,721

Top 5 Industries: (1) Educational services, and health care and social assistance; (2) Arts, entertainment, and recreation, and accommodation and food services; (3) retail trade; (4) Construction, and (5) Manufacturing

Presidentially-Declared Disasters

Flood-related total: $969,760
Recent flood related: February 28; 1986; January 3, 1997; February 3, 2006
Other hazards: None

Insurance

Total Policies: 1,076
Floodprone Policies: 640

Zone X Policies: 436
Zone D Policies: 0

Mitigation Projects and Other Grants

Mitigation Project: U.S. Highway 395 Culvert Project
FEMA Funding: $875,916.00
Local Cost-Share: $41,972 (Douglas County), $250,000 (NDOT)

Mitigation Plans:

Douglas County Natural Hazard Disaster Mitigation Plan
Effective: March 24, 2008
Expires: March 24, 2013

Other Plans: *Douglas County Master Plan*
Effective: 2012

Douglas County Open Space and Agricultural Lands Preservation Implementation Plan
Effective: 2004

Douglas County Code Title 20 Zoning Ordinance of Douglas County
Effective: 1996

Carson River Watershed Regional Floodplain Management Plan
Effective: 2008

RIX Discovery 2012: Carson River Watershed

Fact Sheet: Lyon, Nevada

CID: 320029, 320038, 320016	**FIS/FIRM:** Effective Date: January 16, 2009 Level of Study: Detailed
LOMCs: 2	**Last CAV/CAC Date:** October 20, 2009
Demographics: Population: 51,871 Median Age: 39.9 Elderly (65+): 15.1% Native: 24.4%	**Social Characteristics** Non-English Speakers: 4.3% High School + Education: 84.7% Bachelors + Education: 11.9%
Industrial Population in labor force: 58.8% Median Income: $48,433	**Top 5 Industries:** (1) Retail trade; (2) Educational services, and health care and social assistance; (3) Manufacturing; (4) Arts, entertainment, and recreation, and accommodation and food services; and (5) Construction.
Presidentially-Declared Disasters Flood-related total: $1,044,838 Recent flood related: February 28; 1986, January 3, 1997; February 3, 2006; February 15, 2008 Other hazards: None	
Insurance Total Policies: 363 Floodprone Policies: 195	 Zone X Policies: 167 Zone D Policies: 1
Other Plans: *Lyon County Comprehensive Master Plan* Effective: 2010 *Carson River Watershed Regional Floodplain Management Plan* Effective: 2008	

RIX Discovery 2012: Carson River Watershed
Fact Sheet: Storey County, Nevada

CID: 320033

FIS/FIRM: Effective Date: January 16, 2009
Level of Study: Detailed
Last Community Meeting: April 23, 2008

LOMCs: 0

Last CAV/CAC Date: September 6, 2007

CRS Status

Class: 8
Effective: 10/01/1994

SFHA Discount: 10%
Non-SFHA Discount: 5%

Demographics:

Population: 3,896
Median Age: 46.4
Elderly (65+): 16.9%
Native: 95.2%

Social Characteristics

Non-English Speakers: 1.2%
High School + Education: 91.8%
Bachelors + Education: 13.9%

Industrial

Population in labor force: 67.6%
Median Income: $61,525

Top 5 Industries: (1) Manufacturing; (2) Educational services, and health care and social assistance; public administration; (3) Construction; (4) Arts, entertainment, and recreation, and accommodation and food services; and, (5) Professional, scientific, and management, and administrative and waste management services.

Presidentially-Declared Disasters

Flood-related total: $1,171,546
Recent flood related: February 28; 1986, January 3, 1997; February 3, 2006
Other hazards: None

Mitigation Projects and Other Grants

Mitigation Project: Six Mile Canyon Drainage Improvements Project
FEMA Funding: $1,141,160.97
Local Cost-Share: $380,387.00

Mitigation Plans:

Storey County Hazard Mitigation Plan
Effective: December 4, 2009
Expires: December 4, 2014

Other Plans: *Storey County Master Plan*
Effective: 1994
Carson River Watershed Regional Floodplain Management Plan
Effective: 2008

Carson River Watershed
Discovery Meeting 09/13/2012
Attendance Roster

Appendix C

Name	Organization	Email	Phone
Ron JuLiFF	Churchill County	ccem@phonewave.net	(775) 423-4188
Robb Fellows	Carson City	RFellows@carson.org	775 283-7370
Eric Simmons	FEMA	eric.simmons@dhs.gov	510 627-7027
Jean Stone	NDEP	jstone@ndep.nv.gov	775-687-9456
Ed James	CWSD	edjames@cwsd.org	
Brenda Hunt	CWSD	brenda@cwsd.org	887-9005
Barbara Resnik	D.C.	bresnik@co.douglas.nv.us	(775) 782-6234
Erik Nilssen	D.C.	enilssen@co.douglas.nv.us	775 782-9063
Pat Fritchel	Reclamation	pfritchel@usbr.gov	775-884-8358
Elizabeth Ashby	NDEM	eashby@dps.state.nv.us	775687-0314
KIM DAVIS	NDWR	kadavis@water.nv.gov	775-684-2884
DAVID THOMPSON	RDA ENGRG	dthompson@randson.com	775/215-5013 or 782-2322
Mitch Blum	HDR	mitchell.blum@hdrinc.com	775/337-4726
Zach Wood	Alpine County	zwood@alpinecountyca.gov	530-694-2140 x 437
Toni Heffter	CWSD		

Carson Water Subconservancy District
Carson River Risk MAP Charter Meeting
September 13, 2012, 9:00 a.m.

MEETING NOTES

Attendees:

Elizabeth Ashby, NV Dept. of Emergency Management
Mitch Blum, HDR Inc.
Kim Davis, NDWR
Robb Fellows, Carson City Public Works
Pat Fritchel, USBR
Eric Herron, R.O. Anderson
Stephanie Hicks, R.O. Anderson
Brenda Hunt, CWSD
Ed James, CWSD
Ron Juliff, Churchill County
Toni Leffler, CWSD
Erik Nilssen, Douglas County
Barbara Resnik, Douglas County
Eric Simmons, FEMA
Jean Stone, NDEP
David Thompson, R.O. Anderson
Zach Wood, Alpine County

This meeting of the Carson River Risk Mapping, Assessment, and Planning (MAP) Charter Discovery Group was held in the Carson Water Subconservancy District's Conference Room, 777 E. William St., #110, Carson City Nevada. Introductions were made around the room.

Item #2 - Presentation (R.O. Anderson

a. **Discovery Process Overview** – Eric Simmons of FEMA gave an overview of the process. Discovery is a watershed-wide discussion of the Risk Mapping, Assessment and Planning (MAP) process. The Carson River watershed is a good model because there are already watershed-wide efforts. Stephanie Hicks explained the presentation today. The discovery process is designed to:
    - start a dialogue about your flood risk;
    - understand your needs and priorities;
    - communicate available resources;
    - offer partnerships and answer questions; and
    - give a complete, current picture of flood hazards and risks to help better plan for the risk, take action to protect communities, and communicate the risks to citizens.

The goal of the Risk MAP process is to reduce loss of life and property due to flooding by:

- identifying risk;
- using the Risk MAP data to assess present and future risks areas;
- measuring quantifiable risk reduction;
- communicating the risk;
- planning for the risk;
- mitigating the risk; and
- transferring and reducing the risk.

What is Risk Map?

- Flood mapping products and flood hazard maps that are:
    - developed by FEMA in accordance with communities;
    - based on the best available data from the community and the latest technologies;
    - conducted by watershed; and
    - strengthened by partnerships.

- Risk MAP tools can be used to:
    - create or improve Hazard Mitigation Plans;
    - make informed decisions about development, ordinances, and flood mitigation projects; and
    - communicate with citizens about flood risks.

The Risk MAP Process timeline, a 3-5 yr. process, includes a discovery meeting, project kickoff, flood study review, resilience meeting, and final CCO meeting.

The Discovery Process includes:

- data collection of information about the communities in the watershed to develop a draft Discovery Report and Map;
- a discovery meeting to present potential flood risk products and get feedback, discuss and prioritize areas needing flood risk study, and discuss local planning and communication assistance; and
- the outcome to finalize the Discovery Map and Report based on meeting input, develop a scope of work and budget for Risk MAP projects, and determine available local contributions.

The data collected to date from this watershed includes:

- local flood history, risks, and hazards;
- current and future mitigation activities;
- development and floodplain management plans and ordinances;

- flood studies and flood mapping needs;
- infrastructure information for levees and new bridges, dams, culverts, and road improvements;
- boundary, hydrography, and transportation layers; and
- regional watershed plans.

Additional data reviewed to date included:

- FEMA approved Hazard Mitigation Plans;
- previous flood hazard studies conducted;
- Letters of Map Amendments and/or Letters of Map Revisions;
- Average Annualized Loss (AAL) information;
- census data; and
- Federal and State disaster information.

There are concerns about riverine flooding, development within the floodplain, and the capacity of Lahontan Reservoir. Possible needs and solutions include:

- updating recent DFIRMs based on recent LiDAR,
- conducting Flood Risk Assessment using multiple risk factors;
- mitigating repetitive loss properties; and
- other mitigation projects.

b. Meeting Goals and Objectives -

- Continued dialogue about flood risk by reviewing and validating the information received;
- Communicating available resources;
- Presenting a current picture of flood hazards and risks to help better plan for the risk to increase flood resilience, take action to protect communities, and communicate the risk to the citizens;
- Understanding our needs; and
- Developing a list of our flood risk study needs to be included in the Discovery Report.

It was noted that the maps appeared to over state some of the flooding damage area because they are based on census area, not flood risk areas. Additional Info needs to be provided to R.O. Anderson by Oct. 11 to be included in the Discovery Report.

Item #3 - Discovery Stations - Breakout Session. – Stephanie explained the purpose of the breakout stations. She suggested naming the comments (like DC1 for Douglas County comment #1) and put the identifier on the map to show

location. On each map there is a breakdown to identify what they are looking for, completed or needed. The four breakout stations are as follows:

a. Grants/Hazard Mitigation Planning Session - Hazard Mitigation is a sustained action taken to reduce or eliminate long-term risk to people and property from hazards.

- Types of mitigation include:
  - ✓ prevention,
  - ✓ structural projects,
  - ✓ property protection,
  - ✓ natural resource protection, and
  - ✓ education and awareness.
- Map and identify flood mitigation projects completed or planned.

b. NFIP Coordination Station –

- Identify any repetitive and severe repetitive loss properties.
- Identify/discuss areas of urban change or planned growth.
- Are there areas of high population (or population growth) where a Zone A exists on the FIRM?
- Are there areas of future development pressure where a mapped floodplain would be helpful to identify risk?

c. Risk Mapping Station –

- Indicate places where bridges or roads are regularly closed due to flooding.
- Identify dams causing local flood issues, flood gauges for advance warning, safe room for schools, low water crossings, and high water marks.
- Identify places where structures flood and there is no current special flood hazard defined.
- Identify areas that may have additional topographic or ground survey information.
- Where are areas of concern for emergency response, i.e. evacuation routes, critical facilities, and other vulnerabilities?
- Identify other factors that should be used in risk assessment.

COMMENTS: The Risk Map was creating using very course data. It was suggested that multiple risk factors should be depicted and used to more accurately analyze risk. This could be identified as a needed project.. There are areas which are not reflecting damage where they should and others that shows damage where you wonder why. Identify projects within communities. Prioritize.

d. Floodplain Mapping Station –

- Are there inaccuracies in the FIRMS for your community? Where?
- Are there new road crossings that are not reflected on the FIRM?

