

RWPC REGIONAL FLOODPLAIN MANAGEMENT STRATEGY

**PREPARED BY:
REGIONAL WATER PLANNING COMMISSION
2ND DRAFT— JUNE 2003**

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- FEMA, "Modernizing FEMA's Flood Hazard Mapping Program: Recommendations for Using Future-Conditions Hydrology for the National Flood Insurance Program (Final Report). November 2001.

Introduction

This Regional Water Planning Commission (RWPC) Floodplain Management Strategy (FMS) is one of the key elements required by the Army Corps of Engineers prior to entering into the Project Cost Agreement (PCA) for the Truckee River Flood Project and, if adopted by local governments, can serve as an element of the All Hazard Mitigation Plan required of all communities under the Disaster Mitigation Act of 2000 (DMA-2000). The FMS, once approved, also suggests ideas and policies which will allow each entity to participate in the Community Rating System (CRS), reduce National Flood Insurance Program rates, and receive increased assistance from the Federal Emergency Management Agency (FEMA) in times of disaster.

The FMS is a "living document" that may be amended or revised as conditions change. Periodic amendment of the FMS is also a condition of the FEMA Flood Mitigation Assistance grant under which the work was performed. This document is intended for use as a tool to achieve effective floodplain management within Washoe County.

Abbreviations

BFE: Base Flood Elevation, relating to the 1% chance of recurrence flood interval (also known as the 100-year flood)
CRS: Community Rating System
DMA 2000: Federal Disaster Mitigation Act of 2000
FEMA: Federal Emergency Management Agency
FIRM: Flood Insurance Rate Map prepared by FEMA
FMA: Flood Mitigation Assistance grant program administered by the Nevada Division of Water Resources
HMGP: Hazard Mitigation Grant program; a FEMA program to implement flood mitigation projects
ISO: Insurance Services Organization
NFIP: National Flood Insurance Program
NRS: Nevada Revised Statute
Regional Plan: Truckee Meadows Regional Plan (a product of the Truckee Meadows Regional Planning Agency)
RWMP: Regional Water Management Plan prepared by the Regional Water Planning Commission
RWPC: Regional Water Planning Commission
TMRPA: Truckee Meadows Regional Planning Agency
TRFMCC: Truckee River Flood Management Community Coalition
TRFMS: Truckee River Flood Management Project
WCDWR: Washoe County Department of Water Resources
USACE: United States Army Corps of Engineers

Glossary

Critical Flood Storage Areas: Areas that have been identified as part of a technical planning process that are required for the storage of flood volumes in an adopted watershed based flood control master plan.

Design Manual: Hydrologic Criteria and Drainage Design Manual

Floodplain Management: The operation of an overall program of corrective and preventive measures to reduce the risk of flood damage while preserving and enhancing, where possible, natural resources in the floodplain. Examples of floodplain management activities include emergency preparedness plans, flood control works, floodplain management regulations, and open space plans.

Green Infrastructure: Use of bioengineering techniques such as grassy swales, fiber mats, vegetated banks, native materials in flood control or drainage infrastructure.

Living River: A river that is managed to support the natural processes and characteristics of the river, including riparian habitat, fish habitat, connected floodplains, and connectivity of these areas along its course.

Local Government Sponsors or Local Governments: City of Reno, City of Sparks, and Washoe County

No Adverse Impact: Activities that could exacerbate flood damage to another property or community will be allowed only to the extent that the impacts are mitigated or have been accounted for within an adopted community-based plan.

Executive Summary

Purpose and Definitions for the RWPC Regional Floodplain Management Strategy

This Floodplain Management Strategy was developed based on input from a number of local stakeholders, and included a review of flood damage reduction activities that have been implemented in other communities. The definition and purpose statements for the role of floodplain management in Washoe County are articulated below.¹

Floodplain management means the operation of an overall program of corrective and preventive measures to reduce the risk of flood damage while preserving and enhancing, where possible, natural resources in the floodplain. Examples of floodplain management activities include emergency preparedness plans, flood control works, floodplain management regulations, and open space plans.

The purpose of floodplain management is to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- a. Protect human life and health;
- b. Manage development to ensure that potential flood damage to existing properties is not exacerbated;
- c. Minimize expenditure of public money for costly flood control projects;
- d. Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- e. Minimize prolonged business interruptions;
- f. Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, and streets and bridges located in areas of special flood hazard;
- g. Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future blighted areas caused by flood damage;
- h. Ensure that potential buyers are notified that property is in an area of special flood hazard.

Background

There are different types of flood hazards in Washoe County that require unique management strategies. Truckee River flooding has been of primary concern to the Reno/Sparks metropolitan area for decades, the most recent and costly event occurred in 1997. Also of concern are flooding on Truckee River tributaries, alluvial fan flooding, sheet flooding, and lake/playa flooding.

The local governments in Washoe County, and the Regional Water Planning Commission, have exercised leadership in changing the focus of floodplain management from one that reacts to flooding and relies on the National Flood Insurance Program for

¹ From California Department of Water Resources Floodplain Management Internet Home Page, www.dwr.water.ca.gov, with addition of item "b".

damage recovery, to one that seeks to reduce the potential for flood damage through watershed based planning of both existing and future developed conditions.

There are two key points that must be recognized when planning for the management of flood events: 1) Flooding is a regional phenomenon. It does not respect municipal or property boundaries, and 2) Every area has a MINOR (stormwater) and MAJOR (flood) drainage conveyance system, whether planned for or not. The community requires coordination among local government agencies in implementing a strong floodplain management program that will minimize future flood risks to people and property.

Historically, the greatest flood damages in Washoe County have resulted from Truckee River flooding. There are a number of approaches that have been considered to reduce the flood damages over the past 50 years. When the flooding of 1997 re-energized the effort to implement measures to reduce the impact of flooding on the community, there was a strong interest in evaluating options that would also enhance the Truckee River as a community asset, with restoration of the natural flooding functions of both the river and portions of its historical floodplain.

The Truckee River Flood Management Community Coalition (TRFMCC) has spent three years developing a community concept for the river that minimizes flood damage while embracing the concept of a "Living River". There is recognition of the Truckee River as a valuable resource to the community and a natural system with beneficial functions that need to be restored and preserved. This concept of restoring and working with natural systems is one that will be expanded as planning is completed for the remainder of Washoe County.

Alluvial fan and flash flooding, while not as present in the community's recent memory, has been even more catastrophic than Truckee River flooding in terms of loss of life (see Section 3.2.1: 1956 Galena Creek flooding resulted in four fatalities vs. one fatality due to Truckee River flooding in 1997). In some cases, development is progressing on alluvial fans without the benefit of upstream protective measures.

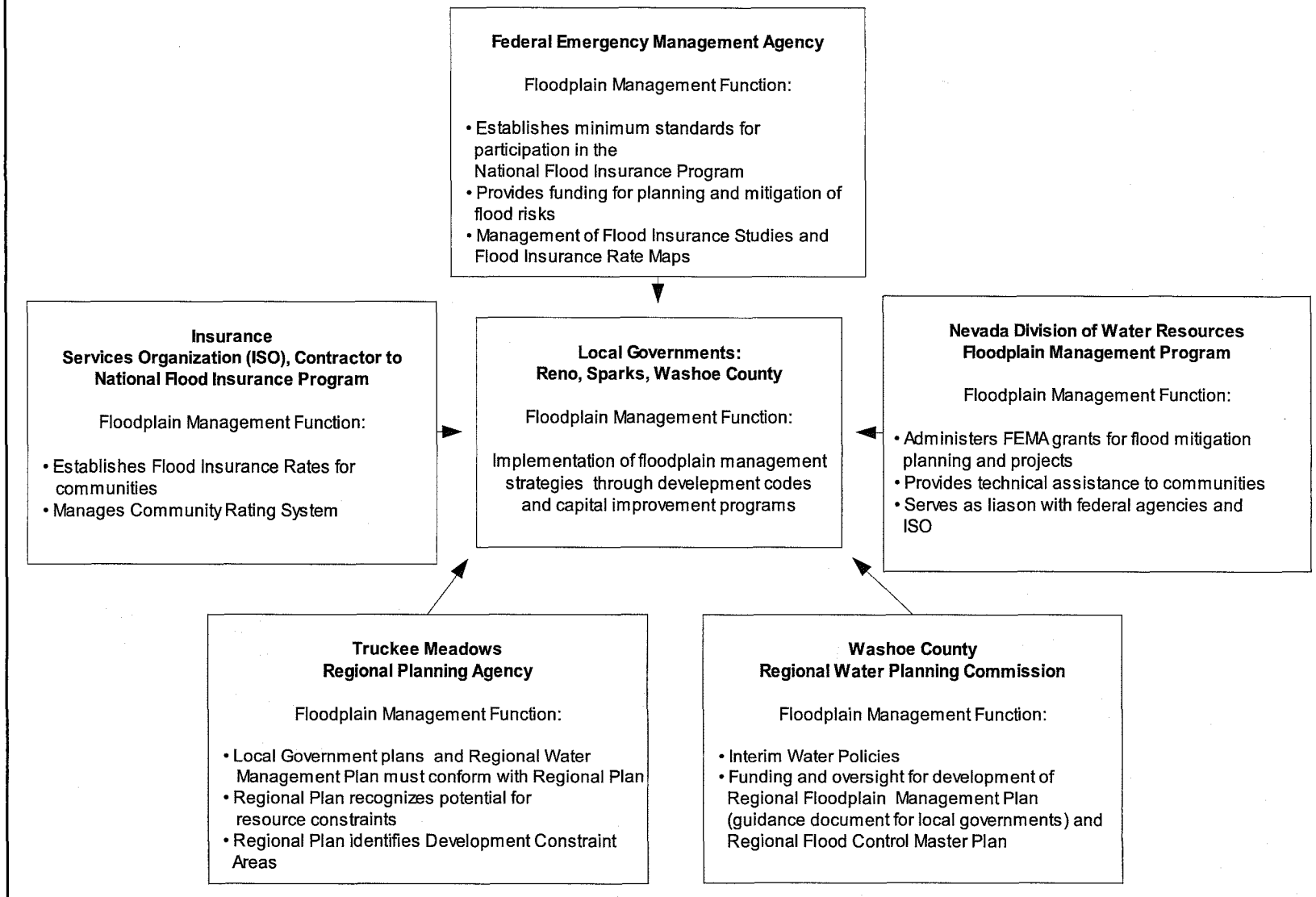
Local Regulatory Context for Floodplain Management

There are at least five programs that provide input to floodplain management in Washoe County from either an advisory, regulatory or financial standpoint. These programs are briefly described below and depicted in Figure 1.

Federal Emergency Management Agency (FEMA): Establishes minimum standards for participation in the National Flood Insurance Program, provides funding for flood mitigation planning and post-disaster relief, oversees the development of Flood Insurance Studies and Flood Insurance Rate Maps, and provides technical assistance to local governments.

Regional Floodplain Management Strategy role: FEMA will review FMS for compliance with grant funding requirements.

**Figure 1
Regulatory Relationships
for Floodplain Management in Washoe County**



Insurance Service Organization (ISO): The ISO, a contract entity under the National Flood Insurance Program, establishes flood insurance rates for communities based on a number of factors, including previous losses, participation in the ISO's Community Rating System (CRS) program, and flood damage reduction strategies employed by the community. The ISO also provides technical assistance to communities wishing to participate in the CRS.

Regional Floodplain Management Strategy role: Upon request by local governments for participation in the Community Rating System, will use Plan to assist in assigning a CRS classification to each of the NFIP communities (Reno, Sparks, Washoe County).

Nevada Division of Water Resources (NDWR), Floodplain Management Program: The State of Nevada often administers grant funds received by local governments for Federal programs that fund floodplain management planning and hazard reduction activities. The State's floodplain management program also provides guidance to local governments regarding National Flood Insurance Program requirements and technical assistance for flood damage reduction planning and implementation.

Regional Floodplain Management Strategy role: NDWR will review FMS for compliance with grant funding requirements.

Truckee Meadows Regional Planning Agency (TMRPA): Generally speaking, under the requirements of Chapters 278 and 540A of the Nevada Revised Statutes, the Regional Plan, the RWMP, local master plans and facility plans, and local annual capital improvement programs must be consistent with, and mutually supportive of, each other. The Regional Plan identifies Development Constraint Areas intended in part to protect waterways, water bodies, wetlands, and playas from encroachment and degradation of water resources and habitat.

Regional Floodplain Management Strategy role: To the extent that the RWPC Regional Floodplain Management Strategy is incorporated into the Regional Water Management Plan, the TMRPA will review it for conformance with the Regional Plan.

Washoe County Regional Water Planning Commission (RWPC): The Regional Water Management Plan (RWMP) prepared by the RWPC must conform with the Regional Plan, and must carry out and be consistent with local master plans. Proposals to construct certain water facilities (including flood control facilities) must conform with the RWMP. Generally speaking, under the requirements of Chapters 278 and 540A of the Nevada Revised Statutes, the Regional Plan, the RWMP, local master plans and facility plans, and local annual capital improvement programs must be consistent with, and mutually supportive of, each other. In addition to providing for the regional coordination of water related infrastructure to support implementation of local master plans, the RWMP provides technical recommendations to local governments regarding the availability and management of water resources.

Regional Floodplain Management Strategy role: Sponsoring agency with responsibility for review, comment, acceptance, and possible recommendation to local governments for adoption.

Summary of Recommendations

Suggested Changes to Development Codes

Section 6.4 contains suggestions for modifications to the development codes for Reno, Sparks, and Washoe County. The suggested modifications seek to accomplish the following:

- Apply common floodplain management standards through region-wide adoption of the strictest standard that is currently applied by the three entities;
- Ensure consistency in analysis, planning and design of projects with components that could impact flooding through adoption by all three local governments of the RWPC Regional Hydrologic Criteria and Drainage Design Manual (Design Manual);
- Ensure that local governments use the best available technical information relating to flood hazards so that new construction and substantial improvements to existing structures incorporate the most current understanding of flood related risks;
- Protect flood storage volumes required for the functioning of the overall watershed-based flood control network;
- Implement protective measures for proposed development downstream of dams;
- Enhance the protection of, and access to, future critical facilities during flood events.

Many of the recommendations that might have been suggested for inclusion in development code sections are included as recommendations for inclusion in the Design Manual. If the local governments are successful in agreeing to the criteria contained in the updated manual, and can each adopt it, then a great step forward will have been made in future implementation of many of the recommendations developed by this Floodplain Management Strategy.

If the local governments are not successful in adopting the same design manual, then the recommendations for the regional manual update are suggested for inclusion in the individual local government manuals with the goal of being as consistent as possible.

Suggested Mitigation Programs and Projects

Section 7 contains the suggested flood damage reduction projects and programs. The greatest reduction in future flood damages within Washoe County will result from the implementation of the Truckee River Flood Management Project, a \$260 million project under development in a joint effort between local governments and the U.S. Army Corps of Engineers. This project is discussed in detail in Section 5.1.

The approach to reducing potential damages associated with future changes in the watershed focuses around:

1. Preventing the exacerbation of flood damages to developed properties
2. Understanding and planning for the cumulative effects of development in the watershed
3. Watershed based master planning for build-out conditions
4. Recognition of the need for management of flood volumes

5. Development of mitigation programs to prevent any increase in damage to properties that will not be protected by a flood control project
6. Development of an ongoing community based program to inform the public and elected officials on pro-active flood damage reduction strategies

Participation in the Community Rating System

Completion of this Floodplain Management Strategy, and subsequent adoption by the local governments, is the first step towards participation in the National Flood Insurance Program's Community Rating System (CRS) program. Local governments are encouraged to take the next step by applying for inclusion in the CRS; each one would need to apply individually. While not all CRS recommended mitigation activities are appropriate to the local condition, there are many that the local governments are already implementing and would qualify for credit under the CRS. Property owners benefit from reduced flood insurance premiums as the community increases its CRS credits and ranking.

Data depicted in Table 1 indicates that the community pays over \$1.4 million annually in federal flood insurance premiums.² These premiums can be lowered by as much as 45% when a community participates in the CRS.

Table 1 Flood Insurance Premiums and Claims Paid							
	Number of Policies	Current Premiums	Avg Premium /policy	Value of Coverage	Number of Claims	Historical Amount of Claims Paid	Repetitive Loss Properties*
Reno	850	\$466,951	\$549	\$165,662,000	161	\$3,809,124	2
Sparks	346	\$566,796	\$1,638	\$106,059,000	124	\$10,780,740	4
Unincorporated Washoe County	773	\$387,286	\$501	\$132,617,000	139	\$2,817,347	2
Total	1,969	\$1,421,033	\$722	\$404,338,000	424	\$17,407,211	8

*any building with 2 or more flood losses greater than \$1,000 in any ten-year period since 1978

A community is assigned a CRS classification based on its implementation of flood damage reduction measures. Table 2 indicates the potential savings community-wide as higher classifications are obtained.

² Information for Table 1 provided by the Nevada Division of Water Resources, Floodplain Management Program.

Table 2 Potential Premium Reductions Community-Wide			
ISO Classification	Premium Reduction	Potential Community-wide Savings	Range of Points for CRS Activities
Class 10	0%	\$0	0
Class 9	5%	\$71,052	500-999
Class 8	10%	\$142,103	1000-1499
Class 7	15%	\$213,155	1500-1999
Class 6	20%	\$284,207	2000-2499
Class 5	25%	\$355,258	2500-2999
Class 4	30%	\$426,310	3000-3499
Class 3	35%	\$497,362	3500-3999
Class 2	40%	\$568,413	4000-4499
Class 1	45%	\$639,465	4500+

Table 3 depicts the types of flood damage reduction strategies that are eligible for credit under the CRS. The local governments in Washoe County already have ongoing programs that are eligible for credit under several of these categories.

Table 3 Community Rating System Point Classifications					
CRS Activity Points	Activity	Maximum Points	Reno Activities	Sparks Activities	Washoe County Activities
Series 300	Public Information	754			
	Elevation Certificates		x	x	x
	Map Information		x	x	x
	Outreach Projects				
	Hazard Disclosure				
	Flood Protection Library				
	Flood Protection Assistance		x	x	x
Series 400	Mapping & Regulatory	4,776			
	Additional Flood Data		x	x	x
	Open Space Preservation		x	x	x
	Higher Regulatory Standards		x	x	x
	Flood Data Maintenance		x	x	x
	Stormwater Management		x	x	x
Series 500	Flood Damage Reduction	6,565			
	Floodplain Management Planning		x	x	x
	Acquisition and Relocation				x
	Retrofitting				
	Drainage System Maintenance		x	x	x
Series 600	Flood Preparedness	1,220			
	Flood Warning Program		x	x	x
	Levee Safety		x	x	
	Dam Safety		x	x	x
Total Possible		13,315			

x = Local government has a program in this area that would likely qualify for CRS credit.

Overview of Floodplain Management Strategy Sections

Section 1 - Overview of the Planning Process:

For the purposes of review by entities interested in compliance with the Community Rating System planning process, this section identifies the major required planning steps and where in the document the relevant work can be found.

Section 2 – Review of Existing Flood Related Plans and Programs:

There are a number of government entities within Washoe County that have responsibilities for floodplain management and land use planning. Additionally, there are a number of significant projects and programs underway that are directly related to floodplain management within the region. This section seeks to identify the major programs and projects of various local government bodies to facilitate a reader's understanding of the status of floodplain management within the community.

Section 3 – Types of Flood Hazards in Washoe County:

This section discusses the types of flood hazards within the planning area and provides suggestions for management strategies that are preferred for each category.

Section 4 – Flood Related Problems and Concerns:

This section presents the issues that were identified during the public planning process.

Section 5 - Review of Possible Management and Mitigation Strategies:

This section presents the possible management strategies to respond to issues identified in Section 4.

Section 6 – Suggested Actions:

This section discusses the Goals and Objectives developed to respond to the issues from Section 4, and presents a number of Suggested Actions that are consistent with the Management and Mitigation Strategies developed under Sections 3 and 5.

Section 7 – Implementation Plan:

The Suggested Actions were integrated into a nine element Implement Plan that is presented in this section.

1.0 Overview of the Planning Process

1.1 Funding and Agency Sponsorship

Funding for preparation of this RWPC Regional Floodplain Management Strategy was obtained via a joint grant application to the State of Nevada for Flood Mitigation Assistance Planning Grant (FMA grant) funds on behalf of the City of Reno, City of Sparks, and Washoe County through the Truckee River Flood Management Community Coalition (TRFMCC).³

FMA grants administered by the State of Nevada's Division of Water Resources Floodplain Management Program are FEMA pass through funds provided for the purpose of preparing a FEMA approved Flood Mitigation Plan that identifies specific mitigation activities that would reduce the risk of future flood damage to communities.

The grant was awarded in August of 2000. In April of 2002 the RWPC was asked by the local government sponsors to take on the task of preparing the Regional Floodplain Management Strategy.

1.2 Public Involvement

An initial invitation was extended via electronic mail to more than 160 community stakeholders from the Reno, Sparks, and Washoe County community⁴, including:

- Local government elected officials
- Land use planning commissioners
- Regional Water Planning Commissioners
- Citizen and Neighborhood Advisory Board members
- State of Nevada Division of Water Resources staff
- Local government planning and engineering staff
- Truckee River Flood Management Community Coalition members
- Citizens who have expressed an interest in floodplain management
- U.S. Fish and Wildlife Service staff
- U.S. Army Corps of Engineers staff
- University of Nevada, Reno staff
- Tahoe Regional Planning Agency staff
- The Nature Conservancy
- Land developers

The result of this initial outreach was the establishment of a subcommittee of the RWPC called the "Regional Floodplain Management Planning Committee" (FMP committee) and an associated Technical Advisory Committee (FMP TAC). The role of the FMP committee is to oversee the development of the Regional Floodplain Management Strategy, which will ultimately be forwarded to the RWPC for review, acceptance, and recommendation to the local government agencies for adoption.

³ Flood Mitigation Assistance Planning Grant award, Appendix B

⁴ Letter from Jeanne Ruefer, Washoe County Department of Water Resources Planning Manager, April 22, 2002, Appendix B

The FMP Committee met monthly throughout the planning process from April 2002 through June 2003. The entire initial email list received agendas and meeting notes. The FMP TAC was formed to carry out very focused work on policy and technical issues with resulting recommendations that could be brought forward to the larger FMP Committee. The FMP TAC met several times each month throughout the process.

Both the FMP Committee and FMP TAC have open membership, with decisions made by consensus. This process was used to encourage an atmosphere of open communication and sharing of ideas and concerns.

Agendas for all committee meetings and the Floodplain Management Workshop that was held as part of the public education element of this plan are included in Appendix I.

The following individuals and their respective organizations are recognized for their regular attendance at FMP Committee meetings and/or their contributions to the development of the RWPC Regional Floodplain Management Strategy:

Core group providing input to development of floodplain management strategies:

Susan Lynn, FMP Committee Chair, RWPC Chairperson
Jeanne Ruefer, FMP Committee Vice-Chair, WCDWR Planning Manager
Peggy Bowker, TRFMCC, Nimbus Engineers, TRWMC
Marilyn Brainard, TRFMCC, City of Sparks Parks and Recreation Commissioner
Kimble Corbridge, Washoe County Public Works
Glen Daily, City of Reno Engineering
Mary Jo Elpers, U.S. Fish and Wildlife Service
Marge Frandsen, Regional and Washoe County Planning Commissioner
Shawn Gooch, City of Sparks
Kim Groenewold, Nevada Division of Water Resources
Lisa Haldane, Eagle Nest Engineering LLC, RWPC Floodplain Mgmt Planning Facilitator
Alison Harlick, CDM
Robert Joiner, City of Sparks Planning
Elisa Maser, MIG
Burnham Moffat, TRFMCC and Rosewood Lakes Homeowner's Association
Bob Ramsey, TRFMCC and Rosewood Lakes Homeowner's Association
Jim Shaffer, Washoe County District Health Department
Terri Svetich, City of Reno Public Works
Neil Upchurch, Truckee Meadows resident
Paul Urban, WCDWR
Bill Whitney, Washoe County Community Development

Additional community stakeholders receiving information and providing feedback during planning process:

Mitch Blum, University of Nevada, Reno
John Bradbury, Spanish Springs Citizen Advisory Board member
Mike Brisbin, Truckee Meadows Water Reclamation Facility
Michael Cameron, The Nature Conservancy
Chris Conway, Kennedy/Jenks Consultants
Doug Coulter, Washoe County District Health Department
Franco Crivelli, Truckee Meadows resident
Michael DeMartini, RWPC Vice-Chair
Greg Dennis, Regional Water Planning Commissioner and City of Reno Public Works
Julie Etra, Western Botanical Services, Inc.
Mark Forest, WRC, Nevada

Dennis Ghiglieri, TRFMCC
Robert Gottsacker, City of Reno Community Development
Jeff Jesch, HD&C
Roger Jordan, HDR Engineering
Bob Kershaw, Storey County Commissioner
Pan Lambert, Spanish Springs Valley resident
Thelma Matlin, TRFMCC
Margaret Powell, City of Sparks Planning
Gail Prockish, WCDWR
Chris Robinson, City of Reno Community Development
Gene Scala, Rosewood Lakes Homeowner's Association
George Shaw, Regional Water Planning Commissioner and Shaw Engineering
Wayne Seidel, Regional Water Planning Commissioner and City of Sparks
Jim Smitherman, WCDWR
Amir Soltani, Nevada Department of Transportation
Arlo Stockham, City of Reno Community Development
Rose Strickland, TRFMCC
Truckee River Water Management Council Members:
 DP Properties (Dermody)
 Trammel Crow
 ProLogis
 Trainor and Associates
 John Kleppe
 Hytmen Properties
Steve Varela, City of Reno Engineering
Hillary Vonich, Pro Logis

1.3 Hazard Assessment

Section 3 is a description of the type of flood hazards present in Washoe County, including alluvial fan flooding, flash flooding, riverine flooding, sheet flooding, and lake / playa flooding.

Most flood hazard areas in Washoe County have been mapped by FEMA. Appendix C contains figures depicting the FEMA 100 and 500-year regulatory flood zones. Also included on these figures are additional areas of known flooding that have been studied by or on behalf of local or federal government agencies. The figures were prepared from Q3 flood zone data purchased from FEMA, with modifications to reflect new mapping developed by local consultants or local governments for Letters of Map Revision that occurred after publication of the FEMA Q3 data.

1.4 Problem Evaluation

Section 4 describes the flood related issues and concerns that have been identified by the FMP Committee. Section 2.1 includes a description of the issues related to Truckee River flooding in the central Truckee Meadows.

1.5 Goal Setting

Section 6 details the goals, objectives, and suggested actions for floodplain management. The six goals of floodplain management in Washoe County are:

1. Reduce flood damages countywide.
2. Protect the community's investment in the Truckee River Flood Management project and regional flood control infrastructure.

3. Provide protection of life and property from flooding events through cooperative planning and development policies, including common design standards and consistent floodplain management ordinances.
4. Implementation of floodplain management strategies that are coordinated with public health, water quality, water resource, open space, and watershed protection programs.
5. Reduce community flood insurance costs to the maximum extent possible through participation in the Community Rating System.
6. Develop flood mitigation strategies that are cost effective and low maintenance to the greatest extent possible.

1.6 Plan Development

This Floodplain Management Strategy was developed with oversight from the FMP Committee, and with extensive input from state and local government staff with responsibilities in floodplain management, engineering, land use and open space planning.

A number of local engineering professionals in the flood control consulting profession also participated in the development of recommendations contained in the FMS.

1.7 Floodplain Management Strategy Implementation

Section 7 takes the Suggested Actions from Section 6, and develops them into a nine-element implementation plan. Once accepted by the RWPC, the FMS will be recommended for adoption by local governments. Implementation of FMS recommendations will be the responsibility of a number of organizations, as appropriate to the specific recommendation.

1.8 Ongoing Review and Modification of Floodplain Management Strategies

As elements of the implemented plan are completed, new information will become available regarding management and mitigation strategies that are more specific and cost effective for the community. Additionally, new hazards and needs for mitigation planning and project implementation may be identified.

The local government role in floodplain management will continue to evolve over time, with the result that the suggested strategies contained in this document will also evolve. The document should be considered a living document that continues to be updated as better information becomes available for the reduction of flood damages within the community.

In the absence of a regional flood control entity, it is hoped that the RWPC will continue to provide the leadership in coordinating floodplain management at the regional level for the benefit of all citizens of the community.

2.0 Review of Existing Flood Related Plans and Programs

2.1 Truckee River Flood Management Project

Background and Need⁵

The Truckee River is a unique natural resource, treasured for its scenic and recreational attributes, as well as for the rich habitat and diverse wildlife it supports. The River is also associated with a history of flooding in the Truckee Meadows. A major flood has occurred on the average of once every decade during this century. The Corps of Engineers estimated regional damages in the 1997 flood to be about \$500,000,000. Local estimates of regional and local damages amount to about \$700,000,000. With each flood, damage to property and disruption of lives and the local economy have increased dramatically. Future floods threaten to cause even greater damage.

In 1999, the Washoe County Board of Commissioners, with the support of the Cities of Reno and Sparks, the Nevada State Legislature, and many local community organizations, enacted an 1/8 cent sales tax to be used for public safety and flood management for the Truckee Meadows region. The Community Coalition for Truckee River Flood Management was formed by the project sponsors (Reno, Sparks, and Washoe County), with the cooperation of the U.S. Army Corps of Engineers, in order to ensure direct community input into the design of a Flood Management Plan for Reno, Sparks, and the Truckee Meadows. The Coalition is a diverse group, representing over 25 local stakeholder organizations, 15 resource and regulatory agencies, and members of the public.

The TRFMCC has spent more than two years developing the Truckee River Flood Management project alternatives. The alternatives being evaluated in the Corps of Engineers' integrated General Re-evaluation Report and Environmental Impact Statement (GRR-EIS) are based on 2002 conditions and the assumption that future conditions in the region will not cause a net loss of floodplain storage volumes nor changes to the base flood elevation in the project's hydrology.

TRFMCC
Truckee River Flood Management
Community Coalition

Local governments need to be especially careful in managing development in the period preceding implementation of the Truckee River Flood Management Project to ensure that flood damages to existing properties are not exacerbated. Any increase in current flood levels during this period will increase flood damages. The following points are made to illustrate the problem:

- The base flood elevation for the January 1997 flood event was approximately 1.6 feet higher than the existing FEMA base flood elevation at the Vista gage. This event was considered to be slightly greater than the 100-year flood event.

⁵ Portions of this section excerpted from "The Living Truckee River", a publication of the Truckee River Flood Management Community Coalition and from "RWPC Interim Water Policies and Criteria" packet submitted to Judge Hardesty in February 2003, specifically the portion called "Water Resource Overview by Hydrobasin", starting on pg 8 of 18.

- Existing homes and businesses were constructed based on current ordinance requirements, that is, with the first floor elevated either one or two feet above the FEMA base flood elevation. Structures constructed prior to current ordinances may have been elevated to a lesser extent or not at all. As stated above, the Corps of Engineers estimated regional damages in the 1997 flood to be about \$500,000,000. Local estimates of regional and local damages amount to about \$700,000,000.
- Information prepared by participants in the Truckee River Flood Management Project Working Group (a sub-group of the TRFMCC) indicates an increase in the base flood elevation, even as little as a couple of inches over the 1997 flood event, could result in the inundation of approximately 1800 additional homes in the Steamboat Creek area.⁶ Other properties throughout the region may also be subject to additional damages.
- Information prepared by WRC, Nevada for the Regional Water Planning Commission indicates that loss of flood storage volumes due to development of existing approved land uses within the floodplain on the north and south sides of the river could result in an increase of 0.4 to 0.6 feet in the base flood elevation.⁷

Several constraints were identified during the development of the Truckee River Flood Management project alternatives that resulted in a proposed project configuration that does not accommodate increased peak flow or volume of runoff during the critical flooding period. This means that other measures must be implemented within the watershed to manage the runoff from future development. Following is a list of some of the key constraints that resulted in the currently proposed project configuration:

- Broad community support is essential to implementing a project of such magnitude. Many objectives must be balanced, including flood damage reduction for properties within the floodplain, continued economic viability of commercial / industrial areas, quality of life for existing residents, enhancement of the river as a community and environmental amenity, mitigation of possible flood damages to downstream communities, and many more.
- Existing businesses and residences within the 100-year floodplain need to be protected. This could be largely accomplished if the base flood elevation for the 100-year design event could be reduced to the existing FEMA recognized base flood elevation (as compared to the 1.6 ft higher base flood elevation of 1997).
- Alternatives to reducing the base flood elevation are:
 - 1) Build levees and floodwalls - an extremely costly project element that was limited to areas where absolutely necessary for a number of reasons: cost, vulnerability to failure, unacceptable impacts to residences, creation of interior drainage problems, loss of access to the Truckee River, and environmental degradation of the river.

⁶ Information provided by members of the Rosewood Lakes Homeowner's Association based on 1997 flood elevation and evaluation of elevation certificates for constructed homes

⁷ Analysis of base flood elevation impacts due to loss of floodplain storage, WRC, Nevada, June 2003

- 2) Increase peak discharge from the Truckee Meadows - increasing the discharge from the Truckee Meadows has been discussed with downstream communities, and is only acceptable to the point that any potential damages have been mitigated through restoration of the river between Vista and Pyramid Lake. The use of this strategy is limited by existing informal agreements between the downstream communities (Pyramid Lake Paiute Tribe, Storey County) and the project sponsors.

(Note: These agreements are informal – the U.S. Army Corps of Engineers will evaluate an increased downstream discharge in the GRR-EIS process. There are not any formal agreements to accept the proposed increase in downstream discharge. Such agreements would be formalized when it can be demonstrated that there won't be an adverse impact to downstream communities.)

- U.S. Army Corps of Engineers funding for this project is limited to mitigating existing flood damages; federal funding is not available to mitigate flood damages that result from future development conditions. Local sponsors do have the option of designing for and fully funding a higher level of protection than required for existing conditions.

With the above constraints identified, it is apparent that in order to put together economically feasible flood damage reduction alternatives, existing conditions must not be aggravated as a result of changes in the watershed. The opportunities to mitigate damages within the floodplain itself are extremely limited. Therefore, increased peak flows that add to the Truckee River flood peak and volume must be mitigated elsewhere within the watershed. The RWPC will be overseeing the development of a Floodplain Storage Mitigation Plan in 2003.

Description of Community Coalition Project Concept⁸

The TRFMCC Concept Plan recognizes that traditional approaches to flood control may have failed in the past because they often don't respect a river's natural tendencies or take into account the natural processes and habitats surrounding the river. This plan combines unique elements that allow the Truckee River to be a river, not just a flood channel.

The Coalition's Concept Plan contains four major elements: Structural, Restoration and River Parkway, Mitigation, and Flood Management.

Structural: The overall proposal is to flood a smaller area of the Truckee Meadows, reducing the need for floodwalls and levees. Some urban areas such as the southern part of Sparks, the Reno/Tahoe International Airport, downtown Reno, and the lowest lying residential areas (for example, Pebble Beach and Eastside subdivision areas) will need flood solutions. Those floodwalls will be as low as possible, designed to fit the location and will maintain access to the river where appropriate. Some buildings can also be flood-proofed to act as floodwalls.

Other structural elements include:

⁸ This section excerpted from "The Living Truckee River", a publication of the Truckee River Flood Management Community Coalition.

- Meandering river that can flood onto curved, terraced riverbanks
- New causeways and overflow channels to move floodwaters past existing bridges
- Removing or replacing dams or diversions in the river
- Design that allows for creation of fish-friendly, dam-free whitewater parks in downtown Reno
- Minimize levees or flood barriers in residential areas, except for especially low areas
- New interior drainage systems

Restoration and River Parkway: The primary objective is to restore a living river and create river parkway areas that provide recreational activities, nurture wildlife and improve water quality.

Elements include:

- River parkways along the banks
- Natural-looking berms and trails to act as levees
- Re-creating natural river meanders
- Removing unnecessary floodwalls and sewer pipes that cross over the river
- Removing riprap where possible and restore riverbank areas for riparian vegetation
- Restoring wetlands where possible to improve water quality and habitats

Mitigation: The Plan has provisions to mitigate increased flooding down river, including securing flood easements, restoring down river lands as active floodplains, and flood proofing. In the project area, mitigation actions include managing construction impacts, managing noxious weeds, and protecting archeological resources.

Floodplain Management: The recommendations contained in this Floodplain Management Strategy are intended to protect the investment the community is making in flood protection. Integral to the Plan is joining the National Flood Insurance Program's Community Rating System, which provides monetary incentives for flood protection activities that can include adopting higher building standards, acquiring open space, and implementing an early warning system. The local sponsors handle floodplain management and are working to increase coordination on these critical issues.

Reno, Sparks, and Washoe County are working together to ensure that with continued involvement and support from citizens, stakeholders, local technical experts, environmental resource agencies, businesses, industry, and community organizations, a plan is finalized that protects the Truckee River community from the threat of floods and restores the life of the Truckee River.

2.2 Truckee Meadows Regional Stormwater Quality Management Program

The Truckee Meadows Regional Stormwater Quality Management Program is a comprehensive program comprised of efforts by local governments and private citizens to reduce the pollution associated with urban runoff in the Truckee Meadows. The program is required by the National Pollutant Discharge Elimination System (NPDES) permit issued jointly to the Cities of Reno and Sparks, Washoe County, and the Nevada Department of Transportation on January 14, 2000.⁹

⁹ From City of Reno Stormwater Management Program Website: www.tmstormwater.com

The program is still under development, and will ultimately have a number of components, including stormwater discharge monitoring, land use planning requirements, structural controls for new development, vector control standards, construction site discharge requirements (in-place), illicit discharge detection and elimination and an industrial discharge program.

The Truckee Meadows Regional Stormwater Quality Management Program is complementary to and consistent with the flood damage reduction strategies proposed herein. There is acknowledgement at the regional level of the importance of continued coordination between floodplain management goals and stormwater quality management program elements as the work continues on the implementation of both plans.

2.3 Truckee Meadows Regional Planning Agency¹⁰

The Truckee Meadows Regional Planning Agency (TMRPA) was created in 1989 by the Nevada State Legislature to foster coordination among the three local governments; Reno, Sparks and Washoe County. The TMRPA is comprised of the Regional Planning Governing Board (RPGb), the Regional Planning Commission (RPC), the TMRPA's Director, and staff.

The first comprehensive Truckee Meadows Regional Plan ("Regional Plan") was adopted in March 1991 and updated for the first time as required by law in June 1996. The second update was adopted in May 2002 and was subsequently amended on February 13, 2003. Sections of the Regional Plan quoted in this Regional Floodplain Management Strategy include the modifications made in February 2003.

The area covered by the Regional Plan includes all of Washoe County except the portions within the drainage basin of Lake Tahoe (see *Nevada Revised Statutes* (NRS) 278.0288) and the lands of the Pyramid Lake Paiute Tribe, but the effective planning area is the developed area in the southern 15% of Washoe County.

Creating and carrying out the Truckee Meadows Regional Plan (Regional Plan) is a cooperative effort involving a large number of agencies, organizations and individuals. Reno, Sparks, Washoe County and others implement the Regional Plan through their planning and regulatory efforts, capital improvement programs and other programs. The three local government master plans must be found in conformance with the Regional Plan.

Nevada law grants the authority and provides the direction for the regional planning process in the Truckee Meadows. The TMRPA, organized under NRS 278.026 - 278.029, was formed to develop and maintain a comprehensive Regional Plan for the jurisdictions of Reno, Sparks and Washoe County.

2.3.1 Regional Plan - Relationship to Floodplain Management

There are four fundamental planning principles contained in the Regional Plan. Each planning principle has an associated group of goals and policies. Floodplains are dealt with in the Regional Plan under the term "*natural resource*" which is defined as ..."*air*

¹⁰ Portions of this text excerpted from "2002 Truckee Meadows Regional Plan", pgs. 1-2

quality; quality and quantity of surface water and groundwater; habitat for fish, vegetation, and wildlife; open space; floodplains; wetlands; aquifer recharge areas; stream channels; soils; scenic quality; and energy sources.”¹¹

The Regional Planning Governing Board has recognized the significance of natural resources in supporting the sustainability of the community, and has incorporated several principles, objectives and policies into the Regional Plan that acknowledge the need to manage and protect natural resources for protection of public health and safety, sustainability of water resources, maintenance of habitat, and preservation of open and green spaces.

A review of the Regional Plan indicates general consistency between the goals, objectives, and suggested actions proposed under this Regional Floodplain Management Strategy and the principles, goals, and policies of the Regional Plan. Following are excerpts and discussion of some of the key sections of the Regional Plan that relate to floodplain management. Excerpts from the Regional Plan are shown in italics.

Regional Planning Principle #1: “Regional Form and Development Patterns”

One of the objectives under this planning principle is to “*Preserve our designated natural resources and open space*”.

Regional Plan Policy 1.1.8 defines Development Constraints Areas as follows: *...“playas, significant water bodies, natural slopes over 30%, publicly owned open space, and properties that are deed restricted to prevent development.”* Policies relating to these areas are contained under Regional Planning Principle #2.

Regional Planning Principle #2: “Management of the Region’s Natural Resources”

Following are the planning principles contained under Regional Planning Principle #2 of the Regional Plan:

- *Within the Regional Plan, open space, green space and natural features will help define the Regional Form.*
- *Our unique and significant natural resources will be identified and managed in a sustainable manner and as “whole systems” to ensure the availability of resources for generations to come.*
- *The Regional Plan will require Local Government Master Plans to encourage land uses that promote the responsible management of the region’s air quality and water resources.*
- *The Regional Plan will require a regional approach to watershed, wastewater, and stormwater management to ensure state water quality standards are met.*
- *The Regional Plan will require the identification of sustainable regional water resources and the promotion of development patterns and practices that promote sustainable water use.*
- *The Regional Plan will require Local Government Master Plans to preserve the natural function and scenic value of mountains, rivers, significant ridgelines,*

¹¹ Per the February 13, 2003 amendments to the Regional Plan approved by the RPGB

wetlands, aquifer recharge areas, and water bodies as wilderness, habitats, open space, green space, parks, trails and recreational areas.

- Local Governments and Affected Entities will manage our natural resources in co-operation with State and Federal partners.
- The Regional Plan recognizes that the natural resources within our region are constrained.
- The Regional Plan will ensure the effective management of our natural resources, recognizing their importance to the public health, safety, and welfare of our community.

Regional Plan Policy 2.1.1 places the following minimum requirements on development within Development Constraints Areas:

1. *As defined in Local Government Master Plans, allowed land uses are limited to communication facilities, recreational facilities, parks and open space, utilities, agriculture, forestry, mining and transportation infrastructure necessary to service development. Residential development is allowed at a maximum density of one unit per 40 acres or one unit per parcel in existence when the 2002 Regional Plan is adopted, whichever is greater. Other uses may encroach into the Development Constraints Area in isolated areas if the encroachments enhance the overall project design and a 2:1 ratio of non-constrained area is preserved as open space for every constrained area that is developed.*
2. *Commercial, office, industrial and residential development is not allowed in the Development Constraints Area, except as provided for in Policy 2.1.1 (1).*
3. *All Local Government and Affected Entity Master and Facility Plans must include components to preserve Development Constrained Lands in an undeveloped state wherever possible, to minimize encroachments into the Development Constraints Area, and to provide design features to mitigate the visual impact of necessary encroachments.*

The map of Development Constraints Areas is contained in Appendix D of this Regional Floodplain Management Strategy. A color copy of the map can also be found at the TMRPA website: www.TMRPA.org.

Of additional significance to floodplain management activities in Washoe County are Regional Plan Goal 2.4 and Policy 2.4.4:

Regional Plan Goal 2.4: *The RWPC and Washoe County will revise the Regional Water Management Plan (RWMP) and Local Governments will revise their Master Plans to: (a) attain and maintain state and federal water quality standards, (b) protect water resources from degradation by stormwater runoff, and (c) protect natural resources and the public health, safety, and welfare during flood events.*

Regional Plan Policy 2.4.4: *Within 18 months of the adoption of the Regional Plan, the Regional Planning Governing Board, in cooperation*

with relevant agencies and entities, shall prepare a comprehensive report on federal, state, and local government policies and programs for the management of the Truckee River watershed, its banks, and its floodplain, and appropriate groundwater supplies in order to determine the efficiency of existing management strategies.

The goals, objectives and suggested policies and programs contained in this RWPC Regional Floodplain Management Strategy can provide a significant contribution to the work required under the above stated Regional Plan goal and policy.

Regional Planning Principle #3: "Public Services and Facilities"

Under Planning Principle #3 there is recognition that public service providers may determine that natural and/or physical resources may be limitations to preparing a plan that conforms to the Regional Plan. This could be particularly true in the case of floodplain management in the central Truckee where there are constraints on the base flood elevation and peak flood discharges propagated downstream of the Truckee Meadows.

Regional Plan Appendix I: "Public Facilities and Services in the Truckee Meadows: Problems, Needs, Service Providers, Timing and Plans for Capital Improvements"

This section of the Regional Plan discusses the problem of flooding on the Truckee River and its impacts on the economy of the Reno / Sparks metropolitan area. The TRFMCC Concept Plan for the Truckee River Flood Management Project is referred to under Section C: "Required Facilities". This appendix is to be updated upon completion of the Environmental Impact Statement for the Truckee River Flood Management Project.

2.4 Regional Water Planning Commission (RWPC)

2.4.1 Watershed Management and Protection Plan for Tributaries to the Truckee River

The RWPC Watershed Management and Protection Plan, currently in draft form, recommends strategies for protection and restoration of stream corridors and drainages that discharge to the Truckee River to meet the multiple objectives of protection and enhancement of water quality, preservation of habitat, preservation of beneficial functions of floodplains, and others.

The plan recognizes that there is a tremendous amount of work that is ongoing within the Truckee Meadows with respect to the management of the region's water resources, and proposes a framework for the integration of these many efforts to ensure that there is regional coordination and efficient expenditure of the communities' financial resources, meeting multiple objectives wherever possible.

Floodplain management is one component of watershed management and should be part of the integrated approach to watershed management and protection in whatever the regionally adopted management framework turns out to be.

2.4.2 Interim Water Policies

In May of 2002, the RPGB adopted the update to the Regional Plan. Subsequent to this adoption, a lawsuit challenging elements of the plan was brought by Washoe County and the Sun Valley General Improvement District, in part due to the concern that the Plan didn't adequately reflect the development constraints that could be posed by limited natural resources.

The lawsuit was resolved through a negotiated settlement agreement and, among other things, required the RWPC to develop Interim Water Policies that would address the constraints related to water resources under the jurisdiction of the RWPC.

These Interim Water Policies were intended, at a minimum, to apply to Cooperative Planning Areas as defined in the settlement agreement and would remain in effect until the RWPC completed the update to the Regional Water Management Plan, expected later in 2003.

Of the sixteen Interim Water Policies, six have a relationship to flood control and floodplain management:

- Policy 1.3.b: Protection and Enhancement of Recharge Areas
- Policy 3.1.a: Regional Floodplain Management and Flood Control Master Plan
- Policy 3.1.b: Floodplain Storage in the Truckee River Watershed
- Policy 3.1.c: Floodplain Storage outside of the Truckee River Watershed
- Policy 3.1.d: Truckee River Restoration
- Policy 3.1.g: Management Strategies for Slopes Greater than 15%

Additionally, the RWPC adopted a program of work called "Floodplain Storage Mitigation".

Pursuant to the terms of the settlement agreement, local governments must adopt the Interim Water Policies. The Interim Water Policies and Floodplain Storage Mitigation program differ from the floodplain management strategies presented in this document in that they must be implemented pursuant to the terms of the Settlement Agreement. They are part of the regional tool kit that is being developed to reduce flood damages.

2.4.3 Regional Flood Control Master Plan

The Regional Flood Control Master Plan, first prepared in the early 1990s, identified the regional flood control facilities that were required to manage flooding for southern Washoe County. Some of the recommended facilities have since been constructed. Many of the recommended facilities have not been constructed, primarily due to a lack of funding for regional flood control facilities in the unincorporated area of Washoe County.

The RWPC has issued a contract to update the Regional Flood Control Master Plan based on current conditions in the watershed and anticipated future development. The updated plan will incorporate flood control strategies for the region that are consistent with floodplain management recommendations contained in this Floodplain Management Strategy.¹²

¹² See RWPC Interim Water Policy 3.1.a: "Regional Floodplain Management Plan and Regional Flood Control Master Plan"

2.4.4 Design Manual

The Design Manual was also developed in the early 1990s, and was recommended for adoption by the local government agencies. Since that time, the City of Sparks is the only entity that has formally adopted the manual, though it is used to varying degrees by both Washoe County and the City of Reno.

The purpose of the manual is to provide technical guidance for hydrologic and hydraulic studies and design criteria for flood control and stormwater management facilities. The RWPC has issued a contract to prepare a substantial update to the manual.

*Design Manual:
Hydrologic Criteria and Drainage
Design Manual*

2.5 City of Reno

The following sections of the City of Reno Municipal Code have requirements relating to floodplain management and can be found on-line at the city's website:

www.ci.reno.nv.us.

2.5.1 City of Reno Municipal Code Chapter 12.24: "Flood Hazard Areas"

The City of Reno implements the requirements for participation in the National Flood Insurance Program under Chapter 12.24 of the City of Reno Municipal Code. The City's requirements meet the minimum standards of the NFIP and are more restrictive than the standard with respect to elevation of structures in the floodplain.

2.5.2 City of Reno Municipal Code Chapter 18.06.800: "Environmental Standards"

This section of the Reno Municipal Code contains standards for the review of development proposals within wetlands, stream environments and areas of significant hydrologic resources for the purpose of:

- 1) Improving water quality;
- 2) Retaining natural flood storage capacity;
- 3) Protecting rare and endangered species;
- 4) Enhancing the aesthetics of the community.

The code section is implemented through an administrative manual and maps indicating "Potential Wetlands, Stream Environments and Regionally Significant Hydrologic Resources".

2.5.3 City of Reno Municipal Code Chapter 18.06.449 of the Zoning Code

As a result of the settlement agreement over the Regional Plan, the City of Reno adopted a new section of the zoning code in February 2003. The purpose of the section is to establish criteria for review of master plan and zoning amendments in a newly created Cooperative Planning Overlay District.

Of relevance to floodplain management is the part of the new code section called "Significant Hydrologic Resources", that appears to be the same as the Washoe County Development Code Article 418 by the same name.

2.5.4 Sewer Enterprise Fund

The City of Reno funds the operation, maintenance and construction of new flood control facilities through its sewer enterprise fund. A flood control fee is collected on sewer bills for customers within the City of Reno.

2.6 City of Sparks

The following sections of the City of Sparks Municipal Code have requirements relating to floodplain management and can be found on-line at the city's website:

www.ci.sparks.nv.us.

2.6.1 City of Sparks Municipal Code Chapter 15.11: "Floodplain Management"

The City of Sparks implements the requirements for participation in the National Flood Insurance Program under Chapter 15.11 of the City of Sparks Municipal Code. The City's requirements meet the minimum standards of the NFIP and are more restrictive than the standard with respect to elevation of structures in the floodplain.

2.6.2 City of Sparks Drainage Master Plan

The City of Sparks has developed a Drainage Master Plan covering the Spanish Springs watershed and discharge from the watershed through the North Truckee Drain to the Truckee River.

New development in the City's Spanish Springs area of jurisdiction must show that run-off from the proposed project does not adversely impact existing properties under both existing and build-out conditions. This is done by incorporating the proposed project concept into the City's hydrologic and hydraulic modeling of the watershed and ensuring that constraining criteria are met at specific control locations. Developers construct components of the Drainage Master Plan in conjunction with land development.

2.6.3 City of Sparks Stormwater Utility

The City of Sparks funds operation, maintenance and construction of new facilities through its Stormwater Utility, a monthly fee that is included on sewer bills within the City of Sparks.

2.7 Washoe County

2.7.1 Washoe County Development Code Article 416: "Flood Hazards"

Washoe County implements the requirements for participation in the National Flood Insurance Program under Article 416 of the Washoe County Development Code. The County's requirements meet the minimum standards of the NFIP and are more restrictive than the standard with respect to elevation of structures in the floodplain.

2.7.2 Washoe County Development Code Article 418: "Significant Hydrologic Resources"

Washoe County Development Code Article 418 "Significant Hydrologic Resources" seeks to preserve the natural functions of perennial streams within Washoe County for the multiple purposes of flood control, preservation of tributary stream water quality, riparian habitat, and control of encroachment.

2.7.3 Flood Control Districts

The developing area of the Southeast Truckee Meadows Specific Plan includes significant flood control facilities that will be constructed, operated and maintained with funding obtained through a utility established specifically for the area. A second stormwater utility is under development for a portion of the unincorporated area of Spanish Springs (first reading of ordinance establishing the utility has occurred). The purpose of both utilities is to fund the operation, maintenance and construction of major flood control facilities.

2.8 Tahoe Regional Planning Agency

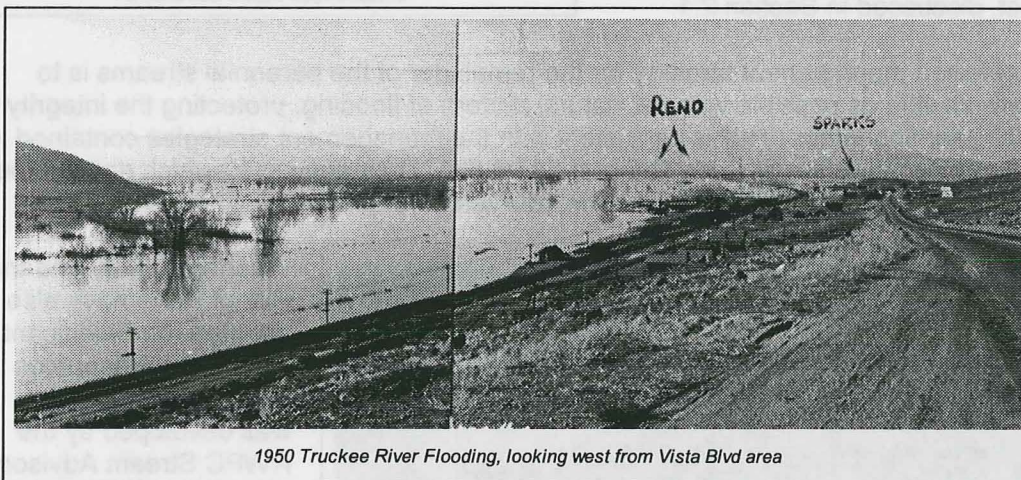
The Tahoe Regional Planning Agency (TRPA) has jurisdiction over flood control within the Tahoe Basin, a portion of which is within southern Washoe County. Flood control regulations within the Tahoe Basin can be seen at the TRPA website: www.TRPA.org.

3.0 Types of Flood Hazards in Washoe County¹³

3.1 Riverine Flooding: Truckee River, Steamboat Creek, Thomas Creek, Whites Creek, Boynton Slough, Dry Creek

The primary cause of riverine flooding in Southern Washoe County are winter rainstorms that saturate and melt the Sierra snow pack at elevations between 4,500 and 8,000 feet or higher. Though most winter storms bring snow to elevations above 6,000 feet, a series of warm storms occasionally dumps rain at higher elevations. The January 1997 floods were caused by several warm storms, which swept into the Sierra Nevada from the Hawaiian Islands and rained on a heavy snow pack. This weather pattern is called "The Pineapple Connection" or "The Pineapple Express".

Winter flooding by rain-on-snow weather events will continue to cause damage to urbanized floodplain areas in Reno, Sparks and other low-lying communities. Large



1950 Truckee River Flooding, looking west from Vista Blvd area

river floods may occur any time between November and April in successive years, or not occur at all for many years.

3.1.1 Historical Riverine Flooding in Washoe County

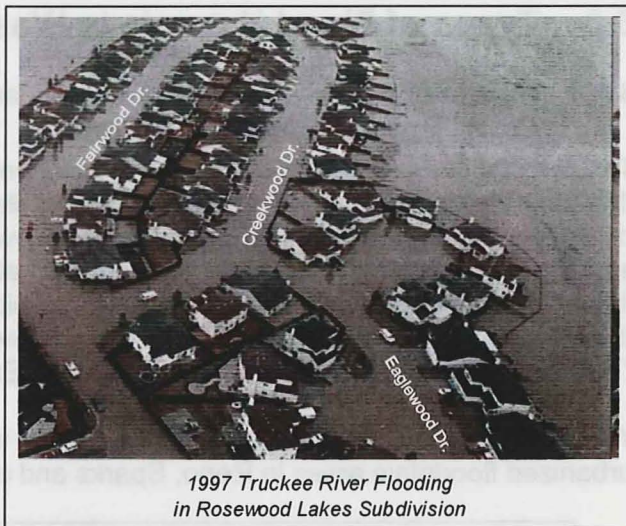
The famous New Year's flood of 1997 was a classic winter flood on the Truckee River. It flooded low-lying floodplains adjacent to the river and its major tributaries such as Steamboat Creek and the North Truckee Drain. Local estimates of regional and local damages amount to about \$700,000,000, closing the Reno / Tahoe International Airport and shutting down businesses for days and weeks. The flood also caused environmental damage when sediments, urban pollutants and flood debris were washed downstream.

¹³ "Flood Facts". University of Nevada Cooperative Extension and Washoe County Emergency Management Services, 1998 (Source for description of riverine and alluvial fan flood hazard types and historical flooding chronology)

Winter floods of the Truckee River have occurred many times since Reno and Sparks were founded. Major floods occurred in the Truckee Meadows in 1862, 1867, 1875, 1890, 1904, 1907, 1928, 1937, 1943, 1950, 1955, 1963, 1986 and 1997.

3.1.2 Riverine Flooding Management Strategies

The preferred management strategy for Truckee River flooding has been developed by the community as part of the Truckee River Flood Management Project, discussed in Section 2.1.



1997 Truckee River Flooding
in Rosewood Lakes Subdivision

The preferred management strategy for the remainder of the perennial streams is to interfere as little as possible with the natural pattern of flooding, protecting the integrity of the 100-year floodplain. This is consistent with the management strategies contained in the City of Reno Municipal Code Chapter 18.06.806 "Drainageways", which defines the area protected from encroachment as the 100-year floodplain.



1997 Truckee River Flooding in Sparks

Washoe County and the City of Reno have also adopted the Significant Hydrologic Resources (SHR) ordinance that was developed by the RWPC Stream Advisory Committee.¹⁴ The City of Reno has adopted the SHR in Cooperative Planning Areas only. This ordinance identifies "critical" and "sensitive" stream zone buffer areas that must be protected.

Management of the perennial streams becomes more complex as they traverse developed and developing areas. Where possible, the preference is to continue to maintain the 100-year flood zone in a way that seeks to preserve the natural functions of the system. It will be necessary to proactively stabilize the watercourse in these areas due to the changed hydrology that results from a developed watershed (see suggestions in Section 6.1).

¹⁴ Washoe County Development Code Article 418 and Reno Municipal Code Chapter 18.06.400 (applicable in Cooperative Plan Overlay District, February 25, 2003)

Many of the streams have been confined to concrete channels as they pass through the urban areas. When there is a need to perform construction that affects these constructed channels, the preference is to begin to restore these waterways to a more natural configuration. This may require the acquisition of adjacent land to re-establish a floodplain area for the stream.

There are a number of ongoing restoration plans and studies on the perennial streams. The two most significant of these are the Lower Truckee River Restoration Plan and the Steamboat Creek Restoration Plan that are being incrementally implemented as funds become available. Stream and river restoration efforts are consistent with the floodplain management approach that is preferred by this Plan.

3.2 Alluvial Fan and Flash Flooding: Hidden Valley, Jumbo Grade, Stormy Canyon, Virginia Foothills, Whites Creek, Galena Creek

As a flash flood rushes out of a confined (concave) canyon at the top (apex) of a fan, it's contained for a short distance in a single high-velocity channel. This channel, like the ravine upstream, is a high hazard flood zone, threatening lives and structures in its path. In areas where the channel is not deeply entrenched, it can become clogged with debris not far below the apex, and cut a new path on the convex surface of the fan. This makes alluvial fan flooding much less predictable than valley bottom flooding. Where canyons are close together, their fans tend to merge. These fans are sometimes hard to recognize because they're not always cone shaped. FEMA provides the following definitions of an alluvial fan and alluvial fan flooding hazard:

Alluvial Fan - An alluvial fan is a sedimentary deposit located at a topographic break such as the base of a mountain front, escarpment, or valley side, that is composed of streamflow and/or debris flow sediments and which has the shape of a fan, either fully or partially extended.

An **active alluvial fan flooding hazard** is indicated by three related criteria: (a) flow path uncertainty below the hydrographic apex, (b) abrupt deposition and ensuing erosion of sediment as a stream or debris flow loses its competence to carry material eroded from a steeper, upstream source area, and (c) an environment where the combination of sediment availability, slope, and topography creates an ultrahazardous condition for which elevation on fill will not reliably mitigate the risk. Inactive alluvial fan flooding is similar to traditional riverine flood-hazards, but occurs only on alluvial fans. It is characterized by flow paths with a higher degree of certainty in realistic assessments of flood risk or in the reliable mitigation of the hazard."¹⁵

While predicted flood depths may average a foot or less over much of the fan, a rampaging flood can erode a gully from one to more than ten feet deep in one location and deposit the sediment several feet deep a short distance down the street. Flash floods can also deposit large boulders, tree trunks and other debris on the fan surface below sierra canyons. In the arid Western United States, there is a tendency to underestimate the potential and severity of flash flood events on alluvial fans.

¹⁵ From FEMA website: www.fema.gov/mit/tsd/fq_afdef.htm

3.2.1 Historical Alluvial Fan and Flash Flooding in Washoe County

Flash floods have occurred on most small streams, drainages and washes in the Truckee Meadows vicinity. Detailed accounts of many of these cloudburst floods have described them as "walls of water". It's interesting to note that in several accounts, flooding resulted from the merging of convective thunderstorm cloud cells. A rainfall rate as high as 10 inches an hour was estimated for short durations in one particular instance.

July 1869: A cloudburst flood resulted from a heavy thunderstorm. Intense rain accompanied by hail resulted in flooding two feet deep from Browns School to Huffaker School in the southern Truckee Meadows.

August 15, 1878: Torrential rain (a "monster cloudburst") fell for 3 hours on watersheds southwest of Reno. Thomas Creek turned into a raging torrent 400 feet wide and three feet deep, gouging its channel to bedrock in many locations.

July 18-26, 1913: An almost daily occurrence of thunderstorms produced flooding from canyons draining into the Truckee River west of Reno. The most severely affected streams were Hunter Creek and Alum Creek. Galena and Browns Creek poured a "solid sheet of water" into Pleasant Valley. An automobile mired on the highway was buried under a 30-foot thick deposit of flood debris.

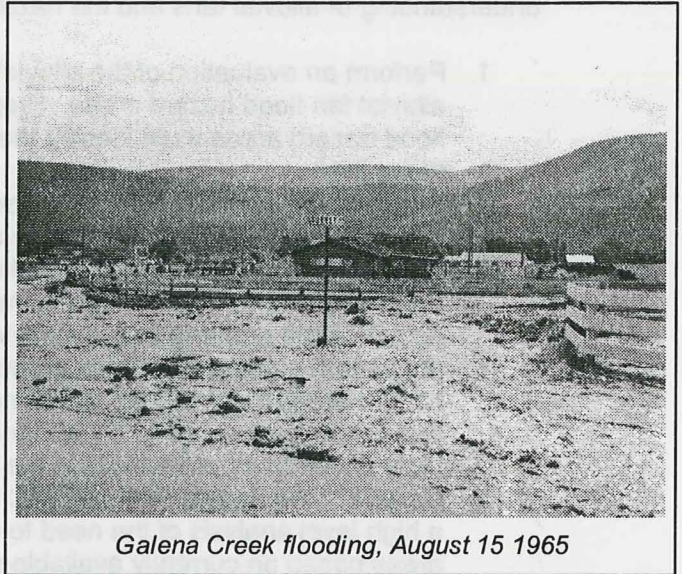
July 29, 1952: Floodwater from Galena Creek inundated hayfields in Pleasant Valley and deposited a thick layer of silt and sediment, damaging or destroying most of the baled hay in the fields. Highway 395 was blocked, and miles of fence and irrigation ditches were destroyed.

July 20, 1956: A wall of water, reportedly 10 feet high, rushed down Galena Creek, washing several cars off the Mount Rose Highway. Peak flow on the stream gage at Galena Creek near Steamboat was recorded as 4,730 cubic feet per second (cfs). A mother and two children tragically perished in this flood. A fourth victim died while trying to rescue the family. The same convective storm that deluged Galena Creek dumped heavy rains on Peavine Mountain, causing the most disastrous flood ever seen on the mountain's barren south slopes. The waters ravaged homes, yards and streets in northwest Reno, and flooded business establishments in the northwest part of downtown Reno.



*New Cadillac convertible swept from
Nevada Hwy 27 at Galena Creek, July 20 1956*

August 15, 1965: An intense summer thunderstorm caused significant flooding in the southwest drainages. Extensive development of homes in lower Galena Creek in Pleasant Valley suffered flood damage from the middle to lower portions of the valley. Highway 395 in Pleasant Valley was closed to traffic for three hours by a 300 ft wide, 5-foot tall wall of water, mud, rocks and debris. A 2,000 foot stretch of the Mount Rose Highway was also blocked by flood debris. Whites Creek produced flood flows that reached a peak of 2,280 cfs, and the flow at Galena Creek near Steamboat peaked at 3,670 cfs. The storm that caused this flood was also responsible for disastrous flooding in Incline Village.



Galena Creek flooding, August 15 1965

July 16, 1971: One of the more recent flash floods occurred in the east foothills of Hidden Valley. This flood caused considerable property damage, but no injuries.

3.2.2 Alluvial Fan Flooding Management Strategies

The unique nature of the hazard associated with alluvial fans makes them very difficult and costly to manage in a holistic fashion. Current management strategies within the community are consistent with minimum NFIP standards, i.e., individual foundation elevation and armoring to protect from erosion, but FEMA now recognizes that elevation and armoring are not adequate to protect against the hazardous nature of alluvial fans. The professional standard for management of alluvial fans now indicates the need for development of a whole-fan mitigation solution with structural measures.

Some communities are finding that it is more cost effective in some cases to purchase developable land in extreme hazard areas, than to try to protect it.¹⁶

Some of the most valuable properties in southern Washoe County are constructed in the potential path of alluvial fan flooding in areas such as Galena Creek, Whites Creek, Virginia Foothills, and Hidden Valley. Where structures have been constructed to provide protection in these areas, they are not adequate to protect against the alluvial fan flooding hazard. The science for management of alluvial fans has been evolving over the past 10 years. More detailed discussion of alluvial fan flooding is contained in FEMA's "Guidance for Alluvial Fan Flooding Analyses and Mapping" (Appendix J).

¹⁶ Julia Fonseca, Pima County Flood Control District in Tucson, Arizona and Ben Urbonas, Urban Drainage and Flood Control District in Denver area of Colorado

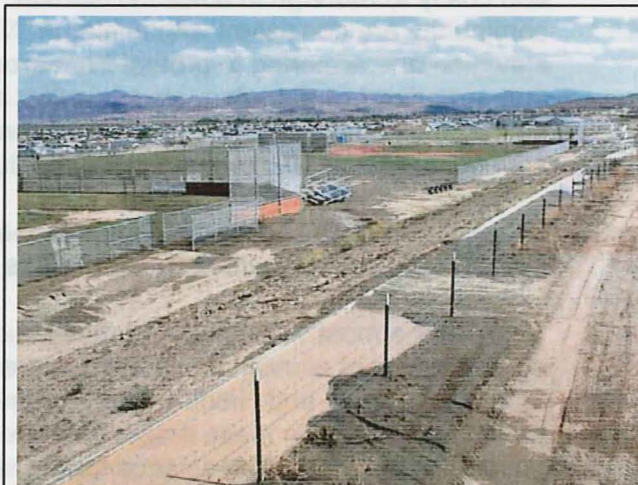
The following management strategy is suggested based on the current technical understanding of alluvial fans and the hazard they represent:

1. Perform an evaluation of the alluvial fan flood hazard and planned land uses in alluvial fan flood hazard areas. Proposed mass graded projects in alluvial fan flood hazard areas must identify the area-wide facilities necessary to stabilize these areas.
2. Construction of these recommended facilities should be required prior to allowing additional development in the alluvial fan flood hazard area.
3. When evaluating the cost of providing protection from alluvial fan flooding for mass graded projects, include in the analysis of alternatives the potential of acquiring the property that is most vulnerable to severe impact.
4. Implement a public education program for existing properties in alluvial fan flood hazard areas that includes recommendations on additional protective measures that property owners can implement. One such measure currently required by local government ordinances is the armoring of building foundations.
5. As part of the update to the RWPC Regional Flood Control Master Plan, perform a high level analysis of the need to update mapping for alluvial fan flood hazard areas based on currently available mapping, modeling, and geologic analytical technology that might more clearly define the hazard. There may be some hazard areas that are not currently identified and others that are incorrectly identified as active alluvial fan hazard areas.
6. Develop an emergency response plan for areas subject to alluvial fan or flash flood hazards.

Alluvial fan flooding mitigation strategies should also take into consideration the contribution of runoff on the fan to groundwater recharge and maintenance of down-gradient wetlands. This is an example of where flood control facilities designed for mitigation purposes only could have an impact on available water resources over the long term.

3.3 Sheet Flooding¹⁷

Sheet flooding is the broad, relatively unconfined down slope movement of water across sloping terrain that results from many sources, including intense rainfall and/or snowmelt, overflow from a channel that crosses a drainage divide, and overflow from a perched channel onto deltas or plains of lower elevation. Generally, it enters a channel or drainage system that intersects its flow, but occasionally it dissipates



*Spanish Springs High School Flooding, June 2002
Courtesy WRC Nevada*

¹⁷ Flood Insurance Study Guidelines and Specifications for Study Contractors, Appendix 2. FEMA 37, January 1995

before reaching a channel. Sheet runoff is typical in areas of low topographic relief and poorly established drainage systems.

3.3.1 Historical Sheet Flooding

Many sheet flooding events within Washoe County go unnoticed because they occur in relatively undeveloped areas, the depth of flow is shallow, or because protective measures have been incorporated into development projects under existing development codes. The most recent event of note was the June 2002 flood event in the unincorporated area of Spanish Springs that resulted in over \$500,000 damages to the new Spanish Springs High School and significant deposition of sediment in the interior drainage system of the Eagle Canyon subdivision.

3.3.2 Sheet Flooding Management Strategies

Existing development requirements for all three local governments may be adequate to provide protection related to the water-related hazard associated with sheet flooding, but there is a need to modify current design criteria to manage the sediment that can be carried by the flood flows in watersheds that are vulnerable to erosion. These criteria should be developed as part of the update to the Design Manual.

3.4 Lake and Playa Flooding: Washoe Lake, Silver Lake, Swan Lake, Boneyard Flat, White Lake

There are several watersheds in Washoe County that have no outlet, or which must accumulate a significant volume of water before reaching an elevation that allows additional water entering the basin to drain (Washoe Lake).

These watersheds are often referred to as closed basins. The risk of flooding in these areas is due to water levels that gradually increase over a period of time, maybe even years. Elevated groundwater levels may also be a consideration in these areas, with the potential to negatively impact the operation of septic tanks and cause the premature failure of roadbed materials.

New development within a closed basin will cause flood heights to increase unless the additional volume of flow created by the development is permanently retained higher in the watershed.

3.4.1 Historical Lake and Playa Flooding

Development adjacent to Washoe Lake and the north valley playas is relatively low and mostly consists of single-family homes on large lots. There have been instances of residential flooding at Swan Lake (Lemmon Valley) and Washoe Lake.



*Swan Lake Flooding, Lemmon Valley, 1986
Courtesy WRC Nevada*

3.4.2 Lake and Playa Flooding Management Strategies

While historical flooding due to increasing playa or lake levels has not been great, these areas are becoming attractive for development as supplies of developable land diminish. The preferred management strategy is to recognize the functions of these areas as part of the overall flood control master plan for the build-out watershed condition. The factors that need to be considered in the development of the build-out flood control master plan for a closed basin are 1) the volume of storage required at build-out of the watershed, and 2) the volume of storage required as a result of a multiple wet year period. Each closed basin is unique and must be studied individually. Once this volume has been determined, then an appropriate regulatory base flood elevation can be established for the playa or lake.

4.0 Flood Related Problems and Concerns

The following are some of the key issues of concern relating to floodplain management activities in Washoe County that must be addressed to ensure that flood damages for already developed properties don't increase:

Issue 1: FEMA flood zone boundaries reflect an earlier point in time.

FEMA mapping of flood hazard areas is based on the condition of the watershed at the time the Flood Insurance Study was performed. Hydrologic analysis of a drainage area would typically take into account the volume of flood storage available in naturally low areas. In order to prevent negative impacts to existing developed properties, it is important to understand where these areas are and either protect their ongoing flood storage capabilities, or provide compensatory flood storage elsewhere.

Issue 2: Flood control facilities were designed for an earlier point in time.

The majority of flood control facilities in the Reno/Sparks metropolitan area have been designed for the level of development that existed at the time the project was designed. As development progresses in the watershed upstream of these facilities, existing policies require post-development peak flow rates to be reduced to the pre-development level. Projects are typically not required to mitigate the increase in run-off volume that is created by new impervious surfaces, with the result that downstream flood control facilities could be overcome or base flood elevations could increase.

Issue 3: Structures in low-lying areas are very vulnerable to increased flooding as the watershed urbanizes.

There are certain areas in Washoe County where any increase in the base flood elevation would have a substantial negative impact on already developed properties. One such area is the central Truckee Meadows where there has been repeated flooding from the Truckee River.

Issue 4: There are structures that have been constructed with more freeboard than the minimum required by the National Flood Insurance Program (NFIP), that have been determined to be vulnerable to flooding.

The local governments have been implementing flood damage reduction programs for quite some time. There are several reasons why a property that was once thought to be protected from flood damages would later be determined to be vulnerable. Some of the factors affecting the base flood elevation are based on better information due to improvements in computer modeling and changes in mapping techniques, and changes in watershed conditions. This makes the case for a community to be very cautious in how it manages floodplain development.

Issue 5: There are existing drainage deficiencies that need to be addressed.

Several areas in Washoe County have developed without the benefit of regional planning and implementation of projects. In the unincorporated areas, it has been a challenge to develop funding mechanisms to correct these deficiencies. There are also areas internal to the cities with undersized infrastructure that makes them vulnerable to flooding during large events. Retrofit of existing areas is extremely costly and difficult to undertake.

Issue 6: Increased risk of future flooding to properties located downstream of the Truckee Meadows metropolitan area

Changes to the timing and volume of run-off, and the loss of floodplain storage volume within the Truckee River watershed could lead to increased flood peaks downstream of the Truckee Meadows.

Issue 7: Risk of localized flooding to properties outside of the FEMA regulatory floodplain

There may be flood hazards outside the limits of existing FEMA flood insurance studies. Current development codes do not require the identification of unmapped flood hazards. Additionally, current development codes do not require the analysis of the cumulative impact of changes in the watershed, and the possible changes to existing FEMA base flood elevations.

Issue 8: Health risk and nuisance posed by vectors such as mosquitoes when stormwater remains ponded or stagnant

The spread of West Nile Virus throughout the United States has raised the awareness of local governments to the potential health hazards that can be caused by the creation of stagnant water areas that are breeding grounds for mosquitoes.

Issue 9: Erosion due to:

- Localized high-intensity storms
- Changes to natural watercourses that affect geomorphic stability
- Loss of vegetative cover on slopes due to such things as fire, inappropriate development activities and recreational over-use (i.e. off-road vehicle use)

Issue 10: Local governments have not taken advantage of opportunities to participate in the FEMA CRS programs that could reduce flood insurance premiums for property owners.

Reno, Sparks and Washoe County all participate in the National Flood Insurance Program. Additional community benefit in terms of reduced flood insurance premiums could be achieved if the local governments sought to participate in the NFIP Community Rating System program. The cost to local governments for participation in the CRS is a dedication of staff time to maintain program elements that are implemented by the community. There are many program elements already in place for local governments that are eligible for credit under the CRS.

5.0 Review of Possible Management and Mitigation Strategies

Section 3, in addition to identifying the types of flood hazards present in Washoe County, also contains suggested management strategies when there are proposed changes in the watershed that could be impacted by an existing flood hazard. There are also recommendations as to issues that should be considered during the development review process to ensure that existing flood hazards are not exacerbated and / or new hazards are not created.

Section 2 includes a review of the regional and local government plans and programs currently in place that have a relationship to floodplain management. The local government sponsors each have extensive programs in place to manage flood risk and reduce flood damage. Each of the local governments exceeds the minimum standards of the National Flood Insurance Program for floodplain management.

In addition to local governments, the Washoe County Regional Water Planning Commission, Truckee Meadows Regional Planning Agency, and Tahoe Regional Planning Agency have regional programs and standards that relate to floodplain management.

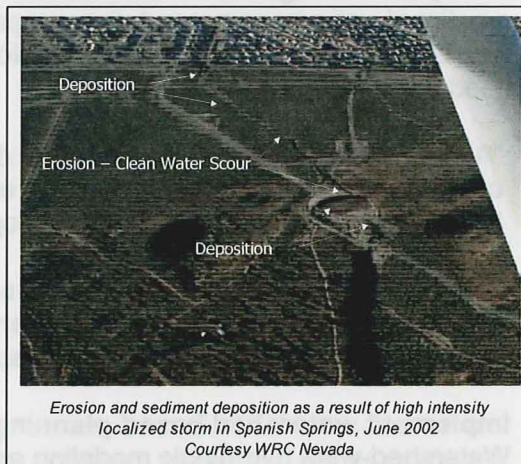
There are many strategies that can be used to manage the watershed for the reduction of flood damages. The following suggested floodplain management strategies have been developed as a result of a community-based public involvement process, and reflect the community's preferred approach to watershed management activities for the reduction of flood damage:

- **Adopt a "No Adverse Impact" approach to floodplain management.**
Floodplain management should embrace the concept of "No Adverse Impact" (NAI), a national policy recommendation supported by the Association of State Floodplain Managers. The RWPC has defined "No Adverse Impact" as it specifically relates to floodplain management as follows:

"Activities that could exacerbate flood damage to another property or community will be allowed only to the extent that the impacts are mitigated or have been accounted for within an adopted community-based plan."¹⁸
- **Preserve floodplain storage volumes.**
Lands which are identified as necessary for the storage or attenuation of flood flows need to be preserved or acquired for such use in perpetuity.
- **Implement watershed based planning and management.**
Watershed-wide hydrologic modeling and master planning should be implemented in developed and developing areas countywide. This will ensure that both existing deficiencies and mitigation of the impacts of new development are addressed comprehensively and as efficiently as possible.

¹⁸ Definition adopted by RWPC for inclusion in Regional Water Management Plan on February 14, 2003. Examples of "adopted community based plan" locally are the Spanish Springs Flood Control Master Plan, the Stead Flood Control Master Plan once adopted, and the Truckee River Flood Management Project once adopted.

- **Implement zero allowable impact standard in critical flooding areas where technically justified.**
Areas that are vulnerable to increased flood damages due to increases in the base flood elevation must be proactively managed to prevent such increases.
- **Plan for and mitigate cumulative effects of watershed urbanization.**
Any activity that could result in changes to the timing or volume of run-off should be evaluated to ensure that the individual and cumulative effect on base flood elevations is quantified and that potential exacerbation of flood damages to other properties in the watershed and in downstream communities are mitigated.
- **Provide zoning flexibility to protect drainageways and floodplains.**
Local governments should consider flexibility in zoning, which would allow for the clustering of development or shifting of densities when necessary to provide for either the detention or passage of flood flows in natural drainageways. (City of Reno Municipal Code currently provides for this flexibility)
- **The RWPC Regional Flood Control Master Plan should support multiple community benefits.**
The Regional Flood Control Master Plan should strive towards the preservation or creation of linked open spaces that serve the multiple needs of floodplain management, habitat preservation, recreation, water quality, public health enhancement, and water supply replenishment. Implementation of such a plan may involve retrofit of some existing developed areas and acquisition of some properties.
- **Study options and provide technical guidance for the management of sediment.**
Erosion is a natural process that can be greatly accelerated by disturbances in the watershed. In areas with unstable soils, collection of sediment and debris in basins and other structures leads to costly maintenance requirements. Additionally, once the sediment load has been removed from flood flows, the floodwater becomes sediment starved and downstream channels need to be hardened to prevent even further scour and erosion. This is inconsistent with the goals of minimizing structural measures and lowering maintenance requirements. Options for the management of sediment need to be investigated with resulting technical guidance provided for design professionals.
- **Utilize bioengineering techniques, “Green Infrastructure”.**
When structural projects are necessary, design guidelines should encourage the use of alternative methods that support both aesthetic and ecological values.



- **When evaluating alternatives, include an analysis of the economic value of retaining to the extent possible the functions of a natural drainage system.** Facilities that will form part of the regional flood control infrastructure should undergo this sort of evaluation in addition to the current method of alternatives analysis relating to the cost of infrastructure.

- **Proactively manage the transition of natural systems to a system with urban impacts to preserve as much of the natural functions as possible.**

There is a strong community preference for designs that work with natural systems to the extent possible, providing open space both high and low in the watershed for spreading and attenuation of flood flows and the associated sediment and debris that they carry.

Some specific

recommendations follow:

- Analyze a range of flow conditions to fully understand the impacts of changes in hydrology due to urban influences.
- Consider stream channel stability and the need to pro-actively provide grade control in advance of development.
- Consider vector control (insects, rodents, etc.) issues
- Consider conditions required to support habitat



*Degraded drainageway as a result of upstream development
Courtesy Urban Drainage and Flood Control District, Denver*



*Bio-engineered major drainageway channel using
grade control structures
Courtesy Urban Drainage and Flood Control District, Denver*

- **Management strategies should attempt to limit structural measures such as dams, levees, and floodwalls.**

The cost and failure risk of ever-greater structural measures to accommodate increasing run-off volumes should be weighed against the cost of property acquisition to provide for attenuation of flood flows. Structural measures are typically designed for the 100-year flood event, but greater floods will occur with the result that facilities will be overcome. Strategies that result in channelization and damming of flood flows can result in higher velocity waters with a much greater destructive force released if a structure fails.

- **Fund and perform maintenance of facilities.**

It is essential that the operational characteristics of both existing and future flood control facilities be maintained. Whether maintenance is the responsibility of a public or private entity, measures to ensure that maintenance is properly funded and performed must be implemented.

The intent of these strategies is to ensure that the flood related effects of new development and changes in the watershed are mitigated. Planning and implementation of projects that are developed in accordance with the above guidance will have an ongoing positive impact on the quality of life in the community.

6.0 Suggested Actions

Evaluation of the Issues identified in Section 4 lead to the development of Goals and Objectives for floodplain management in the community. The Suggested Actions were developed to integrate the desired management strategies into a program that would satisfy the Goals and Objectives. The results of this effort are contained in Tables 4 through 9. The details of some of the Suggested Actions precede the tables in Sections 6.1 through 6.4 below.

6.1 Suggestions for Update to the Design Manual (SA 3a.4)

Following are a number of suggestions for issues that should be addressed in the Design Manual update:

- technical guidance for use of “green infrastructure” and working with natural drainage systems
- technical guidance for watershed based hydrologic modeling and master planning for flood control that includes both the existing and build-out watershed conditions
- technical guidance for the management of sediment from undeveloped watersheds upstream of developing areas
- technical guidance for the stabilization of drainageways as the watershed develops
- technical guidance for modifications to natural drainageways
- technical guidance for the management of alluvial fan flood hazards in mass-graded projects
- technical guidance for the analysis of the cumulative impacts of development in a watershed that include both the peak flow and volume of run-off
- technical guidance for the analysis of closed basins that takes into the consideration the risk of a multiple wet year period and rising lake / playa levels

6.2 Suggestions for Modifications to Regional Plan (SA 1b.2)

It is suggested that the TMRPA work with the RWPC to more clearly define what Development Constraints Areas (DCA) means with respect to hydrologic resources such as water bodies and drainageways and then prepare maps that clearly delineate the DCA boundaries with respect to property boundaries.

For example, while the north valley playas and Washoe Lake are identified on the Development Constraints map, it would be very useful to have, at a minimum, a potential base flood elevation and wetted footprint that would result at build-out of the watershed with fully developed conditions and in consideration of master planned flood control facilities so that the required volume of storage in the playa or lake could be reserved.

6.3 Developed Areas Requiring Additional Flood Damage Reduction Planning and Project Implementation (SA 1c.1)

In addition to the above general issues of concern, there are specific locations within Washoe County that are vulnerable to flooding from the 100-year flood event that need mitigation solutions. Preliminary areas that have been identified as part of this and other floodplain management planning processes are:

- The Evans Creek (Block N) watershed that drains through residential areas and the University of Nevada, Reno
- The Eastside subdivision in the unincorporated area of Washoe County, near Pembroke and McCarran Boulevard
- The Bellevue Road area of Washoe Valley
- The Swan Lake area of Lemmon Valley
- The Galena Creek watershed at the outlet to Pleasant Valley (old Pagni Ranch)
- Hidden Valley alluvial fan area
- Virginia Foothills alluvial fan area
- Bailey Canyon area

This is not a comprehensive list. There may be additional areas needing flood mitigation strategies that have not yet been identified.

The Evans Creek watershed has undergone an extensive public planning process to develop a range of flood damage reduction solutions. Appendix H contains both the draft report developed as part of the stakeholder process, and the most recent City of Reno staff report that summarizes the current recommendations.

The remainder of these areas has not undergone any public planning process, and is recommended for inclusion in the update to the Regional Flood Control Master Plan.

6.4 Suggested Modifications to Local Government Codes and Ordinances (SA 2b.2 and SA 3a.3)

6.4.1 City of Reno

Municipal Code Chapter 12.24 – Flood Hazards or other appropriate sections

- 1) Review definitions to ensure completeness and consistency between local governments with floodplain management terminology:
Add definition:
- 2) **Critical facilities:** (definition taken from CRS Manual)
 - Structures or facilities that produce, use, or store highly volatile or flammable explosive, toxic and/or water-reactive materials;
 - Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a flood;
 - Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during, and after a flood; and
 - Public and private utility facilities that are vital to maintaining or restoring normal services to flooded areas before, during, and after a flood.
- 3) **Permanently located critical facilities:** Restrict construction of new critical facilities in 100- and 500-year flood zones unless all other locations have been considered and rejected. (CRS 431e) Existing critical facilities to be considered grandfathered in.
- 4) **Annually adopt best available technical information for flood hazards:** Regulate flood hazard areas based on the best available technical information, in accordance with RWPC Interim Policy 3.1.b and Program: Floodplain Storage Mitigation.
- 5) **Floodplain storage volume:** Provide mitigation for any activity that results in a net loss of floodplain storage volume, or any activity that would increase the base flood

elevation in critical flood storage areas. Such areas are to be identified as a part of regional watershed-based flood control master planning for the build-out condition. (CRS 430 PSC)

- 6) **Development downstream of dams:** Require a dam break analysis at a minimum for facilities that are regulated under the State of Nevada dam safety program, and for additional facilities as determined by the Floodplain Manager. The Floodplain Manager will use the results of the analysis to determine what appropriate restrictions should be placed on development downstream of the dam.
- 7) **Critical flood storage areas:** Retain existing zoning for land with low density zoning in areas that are recognized as critical for flood storage volume in the community's flood control master plans. (CRS 430 LDC or LZ)
- 8) **Require use of most current version of regionally adopted Design Manual for:**
 - a. Criteria for performance of hydrologic and hydraulic studies and design
 - b. Criteria for identification of flood and erosion hazards not identified by FEMA
 - c. Analysis of impacts to downstream and hydrologically connected properties
 - d. Standards and criteria for development in closed basins and the evaluation of impacts on playa flood elevations
 - e. Alternatives analysis and design criteria for flood control facilities
 - f. Criteria for the analysis and design of improvements needed to ensure the stability of natural drainageways
- 9) **Zone AE (base flood elevation determined):** Residential properties – finished floor elevation recommend 2 feet above BFE. Commercial properties – finished floor elevation 2 feet above BFE or flood-proofing to same elevation, in accordance with State recommendation.
- 10) **Zone A (base flood elevation not determined):** Recommend completion of study to locally determine BFE, in accordance with Design Manual.
- 11) **Zone AO:** To be consistent with most stringent existing regulation (Sparks), require elevation of finished floor to 3 feet above adjacent grade if no depth number is available. This is also a state recommendation.
- 12) **Zone AO, mass-graded projects:** Require development to conform to criteria to be included in update of Design Manual.

Municipal Code Chapter 18.06.805: Wetlands and stream environments and Chapter 18.06.806 – Drainageways:

- 1) Work with Washoe County and Washoe County District Health staff to merge the City's Wetlands, Stream Environments, and Drainageways code sections with the Washoe County Significant Hydrologic Resources (WC Article 418) code section to make them consistent. Encourage City of Sparks staff to participate in code modification discussions so that the resultant code product could also be recommended to the Sparks City Council for adoption.
- 2) Require that modifications within protected areas covered by these code sections conform to standards set forth in the updated Design Manual.

General recommendation: Certification of all floodplain management staff as Floodplain Manager from a program accredited by the Association of State Floodplain Managers

6.4.2 City of Sparks

Municipal Code Chapter 15.11: Flood Hazards:

- 1) Review definitions to ensure completeness and consistency between local governments with floodplain management terminology:
Add definition:
- 2) **Critical facilities:** (definition taken from CRS Manual)
 - Structures or facilities that produce, use, or store highly volatile or flammable explosive, toxic and/or water-reactive materials;
 - Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a flood;
 - Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during, and after a flood; and
 - Public and private utility facilities that are vital to maintaining or restoring normal services to flooded areas before, during, and after a flood.
- 3) **Permanently located critical facilities:** Restrict construction of new critical facilities in 100- and 500-year flood zones unless all other locations have been considered and rejected. (CRS 431e) Existing critical facilities to be considered grandfathered in.
- 4) **Annually adopt best available technical information for flood hazards:** Regulate flood hazard areas based on the best available technical information, in accordance with RWPC Interim Policy 3.1.b and Program: Floodplain Storage Mitigation.
- 5) **Floodplain storage volume:** Provide mitigation for any activity that results in a net loss of floodplain storage volume, or any activity that would increase the base flood elevation in critical flood storage areas. Such areas are to be identified as a part of regional watershed-based flood control master planning for the build-out condition. (CRS 430 PSC)
- 6) **Development downstream of dams:** Require a dam break analysis at a minimum for facilities that are regulated under the State of Nevada dam safety program, and for additional facilities as determined by the Floodplain Manager. The Floodplain Manager will use the results of the analysis to determine what appropriate restrictions should be placed on development downstream of the dam.
- 7) **Critical flood storage areas:** Retain existing zoning for land with low density zoning in areas that are recognized as critical for flood storage volume in the community's flood control master plans. (CRS 430 LDC or LZ)
- 8) **Require use of most current version of regionally adopted Design Manual for:**
 - a. Criteria for performance of hydrologic and hydraulic studies and design
 - b. Criteria for identification of flood and erosion hazards not identified by FEMA
 - c. Analysis of impacts to downstream and hydrologically connected properties
 - d. Standards and criteria for development in closed basins and the evaluation of impacts on playa flood elevations
 - e. Alternatives analysis and design criteria for flood control facilities
 - f. Criteria for the analysis and design of improvements needed to ensure the stability of natural drainageways

- 9) **Zone AE (base flood elevation determined):** Residential properties – finished floor elevation recommend 2 feet above BFE. Commercial properties – finished floor elevation 2 feet above BFE or flood-proofing to same elevation, in accordance with State recommendation.
- 10) **Zone A (base flood elevation not determined):** Recommend completion of study to locally determine BFE, in accordance with Design Manual.
- 11) **Shaded X:** For areas designated Shaded X due to their vulnerability to flooding in a 100-year flood with a depth of less than one foot, require either: 1) elevation to one foot above highest adjacent grade, or 2) determination of base flood elevation and elevation to one foot above base flood elevation.
- 12) **Zone AO, mass-graded projects:** Require that development conform to criteria to be included in update to Design Manual.
- 13) **Recommend adding code requirements for drainageways, wetlands, and stream environments:**
 - a. Work with Washoe County and Washoe County District Health staff to merge the City's Wetlands, Stream Environments, and Drainageways code sections with the Washoe County Significant Hydrologic Resources (WC Article 418) code section to make them consistent. Encourage City of Sparks staff to participate in code modification discussions so that the resultant code product could also be recommended to the Sparks City Council for adoption.
 - b. Require that modifications within protected areas covered by these code sections conform to standards set forth in the updated Design Manual.
 - c. Recommend City adoption of resultant modified code sections.

General recommendation: Certification of all floodplain management staff as Floodplain Manager from a program accredited by the Association of State Floodplain Managers

6.4.3 Washoe County

Development Code Article 416: Flood Hazards, or other articles or ordinances, as appropriate

- 1) Review definitions to ensure completeness and consistency between local governments with floodplain management terminology:
- 2) **Add definition:**

Critical facilities: (definition taken from CRS Manual)

 - Structures or facilities that produce, use, or store highly volatile or flammable explosive, toxic and/or water-reactive materials;
 - Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a flood;
 - Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during, and after a flood; and

- Public and private utility facilities that are vital to maintaining or restoring normal services to flooded areas before, during, and after a flood.
- 3) **Permanently located critical facilities:** Restrict construction of new critical facilities in 100- and 500-year flood zones unless all other locations have been considered and rejected. (CRS 431e) Existing critical facilities to be considered grandfathered in.

- 4) **Annually adopt best available technical information for flood hazards:** Regulate flood hazard areas based on the best available technical information, in accordance with RWPC Interim Policy 3.1.b and Program: Floodplain Storage Mitigation.
- 5) **Floodplain storage volume:** Provide mitigation for any activity that results in a net loss of floodplain storage volume, or any activity that would increase the base flood elevation in critical flood storage areas. Such areas are to be identified as a part of regional watershed-based flood control master planning for the build-out condition. (CRS 430 PSC)
- 6) **Development downstream of dams:** Require a dam break analysis at a minimum for facilities that are regulated under the State of Nevada dam safety program, and for additional facilities as determined by the Floodplain Manager. The Floodplain Manager will use the results of the analysis to determine what appropriate restrictions should be placed on development downstream of the dam.
- 7) **Critical flood storage areas:** Retain existing zoning for land with low density zoning in areas that are recognized as critical for flood storage volume in the community's flood control master plans. (CRS 430 LDC or LZ)
- 8) **Require use of most current version of regionally adopted Design Manual:**
 - a. Criteria for performance of hydrologic and hydraulic studies and design
 - b. Criteria for identification of flood and erosion hazards not identified by FEMA
 - c. Analysis of impacts to downstream and hydrologically connected properties
 - d. Standards and criteria for development in closed basins and the evaluation of impacts on playa flood elevations
 - e. Alternatives analysis and design criteria for flood control facilities
 - f. Criteria for the analysis and design of improvements needed to ensure the stability of natural drainageways
- 9) **Zone AE (base flood elevation determined):** Residential properties – finished floor elevation recommend 2 feet above BFE. Commercial properties – finished floor elevation 2 feet above BFE or flood-proofing to same elevation, in accordance with State recommendation.
- 10) **Zone A (base flood elevation not determined):** Recommend completion of study to locally determine BFE, in accordance with Design Manual.
- 11) **Zone AO:** To be consistent with most stringent existing regulation (Sparks), require elevation to 3 feet above adjacent grade if no depth number available. This is also a state recommendation.
- 12) **Zone AO, mass-graded projects:** Require that development conform to criteria to be included in update to Design Manual.
- 13) **Floodway:** To be consistent with most stringent existing regulation (Reno), prohibit any encroachment in the floodway.
- 14) **Shaded X:** To be consistent with most stringent existing regulation (Reno), require elevation to one foot above highest adjacent grade.

Development Code Article 418: Significant Hydrologic Resources

- 1) Work with City of Reno and Washoe County District Health staff to merge the City's Wetlands, Stream Environments, and Drainageways code sections with the Washoe County Significant Hydrologic Resources (WC Article 418) code section to make them consistent. Encourage City of Sparks staff to participate in code modification discussions so that the resultant code product could also be recommended to the Sparks City Council for adoption.
- 2) Require that modifications within protected areas covered by these code sections conform to standards set forth in the updated Design Manual.

General recommendation: Certification of all floodplain management staff as Floodplain Manager from a program accredited by the Association of State Floodplain Manager

<p align="center">Table 4 Goals, Objectives and Suggested Actions (SA)</p>	
Goal 1: Reduce flood damages county-wide.	
Issues addressed by this goal: 1,3,4,5,6,7,10	
Objective 1a: Implement the Truckee River Flood Management Project	
SA 1a.1	Completion of General Re-evaluation Report / Environmental Impact Statement (GRR / EIS), and final design of Truckee River Flood Management Project.
SA 1a.2	Local government implementation of land acquisition program for properties that are essential to a function of the Truckee River Flood Management Project, including those properties identified in Floodplain Storage Zone 1 (see Interim Water Policy 3.1.b)
SA 1a.3	Early implementation of project elements that can provide flood damage reduction benefits to mitigate loss of floodplain storage volume in Floodplain Storage Zones 1&2. (see Interim Water Policy 3.1.b)
SA 1a.4	RWPC and RPC conformance review of locally preferred project concept that results from the GRR / EIS process.
SA 1a.5	Construction of Truckee River Flood Management Project.
Objective 1b: Expand floodplain management philosophy and strategies for local governments to embrace the concept of No Adverse Impact at the watershed level.	
SA 1b.1	Development of informational materials and speaker's bureau to provide ongoing education for elected officials, stakeholders, and agency staff on No Adverse Impact strategies that are needed locally to ensure that there is not increased flood damage to existing developed properties.
SA 1b.2	More clearly define meaning of "Development Constraints Areas" in the Regional Plan as it relates to floodplain management, water bodies, and drainageways. Include maps that more clearly define DCAs with respect to property boundaries.
Objective 1c: Develop flood damage reduction plan for developed areas that are vulnerable to flooding, but that will not be protected by a planned flood control project.	
SA 1c.1	Development and implementation of a strategy to reduce flood damages in existing areas not planned for protection by a regional flood control project. (See Section 6.3)
SA 1c.2	Perform analysis of known and possible alluvial fan areas to 1) determine active alluvial fan hazard areas, and 2) modify FIRMs as necessary.
Objective 1d: Reduce future flood damages and injuries through increased public awareness of flood hazards and effective emergency response planning.	
SA 1d.1	Development of a continuing public information program to educate citizens and elected officials regarding pro-active flood damage reduction strategies and flooding issues within Washoe County.
SA 1d.2	Completion of Truckee River Flood Response Plan
SA 1d.3	Development of Threat Recognition Plan for areas that could be severely impacted by alluvial fan or flash flooding.

Table 5 Goals, Objectives and Suggested Actions (SA)	
Goal 2: Protect the community's investment in the Truckee River Flood Management Project and regional flood control infrastructure	
Issues addressed by this goal: 1,2,3,6	
Objective 2a: Manage watershed changes watershed to ensure that:	
1. There is no un-mitigated increase in the Truckee River Flood Management Project design base flood elevation in the central Truckee Meadows.	
2. There is no un-mitigated increase in the Truckee River Flood Management Project design volume and peak flow rate leaving the Truckee Meadows.	
3. The potential for flood damage is not exacerbated for existing properties.	
SA 2a.1	Local government adoption and implementation of RWPC Interim Water Policies 3.1.b - "Floodplain Storage within the Truckee River Watershed" and 3.1.c - Floodplain Storage outside of the Truckee River Watershed"
SA 2a.2	RWPC completion and local government adoption of Floodplain Storage Mitigation Plan for southern Washoe County, including areas outside of the Truckee River watershed.
Objective 2b: Manage proposed changes in watersheds to ensure that if there is reduced protection from existing regional flood control facilities, that the reduction in protection has been mitigated in a watershed based plan that does not exacerbate flood damages.	
SA 2b.1	RWPC completion and local government adoption / implementation of Regional Flood Control Master Plan.
SA 2b.2	Modification to local government development codes requiring the use of watershed based modeling tools to evaluate and mitigate the flood related impacts of changes in the watershed.
Objective 2c: Ensure that regional flood control facilities are adequately maintained to preserve operational characteristics.	
SA 2c.1	Incorporate evaluation of maintenance considerations in design criteria for flood control projects.
SA 2c.2	Local government establishment of funding mechanism and performance criteria for maintenance of flood control facilities.

Table 6 Goals, Objectives and Suggested Actions (SA)	
Goal 3: Provide protection to life and property from flooding events through cooperative planning and development policies, including common design standards and floodplain management ordinances.	
Issues addressed by this goal: 1,3,4,6,7	
Objective 3a: Regionally consistent guidance to flood control design professionals that is based on the best available technical information.	
SA 3a.1	Local government establishment and funding of a Modeling Technical Advisory Committee to serve as a an oversight committee to establish standards for, oversee the development of, and approve modifications to hydrologic and hydraulic models for all developing watersheds in Washoe County.
SA 3a.2	Local government development, adoption and ongoing maintenance of hydrologic and hydraulic modeling of existing and build-out conditions for the purposes of flood control for all developing watersheds in Washoe County.
SA 3a.3	Local government adoption of suggested modifications to ordinances and development codes to ensure consistency in floodplain management requirements and to incorporate recommendations contained in this strategy (See Section 6.4).
SA 3a.4	RWPC completion of update to, and local government adoption of Design Manual to include the suggestions contained in Section 6.1.

Table 7 Goals, Objectives and Suggested Actions (SA)	
Goal 4: Floodplain management strategies that are coordinated with public health, water quality, water resource, open space, and watershed protection programs.	
Issues addressed by this goal: 8,9	
Objective 4a: Integrated watershed management to achieve the multiple purposes of floodplain damage reduction, protection of public health, watershed protection, water quality enhancement, recreation, and sustainability of water resources.	
SA 4a.1	Consolidate the many regional watershed management related committees into a single formal committee with an expanded purpose and focused work plan for integrated watershed management that includes local government staff, stakeholder, and community membership.
SA 4a.2	Encourage the use of publicly owned floodplain storage areas for public benefit when compatible uses can be identified. (Example: river access, recreation facilities, trails, parks, etc.)

Table 8 Goals, Objectives and Suggested Actions (SA)	
Goal 5: Reduce community flood insurance costs to the maximum extent possible through participation in the Community Rating System	
Issues addressed by this goal: 13	
Objective 5a: Reduction in flood insurance premiums paid by the community.	
SA 5a.1	Local government adoption of RWPC Regional Floodplain Management Strategy, a prerequisite to participation in the Community Rating System (CRS).
SA 5a.2	Reno, Sparks, and Washoe County application for inclusion in CRS.
SA 5a.3	Ongoing implementation of flood damage reduction strategies identified in the RWPC Regional Floodplain Management Strategy to improve the communities' standing under the CRS.
SA 5a.4	Encourage local governments to ensure that staff with responsibility for implementation of floodplain management regulations to receive certification as Floodplain Managers under a program accredited by the Association of State Floodplain Managers.

Table 9 Goals, Objectives and Suggested Actions (SA)	
Goal 6: Develop flood mitigation strategies that are cost effective and low maintenance to the greatest extent possible.	
Issues addressed by this goal: 5,12	
Objective 6a: Consider broad range of mitigation strategies, including both structural and non-structural measures, to reduce overall cost to the community.	
SA 6a.1	Expand range of possible options for flood damage reduction strategies in RWPC Regional Flood Control Master Plan to include both structural and non-structural measures, including acquisition of floodplain storage areas or areas vulnerable to flooding.
SA 6a.2	Seek opportunities to develop multi-purpose flood control facilities that can benefit from shared construction and maintenance costs between programs.

7.0 Implementation Plan

The Suggested Actions developed under Section 6 are integrated into a nine-element Implementation Plan contained in Tables 10 through 18. A number of potential responsible parties have been identified to take the lead role on various elements. As the strategies presented in this document are suggestions to local and regional governing bodies, it will be the task of the respective body to accept the suggestion, further refine the scope of work to be performed, and identify staff and funding resources to accomplish the task.