- Where are problem flooding areas?
- Identify areas where the effective Flood Insurance Rate Maps (FIRM) and Flood Insurance Study (FIS) products do not reflect current conditions.
- Identify locations of new bridges, culverts, channel realignment.
- Do you have flood hazard data used for planning/management not reflected on the FIRM such as local flood studies that have not gone through the Letter of Map Change (LOMC) process but are used for local permitting as the best available data?

COMMENTS: FIRM maps don't accurately reflect the 2010 data, esp. in Douglas County. We are starting a process of better studies of the Carson River floodplain. We might want to ask communities to list their top three or four concerns. Some projects in one area may benefit another area. Identify top, medium, and low priority projects on each county's list for mapping and mitigation. We may need to go through this process again in the future to reassess.

Risk to what? Structures, transportation, water/sewer infrastructure, clean water production. This information may be available in the state hazard mitigation plan which identifies costs. Consider funding sources which may not be in priority order. Additional gauges may be useful in making decisions. Ongoing gauge maintenance important. Consider areas for conservation easements or attenuation facilities.

Item #4 - Next Steps - Mr. James mentioned that the next step is to begin prioritizing projects throughout the watershed. One issue brought up was a concern that the priority list would be based on cost of damage. If this occurs, some counties which have small populations would not have their projects listed very high on a watershed basis but are important to their areas. It was suggested that at the next meeting the group would set up raking criteria and each county would rank their list of projects in their county. The counties' rankings would then be merged together to create a watershed-wide priority list.

Item # 5 - Discuss 2012 NFIP Reform Act (Kim Davis) – Ms. Davis explained the reauthorization of National Flood Insurance Program (NFIP) on July 6, 2012. No one in the region can say how it will be implemented at the format level. The Association of Floodplain Managers created a good summary of the contents of the Biggert-Waters Flood Insurance Reform Act of 2012, which was distributed to the group. The authority of the NFIP is extended five years to Sept. 30, 2017. The bill addresses primarily flood insurance and mapping.

The biggest issue with flood insurance is that the large catastrophes, like Katrina, have depleted FEMA funds and the bill is to make the NFIP actuarially sound. FEMA owes the Federal government $15 billion for Katrina.

- Historically the NFIP could not raise insurance premiums by more than 10% per year, but rates have been raised to be phased in over a five-year period at 25% per year until the actuarial rates are achieved.
- The bill increases the limit for annual rate increases within any risk classification of structures from 10% to 20%, effective July 1, 2012.
- Defines Severe Repetitive Loss properties for single family residences as four or more claims, each for more than $5,000 and cumulatively more than $20,000. For multi-family residences, the Director may provide a definition by regulation.
- Places limits on a bank's forced placement of flood insurance wherein the forced placed insurance would be cancelled and premiums refunded upon proof of a borrower's existing flood insurance coverage.
- Effective on the effective date of the new map, when flood maps change a property that has a higher rate as a result of a new map shall have the new rates phased in over a five-year period at 20% per year.
- Lender penalties for non-compliance with mandatory flood insurance purchase requires is increased from $350 to $2,000 per violation, with the annual limit removed.
- Minimum annual deductibles on claims are changed to $1,500 for coverage up to $100,000 and $2,000 for coverage over $100,000 for pre-FIRM (the date community receives first Risk MAP) properties, and $1,000 and $1,250 for below and above $100,000 coverage for post-FIRM properties.
- Rates must be set to cover historical loss, including catastrophic loss.
- The bill requires FEMA must establish a National Flood Insurance Reserve Fund to handle Katrina-type events.
- Requires a 10-yr repayment plan for the current insurance fund debt and a report and repayment plan whenever FEMA has to borrow funds to pay NFIP claims.
- Clarified that private flood insurance may satisfy flood insurance coverage requirements if it meets certain standards.
- Allows state sponsored non-binding mediation of flood insurance claims disputes, including NFIP representatives participation.
- Amends the Real Estate Settlement Procedures Act (RESPA) to require explanation of the availability of flood insurance under the NFIP or through private insurance for properties both in and out of Standard Flood Hazard Areas (SFHAs).
- Establishes reporting requirements associated with reimbursement of expenses for Write Your Own (WYO) insurance companies.
- Establishes a process involving the National Oceanographic and Atmospheric Administration (NOAA) to allocate tropical storm and hurricane damages between wind and water damage.

Regarding mapping, the Act:

- Establishes a Technical Mapping Advisory Council to advise FEMA on improving accuracy, on standards that should be adopted for flood maps, data, and map maintenance, and on funding needs and strategies.
- Establishes an on-going National Flood Mapping Program requiring that flood maps show 100-yr and 500-yr floodplains for all populated areas and areas of possible population growth, as well as areas with residual risk behind levees or below dams.
- Requires FEMA to notify property owners when their properties are included in or removed from an area covered by mandatory insurance purchase requirements.
- Authorizes $400 million for flood mapping per year for fiscal years 2013-2017. This is the first time it has been a congressional authorization, but it still needs to be appropriated for FY 2013-17.
- Formalizes a Scientific Resolution Panel to arbitrate when a community has received an unsatisfactory ruling with respect to an appeal of a revised flood insurance rate map.
- Removes limitations of state contributions to updated flood mapping, previously 50%.
- Requires a study on federal interagency coordination of flood mapping, including collection and utilization of data among all governmental users.

The Mitigation Programs:

- consolidates the NFIP-funded mitigation programs (Repetitive Flood Claims, Severe Repetitive Loss Properties, and Flood Mitigation Assistance) into a single program. Addresses levees, flood structure accreditation task force. FEMA is updating Levee Analysis and Mapping Project (LAMP). Levee is a man-made structure designed and maintained for flood control, so does not include roads. Different approaches on how to map current zone designations. LAMP is for non-certified levee structures. Allows for different approaches for levees built to protect some flooding but not 100-year flood. Non-levee embankments are not recognized by FEMA. Model as though they are not there. Not maintained to be a flood control structure.
- Allows the required Flood Mitigation plan to be part of a community's multi-hazard mitigation plan.
- Removes beach nourishment as an allowed mitigation activity.
- Adds elevation, relocation or flood-proofing of facilities as allowed mitigation activities.
- Adds demolition and rebuild as an allowed mitigation activity.
- Notes the capacity for "direct" grants if the Administration, after consulting with the Sate and community, determines that neither has a capacity to manage the mitigation grant.
- Caps the use of mitigation grant funds for state mitigation plan development at $50,000 and at $25,000 for a community.
- Provides for denial of grant funds if not obligated in five years.

- Restructures federal share requirement.

The bill also establishes a Flood Protection Structure Accreditation Task Force in cooperation with the Corps of Engineers (COE)which is charged with better aligning the information collected by the COE's Inspection of Completed Works Program with FEMA's flood protection structure accreditation requirements. FEMA is required to develop a process for determining when a flood event has commenced for the purpose of flood insurance coverage. Education is key to helping people understand flooding possibilities and the need for insurance.

Item #6 - Other items – Brenda Hunt explained that John Cobourn and Steve Lewis with UNCE are applying for a 319 grant for education about the Carson and Truckee Rivers to include billboards, etc.

Elizabeth Ashby noted that the Hwy. 88 application for FEMA funding was not approved for funding last year but will be resubmitted. The committee will prioritize submissions for application. The project must fit NFIP requirements or be Pre-Disaster Mitigation (PDM) qualified. The mercury Superfund site in Lyon County extends to Lahontan Reservoir or Carson Sink and does not qualify. She suggested that perhaps a proposal for acquisition of property would be better received for funding than bank stabilization projects. Mr. James noted that bank stabilization projects are what are needed.

Item #7 - Schedule Next Meeting -. Mr. James will send out a Doodle poll to determine the next meeting date in mid-to-late-October after all data has been submitted and the report reviewed.

The meeting concluded at 10:50 a.m.
tl

CARSON WATER SUBCONSERVANCY DISTRICT
Carson River Risk MAP Charter Discovery Meeting
October 31, 2012, 11:00 A.M.

LIST OF ATTENDEES

Name	Agency	Phone/Fax Number	E-Mail Address
Kate Rutan	TCID	423-2141/423-5354	Kate@Tcid.org
Tom Dallaire	Town of Gville	782-7134 x102	TDallaire@Co.douglas.nv.us
Stephanie Hicks	RO Anderson Eng	215-5042	shicks@roanderson.com
Robb Fellows	CCPW	283-7370	RFellows@carson.org
Brian Peters	Alpine Co.	530 6942140x425	bpeterse@alpinecountyca.gov
Eric Nilssen	D.C.	775 782-0963	enilssen@co.douglas.nv.us
Ron Juliff	Churchill County/City of Fallon	775 423-4188	ccem@phonewave.net
Steve Berris	USGS	775-887-7693	sberris@usgs.gov
Toby Welborn	USGS	775-887-7671	tlwelbor@usgs.gov
KIM DAVIS	NDWR	775-684-2884	kadavis@water.nv.gov
Jean Stone	NDEP	687-9456	jstone@ndep.nv.gov
Brenda Hunt	CWSD		brenda@cwsd.org
Judy Santoro	ACOE	(by teleconf.)	
Gary Barbato	Weather Serv.-Reno	(")	
Austin Osborne	St. Co.	(")	
Eric Simmons	FEMA	(")	
Ed Jones	CWSD		
Toni Leffler	CWSD		
Mitch Blum	HDR		

Carson Water Subconservancy District
Carson River Risk MAP Discovery/Charter Meeting
October 31, 2012, 11:00 a.m.

MEETING NOTES

Attendees:

Gary Barbatos, Weather Service, Reno (by teleconference)
Steve Berris, U.S. Geological Survey (USGS)
Mitch Blum, HDR Inc.
Kim Davis, NDWR
Tom Dullaire, Town of Gardnerville
Robb Fellows, Carson City Public Works
Stephanie Hicks, R.O. Anderson
Brenda Hunt, Carson Water Subconservancy District (CWSD)
Ed James, CWSD
Ron Juliff, Churchill County
Toni Leffler, CWSD
Erik Nilssen, Douglas County
Austin Osborne, Storey County (by teleconference)
Brian Peters, Alpine County
Kate Rutan, Truckee Carson Irrigation District (TCID)
Eric Simmons, FEMA (by teleconference)
Judy Soutiere, Army Corps of Engineers (ACOE) (by teleconference)
Jean Stone, Nevada Division of Environmental Protection (NDEP)
Toby Welborn, USGS

This meeting of the Carson River Risk Mapping, Assessment, and Planning (MAP) Discovery/Charter Discovery Group was held in the Carson Water Subconservancy District's Conference Room, 777 E. William St., #110, Carson City Nevada. Introductions were made around the room.

Item #1 - Review of Project Prioritization Criteria - Ed James reviewed the proposed prioritization criteria as follows:

A. Does this project provide immediate impact or benefit to the county or community? (Is there urgency to this project?)
B. What are the potential direct and/or indirect damages to the community if a flood occurs?
C. Will this project provide benefits to public safety and/or infrastructures? transportation
D. Does the project provide a positive benefit to cost ratio?
E. Are there other grant funding programs or other likely sources available through which this project could be funded?
F. What is the estimated cost of the project? Lower expense would probably get done sooner.