**Table 10
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
1	Truckee River Flood Management Project					
SA 1a.1	Completion of General Re-evaluation Report / Environmental Impact Statement (GRR / EIS), and final design of Truckee River Flood Management Project.	underway	USACE	n/a	USACE	underway
SA 1a.2	Local government implementation of land acquisition program for properties that are essential to a function of the Truckee River Flood Management Project, including those properties identified in Floodplain Storage Zone 1 (see Interim Water Policy 3.1.b)	underway	Truckee River Flood Management Project Manager	to be determined	1/8 cent sales tax	land acquisition consultant to be hired
SA 1a.3	Early implementation of project elements that can provide flood damage reduction benefits to mitigate loss of floodplain storage volume in Floodplain Storage Zones 1&2. (see Interim Water Policy 3.1.b)	to be developed	local governments	to be determined	1/8 cent sales tax	development of facility plan
SA 1a.4	RWPC and RPC conformance review of locally preferred project concept that results from the GRR / EIS process.	future planned action	Truckee River Flood Management Project Manager	n/a	n/a	completion of GRR / EIS
SA 1a.5	Construction of Truckee River Flood Management Project.	future planned action	USACE	\$260 million	USACE & local govt	Congressional funding

**Table 11
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
2	Public Education Regarding Flood Hazards					
SA 1b.1	Development of informational materials and speaker's bureau to provide ongoing education for elected officials, stakeholders, and agency staff on No Adverse Impact strategies that are needed locally to ensure that there is not increased flood damage to existing developed properties.	new	suggested: local govt in cooperation with RWPC or Cooperative Extension	staff time and office support	RWPC and / or local govts	development of stakeholder education plan and formal speaker's bureau
SA 1d.1	Development of a continuing public information program to educate citizens and elected officials regarding pro-active flood damage reduction strategies and flooding issues within Washoe County.	new	suggested: local govt in cooperation with RWPC or Cooperative Extension	to be determined	grant / RWPC / contributions	development of public education plan

**Table 12
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
3	Emergency Response Preparedness					
SA 1d.2	Completion of Truckee River Flood Response Plan	under development	TRFMP Sponsors	\$150,000	1/8 cent sales tax / USACOE	completion of plan
SA 1d.3	Development of Threat Recognition Plan for areas that could be severely impacted by alluvial fan or flash flooding.	new	local governments		HMGP or DMA 2000	dedication of staff to oversee plan development

**Table 13
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
4	Mitigation of the Cumulative Effects of Development					
SA 2a.1	Local government adoption and implementation of RWPC Interim Water Policies 3.1.b - "Floodplain Storage within the Truckee River Watershed" and 3.1.c - Floodplain Storage outside of the Truckee River Watershed"	required under Settlement Agreement	local governments	staff time and office support	local govts	local govt adoption of Interim Water Policies
SA 2a.2	RWPC completion and local government adoption of Floodplain Storage Mitigation Plan for southern Washoe County, including areas outside of the Truckee River watershed.	required work under RWPC Interim Policies	RWPC	to be determined	varies	RWPC to determine how different components of the plan will be developed
SA 2b.2	Modification to local government development codes requiring the use of watershed based modeling tools to evaluate and mitigate the flood related impacts of changes in the watershed.	new	local governments	staff time and office support	local govts	dedication of staff to oversee code changes
SA 3a.4	RWPC completion of update to, and local government adoption of Design Manual to include the suggestions contained in Section 6.1.	current project	RWPC	part of \$250,000 RWPC contract	RWPC	clarification of scope of work for Design Manual update

**Table 14
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
5	Completion of Watershed Based Master Plans and Models					
SA 2b.1	RWPC completion and local government adoption / implementation of Regional Flood Control Master Plan.					
SA 3a.1	Local government establishment and funding of a Modeling Technical Advisory Committee to serve as a an oversight committee to establish standards for, oversee the development of, and approve modifications to hydrologic and hydraulic models for all developing watersheds in Washoe County.	existing committee needs formalization	local governments	staff time and office support	local govt	local government interlocal agreement to formalize the committee
SA 3a.2	Local government development, adoption and ongoing maintenance of hydrologic and hydraulic modeling of existing and build-out conditions for the purposes of flood control for all developing watersheds in Washoe County.	part of this work included in Regional Flood Control Master Plan	local governments and RWPC	varies	local govt or development community	program model development into CIP programs
SA 3a.3	Local government adoption of suggested modifications to ordinances and development codes to ensure consistency in floodplain management requirements and to incorporate recommendations contained in this strategy (See Section 6.4).	new	local governments	staff time and office support	n/a	staff concurrence to recommendations

**Table 15
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
6	Integrated Watershed Management					
SA 4a.1	Consolidate the many regional watershed management related committees into a single formal committee with an expanded purpose and focused work plan for integrated watershed management that includes local government staff, stakeholder, and community membership.	new	local govt	n/a	n/a	completion of Watershed Management and Protection Plan
SA 1b.2	More clearly define meaning of "Development Constraints Areas" in the Regional Plan as it relates to floodplain management, water bodies, and drainageways. Include maps that more clearly define DCAs with respect to property boundaries.	new	recommendation to RPC	undetermined	HMGP / RPC / RWPC	identification of critical floodplain storage areas as part of Regional Flood Control Master Plan

**Table 16
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
7	Reduce Cost to Community of Regional Flood Control Facilities					
SA 2c.1	Incorporate evaluation of maintenance considerations in design criteria for flood control projects.	new	local governments	staff time and office support	local govts	staff concurrence to recommendation
SA 2c.2	Local government establishment of funding mechanism and performance criteria for maintenance of flood control facilities.	new	local governments	staff time and office support	local govts	staff concurrence to recommendation
SA 4a.2	Encourage the use of publicly owned floodplain storage areas for public benefit when compatible uses can be identified. (Example: river access, recreation facilities, trails, parks, etc.)	new	local govt	varies	varies	staff concurrence to recommendation
SA 6a.1	Expand range of possible options for flood damage reduction strategies in RWPC Regional Flood Control Master Plan to include both structural and non-structural measures, including acquisition of floodplain storage areas or areas vulnerable to flooding.	new	RWPC	n/a	n/a	clarification of scope for Regional Flood Control Master Plan
SA 6a.2	Seek opportunities to develop multi-purpose flood control facilities that can benefit from shared construction and maintenance costs between programs.	new	local govt	n/a	n/a	staff concurrence to recommendation

**Table 17
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
8	Reduce Cost to Community of Flood Insurance Premiums					
SA 5a.1	Local government adoption of RWPC Regional Floodplain Management Strategy, a pre-requisite to participation in the Community Rating System (CRS).	new	local govt	staff time and office support	local govt	local govt staff shepherding of plan through approval process
SA 5a.2	Reno, Sparks, and Washoe County application for inclusion in CRS.	new	local govt	staff time and office support	local govt	local govt adoption of Regional Floodplain Mgmt Plan
SA 5a.3	Ongoing implementation of flood damage reduction strategies identified in the RWPC Regional Floodplain Management Strategy to improve the communities' standing under the CRS.	new	local govt	varies	varies	staff concurrence to plan recommendations
SA 5a.4	Encourage local governments to ensure that staff with responsibility for implementation of floodplain management regulations to receive certification as Floodplain Managers under a program accredited by the Association of State Floodplain Managers.	new	local govt	\$100 exam cost for ASFPM members	local govt	staff concurrence to recommendation

**Table 18
Implementation Plan**

Plan Element	Title	Programming Status	Responsible (or suggested responsible) Party	Estimated Cost	Existing or Potential Funding Source	Action Required for Next Step
9	Specific Flood Damage Reduction Projects					
SA 1c.1	Development and implementation of a strategy to reduce flood damages in existing areas not planned for protection by a regional flood control project. (See Section 6.3)	new	local govt		FEMA Hazard Mitigation Planning Grant	grant application
SA 1c.2	Perform analysis of known and possible alluvial fan areas to 1) determine active alluvial fan hazard areas, and 2) modify FIRMs as necessary.	see below	see below	see below	see below	dedication of staff to oversee plan development
	North Spanish Springs Flood Control Improvements	stakeholder plan completed	Washoe County	\$6,500,000	USACE / local district / Sparks	USACE funding
	Interior Drainage Improvements in City of Sparks	initial planning completed	City of Sparks	not determined	1/8 cent and USACE	detailed planning
	Virginia Foothills	plan needs to be updated	Washoe County	\$85,000	RWPC / HMGP / FMA	plan development
	Hidden Valley	plan needs to be updated	Washoe County	\$85,000	RWPC / HMGP / FMA	plan development
	Bailey Canyon	plan needs to be updated	Washoe County	\$85,000	RWPC / HMGP / FMA	plan development
	Eastside Subdivision	new	Washoe County	\$35,000	RWPC / HMGP / FMA	plan development
	Bellevue Road area of Washoe Valley	new	Washoe County	\$50,000	RWPC / HMGP / FMA	plan development
	Lower Galena Creek (old Pagni Ranch)	new	Washoe County	\$50,000	RWPC / HMGP / FMA	plan development
	Swan Lake	new	Washoe County	\$50,000	RWPC / HMGP / FMA	plan development

Floodplain Management Resources:

1. "A Guide For Community Officials", FIA 12, December 1993.
2. "A Unified National Program for Floodplain Management", 1994, Federal Interagency Floodplain Management Task, FEMA 248.
3. "Addressing Your Community's Flood Problems, A Guide for Elected Officials", ASFPM.
4. All-Hazard Authorities of the FEMA, The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended.
5. "An Action Plan for Reducing Flood Risk in the West", Western Governors' Association, December 1997.
6. "Answers to Questions About Substantially Damaged Buildings", NFIP, Community Assistance Series, FEMA 213.
7. "Answers to Questions About the National Flood Insurance Program", FEMA-387, F-084.
8. "Avoiding Public Liability in Floodplain Management", ASFPM, 1989.
9. "Basics of Community Mitigation", SM 393.1, April 1998.
10. "Design Guidelines for Flood Damage Reduction", FEMA 15.
11. "Design Manual for Retrofitting Flood-prone Residential Structures", FEMA 114.
12. FEMA, NFIP Regulations, Part I and Part II, Revised July 2001.
13. FIA-11, January 1995, NFIP Reform Act, 1994, Flood Disaster Protection Act of 1973, HUD Acts of 1968 and 1969.
14. "Floodplain Management Guidelines", E.O. 11988, 43 FR 6030, Water Resources Council.
15. "Flood Mitigation Assistance, Guidance", August 1997, FEMA 299.
16. "Flood-proofing Non-Residential Structures", FEMA 102.
17. "Homeowner's Guide to Retrofitting", FEMA 312.
18. "Managing Floodplain Development in Approximate A Zones, A Guide for Obtaining and Developing Base (100-year) Flood Elevations", FEMA 265.
19. "Mandatory Purchase of Flood Insurance Guidelines", FEMA 186.
20. "Manufactured Home Installation in Flood Hazard Areas", FEMA 85, September 1985.
21. "Mitigation Success Stories", four editions, ASFPM
22. "National Flood Programs in Review", ASFPM, 2000.
23. "No Adverse Impact: A Common Sense Strategy for Protecting your Property", ASFPM, 2001.
24. "Planning for a Sustainable Future", FEMA 364.
25. "Protecting Building Utilities from Flood Damage", FEMA 348.
26. "Protecting Floodplain Resources, A Guidebook for Communities", FEMA 268.
27. "Reducing Losses in High Risk Flood Hazard Areas: A Guide for Local Officials", FEMA 116.
28. "Using Multi-Objective Management to Reduce Flood Losses in Your Watershed", ASFPM: EPA, 1996.

Communities Implementing Similar Floodplain Management Strategies:

1. City of Phoenix, Arizona. TA-19-00: "Flood Hazard and Erosion Management District". The new zoning district is intended to be used in those applications where a natural (or limited structural) approach to floodplain management is selected.

2. Pima County, Arizona. "Sonoran Desert Conservation Plan". The Sonoran Desert Conservation Plan expands on floodplain management concepts to protect the region's unique natural resources. The plan combines short-term actions to protect and enhance the natural environment with long-range planning to ensure that natural and urban environments enhance each other.
3. Urban Drainage and Flood Control District, Denver, Colorado. 1608 sq miles jurisdictional area, 5 counties, 33 cities and towns with population of 2.2 million. Mitigation measures employed: watershed based master planning for build-out condition, watercourse stabilization in advance of development, regional drainage criteria manual for local governments, maintenance program for regional facilities.
4. Fort Collins, Colorado. Mitigation measures employed: higher regulatory standards such as hydrology based on fully developed conditions, 0.5 ft instead of 1.0 allowable rise in floodway. Channel stability studies and erosion buffer zones. Master Drainageway Plans for all streams within Urban Growth Area. Floodplain property acquisition and structure relocation.
5. Trinity River Corridor, North Central Texas. Mitigation measures employed: watershed modeling based on build-out condition, zero rise in 100 yr base flood elevation, no net loss in valley storage, no increases in erosive water velocities.
6. Lake County, Illinois. Mitigation measures employed: floodplain subdivision property acquisition, countywide flood hazard mitigation plan, sub-watershed maps showing flood hazard areas, repetitive loss property acquisition program.
7. Portland, Oregon. Mitigation measures employed: floodplain and repetitive loss property acquisition to increase flood storage capacity, restore wetlands, create passive recreational areas, improve fish and wildlife habitat.

Organizations:

1. Association of State Floodplain Managers, 2809 Fish Hatchery Road, Suite 204, Madison, WI 53713-3120. tel: 608 274-0123, website: www.floods.org
2. Federal Emergency Management Agency, website: www.fema.gov/fima
3. Floodplain Management Association, P.O. Box 50891, Sparks, NV 89435-0891. tel: 775 626-6389, website: www.floodplain.org

**RWPC Floodplain Management Plan
Comments on March 2003 Draft**

Comment Source:			Comments on Water EIS Draft		
Brainard: Marilyn Brainard		USFWS ME: Mary Jo Elpers			
Reno: City of Reno Staff		WC KC: Kimble Corbridge			
Sparks RJ: Rob Joiner		WCCD: WC Community Development Staff			
Sparks SG: Shawn Gooch		WCDH: Jim Shaffer			
TMRPA DZ: Dave Ziegler		WCDWR: Jeanne Rueffer			
TRWMC: TR Water Mgmt Council		FMP 04/29: Comments from 04/29 FMP Meeting			
Comment Source	FMP Plan Page	FMP Plan Section	Comment Type	Paraphrased or quoted comments regarding Floodplain Management Plan	Committee Recommendation
WC KC 10	22	5.1	zero increase concern - TRFMP	"6th paragraph: The increase should be allowed or the land use changed"	Land use change should be the last measure to consider after all other avenues for mitigating the effects of development have been explored.
Reno 15	11	2.6.1	zero increase concern	"page 11 and elsewhere - question the appropriateness and impact of the "zero allowable increase" provision. Would this prohibit any development in areas? Is that a taking? Was the impact of minor increases evaluated?"	Development of the Floodplain Storage Mitigation Plan will provide for the continued development of properties in Zones 1 and 2, with the possible exception of certain key parcels that have been identified for acquisition under the Truckee River Flood Management Project. The impact of minor increases has been preliminarily evaluated by the RWPC over the past six months.
Reno 21	31	5.5.5	zero increase concern	Item 4: same as Reno 15 (?)	See above response.
WC KC 03	10	2.6.1	zero increase concern	Community based plan must account for development that would be allowed under existing zoning under an NAI approach	The committee agrees with this comment, that is why the FMS strategies recommend the completion of the Floodplain Storage Mitigation Plan and Regional Flood Control Master Plan, which would then become part of the overall "community based plan".
WC KC 05	10	2.6.1	zero increase concern	Preserve Floodplain storage volumes. The plan should account for the loss of storage volumes based on existing zoning or land use, not just existing development. If the zoning is not acceptable, change the zoning before the adoption of "no loss in storage volume".	See response to comment "WC KC 10".
WC KC 06	11	2.6.1	zero increase concern	Zero base flood elevation increase: same as above.	See response to comment "WC KC 10".

**RWPC Floodplain Management Plan
Comments on March 2003 Draft**

Comment Source:					
Brainard: Marilyn Brainard			USFWS ME: Mary Jo Elpers		
Reno: City of Reno Staff			WC KC: Kimble Corbridge		
Sparks RJ: Rob Joiner			WCCD: WC Community Development Staff		
Sparks SG: Shawn Gooch			WCDH: Jim Shaffer		
TMRPA DZ: Dave Ziegler			WCDWR: Jeanne Rueffer		
TRWMC: TR Water Mgmt Council			FMP 04/29: Comments from 04/29 FMP Meeting		
Comment Source	FMP Plan Page	FMP Plan Section	Comment Type	Paraphrased or quoted comments regarding Floodplain Management Plan	Committee Recommendation
WC KC 09	from 19	from 4.0	zero increase concern	Regarding separation of issues and suggested solutions: suggested mitigations "should include changes in land use that restrict development in the floodplain"	The committee suggests that in critical flood storage areas, existing low density land uses not be increased unless the change is part of an overall community based plan for the area that incorporates mitigation for the loss of flood storage volume.
WCCD 12	general		zero increase concern	FMP could include recommendations to the three local governments that would keep intensification of land use in check so that development doesn't happen in critical areas prior to the recommendations of the draft plan being implemented.	See above response.
TRWMC 09	general	6	process	In general, within the Goals, Objectives and Recommended Actions, many actions are assigned as responsibility of the Design Manual and the Flood Control Master Plan. In some cases we feel the assignment is not appropriate, such as providing planning guidance when that is the purpose of this document. There does not seem to be a clear definition of purpose of those other documents. We suggest that those purposes and the proposed uses for the documents be very clearly defined prior to such assignments.	Definition of the scope for these other documents is beyond the work of this committee. What is contained herein are suggestions for issues which should be considered when the scope for these documents is more clearly defined.
TRWMC 13	general		process	"An undertaking such as the flood control project and this floodplain management plan would seem to need oversight by an entity with a more global perspective than the individual local governments. No such entity appears to be contemplated or identified. How will this be addressed?"	The committee agrees with this comment. The political situation in the region makes such a suggestion by this committee very controversial, therefore, the issue is left for future work by others.
TRWMC 06	30	5.4.5	plan suggestion	Bullet 4: eliminate this bullet, this is a planning level task, not design level.	Agree.

**RWPC Floodplain Management Plan
Comments on March 2003 Draft**

Comments on March 2000 Draft

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Reno: City of Reno Staff			WC KC: Kimble Corbridge		
Sparks RJ: Rob Joiner			WCCD: WC Community Development Staff		
Sparks SG: Shawn Gooch			WCDH: Jim Shaffer		
TMRPA DZ: Dave Ziegler			WCDWR: Jeanne Rueffer		
TRWMC: TR Water Mgmt Council			FMP 04/29: Comments from 04/29 FMP Meeting		
Comment Source	FMP Plan Page	FMP Plan Section	Comment Type	Paraphrased or quoted comments regarding Floodplain Management Plan	Committee Recommendation
TRWMC 11	42	RA 4a.4	plan suggestion	"RA 4a.4 should be eliminated, as that is not a design function."	Agree.
WC KC 08	19	4.0	plan suggestion	Issues should state problem or concern, but should not recommend or suggest a solution	Leave as is.
Reno 18	25	5.3.1	Regional Plan impact	"page 25 - same problem as #s 1 and 2 above [Reno 07 and Reno 08]. Also, in the regional plan section, no analysis was provided regarding the impact of recommendations on regional plan priority development areas (centers, corridors, infill, etc). The water plan appears to prohibit development in areas where the regional plan promotes development. This should be addressed."	The committee does not feel that the strategies proposed in this document conflict with goals in the regional plan for priority development areas. Rather, the goal of the strategies is to recognize the flood related constraints that are present and plan for future growth with those constraints in mind. The critical flood storage areas are for the most part outside of the McCarran Ring.
WCCD 07	general		Regional Plan impact	How does TMRP core intensification fit with FMP policies?	See above comment.
WCCD 08	general		Regional Plan impact	Include an analysis if any of the FMP recommendations will result in the cities or county being found "not in conformance" with the TMRP	Such an analysis is beyond the scope of this committee.
WCCD 09	general		Regional Plan impact	"Include an analysis of how the TMRP would need to be amended in order to make the FMP recommendations implementable. Suggestions: map the different flood zones, critical facilities and floodplain storage areas on a consistent scale and format to allow TMRPA to identify these areas as constrained."	See response to comment "Reno 18"
WCDH 03	26	5.3.1	Regional Plan comment	Add text to TMRP Planning Principle #2	The comment is relevant to a different plan that is quoted here. No change proposed to this plan.

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WCDH 04	27	5.3.1	Regional Plan comment	Add text to Goal 2.4	The comment is relevant to a different plan that is quoted here. No change proposed to this plan.
Reno 09	4	1.4.1	question	Is strictest standard necessarily the best? Urban vs. rural issues	The request from various stakeholders at the onset of the floodplain management planning process was that a goal should be to achieve more uniform standards between local governments for floodplain management. In reviewing local government floodplain management regulations, the strictest standard was most often found to be contained within the cities, Reno or Sparks.
Reno 14	10	2.6.1	question	What is an "adopted community based plan"?	Will clarify in the plan document that local examples of community based plans are things like the Stead Flood Control Masterplan, Spanish Springs Flood Control Masterplan, and upcoming Regional Flood Control Masterplan, all of which do or will address build-out conditions.
USFWS ME 04	13	3.1	question	Has global warming effect on frequency of rain on snow events been evaluated?	Not evaluated as part of this process.

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Comment Source	FMP Plan Page	FMP Plan Section	Comment Type	Paraphrased or quoted comments regarding Floodplain Management Plan	Committee Recommendation
Reno 03	general		process	"From the City's perspective, there are legal concerns that should this plan be adopted into the RWP and subsequently into the RP, then the plan would no longer serve to provide guidance to the local governments, to being mandatory. The City of Reno recognizes that there are a benefit to the development of a plan, however, also recognizes that it must be done in a fiscally responsible manner that considers the cost/benefit ratios, impacts to development and economics of the region."	The plan doesn't establish requirements, it makes suggestions and identifies additional work that could be done to improve the management of flooding within the region. The more detailed analysis of cost / benefit ratios, impacts to development, etc., would be accomplished with this additional suggested work.
Reno 06		ES & Ch 6	plan suggestion	See attached document excerpted from Reno comment letter for suggested text addition	Text addition to document partially accepted. Remainder of text was felt to be more appropriate to the staff report that will accompany the document to the RWPC.
Reno 10	5	1.4.2	plan suggestion	Item 4: density of development not the issue, rather the impact is impervious area and runoff which can be managed with design features	It is noted that the term "low density development " has different connotations for different staff professionals. This comment is accepted. In place of referring to development density, the reference will be made to the technical issue of concern, i.e. change in floodplain storage volume and timing of run-off.
Reno 19	31	5.5.5	plan suggestion	page 31 - 5.5.5: #2 - has the impact of this recommendation been evaluated - how many properties are currently out of conformance with this. Should complete cost/benefit analysis.	Plan will be corrected to note that the reference is to proposed new critical facilities only. Existing facilities would be grandfathered in.

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Reno 23	32	5.5.5	plan suggestion	"Page 32 - why do ordinances need to be the same - would it not be appropriate to have different regulations for urban vs. rural areas?"	Propose to create a single ordinance that recognizes urban and rural needs. It is helpful to have consistent standards between local governments as watersheds cross jurisdictional boundaries, jurisdictional boundaries are constantly changing, and cities and county contain both urban and rural areas within each jurisdiction.
TMRPA DZ 02	10	2.6.1	plan suggestion	"Regarding the sentence that says "This concept should be applied to existing developed areas that are adversely impacting downstream properties, as well as to areas of new growth," my comment is simply "how?" In other words, the sentence seems to beg for more detail or explanation."	Referenced sentence to be deleted. See response to comment "WC KC 04".
TRWMC 05	21	4.2	plan suggestion	Delete section 4.2. This should be handled as part of Master Plan.	One of the purposes of the floodplain management strategies document is to identify specific mitigation projects that could be funded under future mitigation funding programs. The discussion will be modified to state that this is not necessarily a comprehensive list.
TRWMC 07	30	5.4.5	plan suggestion	Bullet 7: not appropriate recommendation for Design Manual	Accept. Alluvial fan mapping is addressed under RA 1c.2 (pg 38)
USFWS ME 06	14	3.1.1	plan suggestion	provide discussion on the extent to which the 100 yr flood zone is expected to change, if at all, with future development.	This analysis is beyond the scope of this project, it would be accomplished as part of a build-out master plan for a particular watershed.

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Comment Source	FMP Plan Page	FMP Plan Section	Comment Type	Paraphrased or quoted comments regarding Floodplain Management Plan	Committee Recommendation
USFWS ME 07	17	3.2.2	plan suggestion	Alluvial fan solutions should also take into consideration the contribution of runoff on the fan to groundwater recharge and maintenance of down gradient wetlands.	Will be mentioned as an issue that should be considered when evaluating whole fan solutions.
USFWS ME 08	19	4.1	plan suggestion	Urge that biological values of areas with natural flood storage potential always be evaluated as part of the decision making process to determine whether to protect the flood storage capabilities of a potentially impacted area or to allow it to be modified.	Will be mentioned as an issue that should be considered when considering modification of natural floodplains.
USFWS ME 09	51	RA 3a.2	plan suggestion	Recommend that this measure include the modeling necessary to determine run-off volumes from new impervious surfaces throughout the entire watershed and incorporated into a cumulative effects analysis.	RA 3a.5 addresses the items proposed for inclusion in the update to the Design Manual. See also pg 30 of Floodplain Management Plan, 2nd bullet.
WC KC 07	11	2.6.1	plan suggestion	Regarding "cumulative effect", complete baseline study against which future proposals can be compared	This is included in the plan already as part of watershed based master plans and is already in use in places such as Spanish Springs and Stead.
WCCD 04	35	5.7.4	plan suggestion	Item 6: need definition of low density zoning	Will change terminology, see response to Reno 10.
WCCD 10	general		plan suggestion	The plan should include text about liability of local government if recommendations are not implemented.	This is not an issue that is clearly defined yet within the floodplain management community nationwide, although there have been legal presentations at FMP conferences about community liability.
WCCD 11	general		plan suggestion	FMP should detail the order in which recommendations should be implemented and an analysis of the consequences	The committee has run out of time to perform this additional work. This could be handled as a future work item by the RWPC or local governments.

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Comment Source	FMP Plan Page	FMP Plan Section	Comment Type	Paraphrased or quoted comments regarding Floodplain Management Plan	Committee Recommendation
WCDH 01	24	5.1	Flood Project comment	Add bullet to project description: "Minimize nuisance insect habitat in the design of river parkways"	The comment is relevant to a different plan that is quoted here. No change proposed to this plan.
Ramsey 01	5,20	1.4.2, 4.0	editorial	Several editorial comments on numbers 4., 5., 6. under 1.4.2 for sentence improvement and Issue 13 on pg 20	Accepted with the exception of comment regarding Item 4 on pg 5. Propose to take a different approach to this item, see response to "Reno 10"
Reno 12	5	1.4.3	commentary	Plan appears to give existing development cost savings and pass expenses to new development	Comment is not specific enough to respond to.
WC KC 02	5	1.4.3	commentary	Costs associated with participation are not reported on Table 2	Plan will note that there is a cost to local governments associated with staff support required to participate in the CRS
WC KC 11	22	5.1	commentary	Don't understand last paragraph	Will re-state to clarify the point that is being made. One of the goals of the flood project is to reduce 100 yr base flood elevation to FEMA recognized levels as this is the threshold that many structures were designed to.
TRWMC 02	12	2.6.1	clarification required	What type and size of projects should be subject to this analysis? Why is economic analysis not required for other measures?	Will provide more clarification. Perhaps the following wording: "When evaluating alternatives for regional flood control facilities that will become part of the public infrastructure, include an analysis of the economic value of retaining as much as possible the functions of a natural drainage system." This is in addition to the cost analysis that is already performed for regional infrastructure projects.

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TRWMC 08	32	5.5.5	clarification required	Is suggested compliance related to elevation of finished floor?	Will clarify: Sparks Municipal Code section 15.11.0220 requires elevation of lowest floor, including basement. Will refer to lowest finished floor.
WCCD 13	general		clarification	Not clear how FMP addresses critical facilities that are present in the floodplain	Existing critical facilities are proposed to be grandfathered in, will clarify in the plan.
WC KC 04	10	2.6.1	change emphasis	Delete last sentence under first bullet.	Accept. Retrofit of existing problem areas is something that needs to be performed, but not necessarily appropriate to this bullet.
Reno 17	22	5.1	zero increase concern - TRFMP	Additional concern over no allowable increase in base flood elevation.	This is a concern specific to the TRFMP, which is being addressed through a separate process.
Reno 04	general		process	"Other benefits or driving forces for the community to develop a Floodplain Management Plan is the Army Corps of Engineers requirements for the Truckee River Flood Control Project. Tying this plan into a project of this magnitude raises many concerns regarding overall "process".	This concern will be addressed as part of the TRFMP Modeling Committee's "Navigation Chart"

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Comment Source	FMP Plan Page	FMP Plan Section	Comment Type	Paraphrased or quoted comments regarding Floodplain Management Plan	Committee Recommendation
Reno 05	general		process	"To date there has been no program to fuse all of the components of the flood program into a package that includes the Regional Plan elements, financial components related to who pays issues, flood easements, or required land purchases and design and construction processes. This proposed Flood Plain Management Plan further confuses the issues because it has been developed prior to any knowledge of the relative impacts of future land uses on the flood program elements except within the flood plain area itself. Thus many elements may be too conservative or not needed."	See response to comment "Reno 03".
Sparks RJ 03	general		process	RWPC should not "adopt" plan until process is completed	The RWPC will accept the plan as a work in progress initially. Subsequent to additional technical analysis and development of a regional process, the plan will be accepted and recommended for adoption by local governments.

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TMRPA DZ 06	28	5.3.2	process	"In general, I do not object to the recommendation. It makes sense. My comment is simply that we would need to think about what this means, procedurally. Basically, I think an amendment to the DCA definition and the map would be a Regional Plan amendment. That means there would be some process steps and timing questions to consider. The definition could possibly be clarified with a policy interpretation or some such vehicle, but I shy away from that, since I would rather amend the Regional Plan for clarification, rather than start down the slippery slope of "interpreting" the plan."	This is a comment reflecting future work that Regional Planning would need to undertake to implement this plan recommendation. No change proposed to floodplain management plan.
USFWS ME 01	general		process	Clarify process for FMP conformance review with other plans and vice versa.	Accept, but process needs to be defined as part of ongoing work.
USFWS ME 02	2-3	1.3	process	Clarify process for FMP conformance review with other plans and vice versa.	Accept, but process needs to be defined as part of ongoing work.
USFWS ME 03	13	2.8	process	What would happen if local govts do not adopt the plan or if they adopt something different?	There are various implications to this depending on whether the entity follows a public planning process for the development of a different plan.
WC KC 12	29	5.4.2	process	Need greater understanding of Interim Policies and what is mandatory	Will be addressed in "Navigation Chart" process and will provide more clarification within the FMP.
Reno 07	3	Figure 1	Regional Plan relationship	Correct relationship between TMRP and FMP	Accept
Reno 08	4	1.3	Regional Plan relationship	Correct discussion of relationship between TMRP and FMP, including requirement for RP conformance review of RWMP	Accept
WCCD 06	26	5.3.1	Regional Plan relationship	Assess how FMP does or does not conform to TMRP principles listed on pg 26-27	Accept

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Reno 22	31	5.5.5	question	same as Reno 16	Will acknowledge in the plan
Sparks RJ 02	general		process	Follow May 15 mtg roadmap for approval process	Accept
Brainard 01	general		plan suggestion	Incorporate changes from April 29 2003 mtg	Accept
FMP 04/29 01	general		plan suggestion	Clarify that FMP is advisory	Accept
FMP 04/29 03	general		plan suggestion	Change "Recommendations" to "Suggestions" regarding Development and Municipal Code modifications	Accept
Ramsey 03	39	RA 1d.1	plan suggestion	Public education program should be a continuing program	Accept
Reno 01	general		plan suggestion	Clarify FMP purpose, source of funding, HMGP linkages, previous FEMA funding received by the community and consequences of not having this funding available in the future.	Accept
Reno 02	general		plan suggestion	Clarify that FMP is intended to serve as a guidance document	Accept
Reno 20	31	5.5.5	plan suggestion	Change "recommended" to "suggested"	Accept
Reno 24	46-56	Implementation Plan	plan suggestion	Shouldn't 1/8 cent sales tax be shown for more of costs?	Costs will be further refined, question will be noted with 1/8 cent sales tax shown as fund source where appropriate.
Reno 26	App B	Interim Policies	plan suggestion	Remove Interim Policies from Appendix	Accept
RWPC SL 01	23	5.1	plan suggestion	mention Storey County under second clear bullet	Accept
Sparks RJ 01	general		plan suggestion	Incorporate changes from April 29 2003 mtg	Accept
Sparks SG 01	App B	Interim Policies	plan suggestion	Remove Interim Policies from Appendix	Accept

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TMRPA DZ 01	4	1.3	plan suggestion	Wording to clarify relationship between TMRP and RWMP: "The [RWMP] must conform with the Regional Plan, and must carry out and be consistent with local master plans. Proposals to construct certain water facilities (including flood control facilities) must conform with the RWMP. Generally speaking, under the requirements of chapters 278 and 540A of NRS, the Regional Plan, the RWMP, local master plans and facility plans, and local annual capital improvement programs must be consistent with, and mutually supportive of, each other. In addition to providing for the regional coordination of water related infrastructure to support implementation of local master plans, the RWMP provides technical recommendations to local governments regarding the availability and management of water resources."	Accept
TMRPA DZ 03	14	3.1.2	plan suggestion	"Re the sentence that says, "Washoe County and the City of Reno have also adpted (sic) the [SHR] ordinance that was developed by the RWPC Stream Advisory Committee," the footnote (#6) provides some detail about this statement that qualifies it, as to Reno's action. As I understand it, Reno's action applies only to the co-op planning area."	Accept
TMRPA DZ 04	17	3.2.2	plan suggestion	"In the numbered list, #4, can you cite an example of a protective measure that a property owner could implement on an alluvial fan?"	Accept
TMRPA DZ 07	general		plan suggestion	FMP could place more emphasis on toxic and hazardous materials washed downstream in a flood event.	Accept
TRWMC 03	20	4.1	plan suggestion	Delete Issues 10,11,12 as they are included in other issues	Accept

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TRWMC 04	20	4.1	plan suggestion	Issues 8 and 13 should have more explanation	Accept
TRWMC 12	general		plan suggestion	No costs are given within the implementation plan. For a document and program as ambitious as this, some projected costs should be available, so that prior to adoption, the local governments can identify and/or budget appropriate funding.	Accept. Further work has been done on this subsequent to the date of the draft plan.
USFWS ME 05	14	3.1.1	plan suggestion	Provide more information on what is meant by "proactively stabilize" a water course.	Accept
WC KC 14	43	Goal 6	plan suggestion	Note cost to agencies of participation in CRS	Accept
WCCD 01	35	5.7.4	plan suggestion	Item 1: further distinguish between permanent or transitory critical facilities	Accept
WCCD 05	34	5.7.4	plan suggestion	Article 418, Item 2: rather than modify Article 418 to fit all three entities, look towards merging all three jurisdictions' codes as they apply to streams, wetlands, drainageways, etc. (choosing the best practices from each), and place those in the appropriate section of the Development Code.	Accept
WCDH 02	24	5.2	plan suggestion	Add (?): "This program is under development and will, after structural controls for new development, add vector control standards."	Accept
WCDH 05	34	5.6.4	plan suggestion	Add WC District Health to list of entities to coordinate with	Accept
WCDH 06	34	5.7.4	plan suggestion	Add WC District Health to list of entities to coordinate with	Accept
WCDH 07	42	RA 4a.1	plan suggestion	Add "Health Vector officials" to end of statement.	Accept
WCDH 08	52	RA 4a.1	plan suggestion	Add "Health Vector officials" to end of statement.	Accept
Nevada KG 01	general	all	plan organization	Rename sections to more closely follow CRS process	Accept
Nevada KG 02	general		plan organization	Incorporate section for "Review of Possible Activities"	Accept
Nevada KG 03	13,15,21		plan organization	Include map of creeks and locations referenced	Accept
Nevada KG 04	21	4.2	plan organization	Include locations on pg 21 in Section 3.0	Accept
Nevada KG 05	25-28	5.3.1	plan organization	Clearly distinguish sections that are quoted from Regional Plan	Accept

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Nevada KG 06	1-7	ES	plan organization	Don't use outline format for ES	Accept
WCDWR 01	several	several	plan organization	Suggestions for plan organization, corrections, and typos and wordsmithing	Accept
Reno 11	5	1.4.3	plan clarification	Table 1: clarify WC figures are for unincorporated area and whether Tahoe basin is included in statistics	Accept
RWPC SL 02	52		formatting	clean up spreadsheet cell widths to capture all text	Accept
Ramsey 02	32,35	5.5.5	editorial	Sentence improvement and clarifications in several locations	Accept
Sparks SG 02	1	ES	editorial	Change "INITIAL" to "MINOR"	Accept
FMP 04/29 04	general	App B	correction	Update land use maps to reflect General Rural to Open Space changes in planned land use within Washoe County.	Accept
Reno 25	App B & D	maps	correction	TMSA boundary needs to be corrected to show rollbacks	Accept
TMRPA DZ 05	24	5.1	correction	Typo "project" for "protect"	Accept
WCCD 02	35	5.7.4	correction	Item 5: not a Development Code Amendment	Accept, will correct
WCCD 03	35	5.7.4	correction	Item 5: wording change to "county's floodplain manager"	Accept
TRWMC 10	38	RA 1a.3	concern	"We strenuously object to RA 1a.3 as a recommended action in this document. It has always been understood that an assessment district might be formed to assist in maintenance of the flood control project, and we are in general agreement with that concept. We do not feel it appropriate to single out this portion of <i>a future action that might be taken if the flood control project is funded and built and would strongly object to an assessment district if the project does not come to fruition.</i> "	Accept.
FMP 04/29 02	general		commentary	Interim Water Policies are a separate entity	Accept

***RWPC Floodplain Management Plan
Comments on March 2003 Draft***

[illegible]



Phone: (775) 687-3600
Fax: (775) 687-1288
E-mail: ndwpinfo@govmail.state.nv.us

Division of Water Planning

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

August 14, 2000

Paul Urban
Washoe County Department of Water Resources
4930 Energy Way
Reno, Nevada 89502-4106

Subject: Flood Mitigation Assistance Planning Grant

Dear Paul:

The Division of Water Planning is pleased to award a Flood Mitigation Assistance Planning Grant to support the floodplain management planning efforts of the Truckee River Flood Management Coalition. The award in the amount of \$37,200 must be used by the Coalition to support development of a Floodplain Management Plan, which will be adopted by the three sponsors of the flood management project along the Truckee River. This grant requires a 25% local match (\$12,400).

The Truckee River Flood Management Coalition has demonstrated a strong commitment to developing a Flood Management Plan by forming the Floodplain Management Planning subcommittee. The objective of this committee is to propose a plan that protects the long term effectiveness of the community's flood management project and provides an outline for restoration of the natural and beneficial function of the floodplain in the project area.

The Division of Water Planning recommends following the public planning process described in the NFIP Community Rating System. This model is similar to the community based planning process the Coalition is currently following for designing the Concept Plan. The current committee process may be eligible for reimbursement under the grant.

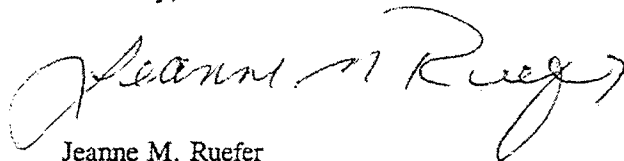
I have enclosed the Flood Mitigation Assistance Guidance from FEMA. Appendix C of this document describes the Community Rating System Floodplain Management Planning Process. Included in Appendix F are the financial reporting documents for this program.

Please be advised that by accepting this award you assume certain administrative and financial responsibilities, found in the Code of Federal Regulations, Title 44, Parts 13 and 14, and must enter into an Funding Agreement with the Nevada Division of Water Planning. A draft of the

~~JEANNE RUEFER, Program Officer~~
Division of Water Planning
1550 East College Parkway
Suite 142
Carson City, Nevada 89706
(775) 687-3600 ex 23
fax (775) 687-1288

Please telephone me at (775) 687-3600 ex. 23 should you have questions about the application process.

Sincerely,

A handwritten signature in cursive script, appearing to read "Jeanne M. Ruefer".

Jeanne M. Ruefer
Program Officer
Floodplain Management Program

pc: Gregor Blackburn, FEMA Region IX
Naomi S. Duerr, Administrator



**Washoe County
Department of
Water Resources**

4930 Energy Way
Reno, NV 89502-4106
Tel: (775) 954-4600
Fax: (775) 954-4610

**Regional Water
Planning
Commission**

Voting Members:

Bob Firth, Chair
George Shaw,
Vice-Chair
Diana Langs
Lori Williams
Elwood Lowery
George W. Ball, Jr.
Michael DeMartini
Bill Isaëff
Susan Lynn

Voting Alternates:

Greg Dennis
Peter A. Krenkel
Birmie McGavin
John Erwin
Gerry Emm
Don Casazza
Charlie Donohue
John Gonzales

**Non-Voting
Members:**

John Patterson
Dale Stransky
Randy Pahl
Tracy Taylor
Kim Groenewald
Don Casazza
Bryan Tyre
Bill Carlos
Harry Fahnestock

Non-Voting

Alternates:

Steve McGoff
Tim Hay
Tom Porta
Jason King

Steve Bradhurst
Director

Jim Smitherman
Water Management
Planner Coordinator

Department of



Water Resources

AGENDA

**MEETING OF THE
Regional Water Planning Commission
Washoe County Commission Chambers
1001 East Ninth Street
Reno, Nevada**

Wednesday, September 19, 2001

1:30 DETERMINATION OF QUORUM

APPROVAL OF AGENDA

REVIEW, AMENDMENT AND APPROVAL OF MINUTES

Approval of minutes from the July 25 and September 5, 2001 meetings.

18

PUBLIC COMMENTS (Three-minute time limit per person, limited to items not listed on the agenda.)*

COMMISSION ITEMS* (Unless otherwise listed with a topic description, this portion of the agenda is limited to announcements and discussions of items proposed for action at future meetings.)

BUSINESS ITEMS OF THE DAY

1. Discussion and possible approval of a request by the Truckee River Flood Management Coalition Steering Committee for the Regional Water Planning Commission (RWPC) to coordinate the development of the Regional Floodplain Management Plan – Jeanne Ruefer – 15 minutes.
2. Review and possible approval of a Regional Water Plan Update Schedule and recommendation to the Board of County Commissioners for its adoption – Jim Smitherman – 15 minutes.
3. Review of UNR Farms effluent re-use pipeline expansion to determine if it is in conformance with the regional water plan – Greg Dennis – 20 minutes.
4. Review and possible approval of voting results from the 9-5-01 RWPC meeting during which the priorities list was amended – Jim Smitherman – 10 minutes.
5. Review of Regional Water Plan chapters 6 and 11 and recommend for update – Jim Smitherman – 20 minutes.
6. Workshop on the Steamboat Creek Restoration Program– Sandi Gotta, District Manager, Washoe/Storey Conservation District – 1 ½ hours. *

Notes: Items on the agenda without a time designation may not necessarily be considered in the order in which they appear. The Commission may take action on any of the action items listed.

Facilities in which this meeting is being held are accessible to the disabled. Persons with disabilities who require special accommodations or assistance (e.g. sign language interpreters or assisted listening devices) at the meeting should notify the Washoe County Department of Water Resources, at 954-4665, 24 hours prior to the meeting.

In accordance with NRS 241.020, this agenda closes three (3) days prior to the meeting date. Only items of interest and not requiring Commission action may be added to the agenda within the three-day period. This agenda has been posted at the following locations: Washoe County Administration Building (1001 E. 9th Street), Washoe County Clerk's Office-Courthouse (Court and Virginia Streets), Washoe County Library (301 South Center Street), Sparks Justice Court (630 Greenbrae Drive), and the Washoe County web site.

STAFF ITEMS *

(Unless otherwise listed with a topic description, this portion of the agenda is limited to announcements and discussions of items proposed for action at future meetings.)

COMMISSION ITEMS*

(Unless otherwise listed with a topic description, this portion of the agenda is limited to announcements and discussions of items proposed for action at future meetings.)

Agenda Committee Report: Summary, discussion and possible action regarding proposed agenda items for future meetings -- Committee Chairman -- 5 minutes.

ADJOURNMENT

***Indicates a non-action item.**

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**Washoe County
Department of
Water Resources**

4930 Energy Way
Reno, NV 89502-4106
Tel: (775) 954-4600
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**Regional Water
Planning
Commission**

Voting Members:

Bob Firth, Chair
George Shaw,
Vice-Chair
Diana Langs
Lori Williams
Elwood Lowery
George W. Ball, Jr.
Michael DeMartini
Bill Isaefff
Susan Lynn

Voting Alternates:

Greg Dennis
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**Non-Voting
Alternates:**

Steve McGoff
Tim Hay
Tom Porta
Jason King

Steve Bradhurst
Director

Jim Smitherman
Water Management
Planner Coordinator

Department of



Water Resources

AGENDA ITEM 1

September 19, 2001

TO: Regional Water Planning Commission (RWPC)

FROM: Jeanne Ruefer, Water Resources Planning Manager

SUBJECT: The Truckee River Flood Management Coalition Steering Committee requests having the RWPC coordinate the development of a floodplain management plan.

BACKGROUND

The Sponsors of the Truckee River Flood Management Coalition are interested in developing a Flood Mitigation / Floodplain Management Plan. This is needed to assure that the flood management project that is eventually agreed to and built will remain viable and continue to provide the full 100-year flood protection it is being designed to do. It is recognized that if development is done in a way that increased peak flows or storm runoff volume above what occurs naturally, the amount of protection from a flood project is diminished. A floodplain management plan, developed and implemented in coordination with the existing policies of the local sponsors, will provide a higher level of flood protection throughout our region. Development and implementation of a floodplain management plan has the added benefit of being eligible for credit under the Community Rating System, thus reducing the cost of flood insurance in our community.

The Steering Committee of the Truckee River Flood Management Coalition has recommended that the Regional Water Planning Commission oversee the development of the Floodplain Management Plan on behalf of the project sponsors. Control of floods and management of stormwater, is one of the required elements defined in the RWPC's enabling legislation (NRS540A 140).

The Federal Emergency Management Agency (FEMA) has funds to do floodplain management planning available through the Flood Mitigation Assistance Program. These funds are available in the form of a pass-through grant from the State Division of Water Resources (DWR). The grant is provided on a cost share basis, with the local share covered by staff time as in-kind contribution. RWPC participation would have no financial implications.

The role of the RWPC would be to implement the public planning process and administer plan development, including solicitation of proposals from outside consultants. The attached document describes the Flood Mitigation Planning approach in detail.

SCOPE OF WORK

The Cities of Reno and Sparks and Washoe County have agreed to act as Sponsors of the Truckee River Flood Management Project (Project). The Sponsors are interested in developing and implementing a Flood Mitigation/Management Plan to reduce the risk of flood damages throughout the communities of Reno, Sparks and the unincorporated area of Washoe County. The Sponsors will undertake the following tasks.

Task 1, Coordination with Public Stakeholders and Other Agencies

This task will include contacting stakeholders from the public and other local, state, and federal agencies. The Truckee River Flood Management Coalition is an existing stakeholder group that will be utilized for this planning process. This task will include development of a Floodplain Management Planning Committee, and coordination with the local Community Development, Public Works, and Planning Departments of the three Sponsors.

Task 2, Flood Hazard Inventory

This task will include identifying flood prone areas throughout the community, using FEMA Flood Insurance Rate Maps (FIRMs), known flood hazards that may not show up on the FIRMS, and localized drainage problems. This task will result in a description and assessment of the flood hazard.

Task 3, Problem Identification

This task will include an evaluation of the number of homes, businesses, critical facilities, and infrastructure affected by flood hazard. An assessment of predicted damages will be performed. If the HAZUS database is available for flood damages, it will be used. Master plans of the communities will be evaluated for future land use.

Task 4, Review of Mitigation Strategies

The following mitigation measures will be evaluated for feasibility:

Preventive measures, including planning and zoning, open space preservation, building code changes, stormwater management, and drainage system maintenance;

Property protection measures, including relocation, acquisition, and retrofitting;

Structural measures, including detention, channel modification, and storm sewers;

Natural resource protection, including wetlands management, best management practices, and erosion and sediment control; and

Public information programs, including outreach projects, technical assistance, real estate disclosure, and environmental education programs.

This task will evaluate feasibility using the following criteria: Technical feasibility; supportive of goals and objectives; cost; environmental feasibility; supportive of multiple objectives; and compliance with regulations.

Task 5, Plan Preparation

The results of Tasks 1 through 4 will be summarized in a report, which will include the following:

1. A description of how the plan was developed, including background and reasons for the plan, and the public input process.
2. Recommendations for action, defining what will be done, by whom, a schedule, and potential funding sources.
3. A budget for implementing the recommendations.
4. A schedule for implementation.

Task 6, Plan Adoption

The plan will be presented to the three sponsors, and the sponsors' planning agencies for conformance review and adoption pursuant to local codes and requirements.

Schedule

Tasks 2 through 6 will be conducted sequentially. Thus the total project will require 12 to 18 months to complete.

Task 1, Coordination with Public Stakeholders and Other Agencies, is ongoing.

Tasks 2 and 3, Hazard Inventory and Problem Identification, have begun, and will require approximately six months to complete.

Task 4, Review of Mitigation Strategies, will require approximately four months.

Task 5, Plan Preparation, will require approximately three months.

Task 6, Plan Adoption, will require three to six months to complete.

REGIONAL WATER PLANNING COMMISSION

MINUTES September 5, 2001

The regular meeting of the Regional Water Planning Commission was held on Wednesday, September 5, 2001 at 1:30 p.m., at Washoe County Commission Chambers, 1001 East Ninth Street, Reno, Nevada.

DETERMINATION OF QUORUM

Chairman Firth called the meeting to order at 1:35 p.m.

Voting Members present:

Bob Firth
Bill Isaeff
George Shaw
Michael DeMartini (arrived at 1:45 pm)
Diana Langs
Susan Lynn
Lori Williams
Elwood Lowery
George Ball, Jr.

Voting Members absent:

None

Non-Voting Members present:

Kim Groenewold
Randy Pahl
Tracy Taylor
Bryan Tyre

Non-Voting Members absent:

Bill Carlos
Harry Fahnestock
John Patterson
Dale Stransky

Voting Alternates present:

Charlie Donohue
Birnie McGavin

Voting Alternates absent:

Don Casazza
Greg Dennis
Gerry Emm
John Erwin
John Gonzales
Peter Krenkel

Non-Voting Alternates present:

None

Non-Voting Alternates absent:

Jason King
Tim Hay
Steve McGoff
Tom Porta

Staff members Present:

Steve Bradhurst (arrived at 4:15pm)
Jeanne Ruefer
Jim Smitherman
Mike Widmer
Debra Carr
Jim Barnes, Legal Counsel

APPROVAL OF AGENDA

Jim Smitherman made a request to reverse the order of Agenda Item 2 and 3. There were no objections.

COMMISSIONER LANGS MADE A MOTION TO APPROVE THE AGENDA AS AMENDED. THE MOTION WAS SECONDED BY COMMISSIONER SHAW, AND CARRIED UNANIMOUSLY.

PUBLIC COMMENT

None

COMMISSION ITEMS

Chairman Firth stated he had received two letters of appointment. The first stated the Sparks City Council and the Reno City Council had appointed Susan Lynn to replace Mike Buschelman as a voting member to the RWPC.

The second letter, from the Division of Environmental Protection, appointed Randy Pahl to the RWPC to replace Adele Basham, with Tom Porta remaining as his alternate.

Commissioner Isaeff stated the cities of Reno and Sparks had identified a candidate to fill the voting alternate position for the Environmental seat on the RWPC, and hoped to have that position filled by the end of September.

Commissioner Isaeff announced he had submitted his resignation to the City of Sparks, effective November 2, due to his retirement. He would also submit a resignation to the RWPC, effective October 5, so that his replacement, Wayne Sidell, could be designated on Monday, October 8. Commissioner Isaeff's last RWPC meeting would be on October 3.

BUSINESS OF THE DAY

AGENDA ITEM 1

Request to recommend that the Board of County Commissioners approve funding for a Watershed Protection Program for Truckee River Tributaries.

Mike Widmer, Department of Water Resources, acknowledged Sandy Gotta and Sue Donaldson of the Washoe Storey Conservation District and University of Nevada Cooperative Extension, respectively, who had assisted on this proposal and would be key members of the program if approved.

Mr. Widmer reviewed the purpose of a Watershed Protection Program, and listed the watersheds in this study. He stated this program would augment three other programs currently in progress: the South Truckee Meadows General Improvement District, the Nevada State Health Division's Source Water Protection Program, and Carollo's WARMF model.

Mr. Widmer reviewed the background of the program, how assessment was done, the management plan development, goal setting, and management and operations from his staff report dated August 27, 2001. He also discussed the implementation, scheduling and budget of the program. The total budget requested for the assessment and management plan development had been \$175,000, but upon further review, Mr. Widmer felt water quality sampling lab costs could be reduced by approximately \$20,000.

Commissioner Lynn asked if the water sampling in the summer would be adequate since the water level was so low. Mr. Widmer stated he would do one round of sampling as soon as possible, and another one during the spring snowmelt runoff. Ms. Lynn asked if the program would pay Washoe Storey Conservation District and the Cooperative Extension out of the budget. Mr. Widmer said that was correct.

Commissioner Isaefff asked who would do the water quality sampling, and why Mr. Widmer felt he could reduce the cost by \$20,000. Mr. Widmer explained that Department of Water Resources staff would do the sampling, and money could be saved by not doing lab tests on inorganic substances, which was very expensive. Commissioner Isaefff also requested that, in addition to the Washoe County CAB's and Reno NAB's, the Sparks Citizen Advisory Council be included in public presentations. Mr. Widmer assured him the CAC would be included.

Chairman Firth asked if the South Truckee Meadows creeks had been analyzed, and if an update could be presented to the RWPC soon. Mr. Widmer stated those creeks were in the process of being analyzed. Chairman Firth asked what the capital expenses were in the budget. Mr. Widmer explained they were for lab analysis, publication costs, and presentations. Chairman Firth asked the total amount being requested for the program. Mr. Widmer said it was \$175,000. (Later revised to \$155,655.) Jim Smitherman said it would come out of the \$422,000 available budget.

Charlie Donohue thanked Mr. Widmer for the complete and thorough proposal, which he had requested. He also said the timing of the water sampling was critical, and suggested the land use compilation and watershed assessment be done before the water sampling. Mr. Donohue also requested that the Real Estate Association and developers be included in the public agencies involved in this program, since many of the creeks flowed through private property.

Commissioner Lynn suggested including the watersheds upstream of the state line, where many creeks originate. Mr. Widmer said he would contact the community of Truckee and would coordinate activities with them.

Randy Pahl stated the Nevada Division of Environmental Protection (NDEP) was in favor of this program, and was very interested in TMDL's and assessments on impaired streams. This program would help the NDEP with its assessments. Commissioner Lynn asked if the state could help fund this program; Mr. Pahl said he would ask.

Bryan Tyre pointed out that on the list of priorities for the RWPC, Item No. 2, Watershed Protection Program, had a cost estimate of \$15,000, and if this program would cover that item or any other items on the priority list. Mr. Widmer said the proposal would cover the Watershed Protection Program item, and also cover Item No. 12 and possibly Item No. 13. Mr. Smitherman

said the \$15,000 for the watershed program was only to cover a review of work being done by other agencies.

Commissioner Isaeff asked the total dollar amount being requested. Mr. Widmer said he could reduce it to \$155,655 due to savings on lab costs.

COMMISSIONER ISAEFF MADE A MOTION TO APPROVE THE WATERSHED PROTECTION PROGRAM AND FUNDING IN THE AMOUNT OF \$155,655, SECONDED BY COMMISSIONER LANGS.

Commissioner Lynn asked that the maker of the motion consider amending it to request funding from the State of Nevada.

COMMISSIONER ISAEFF AMENDED THE MOTION TO INCLUDE REQUESTING MONEY FROM THE STATE OF NEVADA, IF IT WOULD NOT DELAY THE START OF THE PROJECT; SECONDED BY COMMISSIONER LANGS. THE MOTION CARRIED UNANIMOUSLY.

REVIEW, AMENDMENT AND APPROVAL OF MINUTES [Taken out of agenda order.]

COMMISSIONER LYNN MADE A MOTION TO APPROVE THE MINUTES OF THE AUGUST 1, 2001 MEETING AS POSTED. THE MOTION WAS SECONDED BY COMMISSIONER SHAW, AND CARRIED UNANIMOUSLY.

Chairman Firth asked that approval of the minutes of the July 25, 2001 meeting be postponed until the next meeting, as they had been sent in a previous packet and Commissioners wanted to review them again. Mr. Smitherman said they would be sent out in the next packet.

AGENDA ITEM 3 [Taken out of agenda order, see Approval of Agenda.]

Review of RWPC Priorities List and Budget for amendment or approval.

Chairman Firth asked Jim Smitherman to review the process the Commission would follow on the priority list.

Jim Smitherman stated the prioritization list was being done at this time because it would help to guide the use and expenditures of the Regional Water Management Fund, and guide staff in the Regional Water Management Plan review and update process.

Mr. Smitherman stated he had compiled a table of the December 2000 priority list, with the first ten items in order of importance, and the remaining items listed in no particular order. He explained the rest of the table, and how the Commissioners would vote on the priorities for this year. He asked for suggestions for adding items under the Project Activity column, which would help him in updating the Plan.

Mr. Smitherman read each item on the priority list, and the Commissioners asked questions and made suggested changes. Chairman Firth suggested finishing the priority list first, and then deciding the budget of each item.

Changes to the list were as follows:

- Item 1 was divided into two parts, with sentences one and three becoming part a, and sentences two and four becoming part b. Under the CIP column, the word “improvements” was changed to “planning” on the last two items, and the Truckee River Flood Plan was added under the Project Activity column.
- It was suggested on Item 2, Watershed Protection, that South Truckee Meadows creeks, Steamboat Creek, Evans Creek, and the WARMF model be added under the Project Activity column.

Commissioner Lynn asked if these items would be prioritized on the amount spent or, if already approved, should they remain on the list. Mr. Smitherman asked that items be prioritized based solely on their merits, and that budgetary amounts be assigned later. Chairman Firth said Item 2, Watershed Protection, was already in progress and should be taken off the list. Mr. Smitherman suggested the Commission look ahead to implementation of a Watershed Protection Management Plan, and if this item were dropped off the list now, it might have to be put back on the list in the future. Commissioner Williams had a concern about taking this off because everything that needed to be funded might not be known until Mike Widmer’s study was completed, and keep the priorities separate from the funding. Commissioner Langs agreed.

- Item 3: The word “Fund” was changed to “Identify” non-structural water quality improvements.

Charlie Donohue asked whether the RWPC could fund projects, and asked staff to clarify that before the wording was changed. Mr. Smitherman said he would review the record for a legal opinion on that. Chairman Firth said the understanding was that actual improvements could not be funded, but planning could be funded. Commissioner DeMartini said he thought the legislature had made a change on that ruling. Mr. Smitherman would research this.

- Item 6: The word “Analyze” was added to the beginning of the sentence, and “in Mount Rose” was taken out of the sentence and added as a bulleted item underneath.

Mr. Smitherman said he had a copy of a report on this item, and would have copies made and distributed to all the Commissioners.

- Item 10: The item was changed to read, “Emergency water supply projects.” Under the Project Activity column, the project completion date should be corrected to 2002.
- Item 11: Change the SPPC reference to TMWA.
- Items 12 and 13: These items were incorporated under the Watershed Protection Program, and dropped as individual items.

- Item 14: Commissioner Ball stated a test program had been completed by Jensen, and asked staff to talk to Jim Arden about the report on the study.
- Item 23: This was incorporated into the other facility plans, and was dropped as an item.
- Item 25: Wording was changed to read: "Policies and procedures for flood control projects."

Chairman Firth said projects were done on a case-by-case basis. Jeanne Ruefer commented that she would prefer that flood control be looked at from a more holistic perspective, instead of on a case-by-case basis. Chairman Firth stated each drainage basin was so different that he wondered if generalities could be applied to all of them. Ms. Ruefer envisioned a committee that would develop an overall vision of what flood control should be on a regional basis. Chairman Firth suggested listing this item as "flood control guidelines." Ms. Ruefer agreed.

- Item 27: Chairman Firth said this would be included under the Spanish Springs study, and suggested it be more generic. The wording was changed to "Options for overly dense septic" with other items bulleted below.
- Item 28: Greg Dennis stated this plan was well underway, and a report would be given soon. This item was dropped from the list.

Three additional items were proposed and added to the list: Conjunctive Use (Greg Dennis); completion of the Truckee River Flood Plan (Susan Lynn); and an Interlocal Agreement between counties on both sides of the Truckee River regarding joint planning efforts (Bill Isaef).

With no other changes or additions to the list, Chairman Firth announced it was time to start the voting process. Before he recessed the meeting, he recognized Steve Bradhurst, the new Director of Water Resources for Washoe County replacing Ed Schmidt. Chairman Firth welcomed Mr. Bradhurst, stating he was a former Washoe County Commissioner and had extensive water planning experience.

Steve Bradhurst thanked Chairman Firth for the welcome, stating he was very pleased with the work of the Regional Water Planning Commission. As a Reno resident since 1969, Mr. Bradhurst was honored to work with the Commissioners and the great staff in his department. He pledged to do everything he could to work cooperatively with TMWA.

Chairman Firth called a recess at 3:40 p.m. so that the changes could be made to the chart and Commissioners could vote. Fifteen Commissioners and alternates voted, and the meeting reconvened at 4:15 p.m.

[Commissioner Langs did not return after the recess.]

AGENDA ITEM 2 [Taken out of agenda order, see Approval of Agenda.]

Review and possible approval of updated Regional Water Planning Commission (RWPC) Policies and Procedures, which include specifications for the Conservation Committee.

Jim Smitherman referred to page 5 of the Policies and Procedures in the packet. The underlined text under *The Advisory Committee on Conservation* was the proposed addition requested by the Commission setting the number on the committee, terms, purpose, and meeting schedule.

Chairman Firth suggested changing the Committee to a *minimum* of five members and up to seven members. Commissioner Isaeff asked that it state a *majority* of the Committee would be RWPC members. Commissioner DeMartini asked if a majority of those attending a given meeting had to be RWPC members in order to have a quorum. Chairman Firth said only one member he had chosen was not an RWPC member, so that would not be an issue at this time.

Mr. Smitherman also suggested adding that the Chair of the RWPC would appoint the Chairperson of the Advisory Committee. Chairman Firth agreed.

Commissioner Isaeff said that on page 1, under *Election of Officers*, the same statement was repeated under *Election of Officers* on page 3, and recommended deleting it from page 1. He also suggested deleting the sentence stating, "the Past Chairman will serve as the Recording Secretary," and replace it with "the Water Resources Department will provide the Recording Secretary."

Commissioner Isaeff also suggested, on page 4, under *Committees*, under Purpose, paragraph 2, the words "Regional Water Authority" were not clear. Mr. Smitherman said he assumed that referred to the Board of County Commissioners, and if so, the wording should be changed to the "Regional Water Management Agency."

COMMISSIONER WILLIAMS MADE A MOTION TO APPROVE THE POLICIES AND PROCEDURES WITH THE CHANGES SUGGESTED BY THE COMMISSIONERS AND STAFF. THE MOTION WAS SECONDED BY COMMISSIONER BALL, AND CARRIED UNANIMOUSLY.

Chairman Firth announced the appointees to the two committees. For the *Committee on Jurisdiction and Agenda*, the Vice-Chair of the RWPC, George Shaw, would become the Chair. The other members were John Gonzales, Diana Langs, Greg Dennis, and Bryan Tyre.

For the *Advisory Committee on Conservation*, Chairman Firth said Susan Lynn had graciously agreed to be the Chairperson, and the other members so far were Diana Langs, Catherine James (an employee of TMWA), Harry Fahnestock, Bill Carlos, and Joan Lambert. He said there might be one additional appointment.

Chairman Firth also referred to the informational item in the packet, an update on the funding and budget. Commissioner Ball asked if \$422,337 was the amount not committed, and if the money approved today on the Watershed Protection Plan for \$155,000 would come from that money. Chairman Firth said that was correct.

Chairman Firth asked what the quarterly payment was to the Department of Interior. Mr. Smitherman said he thought it was for the North Valleys Hydrographic Basin Study, done in part by the US Geological Survey, but would check on it and report back to the Commission.

Chairman Firth also asked what the payments to Intermountain Environment were, and asked for clarification at the next meeting.

AGENDA ITEM 3 [Continued]

Review of RWPC Priorities List and Budget for amendment or approval.

Chairman Firth called for the results of the voting on the Priority List. Mr. Smitherman read the new top ten priority items to the Commissioners, as follows:

- No. 1 – Watershed Protection Program (Old Item 2)
- No. 2 – Accelerate Meter Retrofit Program (Old Item 5)
- No. 3 – Update Base Case Conservation Plan (Old Item 4)
- No. 4 – Quantify effect of runoff in urbanized areas as to flood potential, ground water recharge, and water quality. Coordination of surface water quality and floodplain management plans. (A portion of Old Item 1)
- No. 5 – Utilize dual water systems for water quality standard compliance (Old Item 15)
- No. 6 – Analyze domestic well conflicts related to over pumping of groundwater (Old Item 6)
- No. 7 – Investigate solution to over pumping of groundwater (Old Item 21)
- No. 8 – Conjunctive Use (New Item)
- No. 9 – Inclusion of Natural Recharge Analysis in land-use planning (Old Item 7)
- No. 10 – Coordinated planning between counties on both sides of the Truckee River (New Item)

Mr. Smitherman stated he would update the table prior to the next RWPC meeting. Chairman Firth thanked Mr. Smitherman and Debra Carr for their work on this item.

Mr. Smitherman gave an update on the Regional Water Management Plan. He said the statute stated that the Plan had to be reviewed and updated before its fifth anniversary of adoption, which will be February 24, 2002. After the RWPC review, a report is then made to the Board of County Commissioners (BCC). Mr. Smitherman said he would review the Plan chapter by chapter with the committee he had formed, and bring recommendations back to the RWPC at each meeting. After it was reviewed, it would take six months to complete the update and present the amendments to the BCC. Amendments would then go to the Regional Planning Commission for conformance review. Mr. Smitherman said if the schedule was adhered to, the Plan should be completed by January 2003. Mr. Smitherman said this proposal had to be acted upon at the next meeting.

Chairman Firth said this would be on the next agenda as an action item.

STAFF ITEMS

Jim Smitherman gave an update on the Toilet Retrofit Program. At this time the staff had processed 61 applications, and the public information program would begin soon. Rebate checks should be issued within a week. The website address is: www.co.washoe.nv.us/utilities, then go to the button "Toilet Rebate."

Commissioner Isaeff suggested a great press release for publicity of the program would be to take a photo of the first rebate check being handed out to the recipient. Mr. Smitherman said he would follow up on that suggestion.

Mr. Smitherman reported that at the last Board of County Commissioner's meeting, the emergency water supply contract was approved, as well as a letter opposing the repeal of the plumbing standards in the Energy Policy Act.

Mr. Smitherman asked Jeanne Ruefer to give an update on the action taken by the Reno City Council regarding the Evans Creek dam. Ms. Ruefer said the Council heard the recommendation from its staff on Wednesday, August 29, which was to perform an extensive alternative analysis study of flood control projects in the Evans Creek area, including another look at the dam. She stated there would be a facilitated process by the West University Neighborhood Advisory Board (NAB), and Washoe County had been asked to participate.

COMMISSION ITEMS

Bryan Tyre stated that on July 25, the District Health Department approved the revision to its regulations governing on-site wastewater disposal to require a five-acre minimum lot size for new subdivisions that employ on-site sewage disposal. The first four lots will still be one-acre minimum, but any number of lots after that will be a five-acre minimum. He said no existing lots would be affected, and that the District Board of Health could approve smaller acreages if a landowner could prove impacts on groundwater would be reduced.

Agenda Committee Report

George Shaw reported the following items would be on the next agenda:

1. Workshop on Steamboat Creek – Sandy Gotta
2. Regional Water Plan Update – Jim Smitherman
3. Conformance review from the City of Reno regarding the effluent re-use pipeline at UNR Farms.
4. Approve administration of a Federal pass-through grant for floodplain management.

ADJOURNMENT

There being no further business, Chairman Firth adjourned the meeting at 4:50 p.m.

Respectfully submitted,
Katherine McShane, Recording Secretary

Approved by Commission in session on September 19, 2001.

Steve Bradhurst, Secretary to the Commission



April 22, 2002

**Washoe County
Department of
Water Resources**

4930 Energy Way
Reno, NV 89502-4106
Tel: (775) 954-4600
Fax: (775) 954-4610

**Regional Water
Planning
Commission**

Voting Members:

Bob Firth, Chair
George Shaw,
Vice-Chair
Diana Langs
Lori Williams
Elwood Lowery
George W. Ball, Jr.
Michael DeMartini
Wayne Seidel
Susan Lynn

Voting Alternates:

Greg Dennis
Peter A. Krenkel
Birmie McGavin
John Erwin
Gerry Emm
Don Casazza
Charlie Donohue
John Gonzales
Thomas Hultin

**Non-Voting
Members:**

John Patterson
Dale Stransky
Randy Pahl
Tracy Taylor
Don Casazza
Doug Coulter
Bill Carlos
Harry Fahnestock

**Non-Voting
Alternates:**

Steve McGoff
Tim Hay
Bryan Tyre
Tom Porta
Jason King

Steve Bradhurst
Director

Jim Smitherman
Water Management
Planner Coordinator

Department of



Water Resources

Dear Truckee Meadows Stakeholder:

The Washoe County Regional Water Planning Commission is undertaking a project to develop a Floodplain Management Plan for the urbanized area of southern Washoe County, to include the Truckee Meadows, Washoe Valley, Spanish Springs, North Valleys, Sun Valley, and Cold Springs. The Floodplain Management Plan will cover areas both within and outside of the Reno and Sparks incorporated city limits.

The primary purpose of the Floodplain Management Plan is to develop a community-wide consensus plan to reduce the risk of flooding through the implementation of both structural and non-structural measures. Examples of structural measures include the proposed North Spanish Springs Stormwater Project and the Truckee River Flood Control project, currently undergoing a community-wide planning effort. Non-structural measures may include items such as recommended building code modifications, drainage system maintenance, and open space/floodplain preservation.

The planning process will recognize the unique needs of each jurisdiction while promoting better understanding of regional flood control issues and developing complementary watershed management strategies. Recognition of the linkages that exist between flood protection, preservation of water quality, enhancement of water supplies, and open space planning will also be explored in the development of flood mitigation strategies.

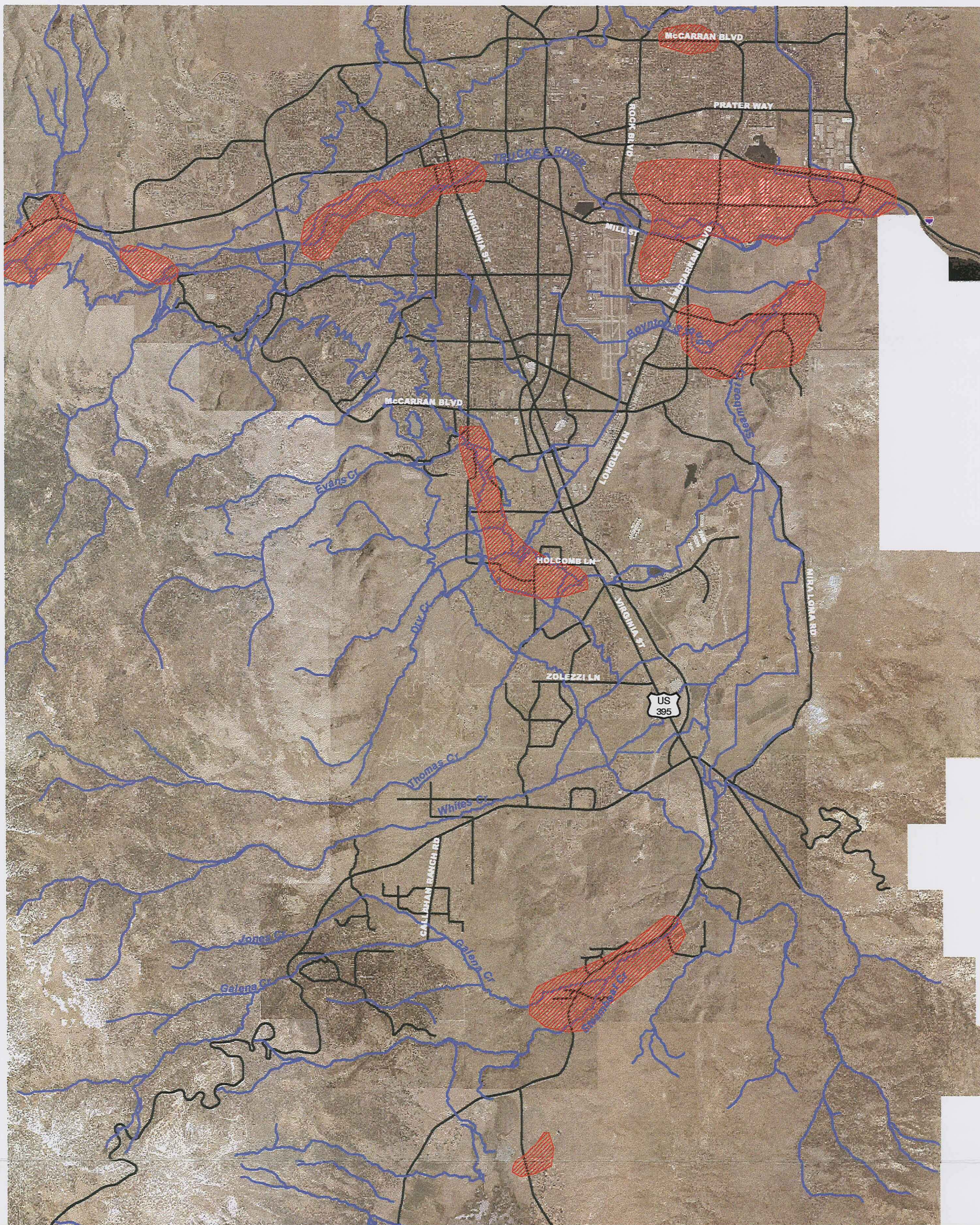
As the Reno metropolitan area continues to grow, it is essential that the community implement coordinated floodplain management planning to ensure that the flood control facilities currently under design will continue to be viable for future generations. The community investment in these facilities is tremendous. The estimated cost of the Truckee River Flood Control project alone is \$260 million.

It is with these issues in mind that you are invited to participate in the development of the Floodplain Management Plan. Attached is an agenda for the kick-off meeting to be held Monday, April 29th 2002 at the Washoe County Department of Water Resources, , 4930 Energy Way, Reno, Nevada.

If you have questions regarding this project or would simply like to ensure that you are included in ongoing project correspondence, please don't hesitate to contact either myself or Lisa Haldane, Project Facilitator, at (775) 425-5777, email: haldane@eaglenesteng.com.

Sincerely,

Jeanne Ruefer
Water Resources Planning Manager



RWPC FLOODPLAIN MANAGEMENT STRATEGY **AREAS THAT EXPERIENCED FLOOD DAMAGE** **1997 FLOOD EVENT**

-  Areas that Experienced Flood Damage in the 1997 Flood Event
-  Major Roads
-  Major Tributaries

Notes: The scale and configuration of all information shown hereon are approximate only and are not intended as a guide for design or survey work. Reproduction is not permitted without prior written permission from the Washoe County Department of Water Resources

The FEMA flood hazard areas shown are based on FEMA Q3 data and subsequently processed LOMRs and map updates. This map has been developed for the purposes of floodplain management planning only, and is not to be used to make flood zone

Department of Water Resources
WASHOE COUNTY
NEVADA

4930 Energy Way
 Reno, Nevada 89502
 (775) 954-4600





RWPC FLOODPLAIN MANAGEMENT STRATEGY NORTH VALLEYS FLOOD HAZARD AREAS

- Floodway
- FEMA - 100 Year Flood Zone
- FEMA - 500 Year Flood Zone
- Areas of 100 Year Flood with Average Depths less than 1 Foot

- Areas of Known Flooding Studies Pending
- Major Roads
- Major Tributaries

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7000 0 7000
Scale in Feet

Department of Water Resources
WASHOE COUNTY
NEVADA





4930 Energy Way
Reno, Nevada 89502
(775) 954 4600








RWPC FLOODPLAIN MANAGEMENT STRATEGY

SPANISH SPRINGS FLOOD HAZARD AREAS

-  Floodway
-  FEMA - 100 Year Flood Zone
-  FEMA - 500 Year Flood Zone
-  Areas of 100 Year Flood with Average Depth less than 1 Foot

-  Areas of Known Flooding Studies Pending
-  Major Roads
-  Major Tributaries

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7000 0 7000
Scale in Feet





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WASHOE COUNTY
NEVADA




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Reno, Nevada 89502
(775) 954 4600





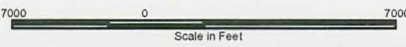
RWPC FLOODPLAIN MANAGEMENT STRATEGY WASHOE VALLEY FLOOD HAZARD AREAS

-  Floodway
-  FEMA - 100 Year Flood Zone
-  FEMA - 500 Year Flood Zone
-  Areas of 100 Year Flood with Average Depths less than 1 Foot

-  Areas of Known Flooding Studies Pending
-  Major Roads
-  Major Tributaries

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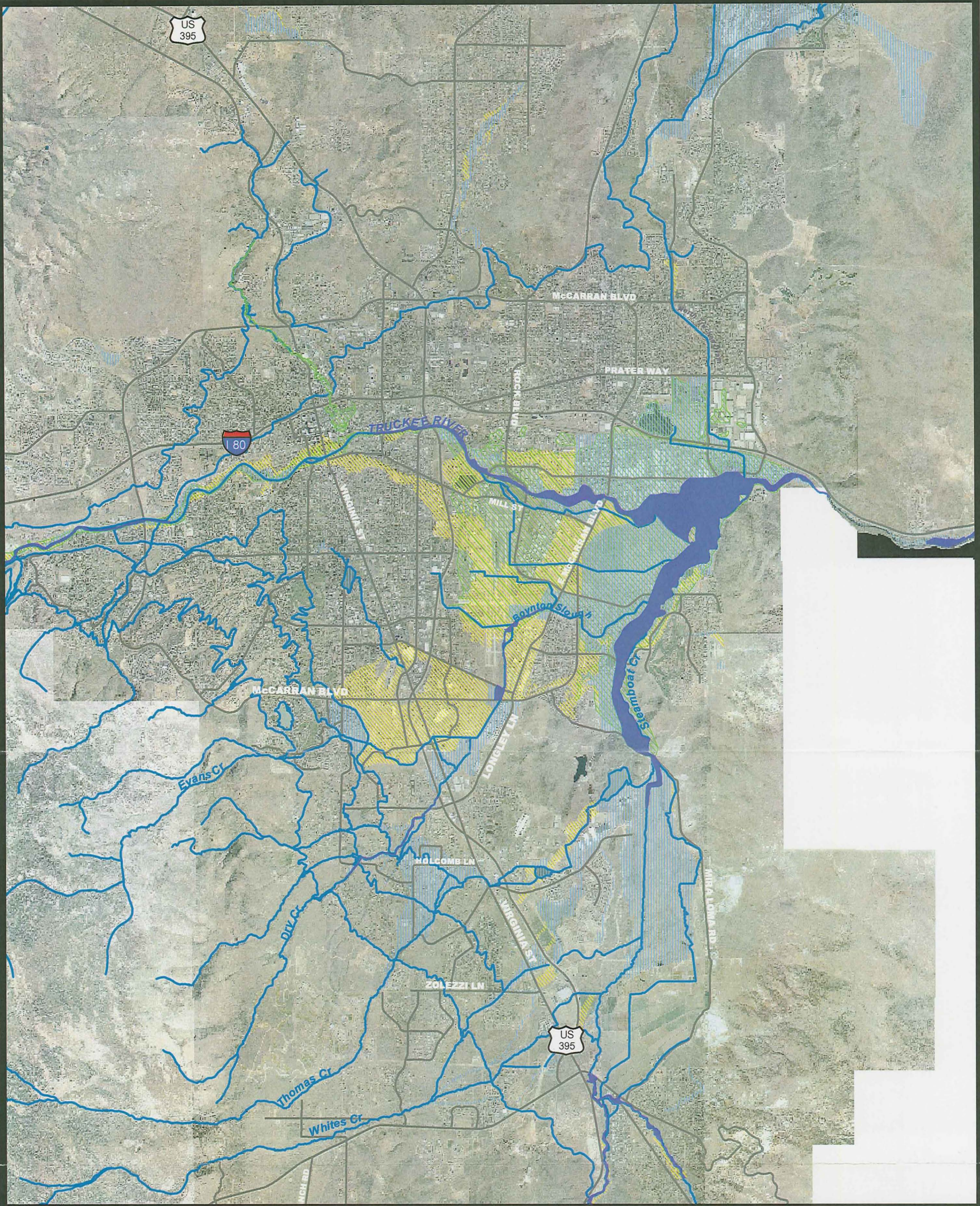
The FEMA flood hazard areas shown are based on FEMA Q3 data and subsequently processed LOMRs and map updates. This map has been developed for the purposes of floodplain management planning only, and is not to be used to make flood zone



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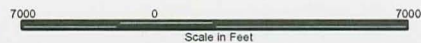


RWPC FLOODPLAIN MANAGEMENT STRATEGY TRUCKEE MEADOWS FLOOD HAZARD AREAS

- | | |
|---|--|
|  Floodway |  Areas of Known Flooding |
|  FEMA - 100 Year Flood Zone |  Major Roads |
|  FEMA - 500 Year Flood Zone |  Major Tributaries |
|  Areas of 100 Year Flood with Average Depths less than 1 Foot | |

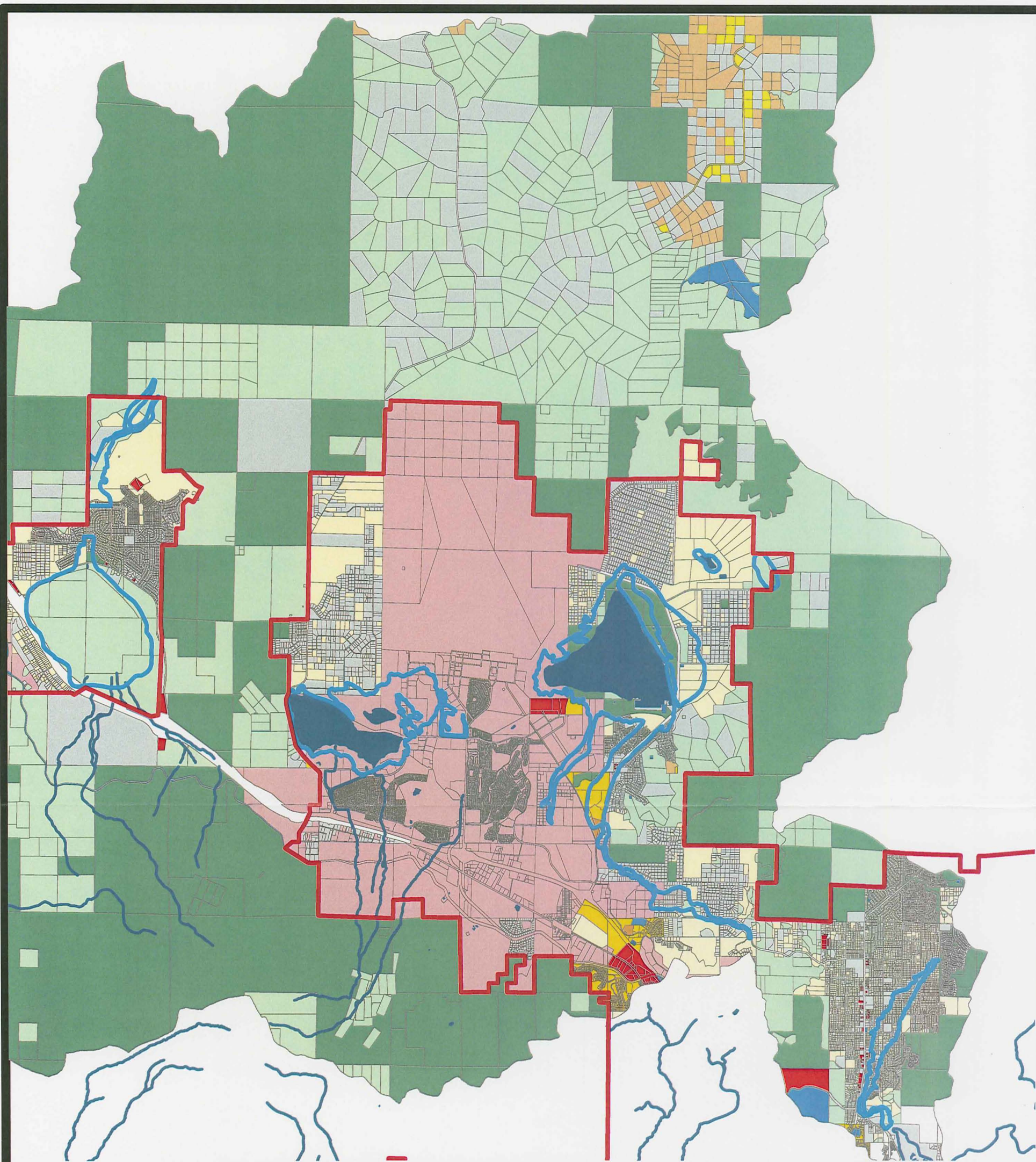
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WASHOE COUNTY
NEVADA
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Reno, Nevada 89502
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RWPC FLOODPLAIN MANAGEMENT STRATEGY
NORTH VALLEYS PLANNED LAND USE
UNDEVELOPED PARCELS

- Developed Parcels

Residential <2.5 Acres

Residential 2.5-10 Acres

Residential >10 Acres

Commercial / Industrial

Fema 100 Year Flood Plain

Truckee Meadows Service Area Boundary
- General Rural

Parks and Open Space

Public Facilities

Reno Mixed Residential

Reno Single Family Residential

Reno Urban Residential

Reno Special Planning Area

SOURCE: WASHOE COUNTY DEPARTMENT OF WATER RESOURCES

DATE: MARCH 2003

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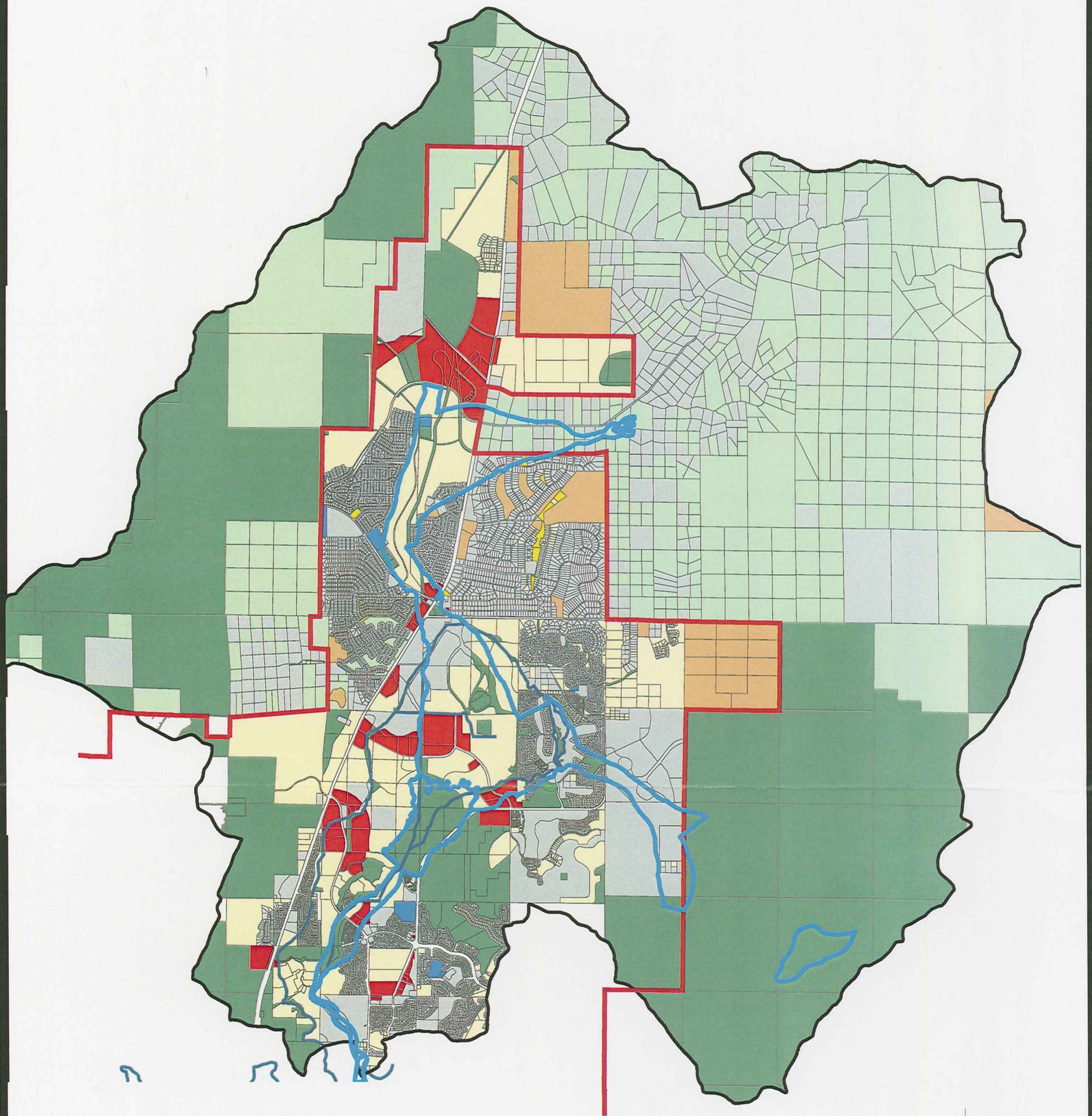
ZONING DELINEATED BY ACREAGE	ACRES IN TOTAL HYDROBASIN	ACRES IN FEMA 100 YEAR FLOOD PLAN
Residential <2.5 Acres	5916.4	468.6
Residential 2.5-10 Acres	243.1	0
Residential >10 Acres	1648.2	0
Commercial / Industrial	297.9	1.7
Parks / Open Space	37883.62	738.43
Public Facilities	519.9	11.4
General Rural	25777.18	2027.07
Reno Residential	704	77.9
Special Planning Areas	13093.5	1140.3
Roads & Developed Parcels	16546	794.3

Department of Water
Resources
WASHOE COUNTY
NEVADA



Department of
Water Resources

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RWPC FLOODPLAIN MANAGEMENT STRATEGY
**SPANISH SPRINGS PLANNED LAND USE
UNDEVELOPED PARCELS**

- | | |
|--------------------------|---------------------------------------|
| Developed Parcels | General Rural |
| Residential <2.5 Acres | Parks / Open Space |
| Residential 2.5-10 Acres | Public Facilities |
| Residential >10 Acres | Fema 100 Year Flood Plain |
| Golf Course (Sparks) | Truckee Meadows Service Area Boundary |
| Commercial / Industrial | |

SOURCE: WASHOE COUNTY DEPARTMENT OF WATER RESOURCES & CITY OF SPARKS

DATE: MARCH 2003

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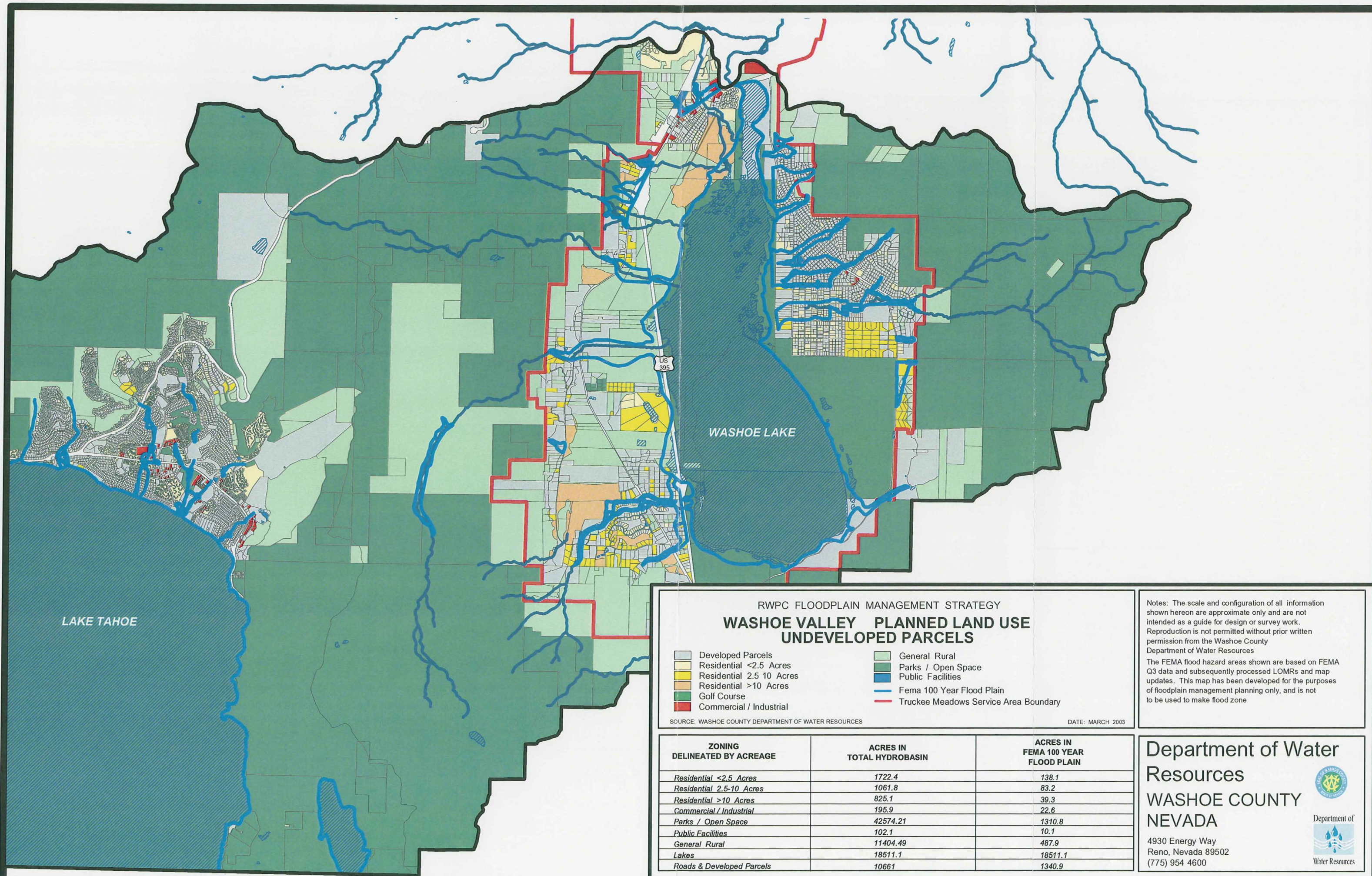
ZONING DELINEATED BY ACREAGE	ACRES IN TOTAL HYDROBASIN	ACRES IN FEMA 100 YEAR FLOOD PLAIN
Residential <2.5 Acres	6088.5	1146.9
Residential 2.5-10 Acres	59.05	2.11
Residential >10 Acres	1735.7	4.11
Commercial / Industrial	1068.9	219.32
Parks / Open Space	13267.77	617.9
Public Facilities	97.34	12.66
General Rural	15856.13	408.1
Golf Course (Sparks)	8.68	0.06
Roads & Developed Parcels	13114.5	1047.87

**Department of Water
Resources**
**WASHOE COUNTY
NEVADA**

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Department of
Water Resources



RWPC FLOODPLAIN MANAGEMENT STRATEGY
**WASHOE VALLEY PLANNED LAND USE
UNDEVELOPED PARCELS**

- Developed Parcels

Residential <2.5 Acres

Residential 2.5-10 Acres

Residential >10 Acres

Golf Course

Commercial / Industrial
- General Rural

Parks / Open Space

Public Facilities

Fema 100 Year Flood Plain

Truckee Meadows Service Area Boundary

SOURCE: WASHOE COUNTY DEPARTMENT OF WATER RESOURCES

DATE: MARCH 2003

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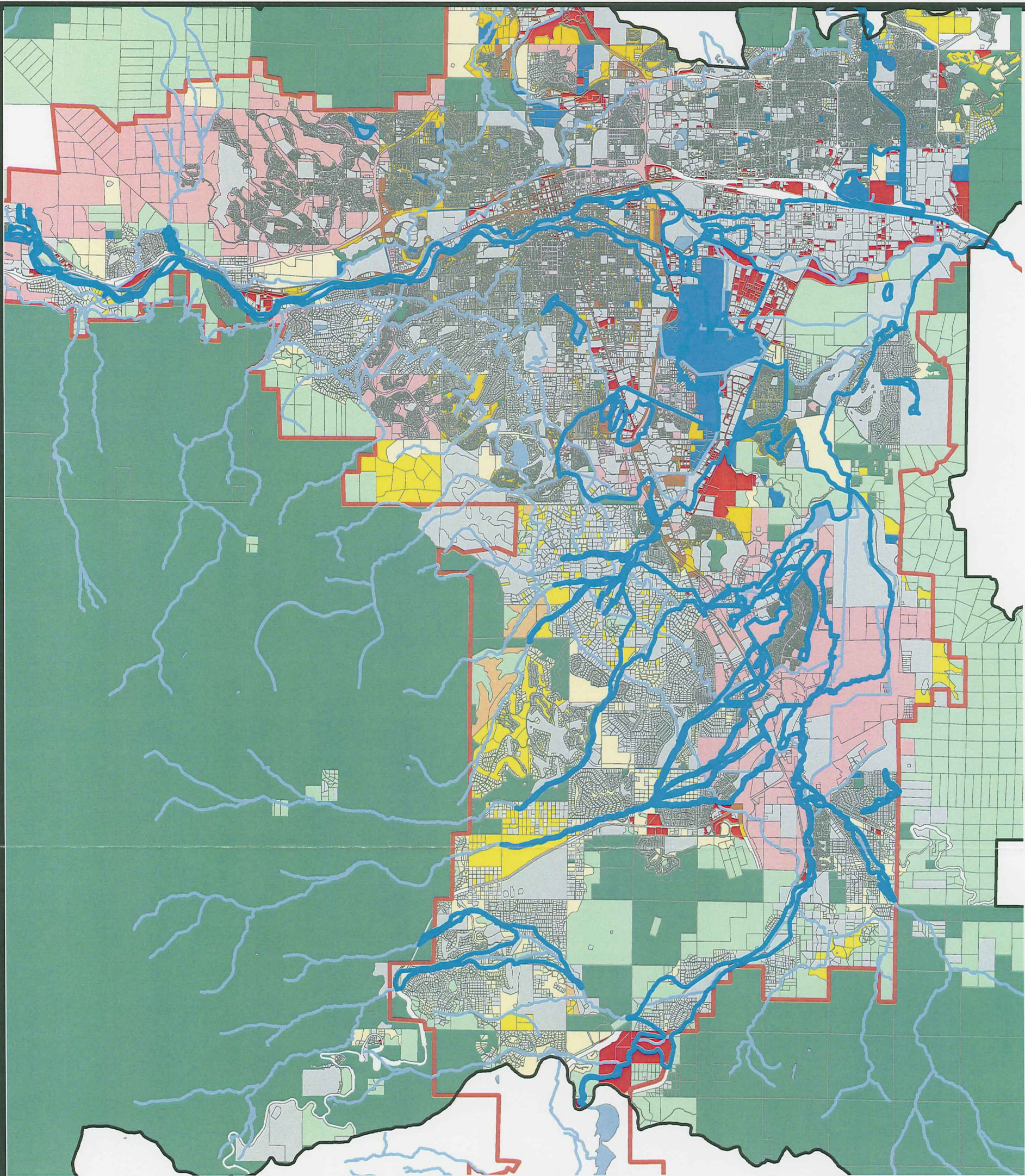
ZONING DELINEATED BY ACREAGE	ACRES IN TOTAL HYDROBASIN	ACRES IN FEMA 100 YEAR FLOOD PLAIN
Residential <2.5 Acres	1722.4	138.1
Residential 2.5-10 Acres	1061.8	83.2
Residential >10 Acres	825.1	39.3
Commercial / Industrial	195.9	22.6
Parks / Open Space	42574.21	1310.8
Public Facilities	102.1	10.1
General Rural	11404.49	487.9
Lakes	18511.1	18511.1
Roads & Developed Parcels	10661	1340.9

Department of Water
Resources
WASHOE COUNTY
NEVADA

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Department of
Water Resources



RWPC FLOODPLAIN MANAGEMENT STRATEGY
**TRUCKEE MEADOWS PLANNED LAND USE
UNDEVELOPED PARCELS**

- Developed Parcels

Residential <2.5 Acres

Residential 2.5-10 Acres

Residential >10 Acres

RenoS parks Indian Colony

Commercial / Industrial

Fema 100 Year Flood Plain

Truckee Meadows Service Area Boundary
- General Rural

Parks and Open Space

Public Facilities

Reno Mixed Residential

Reno Single Family Residential

Urban Residential/Commercial

Reno Special Planning Area

SOURCE: WASHOE COUNTY DEPARTMENT OF WATER RESOURCES & CITY OF RENO

DATE: MARCH 2003

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ZONING DELINEATED BY ACREAGE	ACRES IN TOTAL HYDROBASIN	ACRES IN FEMA 100 YEAR FLOOD PLAN
<i>Residential <2.5 Acres</i>	5516.1	477.8
<i>Residential 2.5-10 Acres</i>	3576.4	117.5
<i>Residential >10 Acres</i>	550.4	18.8
<i>Commercial / Industrial</i>	3236.3	818.16
<i>Parks / Open Space</i>	89942.1	113.87
<i>Public Facilities</i>	2871.7	1039.4
<i>General Rural</i>	26756.8	1492.10
<i>Reno Residential / Indian Colony</i>	7100.8	856.5
<i>Special Planning Areas</i>	15106.7	1697.9
<i>Roads & Developed Parcels</i>	45655.8	6982.8

**Department of Water
Resources**
**WASHOE COUNTY
NEVADA**

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2002 REGIONAL PLAN MAP 1

Policy 1.1.3, 1.1.4, 1.1.5, & 3.3.1

Adopted May 9, 2002

Amended Feb. 13, 2003. (6.1)

Truckee Meadows Service Areas (TMSA) TMSA Study Areas Unincorporated Areas Spheres of Influence (SOI)

 Truckee Meadows
Service Areas (TMSA)


Spheres of Influence (SOI) per policy 3.3.1


Reno

 Sparks

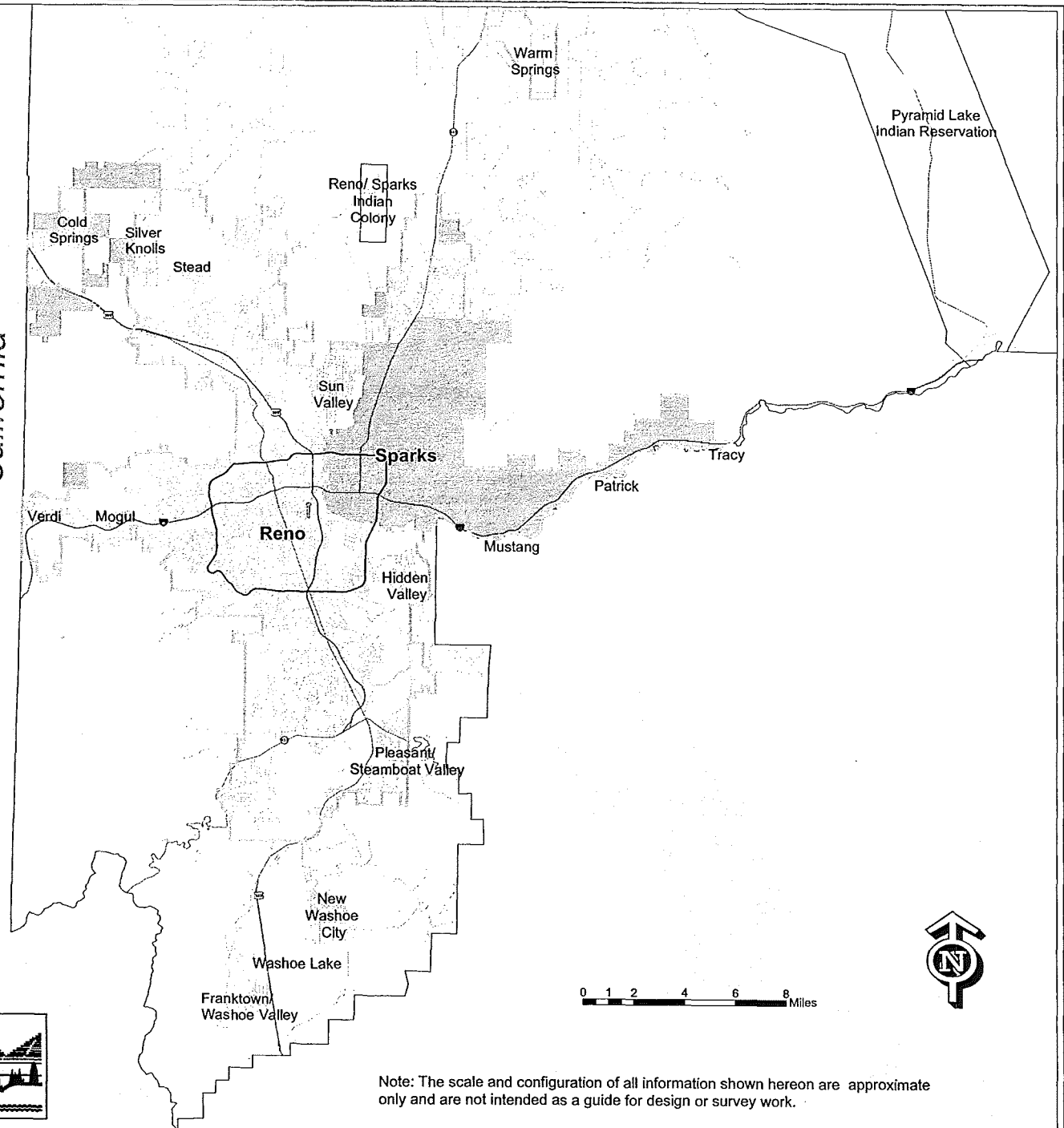
Unincorporated Areas where
communities may be designated
in the Washoe County
Comprehensive Plan.