G. What amount of match could the community come up with to support the project? Local funding for specific projects as match for FEMA funding.
H. Does the project/program preserve the integrity, resources, and functions of the floodplain? Conservation easements, avoiding construction/building in floodplain.
I. Does this project reduce the potential impacts to water quality in the watershed (i.e., public health and safety)? Sediment and WQ in river.
J. Your personal view on how important the project is to flood protection in the Carson River Watershed.

Mr. James noted that a low or medium priority project might be pursued sooner if funding available and that discussion was going to focus today on rating criteria A-I since J is so subjective. Stephanie Hicks said she would take notes to add in Discovery Report.

Item #2 - Prioritization of Projects

a. Counties Provide Project Overview –

Alpine County - Brian Peters:

- *Old Markleeville Guard Station Restoration Project* in downtown Markleeville is the farthest along – 1st priority - $1-1.5 million
- *Grover Hot Springs bridge* (3-4 yrs.)
- *American Rivers Floodplain Restoration in Hope Valley* is a project being done by the Alpine Watershed Group (AWG) on the West Fork between Hwy 88 and Blue Lakes Rd. on U.S. Forest Service (USFS) property. The group hired Mitch Swanson to look at restoring portions of the river to allow it to reach its floodplain but not re-watering the entire meadow. The design phase to be done soon. They are seeking funding to do projects and may be moving upstream into Faith and Charity Valleys
- In prioritizing the projects, none of them are urgent for risk to property or lives. They are *environmental improvement project*s which provide benefits to resources and functions to the river and water quality. They are all in the medium priority category to Alpine County. The *bridge projects* which are state projects are problematic because none are of high priority for replacement, so they would be low priority

Douglas County - Eric Nilssen:

- 80% of the *flood mapping* is designated as Zone A. Having more detailed flood mapping would be helpful to Douglas County. This is important after FEMA's remapping put 8,000 houses in the floodplain that weren't in before. Douglas County would like to remap as soon as possible because of flood

insurance requirement for folks who don't need to be paying flood insurance - high priority.

- *Attenuation area studies* –Property owned by BLM is subject to flash flooding on the east side of valley. The fire stations are on west side with most homes on east side of river. They need better all-weather access to first responders. Attenuation studies would benefit areas downstream. Medium priority.
- *Flood mapping for other washes or sloughs* are low priority.

Tom Dallaire:

- The *Pine Nut area* which effects Gardnerville is most important to provide for emergency access. It is high priority for Hazard Mitigation Plan. It has some funding already and is reported as ongoing project. They need to identify funding and implementation.

Carson City – Robb Fellows:
Emergency Action Procedures was updated last year.
Project list comes from the Capital Improvement Program for flood protection and water quality improvement. Nine projects have been added to the original remapping (see handout). Most are effecting industrial areas. He suggests the following priorities:

1. *Golf Course A & B Drainage Basin & System Improvements* - high priority because it effects 70 different structures and is closest to river, drainage problems, could cut off emergency access.
2. *Goni Wash Sediment & Detention Basins* - (going north) - Carson City is trading BLM land to put detention/ sedimentation basins to provide protection and relief for industrial businesses in Goni area. – high priority
3. *Goni Wash Drainage Channel & System Improvements* - going south to protect downtown and relieve flooding in the Carson Mall area. - high priority
4. *South Carson Street Storm Drain System Improvements*- medium priority
5. *South Carson Street/South Current Storm Drain Systems*- medium priority
6. *Empire Drainage System Improvements* - medium priority
7. *Voltaire Canyon Channel and Drainage System Improvements* - low priority
8. *Saliman & Carson High Drainage System Improvements*- low priority
9. King Street Drainage/Flood Protection Improvements - low priority

Lyon County – Stephanie Hicks went over list given by Rob Loveberg:

1. First priority is *River Road project*. Jean Stone noted NDEP funding for a DVCD restoration project where the road being undercut – high priority
2. *Bank stabilization projects along the Carson River through Dayton Valley including Ft. Churchill.* There is uncertainty about being able to do this project because it is a Superfund Site. It is important to establish communication about funding with NDEP, FEMA, etc. FEMA won't fund because other federal funds are already designated toward the Superfund Site. This is a policy issue that group could work to get an exemption.
3. *Drainage system studies to have a conveyance system for alluvial fans* – study/restudy, construction – medium priority
4. *Silver Springs* is a low priority because of problems with the cost benefit analysis.

Churchill County – Ron Juliff:

- *Feasibility Study for a Flood Retention Basin Upstream of Fort Churchill* - This addresses high risk areas of flooding. It might be feasible to construct a barrier to backfill flood water into uninhabited areas upstream of Lahontan Reservoir. Because this land is located in Lyon County, Jeff Page needs to be involved in the conversation. – Churchill County's #1 priority - high priority
- *Flood Water Shunt to Sheckler Reservoir addresses flooding below Lahontan* - It is an effort to slow down water before overflowing the river which presents a risk to life and property causing millions of dollars worth of risk. They plan to implement Misha Stojicevic's engineering study using a natural swale to Sheckler. - Churchill County's #2 priority - high priority
- *FIRM Impact Study of a Levee Along Casey and Bottom Road*s - FIRM maps are based on old data. A LiDAR study done and FEMA may be able to accept the data to update maps. Judy Soutiere said that the ACOE assumed the LiDAR would meet FEMA requirements but she will verify that. Churchill County will send a letter to ACOE to make sure the LiDAR met FEMA requirements. - Churchill County's #3 priority - medium priority
- *Firm Flood Scenario Review* - Churchill County's #4 priority - low priority
- *Matrix for Flood Risk Assessment* - There have been changes to the sewer and water systems so Churchill County needs a matrix for flood risk assessment to consider

the infrastructure between the city and the county. There have been situations where water travelling in canals has been higher than homes, wells, and septic tanks. - Churchill County's #4 priority - low priority

When asked if TCID had any concerns with Churchill County's list of projects and priorities, Kate Rutan responded that TCID is okay with the study about the retention pond above Lahontan to determine feasibility. Ms. Rutan mentioned that her boss said that the concept of the retention pond had been looked at before and required a "perfect storm" for there to be a need. Lahontan Reservoir is capable of taking overflows as long as they are able to dump into Sheckler Reservoir before the water gets to downtown and the Walmart area. To reduce flooding on the Carson River itself, *the channel needs to be cleaned out*. It is an ongoing project to take out debris but they want to take out sediment. Add this to the list and give it a high priority. It can be done immediately, pending permitting.

b. Watershed Prioritization -

- Regional projects – *restudy of CR Floodplain* is on-going – high priority
- *Early warning system* - Set up in Douglas County to include a tipping bucket and reverse 911 - Is operational in Carson City with warnings issued by National Weather Service.
- *Floodplain Preservation*
- *Building Codes* – things to do by counties to protect floodplain
- *Public Awareness Campaign* – floodplain, flood insurance
- *ERM Gap Analysis* – markers and data gaps?
- *DFIRM Update Procedure* – keep model updated
- *Photo Monitoring* – photos during flood events to get identify flood risks and get info out, gather historical data/photo
- *Hazard Areas* – where? Need to be more robust? Chemical plants, hazards on river unstable banks
- *Infrastructure design/replacement* – road can act as levee
- *Carson River Inundation Mapping* – look at inundation mapping in different flood events. Mr. Barbatos reported that this is ongoing with NOAA throughout the U.S. There is only one in the western U.S. at the Boise River at Boise, ID. The Weather Service doesn't have GIS expertise so they rely on FEMA and others to get the whole suite of maps. They can be used in real time during flood to determine where the flooding is effecting and where to sandbag/evacuate, etc. Someone besides the Weather Service needs to do the modeling. The Weather Service maintains a website for $4,500 per site to host the information. This shows the

area and depth to determine sandbagging vs. evacuation. Ms. Davis noted that this gets to flood warning and public outreach with a visual example. The Nevada Silver Jackets Pilot Project has been approved by COE with part allowing to leverage to incorporate mapping into a website that Toby is working on. High population areas would benefit greatly.

Ms. Stojicevic added that there is a need to analyze the aquifer because there are two different types of flooding with energy and standing water which causes problems with septic tanks. The invisible damages of flooding can be bigger than what is seen since visibility is only ½-1 foot.

Each person was given a priority listing of watershed projects to rate from 1(low) to 5 (high) by how well it meets the list of criteria A-J. Those projects were numbered 1-12 for ease of reference as below:

1. *Restudy of Carson River Floodplain*
2. *Early Warning*
3. *Floodplain Preservation*
4. *Building Codes*
5. *Public Awareness Campaign*
6. *ERM Gap Analysis*
7. *DFIRM Update Procedure*
8. *Photo Monitoring*
9. *Hazard Areas*
10. *Infrastructure Design/Replacement*
11. *Carson River Inundation Mapping*
12. *Churchill County Aquifer Study*

The ratings were totaled by each person to determine an overall rating for each project. Each person posted their ratings on the board to determine a watershed-wide rating for each project. The postings are shown below as a summary of the priority list of watershed projects. NOTE: When assigning values to high (3), medium (2), and low (1), the final numbers in **bold** below, reflect a numerical priority of each project.:

1. 14-H, 2-M, 1-L = H = **47**
2. 13-H, 4-M, 0-L = H = **47**
3. 13-H, 4-M, 0-L = H = **47**
4. 3-H, 13-M, 3-L = M = **38**
5. 5-H, 9-M, 1-L = M = **43**
6. 0-H, 4-M, 13-L = L = **21**
7. 2-H, 5-M, 10-L = L = **26**
8. 5-H, 3-M, 9-L = L = **30**
9. 12-H, 4-M, 1-L = H = **45**

10. 10-H, 3-M, 4-L = M = **40**
11. 13-H, 3-M, 1-L = H = **46**
12. 9-H, 5-M, 2-L = H = **39**

Item #3 - Finalizing the Discovery Process

a. Discovery Report & Map – Stephanie incorporated comments received this far and created a table. From October 11, R.O. Anderson had 20 working days to finalize the report and mapping. They will incorporate the project priorities set today. The deadline was originally November 8th prior to inclusion of the second Discovery Meeting.

Mr. James added some comments: The Discovery meeting blank will incorporate comments from today's meeting. We want to meet FEMA criteria.

Mr. Blum said that the new FEMA notebook has including Discovery process information into the report as a requirement.

Item #4 - Other items – None.

The meeting concluded at 1:05 p.m.
tl

Carson River Watershed Discovery Project
Recommended Watershed Projects

Appendix D

Project Name	Jurisdiction	Project Description	Watershed Project Priority
Markleeville Creek Floodplain Restoration Project	Alpine County	Alpine Watershed Group has hired a consultant to complete the final restoration planning and design stages for the Markleeville Creek Floodplain Restoration. The next phase is for acquisition of the property and then to perform the restoration.	High
Woodfords-Highway 88 Bridge	Alpine County	Woodfords-Highway 88 Bridge and STPUD mainline is a known flood hazard area.	Medium
Various Mitigation Projects for Roads Prone to Flooding	Alpine County	`	Medium
State Highway 89/4	Alpine County	State Highway 89/4 known flood damage in the past.	Low
Alpine County HMP	Alpine County	Update Alpine County's Lapsed Hazard Mitigation Plan.	Medium
Goni Canyon Wash	Carson City	This tributary consists of approximately 6 square miles and is located north of Hwy 50 east, centered around Goni Road. Hydrology and mapping of the flood hazard from this tributary was completed in the mid 1980's with topographic data gathered in the mid 1970's. Over the years there have been many changes in the tributary and numerous CLOMR applications were approved by FEMA. The largest change was between 1980 and 1990 when the airport park and industrial areas were developed. There are about 55 structures at risk within the SFHA. The current FIS 1% annual chance flood flow is 2,776 cfs. Recently with the Freeway project and CLOMR, the 1% annual chance flood flow was revised to 2,193 cfs.	High
Tributary Golf Course Creek A and B	Carson City	This tributary consists of approximately 5 square miles and is located north of Highway 50 East and east of College Parkway. Hydrology and mapping of the flood hazard from this tributary was completed in the mid 1980's with topographic data gathered in the mid 1970's. Over the years there have been many changes in the tributary. Golf Course Creek B, west side subarea, had seen a flood control dam built in 1986. Whereas Golf Course Creek A, east side subarea, had seen diversion channels and piping installed in the late 1980's. There are about 80 structures at risk within the SFHA. The current FIS 1% annual chance flood flow is 1,930 cfs. Recently with the Freeway project and CLOMR, the 1% annual chance flood flow was revised to 1,232 cfs. However, this did not include the flood control dam. therefore, the flows should be reduced more taking into account the dam facility.	High
Clear Creek & Prison Hill	Carson City	This tributary consists of approximately 23 square miles and is located south end of Carson City and north border of Douglas County. Hydrology and mapping of the flood hazard from this tributary was completed in the mid 1980's with topographic data gathered in the mid 1970's. Over the years there have been some topographic changes and Clear Creek was realigned in the late 1980's. There are about 50 structures at risk within the SFHA. The current FIS 1% annual chance flood flow is 2,450 cfs.	High
Voltaire Canyon Channel and Drainage System Improvements	Carson City	Voltaire Canyon Channel and Drainage System Improvements consist of piping, channel and surface changes to convey flood flow to the freeway phase 2B drainage facilities. The system will reduce the BFE. About 50 commercial structures benefit from the improvements. The main flooding source is Voltaire Canyon and the approximate cost is $2,000,000.	Low
Saliman and Carson High Drainage System Improvements	Carson City	Saliman and Carson High Drainage System Improvements consist of piping, inlets, and surface changes to re-direct flows from Mills Park to the southeast to Robinson Street then east to the freeway facilities. They system will reduce the BFE and reduce the flood impact to the Carson High School. The main flooding source is Ash Canyon Creek and the approximate cost is $500,000.	Low
South Carson Street Storm Drain System Improvements	Carson City	South Carson Street Storm Drain System Improvements consist of piping, inlets, and surface changes beginning at the linear ditch/S. Roop Street running west to Stewart then to South Carson Street then north to 8th Street. The system will reduce the BFE. About 30 commercial and multifamily structures benefit from the reduction. Access and evacuation during an event is a benefit. The main flooding source is Kings Canyon Creek and the project is estimated to cost $1,750,000.	High
South Carson Street/South Curry Storm Drain System Improvements	Carson City	The South Carson Street/South Curry Storm Drain System Improvements consist of piping, inlets, and surface changes beginning at Rhodes Street running north along South Carson Street to Stewart Street, then east to the open area south of the State DMV building. The system will convey flood flow and provide water quality benefits. The system will reduce the BFE and about 10 commercial structures will benefit from the reduction. Access and evacuation during an event is a benefit. The main flooding source is H and I Tributary and Voltaire Canyon. The project is estimated to cost $1,000,000.	High
King Street Drainage/Flood Protection Improvements	Carson City	The King Street Drainage/Flood Protection Improvements consist of curb, gutter, and sidewalk improvements with a flood wall beginning at South Ormsby Boulevard running west about 360 feet on the south side of King Street. The system will direct flood flow east preventing a breakout to the southeast. About 25 residential structures benefit from the improvements. The main flooding source is Kings Canyon Creek and the approximate cost is $100,000.	Medium

Carson River Watershed Discovery Project
Recommended Watershed Projects

Project Name	Jurisdiction	Project Description	Project Priority
Goni Wash Sediment and Detention Basins	Carson City	The Goni Wash Sediment and Detention Basins project consists of two basins located on city property, one north of Danielle Drive and east of Kelvin Road, the other one is north of Maxwell Road. The system will reduce the BFE. About 25 commercial/industrial structures benefit from the improvements. The main flooding source is the Goni Wash and the approximate cost is $1,000,000.	High
Empire Drainage System Improvements	Carson City	Empire Drainage System Improvements consist of piping, inlets, and surface changes beginning at Fairview/Hwy 50 East running east to Darla Way, to Morgan Mill Road, then to the Carson River. Easement purchase is a part of this project. They system will reduce the BFE. About 33 residential structures benefit from the improvements. The main flooding source is the local urban area from the southwest. The project is estimated to cost $1,100,000.	Medium
Goni Wash Drainage Channel & System Improvements	Carson City	The Goni Wash Drainage Channel and System Improvements project consists of piping, inlets, and surface changes to reinforce an existing levee-like structure and to improve various other existing systems. Easement purchase is part of the project. Locations are north of the airport. The system will reduce the BFE and about 65 residential/industrial structures will benefit from the improvements. The main flooding source is Goni Wash and Tributary D. The project is estimated to cost $ 4,000,000.	Medium
Golf Course A & B Drainage Basin & System Improvements	Carson City	The Golf Course A and B Drainage Basin and System Improvements project will consist of piping, inlets, and surface changes to convey flood flows to detention/water quality basins, then to the river. Land or easement purchase is part of this project. Locations are Arrowhead Drive south to the Carson River. About 70 residential/industrial structures will benefit from the improvements. The main flooding source is Golf Course Creek A and B. The project is estimated to cost $5,000,000.	High
Feasibility Study for a Flood Retention Basin Upstream of Fort Churchill	Churchill County	The City of Fallon is requesting a study to determine what kind of structure could be put in place to meter Carson River flood flows, as well as understand the impacts of implementing a retention basin upstream of Fort Churchill. Lahontan Reservoir was not designed as a flood control works. However, by careful, proactive management of outflow, the dam has a significant flood mitigation effect on the downstream community. Increasing the storage capacity of the reservoir is considered neither feasible nor effective for flood control. However, being able to meter or control the inflow to Lahontan Reservoir would provide more time, efficiency (and margin of safety) for precautionary water releases to occur. In other words, significant flood mitigation would occur through controlling the reservoir in-flow / out-flow, verses increasing the storage capacity. To that end, a relatively deserted area with naturally occurring retention features has been identified along the Carson River just upstream of Fort Churchill where a railroad bridge crosses the Carson River. Communities that stand to benefit from such a structure would be, Silver Springs, Churchill County and the City of Fallon. *Note: The two items that comprise our highest priority are linked and must work in tandem for flood prevention to be effective. Creating a flood retention basin before Lahontan reservoir, will allow the inflow to Lahontan to be managed. Uncontrolled run off entering the reservoir can result in exceeding the dams' capacity. Thus, requiring water spreading before it enters the Carson River channel to avoid flooding flows. Even with controlled inflow to Lahontan, during peak run off, capacity may still be an issue and require water spreading. However, without (1.) above, the only prevention measure that remains is to divert flood flows before they enter the Carson River channel below Lahontan dam. Flood water flow must be shunted to non-populated areas such as Sheckler Dry Reservoir and the uninhabited Navy bombing range south of Sheckler. Dam overflow and uncontrolled release of water from Lahontan to the Carson River channel has historically resulted in Churchill County and City of Fallon flooding. Any future uncontrolled releases will imperil county and city residents.*	High
Flood Water Shunt to Sheckler Reservoir	Churchill County	The City of Fallon has identified a need to enhance or institutionalize a method of mitigating flooding below Lahontan Dam that has been used in the past is to shunt water from the V line canal to Sheckler Reservoir. Once Sheckler is full, and water "spreading" has been authorized, water is released from Sheckler Dam and spreads onto open desert, most of which is owned by the US Navy. The Navy has authorized this action during flood emergency situations. Actions required include upgrading the works at Diversion Dam structure upstream of the V line canal, increasing the flow capacity of the diversion to Sheckler, and any enhancements required to keep Sheckler Dam stable when water is released into the desert. The enhanced drain to Sheckler could be accomplished by increasing the capacity of the existing drain, or by constructing a new drain further upstream on the V Line Canal. *Note: The two items that comprise our highest priority are linked and must work in tandem for flood prevention to be effective. Creating a flood retention basin before Lahontan reservoir, will allow the inflow to Lahontan to be managed. Uncontrolled run off entering the reservoir can result in exceeding the dams' capacity. Thus, requiring water spreading before it enters the Carson River channel to avoid flooding flows. Even with controlled inflow to Lahontan, during peak run off, capacity may still be an issue and require water spreading. However, without (1.) above, the only prevention measure that remains is to divert flood flows before they enter the Carson River channel below Lahontan dam. Flood water flow must be shunted to non- populated areas such as Sheckler Dry Reservoir and the uninhabited Navy bombing range south of Sheckler. Dam overflow and uncontrolled release of water from Lahontan to the Carson River channel has historically resulted in Churchill County and City of Fallon flooding. Any future uncontrolled releases will imperil county and city residents.*	High

Carson River Watershed Discovery Project
Recommended Watershed Projects

Project Name	Jurisdiction	Project Description	Project Priority
FIRM Impact Study of a Levee Along Casey or Bottom Roads	Churchill County	The current flood scenario for the Churchill County and City of Fallon Flood Rate Insurance Maps (FRIM) predicts flood waters in the Carson River backing up at the Highway 50 Bridge and then overtopping the V line canal near Casey Road. The result is "nuisance flooding" along the New River Drain, which meanders through the heart of Fallon's residential area. Because of the areas topography, even a low amount of flood water has the potential to create significant damage to the community, and mitigating this flow would release numerous moderate and low income residents from the requirement to purchase flood insurance (a stated goal of the CWSD). Therefore, the recommendation is to study the feasibility and floodplain impact of building a levee along the southwest bank of the V line canal. *Note: If the solutions for flooding risk listed in (1.) and (2.) above cannot be accomplished; creating a physical barrier to divert flood water from low lying areas of the City of Fallon will provide relief for city residents. This would only be a partial solution, since county residents may still be exposed to significant flood damage.*	Medium
FIRM Flood Scenario Review	Churchill County	In 2007, FEMA released a Churchill County Preliminary Flood Insurance Study (FIS) report. Overall, the preliminary FIS was an excellent summation of the history of the flood problem for the City of Fallon, the past studies and the assumptions that contributed to its development. However, the supporting information for the FIS was based on a 1977 study conducted by the Corp of Engineers using historical storage of Lahontan Dam. Consequently, this information was significantly out of date and did not take into account current operating procedures for Lahontan Dam nor the flood mitigation initiatives and procedures put in place by the City of Fallon, Churchill County, the Bureau of Reclamation and the Truckee Carson Irrigation District (TCID). Therefore, the recommendation is to reassess the FIRM flood scenario for Churchill County taking into account the significant technological and procedural advancements that have occurred since 1977.	Low
Matrix for Flood Risk Assessment	Churchill County	Risk Mapping would be more beneficial if there was a deeper analysis with specific methods and criteria. Criteria for risk should include more than only depth of the water and probability. The current approach is only a partial answer and does not consider areas where there are wells, sewer, water and other critical infrastructures that can multiply damages caused by flooding. Development of a criteria matrix that covers multiple risk components would be valuable and provide a more realistic risk assessment.	Low
Cleaning Out of Carson River	Churchill County	Removal of built up sedimentation will help to increase the capacity of the river.	High
Sunrise Pass, Buckbrush, & Johnson Lane Wash	Douglas County	FEMA Flood re-study and floodplain analysis of the Sunrise Pass, Buckbrush, and Johnson Lane Wash Watersheds, which were mapped by FEMA with technical errors in 2008 (NHC FIS). This work would complete the re-mapping of the area under the current effective FIRM dated January 2010. Anticipated total cost to re-study is approximately $240,000.	High
Attenuation Area Studies	Douglas County	Douglas County is requesting to study the feasibility of potential attenuation areas for the washes that come out of the Pinenut Mountains, one specifically being the Pinenut Wash. The Pinenut Wash causes overtopping at all major intersections with homes on the east side of U.S. Highway 395. If the flood could be attenuated, the county may be able to maintain access to those residences during a 100-year event and reduce the local costs for repair and reconstruction of these roads.	Medium
"Zone A Base Flood Elevation Unknown"	Douglas County	Douglas County is requesting a restudy of areas classified as "Zone A Base Flood Elevation Unknown" in an effort to establish floodways (if they exist) and determine elevations in order to implement floodplain development regulations. It is anticipated that the establishing elevations may remove large areas from the floodplain. Areas to be included are the West Fork of the Carson River, east of State Route 88, and the Brockliss Slough.	Low
Studies of Other Washes and Sloughs	Douglas County	No further description.	Low
River Road Project	Lyon County	Due to the Carson River undercutting the bank adjacent to River Road in Dayton, Nevada, there is an immediate need to stabilize the bank. This will not only save the road infrastructure but will also protect a home in close proximity to area and at risk should the bank fail. This project is rate as Lyon County's #1 priority because there is an immediate need and immediate risk.	High