TMSA Study Areas per policy 3.3.2 (See Appendix 7, Table 1, with listing of parcel numbers)

 TMSA Study Areas

 SOI Study Areas that may affect
TMSA but are not included in TMSA
Study Areas (Policy 3.3.2)

California



Note: The scale and configuration of all information shown hereon are approximate only and are not intended as a guide for design or survey work.



Truckee Meadows
Regional Planning Agency

One East First Street, Suite 800, Reno, NV 89501-1625
(775) 331-4335 Fax: (775) 331-4336



Website: <http://www.tmrpa.org/>
Email: info@tmrpa.co.washoe.nv.us

2002 REGIONAL PLAN MAP 3




Policy I.1.8

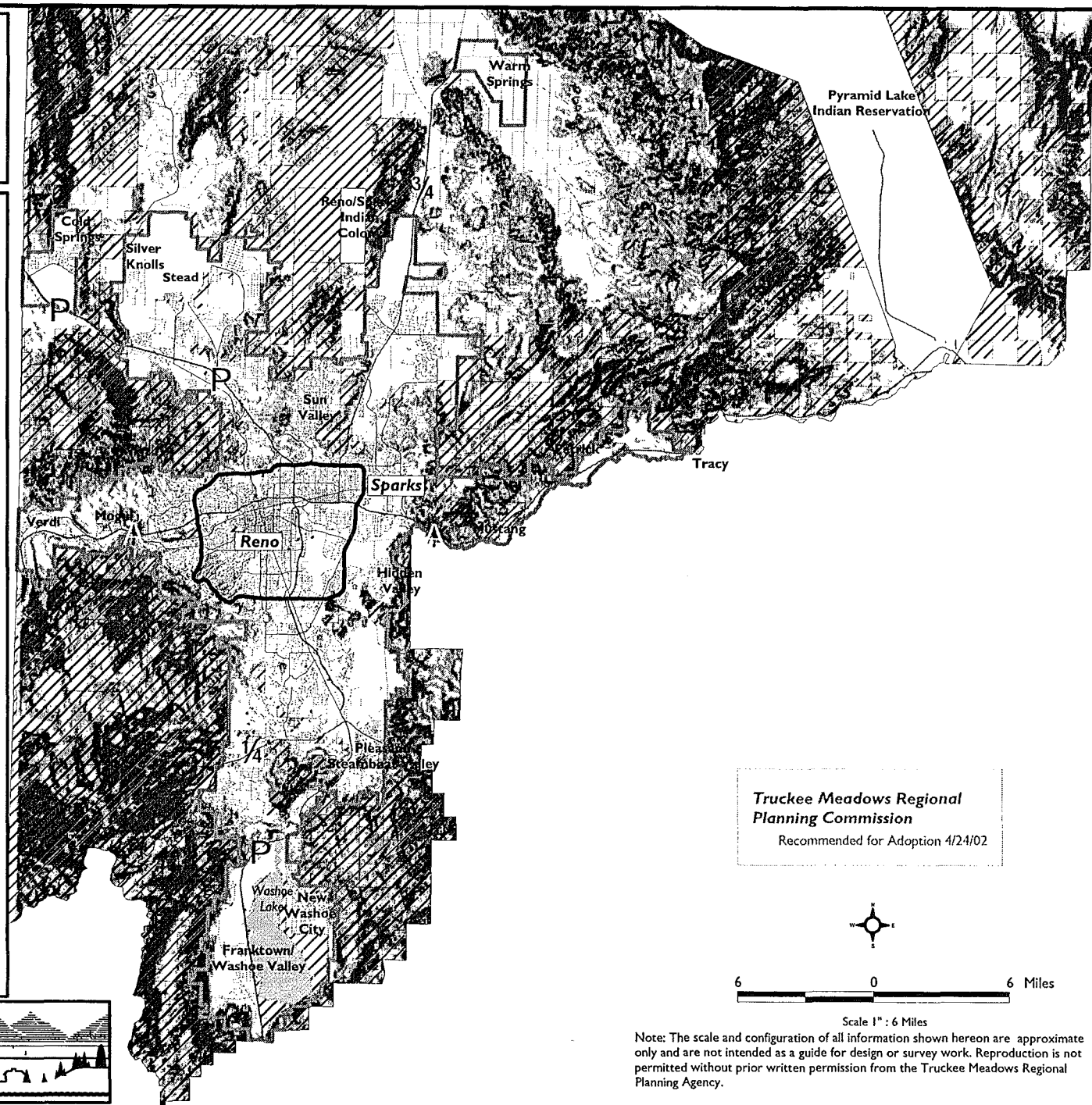
Version 7 (04-24-02)

Development Constraints Area (DCA)

-  Truckee Meadows Service Areas (TMSA)
-  Playas
-  Water Bodies
-  Public Land (Constrained)

Slope Percentage

-  < 15% (Unconstrained)
-  15% - 30% (Managed)
-  > 30% (Constrained)



Truckee Meadows Regional
Planning Commission
Recommended for Adoption 4/24/02



6 0 6 Miles

Scale 1" = 6 Miles

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Truckee Meadows
Regional Planning Agency

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(775) 321-8385 Fax (775) 321-8386

Website: <http://www.tmrpa.org> Email: input@tmrpa.co.washoe.nv.us

Title 12 PUBLIC WORKS AND UTILITIES*

CHAPTER 12.24. FLOOD HAZARD AREAS*

CHAPTER 12.24. FLOOD HAZARD AREAS*

***Cross references:** Trailer parks, Ch. 4.54; civil emergencies, Ch. 8.34; health and sanitation, Tit. 10; buildings and construction, Tit. 14; mobile home subdivisions, Ch. 18.12.

—————Art. I. In General

—————Sec. 12.24.010. Purpose and authority

—————Sec. 12.24.020. Definitions

—————Sec. 12.24.030. Lands to which this chapter applies

—————Sec. 12.24.040. Basis for establishing flood hazard areas and limited flooding areas

—————Sec. 12.24.050. Compliance

—————Sec. 12.24.060. Abrogation and greater requirements

—————Sec. 12.24.070. Interpretation

—————Sec. 12.24.080. Warning and disclaimer of liability

—————Sec. 12.24.090. Letter of map amendment

—————Art. II. Permit

—————Sec. 12.24.100. Building and/or grading permit required

—————Sec. 12.24.110. Responsibilities of the owner or developer

—————Sec. 12.24.120. Responsibilities of the city

—————Art. III. Provisions for Flood Hazard Reduction

—————Sec. 12.24.130. Standards of construction

—————Sec. 12.24.140. Standards for alluvial fans

—————Sec. 12.24.150. Standards for utilities

—————Sec. 12.24.160. Standards for subdivisions

—————Sec. 12.24.170. Standards for manufactured homes, manufactured home parks and subdivisions

—————Sec. 12.24.180. Floodways

—————Sec. 12.24.185. Closed intermittent lakes, restrictions

—————Art. IV. Penalties

—————Sec. 12.24.190. Penalties for violations

ARTICLE I. IN GENERAL

Sec. 12.24.010. Purpose and authority.

12.24-1

Title 12 PUBLIC WORKS AND UTILITIES*

CHAPTER 12.24. FLOOD HAZARD AREAS*

ARTICLE I. IN GENERAL

Sec. 12.24.010. Purpose and authority.

Sec. 12.24.010. Purpose and authority.

The purpose of this chapter is to safeguard the public health, safety and welfare by establishing guidelines and requirements for development of property within areas determined to be subject to flood damage. The requirements set forth herein are authorized by NRS Ch. 278.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.020. Definitions.

Unless specifically defined below, words or phrases used in this chapter shall be interpreted so as to give them the meaning they have in common usage and to give this chapter its most reasonable application. The following words and phrases when used in this chapter shall have the meanings respectively ascribed to them:

Alluvial fan is an area subject to flooding when the floodplain is comprised of a series of low flow channels where sediment accompanies the shallow flooding and the unstable soils scour and erode during a flooding event.

Architect is a registered professional architect in the State of Nevada.

Area of shallow flooding is an area within the flood hazard area designated as an AO or VO Zone on the flood insurance rate map (FIRM). The base flood depths range from one to three feet; a clearly defined channel does not exist; the path of flooding is unpredictable and indeterminate; and, velocity flow may be evident.

Base flood is the flood having a one percent chance of being equalled or exceeded in any given year.

Closed intermittent lake means a substantial enclosed area that contains water on an intermittent basis without a means of outlet.

Development is any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations.

12.24-2

Engineer is a registered professional engineer in the state.

Flood or flooding is a general and temporary condition of partial or complete inundation of normally dry land areas from:

_____(1) The overflow of inland waters and/or
and/or

_____(2) The unusual and rapid accumulation of runoff of surface waters from
any source.

Flood boundary floodway map is the official map on which the Federal Insurance Administration has delineated both the areas of flood hazard and the floodway.

Flood hazard area is the area designated as being flooded by the base flood, and is designated as zone A on the flood insurance rate map (FIRM).

Flood insurance rate map (FIRM) is the official map on which the Federal Insurance Administration has delineated the flood hazard area, the limited flooding area, and the risk premium zones applicable to the community.

Flood insurance study (FIS) is the official report provided by the Federal Emergency Management Agency that includes flood profiles, the flood insurance rate map (FIRM), the flood boundary-floodway map, and the water surface elevation of the base flood.

Floodproofing means any combination of structural and nonstructural additions, changes or adjustments to nonresidential structures which reduce or eliminate flood damage to real estate or improved property.

Floodway means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. The floodway is delineated on the flood boundary-floodway map.

Limited flooding area is the area between the limits of the base flood (one hundred-year flood) and the five hundred-year flood; or certain areas subject to one hundred-year flooding with average depths less than one foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. This area is designated as "shaded X" on the flood insurance rate map (FIRM).

Lowest floor means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage, in an area other than a basement area, is not considered a building's lowest floor, provided that such enclosure is not built so as to render the structure in violation of the applicable nonelevation design requirements of this chapter.

Manufactured home means a structure, transportable in one or more sections,

which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. For floodplain management purposes the term "manufactured home" also includes park trailers, travel trailers, and other similar vehicles placed on a site for greater than 180 consecutive days. For insurance purposes the term "manufactured home" does not include park trailers, travel trailers, and other similar vehicles.

Manufactured home park or subdivision is a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

Mean sea level means for purposes of the National Flood Insurance Program, the National Geodetic Vertical Datum (NGVD) of 1929 or other datum, to which base flood elevations shown on a community's flood insurance rate map are referenced.

Mobile home is a structure that is transportable in one or more sections, built on a permanent chassis, and designed to be used with or without a permanent foundation when connected to the required utilities. It does not include recreational vehicles or travel trailers, or manufactured unit housing on permanent slab foundations.

New construction means structures for which the "start of construction" commenced on or after the effective date of Ordinance No. 3529.

Remedy a violation means to bring the structure or other development into compliance with state or local floodplain management regulations, or, if this is not possible, to reduce the impacts of its noncompliance. Ways that impacts may be reduced include protecting the structure or other affected development from flood damages, implementing the enforcement provisions of the ordinance or otherwise deterring future similar violations, or reducing federal financial exposure with regard to the structure or other development.

Start of construction includes substantial improvement, and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement, or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure.

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Title 12 PUBLIC WORKS AND UTILITIES*

CHAPTER 12.24. FLOOD HAZARD AREAS*

ARTICLE I. IN GENERAL

Sec. 12.24.030. Lands to which this chapter applies.

Sec. 12.24.030. Lands to which this chapter applies.

This chapter shall apply to all flood hazard areas (zone A) and limited flooding areas (shaded X) within the jurisdiction of the city. Said flood hazard areas are depicted on FIRM panel numbers 2793 E, 2794 E, 2800 E, 2811 E, 2813 E, 2825 E, 2968 E, 2969 E, 2976 E, 2977 E, 2984 E, 2986 E, 2988 E, 2989 E, 2993 E, 2994 E, 2995 E, 3013 E, 3150 E, 3156 E, 3157 E, 3158 E, 3159 E, 3170 E, 3176 E, 3186 E; dated September 30, 1994.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.040. Basis for establishing flood hazard areas and limited flooding areas.

The flood hazard areas (zone A) and limited flooding areas (shaded "X") are identified by the Federal Insurance Administration, through the Federal Emergency Management Agency in a scientific and engineering report entitled "The Flood Insurance Study for the City of Reno," dated September 30, 1994, with an accompanying flood insurance rate map, which is hereby adopted by reference and declared to be a part of this chapter. The flood insurance study is on file at the city engineer's office, 450 Sinclair Street, Reno, Nevada 89505.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.050. Compliance.

No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this chapter and other applicable regulations.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.060. Abrogation and greater requirements.

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This chapter is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this chapter and another chapter, easement, covenant, or deed restriction conflict or overlap, whichever imposes the more stringent requirements shall prevail.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.070. Interpretation.

In the interpretation and application of this chapter, all provisions shall be considered as minimum requirements, shall be liberally construed in favor of the city, and shall be deemed to neither limit nor repeal any other powers granted under state statutes.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.080. Warning and disclaimer of liability.

The degree of flood protection required by this chapter is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. This chapter does not imply that land outside flood hazard areas or limited flooding areas or uses permitted within such areas will be free from flooding or flood damages. This chapter shall not create liability on the part of the city, any officer or employee thereof, or the Federal Insurance Administration, for any flood damages that result reliant on this chapter or any administrative decision lawfully made thereunder.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.090. Letter of map amendment.

(a) If an owner or developer believes his or her property to be inappropriately designated as being in a flood hazard area (zone A), or an area of limited flooding (shaded X) on the flood insurance rate map, he or she may appeal to the Federal Emergency Management Agency (FEMA). A successful appeal will show either that the property is higher in elevation than the base flood, or that the elevation of the base flood is incorrect. If the appeal is successful, the Federal Emergency Management Agency will provide the owner or developer with a letter of map amendment, which will exempt him or her from the requirements of this chapter and from the mandatory purchase of flood insurance.

(b) All appeals should be submitted to the city engineer for review and endorsement. The city engineer will transmit the appeals to the Federal Emergency Management Agency for its consideration. Appeals should include the

following:

- _____ (1) An actual stamped copy of the recorded plat of the property showing official recordation and proper citation, or a photocopy of the property's legal description (e.g., lot, block, and plot number, etc.), or a photocopy of the appropriate page of the county assessor's parcel map.
- _____ (2) A copy of the flood insurance rate map (FIRM) with the location of the property identified.
- _____ (3) Certification by an engineer or land surveyor stating:
 - _____ a. The type of structure.
 - _____ b. The elevation of the lowest finished grade adjacent to the structure.
 - _____ c. The elevation of the bottom of the lowest floor beam.
- _____ (4) When appealing the elevation of the base flood, a thorough technical hydrological study of the contributing area which will substantiate the appeal must be submitted and must be certified by an engineer.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

ARTICLE II. PERMIT

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Title 12 PUBLIC WORKS AND UTILITIES*

CHAPTER 12.24. FLOOD HAZARD AREAS*

ARTICLE II. PERMIT

Sec. 12.24.100. Building and/or grading permit required.

Sec. 12.24.100. Building and/or grading permit required.

Any person desiring to construct, locate, extend, convert, or alter a structure or alter any land within any flood hazard area (zone A) or limited flooding area (shaded X) must obtain a building and/or grading permit and none of the exemptions to the Uniform Building Code, Reno Municipal Code 14.04.010(a), shall apply to any such development. The city shall determine whether the proposed development is within any flood hazard area (zone A) or limited flooding area (shaded X). If so, the procedures and requirements set forth hereinafter must be satisfied before a building and/or grading permit is issued.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.110. Responsibilities of the owner or developer.

(a) The owner or developer shall submit the following information for review by the city:

_____(1) The elevation of the base flood at the site(s) proposed for development.

_____(2) In all A zones except zone AO, proposed elevation in relation to mean sea level, certified by an engineer or surveyor, lowest point of the lowest horizontal member of the lowest floor of all structures; in zone AO, elevation of proposed finish grade and proposed elevation of lowest floor of all structures.

_____(3) Proposed elevation in relation to mean sea level to which any structure will be floodproofed, certified by an architect, engineer or land surveyor.

_____(4) Certification by an engineer that the proposed development will comply with the provisions for flood hazard reduction required in article III.

_____(5) Description of the extent to which any watercourse will be altered or relocated as a result of proposed development, certified by an engineer. The flood-carrying capacity of the unaltered watercourse shall be maintained in the altered watercourse and certified to that effect.

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_____ (6) An operation and maintenance plan for any and all flood protection measures, such as levees, dams, dikes, reservoirs, etc.

(b) The owner or developer shall obtain a permit from the Nevada Division of State Lands before altering or relocating any waterway. This permit will be provided to the city.

(c) The owner or developer shall provide the city with certification by an engineer that all development was completed in compliance with the provisions of this chapter and all other applicable city codes.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4162, § 1, 10-22-91; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.120. Responsibilities of the city.

(a) The city will review all permit applications to determine:

_____ (1) That the requirements of this chapter have been satisfied.

_____ (2) That the site is reasonably safe from flooding.

_____ (3) That the cumulative effect of the proposed development when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point.

_____ (4) That the flood discharge exiting the development after construction is equal to or less than the flood discharge at the location prior to development and that no property upstream or downstream will be subject to increased flood levels or velocities as a result of the development.

(b) The city will maintain for public inspection and make available as needed for flood insurance policies all certifications required in this chapter.

(c) The city will ensure that adjacent communities, the state civil defense and the Nevada Lands Divisions are notified prior to any alteration or relocation of a watercourse and submit evidence of such notification to FEMA.

(d) The city will provide interpretations, where needed, as to the location of the boundaries of the flood hazard areas and limited flooding areas, and the elevation of the base flood.

(e) When base flood elevation data has not been provided in accordance with section 12.24.040, the city shall obtain, review and reasonably utilize any base flood elevation data available from a federal, state, or other source in order to administer article III. The city may require that the developer provide an engineering study which determines the base flood elevation.

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Title 12 PUBLIC WORKS AND UTILITIES*

CHAPTER 12.24. FLOOD HAZARD AREAS*

ARTICLE III. PROVISIONS FOR FLOOD HAZARD REDUCTION

Sec. 12.24.130. Standards of construction.

Sec. 12.24.130. Standards of construction.

In all flood hazard areas, the following standards are required:

——(1) *Anchoring:*

- a. All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the structure.
- b. All manufactured home units shall meet the anchoring standards of section 12.24.170(a).

——(2) *Construction materials and methods:*

- a. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.
- b. All new construction and substantial improvements shall use methods and practices that minimize flood damage.
- c. All elements that function as a part of the structure, such as furnace, hot water heater, air conditioner, etc., shall be elevated to one foot or more above the base flood elevation or depth number specified on the flood insurance rate map (FIRM).
- d. For all new construction and substantial improvements, fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or must meet or exceed the following minimum criteria: A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

(3) *Elevation and floodproofing:*

a. In a zone A, except zone AO, new construction and substantial improvement of any structure shall have the bottom of the lowest floor beam or basement floor elevated to one foot or more above the base flood elevation. Nonresidential structures will meet the standards in paragraph d, below.

b. New construction and substantial improvement to any structure in a zone AO shall have the bottom of the lowest floor beam or basement floor elevated from finish grade adjacent to the building at least one foot above the depth number specified on the flood insurance rate map (FIRM). If there is no depth number on the flood insurance rate map (FIRM), the bottom of the lowest floor beam or basement floor shall be elevated to a depth of at least two feet above the finished grade adjacent to the building. Nonresidential structures will meet standards in paragraph d, below.

c. New construction and substantial improvement to any structure in a "shaded X" shall have the bottom of the lowest floor beam or basement floor elevated to at least one foot above the highest existing grade adjacent to the building, or one foot above the highest top of curb on the street adjacent to the property, as approved by the city engineer. Nonresidential structures will meet standards in paragraph d, below.

d. Nonresidential construction shall either be elevated in conformance with paragraphs a, b, c, or together with attendant utility and sanitary facilities, be floodproofed as follows:

Zone A: At least one foot above the base flood elevation.

Zone AO: At least one foot above the depth number from finish grade adjacent to the building or where no depth number is given, two feet above the finish grade adjacent to the building.

Shaded X: At least one foot above the highest existing grade adjacent to the building, or one foot above the highest top of curb on the street adjacent to the property, as approved by the city engineer.

Examples of floodproofing include, but are not limited to:

1. Installation of watertight doors, bulkheads, and shutters.
2. Reinforcement of walls to resist water pressure.
3. Use of paints, membranes, or mortars to reduce seepage through walls.

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_____ 4. Addition of mass or weight to the structure to resist flotation.

_____ 5. Armor protection of all fill materials from scour and erosion.

_____ e. Manufactured homes shall meet the above standards and also the standards in section 12.24.170.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4162, § 2, 10-22-91; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.140. Standards for alluvial fans.

Areas subject to alluvial fan flooding have irregular flow paths that result in erosion of existing channels and the undermining of fill material. Those areas are identified on the flood insurance rate map (FIRM) as AO zones with velocities.

_____ (1) All structures must be securely anchored to minimize the impact of the flood and sediment damage.

_____ (2) All new construction and substantial improvements must be elevated on pilings, columns, or armored fill so that the bottom lowest floor beam is elevated at least one foot above the depth number.

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Title 12 PUBLIC WORKS AND UTILITIES*

CHAPTER 12.24. FLOOD HAZARD AREAS*

ARTICLE III. PROVISIONS FOR FLOOD HAZARD REDUCTION

Sec. 12.24.140. Standards for alluvial fans.

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Areas subject to alluvial fan flooding have irregular flow paths that result in erosion of existing channels and the undermining of fill material. Those areas are identified on the flood insurance rate map (FIRM) as AO zones with velocities.

- ____(1) All structures must be securely anchored to minimize the impact of the flood and sediment damage.
- ____(2) All new construction and substantial improvements must be elevated on pilings, columns, or armored fill so that the bottom lowest floor beam is elevated at least one foot above the depth number.
- ____(3) Use of all fill materials must be armored to protect the material from the velocity of the flood flow.
- ____(4) All proposals for subdivision development must provide a mitigation plan that identifies the engineering methods used to:
 - ____a. Protect structures from erosion and scour caused by the velocity of the flood flow.
 - ____b. Capture or transport flood and sediment flow through the subdivision to a point of deposition that will not create a health or safety hazard.
- ____(5) All manufactured homes shall be prohibited within the identified hazard area except within existing manufactured home parks or manufactured home subdivisions.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.150. Standards for utilities.

- (a) Electrical, heating, ventilation, plumbing, and air-conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

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(b) On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Cross references: Water service, Ch. 12.12; sewer service, Ch. 12.16.

Sec. 12.24.160. Standards for subdivisions.

(a) All tentative subdivision maps shall identify the flood hazard area, the limited flooding area, and the elevation of the base flood.

(b) All subdivision improvement plans shall identify the flood hazard area, the limited flooding area, the elevation of the base flood, the elevation of proposed structure(s), pads, and adjacent grade. If the site is filled above the base flood, the final pad elevation shall be certified by an engineer or surveyor and provided to the city.

(c) All subdivision proposals shall be consistent with the need to minimize flood damage.

(d) All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage.

(e) All subdivision proposals shall have adequate drainage provided to reduce exposure to flood damage as set forth in this chapter.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Cross references: Subdivisions, Ch. 18.08.

Sec. 12.24.170. Standards for manufactured homes, manufactured home parks and subdivisions.

(a) All new manufactured homes and additions to manufactured homes shall be set on permanent foundation by anchoring the unit to resist flotation, collapse, or lateral movement by one of the following methods:

____ (1) By providing an anchoring system designed to withstand horizontal forces of 15 pounds per square foot and uplift forces of nine pounds per square foot, and vertical (down) loading as required by NRS 489.251.

____ (2) By the anchoring of the unit's system, designed to be in compliance to the U.S. Department of Housing and Urban Development, "Manufactured Home Construction and Safety Standards"; or

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- _____(3) By bolting the frame or undercarriage to a reinforced, permanent foundation such as a retaining wall or storm wall used to set the unit.
- (b) Adequate surface drainage and access for a hauler shall be provided.
- (c) All manufactured homes shall be placed on pads or lots elevated on compacted fill or on pilings so that the lowest floor of the mobile home is at least one foot above the base flood level. If elevated on pilings:

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Title 12 PUBLIC WORKS AND UTILITIES*

CHAPTER 12.24. FLOOD HAZARD AREAS*

ARTICLE III. PROVISIONS FOR FLOOD HAZARD REDUCTION

Sec. 12.24.180. Floodways.

Sec. 12.24.180. Floodways.

(a) Located within flood hazard areas are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of floodwaters which carry debris, potential projectiles, and erosion potential, any encroachment, including fill, new construction, substantial improvements, and other development is prohibited in the floodway.

(b) If no floodway is identified, the permit applicant shall provide an engineering study for the project area that establishes a setback from the stream bank within which no encroachment of any new development will be allowed. Development occurring beyond the setback will be allowed only to the extent that the elevation of the base flood is not increased more than one foot at any point. The area reserved for conveyance between the stream channel and the setback shall be capable of discharging the base floodwaters without causing increased flood levels or velocities upstream or downstream.

(Ord. No. 3153, § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

Sec. 12.24.185. Closed intermittent lakes, restrictions.

Development within flood hazard areas of closed intermittent lakes shall be allowed only to the extent that the highest water surface elevation of the base flood is not raised. Any development that would cause an expansion of the limits of the area designated as A zone as shown on the FEMA maps shall require prior map amendment pursuant to RMC section 12.24.090.

(Ord. No. 3765, §§ 2, 3, 2-27-89)

ARTICLE IV. PENALTIES

Sec. 12.24.190. Penalties for violations.

The following penalties are fixed and imposed for the violation of this chapter:
chapter:

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(1) Any person who is convicted of violating any of the provisions of this chapter or of failing to comply therewith, or of violating or failing to comply with any order made thereunder, or of building in violation of any detailed statement of specifications or plans submitted and approved thereunder, or any certificate or permit issued thereunder, shall, severally for each and every such violation and noncompliance respectively, be punished by a fine not less than \$1.00 nor more than \$1,000.00 or be punished by imprisonment in the city jail not to exceed six months, or be punished by both fine and imprisonment.

(2) The imposition of one penalty for any violation of this chapter shall not excuse the violation or permit it to continue; and all persons convicted of violating any of the provisions of this chapter shall be required to correct or remedy such violations or defects within a reasonable time; and when not otherwise specified, each ten days that prohibited conditions are maintained constitutes a separate offense.

(3) The application of the above penalty shall not preclude the enforced removal of prohibited conditions.

(4) The enforced removal of prohibited conditions shall not preclude the application of the above penalty.

(Ord. No. 3153 § 1, 1-9-84; Ord. No. 3529, § 1, 6-22-87; Ord. No. 4418, § 1, 8-23-94)

CHAPTER 12.26. RESERVED*

***Editor's note:** Ord. No. 3700, § 1, adopted July 11, 1988, repealed chapter 12.26, §§ 12.26.010--12.26.040, pertaining to traffic engineer, as derived from Ord. No. 3608, § 1, adopted Nov. 23, 1987.

CHAPTER 12.28. MAINTENANCE DISTRICTS OF LANDSCAPING, PUBLIC LIGHTING, AND SECURITY WALLS

[Art. I. In General]

Sec. 12.28.010. Definitions

Sec. 12.28.020. Authority

Sec. 12.28.030. Applicability

Sec. 12.28.040. Procedure for applying to the city to create a maintenance district

Sec. 12.28.050. City's determination to form a maintenance district

Sec. 12.28.060. Dissolution of a maintenance district

Sec. 12.28.120. Severability

18.06.805. Wetlands and stream environments.

A. *Purpose.* The purpose of this section is to establish standards for the review of development proposals within wetlands, stream environments and areas of significant hydrologic resources to:

1. Improve area water quality;
2. Retain natural flood storage capacity;
3. Protect rare and endangered plant and animal species; and
4. Enhance the aesthetics of the community.

B. *No loss of streams and wetlands.*

1. There shall be no net loss of wetlands, stream environments, playas, spring fed stands of riparian vegetation, and non-404 wetlands in the city, in terms of both acreage and value. The goal of no net loss shall be achieved in one or more of the following ways:

- a. Designation of lands for resource or open space use;
- b. Avoidance of these areas for development;
- c. Mitigation of impacts on site; or
- d. Mitigation off-site.

2. No building permit shall be issued to erect or construct any structure; no grading permit or drainage plan shall be approved; and no tentative subdivision map, parcel map or special use permit shall be approved, unless the requirements of this section are met.

C. *Administrative manual.* The "Administrative Manual for Implementation of the Wetland and Stream Environment Policy" is adopted for the purpose of providing guidance in the administration of this chapter. This manual may be amended only after a public hearing by the planning commission and adoption of a resolution by the city council. It shall be available from the community development and engineering departments.

D. *Location of significant hydrologic resources.* The map, incorporated by reference, entitled "Potential Wetlands, Stream Environments and Regionally Significant Hydrologic Resources Map" depicting significant hydrologic resources is adopted. Potential stream environments are listed in the "Administrative Manual for Implementation of the Wetland and Stream Environment Policy" as a companion document to the map. It shall be available from the community development and engineering departments.

E. *Requests for development permits within or adjacent to significant hydrologic*

resources.

1. *Development permit.* The term "development permit" as used in this section, includes:

- a. Building permits, grading permits, drainage plans;
- b. Tentative subdivision or parcel map applications;
- c. Master plan amendments, zoning map amendments, special use permits.

2. *Requirements for development permit application.* Developments which include or are within 150 feet of areas depicted on the map as significant hydrologic resources shall be accompanied by technical surveys sufficient to determine:

- a. If a significant hydrologic resource is present and its classification and value;
- b. The need for protection of the resource; and
- c. The appropriate design techniques or mitigation measures which should be incorporated into the development.

F. *Waiver of technical surveys.* The requirement for a technical survey may be waived by the administrator when the landowner or developer sets aside as open space, any lands involved in the development permit request which have been identified on the potential wetland, stream environment and regionally significant hydrologic resources map.

G. *Technical surveys.*

1. Technical surveys should be based on field methods described in the Federal Delineation Manual. On the basis of the technical survey, lands which do not meet the definition of federally significant hydrologic resources, or regionally significant hydrologic resources found in the administrative manual shall be removed from the map as areas of concern.

2. Lands which only meet the definition of potential mitigation sites shall be so noted on the map, and shall not trigger additional surveys or protection at the time of development unless voluntarily protected through the use of incentives, or other desires of the property owner, actively targeted for off-site mitigation efforts or acquisition by a public or non-profit organization.

H. *Exemptions.* The following developments shall be exempt from this section:

1. *No over-covering of additional land.* Development projects, or permit applications which do not involve over-covering of additional land area (i.e. signs, interior remodels, master plan amendments to open space).

2. *Projects previously approved.* Development projects which have been approved, or are substantially approved prior to the effective date of this chapter as determined by the administrator or designee.

3. *Farming activities.* Normal farming activities as described in Section 404(f) of the Clean Water Act as amended from time to time.

4. *Fully developed property.* Lands which have been entirely developed with buildings and pavement, and/or altered to such an extent that significant hydrologic resources are not present.

5. *Certain lots or parcels.* Development on lots or parcels in existence prior to September 24, 1991, shall not be required to meet the requirements of this chapter provided that all of the following criteria are met:

a. The impact to the stream environment, playa, spring fed stand of riparian vegetation or non-404 wetlands is one-half acre or less;

b. The property is adjacent to urban or suburban development along 75 percent of its perimeter; and

c. Off-site mitigation, or in-lieu fees, are provided in accordance with the "Administrative Manual for Implementation of the Wetland and Stream Environment Policy."

I. *Mitigation.*

1. *Mitigation plan required.* Negative impacts to wetlands, stream improvements, playas, spring fed riparian and non-404 wetlands shall be mitigated. A detailed mitigation plan in compliance with the administrative manual shall be submitted when a federally or regionally significant hydrologic resource is proposed or expected to be destroyed or substantially altered by development.

2. *Approval of plan.* The mitigation plan, including an erosion control and landscape plan, shall be approved by the administrator prior to final action on the primary development permit. Once approved, the mitigation plan shall be considered a condition of approval and subject to enforcement.

(Ord. No. 5189, § 1, 9-26-00)

18.06.806. Drainageways.

A. *Purpose.* The purpose of this section is to establish standards for the review of development proposals within major drainageways to:

1. Preserve major drainageways as open space and recreational space and to save and improve these public resource areas for future generations;
2. Ensure the safety of people and property by providing for drainage of stormwaters;
3. Maintain, preserve or enhance the quality of the water in both the Truckee River and Stead basins;
4. Maintain or improve wildlife habitats, native vegetation, and natural terrain;
5. Reduce the need for the expenditure of public funds to remedy or avoid flood hazards, erosion, or other situations caused by inappropriate alterations of natural watercourses;
6. Provide open space land, especially in environmentally sensitive areas, with development where high densities require new approaches and attention to open space needs;
7. Improve or enhance wildlife corridors in urban areas to maintain the quality of life and the ecological balance of the community; and
8. Assure that drainageways are used for public access and recreational facilities, where determined appropriate.

B. *Applicability.* The following performance standards shall apply to all zoning districts:

A "major drainageway" is a drainageway which drains a land area of 100 acres or more. Some of these are shown on the major drainageways plan map. Others may exist that are not shown on this map (i.e. in recently annexed areas). Within "major drainageways" there are three types of drainageways:

"Natural" - drainageways which have not been or should not be altered by man or which have significant vegetation or which by their nature provide for filtration or impoundment of stormwaters.

"Disturbed" - drainageways which have been or will be significantly graded, filled or otherwise altered by man.

"Landscaped" - drainageways which have been or will be improved with landscaping and may include turf or non-native plant species. These drainageways are generally part of a park or planned unit development and are designed to address aesthetics, and should also include water quality,

stormwater management and recreation functions where appropriate.

C. *General provisions.*

1. Unless otherwise specified though the approval of a special use permit, all drainageways shall be the width of the 100-year floodplain with a minimum 15-foot wide area on each side.
2. Maintenance of the drainageways shall be performed by the property owner including but not limited to, removal of trash, clearing of sediments and debris, and clearing of weeds.
3. Soils, grading spoils, rubbish, abandoned autos and auto bodies, etc., which impair the usefulness or capacity of the drainageway as a water storage and transport area, shall not be introduced into the drainageway. In cases of severe destruction (cannot be remedied by general maintenance) of the drainageway's vegetation and capacity as a water storage and transport area, the property owner or the person determined to have disrupted the channel will be required to rehabilitate the drainageway back into a stable condition comparable to pre-disturbance capacity.
4. There shall be no net loss of wetlands, stream environments, playas, stream fed riparian and non-404 wetlands in terms of both acreage and value.
5. Drainageways will not be piped and/or filled in unless there are no alternatives (i.e. re-route or bridge).
6. Engineered improvements to the drainageway shall emphasize reducing erosion, improving water quality, and controlling velocities.

D. *Natural drainageways.*

1. All natural drainage courses within project sites that are shown on the major drainageway plan or the wetland and stream environment policy must be preserved as open space.
2. All natural drainageways shall remain undisturbed except for enhancements to existing vegetation.
3. No grading shall occur within a natural drainageway except for that which is required for the construction of bicycle/pedestrian paths or necessary roadway or utility crossings.
4. Whenever development comes in contact with a natural drainageway, the drainageway shall be marked and restricted as a non-construction area during construction (i.e. no stock piling of materials, no parking of equipment, no dumping of refuse, soils, or rocks, and no construction roads). Sediment fencing or other suitable treatment shall be employed to protect the channel from sediment loaded runoff into the drainageway.

5. The fencing of properties adjacent to the natural drainageway shall be no more than 6 feet in height and shall be black, green, or brown chain link, wooden split-rail, ornamental iron or an acceptable alternative. Such alternative treatment shall be described in detail at the time the project is presented to the planning staff. Slats will not be allowed in the chain link fence; however vegetative screening is permissible. Solid wooden fences are strongly discouraged adjacent to drainageways. Any development adjacent to a drainageway shall submit a detailed fencing plan for approval by the administrator or decision making body.

6. Native and drought-tolerant or riparian vegetation, whichever is deemed most appropriate, shall be used in the natural drainageway.

7. If channelization of a natural drainage course is deemed necessary by the city, natural materials must be utilized.

E. *Disturbed drainageways.*

1. Native and drought-tolerant or riparian vegetation, whichever is deemed most appropriate, shall be used in the disturbed drainageway.

2. In the event that a drainageway is disturbed during development activity, (e.g. stripping of natural vegetation), the developer will be required to:

a. Perform analysis of soils including pH texture, depth, type, and compaction;

b. Identify the direction of exposure (i.e. southern) of all surfaces and slopes of the drainageway;

c. Prepare discussion of the characteristic behavior of water and moisture in the drainageway;

d. Except for drainageways designated to be "landscaped", prepare listing of diversified plant communities, with an emphasis on shrubs and forbs and consideration of wildlife needs, proposed for planting in the drainageway and the methods for irrigation;

e. Submit above with any other information explaining process by which the drainageway will be enhanced or the natural condition reestablished for review and approval by planning staff;

f. If the rehabilitation or modification is deemed acceptable, the owner/developer shall deposit a bond or letter of credit in the amount determined by the city to assure that plantings within the natural drainageway will be permanently established. The security shall remain in effect until the city determines that plantings have been permanently established, or for a period of not more than four years; and

g. In the event the city determines that rehabilitation and plantings have not been permanently established within the four-year period following

construction, the city will determine the cost to replace and permanently establish such plantings. Such costs shall be deducted from the security and retained by the city for rehabilitating the drainageway. Any remaining security will be returned to the owner/developer.

(Ord. No. 5189, § 1, 9-26-00)

EXPLANATION: Matter underlined is new; matter in brackets [] is material to be omitted.

BILL NO. 5970

ORDINANCE NO. 5430

AN ORDINANCE TO AMEND CHAPTER 18.06 OF TITLE 18 OF THE RENO MUNICIPAL CODE ENTITLED "ZONING" BY ADDING LANGUAGE TO SECTION 18.06.400 (OVERLAY AND SPECIAL PURPOSE DISTRICTS) IN ORDER TO: 1. CREATE A COOPERATIVE PLAN OVERLAY DISTRICT IN ACCORDANCE WITH THE SETTLEMENT AGREEMENT FOR DISTRICT COURT CASE NUMBER CV02-03469, WASHOE COUNTY V. TRUCKEE MEADOWS REGIONAL GOVERNING BOARD; 2. ADOPT LIGHT STANDARDS TO APPLY WITHIN THE COOPERATIVE PLAN OVERLAY DISTRICT; 3. ADOPT STANDARDS FOR SIGNIFICANT HYDROLOGIC RESOURCES WITHIN THE COOPERATIVE PLAN OVERLAY DISTRICT; 4. ADOPT LOT ADJACENCY STANDARDS WITHIN THE COOPERATIVE PLAN OVERLAY DISTRICT; 5. ADOPT GRADING STANDARDS WITHIN THE COOPERATIVE PLAN OVERLAY DISTRICT; 6. ADOPT RIDGELINE DEVELOPMENT STANDARDS WITHIN THE COOPERATIVE PLAN OVERLAY DISTRICT; AND 7. ADOPT CRITERIA FOR EVALUATION OF MASTER PLAN AND ZONING AMENDMENTS WITHIN THE COOPERATIVE PLAN OVERLAY DISTRICT; TOGETHER WITH OTHER MATTERS PROPERLY RELATING THERETO.

SPONSORED BY: RENO CITY PLANNING COMMISSION

THE CITY COUNCIL OF THE CITY OF RENO DO ORDAIN:

SECTION 1. Chapter 18.06.449 of the Reno Municipal Code is hereby created; the same to read as follows:

(a) Site compatibility and adjacency standards.

(1) Introduction. In cooperative planning areas applications for development within 500 feet of sphere of influence boundaries shall be subject to the following regulations, which will be contained within: the Washoe County

Development Code; the Reno Municipal Code; and the Sparks Municipal Code. Amendments and variances to these provisions shall be subject to cooperative planning when the property is located in a cooperative planning area.

(2) Purpose. The purpose of this section is to define adjacency standards for different types and intensities of development.

(3) Applicability. The standards established in this article apply to:

a. All C cooperative Planning Areas, except for 18.06.449 (4) through 18.06.449 (8), which only apply to new development proposed in cooperative planning areas within 500 feet of the existing built environment, or within 500 feet of platted lots. Wherever, in the opinion of all affected zoning administrators, a natural barrier (e.g., ridgeline, river, open space, or natural terrain change) buffers the existing built environment or platted lots from the new development, these standards shall not apply. 18.06.449 (4) through 18.06.449 (8) shall not apply where the property is within an adopted center or corridor plan that includes adjacency standards and was prepared in accordance with the cooperative planning process.

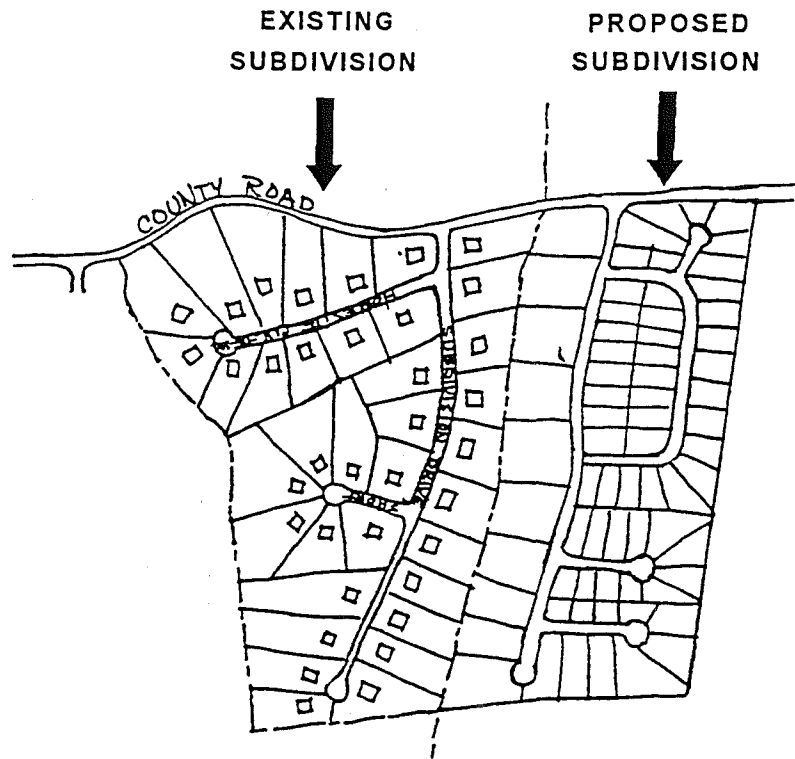
(4) Density. To the extent that land in such areas affected by this standard would be buildable under federal, state, or local regulations, the full eligible density may be utilized on other locations on the site.

(5) Lot Adjacency Standards—Large-lot single family residential (SFD)-to-SFD. To provide adequate transition between varying sizes of single-family residential parcels designated one dwelling unit per 5 acres to one dwelling unit per acre, the minimum adjacent lot size shall be one acre.

(6) Lot Adjacency Standards--Single Family Residential (SFR)-to-SFR. To provide adequate transition between varying sizes of single-family residential parcels designated as one unit per acre or greater density, one of the following methods shall be utilized::

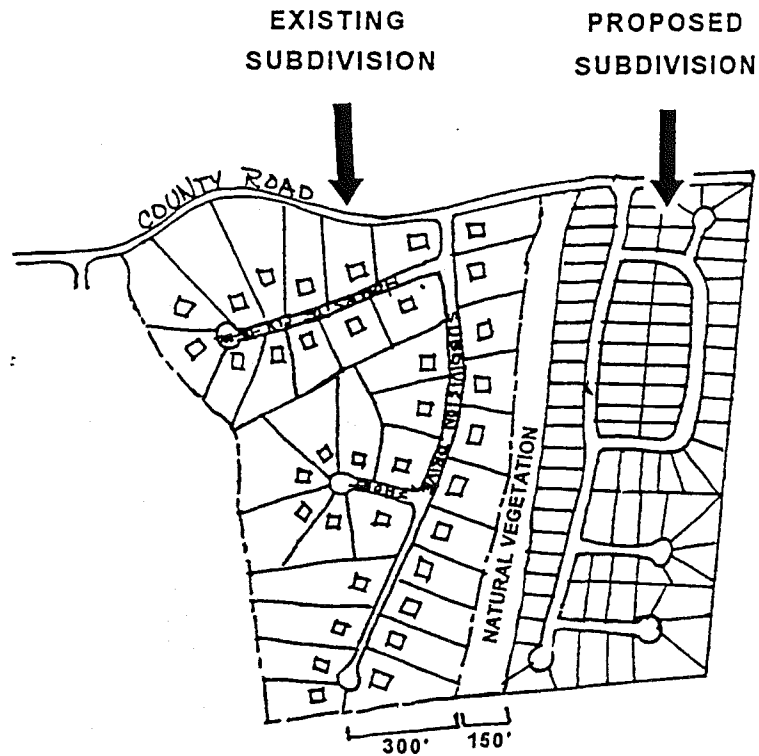
a. Parcel Size Matching. The minimum lot sizes identified in the land use designation of the immediately adjacent developed subdivision shall be maintained at the edge of the proposed subdivision as depicted in Figure 4-2.

Figure 4.2
PARCEL SIZE MATCHING



- b. Buffering. A "buffer zone" shall be established. When the buffer remains natural vegetation, the buffer zone shall be equivalent to one hundred (100) feet or one-half of the average minimum lot depth of the adjoining developed property, whichever is greater (see Figure 4.3). The buffer zone may be common open space for the proposed subdivision and may include paths, trails or other subdivision amenities

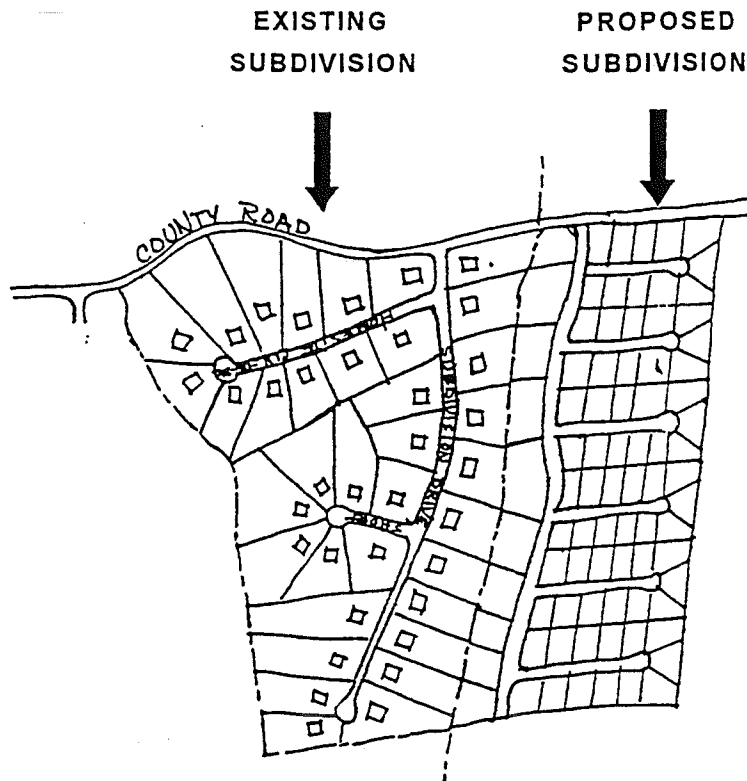
Figure 4.3
BUFFERING



or

- c. Yard Matching. The rear yard widths of the proposed development shall match the rear yard widths of the existing development as depicted in Figure 4.4.

Figure 4.4
YARD MATCHING



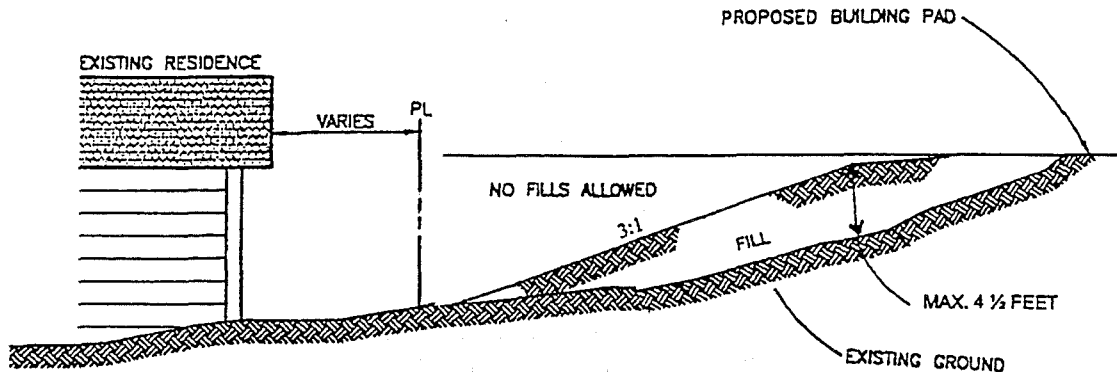
In addition, lots proposed within a new subdivision that share a common property line with an established subdivision shall not contain structures that exceed the maximum height of the adjacent equivalent zoning district or land use district.

- (7) Lot Adjacency Standards—Multi-family residential (MFR)-to-SFR. To provide adequate transition between multi-family and single-family residential parcels, the development code standards of the closest cooperative planning agency, City of Reno or City of Sparks shall apply.
- (8) Lot Adjacency Standards—Residential (SFR and MFR)-to-Non-residential. To provide adequate transition between non-residential parcels and MFD parcels, and between non-residential parcels and SFD the development code standards of the closest cooperative planning agency, City of Reno or City of Sparks shall apply.
- (9) Lot Adjacency Standards—Non-residential-to-Non-residential. To provide adequate transition between varying uses on parcels designated non-residential, the side and rear setbacks shall be as required by the Washoe County Code.

(10) Grading. Grading for subdivision improvements, minor or major special use permits, or other discretionary or building permits adjacent to lots up to five (5) acres in size shall:

- a. Not result in slopes on fill in excess of, or steeper than, three horizontal to one vertical (3:1).
- b. For a distance of fifty (50) feet from the shared common property line with an existing residence (see Figure 4.5), fills shall not differ from the natural grade by more than forty-eight (48) inches and may not exceed a slope of three horizontal to one vertical (3:1).

Figure 4.5
GRADING



- c. Not results in slopes that differ from the natural grade by more than 20 feet within 500 feet of a shared common property line with existing development.
- d. Be limited on cut slopes to equal to, or less than, a slope of three to one (3:1). However, major cut slopes, in excess of one hundred (100) lineal feet, shall be permitted when the cut slopes include stepped-back structural containment in the form of benches and terraces that include landscaping on the terraces. Rockery walls used to create benches are limited to a maximum vertical height of six (6) feet. The resulting terraces shall include a minimum horizontal width of six (6) feet to provide for the landscaped bench. An exception may be allowed for cuts into stable rock, supported by a geotechnical report.

- e. Utilize a gradual transition or "rounding or contouring" of the manufactured slope at the intersection of a manufactured cut or fill slope and a natural slope.
 - f. Visually integrate all slope faces (cut or fill) into the natural terrain by a gradual transition or "contouring/rounding" of the man-made land forms into the natural terrain to add sinuosity to the grading of the site.
 - g. Prohibit the use of riprap and gabions as a mechanical stabilization for cut slopes, except where essential for safe access, for passage within the rights-of way of public roads and for storm drainage control device(s).
 - h. Address compatibility with adjacent lots, demonstrate visual impacts to the community, and propose design criteria, landscaping and buffering to mitigate impacts on adjacent property owners and the community's scenic character, if the applicant proposes cut, fills or slopes in excess of the requirements. Alternative materials and procedures supported by adequate engineering documentation may be approved, provided that they meet the aesthetic intent of these requirements and incorporate mitigation. All mitigation shall be reviewed and approved by the zoning administrators of affected local governments.
- (11) Ridgelines. Visually important ridgelines, as identified on the July 1997 map of the Washoe County Regional Open Space Program and also those significant ridgelines identified (as of February 14, 2003) in the Washoe County Forest Area Plan, the Washoe County North Valleys Area Plan and the Washoe County Verdi Area Plan, shall be considered in applications for master plan and zoning map amendments. Applications for master plan and zoning map amendments shall identify how the project furthers the goal of preserving the aesthetic appearance of important ridgelines and shall include information related to the following issues:
- a. Potential developable areas (0-30 percent slope) shall be identified;
 - b. The existing landscape of such slope areas shall be described; and
 - c. Information shall be provided and provisions shall be made to mitigate the visual impact of the project from developed areas, as follows:
 - 1. A minimum of three (3) sight-line analyses shall be provided from the existing built environment, generally within ¼ to ½ mile of the project site. Staff members of the local

governments involved in the cooperative plan shall jointly select the locations for the sight-line analyses to represent typical views of the project site from nearby neighborhoods;

2. The maximum height, placement, design and coloration of structures shall be identified to minimize visual impacts of areas identified in the sight-line analyses; and
3. Minimum setbacks and height limits for structures on the back sides of slopes shall be identified to minimize visual impacts of areas identified in the sight-line analyses.