Carson River Watershed Discovery Project
Recommended Watershed Projects

Project Name	Jurisdiction	Project Description	Project Priority
Superfund Site Resolution	Lyon County	Lyon County has several project needs along the Carson River for bank stabilization. Several of the projects, including the River Road Project and the Fort Churchill Project would be eligible under FEMA HMGA Program for grant funding; however, there is an issue with the area being designated as a Superfund Site. In a previous application, the Fort Churchill Project was selected for further review and then later denied based on being located in the Superfund site. Because funding for PDM was pulled shortly after this decision was made, it was left unclear what the basis of denial was. It would be worth to effort for the Charter to meet with representatives from FEMA, NDEP, DEM, and DWR to discuss whether with appropriate explanation, these sites could be eligible under FEMA's programs.	High
Alluvial Fan Drainage System	Lyon County	Lyon County has a need for a drainage system to improve conveyance of alluvial fan drainages to the Carson River. However, before such a system could be put into place, these alluvial fans would need to be studied and re-studied in order to analyze flows and thereby determine what kind of system is needed. Then conveyances would then need to be constructed and maintained.	Medium
Silver Springs Project	Lyon County	Division of Water Resources suggested potential project in Silver Springs that could include some type of channel or other means to increase the capacity to reduce back water effects. The project could also include re-mapping of the SFHA with better topo data. The project, however, does not meet the estimated cost-benefit analysis for the project.	Low
Restudy of Carson River Floodplain	Watershed-wide	CWSD's Multiyear plan to restudy Carson River.	High
Early Warning	Watershed-wide	Install additional gauges for the watershed.	High
Floodplain Preservation	Watershed-wide	Easements/leave floodplain as open areas/other means to incentivize floodplain preservation.	High
Build wisely! Codes	Watershed-wide	Develop Build wisely! Codes	Medium
Public Awareness Campaign	Watershed-wide	Create a public awareness campaign to communicate risk to residents and public agencies.	Medium
ERM Gap Analysis	Watershed-wide	Determine if Elevation Reference Marks (ERM) are adequate, or if additional ERMs need to be located or they need replacement.	Low
DFIRM Update Procedure	Watershed-wide	Develop a consistent procedure with GIS, planning, and engineering departments for updating DFIRMS on a watershed-wide basis. This also relates to updating the floodplain model with each new CLOMR/LOMR to ensure cumulative analysis remains consistent (timing, procedure, etc.)	Low
Photo Monitoring	Watershed-wide	Create and establish protocols, applications for photo monitoring of flood events both on-ground and from the air.	Low
Hazard Areas	Watershed-wide	Investigate areas for establishment of setbacks and buffer zones in highly hazardous areas.	High
Infrastructure Design/Replacement	Watershed-wide	Coordinate with NDOT and local jurisdictions to identify, design, investigate options on all future placement or replacement of infrastructure to ensure it is compatible/consistent with the Regional Floodplain Management Plan.	Medium
Carson River Inundation Mapping	Watershed-wide	Development of inundation mapping for the Carson River.	High
Groundwater Quality Impacts	Watershed-wide	Evaluation of groundwater quality impacts due to flooding.	Medium

Draft Discovery Report Comments Table

Date	Page	Comment By Kim Davis, Division of Water Resources	Agency	Response
8/17/2012	9	According to California Department of Water Resources, Alpine County is consider to be in a Zone 'D' with just one panel printed which is a map index. According to DWR records, Alpine County has never had a CAV since they entered into the program in 1989. Also, can provide additional information from the Nevada CAVs for the other communities besides Douglas County, if needed.	KD-DWR	Alpine County information was added to Discovery Report.
9/13/2012	Flood Map	Suggestion to add repetitive loss properties, including one in Churchill County near duck club. Forwarded information on all RLP's.	KD-DWR	Change has been made.

Date	Page	Comment By Milorad Misha Stojicevic, Churchill County	Agency	Response
8/20/2012	Risk Map	Risk Mapping would be more beneficial if there was a deeper analysis with specific methods and criteria. Criteria for risk should include more than only depth of the water and probability. The current approach is only a partial answer and does not consider areas where there are wells, sewer, water and other critical infrastructures that can multiply damages caused by flooding. Development of a criteria matrix that covers multiple risk components would be valuable and provide a more realistic risk assessment.	MMS-CH	Added to Project List
	Risk Map	Matrix for Flood Risk Assessment - Mapping of flood risk is complex task and requires multiple risk factors to be included. Mapping only natural depressions or low elevation terrains in rural area could be insufficient and not complete. In some cases, flooding has positive impact such as: bringing material with more nutrients, recharging groundwater, etc. In case of agricultural usage several days flooding might or might not have impact to the harvest. On opposite side, flooding of unstable lands (landslide sensitive area), with houses can be in some cases tragic. In nowadays engineering science, risk of the flooding is connected to damages caused by flooding. This matrix is a SAMPLE ONLY and should not be used as a code or regulatory lead. Local entities should establish their own criteria based on local conditions and this is just draft. 1. Depression depth related to the flood elevation from existing FEMA maps and revised FEMA elevation documents. Three categories should be generally established: 0 to 1ft; 1 to 3ft; more than 3ft. 2. Groundwater depth in the area where flood zone are established. This will indicate potential hazard to foundation, individual septic systems, back flow to the houses from flooded septic systems and other conduits installed by homeowners. Additional attention should be to populated area where water supply source is GW. Three categories should be developed; 0 to 3ft – high impact; 3 to 10ft – moderate impact and more than 10ft – insignificant impact to groundwater. 3. Terrain slope plays big role in flooding considering sheet or concentrated flow and in case of high slope condition energy developed in flooding flow can destroy objects, cause erosion and life safety. In the same time low slope conditions will retain water longer with different effects to the flooded area. In this category erosion, landslides or liquefaction should be analyzed as subcategory considering soils, water velocity, vegetation and terrain roughness. Five categories should be developed; 0 to 1%; 1 to 3%; 3 to 10%; more than 10%. 4. Population density and land use risk factor is self-explanatory factor and hazard for agricultural lands comparing to populated area is significantly different. In some cases, flooding of agricultural lands has positive effect. Depending on season when flooding occur, some damages can be to the harvest reduction too. This should be addressed through different insurance program. Five categories should be developed base on population density; 5 or less per mi2; 5 to 100 per mi2; 100 to 500 per mi2; 500 to 2500 per mi2; more than 2500 persons per mi2. 5. Coincidence with other environmental risk will require some calculations and deeper analysis. Probability of heavy rain intensity, wind over 60 miles per hour, fast snow melting and deposits, rapid temperature change in time unit etc. This category should be analyzed locally, from the risk aspect and number of categories should be established based on historical risk analysis. 6. Infrastructure risk assessments criteria should be created considering existing and future local conditions. The list of critical infrastructures would include: water supply, sewage collection and treatment, roads and bridges, power plants and distribution, communication infrastructures, evacuation route etc. 7. Livestock and animals habitat risk assessment should be included as a possible category .	MMS-CH	More detail regarding above comment.

Date	Page	Comment By Robb Fellows, Carson City	Agency	Response
8/20/2012	Risk Map	Could a column be added to the loss table that shows the number of structures? Also with the same table - What does County Fips mean? The areas look to be larger than the floodplain.	RF-CC	The initial risk study prepared by Michael Baker for FEMA did not include detailed structure locations, so structure counts are not available at this time. The hazard areas shown on the Risk map are covering census block areas, and do not graphically depict the mapping extent of possible damage or loss. Further studies need to be completed to refine the extent of the Risk and Loss areas. FIPS stands for Federal Information Processing Standard. The numbers shown in the table under that column heading are the State/County codes defined by that standard.
8/20/2012	Hazard Map	The saliman, H&I, Voltaire and Kings SFHAs are missing. Add the levee locations on the map.	RF-CC	Change has been made.
8/20/2012	3	Under Table 1, are the deliverables/products suppose to be in the report? Or do they come later?	RF-CC	Community Fact Sheets and Discovery Map will be included in the final Discovery Report.
8/20/2012	6	1. Mitigation Plans/Status, Mitigation Projects - Remove this "Despite the efforts of each of the communities to involve members of the public, it was noted in the majority of the plans that public participation was almost nonexistent." Put in a more positive comment.	RF-CC	Change has been made.
8/20/2012	6	2. NFIP Mapping needs - the first and second paragraph appears out of order or in the wrong section.	RF-CC	Change has been made.
8/20/2012	9	5ii - there are other dams in the watershed.	RF-CC	Pursuant to discussions with FEMA, we will only be depicting dams that are used for flood control purposes. The two dams identified by Robb have been added.
8/20/2012	10	Watershed projects wording should be similar for each.	RF-CC	Change has been made.
8/20/2012	13	8ii Completed Projects - I'm sure there are other completed projects	RF-CC	A list of completed projects was requested from all stakeholders and we have included what we have received.
8/20/2012	21	Appendix is missing.	RF-CC	These will be part of the final report.
9/13/2012	Risk Map	Possible project would be to prepare a emergency action procedure (SOP) which would show locations where sandbags would be placed, evacuation routes, etc. Would show NIMS, contractor numbers, supplies, shelters. These plans would be developed for each community.	RF-CC	Added to Project List.

Draft Discovery Report Comments Table

Date	Page	Comment by Elizabeth Ashby & Karen Johnson, DEM	Agency	Response
8/20/2012	4 & Community Fact Sheets	Mitigation projects have been initial HM planning grant and current HM planning update grant. Mitigation project to put in a culvert along 395 has been selected for further review but not yet funded. FEMA 1153 - 1997 Flood - Douglas (371,552), Storey (277,842), Lyon (651,966), Carson (792,368) and Churchill (30,149) declared. FEMA 1629 - 2006 Flood - Douglas ($598,207.53), Storey ($893,703.69), Lyon ($392,872.27) and Carson ($2,307,542.49 which includes Carson Water Sub conservancy District) declared. Churchill did not. These amounts are the FEMA 75% and County 25% costs that were recorded on reimbursements through this office. They do not include loss of business, tax or other. These amounts were to get the counties back to before the event. They do not include any NDEM, NDEP, NDOT, NDF assistance.	EEH & KJ - DEM	The report and Community Fact Sheets have been updated.
9/13/2012	Risk Map	Public awareness campaign to communicate risk to residents	EA-DEM	Added to Project List.

Date	Sheet	Comment by Luke Opperman, Division of Water Resources	Agency	Response
8/21/2012	Risk Map	Possible additional flood related things to consider (if time and budget allows): Past flood loss claims Critical Facilities in the SFHAs? Roadways overtopped in storm events? Detention Basins in Carson City • Shenandoah Heights • Others	LO-DWR	Repetitive Loss Claims have been added, roadways were identified in Alpine County and included in projects list, Carson City's Dams for flood control purposes were added.
8/21/2012	Risk Map	Potentially use images in the Discovery Map like sample provided.	LO-DWR	It was decided that at the scale of the Discovery Map orthophotos would not improve delineation of the features that are displayed.

Date	Page	Comment By Paul Pugsley	Agency	Response
8/22/2012	Risk Map	In looking at the map, Alpine county appears to have the largest area that will suffer damage. However, they really have the least flooding.	PP	Luke explained how the model used Census block tracts and that may be why the whole area is green even though they would only receive 1-400 million in damage. So the thought was that maybe we can fade back that green color and make it look less important. We also discussed adding a section to the report that explains this map data, as Eric, I think you previously suggested. Also Luke suggested maybe we show all repetitive loss claims by pinpoints and in a table, which will visually show where damage really has occurred. Luke is going to get me that data, but Eric, he may call you to see what format would be best for the map.

Date	Page	Comment By Barbra Resnik, Douglas County Community Development	Agency	Response
8/30/2012	Risk Map	Provided comments on the Risk Map regarding whether 1) whether MGSD's wastewater ponds were considered in the analysis and reflect the correct hatching; 2) identified an area that is an A flood Zone but shows no risk; 3) identified Meridian Business Park in a AE flood zone which shows they are not a risk; 4) identified some areas that show as risk but are not even in a flood zone. Regarding the AAL table, what does "content" represent? Need to correct CWSCD to CWSD.	BR-DC	Most of these items are addressed in comments to Churchill County above. There was no information regarding the definition of "Contents" in the GIS Metadata. There was table information with the header "Contents" in the GIS attribute information. The example Discovery maps showed this column, so we added it to our Discovery map.
8/30/2012 & 9/13/2012	Hazard Map	This is not reflecting the January 20, 2010 FIRM. Maybe there should be a clearer explanation as to what this map is supposed to be reflecting. Need to correct CWSCD to CWSD.	BR-DC	The Douglas County GIS Flood Zones were reacquired on11/19/2012. This is the best available information to us. Although it would be preferable to obtain from FEMA it was not accomplishable in a timely fashion.
8/30/2012	2	Recommended change - Outreach to community officials and stakeholders were conducted as part of the Discovery process.	BR-DC	No change made.
8/30/2012	3	Recommended change - The data was recorded and reviewed to determine usefulness.	BR-DC	No change made.
8/30/2012	5	Recommended change - Therefore, in 2010, the LiDAR dataset was reviewed and field data collected to validate the topographic dataset according to FEMA guidelines for topographic data to be used for floodplain analyses		Change has been made.
8/30/2012	10	Recommended Change - During ~~the~~ this revision, floodways were developed or revised for the confined reaches of Bobwhite Wash, Buckeye Creek, Calle Hermosa Wash, Calle de Asco Wash, and Juniper Road Wash.	BR-DC	Change has been made.
8/30/2012	11	Recommended Change - In anticipation of another relatively wet year, the Lahontan Conservation District (LCD) performed debris removal ~~of debris~~ from the Carson River in their district to improve channel capacity.	BR-DC	Change has been made.
8/30/2012	12	Recommended Change - County officials have scheduled a meeting with FEMA representatives in ~~early August~~ mid-September to discuss next steps, timing and funding for remapping the flood areas.	BR-DC	This sentence was removed based update that the 2010 maps will remain as best available information.
8/30/2012	12	Recommended Change - Douglas County Martin Slough Path — ~~There is also work being done behind the Minden Inn that was identified as the CVIC pathway along the Martin Slough. This project needs to be mitigated in the floodway.~~ Carson Valley Inn (CVI) has received approval from Douglas County for their Site Improvement Permit (SIP) #00675-02 for the North Parking Lot and Bike Trail Improvements. The Bike Trail will follow a path along the Martin Slough which is in an AE and AE (floodway) so the project has obtained an approval from FEMA for a Conditional Letter of Map Revision (CLOMR). Once US ACOE approval is obtained for work in the wetlands then construction is anticipated to commence.	BR-DC	Change has been made.
8/30/2012	16	Recommended Change - Douglas County is requesting a restudy of areas classified as "Zone A Base Flood Elevation Unknown" in an effort to establish floodways (if they ~~exists~~) and determine elevations in order to implement floodplain development regulations.	BR-DC	Change has been made.
9/13/2012	Risk Map	Needs to reflect "current data", i.e.. Buildings, schools, Meridian Business Park, buildings at 395 & 88, CTH @ 395 & 88.	BR-DC	Added to Project List.
9/13/2012	Maps	Need to show street names.	BR-DC	Currently, only the large format plot will be included in the submittal. The scale of those maps is very large, and only allows for labeling the primary state routes. The smaller maps showing individual HUC locations were for discussion purposes during the discovery process, and will not be further updated at this time.

Draft Discovery Report Comments Table

Date	Page	Comment By Ron Juliff, Churchill County	Agency	Response
9/13/2012	Risk Map	Re-evaluate the 100 & 500 year flows and mapping with H&H study to include new development.	RJ-CC	Added to Project List.
9/13/2012	Risk Map	Additional communication/agreements with neighboring jurisdictions for flood control purposes.	RJ-CC	Added to Project List.
9/13/2012	Risk Map	Consider elevation/relocating properties at risk.	RJ-CC	Added to Project List.

Date	Page	Comment By Erik Nilssen, Douglas County Community Development	Agency	Response
9/13/2012	Flood Map	Use 2010 Maps.	EN-DC	See comments above under Barbra Resnik.
9/13/2012	Risk Map	DC has an interest in a regional flood control basin/structure on BLM land east of Ruhenstroth to lower flows through Pine Nut Wash.	EN-DC	Added to Project List.

Date	Page	Comment By Patrick Fritchel, US Bureau of Reclamation	Agency	Response
9/12/2012	9	Lahontan Dam and Reservoir was constructed by the Bureau of Reclamation in 1911-1915 as part of the Newlands Project to divert and storm water from the Truckee River and Carson River basins to provide irrigation to lands near Fallon. It is located in Churchill County and is owned by the Bureau of Reclamation and operated by the Truckee-Carson Irrigation District. The dam also produces hydroelectric power. The total storage capacity of the Lahontan Reservoir is approximately ~~312~~313,000 acre-feet to the top of the 20-inch high wooden flashboards on the spillways. ~~It is located in Churchill County and is operated by the Truckee-Carson Irrigation District.~~ The ~~Lahontan~~ Dam has a spillway elevation of 4162.0 feet and a top of flashboard elevation of 4163.67 (Lahontan Dam datum). The outlet works have a maximum discharge capacity of approximately 2250 cfs at a reservoir pool elevation of 4162. The two spillways are uncontrolled and have a combined maximum capacity of approximately 66,000 cfs at a reservoir pool elevation near the crest of the dam (elevation 4174). ~~It~~ The dam ~~is~~ has a structural height of 162 feet ~~in height~~ and a crest length of ~~1,700~~1325 feet ~~in length~~.	PF-USBR	Change has been made.
9/12/2012	11	US Bureau of Reclamation (USBR) Safety of Dams Project — The USBR Safety of Dams project was scheduled to begin in April 2012. Models used to manage Lahontan Dam operations include the ~~Riverware~~ RiverWare daily model. In 2011, the ~~Riverware~~ RiverWare daily flow model was used to optimize storage in Lahontan Reservoir. The results were useful in avoiding downstream flooding during a normal snowmelt event. USBR developed a real-time hourly model for projecting flow conditions during a forward five-day scenario, which would assist assessment of short-term flooding conditions. ~~USBR personnel are planning a Carson River basin study similar to the one in progress for the Truckee River. The scoping process is to begin next year.~~ *(According to Tom Scott from BOR, We initially were going to start a scoping process for a basin study, but that is no longer in the planning process. Arlan Nickel (program manager on Truckee River Basin Study) may have discussed this with Ed James. Tom Scott (or Arlan) can talk to Ed if he still feels this is in place.)*	PF-USBR	Confirmed with Ed James and changes made.

Date	Page	Comment By Zach Wood, Alpine County	Agency	Response
9/13/2012	Flood Map	Difference between FEMA and DWR at stateline. Expect FEMA on Alpine County to come closer to match in the future.	ZW-AC	No action at this time.
9/13/2012	Flood Map	Woodfords-Highway 88 Bridge and STPUD mainline is a known structured flood hazard areas.	ZW-AC	Added to Project List.
9/13/2012	Flood Map	County road, bridges, Crystal Springs, Diamond Valley, Laramie with possible flood risk.	ZW-AC	Added to Project List.
9/13/2012	Flood Map	State Highway 89/4 known flood damage in the past.	ZW-AC	Added to Project List.

Date	Page	Comment By Mitchell Blum, HDR	Agency	Response
9/13/2012	Risk Map	Showing proposed land use and ownership may help identify areas that can be preserved as open space or purchased to keep development out of hazard areas.	MB-HDR	We believe this is outside bounds of this project. This is a good comment and would be very important to stakeholders who are trying to regulate development in the floodplains. We could potential include as a project if there are specific areas known where acquisition is desired.
9/13/2012	Flood Map	Lyon County portion needs revision based on PMR. He will provide us revised flood delineation by October 11 deadline.	MB-HDR	HDR is unable to disseminate this information, as the study has not yet been approved by FEMA.

Date	Page	Comment By Jean Stone, NDEP	Agency	Response
9/13/2012	Risk Map	Review Carson Watershed Maps for ideas for conservation from Stewardship Plan. AAL data is not specific enough; maybe start with land use. Need to start with current firms and flood extent to identify risks.	JS-NDEP	We believe review of the land use maps and ownership as shown in the Stewardship plan are not within the scope of this project. from a cursory review of that plan, it did not appear any specific areas have been identified for open space easements or acquisition. Perhaps this could be a separate project to be added to the list. The need for a more refined risk assessment has been added to the project list.

Date	Page	Comments by the group during Discovery Meeting	Agency	Response
9/13/2012		Install additional gauges for the watershed.	Discovery Meeting	Added to Project List.
		Easements/leave floodplain as open areas.	Discovery Meeting	Added to Project List.
		Build wisely! Codes	Discovery Meeting	Added to Project List.