(12) Light and Glare. This section sets forth criteria and standards to mitigate impacts caused by lighting and glare.

a. Light. All light sources shall be located and installed in such a way as to prevent spillover lighting onto adjoining properties. The following provisions shall apply to all existing and proposed development:

1. Any lighting facilities shall be so installed as to reflect away from adjoining properties. Covers must be installed on all lighting fixtures and lamps must not extend below the bottom of the cover.
2. Light standard in or within one hundred (100) feet of residential zones shall not exceed twelve (12) feet in height. Additional standard height may be permitted by the Director of Community Development provided such lights are a sharp cutoff lighting system.
3. No permanent rotating searchlights shall be permitted in any regulatory zone, except that an administrative permit may be issued by the Zoning Administrator for a period not to exceed three (3) days for a temporary searchlight. The administrative permit shall be limited to a maximum of three (3) times in anyone (1) calendar year.

b. Lighting Design. The style and intensity of lighting shall consider not only function and appearance, but shall reflect the existing character of surrounding areas and shall replicate natural light as much as possible.

c. Glare. Reflected glare on nearby buildings, streets or pedestrian areas shall be avoided by incorporating overhangs and awnings, using non-reflective building materials for exterior walls and roof

surfaces, controlling angles of reflection, and placing landscaping and screening in appropriate locations.

- d. Interior Lighting. Where residential uses abut non-residential uses, interior lighting of the non-residential uses shall be controlled at night through the use of timers, window blinds, or other acceptable means. This provision shall apply to all existing and proposed development.
- e. Conflict with Other Portions of the Development Code. Where another provision of the Development Code may conflict with the provisions of this section, the more restrictive provision shall control.

(b) Significant hydrologic resources.

(1) Purpose. To regulate development activity within and adjacent to perennial streams to ensure that these resources are protected and enhanced. This article establishes standards for use of land in "critical stream zone buffer area" and "sensitive stream zone buffer area" to preserving and protecting perennial streams to implement a policy of "no net loss" of significant hydrological resource size, function and value. The purpose of requiring perennial stream buffer areas is to recognize that many uses directly adjacent to a hydrologic resource may compromise the integrity of the resource through various negative features endemic to the specific use. Negative activities in the buffer areas may impact the quality or quantity of the existing hydrology, soil characteristics, vegetation communities or topography thereby jeopardizing the resource's functions. The intent of these regulations is to protect the public health, safety and welfare by:

- a. Preserving, protecting and restoring the natural functions of existing perennial streams;
- b. Reducing the need for the expenditure of public funds to remedy or avoid flood hazards, erosion, or other situations caused by inappropriate alterations of streams;
- c. Ensuring the natural flood control functions of perennial streams including, but not limited to, stormwater retention and slow-release detention capabilities are maintained;
- d. Ensuring stormwater runoff and erosion control techniques are utilized to stabilize existing stream banks, reduce downstream sediment loading, and ensure the safety of people and property;

- e. Ensuring the natural water quality functions of perennial streams including, but not limited to, pollution filtering, groundwater recharge, nutrient storage, nutrient recycling capabilities, and sediment filtering capabilities are not impacted by existing and proposed developments;
- f. Encouraging common open space developments to avoid hazardous or environmentally sensitive areas, protect important habitat and open space areas, and minimize impacts on groundwater recharge areas;
- g. Establishing buffer areas around all significant hydrological resource areas to ensure the resource is not jeopardized or degraded by adjacent offsite development activity;
- h. Ensuring a no net loss of value, acreage and function of each different significant hydrological resources is adhered to; and
- i. Identifying, establishing and managing perennial streams as mitigation sites for destroyed or degraded hydrological resources.

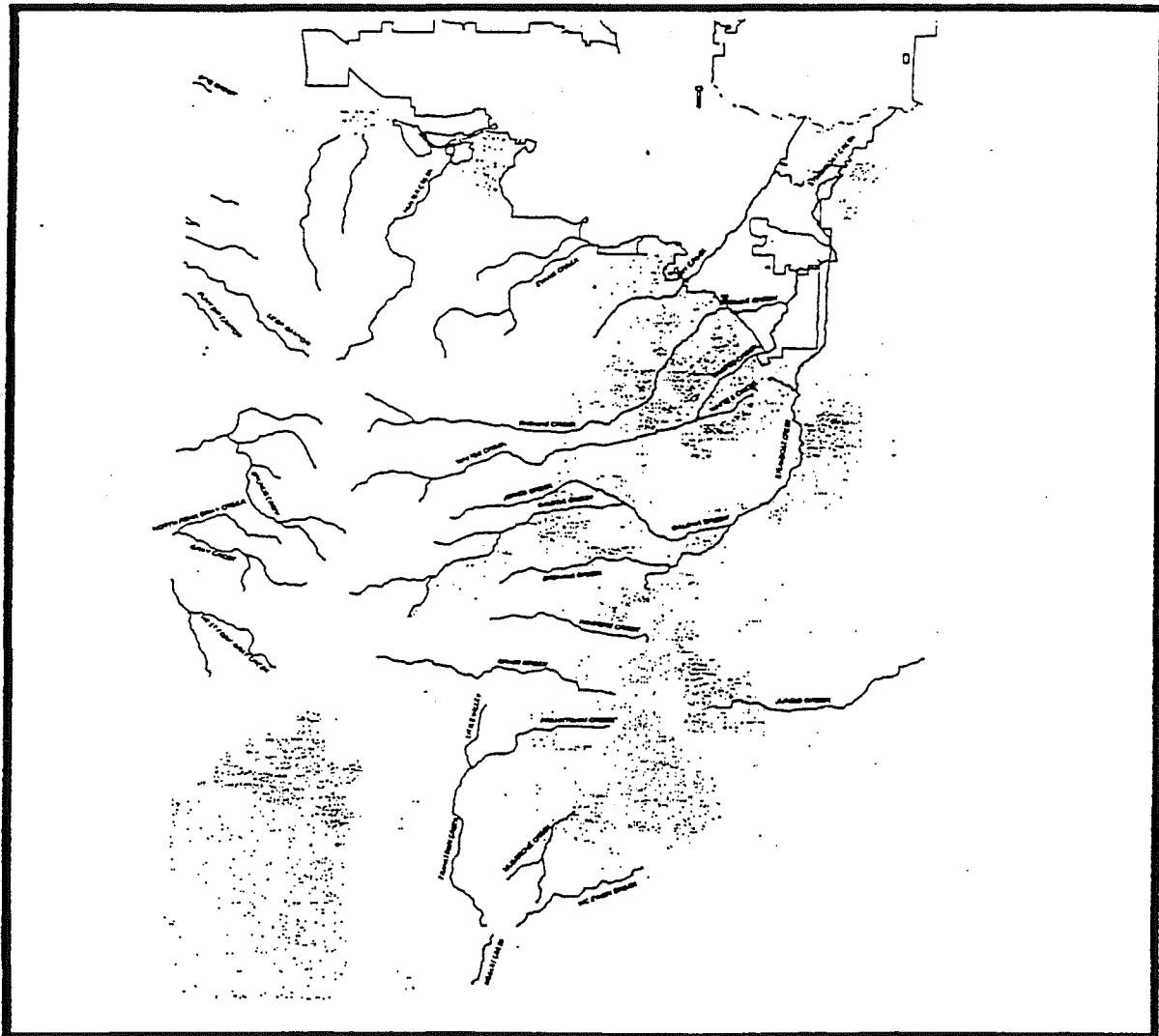
(2) Applicability. The provisions set forth in this article shall apply as follows:

- a. Area of Applicability. All properties containing either perennial streams, or an established buffer area surrounding one of the perennial streams, as identified on Map 4.1, Significant Hydrologic Resources. All new development that requires permitting or review shall be reviewed for compliance with the significant hydrologic resource standards. No variance to the significant hydrologic resource standards shall be processed or approved. Refer to 18.06.449(b)(9) Modification of Standards.





In determining the location of the above-designated streams, staff shall use:

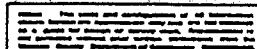
- 1. Published United States Geological Service (USGS) topographic maps, either in 7.5 minute or 15 minute series, to assist in the interpretation of location of significant hydrologic resources.

Map 4.1



SIGNIFICANT HYDROLOGIC RESOURCES

-  PERENNIAL STREAMS (WCDCA ARTICLE 418)
-  PARCELS
-  WATER BODIES
-  RENO - SPARKS CITY LIMITS



0 6000 12000
SCALE IN FEET



Department of
Community
Development
**WASHOE COUNTY
NEVADA**

Post Office Box 11130
Reno, Nevada 89520
(775) 328-3600



SOURCE: DEPARTMENT OF COMMUNITY DEVELOPMENT / TRUCKEE MEADOWS REGIONAL PLANNING AGENCY

DATE: NOVEMBER 2000

2. A determination of the location of a perennial stream resulting from a delineation of wetlands and/or waters of the United States made by the United States Army Corps of Engineers under the provisions of Section 404 of the Federal Clean Water Act, shall be considered the perennial stream crossing any parcel of land.
 3. Field survey by land surveyor or professional engineer licensed and qualified to perform a survey.
- b. Relationship to Other Restrictions. The requirements established in this article are not intended to repeal, abrogate, supersede or impair any existing federal, state or local law, easement, covenant or deed restriction. However, if this article imposes greater or more stringent restrictions, the provisions of this article shall prevail. Specifically, if an applicant also acquires authorization under Section 404 of the Clean Water Act from the United States Army Corps of Engineers, the applicant shall meet any greater or more stringent restrictions set forth in this article in addition to and independent of the restrictions of such permit.
 - c. Application of this Article to the Truckee River. The provisions of this article do not apply for development along the Truckee River from the California/Nevada state line to the terminus in Pyramid Lake.
 - d. Impact on Land Use Designations. The provisions of this article shall neither be used as justification for changing a land use designation nor be used to reduce the development density or intensity otherwise allowed by the land use designation of the property, subject to the provisions and limitations of this article.
- (3) Exemptions. The following are exempt from the provisions of this article:
- a. All existing allowable or permitted use of any single family, detached, residential structure, including interior renovation, and replacement upon catastrophic damaging event, and all related accessory uses (e.g. garages, barns, corrals, storage sheds) constructed or under construction with a valid building permit prior to (effective date of this ordinance).
 - b. All projects with an approved special use permit, any map to divide land, design standards handbook and/or development agreement, currently active (not expired) and having obtained approval or having submitted a valid discretionary permit application prior to (effective date of this ordinance).

(4) Perennial Streams Buffer Areas. Perennial stream buffer areas are established to provide adequate setbacks and land use controls to ensure water quality functions of each perennial stream are not jeopardized through development activity. To limit significant impacts adjacent to hydrological resources, two (2) buffer areas are hereby established-the "critical stream zone buffer area" and the "sensitive stream zone buffer area". All proposals to develop uses within the critical stream zone buffer area and/or the sensitive stream zone buffer area shall submit a site plan with precise dimensions depicting the boundary line for the buffer areas.

a. Critical Stream Zone Buffer Area. The critical stream zone buffer area shall be all land and water surface within thirty (30) feet from the centerline of the perennial stream. The centerline of the stream shall be determined by either survey from a licensed surveyor or by determination of the thalweg (i.e. the line connecting points of maximum water depth) from a topographic survey, or appropriate USGS 7.5 minute topographic map covering the site.

b. Sensitive Stream Zone Buffer Area. The sensitive stream zone buffer area shall be all land and water surface between the critical stream zone buffer area boundary of thirty (30) and one hundred fifty (150) feet from centerline or thalweg of the perennial stream.

(5) Critical Stream Zone Buffer Area Development Standards. All development in the critical stream zone buffer area shall be subject to the following standards:

a. Allowed Uses. Uses allowed within the critical stream zone buffer area are limited to those uses necessary for providing community services such as managing and conserving natural resources, and providing recreational and educational opportunities, including:

1. Weed control consistent with state and County laws.

2. Mosquito abatement consistent with state and County laws.

3. Conservation or preservation of soil, water, vegetation, fish and other wildlife habitats.

4. Outdoor recreation activities such as fishing, bird watching, hiking and swimming.

5. Education and scientific research including, but not limited to, water quality monitoring and stream flow gauging.
6. Maintenance of an existing public or private road, driveway, structure or facility, including drainage facilities, water conveyance structures, dams, fences, trails, and any public or private utility facility used to provide transportation, electric, gas, water, telephone, telecommunication, or other including individual service connections. Written notice shall be provided to the Department of Community Development at least fifteen (15) days prior to the commencement of work, and all impacts to the critical stream zone buffer area are minimized and disturbed areas are immediately restored to their natural state.
7. Landscape improvements and maintenance of native vegetation is allowed within an established critical stream zone buffer area including the pruning of trees and the removal of dead vegetation and debris. Ornamental landscaping that would require fertilizer or pesticide applications for growth and maintenance is not permitted within the critical stream buffer zone area.
8. Landscaping area requirements may be satisfied by using the natural, undisturbed or restored critical stream zone buffer area to count towards the required area to be landscaped for new residential, civic, commercial, industrial or agricultural use types. Parking and loading areas on the developed portion of the site shall continue to require landscaping. Open space requirements may be satisfied by using the natural, undisturbed or restored critical stream zone buffer area.
9. Continuation of existing agricultural operations such as the cultivation and harvesting of hay or pasturing of livestock, or change of agricultural practices such as the relocation of an existing pasture fence, which has no greater impact on perennial stream water quality.
10. Perimeter fencing on a property boundary with a valid building permit pursuant to approval by the County

Engineer to ensure that obstruction to stream flows has been avoided.

b. Permitted Uses Requiring a Planning Commission Approved Special Use Permit. Subject to the regulatory zone in effect for the property establishing the uses, the following use types may be permitted in the critical stream zone buffer area pursuant to a special use permit being issued by the Reno City Planning Commission and this article. Any construction in the critical stream zone buffer area will require submission of a grading plan showing compliance with applicable best management practices to minimize stream bank and stream bed erosion. The grading plan shall also be designed to prevent construction drainage and materials from increasing sedimentation impacts to the stream environment and to minimize impervious surfaces.

1. Construction or enlargement of any public or private roads, driveway, structure or facility including drainage facilities, water conveyance structures, dams, trails and any public or private utility facility used to provide transportation, electric, gas, water, telephone, telecommunication or other services.

2. Civic Use Types. Civic uses classified under the utility services, nature center, active recreation, passive recreation and safety services use types may be permitted in the critical stream zone buffer area.

c. Prohibited Uses. Due to the incompatible nature of certain uses (i.e. ground disturbance, untreated water discharge, hazardous materials, chemical contamination, scale of use, traffic, etc.) and the potential negative impacts on the perennial stream and adjoining critical stream zone buffer area, all new construction and development uses not listed in either the allowed or permitted section of this article shall not be established in the critical stream zone buffer area.

1. Residential. Civic. Commercial. Industrial and Agricultural Use Types. All new residential, civic, commercial, industrial and agricultural use types not listed as allowed or permitted uses are prohibited in the critical stream zone buffer area. Specifically prohibited industrial uses include:

(i) Aggregate facilities -permanent.

(ii) Aggregate facilities -temporary.

(iii) Energy production.

(iv) General industrial- heavy.

(v) Inoperable vehicle storage.

(vi) Mining operations.

(vii) Salvage yards.

(viii) Wholesaling, storage and distribution -heavy.

2. Parking and Ornamental Landscaping. All new parking and ornamental landscaping areas to fulfill the minimum requirements for new residential, civic, commercial, industrial or agricultural use types shall be prohibited in the critical stream zone buffer area.

3. Fences. In order to prevent livestock from destroying the stream bank slope, all new perpendicular-oriented fences except as provided in 18.06.449(b)(5)(a)(10) shall be prohibited in the critical stream zone buffer area. Fencing that is parallel to the stream and is designed to keep livestock from access to the water and stream bank may be permitted after review and approval by the Department of Community Development.

(6) Sensitive Stream Zone Buffer Area Development Standards. development in the sensitive stream zone area shall be subject to the following standards:

a. Allowed Uses. All allowed uses within the critical stream zone buffer area are also allowed in the sensitive stream zone buffer area. Additional allowed uses in the sensitive stream zone buffer area include:

1. Single family, detached residential uses and all related accessory uses associated with the single family residence requiring a building permit. Attached or detached accessory dwellings may also be erected within the sensitive stream zone buffer area. New building structures such as storage sheds and

gazebos that, due to their minimum floor area, do not require a building permit may also be erected within the sensitive stream zone buffer area.

2. Landscaping area requirements, including ornamental landscape planting, may be satisfied by using the sensitive stream zone buffer area to count towards the required area to be landscaped for new residential, civic, commercial, industrial or agricultural use types. Parking and loading areas on the developed portion of the site shall continue to require landscaping. Open space requirements may be satisfied by using the natural, undisturbed or restored sensitive stream zone buffer area.

3. New fencing, constructed in accordance with Reno Code.

b. Permitted Uses Requiring a Planning Commission Approved Special Use Permit. Subject to the regulatory zone in effect for the property, all new use types may be permitted in the sensitive stream zone buffer area pursuant to a special use permit being issued by the Reno City Planning Commission. The special use permit requirement is also applicable to construction or enlargement of any public or private roads, driveway, structure or facility including drainage facilities, water conveyance structures, dams, trails, and any public or private utility facility used to provide transportation, electric, gas, water, telephone, telecommunication or other services. New residential, commercial and industrial subdivisions shall not require the concurrent processing of a special use permit, as long as the "Special Review Considerations" of this article are addressed in the tentative subdivision map review. Any construction in the sensitive stream zone buffer area will require submission of a grading plan showing compliance with applicable best management practices. The grading plan shall also be designed to prevent construction drainage and materials from increasing sedimentation impacts to the stream environment and to minimize impervious surfaces.

c. Prohibited Uses. Due to the incompatible nature of certain uses (i.e. ground disturbance, untreated water discharge, hazardous materials, chemical contamination, scale of use, traffic, etc.) and the potential negative impacts on the perennial stream and adjoining sensitive stream zone buffer

area, the following uses shall not be established in the sensitive stream zone buffer area:

1. Aggregate facilities -permanent.
2. Aggregate facilities -temporary.
3. Energy production.
4. General industrial - heavy.
5. Inoperable vehicle storage.
6. Mining operations.
7. Salvage yards.
8. Wholesaling, storage and distribution -heavy.

(7) Special Review Considerations. In addition to other required findings, prior to approving an application for development in the critical stream zone buffer area or the sensitive stream zone buffer area, the record at the Planning Commission shall demonstrate that the following special review considerations are addressed:

- a. Conservation of topsoil;
- b. Protection of surface water quality;
- c. Conservation of natural vegetation, wildlife habitats and fisheries;
- d. Control of erosion;
- e. Control of drainage and sedimentation;
- f. Provision for restoration of the project site to predevelopment conditions;
- g. Provision of a bonding program to secure performance of requirements imposed; and
- h. Preservation of the hydrologic resources, character of the area and other conditions as necessary.

- (8) Cluster Development. New residential subdivision requests with a protected perennial stream on the property are encouraged to submit in accordance with the provisions of 18.06.303(b) Cluster Development.
- (9) Modification of Standards. Modification of standards, including interpretation of the applicability of the standards in this section, shall be set forth as follows:
- a. Appeals for Errors. Appeals shall be processed in accordance with 18.06.1109(f), Appeals.
 - b. Special Exceptions. The Reno City Planning Commission shall hear and decide requests for special exceptions from the requirements of this article. In passing upon such applications, the Reno City Planning Commission shall consider all technical evaluations and all relevant requirements, factors and standards specified in this article and shall also consider the provisions of this subsection:
 - 1. The potential degradation of the stream environment.
 - 2. The danger to life and property due to flooding or erosion damage.
 - 3. The loss of critical habitat.
 - c. Issuance of Special Exception. Special exceptions shall only be issued when in compliance with the provisions of this section and the Reno City Planning Commission finds:
 - 1. A showing of good and sufficient cause such as renovation, rehabilitation or reconstruction of the stream environment; or
 - 2. A determination that failure to grant the special exception would result in exceptional hardship to the applicant, such as deprivation of a substantial use of property and that the granting of a special exception will not result in degradation of the stream environment.
 - d. Extent of Special Exception. Special exceptions shall only be issued upon a determination that the special exception is the minimum necessary to afford relief.
 - e. Conditions of Special Exceptions. Upon consideration of the factors set forth in this section and the purpose of this article, the Reno City Planning Commission may attach such conditions to the granting of

special exceptions as it deems necessary to further the purpose of this article.

(c) Amendments within cooperative planning areas.

(1) Introduction. Principle #1 of the Regional Plan, adopted May 9, 2002, states that the plan "...aims to limit the spread of the urban footprint and direct more development of homes and jobs toward the traditional core of the region-its downtowns, its designated Regional Centers, and its traditional transportation corridors. This strategy will redirect growth that might otherwise occur at the urban fringe; make more efficient use of land, natural resources and community services; save money on infrastructure; reduce dependence on the private automobile; promote multi-modal transportation choices; protect air quality; conserve energy; preserve designated open space; and create more affordable communities. This strategy, which will result in a more compact form of future development, as well as a more diverse mix of uses, will provide a variety of living and working situations, and will promote human, natural and economic capital, strengthen our communities and ensure that the region's assets are accessible to all." The following policies for review of master plan amendments within the cooperative planning areas are intended to promote the principles of the Regional Plan.

(2) Applicability. The following policies apply to amendments to local master plans and zoning changes in the cooperative planning areas of the Truckee Meadows region. "Cooperative Planning Areas" means:

- a. The expanded city spheres of influence, post May 8, 2002;
- b. Land within the unincorporated area that was identified by the cities in the Settlement Agreement of October 17, 2002; and
- c. Lands annexed by a city under the provisions of NRS 268,670 outside the pre-May 9, 2002, spheres of influence, except as prescribed in the settlement agreements in Nevada Supreme Court Case 38749 (Mortesen et al) and District Court Case CV02-03469 (Regional Plan lawsuit).

The following policies apply throughout the cooperative planning areas, unless the text of a specific policy states otherwise.

(3) Definitions. Except as otherwise noted, the definitions of terms used in this article are the same as the definitions on pp. 54 through 64 of the Truckee Meadows Regional Plan adopted May 9, 2002.

- (4) Master Plan Policies and Goals and Zoning Amendments Criteria. Local governments considering amendments within Cooperative Planning Areas shall be required to make all the applicable following findings:

a. Regional Form and Pattern, Including Open Space.

1. Findings for Policy 1.1.6 -Rural Development Area (for an amendment located within a Rural Development Area):

- (i) The amendment does not allow new divisions of land that would create a parcel less than five (5) acres in size.
- (ii) The permitted uses do not require community water or sewage disposal systems or new publicly maintained roads or parks.

2. Findings for Policies 1.1.8 and 2.1.1 -Development Constraints Area (for an amendment located within a Development Constraints Area):

- (i) Allowed land uses are limited to communication facilities; recreational facilities; parks and open space; utilities; agriculture; forestry; mining; transportation infrastructure necessary to service development; and residential uses that are limited to a maximum density of one (1) unit per forty (40) acres or one (1) unit per parcel in existence on May 9, 2002, whichever is greater.
- (ii) Except for those uses listed in finding (i), uses that encroach on the Development Constraints Area are isolated; enhance the overall project design; and preserve as open space a 2:1 ratio of non-constrained area for every constrained area that is developed.

3. Findings for Policies 1.1.9 and 2.2.1 -Slope Management (15 percent -30 percent) (for an amendment with identified slopes in excess of 15 percent):

- (i) The local government has a management strategy for slopes greater than 15 percent but less than 30 percent found in conformance with the Regional Plan and the amendment is in conformance with that plan.

(ii) Prior to the adoption of a conforming management strategy, the amendment must provide an assessment of the impact on the following desired conditions:

(a) Development on such slopes will not degrade the scenic, public safety, and environmental values of the area to be developed and the region as a whole;

(b) Development on such slopes incorporates on-site and off-site mitigation measures for impacts to habitat and water quality, and for fiscal effects associated with higher-than normal costs of infrastructure, public safety facilities, and public safety services on slopes greater than 15 percent but less than 30 percent;

(c) Recharge areas are protected; and

(d) Activities comply with the terms of National Pollutant Discharge Elimination System (NPDES) permits.

4. Findings for Policies 1.1.12 and 1.2.16 -Emerging Employment Centers (for an amendment in an area identified as an Emerging Employment Center):

(i) The local government has a plants) for the emerging employment center(s) found in conformance with the Regional Plan and the amendment is in conformance with that plan.

(ii) Prior to the adoption of a conforming plan, the amendment must provide an assessment of the impact on the following desired conditions:

(a) Adequate non-residential land supply;

(b) Convenient access to major roads and/or freeways;

(c) Pedestrian connections throughout the areas and to nearby residential areas;

- (d) A plan for transit service;
- (e) Adequate residential land supply in the surrounding area to house the anticipated number of employees;
- (f) Design and intensity standards to maintain the character of nearby residential areas; and
- (g) Reverse commute and trip reduction strategies.

5. Findings for Policy 1.2.1 -Desired population and employment distribution and Jobs/Housing balance:

- (i) The amendment shall provide an assessment of the impact on the desired population, housing and employment distribution, articulated in Regional Plan Policy 1.2.1. The model for this review shall be developed and maintained by the Regional Planning Agency in cooperation with local governments and affected entities.

6. Findings for Policy 12.12 -Regional Centers (for an amendment within an identified Regional Center):

- (i) The local government has a plan(s) for the regional center(s) found in conformance with the Regional Plan and the amendment is in conformance with that plan.
- (ii) Prior to the adoption of a conforming plan, the amendment must provide an assessment of the impact on the following desired conditions:
 - (a) Minimum residential densities for new development of eighteen (18) units per acre of residential;
 - (b) Minimum floor area ratios (FAR) for nonresidential developments and mixed use developments of 1.5 FAR; and
 - (c) Multi-modal transportation including future transit support.

7. Findings for Policies 1.2.8, 1.2.9 and 1.2.12 -Transit Oriented Development (TOD) Corridors (for an amendment within a TOD):

- (i) The local government has a plan(s) for TOD corridors found in conformance with the Regional Plan and the amendment is in conformance with that plan.
- (ii) Prior to the adoption of a conforming plan, the amendment must provide an assessment of the impact on the following desired conditions:
 - (a) Minimum residential densities for new development of eighteen (18) units per acre of residential;
 - (b) Minimum floor area ratios (FAR) for nonresidential developments and mixed use developments of 1.5 FAR;
 - (c) Within 1/4 mile of a designated transportation route, as identified in Regional Plan Policy 1.2.8;
 - (d) Surrounding use compatibility;
 - (e) Airport Authority of Washoe County consultation;
 - (f) Land use and design that supports and enhances multi-modal transportation including future transit;
 - (g) Human scale design; and
 - (h) Development and design standards addressing compatibility with the existing neighborhood.

8. Findings for properties identified as potential Open Space within adopted Regional Open Space plan:

- (i) The property owner has noticed local, regional, state, national and federal organizations charged with the mission of maintaining or enhancing open space in this region that an amendment to the cooperative plan to change land use will be submitted.

9. Findings for Policies 1.3.2 and 1.3.3 -Truckee Meadows Services Area (TMSA) -development standards (for an amendment in the TMSA outside the SOL):

- (i) The local government has a plan for the TMSA outside the cities' sphere of influence found in conformance with the Regional Plan and the amendment is in conformance with that plan.
- (ii) Prior to the adoption of a conforming plan, the amendment must provide an assessment of the impact on the following desired conditions:
 - (a) Residential density no greater than three (3) dwelling units per acre in the Truckee Meadows Services Area;
 - (b) Commercial retail is restricted to a floor area of sixty thousand (60,000) square feet or less for any single tenant and a maximum size for any single development to one hundred thousand (100,000) square feet of floor area;
 - (c) Commercial office is restricted to a floor area of twenty thousand (20,000) square feet or less for any single tenant and a maximum size for any single development to forty thousand (40,000) square feet of floor area;
 - (d) Industrial or warehouse uses are not included;
 - (e) Institutional/civic uses commensurate with the surrounding immediate community; and
 - (f) Maximum ten (10) acres of contiguous nonresidential properties and must be separated by a minimum of one (1) mile from the nearest nonresidential property.

b. Housing

1. Findings.

- (i) The amendment is consistent with criteria for densities established in the regional form and pattern section including subsections A, B, F, and J.
- (ii) The amendment is consistent with the local governments' requirements for inclusionary housing, which must be reviewed by Regional Planning no later than October 2004.
- (iii) Prior to conformance of the local governments' requirements for inclusionary housing, the amendment must document that it is not detrimental to the HOME Consortium's housing efforts.

c. Concurrency, Timing and Phasing of Infrastructure.

1. Findings.

- (i) Service capacity for water, wastewater, storm water, road and parks exists or is planned to exist prior to construction of development within the amendment.
- (ii) When using a community system, each of the following studies must identify and mitigate the cumulative impacts on existing infrastructure and facilities plans. These conceptual studies must propose infrastructure mitigation that constitutes reasonable care with respect to adjacent or adjoining areas.
 - (a) The amendment includes a conceptual drainage study consistent with the adopted standards of the local government.
 - (b) The amendment includes a conceptual wastewater treatment and conveyance, including septic systems, study consistent with the adopted standards of the local government.
 - (c) The amendment includes a conceptual traffic study that is consistent with the adopted Regional Transportation Plan.

- (d) The amendment includes a conceptual potable water supply and conveyance, including individual wells, study.
- (e) The amendment includes a conceptual parks plan consistent with the adopted standards of the local government.
- (f) The proposed cooperative plan amendment that proposes a community system must identify a funding plan for the improvement program.

d. Public Service Levels and Fiscal Effect.

1. Findings.

- (i) The amendment must assess the impacts to public services including police, fire and public recreation based on a level of service that has been adopted by the local government.
- (ii) The amendment provides mitigation measures when the impact to public services drops below the adopted level of service for the local government.
- (iii) The proposed Cooperative Plan Amendment must analyze the fiscal revenue and service expenditures of development.
- (iv) The amendment must identify and evaluate the impacts on public schools.

e. Resources Constraints Not Elsewhere Addressed.

1. Findings.

- (i) The proposed amendment must provide an assessment of wildlife habitats that have been identified in the Regional Open Space Plan. The amendment must include preservation, enhancement and/or mitigation measures.

SECTION 2. If any section, paragraph, clause or provision of this ordinance shall for any reason be held to be invalid or unenforceable, the invalidity or unenforceability of such section, paragraph, clause or provision shall in no way affect any remaining provisions of this ordinance.

SECTION 3. This ordinance shall be in effect from and after its passage, adoption and publication in one issue of a newspaper printed and published in the City of Reno.

SECTION 4. The City Clerk and Clerk of the City Council of the City of Reno is hereby authorized and directed to have this ordinance published in one issue of the Reno Gazette-Journal, a newspaper printed and published in the City of Reno.

PASSED AND ADOPTED this 25th day of February, 2003, by the following vote of the Council:

AYES: Sferrazza, Hascheff, Harsh, Zadra, Dortch, Aiazzi, Cashell


NAYS: None

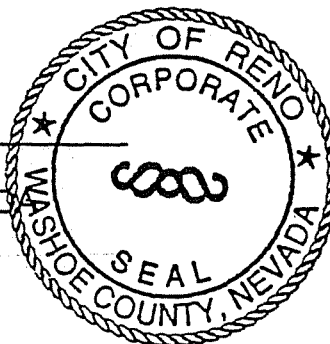
ABSTAIN: None ABSENT: None

APPROVED this 25th day of February, 2003.


MAYOR OF THE CITY OF RENO

ATTEST:


CITY CLERK AND CLERK OF THE CITY
COUNCIL OF THE CITY OF RENO, NEVADA



EFFECTIVE DATE: February 28, 2003

**City of Sparks Municipal Code:
Chapter 15.11 FLOODPLAIN MANAGEMENT.**

Section 15.11.0010 Statutory authorization.
Section 15.11.0020 Finding of fact.
Section 15.11.0030 Statement of purpose.
Section 15.11.0040 Methods of reducing flood losses.
Section 15.11.0050 Definitions.
Section 15.11.0060 Basis for establishing the areas of special flood hazard.
Section 15.11.0070 Compliance.
Section 15.11.0080 Abrogation and greater restrictions.
Section 15.11.0090 Interpretation.
Section 15.11.0100 Warning and disclaimer of liability.
Section 15.11.0110 Severability.
Section 15.11.0120 Floodplain development permit.
Section 15.11.0130 Permit application.
Section 15.11.0140 Use of other flood data.
Section 15.11.0150 Alteration of Watercourses.
Section 15.11.0160 Stop work orders.
Section 15.11.0170 Map determinations.
Section 15.11.0180 Appeals.
Section 15.11.0190 Submission of new technical data to FEMA.
Section 15.11.0200 Anchoring.
Section 15.11.0210 Construction materials and methods.
Section 15.11.0220 Elevation requirements for lowest floor.
Section 15.11.0230 Lowest floor certification requirements.
Section 15.11.0240 Nonresidential floodproofing requirements.
Section 15.11.0250 Requirements for areas below the lowest floor.
Section 15.11.0260 Standards for utilities.
Section 15.11.0270 Standards for subdivisions.
Section 15.11.0280 Standards for critical structures.
Section 15.11.0290 Standards for manufactured homes.
Section 15.11.0300 Standards for recreational vehicles.
Section 15.11.0310 Floodways.
Section 15.11.0320 Mudslide prone areas.
Section 15.11.0330 Flood-related erosion-prone areas.
Section 15.11.0340 Variances.
Section 15.11.0350 Conditions and procedures for variances.
Section 15.11.0360 Map correction procedures.

Section 15.11.0010 Statutory authorization.

The legislature of the State of Nevada has in Nevada Revised Statutes 278.020, 244A.057, and 543.020 conferred upon local government units authority to adopt regulations designed to promote the public health, safety and general welfare of its citizenry. Therefore, the city council of the City of Sparks does hereby adopt the following floodplain management ordinance to regulate development within floodplains. (Ord. 1838, 1994: Ord. 1760, 1992.)
(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0020 Finding of fact.

The flood hazard areas of the city are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare.

These flood losses are caused by uses that are inadequately elevated, floodproofed, or protected from flood damage. The cumulative effect of obstructions in areas of special flood hazards which increase flood heights and velocities also contribute to the flood loss. (Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0030 Statement of purpose.

It is the purpose of this ordinance to promote the public health, safety, and general welfare, and to minimize public and private loss due to flood conditions in specific areas by provisions designed to:

1. protect human life and health;
2. minimize expenditure of public money for costly flood control projects;
3. minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
4. minimize prolonged business interruptions;
5. minimize damage to public facilities and utilities such as water and gas mains, electric telephone and sewer lines, and streets and bridges located in areas of special flood hazards;
6. help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future blighted areas caused by flood damage;
7. ensure potential buyers are notified of property located in areas of special flood hazards;
8. ensure those who occupy the areas of special flood hazards assume responsibility for their actions; and
9. maintain qualifying standards for participation in the National Flood Insurance Program.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

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8. ensure those who occupy the areas of special flood hazards assume responsibility for their actions; and
9. maintain qualifying standards for participation in the National Flood Insurance Program.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0040 Methods of reducing flood losses.

In order to accomplish its purposes, this ordinance includes methods and provisions to:

1. restrict or prohibit uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or flood heights or velocities;
2. require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
3. control the alteration of natural floodplains, alluvial fans, stream channels, and natural protective barriers, which help accommodate or channel flood waters;
4. control filling, grading, dredging, and other development which may increase flood damage; and
5. prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0050 Definitions.

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted to as to give them the meaning they have in common usage and to give this ordinance its most reasonable application.

1. "Administrator" or "Floodplain Administrator" means the public works director of the city.
2. "Anchor" means a series of methods used to secure a structure to its footings or foundation wall so that it will not be displaced by flood or wind forces.
3. "Base flood" means a flood which has a one percent chance of being equalled or exceeded in any given year.
4. "Base flood elevation" means the height in relation to mean sea level expected to be reached by the water of the base flood at pertinent points in the floodplain of riverain areas.
5. "Breakaway wall" means a wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific

lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system.

6. "Channel" means a natural or artificial watercourse with definite bed and banks to confine and conduct flowing water.

7. "Channel capacity" means the maximum flow that can pass through a channel without overflowing the banks.

8. "Conditional Letter of Map Revision (CLOMR)" means procedures by which contractors, developers and communities can request review and determination by the Federal Insurance Administrator of scientific and technical data for a proposed project, when complete and functioning effectively, would modify the elevation of individual structures and parcels of land, stream channels, and floodplains on the Flood Insurance Rate Map (FIRM).

9. "Critical structure" means a structure for which even a slight chance of flooding would reduce or eliminate its designed function of supporting a community in an emergency. Fire stations, hospitals, municipal airports, police stations, communication antennas or towers, elderly care facilities (old folks homes) fuel storage facilities, schools designated as emergency shelters, fresh water and sewage treatment facilities are some examples of critical structures.

10. "Federal Insurance Administration (FIA)" means the government unit, a part of Federal Emergency Management Agency (FEMA), that administers the National Flood Insurance Program (NFIP).

11. "Flood Boundary Floodway Map (FBFM)" means the official map of a community where the boundaries of the flood, mudslide and related erosion areas having special hazards have been designated as Zones A, M and E.

12. "Flood Insurance Rate Map (FIRM)" means the official map on which the Federal Emergency Management Agency has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.

13. "Flood Insurance Study (FIS)" means a document containing the results of and examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, mudslides and erosion hazards.

14. "Floodway" means the channel of a river or other watercourse and the adjacent land area that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

15. Flood Zones are defined as follows:

A. SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

Zone A No base flood elevations determined.

Zone AE Base flood elevations determined.

Zone AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

Zone AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

Zone A99 To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.

Zone V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

Zone VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

B. OTHER AREAS

Zone X Areas of 500-year flood; areas of 100-year flood with average (shaded) depths of less than 1 foot or with drainage areas less than 1 square mile; or areas protected by levees from 100-year flood.

Zone X Areas determined to be outside 500-year floodplain. (unshaded)

Zone D Areas in which flood hazards are undetermined.

16. "Historic structure" means any structure that is:

- a. Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;
- b. Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district; individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of Interior;
- c. Or individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either by an approved state program as determined by the Secretary of the Interior or directly by the Secretary of the Interior in states without approved programs.

17. "Letter of Map Amendment (LOMA)" means the procedure by which any owner or lessee of property who believes his property has been inadvertently included in a Special Flood Hazard Area can submit scientific and technical information to the Federal Insurance Administrator for review to remove the property from said area. The Administrator will not consider a LOMA if the information submitted is based on alteration of topography or new hydrologic or hydraulic conditions since the effective date of the FIRM.

18. "Letter of Map Revision (LOMR)" means the procedures by which contractors, developers, and communities can request changes to flood zones, floodplain and floodway delineations, flood elevations, and planimetric features based on the results of structural works, improvements, or annexations; resulting in additional flood hazard areas.

19. "Lowest floor" means the lowest floor of the lowest enclosed area, including basement. An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of this ordinance. Attached garages are allowed to be built at grade. Below grade garages are not allowed as they are considered to be basements.

20. "Manufactured home (mobile home)" means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when attached to the required utilities. The term "manufactured home" does not include recreational vehicles.

21. "National Geodetic Vertical Datum (NGVD)", as corrected in 1929, means a vertical control used as a reference for establishing varying elevations within the floodplain.

22. "Obstruction" means and includes, but is not limited to, any dam, wall, wharf, embankment, levee, dike, pile, abutment, protection, excavation, channelization, bridge, conduit, culvert, building, wire, fence, rock, gravel, refuse, fill, structure, vegetation or other material in, along, across or projecting into any watercourse which may alter, impede, retard or change the direction and or velocity of the flow of water, or due to its location, its propensity to snare or collect debris carried by the flow of water, or its likelihood of being carried downstream.

23. "Special flood hazard area" means an area having special flood, mudslide or flood-related erosion hazards, and shown on an FHBM or FIRM in Zones A, AO, A1, A30, AE, A99, AH, E or M.

24. "Start of construction" includes substantial improvement and other proposed new development and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, or other improvement was within 180 days from the date of the permit. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation, or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading, and filling; nor does it include the installation of streets and or walkways; nor

does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

25. "Substantial damage" means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damage condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

26. "Substantial improvement" means any reconstruction, rehabilitation, addition, or other proposed new development of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred "substantial damage" regardless of the actual repair work performed. The term does not, however, include either:

a. Any project for improvement of a structure to correct existing violations or state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or

b. Any alteration of a "historic structure" provided that the alteration will not preclude the structure's continued designation as a "historic structure."

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0060 Basis for establishing the areas of special flood hazard.

The areas of special flood hazard identified by the Federal Insurance Administration (FIA) of the Federal Emergency Management Agency (FEMA) in the Flood Insurance Study (FIS) adopted September 30, 1994 and accompanying Flood Insurance Rate Maps (FIRM) and Flood Boundary and Floodway Maps (FBFM) adopted September 30, 1994, and all subsequent amendments and or revisions, are hereby adopted by reference and declared to be a part of this ordinance. The FIS and attendant mapping is the minimum area of applicability of this ordinance and may be supplemented by studies for other areas which allow implementation of this ordinance and which are recommended to the city council by the floodplain administrator. The FIS, FIRMs and FBFMs are on the file at the Public Works Department of the City of Sparks.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0070 Compliance.

No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this ordinance and other applicable regulations. Violations (including violations of conditions and safeguards established in connection with conditions) shall constitute a misdemeanor. Nothing here shall prevent the city from taking such lawful action as is necessary to prevent or remedy any violation.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0080 Abrogation and greater restrictions.

This ordinance is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this ordinance and other ordinances, easement, covenant, or deed restriction conflict or overlap, whichever imposed the more stringent restrictions or that imposing the higher standards, shall prevail.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0090 Interpretation.

The interpretation and application of this ordinance, all provisions shall be:

1. Considered as minimum requirements;
2. Liberally construed in favor of the city; and
3. Deemed neither to limit nor repeal any other powers granted under state statutes.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0100 Warning and disclaimer of liability.

The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This ordinance does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This ordinance shall not create liability on the part of the city, any officer or employee thereof, the State of Nevada, or the Federal Insurance Administration, Federal Emergency Management Agency, for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made hereunder.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0110 Severability.

This ordinance and the various parts thereof are hereby declared to be severable.

Should any section of this ordinance be declared by the courts to be unconstitutional or invalid, such decision shall not affect the validity of the ordinance as a whole, or any portion thereof other than the section so declared to be unconstitutional or invalid.

(Ord. 1838, 1994: Ord. 1760, 1992.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0120 Floodplain development permit.

A floodplain development permit is hereby established for all construction and other development to be undertaken in areas of special flood hazard in the city for the purpose of protecting its citizens from increased flood hazards and insuring new development is constructed in a manner that minimizes its exposure to flooding. It shall be unlawful to undertake any development in an area of special flood hazard, as shown on the Flood Insurance Rate Map enumerated in Section 15.11.0060, without a valid floodplain development permit. Applications for a permit shall be made on forms furnished by the Floodplain Administrator and may include, but not limited to: plans in duplicate drawn to scale showing the nature, location, dimensions and elevation of the area in question, existing or proposed structures, fill, storage of materials, drainage facilities and the location of the foregoing.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0130 Permit application.

The applicant shall provide the following information, where applicable. Additional information may be required on the permit application forms.

1. The proposed elevation in relation to mean sea level, of the lowest floor (including basement) of all residential and non-residential structures whether new or substantially improved to be located in Zones A, A1-A30, AB, AE and AH, if base flood elevations data are available.

2. The proposed elevation in relation to mean sea level, of the lowest floor (including basement) and the elevation of the highest adjacent grade of all residential and non-residential structures whether new or substantially improved to be located in Zone AO.
3. The proposed elevation in relation to mean sea level, to which any new or substantially improved non-residential structure will be floodproofed.
4. A certificate from a licensed professional engineer or architect in the State of Nevada for any utility floodproofing will meet the criteria in Section 15.11.0260.
5. A certificate from a licensed professional engineer or architect in the State of Nevada that any non-residential floodproofed structures will meet the criteria in Section 15.11.0240.
6. A description of the extent to which any watercourse will be altered or relocated as a result of the proposed development. Computations by a licensed professional engineer in the State of Nevada must be submitted that demonstrate the altered or relocated segment will provide equal or greater conveyance than the original stream segment. The applicant must submit any maps, computations or other material required by the Federal Emergency Management Agency (FEMA) to revise the documents enumerated in Section 15.11.0060, when notified by the Floodplain Administrator and must pay any fees or other costs assessed by FEMA for this purpose. The applicant must also provide assurances that the conveyance capacity of the altered or relocated stream segment will be maintained.
7. In certain circumstances the Floodplain Administrator will require a technical analysis, by a licensed professional engineer in the State of Nevada, showing the proposed development located in the special flood hazard area will not cause physical damage to any other property.
8. When there is no base flood elevation data available for Zone A from any source, the base flood elevation data will be provided by the permit applicant for all proposed development of subdivisions, manufactured home and recreational vehicle parks in the special flood hazard areas, for all developments of 50 lots or 5 acres, whichever is less. (Ord. 1838, 1994.)
(1969, Amended, 01/12/1998; 1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0140 Use of other flood data.

When the Federal Emergency Management Agency has designated Special Flood Hazard Areas on the community's Flood Insurance Rate Maps (FIRM) but has neither produced water surface elevation data nor identified a floodway, the Floodplain Administrator shall attempt to obtain, review and reasonably utilize any base flood elevation and floodway data available from a federal, state or other source as criteria for requiring that new construction, substantial improvements or other proposed development meets the requirements of this ordinance.

When base flood elevations are not available, the Floodplain Administrator may use flood information from any other authoritative source, such as historical data, to establish flood elevations within the Special Flood Hazard Areas.
(Ord. 1838, 1994.)
(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0150 Alteration of Watercourses.

Prior to issuing a permit for any alteration or relocation of a watercourse, the Floodplain Administrator shall:

1. Notify all adjacent communities, Nevada's National Flood Insurance Program Coordinator, Nevada Division of Water Resources and submittal of evidence of such notification to the Federal Insurance Administration and the Federal Emergency Management Agency.
2. Determine that the permit holder has provided for maintenance within the altered or relocated portion of said watercourse so that the flood carrying capacity is not diminished.
(Ord. 1838, 1994.)
(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0160 Stop work orders.

The Floodplain Administrator shall issue, or cause to be issued, a stop work order for any floodplain development found non-compliant with the provisions of this ordinance or conditions of the development permit and all development found ongoing without a floodplain development permit. Disregard of a stop work order shall subject the violator to the penalties described in Section 5.11.0070.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0170 Map determinations.

The Floodplain Administrator will make map interpretations where needed as to the exact location of the boundaries of the areas of special flood hazard and where there appears to be a conflict between a mapped boundary and actual field conditions.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0180 Appeals.

The city council of the City of Sparks shall hear and decide appeals when it is alleged there is an error in any requirement, decision or determination made by the Floodplain Administrator in the enforcement or administration of this ordinance.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0190 Submission of new technical data to FEMA.

When base flood elevations either increase or decrease resulting from physical changes affecting flooding conditions, as soon as practicable, but not later than six months after the date such information becomes available, the Floodplain Administrator will submit the technical or scientific data to FEMA. Such submissions are necessary so that upon confirmation of the physical changes affecting flooding conditions, risk premium rates and flood plain management requirements will be based upon current data.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0200 Anchoring.

1. All new construction and substantial improvements shall be adequately anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.

2. All manufactured homes shall meet the anchoring standards of Section 15.11.0290.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0210 Construction materials and methods.

All new construction and substantial improvements shall be constructed:

1. With materials and utility equipment resistant to flood damage;

2. Using methods and practices that minimize flood damage;

3. Ensure electrical, heating, ventilation, plumbing, air conditioning equipment and other service facilities are designed or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

4. Within Zones AH or AO so that there are adequate drainage paths around structures on slopes to guide flood waters around and away from proposed structures.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0220 Elevation requirements for lowest floor.

Residential construction, new or substantial improvements, shall have the lowest floor, including basement:

1. In Zone AO, elevated above the highest adjacent grade to a height exceeding the depth number specified in feet on the FIRM by at least one (1) foot, or elevated at least three (3) feet above the highest adjacent grade if no depth number is specified.
2. In Zone A, elevated to at least one (1) foot above the base flood elevation, as determined by this community.
3. In Zone AE, elevated to at least one (1) foot above the base flood elevation as specified in feet on the FIRM.
4. In all other zones, elevated to at least one (1) foot above the base flood elevation.

(Ord. 1838, 1994.)

(1969, Amended, 01/12/1998; 1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0230 Lowest floor certification requirements.

Upon completion of the structure, the elevation of the lowest floor including basement shall be certified by a registered professional engineer or surveyor and verified by the community building inspector to be properly elevated. The certification shall be provided to the Floodplain Administrator using the current FEMA Elevation Certificate.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1996)

Section 15.11.0240 Nonresidential floodproofing requirements.

Nonresidential construction shall either be elevated to conform with Section 15.11.0220 together with attendant utility and sanitary facilities;

1. Will be floodproofed below the elevation recommended under Section 15.11.0220 so that the structure is watertight with walls substantially impermeable to the passage of water;
2. Will have the structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy;
3. Will be certified by a registered professional engineer or architect that the standards of Section 15.11.0220 are satisfied. The certification shall be provided to the Floodplain Administrator.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0250 Requirements for areas below the lowest floor.

All new construction and substantial improvements with fully enclosed areas below the lowest floor (excluding basements) that are usable solely for parking of vehicles, building access or storage, and which are subject to flooding, shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a licensed professional engineer or architect or meet or exceed the following minimum criteria;

1. Must have a minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding;
2. The bottom of all such openings will be no higher than one foot above the lowest adjacent finished grade.

Openings may be equipped with louvers, valves, screens or other coverings or devices provided they permit the automatic entry and exit of floodwaters.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0260 Standards for utilities.

All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.

All new and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters. Sanitary sewer and storm drainage systems for buildings that have openings below the base flood elevation shall be provided with

automatic backflow valves or other automatic backflow devices that are installed in each discharge line passing through a building's exterior wall.

On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0270 Standards for subdivisions.

All preliminary subdivision proposals shall identify the flood hazard area and the elevation of the base flood.

All subdivision plans will provide the elevation of proposed structures and pads.

All subdivision proposals shall be consistent with the need to minimize flood damage.

All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage.

All subdivisions shall provide adequate drainage to reduce exposure to flood hazards.

Additionally, all subdivision proposals will demonstrate by providing a detailed hydrologic and hydraulic analyses that the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0280 Standards for critical structures.

Critical structures are not authorized in a Special Flood Hazard Area, unless:

1. All alternative locations in Flood Zone X have been considered and rejected.
2. All alternative locations in Flood Zone Shaded X have been considered and rejected.

If the Floodplain Administrator determines the only practical alternative location for the development of a new or substantially improved critical structure is in a Special Flood Hazard Area, he must give public notice of the decision and reasons for the elimination of all alternative locations.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0290 Standards for manufactured homes.

Except within a pre-existing area of a manufactured home park or subdivision, all manufactured homes that are placed or substantially improved within Zones A, AH and AE on the community's Flood Insurance Rate Map must be elevated on a permanent foundation so that the lowest floor will be elevated to or above the base flood elevation and be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting wind forces.

All manufactured homes to be placed or substantially improved on sites in a pre-existing manufactured home park or subdivision within Zones A, AH and AE on the community's Flood Insurance Rate Map that are not subject to the provisions of subsection A will be elevated so that either the:

1. Lowest floor of the manufactured home is at or above the base flood elevation; or
2. The manufactured home chassis is supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade and be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement.

Within Zone A, when no base flood elevation data is available, new and substantially improved manufactured homes shall have the floor elevated at least three feet above the highest adjacent grade.

Within Zone AO, the floor for all new and substantially improved manufactured homes will be elevated above the highest adjacent grade at least as high as the depth number

specified on the Flood Insurance Rate Map, or at least two feet if no depth number is specified.
(Ord. 1838, 1994.)

Section 15.11.0300 Standards for recreational vehicles.

All recreational vehicles placed on sites within the floodplain on the community's Flood Insurance Rate Map will either:

1. Be on the site for fewer than 180 consecutive days;
2. Be fully licensed and ready for highway use. A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick-disconnect type utilities and security devices and has no permanently attached additions, or;
3. Will meet the permit requirements of Section 15.11.0130 and the elevation and anchoring requirements for manufactured homes in Section 15.11.0290.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0310 Floodways.

Designated floodways are located within the special flood hazard areas established in Section 15.11.0060. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles and erosion potential, the following provisions apply.