Draft Discovery Report Comments Table

Date	Page	Comments by Eric Simmons, FEMA	Agency	Response
9/13/2012	Cover	Replace blue rectangle with Carson River watershed photo or map. Could add the CWSD logo and/or logos of counties.	ES-FEMA	Change has been made.
9/13/2012	2	"Hydrologic code units" should be "hydrologic units code."	ES-FEMA	Change has been made.
9/13/2012	3	Do not believe there are facts sheets on all these. Happy to discuss.	ES-FEMA	Community Fact Sheets are included in Appendix.
9/13/2012	4	As a source for Hazard information add FEMA, NFHL, CA DWR, others?	ES-FEMA	Change has been made.
9/13/2012	4	As a source for Effective Models change to FEMA, NFHL?	ES-FEMA	Change has been made.
9/13/2012	5	Under topographic data, could add FEMA LiDAR in Douglas County.	ES-FEMA	Change has been made.
9/13/2012	6	~~According to FEMA's Region IX National Flood Insurance Program Website, Lyon County~~FEMA is currently working on the Walker River PMR, a new riverine analysis along the walker River for 14.5 miles of detailed study on 14 panels in Lyon County.	ES-FEMA	Change has been made.
9/13/2012	8	Remove levees not in Carson River watershed.	ES-FEMA	Change has been made.
9/13/2012	9	Add "datum"? After 4162.0 feet.	ES-FEMA	Addressed in other edits.
9/13/2012	10	~~In September 2008,~~ HDR Engineering Inc. was contracted by FEMA to complete a countywide DFIRM and FIS for the County of Churchill. This became effective on September 26, 2008.	ES-FEMA	Change has been made.
	10	During ~~the~~ this revision, floodways were developed or revised for the confined reaches of Bobwhite...	ES-FEMA	Change has been made.
9/13/2012	10	Alpine County NO FIS Found. Add "The entire County is currently mapped by FEMA as Zone D."	ES-FEMA	Change has been made.
9/13/2012	10	Because of the Fernley ~~levee~~ canal ~~breach~~, ~~levees~~ embankments associated with the extensive canal system in Churchill County are being reviewed by the Churchill County Engineer. Churchill County commissioned collection of a LiDAR topographic dataset of the ~~levees and~~ valleys throughout the Fallon area. The U.S. Army Corps of Engineers (USACE) is currently modeling portions of Churchill County using the LiDAR dataset. Some of the ~~levees~~ structures are 80–90...	ES-FEMA	Change has been made.
9/13/2012	11	If a ~~levee breach~~ canal failure similar to the Fernley breach occurs, the damage and cost could be great because commercial and residential buildings are in risk areas which were not previously developed. The goal is completion of the project before Sept. 30, 2012.	ES-FEMA	Change has been made.
9/13/2012	11	The statistical analysis of records from U.S. Geological Survey (USGS) streamgage records ~~for the remained~~ of the Carson River watershed upstream from Lahontan Reservoir is in progress.	ES-FEMA	Change has been made.
9/13/2012	11	Suggestion - Could mention multi-year plan for remapping flood hazards along the Carson River?	ES-FEMA	Included in ongoing projects list.
9/13/2012	12	Douglas County FEMA Map Challenge - After four years of contesting the data used by the Federal Emergency Management Agency (FEMA) to develop flood maps for the Carson Valley, Douglas County successfully prevailed in a ruling from the Scientific Resolution Panel (SRP). FEMA would disagree with this sentence.	ES-FEMA	This has been modified based on update that the 2010 maps will remain as best available information.
9/13/2012	12	The panel has determined that FEMA's and Douglas County's data does not satisfy National Flood Insurance Program mapping standards .	ES-FEMA	This sentence was removed based on comment above.
9/13/2012	12	County officials have scheduled a meeting with FEMA representatives ~~in early August~~ on September 12, 2012, to discuss next steps, timing and funding for remapping the flood areas.	ES-FEMA	This sentence was removed based on comment above.
9/13/2012	12	The Pine Nut Pre-Disaster Mitigation (~~PRM~~ PDM) grant...	ES-FEMA	Correction was made to keep PMR but remove grant.
9/13/2012	13	They are creating website links which could serve ~~the~~ Carson River data through the USGS website.	ES-FEMA	Change has been made.
9/13/2012	13	CWSD is a part of an experimental in which FEMA technical partners sign a charter agreeing to work together on regional basis. Not sure that this sentence is intended to say. Rewrite to discuss RiskMAP Charter.	ES-FEMA	Change has been made.
9/13/2012	14	Could mention March 21, 2012, meeting and definitely September 13th meeting.	ES-FEMA	Change has been made.
9/13/2012	14	Discuss CWSD's Multiyear plan to restudy Carson River. Include graphics from HDR?	ES-FEMA	Added to Project List.
9/13/2012	15	Recently with the Freeway project and CLOMR, the 1% annual chance flood flow was revised to 1,232 cfs, but had not accounted for the flood control facilities. What does that mean?	ES-FEMA	Received clarification from Robb Fellows and change has been made.
9/13/2012	15	This tributary ~~consists of~~ drains (?) approximately 23 square miles and is located south end of Carson City and north border of Douglas County.	ES-FEMA	Change has been made.
9/13/2012	15	It is anticipated that the establishing elevations may remove large areas from the mapped floodplain.	ES-FEMA	Change has been made.
9/13/2012	15	Lahontan Reservoir was not designed as a flood control work~~s~~.	ES-FEMA	Change has been made.
9/13/2012	16	Communities that stand to benefit from such a structure would be~~,~~ Silver Springs, Churchill County and the City of Fallon. The figures below are provided for reference. Add Figures?	ES-FEMA	Sentence regarding figures was removed as it was erroneously carried over from another area.
9/13/2012	17	Add restudy of Carson River as high priority.	ES-FEMA	Added to Project List.
9/13/2012	17	All projects are prioritized as medium?	ES-FEMA	Projects will be prioritized by the Discovery Charter group.
9/13/2012	18	Could also add (perhaps as low priority?). Update to Alpine County's lapsed mitigation plan, development of a mitigation plan in Lyon County, and others?	ES-FEMA	Added to Project List.
9/17/2012		Provided insurance policy information.	ES-FEMA	Added to Community Fact Sheets.

Date	Page	Comments by Rob Loveberg, Lyon County	Agency	Response
10/5/2012		Dayton Valley Conservation District and R.O. Anderson have completed numerous bank stabilization projects along the Carson River in Dayton Valley.	RL-L	Added to report under completed projects.
10/5/2012		The modeling and studies are complete for the Ramsey Canyon Project. The County is currently working on the hydrology only LOMR in order to get FEMA's approval of those numbers so that other engineers are comfortable using them.	RL-L	Added to report under on-going projects.
10/5/2012		Lyon County is currently working on their Hazard Mitigation Plan.	RL-L	Added to report under on-going projects.
10/5/2012		Due to the Carson River undercutting the bank adjacent to River Road in Dayton, Nevada, there is an immediate need to stabilize the bank. This will not only save the road infrastructure but will also protect a home in close proximity to the area and at risk should the bank fail. This project is rated as Lyon County's #1 priority because there is an immediate need and immediate risk.	RL-L	Added to Project List.
10/5/2012		Lyon County has several project needs along the Carson River for bank stabilization. Several of the projects, including the River Road Project and the Fort Churchill Project, would be eligible under FEMA HMGA Program for grant funding. However, there is an issue with the area being designated as a Superfund site. In a previous application, the Fort Churchill Project was selected for further review and then later denied based on being located in the Superfund site. Because funding for PDM was pulled shortly after this decision was made, it was left unclear what the basis of denial was. It would be worth the effort for the Charter to meet with representatives from FEMA, NDEP, DEM, and DWR to discuss whether with appropriate explanation, these sites could be eligible under FEMA's programs.		Added to Project List.
10/5/2012		Lyon County has a need for a drainage system to improve conveyance of alluvial fan drainages to the Carson River. However, before such a system could be put into place, these alluvial fans would need to be studied and re-studied in order to analyze flows and thereby determine what kind of system is needed. Then conveyances would then need to be constructed and maintained.		Added to Project List.
10/5/2012		Lyon County would like additional gages for flood warning.	RL-L	Included under Early Warning Project - Watershed-Wide on Project List.

Appendix L:

Floodplain Management Plan Update/Revision Process 2013

2013 Update/Revision Process

Section 5.2 Monitoring and Revision calls for an update of the RFMP to be completed on an as needed basis, not to exceed five years. CWSD worked with stakeholders, including the River Corridor Working Group and local floodplain administrators to complete this revision. The process outline is as follows:

A. Work with stakeholders to determine the update format and what revisions/updates are required in the plan.
B. Complete draft revisions on plan and send out for comment by stakeholders.
C. Finalize draft revised plan based on input from stakeholders.
D. Provide final draft revised plan for comments to stakeholders.
E. Incorporate stakeholder comments and present final draft revisions to CWSD Board, August 21, 2013 for adoption by CWSD.
F. Present CWSD adopted final revised plan to Counties and other stakeholders for adoption.
G. Complete Revision Process Appendix L post adoption by CWSD and stakeholders for final

CWSD staff worked with the CRC River Corridor Working Group on the types of revisions/updates to be completed and how to format the update. It was decided an addendum to the document is the best solution for some of the following reasons:

a. The plan largely remains unchanged.
b. Any reprinting will be less expensive.
c. Easier to review and smaller to send via email.

The draft revised plan follows the original table of contents. Updates/revisions and any additions are included per section. Draft revisions were sent out to the River Corridor Working Group in early July 2013. Comments and updates were incorporated into a second draft and sent to stakeholders in early August 2013.

The CWSD Board adopted the *Carson River Watershed Regional Floodplain Management Plan Supplemental Update 2013* on August 21, 2013. Each of the five counties that previously adopted the Regional Floodplain Management Plan also adopted the supplemental update document as follows:

County	Adoption Date	By formal motion/resolution	Resolution #
Alpine County	10/15/2013	Formal motion	
Douglas County	9/5/2013	Formal motion	
Carson City	10/17/2013	Resolution	2013-R.40
Lyon County	10/3/2013	Formal motion	
Churchill County	10/16/2013	Resolution	30-2013

Each County’s formal actions or resolutions adopting the supplemental update are attached to this appendix.

11.2 9:30 am Discussion and possible action regarding approval and adoption of the 2013 updates to the Carson River Watershed Regional Floodplain Management Plan (RFMP).– Supervisor District 1

Supervisor Jardine introduced Carson Water Subconservancy District Executive Director Ed James.

James reported that the Regional Management Floodplain Management Plan was adopted in 2008 and would be periodically updated every five years; the focus of the plan was to avoid nonstructural projects and to keep the rivers natural. James reported that the charter identified working with FEMA from the ground workers to the policy makers; an appendix that includes emergency impacts will be included with the charter.

In response to Supervisor Rakow's question regarding the Pinenut Range area hazard mitigation plan, James reported that it was the responsibility of the Town of Gardnerville and he was unsure of the involvement of the Town of Gardnerville communicating with the Washoe Tribe.

MOTION Jardine / SECOND Rawson approving Contract No. CC2013-89 adoption of the 2013 updates to the Carson River Watershed Regional Floodplain Management Plan (RFMP).
ALL AYES; MOTION CARRIED.

11.3 9:30 am Discussion regarding the Comprehensive Regional Water System Report and overview of the Bureau of Reclamation Plan of Study by Carson Water Subconservancy District Staff. – Supervisor District 1

Carson Water Subconservancy District Executive Director Ed James reported that the report examined future water demands that did not impact the environment and agriculture; maximizing the water resource through the cheapest alternative; meeting the water quality standards. James reported that Desert Research Institute (DRI) would be conducting the analysis; the planning study will be completed and then a more in depth basin study.