1. Encroachment will be prohibited, including fill, new construction, substantial improvements, storage of equipment or supplies, and any other development within the adopted regulatory floodway; unless it has been demonstrated through hydrologic and hydraulic analyses, performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge and the Federal Emergency Management Agency has issued a Conditional Letter of Map Revision.
2. If subsection 1 has been satisfied, all proposed new development and substantial improvements must comply with all other applicable flood hazard reduction provisions.

(Ord. 1838, 1994.)

Section 15.11.0320 Mudslide prone areas.

All permit applications will be reviewed to determine if the proposed development will be located within a mudslide area.

The reviewing process will determine if the proposed site and improvements will be reasonably safe from mudslide hazards. Factors to be considered in making this determination include but are not limited to the following:

1. Type and quality of soils.
2. Evidence of ground water or surface water problems.
3. Depth and quality of any fill.
4. The overall slope of the site.
5. The weight that any proposed structure will impose on the slope.

When a proposed development is located in an area that may have mudslide hazards the following will be the minimum requirements;

1. A site investigation and further review be made by persons qualified in geology and soils engineering.
2. The proposed grading, excavations, new construction and substantial improvements are adequately designed and protected against mudslide damages.
3. The proposed grading, excavations, new construction and substantial improvements do not aggravate the existing hazard by creating either on-site or off-site disturbances.
4. Drainage, planting, watering and maintenance be such as not to endanger slope stability.

When a proposed development is determined to be within a mudslide hazard area, the following requirements will include but not be limited to:

1. Adopting and enforcing a grading ordinance in accordance with data supplied by the Federal Emergency Management Agency.
 2. Regulate the location of foundation systems and utility systems of new construction and substantial improvements.
 3. Regulate the location, drainage and maintenance of all excavations, cuts and fills and planted slopes.
 4. Provide special requirements for protective measures including but not necessarily limited to retaining walls, buttress fills, subdrains, diverted terraces and benchings.
 5. Require engineering drawings and specifications to be submitted for all corrective measures, accompanied by supporting soils engineering and geology reports.
- (Ord. 1838, 1994.)
(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0330 Flood-related erosion-prone areas.

All permit applications will be reviewed to determine if the proposed development will be located within a special flood-related erosion hazard area.

The reviewing process will determine if the proposed site alterations and improvements will be reasonably safe from flood-related erosion and will not cause flood-related erosion hazards or otherwise aggravate the existing flood-related erosion hazard.

When the proposed development is found to be in the path of flood-related erosion or to increase the erosion hazard, require the improvement to be relocated or adequate protective measures to be taken which will not aggravate the existing erosion hazard.

When it has been determined the proposed development is in a special flood-related erosion hazard, as delineated Zone E on the community FIRM, the Administrator shall require a setback for all new development from the lake, bay, riverfront or other body of water, to create a safety buffer consisting of a natural vegetative or contour strip. This buffer will be designated according to the flood-related erosion hazard and erosion rate, in conjunction with the anticipated "useful life" of structures and depending upon the geologic, hydrologic, topographic and climatic characteristics of the community's land.

The buffer may be used for suitable open spaces purposes, such as for agricultural, forestry, outdoor recreation and wildlife habitat areas, and for other activities using temporary and portable structures only.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0340 Variances.

In passing upon requests for variances, the city council shall consider all technical evaluations, all relevant factors, standards specified in other sections of this ordinance, and:

1. The danger that materials being swept onto other lands and injuring others;
2. The danger of life and property due to flooding or erosion damage;
3. The susceptibility of the proposed facility and its contents of flood damage and the effect of such damage on the existing individual owner and future owners of the property;
4. The importance of the services provided by the proposed facility to the community;
5. The necessity to the facility of a waterfront location, where applicable;
6. The availability of alternative locations for the proposed use which are not subject to flooding or erosion damage;
7. The compatibility of the proposed use with existing and anticipated development;
8. The relationship of the proposed use to the comprehensive plan and floodplain management program for that area;
9. The safety of access to the property in time of flood for ordinary and emergency vehicles;
10. The expected heights, velocity, duration, rate of rise and sediment transport of the flood waters expected at the site;

11. The cost of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities such as sewer, gas, electrical and water system and streets and bridges.

Any applicant to whom a variance is granted shall be given written notice that;

1. The issuance of a variance to construct a structure below the base flood level will result in increased premium rates for flood insurance.
2. Such construction below the base flood level increases risks to life and property. A copy of the notice shall be recorded by the Floodplain Administrator in the Office of the Recorder and shall be recorded in a manner so that it appears as an exception on the title of the affected parcel of land.

The Floodplain Administrator will maintain a record of all variance actions, including justification for their issuance and report such variances issued in its biennial report submitted to the Federal Insurance Administration, Federal Emergency Management Agency.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0350 Conditions and procedures for variances.

Generally, variances may be issued for new construction, substantial improvements and other proposed new development contiguous to and surrounded by lots with existing structures constructed below the base flood level, providing that the procedures and requirements of this chapter have been fully considered. The city council may attach such conditions to the granting of variances as it deems necessary to further the purposes of this ordinance.

Variances may be issued for the repair or rehabilitation of "historic structures" upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as an historic structure, and the variance is the minimum necessary to preserve the historic character and design of the structure.

Variances shall not be issued within any mapped regulatory floodway if any increase in flood levels during the base flood discharge would result.

Variances shall only be issued upon a determination that the variance is the "minimum necessary" considering the flood hazard to afford relief. "Minimum necessary" means to afford relief with a minimum of deviation from the requirements of this ordinance.

Applications for variances are subject to the procedures and findings of fact set forth in chapter 20.16 of this code.

(Ord. 1838, 1994.)

(1886, Repealed & Replaced, 12/26/1995)

Section 15.11.0360 Map correction procedures.

The following administrative procedures are provided whereby the Federal Insurance Administration will review information from an owner or lessee of property who believes his property has been inadvertently included in a Special Flood Hazard Area. These procedures shall not apply when there has been any alteration of topography since the effective date of the first FIRM or FHBM showing the property within an area of special flood hazard.

The scientific or technical information submission may include, but is not limited to the following:

1. An actual copy of the recorded plat map bearing the seal of the County Recorder indicating the official recordation and proper citation, Deed or Plat Book Volume and Page Number.
2. A topographical map showing;
 - a. Ground elevation contours in relation to the NVGD;
 - b. The total area of the property in question;
 - c. The location of the structure or structures located on the property in question;
 - d. The elevation of the lowest adjacent grade to a structure or structures;

- e. An indication of the curvilinear line which represents the area subject to inundation by a base flood. The curvilinear line should be based upon information provided by an appropriate authoritative source, such as a Federal Agency, Department of Water Resources, a County Water Control District, a County or City Engineer, a Federal Emergency Management Agency Flood Insurance Study or a determination by a Registered Professional Engineer.
 3. A copy of the FBFM or FIRM indicating the location of the property in question.
 4. A certification by a Registered Professional Engineer or Licensed Land Surveyor that the lowest grade adjacent to the structure is above the base flood elevation.
 5. The completion of the appropriate forms in the Federal Emergency Management Agency's Packet, Amendments and Revisions to National Flood Insurance Program Maps (TOD-1).
- (Ord. 1838, 1994.)
(1886, Repealed & Replaced, 12/26/1995)

Article 416

FLOOD HAZARDS

[This Article amended in its entirety by Ord. 876, provisions eff. 7/7/93; Ord. 1091, provisions eff. 4/28/00.]

Sections:

110.416.00	Purpose
110.416.05	Limitations of Liability
110.416.10	Applicability
110.416.15	Areas of Special Flood Hazard
110.416.20	Compliance
110.416.25	Relation to Other Restrictions
110.416.30	Interpretation
110.416.35	Letter of Map Amendment
110.416.40	Application Requirements for Permits
110.416.45	Owner/Developer Responsibilities
110.416.50	County Responsibilities
110.416.55	Standards for Subdivision
110.416.60	Construction Standards
110.416.65	Flood Zone Requirements
110.416.70	Flood Hazard Reduction: Prohibited Uses and Structures within Floodways
110.416.75	Appeals
110.416.80	Penalties for Violations

Section 110.416.00 Purpose. The purpose of this article, Article 416, Flood Hazards, is to promote the public health, safety and welfare by establishing guidelines and requirements for the development of property within areas determined to be subject to flood damage.

Section 110.416.05 Limitations of Liability. This section provides for limitations of County liability.

- (a) **Rationale for Article.** The degree of flood protection required by this article is considered reasonable for purposes of complying with the minimum standards required by the Federal Insurance Administration for maintaining eligibility for Washoe County property owners who desire flood insurance, the availability of which, or the rates for which, may be dependent upon the existence of this article, and for maintaining eligibility for the Washoe County area for federal disaster relief.
- (b) **Responsibility of Washoe County.** The degree of flood protection required by this article is not intended to create a standard or duty of care on the part of Washoe County or any other person or entity related to the design, construction, inspection or maintenance of flood or drainage facilities. This article does not imply that land outside flood hazard areas or uses permitted within such areas will be free from flooding or flood damage. Larger floods can and will occur. This article shall not create liability on the part of Washoe County, any officer or

employee thereof or the Federal Insurance Administration, for any flood damages that result from reliance on this article or any administrative decision lawfully made thereunder.

- (c) Flood Control Facilities. Nothing in this article may be construed as a determination that any flood or drainage facility is adequate in any respect including, without limitation, adequacy of design, construction, inspection or maintenance. Failure of any person or entity to comply with this article is not intended to provide a basis for negligence or any other type of claim for relief; failure to comply has the sole effect of jeopardizing eligibility for federal funding or other federal assistance respecting flood damage or flood insurance.
- (d) Property Rights. This article is not intended to alter the rights, obligations or liabilities of property owners who develop real estate in areas subject to this article or in areas subject to flooding. Such legal status shall remain as provided by other law, without reference to this article. The minimum standards of this article do not relieve a property owner of the responsibility to do more than this article requires if more is required to provide adequate protection for the property being developed and for other properties that may be affected.
- (e) Severability. This article and the various parts thereof are hereby declared to be severable. Should any section of this article be declared by the courts to be unconstitutional or invalid, such decision shall not affect the validity of the article as a whole, or any portion thereof other than the section so declared to be unconstitutional or invalid.

Section 110.416.10 Applicability. This article applies to all flood hazard areas within the unincorporated areas of Washoe County, pursuant to NRS 543.

Section 110.416.15 Areas of Special Flood Hazard. The flood hazard areas identified by the Federal Insurance Administration through the Federal Emergency Management Agency in a scientific and engineering report entitled "Flood Insurance Study for Washoe County, Nevada, Unincorporated Areas" dated February 1, 1984, and subsequent revisions, with the accompanying Flood Insurance Rate Maps, are hereby adopted and incorporated into the provisions of this article. The "Flood Insurance Study for Washoe County, Nevada, Unincorporated Areas" and subsequent revisions and the accompanying Flood Insurance Rate Maps are on file at the office of the Washoe County Department of Public Works.

Section 110.416.20 Compliance. All structures or land constructed, located, extended, converted or altered after August 1, 1984 shall be in full compliance with this article and other applicable laws and regulations.

Section 110.416.25 Relation to Other Restrictions. This article is not intended to repeal, abrogate or impair any existing easements, covenants or deed restrictions. If those sections or an article of this Development Code or any easement, covenant or deed restriction conflict or overlap, whichever imposes the more stringent requirement shall prevail.

Section 110.416.30 Interpretation. In the interpretation and application of this article, all provisions shall be considered as minimum requirements, shall be liberally construed in favor of Washoe County, and shall be deemed to neither limit nor repeal any other powers granted under state or local statute, ordinance or regulation.

Section 110.416.35 Letter of Map Amendment. If an owner or developer of property believes the property to be inappropriately designated as being in a flood hazard area on the Flood

Insurance Rate Maps, appeal may be made to the Federal Emergency Management Agency (FEMA).

- (a) Appeals Procedure. All appeals must be submitted to the Public Works Director for review. The Public Works Director shall transmit the appeals to the Federal Emergency Management Agency for its consideration. Appeals must include the provisions set forth in this subsection and current FEMA regulations.
 - (1) An actual stamped copy of the recorded plat of the property showing official recordation and proper citation, or a photocopy of the property's legal description as shown on the recorded deed (e.g. lot, block and plot number, etc.), together with a photocopy of the appropriate page of the County Assessor's parcel map.
 - (2) A copy of the Flood Insurance Rate Map (FIRM) with the location of the property identified.
 - (3) Certification by a Nevada registered engineer or surveyor stating:
 - (i) The type of structure;
 - (ii) The elevation of the lowest adjacent grade (LAG) to the structure, which must be above the base flood elevation; and
 - (iii) The elevation of the top of the lowest floor.
 - (4) When appealing the elevation or boundaries of the base flood, a thorough technical hydrological study, certified by a Nevada registered engineer, of the contributing area which will substantiate the appeal shall be submitted.
 - (5) A signed copy of the statement asserting the accuracy of the information, submitted on the form entitled "Request for Letter of Map Amendment".
- (b) Letter of Map Amendment. If the appellant shows that the lowest adjacent grade (LAG) is higher in elevation than the base flood, that the elevation of the base flood is incorrect, or that the boundaries of the base flood are incorrect, the Federal Emergency Management Agency will provide the owner or developer with a Letter of Map Amendment (LOMA) which will exempt the property from the requirements of this article, and which may exempt the owner from the mandatory purchase of flood insurance.

Section 110.416.40 Application Requirements for Permits. Any person desiring to construct, locate, extend, convert or alter a structure or alter any land within any flood hazard area must obtain a building permit, grading permit and/or a special use permit. The Washoe County Department of Public Works shall determine whether the proposed development is within any flood hazard area. If the development is within any flood hazard area, the procedures and requirements set forth in Sections 110.416.45 to 110.416.80, inclusive, must be satisfied before either a building permit, grading permit, and/or a special use permit, is issued.

Section 110.416.45 Owner/Developer Responsibilities. The responsibilities of the owner and developer are as set forth in this section.

- (a) Information Requirements. The owner or developer shall submit the information contained within this subsection for review by the Department of Public Works:
- (1) The elevation of the base flood at each site proposed for development within a flood hazard area;
 - (2) In Zones AE and AH, proposed elevation in relation to mean sea level of the top of the lowest floor of all structures, certified by a Nevada registered engineer or land surveyor; in Zone A and Zone AO, elevation of highest existing grade and proposed elevation of the top of the lowest floor of all structures, certified by a Nevada registered engineer or land surveyor;
 - (3) Proposed elevation in relation to mean sea level to which any structure will be floodproofed, certified by a Nevada registered engineer or land surveyor;
 - (4) Certification by a Nevada registered engineer that the floodproofing methods used for any nonresidential structure meet the floodproofing criteria in Section 110.416.65;
 - (5) Plans for any watercourse proposed to be altered or relocated, which must be designed by a Nevada registered engineer in conformance with the requirements of Washoe County. The flood carrying capacity of the unaltered watercourse shall be maintained in the altered watercourse; and
 - (6) An operation and maintenance plan for any acceptable flood protection measures (e.g. levees, dams, dikes, reservoirs).
- (b) Permit Requirement. The owner or developer shall obtain all applicable permits from the State of Nevada Division of State Lands, Nevada Division of Environmental Protection, and all other state and federal agencies. Permits must be obtained before altering or relocating any waterway under the jurisdiction of such agency. A copy of the permit will be provided to the Department of Public Works.
- (c) Certification Requirements. The owner or developer is responsible for compliance with all provisions of this article. Additionally, the owner or developer shall provide the Department of Public Works with "as-built" certification by a Nevada registered engineer or land surveyor as to the elevation requirements or, if floodproofing is a permissible means of compliance, shall provide the Department of Public Works with "as-built" certification by a Nevada registered engineer as to the floodproofing requirements for any applicable nonresidential structure. Said certification shall be provided prior to issuance of a Certificate of Occupancy. Certification requirements by a Nevada registered engineer or land surveyor as required in this article shall be provided on a FEMA "Elevation Certificate" form. Signing of the Elevation Certificate by a Nevada registered engineer or land surveyor constitutes their assurance that compliance with all requirements of this article have been met.

Section 110.416.50 County Responsibilities. The responsibilities of the County are as set forth in this section.

- (a) Permit Review. The Department of Public Works shall review all permit applications to determine:
 - (1) That the requirements of Sections 110.416.00 to 110.416.80, inclusive, have been satisfied; and
 - (2) That the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one (1) foot at any point.
- (b) Availability of Certifications. The Department of Public Works shall maintain for public inspection and make available as needed for flood insurance policies all certifications required by this article.
- (c) Notification Requirements. The Department of Public Works shall insure that adjacent affected communities and the Nevada Department of Conservation, Division of Water Planning are notified prior to any alteration or relocation of a watercourse and submit evidence of such notification to the Federal Emergency Management Agency.
- (d) Flood Area Delineation. The Department of Public Works shall provide interpretations, where needed, as to the location of the boundaries of the flood hazard areas, and the elevation of the base flood, if known.
- (e) Flood Elevation Determination. If base flood elevation data have not been provided in accordance with Section 110.416.15, the Department of Public Works shall obtain, review and reasonably utilize any base flood elevation and floodway data available from federal, state or other acceptable sources as criteria for requiring that new construction, substantial improvements or other improvements in flood hazard areas as shown on the existing Flood Insurance Rate Maps meet the standards in Sections 110.416.55 to 110.416.80. If deemed necessary by the Department of Public Works, the owner or developer may be required to provide an engineered hydrological study to determine the base flood flow and elevations.
- (f) Availability of Plans. The Department of Public Works shall maintain on file all operation and maintenance plans submitted by the developer for every acceptable flood protection measure.

Section 110.416.55 Standards for Subdivision. The standards for subdivisions subject to flood damage are as set forth in this section.

- (a) All new subdivision proposals and other proposed developments (including proposals for manufactured home parks and subdivisions) greater than fifty (50) lots or five (5) acres, shall provide base flood elevation data.
- (b) All subdivision improvement plans shall identify the flood hazard area, the elevation of the base flood, and the elevation of every proposed structure, pad and adjacent grade. If the site is filled above the base flood, the final pad elevation shall be certified by a Nevada registered engineer or land surveyor and provided to the Department of Public Works.
- (c) All subdivision proposals shall be consistent with the need to minimize flood damage.

- (d) All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage.
- (e) All subdivision proposals shall have adequate drainage provided to reduce exposure to flood damage.
- (f) No subdivision improvement shall be placed in a floodway, except as provided in Section 110.416.70.

Section 110.416.60 Construction Standards. In all flood hazard areas, the standards for construction materials and methods, as set forth in this section, are required:

- (a) All Construction. All new construction and substantial improvements shall be designed and adequately anchored to prevent flotation, collapse or lateral movement of the structure; and be elevated on stemwalls, pilings, columns or armored fill so that the top of the lowest floor is elevated in conformance with provisions of Section 110.416.65, Flood Zone Requirements.
- (b) Manufactured Homes. All manufactured homes shall meet the anchoring standards of Section 110.416.65, Flood Zone Requirements.
- (c) Materials. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.
- (d) Methods. All new construction and substantial improvements shall use methods and practices that minimize flood damage, and provide adequate drainage paths around structures on slopes to guide flood waters around and away from proposed structures.
- (e) Mechanical and Electrical. All elements that function as part of the structure (such as furnace, water heater, air conditioner and other electrical equipment) shall be elevated to one (1) foot or more above the base flood elevation or depth number specified on the Flood Insurance Rate Maps.
- (f) Methods of Hydrostatic Equalization. All new construction and substantial improvements, which have fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement shall be certified by a Nevada registered engineer and must meet or exceed the provisions of this subsection.
 - (1) A minimum of two (2) openings having a total net area of not less than one (1) square inch for every square foot of enclosed area subject to flooding shall be provided.
 - (2) The bottom of all openings shall be no higher than one (1) foot above original grade. Openings may be equipped with screens, louvers or other cover devices, provided that they permit the automatic entry and exit of floodwaters.
 - (3) The exterior walls of all new construction and substantial improvements which have fully enclosed areas below the lowest floor that are subject to

impact forces and drag forces shall also be designed by a Nevada registered engineer to withstand these and all hydrodynamic flood forces.

- (g) Utilities. The construction standards for utilities shall be as set forth below:
 - (1) Water and Wastewater Systems. All new and replacement water supply and sanitary sewerage systems shall be designed to minimize or eliminate infiltration of floodwaters into the system and discharge from systems into floodwaters.
 - (2) On-site Systems. On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

[This Section amended by Ord. 922, provisions eff. retro. to 9/30/94.]

Section 110.416.65 Flood Zone Requirements. In all flood hazard areas, elevation and floodproofing standards shall be in accordance with the provisions of this section. Elevations shall be certified by a Nevada registered engineer or land surveyor.

- (a) Zones AE and AH Requirements. In Zones AE and AH, new construction and substantial improvement of any structure shall have the top of the lowest floor (including basement floor) elevated to one (1) foot or more above the base flood elevation. Nonresidential structures must meet the standards in subsection (f) of this section.
- (b) Zone AO Requirements. Zone AO, areas subject to alluvial fan flooding, have irregular flow paths that result in erosion of existing channels and the undermining of fill material. In every such zone, the provisions of this subsection shall be met.
 - (1) All structures must be securely anchored to minimize the impact of the flood and sediment damage.
 - (2) New construction and substantial improvement to any structure shall have the top of the lowest floor (including basement floor) elevated to at least one (1) foot above the depth number specified on the Flood Insurance Rate Maps. Nonresidential structures must meet the standards in subsection (f) of this section.
 - (3) Use of all fill materials must be armored to protect the material from the velocity of the flood flow.
 - (4) All proposals for subdivision development must provide a mitigation plan that identifies the engineering methods used to:
 - (i) Protect structures from erosion and scour caused by the velocity of the flood flow; and
 - (ii) Capture or transport flood and sediment flow through the subdivision to a point of deposition that will not create a health or safety hazard.
- (c) Zone A Requirements. In an unnumbered Zone A, new construction and substantial improvement to any structure shall have the top of the lowest floor

(including basement floor) elevated to either of the standards in this subsection. Non-residential structures must meet the standards subsection (f) of this section.

- (1) A height of at least two (2) feet above the highest adjacent undisturbed ground elevation if no base flood elevation has been determined; or
 - (2) A height of at least one (1) foot above the base flood elevation as determined by an engineered hydrological study provided by the owner or developer, if deemed necessary by the Department of Public Works.
- (d) **Fabricated Housing Requirements.** All fabricated homes, as specified in Article 312, Fabricated Housing, and additions to fabricated homes shall be constructed using methods and practices in conformance with subsections (a), (b) or (c) of this section to minimize flood damage. Fabricated homes will be set on a securely anchored permanent foundation system to resist flotation, collapse and lateral movement. The foundation shall be designed by a registered engineer.
- (e) **Recreational Vehicle Requirements.** All recreational vehicles placed on sites within Zones A, AH, AE and AO shall meet the following requirements:
- (1) Be on site for fewer than 180 days;
 - (2) Be fully licensed and ready for highway use; or
 - (3) Meet the standards in subsection (d) of this section.
- (f) **Nonresidential Requirements.** Nonresidential construction shall either be elevated in conformance with subsection (a), (b), or (c) of this section, or together with attendant utility and sanitary facilities, be floodproofed to the same appropriate elevations as the top of the lowest floor elevations as indicated in subsection (a), (b), or (c) of this section. All floodproofing measures shall be designed by a Nevada registered engineer. Examples of floodproofing include, but are not limited to:
- (1) Installation of watertight doors, bulkheads and shutters;
 - (2) Reinforcement of walls to resist water pressure;
 - (3) Use of paints, membranes or mortars to reduce seepage through walls;
 - (4) Addition of mass or weight to the structure to resist flotation; and
 - (5) Armor protection of all fill materials from scour and erosion.

[This Section amended by Ord. 922, provisions eff. retro. to 9/30/94.]

Section 110.416.70 Flood Hazard Reduction: Prohibited Uses and Structures within Floodways.

- (a) **Prohibited Floodway Encroachments.** Every new encroachment, including fill, new construction, substantial improvement and other development, is prohibited in a designated floodway, except as provided in subsection (b) of this section.

- (b) Exceptions. Improvements may be allowed in the floodway if it is demonstrated through hydrologic and hydraulic analysis and certified by a Nevada registered engineer that the proposed improvements will not result in any increase in flood levels during the occurrence of the base flood discharge, and that the improvements meet the standards in Sections 110.416.55 to 110.416.65 inclusive.

[This Section amended by Ord. 922, provisions eff. retro. to 9/30/94.]

Section 110.416.75 Appeals. Appeals shall be as set forth in this section.

- (a) Appeals for Variances. The Board of County Commissioners shall hear and decide appeals and requests for variances from the requirements of this article.
- (b) Appeals for Errors. The Board of County Commissioners shall hear and decide appeals when it is alleged there is an error in any requirement, decision or determination.
- (c) Appeals Considerations. In passing upon such applications, the Board of County Commissioners shall consider all technical evaluations and all relevant requirements, factors and standards specified in this article and shall also consider the provisions of this subsection:
 - (1) The danger that materials may be swept onto other lands to the injury of others;
 - (2) The danger to life and property due to flooding or erosion damage;
 - (3) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;
 - (4) The importance of the services provided by the proposed facility to the community;
 - (5) The necessity to the facility of a waterfront location, where applicable;
 - (6) The availability of alternative locations that are not subject to flooding or erosion damage and would suffice for the proposed use;
 - (7) The compatibility of the proposed use with existing and anticipated development;
 - (8) The relationship of the proposed use to the Comprehensive Plan and floodplain management program for that area;
 - (9) The safety of access to the property in times of flood, for ordinary and emergency vehicles;
 - (10) The expected heights, velocity, duration, rate of rise and sediment transport of the floodwaters expected at the site; and
 - (11) The costs of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and

facilities (such as sewer, gas, electrical and water systems, and streets and bridges).

- (d) Issuance of Variance. Variances shall only be issued when in compliance with the provisions of this section.
 - (1) A showing of good and sufficient cause such as renovation, rehabilitation or reconstruction. It is not good and sufficient cause for a variance to be issued upon the basis of economic considerations, aesthetics or because variances have been used in the past.
 - (2) A determination that failure to grant the variance would result in exceptional hardship to the applicant.
 - (3) A determination that the granting of a variance will not result in additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization to the public, or conflict with existing local laws or ordinances.
- (e) Extent of Variance. Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.
- (f) Conditions of Variance. Upon consideration of the factors set forth in subsection (c) of this section and the purpose of this article, the Board of County Commissioners may attach such conditions to the granting of variances as it deems necessary to further the purpose of this article.
- (g) Historic Resources. Variances may be issued for the reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places without regard to the procedures set forth in this section.
- (h) Increase in Flood Levels. Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.
- (i) Written Notice. Any applicant to whom a variance is granted shall be given written notice that the structure will be permitted to be built with a lowest floor elevation below the base flood elevation and that the cost of flood insurance may be commensurate with the increased risk resulting from the reduced lowest floor elevation. The variance does not remove the obligation by the owner to keep and maintain flood insurance.
- (j) Responsibilities of Department of Public Works. The Washoe County Department of Public Works shall maintain the records of all appeal actions and report any variances to the Federal Emergency Management Agency upon request.

[Previous Section 110.416.75 entitled "Construction Standards: Utilities" repealed and this Section amended by Ord. 922, provisions eff. retro. to 9/30/94.]

Section 110.416.80 Penalties for Violations. Any person who violates a provision of this article is guilty of a misdemeanor and shall be punished as provided in Article 910, Enforcement.

[This Section amended by Ord. 922, provisions eff. retro. to 9/30/94.]

Article 418

SIGNIFICANT HYDROLOGIC RESOURCES

[This article added by Ord. 1112, provisions eff. 2/15/01.]

Sections:

110.418.00	Purpose
110.418.05	Applicability
110.418.10	Exemptions
110.418.15	Perennial Streams Buffer Areas
110.418.20	Critical Stream Zone Buffer Area Development Standards
110.418.25	Sensitive Stream Zone Buffer Area Development Standards
110.418.30	Special Review Considerations
110.418.35	Common Open Space Development
110.418.40	Modification of Standards

Section 110.418.00 Purpose. The purpose of this article, Article 418, Significant Hydrologic Resources, is to regulate development activity within and adjacent to perennial streams to ensure that these resources are protected and enhanced. This article establishes standards for use of land in "critical stream zone buffer area" and "sensitive stream zone buffer area" to preserving and protecting perennial streams within Washoe County to implement a policy of "no net loss" of significant hydrological resource size, function and value. The purpose of requiring perennial stream buffer areas is to recognize that many uses directly adjacent to a hydrologic resource may compromise the integrity of the resource through various negative features endemic to the specific use. Negative activities in the buffer areas may impact the quality or quantity of the existing hydrology, soil characteristics, vegetation communities or topography thereby jeopardizing the resource's functions. The intent of these regulations is to protect the public health, safety and welfare by:

- (a) Preserving, protecting and restoring the natural functions of existing perennial streams in Washoe County;
- (b) Reducing the need for the expenditure of public funds to remedy or avoid flood hazards, erosion, or other situations caused by inappropriate alterations of streams;
- (c) Ensuring the natural flood control functions of perennial streams including, but not limited to, stormwater retention and slow-release detention capabilities are maintained;
- (d) Ensuring stormwater runoff and erosion control techniques are utilized to stabilize existing stream banks, reduce downstream sediment loading, and ensure the safety of people and property;
- (e) Ensuring the natural water quality functions of perennial streams including, but not limited to, pollution filtering, groundwater recharge, nutrient storage, nutrient recycling capabilities, and sediment filtering capabilities are not impacted by existing and proposed developments;

- (f) Encouraging common open space developments to avoid hazardous or environmentally sensitive areas, protect important habitat and open space areas, and minimize impacts on groundwater recharge areas;
- (g) Establishing buffer areas around all significant hydrological resource areas to ensure the resource is not jeopardized or degraded by adjacent offsite development activity;
- (h) Ensuring a no net loss of value, acreage and function of each different significant hydrological resources is adhered to; and
- (i) Identifying, establishing and managing perennial streams as mitigation sites for destroyed or degraded hydrological resources.

Section 110.418.05 Applicability. The provisions set forth in this article shall apply as follows:

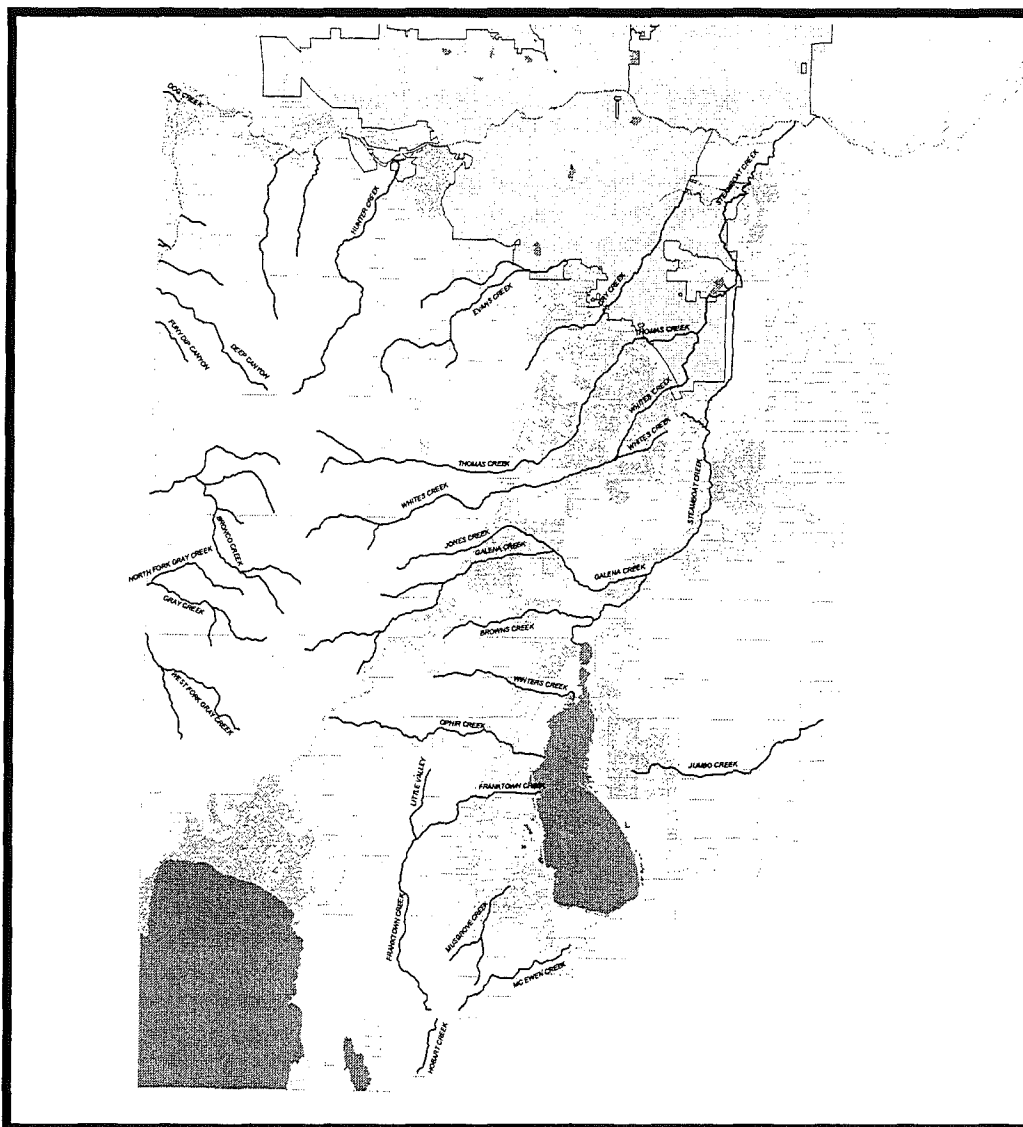
- (a) Area of Applicability. The provisions of Article 418 shall apply to all properties containing either perennial streams, or an established buffer area surrounding one of the perennial streams, as identified on Map 110.418.05.1; Significant Hydrologic Resources. All new development that requires permitting or review by the County shall be reviewed for compliance with the significant hydrologic resource standards. No variance to the significant hydrologic resource standards, pursuant to Article 804, Variances, shall be processed or approved. Refer to Section 110.418.40 Modification of Standards.

In determining the location of the above-designated streams, staff shall use:

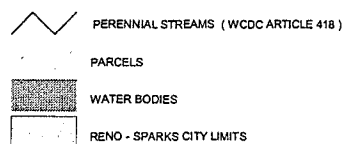
- (1) Published United States Geological Service (USGS) topographic maps, either in 7.5 minute or 15 minute series, to assist in the interpretation of location of significant hydrologic resources.
 - (2) A determination of the location of a perennial stream resulting from a delineation of wetlands and/or waters of the United States made by the United States Army Corps of Engineers under the provisions of Section 404 of the Federal Clean Water Act, shall be considered the perennial stream crossing any parcel of land.
 - (3) Field survey by land surveyor or professional engineer licensed and qualified to perform a survey.
- (b) Relationship to Other Restrictions. The requirements established in this article are not intended to repeal, abrogate, supersede or impair any existing federal, state or local law, easement, covenant or deed restriction. However, if this article imposes greater or more stringent restrictions, the provisions of this article shall prevail. Specifically, if an applicant also acquires authorization under Section 404 of the Clean Water Act from the United States Army Corps of Engineers, the applicant shall meet any greater or more stringent restrictions set forth in this article in addition to and independent of the restrictions of such permit.
 - (c) Application of this Article to the Tahoe Planning Area. The provisions of this article may be waived by the Department of Community Development for development in areas under the jurisdiction of the Tahoe Regional Planning Agency (TRPA) as long as "stream environment zones" are regulated by TRPA.

- (d) Application of this Article to the Truckee River. The provisions of this article do not apply for development along the Truckee River from the California/Nevada state line to the terminus in Pyramid Lake.
- (e) Application of this Article to the High Desert Planning Area. The provisions of this article do not apply for development in the High Desert planning area.
- (f) Impact on Land Use Designations. The provisions of this article shall neither be used as justification for changing a land use designation nor be used to reduce the development density or intensity otherwise allowed by the land use designation of the property, subject to the provisions and limitations of this article.

Map 110.418.05.1



SIGNIFICANT HYDROLOGIC RESOURCES



Note: The scale and configuration of all information shown herein are approximations only and are not intended as a guide for design or survey work. Reproduction is not permitted without prior written permission from the Washoe County Department of Community Development.

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SCALE IN FEET



Department of
Community
Development
**WASHOE COUNTY
NEVADA**

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Reno, Nevada 89520
(775) 328 - 3600



SOURCE : DEPARTMENT OF COMMUNITY DEVELOPMENT / TRUCKEE MEADOWS REGIONAL PLANNING AGENCY

DATE : NOVEMBER 2000

Section 110.418.10 Exemptions. The following are exempt from the provisions of this article:

- (a) All existing allowable or permitted use of any single family, detached, residential structure, including interior renovation, and replacement upon catastrophic damaging event, and all related accessory uses (e.g. garages, barns, corrals, storage sheds) constructed or under construction with a valid building permit prior to (effective date of this ordinance).
- (b) All projects with an approved special use permit, any map to divide land, design standards handbook and/or development agreement, currently active (not expired) and having obtained approval or having submitted a valid discretionary permit application prior to (effective date of this ordinance).

Section 110.418.15 Perennial Streams Buffer Areas. Perennial stream buffer areas are established to provide adequate setbacks and land use controls to ensure water quality functions of each perennial stream are not jeopardized through development activity. To limit significant impacts adjacent to hydrological resources, two (2) buffer areas are hereby established—the "critical stream zone buffer area" and the "sensitive stream zone buffer area". All proposals to develop uses within the critical stream zone buffer area and/or the sensitive stream zone buffer area shall submit a site plan with precise dimensions depicting the boundary line for the buffer areas.

- (a) **Critical Stream Zone Buffer Area.** The critical stream zone buffer area shall be all land and water surface within thirty (30) feet from the centerline of the perennial stream. The centerline of the stream shall be determined by either survey from a licensed surveyor or by determination of the thalweg (i.e. the line connecting points of maximum water depth) from a topographic survey, or appropriate USGS 7.5 minute topographic map covering the site.
- (b) **Sensitive Stream Zone Buffer Area.** The sensitive stream zone buffer area shall be all land and water surface between the critical stream zone buffer area boundary of thirty (30) and one hundred fifty (150) feet from centerline or thalweg of the perennial stream.

Section 110.418.20 Critical Stream Zone Buffer Area Development Standards. All development in the critical stream zone buffer area shall be subject to the following standards:

- (a) **Allowed Uses.** Uses allowed within the critical stream zone buffer area are limited to those uses necessary for providing community services such as managing and conserving natural resources, and providing recreational and educational opportunities, including:
 - (1) Weed control consistent with state and County laws.
 - (2) Mosquito abatement consistent with state and County laws.
 - (3) Conservation or preservation of soil, water, vegetation, fish and other wildlife habitats.
 - (4) Outdoor recreation activities such as fishing, bird watching, hiking and swimming.
 - (5) Education and scientific research including, but not limited to, water quality monitoring and stream flow gauging.

- (6) Maintenance of an existing public or private road, driveway, structure or facility, including drainage facilities, water conveyance structures, dams, fences, trails, and any public or private utility facility used to provide transportation, electric, gas, water, telephone, telecommunication, or other including individual service connections. Written notice shall be provided to the Department of Community Development at least fifteen (15) days prior to the commencement of work, and all impacts to the critical stream zone buffer area are minimized and disturbed areas are immediately restored to their natural state.
 - (7) Landscape improvements and maintenance of native vegetation is allowed within an established critical stream zone buffer area including the pruning of trees and the removal of dead vegetation and debris. Ornamental landscaping that would require fertilizer or pesticide applications for growth and maintenance is not permitted within the critical stream buffer zone area.
 - (8) Landscaping area requirements in accordance with Article 412, Landscaping, may be satisfied by using the natural, undisturbed or restored critical stream zone buffer area to count towards the required area to be landscaped for new residential, civic, commercial, industrial or agricultural use types. Parking and loading areas on the developed portion of the site shall continue to require landscaping. Open space requirements in accordance with Article 432, Open Space Standards, may be satisfied by using the natural, undisturbed or restored critical stream zone buffer area.
 - (9) Continuation of existing agricultural operations such as the cultivation and harvesting of hay or pasturing of livestock, or change of agricultural practices such as the relocation of an existing pasture fence, which has no greater impact on perennial stream water quality.
 - (10) Perimeter fencing on a property boundary with a valid building permit pursuant to approval by the County Engineer to ensure that obstruction to stream flows has been avoided.
- (b) Permitted Uses Requiring a Planning Commission Approved Special Use Permit Subject to the Provisions of Article 810, Special Use Permits. Subject to the regulatory zone in effect for the property establishing the uses as specified in Article 302, Allowed Uses, the following use types may be permitted in the critical stream zone buffer area pursuant to a special use permit being issued by the Washoe County Planning Commission according to the provisions of Article 810, Special Use Permits, and this article. Any construction in the critical stream zone buffer area will require submission of a grading plan showing compliance with applicable best management practices as defined by the Washoe County Department of Public Works to minimize stream bank and stream bed erosion. The grading plan shall also be designed to prevent construction drainage and materials from increasing sedimentation impacts to the stream environment and to minimize impervious surfaces.
- (1) Construction or enlargement of any public or private roads, driveway, structure or facility including drainage facilities, water conveyance structures, dams, trails and any public or private utility facility used to

provide transportation, electric, gas, water, telephone, telecommunication or other services.

- (2) Civic Use Types. Civic uses classified under the utility services, nature center, active recreation, passive recreation and safety services use types may be permitted in the critical stream zone buffer area.
- (c) Prohibited Uses. Due to the incompatible nature of certain uses (i.e. ground disturbance, untreated water discharge, hazardous materials, chemical contamination, scale of use, traffic, etc.) and the potential negative impacts on the perennial stream and adjoining critical stream zone buffer area, all new construction and development uses not listed in either the allowed or permitted section of this article shall not be established in the critical stream zone buffer area.
 - (1) Residential, Civic, Commercial, Industrial and Agricultural Use Types. All new residential, civic, commercial, industrial and agricultural use types not listed as allowed or permitted uses are prohibited in the critical stream zone buffer area. Specifically prohibited industrial uses include:
 - (i) Aggregate facilities - permanent.
 - (ii) Aggregate facilities - temporary.
 - (iii) Energy production.
 - (iv) General industrial - heavy.
 - (v) Inoperable vehicle storage.
 - (vi) Mining operations.
 - (vii) Salvage yards.
 - (viii) Wholesaling, storage and distribution - heavy.
 - (2) Parking and Ornamental Landscaping. All new parking and ornamental landscaping areas to fulfill the minimum requirements for new residential, civic, commercial, industrial or agricultural use types shall be prohibited in the critical stream zone buffer area.
 - (3) Fences. In order to prevent livestock from destroying the stream bank slope, all new perpendicular-oriented fences except as provided in Section 110.418.20(a)(10) shall be prohibited in the critical stream zone buffer area. Fencing that is parallel to the stream and is designed to keep livestock from access to the water and stream bank may be permitted after review and approval by the Department of Community Development.

Section 110.418.25 Sensitive Stream Zone Buffer Area Development Standards. All development in the sensitive stream zone area shall be subject to the following standards:

- (a) Allowed Uses. All allowed uses within the critical stream zone buffer area are also allowed in the sensitive stream zone buffer area. Additional allowed uses in the sensitive stream zone buffer area include:
- (1) Single family, detached residential uses and all related accessory uses associated with the single family residence requiring a building permit issued by the Washoe County Building and Safety Department. Attached or detached accessory dwellings in conformance with Article 306, Accessory Uses and Structures, may also be erected within the sensitive stream zone buffer area. New building structures such as storage sheds and gazebos that, due to their minimum floor area, do not require a building permit issued by the Washoe County Building and Safety Department may also be erected within the sensitive stream zone buffer area.
 - (2) Landscaping area requirements in accordance with Article 412, Landscaping, including ornamental landscape planting, may be satisfied by using the sensitive stream zone buffer area to count towards the required area to be landscaped for new residential, civic, commercial, industrial or agricultural use types. Parking and loading areas on the developed portion of the site shall continue to require landscaping. Open space requirements in accordance with Article 432, Open Space Standards, may be satisfied by using the natural, undisturbed or restored sensitive stream zone buffer area.
 - (3) New fencing, constructed in accordance with Washoe County Code.
- (b) Permitted Uses Requiring a Planning Commission Approved Special Use Permit Subject to the Provisions of Article 810, Special Use Permits. Subject to the regulatory zone in effect for the property establishing the uses as specified in Article 302, Allowed Uses, all new use types may be permitted in the sensitive stream zone buffer area pursuant to a special use permit being issued by the Washoe County Planning Commission according to the provisions of Article 810, Special Use Permits, and this article. The special use permit requirement is also applicable to construction or enlargement of any public or private roads, driveway, structure or facility including drainage facilities, water conveyance structures, dams, trails, and any public or private utility facility used to provide transportation, electric, gas, water, telephone, telecommunication or other services. New residential, commercial and industrial subdivisions processed in accordance with Article 608, Tentative Subdivision Maps, shall not require the concurrent processing of a special use permit, as long as the "Special Review Considerations" of this article are addressed in the tentative subdivision map review. Any construction in the sensitive stream zone buffer area will require submission of a grading plan showing compliance with applicable best management practices as defined by the Washoe County Department of Public Works to minimize stream bank and stream bed erosion. The grading plan shall also be designed to prevent construction drainage and materials from increasing sedimentation impacts to the stream environment and to minimize impervious surfaces.
- (c) Prohibited Uses. Due to the incompatible nature of certain uses (i.e. ground disturbance, untreated water discharge, hazardous materials, chemical contamination, scale of use, traffic, etc.) and the potential negative impacts on the

perennial stream and adjoining sensitive stream zone buffer area, the following uses shall not be established in the sensitive stream zone buffer area:

- (1) Aggregate facilities - permanent.
- (2) Aggregate facilities - temporary.
- (3) Energy production.
- (4) General industrial - heavy.
- (5) Inoperable vehicle storage.
- (6) Mining operations.
- (7) Salvage yards.
- (8) Wholesaling, storage and distribution - heavy.

Section 110.418.30 Special Review Considerations. In addition to the findings required by Article 810, Special Use Permits, prior to approving an application for development in the critical stream zone buffer area or the sensitive stream zone buffer area, the record at the Planning Commission shall demonstrate that the following special review considerations are addressed:

- (a) Conservation of topsoil;
- (b) Protection of surface water quality;
- (c) Conservation of natural vegetation, wildlife habitats and fisheries;
- (d) Control of erosion;
- (e) Control of drainage and sedimentation;
- (f) Provision for restoration of the project site to predevelopment conditions;
- (g) Provision of a bonding program to secure performance of requirements imposed; and
- (h) Preservation of the hydrologic resources, character of the area and other conditions as necessary.

Section 110.418.35 Common Open Space Development. New residential subdivision requests with a protected perennial stream on the property are encouraged to submit in accordance with the provisions of Article 408, Common Open Space Development. A tentative subdivision map that protects the critical stream and the sensitive stream zone buffer areas in a natural, undisturbed or restored state as part of the common open space area is presumed to meet the required finding as specified in Article 608, Tentative Subdivision Map, Section 110.608.25(e) as follows:

"Fish or Wildlife. That neither the design of the subdivision nor any proposed improvements is likely to cause substantial environmental damage, or substantial and avoidable injury to any endangered plant, wildlife or their habitat".

Section 110.418.40 Modification of Standards. Modification of standards, including interpretation of the applicability of the standards in this section, shall be set forth as follows:

- (a) Appeals for Errors. The Board of County Commissioners shall hear and decide appeals when it is alleged there is an error in any requirement, decision or determination. Appeals shall be processed under the provision of Article 810, Special Use Permits, Section 110.810.50, Appeals.
- (b) Special Exceptions. The Board of County Commissioners shall hear and decide requests for special exceptions from the requirements of this article. In passing upon such applications, the Board of County Commissioners shall consider all technical evaluations and all relevant requirements, factors and standards specified in this article and shall also consider the provisions of this subsection:
 - (1) The potential degradation of the stream environment.
 - (2) The danger to life and property due to flooding or erosion damage.
 - (3) The loss of critical habitat.
- (c) Issuance of Special Exception. Special exceptions shall only be issued when in compliance with the provisions of this section and the Board of County Commissioners finds:
 - (1) A showing of good and sufficient cause such as renovation, rehabilitation or reconstruction of the stream environment; or
 - (2) A determination that failure to grant the special exception would result in exceptional hardship to the applicant, such as deprivation of a substantial use of property and that the granting of a special exception will not result in degradation of the stream environment.
- (d) Extent of Special Exception. Special exceptions shall only be issued upon a determination that the special exception is the minimum necessary to afford relief.
- (e) Conditions of Special Exceptions. Upon consideration of the factors set forth in this section and the purpose of this article, the Board of County Commissioners may attach such conditions to the granting of special exceptions as it deems necessary to further the purpose of this article.

AGENDA ITEM # _____
WARD # _____

This report has been reviewed for:	
Financial Implications:	_____
Legal Implications:	_____
Department Approval	_____

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STAFF REPORT

March 18, 2003

To: Mayor and City Council
Thru: Charles McNeely, City Manager
From: Gene A. Jones, P.E., Senior Civil Engineer
Re: **Request For Direction Regarding Flood Control Concepts Related To The Evans Creek (Block N) Watershed**
Date: March 10, 2003

Summary: Staff is requesting direction regarding flood control concepts related to the Evans Creek (Block N) Watershed. On January 28, 2003 Council deferred action, pending discussion at the next joint meeting with Washoe County and The City of Sparks, on the staff request for approval of a consultant contract to complete a Letter Of Map Revision for FEMA designation of the Evans Creek flood plain from Parr Boulevard to the Truckee River as well as provide other related professional services. The January 28, 2003 staff report titled "Consultant Contract – Evans Creek (Block N) Watershed is attached.

Previous Council Action:

July 26, 1994 - Approved the agreement between National Resource Conservation Service, University of Nevada-Reno, Washoe County, Washoe-Storey Conservation District, and the City of Reno to construct a dam in Evans Creek Canyon north of McCarran Boulevard.

June 5, 2001 - Received update on the Evans Creek Watershed project.

August 28, 2001 - Approved option to re-examine all structural and non-structural alternatives including the proposed dam in Evans Creek Canyon. Requested that the West University Neighborhood Advisory Board provide a facilitated process to review various alternatives, with notifications being provided to affected upstream and downstream residents.

November 13, 2001 – Approved the facilitated process outline presented by the West University Neighborhood Advisory Board and approved a budget limit of \$52,700 for professional facilitation and clerical services.

April 9, 2002 – Approved the consultant contracts with Moore, Iacofano, and Goltzman for facilitation services in an amount not to exceed \$52,700 as well as WRC Nevada, Inc. for professional engineering services in an amount not to exceed \$44,800.

October 22, 2002 – Accepted the final oral report presented by the Evans Creek (Block N) stakeholders and directed staff to return to Council November 5, 2002 with recommendations.

November 5, 2002 – Approved staff recommendations in consideration of the oral report delivered by Evans Creek (Block N) stakeholders at the October 22, 2002 Council meeting.

January 28, 2003 – Deferred approval of the consultant contract with WRC, Nevada, Inc. pending discussion of flood control concepts related to Evans Creek at the next joint meeting with Washoe County and the City of Sparks.

Background: Following the February, 1986 flood which damaged buildings on the University of Nevada – Reno campus as well as nearby private property, the local government agencies contacted the National Resource Conservation Service (NRCS) for possible assistance in mitigating future flood events. NRCS, assisted by a steering committee composed of engineering staff from the four local sponsors and local interested citizens looked at numerous structural and non-structural alternatives. The alternatives were narrowed down after many of them, either by themselves or in combination, failed to deliver the desired benefit, were more costly than the benefit they would yield, were unsafe, or had substantial impact on existing land use including the Rancho San Rafael Park. The preferred alternative was a dam located north of Rancho San Rafael Park in Evans Creek Canyon. The Environmental Assessment and 1994 Agreement were prepared for locating the dam in the canyon.

Following almost two years of review by the Regional Water Planning Commission, the Washoe County Commissioners decided to withdraw support of locating the dam in Evans Creek Canyon as proposed in the 1994 Agreement. In addition, they proposed looking at other alternatives. Subsequently, the Reno City Council directed staff to assist the West University Neighborhood Advisory Board (WUNAB) in preparing a proposal to conduct a facilitated public process to identify and gain consensus among stakeholders on viable alternatives to mitigate storm water from Evans Creek. In addition to stakeholders, interested previous participants, and property owners along Evans Creek Canyon, staff was further directed to invite property owners and residents in the downstream flood plain area to participate in the process. With the focus on a potential dam in Evans Creek Canyon for several years, downstream property owners may not have been aware they were in a flood plain.

The WUNAB developed a facilitated process outline and presented it and a request for funding to Council November 13, 2001. Council approved the facilitated process outline and allocated up to \$52,700 for facilitation and clerical support services.