11.4 9:30 am Discussion and possible direction regarding the future utilization of Lost Lakes water rights. – Supervisor District 1

Carson Water Subconservancy District Executive Director Ed James reported that the Carson Water Subconservancy District purchased Lost Lakes water rights in 2001; this allows the District to store water in the summer for recreation and during the fall release water for agriculture; the District invested over $330,000 for water rights and $160,000 in operation costs. James reported that the annual safety fees have jumped from $1,100 to $5,000.

James reported that the District was looking at several options: keep the system as it is (research how to lower cost); submit to the Nevada Legislature that the District was an environmental exemption; move the water rights downstream to Indian Creek Reservoir (contact South Tahoe Public Utility District); possibly selling. James reported that the District would discuss at their 10/16 meeting.

In response to Supervisor Rawson question regarding support, James reported that it would be helpful if the Board would appeal to legislatures and contacts.

Supervisor Jardine requested that this item be placed on the next agenda.

11.5 Request adoption of resolution establishing the position of Alpine County Chief Probation Officer to be a critically needed position and approval of a contract employee agreement by and between Alpine County and Gordon Morse, Chief Probation Officer effective October 16, 2013 through October 16, 2014 and direction to auditor to make budget appropriations. - Management Analyst

Management Analyst Sarah Simis requested to continue this item to address fiscal impact.

This item was continued.

extension is being requested at the last minute. He indicated they will file a lawsuit once the tolling agreement expires. He does not think Max Baer has anything to do with the dirt and we should not be waiting for him to resolve the issue with the casino site.

Chairman Lynn cannot make the connection between extension of the tolling agreement and the dust problem. The tolling agreement and the dust issue are two separate issues.

Commissioner Bonner mentioned there is really not a project to go on there yet. Nothing is in the works; the county has not seen any plans. Everyone would like to see something go up there for a variety of reasons. Michael Hohl is trying to work with the county in good faith so possibly raising the dust issue with him would help.

Commissioner McDermid does not want to see the dust continue either. NDEP is the regulating agency and that puts the county second. Everyone would have liked to have the tolling agreement deadline met but the complications with the other lawsuits has made that impossible thus the request to extend the agreement.

Ms. Gregory added not extending the tolling agreement would not mean something would be developed there. At the end of the tolling agreement, the county would look at options including pursuing litigation. As part of that litigation, the county would ask the court to void the Development Agreement at which point they could develop at any point in time they wanted. The tolling agreement does not force development which addresses the dust issues that are being raised. It would not address the dust issues.

MOTION by Johnson/McDermid to authorize the District Attorney's Office and Mark Bruce, Esq., on behalf of the County and RDA to negotiate an amendment to the current Tolling Agreement, with the Riverwood Parties, including extending the period of time the Riverwood Development Agreement litigation claims would be tolled and authorize the County Manager to execute any and all documents reasonably necessary to amend the Tolling Agreement; carried unanimously.

COMMUNITY DEVELOPMENT

8. For possible action. Discussion to approve an update to the Carson River Watershed Regional Floodplain Management Plan.

Brenda Hunt, CWSD Watershed Coordinator, provided an update and progress report on the plan including a history of the plan, strategies in the document, revisions to the original document, and the update process followed.

DOUGLAS COUNTY BOARD OF COMMISSIONERS
MEETING OF SEPTEMBER 5, 2013

No public comment.

MOTION by Penzel/McDermid to approve an update to the Carson River Watershed Regional Floodplain Management Plan, based on the discussion in the attached memorandum from the Carson Water Subconservancy District staff; carried unanimously.

9. For possible action. Discussion on adoption of Ordinance 2013-1399 amending Douglas County Code Chapters 20.800, 20.820, and Title 20 – Appendix B of the Consolidated Development Code by adopting with stated revisions the 2012 International Building Code, the 2012 International Residential Code, the 2012 Uniform Mechanical Code, the 2012 Uniform Plumbing Code, the 2011 National Electrical Code, the 2009 International Energy Conservation Code, and providing for other properly related matters. (2nd reading)

Dave Lundergreen, Building Official, stated there have been no changes to the Ordinance since its introduction. He summarized the significant changes in the new Codes. Outreach to contractors, builders, and government officials took place to review the changes. These changes will become effective October 1, 2013 if this is adopted by the Board today.

No public comment.

MOTION by McDermid/Penzel to adopt Ordinance 2013-1399 amending Douglas County Code Chapters 20.800, 20.820, and Title 20 – Appendix B of the Consolidated Development Code by adopting with stated revisions the 2012 International Building Code, the 2012 International Residential Code, the 2012 Uniform Mechanical Code, the 2012 Uniform Plumbing Code, the 2011 National Electrical Code, the 2009 International Energy Conservation Code, and providing for other properly related matters; carried unanimously.

10. For possible action. Discussion to approve an amendment to a Grant of Conservation Easement between John C. and Virginia S. Henningsen Nevada Trust of 1996, the Frensdorff Trust, and Douglas County (ref. DA 12-010), the First Amendment to Document #0605596, Bk 0204, Pg(s) 10905-10906 to relocate 0.76 acres of the existing 100.48 acre Conservation Easement. The subject easement is near 1140 Waterloo Lane, located on a total of five parcels (APNs: 1220-05-000-003, -004, -005, -006, & -007) in the South Agricultural Community Plan, and zoned A-19 (Agriculture – 19 acre minimum parcel size). The Board of Commissioners may approve, approve with modifications, or deny the request.

RESOLUTION NO. 2013-R-40

A RESOLUTION TO ADOPT THE CARSON RIVER WATERSHED REGIONAL FLOODPLAIN MANAGEMENT PLAN SUPPLEMENTAL UPDATE

WHEREAS, the Carson River flows through Carson City and is a valuable natural resource; and

WHEREAS, Carson City recognizes that flooding has and will continue to cause economic losses and threats to human life and health throughout the entire Carson River Watershed; and

WHEREAS, allowing the Carson River to access its floodplain provides public safety, slows flood waters, reduces peak flows, provides recharge to groundwater basins, and protects wildlife habitat; and

WHEREAS, a regional approach to floodplain management benefits Carson City and all other communities in the Carson River Watershed; and

WHEREAS, the Carson River Watershed Regional Floodplain Management Plan Supplemental Update provides a variety of strategies for floodplain management and protection of floodplain function.

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NOW, THEREFORE, the Board of Supervisors hereby resolves to adopt the Carson River Watershed Regional Floodplain Management Plan Supplemental Update and will strive to work cooperatively with the Carson Water Subconservancy District and other organizations and communities to continue to implement the suggested actions presented in the Plan.

Upon motion by Supervisor John McKenna, seconded by Supervisor Brad Bonkowski, the foregoing Resolution was passed and adopted this 17th day of October, 2013, by the following vote:

AYES:	Supervisor John McKenna Supervisor Brad Bonkowski Supervisor Karen Abowd Supervisor Jim Shirk Mayor Robert Crowell
NAYS:	None
ABSENT:	None
ABSTAIN:	None

ROBERT L. CROWELL, Mayor

ATTEST:

For: ALAN GLOVER, Clerk - Recorder

22. For Possible Action: Presentation of the Comprehensive Regional Water System Report and overview of the Bureau of Reclamation Plan of Study by Carson Water Subconservancy District Staff

Ed James of the Carson Water Subconservancy District presented. He explained this will not supersede any master plan. He presented a brief overview of the comprehensive regional water management plan they have been working on. The focus of this plan concentrated on the municipal water supply. With the grant funds, they were looking at developing a comprehensive regional water conservation plan. He also discussed the water shed. Our largest water storage facility is located at Lahontan Reservoir. He explained that current water needs are being met. He also discussed threats and other impacts to our water supplies. He discussed tying water lines together for efficiency. He explained they will continue providing information to our utilities.

There was no action taken.

23. For Possible Action: Regarding approval and adoption of the 2013 updates to the Carson River Watershed Regional Floodplain Management Plan (RFMP) (requested by Carson Water Subconservancy District)

Brenda Hunt of Carson Water Subconservancy District presented power point on the regional Floodplain Management Plan. Staff anticipates update within the next three years.

Comm. Fierro made a motion for the approval and adoption of the 2013 updates to the Carson River Watershed Regional Floodplain Management Plan. Comm. Hastings seconded and the motion passed unanimously 5 – 0.

24. For Possible Action: Appeal of Planning Director's denial of an application for an administrative variance and also appeal of subsequent denial of appeal to the Lyon County Planning Commission for property, owned by Jack F. & Maria S. Staten, APN 016-311-08 (requested by applicants)

Jack Staten wants to divide a parcel to allow him to build a home for employees that relocated from Texas.

Comm. Fierro asked Rob Loveberg why planning was not in favor.

Rob Loveberg explained that county code requires that with an administrative variance application, the planning director need to find there is self-evident undue hardship. That is a higher standard than is required for a general variance that can be granted by the planning commission. Rob Loveberg submitted a letter stating reasons for the denial. He discussed the county code with the District Attorney. Rob Loveberg was unable to find an undue hardship.

The Planning Commission made a decision to uphold the denial.

The commissioners had discussion and questions.

Comm. Fierro said we need to stick to the hardship provision addressed in Lyon County Code. In his opinion there is no hardship.

District Attorney Bob Auer explained that the term hardship as it relates to a variance has to relate to the piece of property. There has to be something about the property itself that creates the hardship.

Mr. Staten showed a boundary line adjustment map signed by Rob Loveberg in 2009.

Comm. Fierro moved to deny the appeal of the administrative variance for Jack & Maria Staten, due to the following findings: A. That there are sufficient reasons presented to support the Planning Director's finding that undue hardship is not self-evident. B. That there is sufficient evidence presented to support the Planning Director's decision of denial of the requested Administrative Variance. C. That there are not special circumstances or conditions applying to the property under consideration which makes compliance with the provisions of this Title

DOC # 437853
10/24/2013 10:13 AM
Official Record
Recording requested By
CHURCHILL COUNTY
Churchill County - NV
Joan Sims - Recorder
Page 1 of 19 Fee
Recorded By. TH RPTT
437853

RESOLUTION 30-2013

A RESOLUTION ADOPTING THE CARSON RIVER WATERSHED REGIONAL FLOODPLAIN MANAGEMENT PLAN SUPPLEMENTAL UPDATE 2013.

WHEREAS, the Carson River flows through Churchill County and is a valuable natural resource; and

WHEREAS, Churchill County recognizes that flooding has and will continue to cause economic losses and threats to human life and health throughout the entire Carson River Watershed; and

WHEREAS, allowing the Carson River to access its floodplain provides public safety, slows flood waters, reduces peak flows, provides recharge to groundwater basins, and protects wildlife habitat; and

WHEREAS, a regional approach to floodplain management benefits Churchill County and all other communities in the Carson River Watershed; and

WHEREAS, the Carson River Watershed Regional Floodplain Management Plan provides a variety of strategies for floodplain management and protection of floodplain function.

NOW, THEREFORE, the Churchill County Board of Commissioners hereby resolve to adopt the Carson River Watershed Regional Floodplain Management Plan Supplemental Update

2013 and will strive to work cooperatively with Carson Water Subconservancy District and other organizations and communities to implement the suggested actions presented in the plan.

ADOPTED this 16th day of October, 2013.

THOSE VOTING AYE: Pete Olsen
Harry Scharmann
Carl Erquiaga

THOSE VOTING NAY: N/A
N/A
N/A

CHURCHILL COUNTY BOARD OF COMMISSIONERS

Carl Erquiaga
Chairman Carl Erquiaga

ATTEST:

Pamela D Moore
Deputy Clerk of the Board