The WUNAB selected the firm of Moore, Iacofano, and Goltsman to provide professional consulting services and clerical support for conducting the facilitated process. This firm had provided similar services in the Truckee Meadows. Residents within the watershed and the downstream flood plain as well as previously identified interested citizens and stake holders were invited by written notice, twice, to actively identify and prioritize alternative methods to mitigate storm water from Evans Creek. Representatives of Washoe County, UNR, and NRCS participated in the process. Concurrent with the facilitated public process, the engineering firm of WRC Nevada, Inc. provided additional analysis of the watershed with emphasis on the downstream flood plain and assisted the City in providing technical assistance to the facilitated public process participants.

Stakeholders proposed, discussed, and evaluated numerous structural and nonstructural alternatives to the detention dam designed by NRCS. Structural alternatives included other

potential dam sites and the possibility of building more than one dam. Nonstructural alternatives included re-vegetation of the watershed and methods to minimize impacts from future development. WRC Nevada, Inc. was able to model the alternatives and provide numerical and visual analysis of the effectiveness of flood mitigation alternatives either individually or in combination. The original detention dam designed by NRCS was not re-evaluated or discussed in depth since the funding for construction is no longer available and it is unlikely the dam can be built. Stakeholders presented their process, alternatives, analysis, conclusions and final oral report to Council on October 22, 2002.

Of the alternatives available to the City, only a major structure (dam) properly located on the Evans Creek drainage could significantly mitigate flooding. Other structural alternatives would partially mitigate flooding. The rest of the alternatives either had small, but measurable, impact on mitigating existing flooding or would help prevent worse flooding as development occurs.

On November 5, 2002 Council accepted staff recommendations developed in response to the stakeholders conclusions. The recommendations were: (1) The City withdraw from the dam project and direct NRCS to close the dam project; (2) The city should not pursue reconstructing McCarran Boulevard for use as a dam; (3) The City should not attempt to construct major storm drains from Virginia Street to the Truckee River; (4) The City should pursue using the future Parr Boulevard Extension to provide detention when the extension occurs with future development; (5) The City should research the alternative to retain runoff on new development and take necessary steps for implementation; (6) The City encourage and assist in stream restoration efforts along Evans Creek; (7) The City investigate and implement, if feasible, construction of detention in conjunction with park development at Newport Lane; (8) The City investigate flood proofing and retrofitting as new development occurs in conjunction with designation of the Evans Creek Flood Plain as a FEMA flood zone; (9) The City investigate and implement designation of the Evans Creek Flood Plain as a FEMA flood zone.

On January 28, 2003 Council, pending discussion at the next joint meeting with Washoe County and the City of Sparks, deferred action on the request to approve the consultant contract with WRC Nevada, Inc. to provide professional engineering services to implement several of the recommendations for Evans Creek approved by Council. These include: a Federal Emergency Management Agency letter of map revision to designate flood plains in Evans Creek from Parr Boulevard to the Truckee River; a feasibility study of combining storm water detention with recreational features at the City of Reno's Newport Lane Park site; and performing feasibility analysis for stream zone enhancement of Evans Creek. The consultant contract was not to exceed \$68,900.00.

Discussion: Staff is requesting direction regarding the flood control concepts related to Evans Creek.

Financial Implications: \$250,000 was approved in the CIP for miscellaneous City expenses related to the Evans Creek (Block N) Dam proposed by NRCS. Approximately \$152,000 is still available for Evans Creek flood control issues.

Recommendation: Staff recommends that Council provide direction regarding the flood control concepts related to Evans Creek.

Attachment

FINAL DRAFT
Report of Evans Creek Stakeholders' Recommendations
To Reduce Flood Damages in the Evans Creek Watershed

Prepared by Elisa Maser
Moore Iacofano Goltsman Inc.
October 22, 2002

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Attachment A: Evans Creek Flood Chronology

Attachment B: Database of Participants

Attachment C: Meeting Agendas & Summaries

Attachment D: Evans Creek Watershed Map

Attachment E: Alternatives Considered

FINAL DRAFT
Report of Evans Creek Stakeholders' Recommendations
To Reduce Flood Damages in the Evans Creek Watershed

I. INTRODUCTION & BACKGROUND

Background

Although the high desert City of Reno gets little precipitation every year, flooding is still a serious problem here. Both winter and summer floods occur with varying degrees of damage throughout the region. In the Evans Creek (Block N) watershed, it is difficult to pinpoint the exact extent of damage, however, damaging flooding has occurred in the past and will continue in the future. (See Attachment A: Evans Creek Flooding Chronology including previous Council actions.)

Following the 1986 flood on Evans Creek, Reno and Washoe County worked with state and federal agencies to find a solution to flooding in this watershed. In 1994, Reno, Washoe County, the Washoe Storey Conservation District and the National Resource Conservation Service signed an agreement for a dam as a flood solution. After several years more study, in July 2001, Washoe County withdrew support of the dam requesting analysis of alternative solutions. Later in 2001, the City Council agreed that alternative solutions should be considered.

The West University Neighborhood Advisory Board then asked the City of Reno to undertake a facilitated process with the community to seek alternative resolutions for flooding on the Evans Creek. In April 2002, the City Council agreed to conduct a stakeholders process in order to achieve consensus on prioritized strategies for reducing damages caused by flooding on the Evans Creek drainage. The City Council approved a contract for MIG to handle the facilitated process with support from WRC, Neighborhood Mediation Center, and Robert Cox Enterprises.

The Council agreed these flood reduction strategies would be based on information provided by technical staff, experts and stakeholders. These strategies will be conceptual in nature, not technical or design level strategies. **Deliverable: October presentation to the Reno City Council of a prioritized list of feasible damage reduction strategies with generalized cost / benefit information.**

Facilitated Process To Develop Recommendations

Invitations to the first two meetings of the stakeholders group were sent to all households in the Evans Creek watershed and floodplain. These notices included a map of the floodplain so recipients could see that they live in the Evans Creek floodplain. Notices for the first two meetings were also sent to e-mail lists for the Truckee River Flood Management Coalition process, the Lower Truckee River Restoration Group, and the

Floodplain Management Planning Committee. Presentations were made to the Northeast Neighborhood, West University and Ward One Neighborhood Advisory Boards outlining the project and requesting participation.

From those notices, a database of over 70 interested people and agencies was created to use for meeting notices, agendas and meeting summaries. (See Attachment B: Database of Participants and Attachment C: Meeting Agendas and Summaries.)

The stakeholders went through a six month facilitated process, meeting ten times in that period. WRC Nevada, a hydraulic engineering firm, provided modeling and technical information. Representatives from the neighborhoods, environmental and recreation groups, the University, the City, the County, and Natural Resource Conservation Service attended meetings regularly.

Outcomes – what would stakeholders like to see come out of the process

Early in the process, the stakeholders identified some of the “outcomes” they would like to see as a result of the facilitated process. The “outcomes” identified during a brainstorming session are listed below:

1. Development and presentation of a prioritized list of feasible flood damage reduction strategies to the Reno City Council by October 2002;
2. Wetlands development in the canyon to serve as a natural filter and sponge for excess water;
3. Watershed restoration all the way to Panther Valley – eliminate Tamarisk and invasive weeds, restoration of native plant communities;
4. Move Evans Creek trail out of the streambed;
5. Eliminate overuse/abuse of wetlands, creek and riparian habitat;
6. Add a non-motorized trail through Evans Creek Canyon up to and through the North Valleys;
7. Work with all property owners to minimize risk due to flooding;
8. Stop additional building (development) in the watershed.
9. Set precedent/policy to prevent the many other canyons around the City from becoming targets for “structural” solutions;
10. Work with City Parks, Recreation and Community Services staff to complete plans for the interconnected trail system from Reno to the North Valleys;
11. Build organic dam system, which fits the environment and accommodates the above suggestions;
12. Improve vegetation in canyons, clean-up and build trail above the creek bed.

II. PROBLEM DESCRIPTION

Nature of the Flooding Problem

At the organizational meeting, stakeholders raised concerns over the methodology used to determine 100-year floods in previous planning efforts. Some of the issues raised at the first meeting included the following:

1. What is the size of the problem (key issue);
2. Look at impact of increased drainage from development in the upper watershed;
3. What precautions are being considered due to the possible increased run-off from development on upper Robb Dr. (Peavine);
4. Analyze the damages that actually occurred historically and why they occurred;
5. What flood proofing have UNR (University of Nevada, Reno) and apartment owners done since 1986? And 1997?
6. Why damage has occurred (key issue)

As background for the problem, Mark Forest of WRC Consulting explained that the watershed does not extend from the peak of Peavine. The watershed is approximately ± 5.00 square miles. (See Attachment D: Watershed Map.)

Winter Storm, Summer Storm, 24 hour Statistical (FEMA Criteria) Storm

Records show that flooding occurred on the Evans Creek in 1904, 1914, 1943, 1955, 1956, 1963 and 1986. Historically, the winter storms have been the ones with greater reported damages (1914, 1943, 1963 and 1986). With the exception of the most recent events, reports of flooding in the watershed have been compiled from newspaper reports and are therefore not very detailed or technical.

Evans Creek watershed does not have a gauging station to measure water levels in flood events. FEMA (Federal Emergency Management System) standards require that certain modeling and technical procedures be used to determine a 100-year event on un-gauged watersheds. These standards are designed to develop hydraulic information that is scientifically and technically defensible.

FEMA requires that gauged watersheds with similar characteristics be developed in order to create a "reasonable range" of estimates for flooding on the un-gauged watershed. Any modeling from the un-gauged watershed can then be compared to this range of estimates to ensure its reasonableness.

For the Evans Creek, WRC did a regression analysis of the 15 gauged watersheds in the area plus historic storm data. Watershed size, vegetative cover, and steepness of the slope all affect the results of the regression analysis. This analysis created a "reasonable range of data for different watersheds based on their size" and provided a benchmark to compare the model of a 100-year event on Evans Creek against.

WRC then developed a 100-year mathematical or synthetic storm for Evans Creek using historical information developed by NDOT (Nevada Department of Transportation), FEMA (Federal Emergency Management Administration), National Weather Service and measurements at Reno-Tahoe International Airport. WRC also used a HEC 1 (Hydraulic Engineering Center) model¹ which includes soils, impervious cover, run-off and additional variables in the analysis.

These studies produced a 24-hour long “mathematical storm” or a synthetic event for the Evans Creek watershed that matched what would be expected based on the FEMA requirements for comparison to gauged watersheds. The FEMA criteria storm is a technically defensible event that captures the range of flooding to be expected; for this reason, FEMA requires use of this storm for flood planning purposes.

On the other hand, participants noted that summer and winter storms in the watershed produce very different types of storms. Summer storms have higher peaks but less volume, while winter storms have smaller peaks and greater volume. A comparison of these storms is listed below:

Peak and volume information:

- Summer thunder storm events typically peak in three hours. These events occur rapidly; there is little opportunity to warn residents or businesses about specific storms. These storms have much smaller volumes of water than winter storms.
- The 24-hour event peaks at 12 hours and has a peak of 200 acre feet of volume.
- The 3-day event has a smaller peak much later than the summer event. The total volume of water, measured in acre-feet, is much higher than that of a summer storm.

A summary of results for the different types of modeling is listed in the table below:

Table 1. Flood Peak Summary for Various Modeling Approaches		
Volume/second	Peak @ McCarran	Peak @ I-80
USGS calculation (summer)	1,000 cubic feet / second	1,350 cfs
24 hour storm (mathematical)	900 cfs	1,300 cfs
3 day storm (winter)	700 cfs	900 cfs

Lesser events:

- The 50 year storm is about ½ the size of a 100 year event (FEMA storm).
- The 25 year storm is about 1/3 the size of a 100 year event (FEMA storm).

Damages:

- Summer storms are damaging because of the high peak of water that occurs with little or no warning. Winter storms are damaging due to high volumes of water.
- Anything with inundation levels of less than 1' are not part of the 100-year flood zone according to FEMA standards. However, in the lower Evans Creek watershed,

¹ The Hydraulic Engineering Center models are developed by the U.S. Army Corps of Engineers and are the hydraulic models used and accepted nationwide.

inundation levels under 1' may cause localized damage. Many of the buildings in the floodplain are old and have basements and low floors.

- In 1986, flooding caused over \$700,000 in damages at UNR and an additional \$60,000 in damages to roads, parks and private property. The 1994 Environmental Assessment for the Evans Creek Watershed estimated annualized damages at \$235,500; this figure represents the cost of doing nothing to address flooding in the watershed.

Consensus on the problem:

The stakeholders wanted to analyze flood reduction strategies using both winter and summer storm hydrology in order to understand the full range of effects of each measure. Participants agreed it would not be productive during such a short process to try to get consensus on the exact extent of the flooding problem in the watershed. Therefore, participants agreed to use the following problem statement for the purpose of this process:

The stakeholders agreed that past flooding on Evans Creek has caused damages. They also agreed that additional development in the watershed would exacerbate flood damages in the future. The stakeholders agreed to work on finding ways to reduce damages from flooding on Evans Creek.

There was not consensus on the magnitude of storm to plan for, just agreement to work to reduce damages.

III. PROCESS GOALS AND OBJECTIVES

Criteria to be used in prioritizing alternative solutions:

The stakeholders were given the task of developing and presenting a prioritized list of feasible flood damage reduction strategies to the City Council. Over several meetings, the process participants developed the following criteria to be used to prioritize flood reduction strategies. The stakeholders group agreed to summarize the criteria as follows:

"Doable" and Practical	Social Benefits	Environmental Benefits	Economic Benefits
Benefits outweigh costs	Reduces and/or prevents accidents/death	Preservation of habitat	Mitigate/prevent flood water damage
Mitigates flood water damages upstream and downstream	Preserve and/or enhance aesthetic value	Reduces invasive/noxious weeds/vegetation	Opportunity cost – will effort here provide greater benefit than efforts elsewhere
Stand alone solutions that minimizes human or mechanical interaction	Protect property value	Restore wetlands, native vegetation	Real solution – not a shift of cost or burden to someone else
Public understanding – a solution that the community can readily understand and support	Recreation – protect Rancho San Rafael Park	Improve ground water recharge	
Acceptable to the region's elected officials	Protect high priority areas		
Fundable	Preserve/enhance aesthetic values		

Generally, the alternatives considered were modeled hydraulically to determine their effect on reducing flooding levels and therefore damages. Additional technical analysis regarding the costs and feasibility of these measures was not available, given the short time available in the process. Therefore, all of the measures considered and recommended should be considered conceptual and will require additional analysis to determine if they truly meet the criteria established by the stakeholders.

IV. ALTERNATIVE MEASURES CONSIDERED AND EVALUATED

Alternatives considered and evaluated:

The group spent several meetings brainstorming a variety of potential solutions. Additional options from the FEMA floodplain management Community Rating System process were also considered. (See Attachment ____: Alternatives Considered.) A description of the major alternatives evaluated follows. The alternatives are divided into three categories: baseline, full mitigation, partial mitigation.

BASELINE:

Existing Conditions and Baseline Build-Out Conditions:

WRC conducted analysis of the existing conditions to provide a baseline for the work of the stakeholders. This analysis provides a way to compare the effectiveness of various strategies and also demonstrates the results of doing nothing to address flooding in the watershed.

The hydrology of the current conditions is summarized in the following table. This table demonstrates the difference between summer and winter storms, and shows how the flooding grows as one travels down the watershed.

Current Conditions				
FLOOD:	Summer 100-year		Winter 100-year	
	Peak	Volume	Peak	Volume
@ McCarran	1026 cfs	236 ac ft	794 cfs	428 ac ft
@ Sierra St.	1192 cfs	275 ac ft	912 cfs	487 ac ft
@ I-80	1263 cfs	298 ac ft	964 cfs	520 ac ft

One of the reasons that flood protection is so important in the watershed is that flooding will get worse if development in the watershed continues under the current regulations and standards. The following table demonstrates that flooding will increase by as much as 50% under full build out conditions (as currently allowed in the master planning documents for the watershed).

Current versus Build-out Conditions				
FLOOD:	Summer 100-year		Winter 100-year	
	Peak	Volume	Peak	Volume
@ McCarran – current	1026 cfs	236 ac ft	794 cfs	428 ac ft
@ McCarran – build-out	1505 cfs	338 ac ft	961 cfs	569 ac ft
@ Sierra St. – current	1192 cfs	275 ac ft	912 cfs	487 ac ft
@ Sierra St. – build-out	1691 cfs	378 ac ft	1084 cfs	628 ac ft
@ I-80 – current	1263 cfs	298 ac ft	964 cfs	520 ac ft
@ I-80 – build-out	1769 cfs	401 ac ft	1139 cfs	661 ac ft

FULL MITIGATION:

Full Mitigation Defined:

The stakeholders did not achieve consensus on a “target” for full mitigation. The goal was to reduce flood damages. As one benchmark, it was noted that the storm-drain system could handle 250 cfs of water at Sierra Street. Flooding greater than 250 cfs at Sierra Street would cause floodwaters to get out of the storm drain system and begin causing damages. The level of damages would depend on the amount of water out of the storm-drain system. Stakeholders agreed some amount of flooding may be acceptable if it caused minimal amounts of damage. A full technical assessment of damages was not conducted, however, participants generally agreed that flooding in excess of a foot would be damaging.

Natural Resources Conservation Service (NRCS) Dam Description & Evaluation:

The stakeholders did not re-evaluate the NRCS dam because this option had been fully evaluated in the past. The stakeholders acknowledged that while the dam fully mitigated the flooding problem from a hydraulic perspective, it was unlikely and/or undesirable to be built given the environmental impacts, the costs, and the community opposition.

Detention at McCarran Boulevard Description:

One alternative discussed at length was the option of rebuilding McCarran to use it as a detention facility. As built, McCarran has about a 25’ drop from the Virginia Street intersection to the crest of the hill to the west. The road could be rebuilt to remove the 25’ dip and act as containment for water from the Evans Creek. The cross-section of the change to McCarran used for hydraulic modeling is given below as Figure 1.

Figure 1. McCarran Blvd. Detention Option (WRC August 2002)

Figure 2. Existing view from Basque Monument looking south to McCarran Boulevard (MIG September 2002)

Figure 3. Artist’s sketch of view from Basque Monument looking south at a raised McCarran Boulevard. (MIG September 2002)

Figure 4: Inundation area with McCarran Boulevard detention. (WRC August 2002)

Detention at McCarran Boulevard Evaluation:

Flood Damage Reduction: The modeling results showed that this alternative was the only one to fully mitigate flood damages under existing conditions as demonstrated in the table below. However, detention at McCarran along would not be adequate to address future conditions.

Current versus Build-out Hydrology with McCarran Detention Only				
FLOOD:	Summer 100-year		Winter 100-year	
	Peak	Volume	Peak	Volume
@ McCarran – current	98 cfs	236 ac ft	196 cfs	428 ac ft
@ McCarran – build-out	294 cfs	338 ac ft	328 cfs	569 ac ft
@ Sierra St. – current	282 cfs	275 ac ft	311 cfs	487 ac ft
@ Sierra St. – build-out	494 cfs	378 ac ft	438 cfs	628 ac ft
@ I-80 – current	347 cfs	298 ac ft	372 cfs	520 ac ft
@ I-80 – build-out	647 cfs	401 ac ft	498 cfs	661 ac ft

Doable & Practical: Representatives from the Nevada Department of Transportation (NDOT) indicated that this option would be technically feasible, but extremely expensive. Ballpark estimates were in the neighborhood of twice the cost of the NRCS dam, meaning that the McCarran detention option would have extreme difficulty meeting the cost benefit ratio criteria. In the future, NDOT may widen the road to six lanes; however, this is not currently a part of any of their long-range capital programs. Were the community to build McCarran as a detention facility, NDOT would require that it be built as a six-lane road (probable build-out). The State Engineer would also require that such a structure meet all dam safety regulations, which would mean that the structure would have to be built to withstand the “probably maximum flood.” Although technically feasible, this alternative is not especially practical.

Social Benefits: This alternative would reduce or prevent accidents and damages from flooding by reducing the amount of water outside the storm-drain system. There would be some risk associated with the pool of water stored for a period of time behind McCarran. This alternative rated low on the criteria of protecting aesthetic values and priority properties. Expansion of McCarran would have a large impact on Rancho San Rafael and severely disrupt the park.

Environmental Benefits: McCarran currently runs through Rancho San Rafael Park so environmental impacts already occur. However, expansion of McCarran would require encroachment into the park to provide a footprint large enough to structurally support all the requirements of a dam. The expansion of McCarran into a six-lane dam would have a significant negative impact on the wetlands at Rancho San Rafael and disrupt habitat and wildlife values in the park.

Economic Benefits: The costs associated with the requirements of building a six-lane dam have been estimated (rough ball-park estimate) at \$5 to \$6 million. It would be extremely difficult to achieve a cost-benefit ratio of 1:1 with these costs.

PARTIAL MITIGATION:

Partial Mitigation Defined:

The stakeholders agreed that a combination of elements which partially mitigated the flood could be pursued over time to eventually provide protection for the watershed.

Parr Detention Description:

The stakeholders agreed to look for detention options that might work in series or in combination with other strategies. One detention site discussed was detention on Evans Creek downstream of the spot where Parr Boulevard crosses the Creek. These sketches are actually closer to the original NRCS dam site than the proposed Parr site.

Figure 5. Existing conditions looking north up watershed toward Parr Boulevard site. (MIG September 2002)

Figure 6. Artist's sketch of Parr detention facility looking north. (MIG September 2002)

Figure 7. Inundation area with Parr detention. (WRC August 2002)

Parr Detention Evaluated:

Flood Damage Reduction: The Parr detention site was the second most effective alternative considered from a hydraulic perspective. In the modeling, the detention basin would have many of the same impacts as the previous NRCS dam. A detention basin at the Parr site would not be as effective as the NRCS dam because it would be located higher in the watershed, allowing it to capture less and store less water in a flood. The modeling results are given in the following table.

Current versus Build-out Hydrology with Parr Detention Only				
FLOOD:	Summer 100-year		Winter 100-year	
	Peak	Volume	Peak	Volume
@ McCarran – current	352 cfs	205 ac ft	271 cfs	363 ac ft
@ McCarran – build-out	583 cfs	338 ac ft	388 cfs	569 ac ft
@ Sierra St. – current	572 cfs	242 ac ft	396 cfs	420 ac ft
@ Sierra St. – build-out	821 cfs	378 ac ft	513 cfs	628 ac ft
@ I-80 – current	704 cfs	264 ac ft	455 cfs	452 ac ft
@ I-80 – build-out	926 cfs	401 ac ft	572 cfs	660 ac ft

Doable & Practical: As noted, the Parr detention site would reduce flood damages; however, it is not sufficient in and of itself to fully mitigate flood damages. In order to

achieve the hydraulic benefits as modeled, this detention facility would need to be constructed in a manner very similar to that planned for the NRCS dam. It is unclear whether the soils types at the Parr site would be adequate which was one benefit of the NRCS location that the Parr site may not share. It is assumed that the costs and impacts of the Parr site would be at least as great as if not greater than the NRCS site detention facility making it difficult for the structure to meet a cost/benefit ratio of 1:1.

Social Benefits: The Parr detention site is higher in the watershed than the proposed NRCS site was. The detention facility would not be visible from McCarran Boulevard; however, it would be visible to homes in the Washoe Vista neighborhood and also to some homes off of Hoge Road. This detention facility would have the same disruptive impacts on trails that the NRCS dam would have had.

Environmental Benefits: A detention facility of this magnitude would have environmental impacts to the Evans Creek and existing habitat and wildlife in the watershed. Detention in this location may offer groundwater recharge benefits; however, given the past mining activity in the watershed, groundwater recharge may raise water quality concerns.

Economic Benefits: This structure would be required to meet dam safety regulations and be designed to withstand a maximum probable flood. As noted above, it would be difficult to achieve a positive cost/benefit ratio with detention at Parr given these requirements.

Retain runoff on new development description:

The stakeholders considered the impact of enacting an ordinance that would require all new development in the watershed to detain all runoff until the peak of a 100-year flood had passed. This type of requirement has been used in some places in our region. Participants noted that this requirement may be needed to ensure that the Truckee River Flood Management Project remains effective as development occurs in the region. It was also noted that hillside development ordinances require that a certain portion of hillside sites remain in open space and that detention could be incorporated into this open space as an amenity (greenbelt).

Figure 8. Photos of on-site detention basins. (WRC September 2002)

Retain runoff on new development evaluation:

Flood Damage Reduction: An ordinance to retain runoff on new development would be the third most effective flood reduction strategy of those considered. Although it does not do anything to address current flooding condition, it would significantly reduce future

flooding damages. This option prevents Rancho San Rafael and other downstream interests from increased flood damages in the future.

Current versus Build-out Hydrology with Requirement to Retain Runoff Only				
FLOOD:	Summer 100-year		Winter 100-year	
	Peak	Volume	Peak	Volume
@ McCarran – current	n/a	n/a	n/a	n/a
@ McCarran – build-out	624 cfs	88 ac ft	213 cfs	134 ac ft
@ Sierra St. – current	n/a	n/a	n/a	n/a
@ Sierra St. – build-out	814 cfs	127 ac ft	335 cfs	194 ac ft
@ I-80 – current	n/a	n/a	n/a	n/a
@ I-80 – build-out	899 cfs	151 ac ft	335 cfs	215 ac ft

Doable & Practical: As with other strategies, the stakeholders considered this alternative at a conceptual level. It would require full build-out of the watershed with each parcel fully detaining all runoff until the peak of the 100-year flood had passed. This would put the burden on developers to adequately design these detention facilities. Homeowners associations or the City would need to ensure that these facilities were properly operated and maintained.

Social Benefits: Design standards would need to be put in place to ensure the aesthetic quality of these facilities was acceptable to the community.

Environmental Benefits: Designed properly, these detention facilities may preserve habitat, increase wetlands, and improve water quality and ground water recharge. If they are not designed properly, they could create noxious weed management problems and disrupt habitat. Standing water could also pose problems with mosquitoes and rodents.

Economic Benefits: This option would significantly reduce future flood damages and may be the standard required by the Truckee River Flood Management Project. The costs would be on developers who would pass it along to homeowners. Developers may choose to incorporate detention into open space requirements and use these features as project amenities increasing property values.

Stream Restoration Description:

Participants looked at stream restoration from Sierra Street to Parr Boulevard. Stream restoration could include re-vegetation, relocating the trail so that it does not run along the stream bottom, and reintroducing meanders into the stream at various locations. This is modeled by increasing the “roughness” (or vegetation) in the model. Again, this was evaluated from a conceptual perspective; a full technical assessment of the opportunity for restoration on Evans Creek was not done.

Figure 9. Before and after sketches of stream restoration concepts. (MIG September 2002)

Stream Restoration Evaluated:

Flood Damage Reduction: Stream restoration is the fourth most effective flood reduction strategy of those considered. Restoration work, especially re-vegetation, would take some time to be fully effective. Once complete, it would partially reduce flooding damages in the watershed.

Current versus Build-out Hydrology with Stream Restoration Only				
FLOOD:	Summer 100-year		Winter 100-year	
	Peak	Volume	Peak	Volume
@ McCarran – current	909 cfs	236 ac ft	784 cfs	425 ac ft
@ McCarran – build-out	1356 cfs	338 ac ft	954 cfs	567 ac ft
@ Sierra St. – current	996 cfs	275 ac ft	890 cfs	483 ac ft
@ Sierra St. – build-out	1485 cfs	378 ac ft	1067 cfs	624 ac ft
@ I-80 – current	1031 cfs	298 ac ft	938cfs	516 ac ft
@ I-80 – build-out	1529 cfs	401 ac ft	1118 cfs	657 ac ft

Doable & Practical: A large amount of the land in the watershed is in public ownership. Rancho San Rafael offers an opportunity to do restoration work in the watershed. This option would be fundable by grants from other agencies due to the benefits it offers beyond limited flood protection.

Social Benefits: Stream restoration enhances aesthetic values in the watershed and improves Rancho San Rafael. It also enhances recreation opportunities in the area. If restoration opportunities are pursued in partnership with the University, these measures may also offer educational opportunities.

Environmental Benefits: Stream restoration may offer significant environmental benefits including habitat restoration, wildlife enhancement, and wetlands restoration. Healthy habitat is also more resistant to noxious weeds and may improve water quality as well as groundwater recharge.

Economic Benefits: Considered for its flood damage reduction potential alone, restoration may not meet a cost/benefit ratio of 1:1. However, one significant benefit of pursuing restoration measures would be the City's ability to use outside funding sources.

Newport Detention Description:

Stakeholders also considered a detention facility at Newport Lane, the location of the Panther Valley Park. A detention basin could be designed into Phase 2 and 3 of the Park; many communities in the west combine parks and flood features this way.

Figure 10. Existing conditions at Panther Valley Park looking northeast. (MIG September 2002)

Figure 11. Artist's sketch of Newport detention site during a flood. (MIG September 2002)

Figure 12. Aerial inundation map of Newport site. (WRC August 2002)

Newport Detention Evaluated:

Flood Damage Reduction: The Newport detention facility would be high up in the watershed and small in size. Of the options considered, this was the fifth most effective when evaluated alone.

Current versus Build-out Hydrology with Newport Detention Only				
FLOOD:	Summer 100-year		Winter 100-year	
	Peak	Volume	Peak	Volume
@ McCarran – current	824 cfs	150 ac ft	517 cfs	272 ac ft
@ McCarran – build-out	12246 cfs	206 ac ft	616 cfs	567 ac ft
@ Sierra St. – current	1021 cfs	189 ac ft	638 cfs	483 ac ft
@ Sierra St. – build-out	1444 cfs	245 ac ft	739 cfs	624 ac ft
@ I-80 – current	1124 cfs	213 ac ft	694 cfs	516 ac ft
@ I-80 – build-out	1534 cfs	269 ac ft	797 cfs	657 ac ft

Doable & Practical: The Newport detention was evaluated from a conceptual, not an engineering perspective. Because this detention basin is so high in the watershed, it provides little in the way of hydraulic benefits. In combination with other measures, it could provide an important hydraulic benefit. This park is bounded on one side by the railroad. Any detention basin would need to be designed in a way that did not interfere with the railroad embankments.

Social Benefits: A detention basin could be designed into future phases of the Panther Valley Park in a way that does not detract from the aesthetics of the Park.

Environmental Benefits: Designed properly, the detention basin could provide some habitat, water quality and groundwater recharge benefit. Concerns with standing water include public safety considerations and nuisance control.

Economic Benefits: Given the minimal hydraulic benefit of this site, it may be difficult to reach a positive cost/benefit ratio on this facility. If the City of Reno already owns the park lands, it may make this element economically feasible.

Flood Proofing and Retrofitting Definition:

Specific properties may be suitable for flood-proofing or retrofitting solutions. These options might include elevating foundations or providing a mechanism to make the first floor waterproof. Other strategies to be considered in this category include selective acquisitions or relocations for properties that cannot be protected in any other way.

Flood Proofing and Retrofitting Evaluated:

Flood Damage Reduction: These measures were not evaluated from a hydraulic perspective. They would reduce repetitive losses to specific properties that could not be protected in other ways. There were concerns raised about the feasibility and the costs associated with this option.

Doable & Practical: This option may be practical on a very limited scale. FEMA money is available to do this type of work after a flood occurs, if the region's floodplain management plan includes specific recommendations for these actions. Again, the stakeholders did not do a technical analysis of the feasibility of this option.

Another advantage is that the region's Floodplain Management Planning Committee may be incorporating these elements in their work.

Social Benefits: These solutions have limited impacts on other properties but could provide significant benefits to those whose properties are flood-proofed.

Environmental Benefits: Flood-proofing or retrofitting would not have any significant environmental impacts.

Economic Benefits: These options have the benefit of possibly qualifying for FEMA funding in the event of future flooding. The disadvantage is that FEMA funding for retrofitting and relocations is limited; however, the Floodplain Management Plan may also include opportunities for funding elements of this work in the future.

Other Strategies Definition & Evaluation:

The stakeholders also considered public education and outreach to educate property owners and residents in the floodplain about their flood insurance options. The group noted that flood insurance is less expensive in an area that has not been mapped by FEMA as a flood zone.

FEMA mapping is another option the community may wish to explore. Mapping would provide property owners and residents with a clearer understanding of the extent of flooding in the watershed. FEMA mapping would raise the cost of flood insurance for those in flooding zones, but would make certain FEMA funds available to the community after a flooding event.

V. STAKEHOLDER AGREEMENTS:

The stakeholders have worked diligently over the last six months to come to consensus on approaches to reduce flood damages in the Evans Creek watershed. The following statements represent the stakeholder agreements in this process:

Past flooding has caused damages in the Evans Creek watershed.

Development in the watershed under current regulations will cause flooding to get significantly worse in the future.

Flood damage reduction strategies should be doable, fundable, and provide demonstrable economic and environmental benefits.

Large structural solutions will have difficulty achieving a positive cost/benefit ratio and are generally difficult to build due to environmental constraints and community opposition.

A combination of several strategies could significantly reduce flood damages over time.²

For areas that would not be fully protected by the strategies above, selective flood-proofing and retrofitting may offer protection to properties that would otherwise be subject to repetitive losses.

Education and outreach regarding the benefits of flood insurance for affected properties offers property owners and residents additional options in addressing flooding risks.

A full evaluation of the advantages and disadvantages of FEMA mapping is needed to determine the effectiveness of this tool for the Evans Creek watershed.

VI. CONCLUSION:

The Evans Creek Watershed Stakeholders request that the Reno City Council accept this report of findings and agreements.

² One example of a combination that may be effective would be retention of runoff in new construction areas (which would reduce flood flows to 800 cfs at Sierra Street under build-out conditions), stream restoration (which would reduce flows at Sierra by 200 cfs), and Newport detention (which would also reduce flows by 200 cfs). The storm drain at Sierra Street can handle 250 cfs. The additional 150 cfs could possibly be taken care of by raising Parr Boulevard across Evans Creek when development occurs – this option was not evaluated hydraulically.

Attachment A: Evans Creek Drainage – Flooding Chronology

According to a Nevada Flood Chronology prepared by the Nevada Department of Conservation and Natural Resources in 1977, the following floods have been documented on Peavine. Flooding events with documented damage from Evans Creek are noted with an *. The Chronology notes whether flooding also occurred on the Truckee River in the same year or not. Additional dates are from Reno staff reports supporting the facilitated process.

Feb. 24, 1904 ■ floods on Truckee River, Peavine & Evans Creeks

The Reno Evening Gazette reported: “The little stream which flows down past Senator Roff’s went on a rampage this morning. It inundated the yards and cellars of all adjoining premises and floated chicken-houses and other buildings downstream.”

No documentation of flooding on Evans Creek.

January 15, 1909 ■ floods on Peavine and Evans Creeks

No documentation of flooding on Evans Creek.

***January 24 through 26, 1914 ■ minor flood on the Truckee, major flood on Peavine and Evans Creeks**

The Reno Evening Gazette explained that because of the snow-high-rain-low anomaly, “on January 26 the Truckee River through Reno was only about three and one-half feet above its usual January level. On the other hand, both Peavine and Evans Creeks draining into it had roared out of their debris-clogged channels by the time. As a consequence, these two usually inoffensive little watercourses, and not the Truckee River, become the prime flood culprits at Reno in January 1914. Evans creek’s peak flow was in excess of 1,000 cubic feet per second and reached a depth of two feet across the playing surface of Mackay Field at UNR.”

December 9 through 13, 1937 ■ flooding on the Truckee River; Evans Creek and Peavine Creek did NOT flood

The Reno Gazette noted the difference and said “most of the 1927 flood came from the Truckee River’s watersheds further upstream.”

***January 20-22, 1943 ■ Reno flooding caused by Peavine and Evans Creeks**

Flood water from Peavine/Evans caused debris to jam Evans Creek culverts under 395. Backed-up water caused flooding of Orr Ditch. Debris along Evans Avenue. (Numerous intersections in Reno business district hub-deep in water – most from blocked drains or Peavine Creek.)

November and December 1950 ■ flooding on the Truckee River, no damaging flows noted on Evans Creek

July 14, 1955 ■ **dry-mantle flood from sudden summer storms on fire-denuded and overgrazed lands, flooding on Peavine Creek and Orr Ditch. Evans Creek flooded in vicinity of Mackay Field and facility but not high enough to cause sediment or debris damage.**

December 23-24, 1955 ■ **flooding on the Truckee River, less damaging floods on Peavine and Evans Creeks**

No documentation of damage from Evans Creek.

July 20, 1956 ■ **summer flooding on Peavine and Evans Creek – made worse by previous year's floods there – caused \$600,400 in direct damages**

“The staggering flood toll (of 1956), coming on the heels of the only slightly less traumatic 1955 flood event, clearly indicated to everyone concerned the devastated slopes of Peavine Mountain and the eroded and deeply incised watercourse along Peavine Creek would have to be rehabilitated, and soon.”

No documentation of Evans Creek contribution to flooding.

1962 ■ **P.L. 566 Peavine Watershed flood control land-treatment and structural work – four earthen structures designed to check summer flash floods -- minimized damages of 1963 flood on Peavine Creek**

*January 31, February 1, 1963 ■ **Evans Creek flooding caused \$4,200 in direct floodwater damage to UNR.** The 1914 and 1940's floods caused more damage.

March 4, 1964 ■ **The City of Reno, UNR and NDOT file an application for Federal Assistance under PL-83-566 for works of improvement for the Block N (Evans Creek) Watershed to prevent flooding.**

January, 1966-1970 ■ **Flood retarding structure was planned ¼ mile north of McCarran Blvd. Plan included an eleven-acre recreation lake. Project was terminated in March 1974. Sponsors were unwilling to assume the costs of easements, right-of-ways and the cost-share of the recreation facilities.**

***February of 1986 ■ Evans Creek flooded the University and private property.** North Virginian Apartments in the Evans Creek drainage suffered \$35,000 in damages. Damage to the University heating system and other sensitive equipment in basements of buildings.

1987 - 1994 ■ The City of Reno requested the Soil Conservation Service (now NRCS) to do a floodplain management study under Section 6 PL 83-566, Floodplain Management Program in March 1987. Floodplain management study was completed in March 1989. Authorization for planning was given September 1990. The watershed work plan and environmental assessment was completed in July 1994.

July 26, 1994 ■ Reno approves agreement between the National Resource Conservation Service, University of Nevada, Reno, Washoe County, Washoe Storey Conservation

District and the City of Reno to construct a dam in the Evans Creek Canyon north of McCarran Boulevard.

Following the agreement, the National Resource Conservation Service requested a construction start from the National office. This was approved and design funds were approved to prepare the final designs. While the NRCS studied the dam, they did not build it. The pipeline portion of the plan was designed and installed by consultants and contractors for UNR. NRCS funded this installation.

January 1, 1997 ■ Truckee River floods, Evans Creek does not flood

July 10, 2001 ■ Following almost two years of review by the Regional Water Planning Commission, the Washoe County Commissioners withdrew their support of locating a dam in Evans Creek Canyon and proposed looking at alternatives.

August 28, 2001 ■ Reno City Council approves an option to re-examine all structural and non-structural alternatives including the proposed dam in Evans Creek Canyon. The Council requested that the West University Neighborhood Advisory Board provide a facilitated process to review various alternatives, with notifications being provided to affected upstream and downstream residents.

April 9, 2002 ■ At the request of the West University Neighborhood Advisory Board, the Reno City Council approves a facilitated process to “reach consensus on flood mitigation alternatives acceptable to stake holders within the Evans Creek watershed and flood plain.”

Source: Water and Related Land Resources, Central Lahontan Basin, Nevada . . . California, “Flood Chronology,” Truckee River Sub basin, 1861-1977, Cooperative Survey by the Nevada Department of Conservation and Natural Resources, The Resources Agency of California, and the United States Department of Agriculture, September 1977

Attachment B: Evans Creek Watershed Stakeholders

The Evans Creek Stakeholders database & attendance (individuals who attended stakeholders meetings are marked with an *):

- Richard Adams
- Steve Alastuey, UNR student*
- Fred Atcheson*
- Patti Bakker*
- Gary Benedetti
- Marnee Benson, UNR student*
- Bob Cashell
- James Collier
- Mary Jo Elpers, US Fish & Wildlife*
- Greg Fine, Ding Communications*
- Jason Geddes, UNR Environmental Affairs Manager
- Mike Gerych
- Dennis Ghiglieri, Friends of Rancho San Rafael*
- John Gwaltney*
- Oneita Gwaltney*
- Lisa Haldane, Floodplain Management Program
- Gerald Hicks, Luce & Son
- Chuck Houston, USDA*
- Dorothy Hudig*
- Tom and Nadine Jacobs
- David Krakowiak
- Kenneth Kruger
- James and Susana Leckie
- John and Franki Lukasko*
- Susan Lynn, Public Resource Associates*
- Gary Machabee, Machabee Office Environments*
- Jon and Linda Madsen, Madsen Family Trust
- Robert Martinez, Nevada Division of Water Resources
- Thelma Matlin*
- Betty Mills, West University NAB
- Buzz Nelson, UNR*
- Diane and Marc Nicolet
- Ernie Nielsen, West University Neighborhood Advisory Board*
- Marlene Olsen, Olsen and Associates Public Relations
- Oxford Motel
- Bill Peppin*
- Thomas Peterson
- George and Pat Pimpl
- David Pincolini
- Donald Potter
- Steve Pullman

- Larry Price MD
- Illya Quandt
- Dewey Quong
- Michele Robinson*
- Mike Robinson*
- Alan Roney
- Donna & Bob Rose, Evans Creek Irregulars*
- Joan Rowe
- Jeanne Ruefer, Washoe County Water Resources*
- Maura Ruiz
- Floyd Saltern, Saltern Companies*
- Gene & Beatrice Samproni
- Marco and Anne Sanchez
- Karen Serink, Washoe Vista Homeowners*
- Tom Serink, Northeast Neighborhood Advisory Board*
- Joyce Sharp*
- George Shaw*
- Maria Slaughter, Keystone Realty
- Gary Smyres
- Becky Stock, Nevada Land Conservancy*
- Rose Strickland, Sierra Club*
- Michael Sullivan, Windy Moon Quilts
- Ed and Jeanne Tribble
- Paul Urban, Washoe County Water Resources*
- David Von Seggern*
- Brian Walters, Walters Engineering
- Doris Weber*
- Brian Whalen, UNR*
- Dean & Lisa Whitlock
- Hope Williams, Cheryl's Apartments
- Mary Winston*
- Joe Young
- Tony Zeller, Reno Parks, Recreation and Community services*

Support Staff:

- Trip Barthel, Neighborhood Mediation Center
- Bob Cox, Robert Cox Enterprises
- Mark Forest & Brian Janes, WRC Nevada
- Gene Jones, City of Reno
- Elisa Maser, MIG

Attachment C: Meeting Agendas & Summaries

May 21, 2002

June 4, 2002

June 18, 2002

July 16, 2002

August 19, 2002

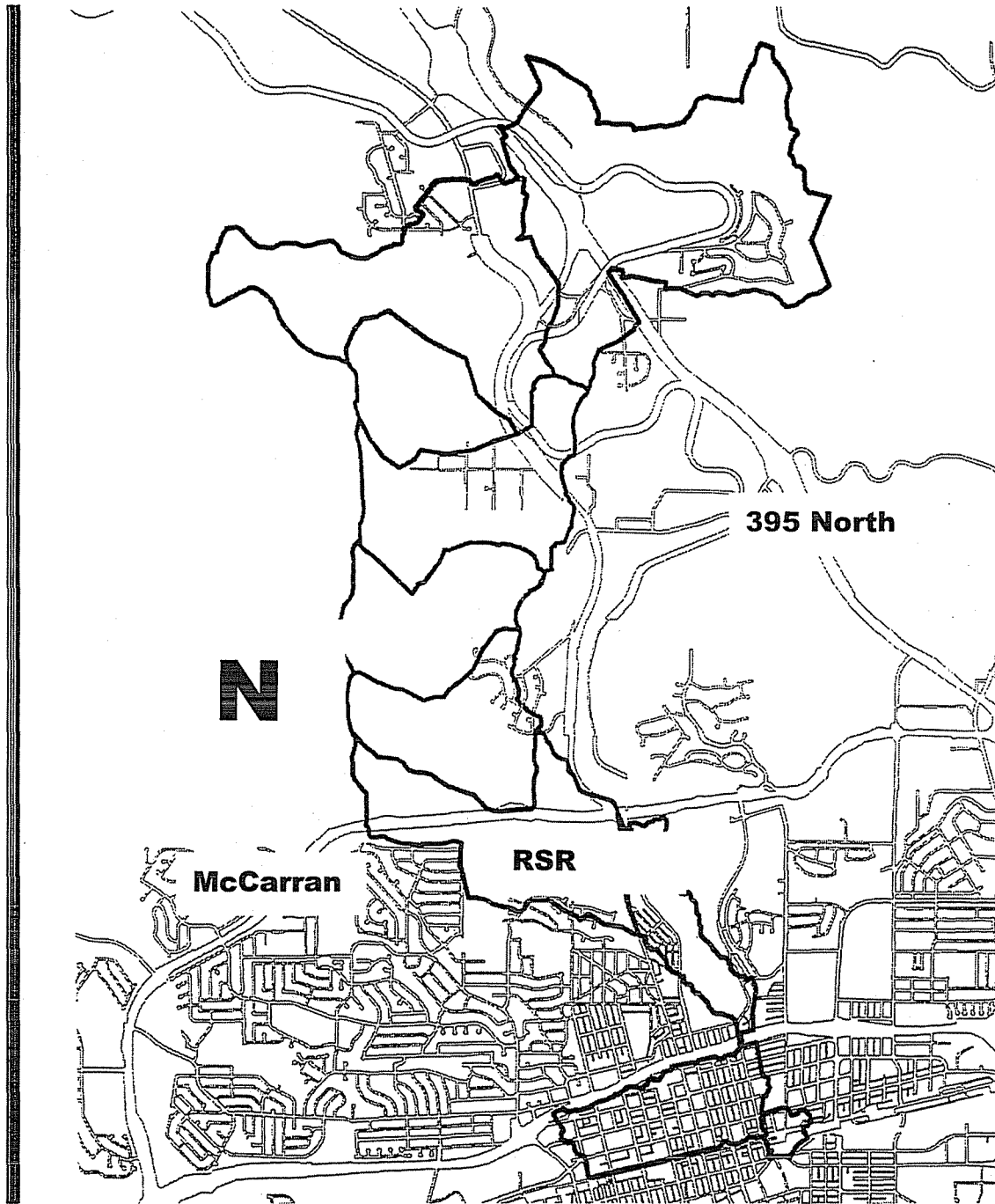
September 17, 2002

September 24, 2002

October 3, 2002

October 10, 2002

Attachment D: Watershed Map



Attachment E: Alternatives Considered

* Evaluated in hydraulic model	Alternative measures:	Notes:
*1 (model run #)	Do nothing / existing conditions baseline	Provides baseline information: what are damages if we do nothing?
	PREVENTATIVE	
*4	Planning & zoning -- <i>Retention in all new construction</i>	Retention of floodwaters in all new zoning requires that any new development not increase the peak of a flood
	Building code development & enforcement*	*Alternatives from FEMA's Community Rating Systems --
	Open space preservation*	
	Stormwater management*	Coordinate with the stormwater quality program
	Drainage system maintenance*	Critical assumption for project: 250 cfs @ Sierra Street
	NATURAL RESOURCE PROTECTION	
*9	Increase sage cover in open areas by 30%	Check with biologist to determine feasibility
*10	Stream Restoration only	
	Demonstration restoration project RSR & UNR**	Linked wetlands, ponds, floodplain, etc. as a demonstration and educational feature.
	Wetlands protection*	May require acquisition of water rights
	Best management practices*	
	Erosion and sediment control*	
	PROPERTY PROTECTION	
	Relocate buildings - Saltern property	
	Relocate buildings UNR master plan	
	Relocate businesses - south of I-80	
	Acquire properties - Saltern property	
	Acquire properties - floodplain property south of I-80	
	Floodproofing or retrofit - UNR buildings	
	Floodproofing or retrofit - buildings in floodplain south of I-80	
	Flood insurance for property south of I-80	Less expensive <i>before</i> FEMA mapping
	STRUCTURAL PROJECTS	
*7	Newport Lane Retention (Panther Valley Park)	Incorporate into Phase 2 & 3 of park, limited hydraulic benefits because site is so high in watershed.
*8	Parr Detention only	
*3	McCarran Detention only	\$5 to \$6 million -- share cost with NDOT
	McCarran Detention -- partial	
*5	Newport Lane and Parr Blvd. Retention	
*2	Newport Lane Retention and McCarran Detention	
	Reservoirs*	
	Levees/floodwalls*	
	Diversions*	
	Channel modifications*	
	Storm sewers*	
	EMERGENCY SERVICES MEASURES	
	Warning*	
	Dam condition monitoring*	
	Emergency response planning*	
	Evacuation*	
	Critical facilities protection*	
	Health and safety maintenance*	
	PUBLIC INFORMATION	
	Flood maps and data*	
	Library resources*	
	Outreach projects*	
	Technical assistance*	
	Real estate disclosure information*	
	Environmental education programs*	

Draft Agenda

Kick-off meeting for Floodplain Management Plan
Washoe County Department of Water Resources
Future Growth Room
4930 Energy Way, Reno, Nevada
3-5pm, April 29th 2002

1. Welcome and Introductions
- *Lisa Haldane, Eagle Nest Engineering*
2. Purpose and Need for Floodplain Management Planning, Local
Regulatory Context
- *Jeanne Ruefer, Water Resources Planning*
3. Overview of State and Federal Roles in Floodplain Management
Planning
- *Kim Groenewold, State of Nevada Floodplain Management*
4. Truckee River Flood Control Project as a Driver for Floodplain
Management Planning
- *Paul Urban, Water Resources Planning*
5. Planning Area
- *Group Discussion Item*
6. Schedule and Committee Work Products
- *Group Discussion Item*
7. Topics for Next Meeting
- *Group Discussion Item*
8. Next Meeting Date



**Washoe County
Department of
Water Resources**

4930 Energy Way
Reno, NV 89502-4106
Tel: (775) 954-4600
Fax: (775) 954-4610

**Regional Water
Planning
Commission**

Voting Members:

Bob Firth, Chair
George Shaw,
Vice-Chair
Diana Langs
Lori Williams
Elwood Lowery
George W. Ball, Jr.
Michael DeMartini
Wayne Seidel
Susan Lynn

Voting Alternates:

Greg Dennis
Peter A. Krenkel
Birn McGavin
John Erwin
Gerry Emm
Don Casazza
Charlie Donohue
John Gonzales
Thomas Hultin

**Non-Voting
Members:**

John Patterson
Dale Stransky
Randy Pahl
Tracy Taylor
Don Casazza
Doug Coulter
Bill Carlos
Harry Fahnestock

Non-Voting

Alternates:

Steve McGoff
Tim Hay
Bryan Tyre
Tom Porta
Jason King

Steve Bradhurst
Director

Jim Smitherman
Water Management
Planner Coordinator

Department of



Water Resources

AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, June 17, 2002**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Truckee River Flood Management Coalition presentation on Truckee River Flood Management Plans, Floodplain Management Planning to date, and Land Acquisition efforts to date – Elisa Maser
2. Handouts on Floodplain Management Plans and Ordinances from other areas

ADJOURNMENT

Notes: Items on the agenda without a time designation may not necessarily be considered in the order in which they appear. The Commission may take action on any of the action items listed.

Facilities in which this meeting is being held are accessible to the disabled. Persons with disabilities who require special accommodations or assistance (e.g. sign language interpreters or assisted listening devices) at the meeting should notify the Washoe County Department of Water Resources, at 954-4665, 24 hours prior to the meeting.

In accordance with NRS 241.020, this agenda closes three (3) days prior to the meeting date. Only items of interest and not requiring Commission action may be added to the agenda within the three-day period. This agenda has been posted at the following locations: Washoe County Administration Building (1001 E. 9th Street), Washoe County Clerk's Office-Courthouse (Court and Virginia Streets), Washoe County Library (301 South Center Street), Sparks Justice Court (630 Greenbrae Drive), and the Washoe County web site.



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Water Resources

AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, July 15, 2002**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. City of Sparks Stormwater Program – Shawn Gooch
2. Spanish Springs Flash Flooding in June 2002 – Jeanne Ruefer
3. Update on Technical Advisory Committee activities

ADJOURNMENT TO LOOK AT INITIAL MAPPING

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Water Management
Planner Coordinator

AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, August 19, 2002**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. City of Sparks Stormwater Program – Shawn Gooch.
2. Presentation and discussion of goals and objectives developed by Technical Advisory Committee.
3. Distribution and discussion of draft outline for Floodplain Management Plan.

ADJOURNMENT

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Department of



Water Resources



**Washoe County
Department of
Water Resources**

4930 Energy Way
Reno, NV 89502-4106
Tel: (775) 954-4600
Fax: (775) 954-4610

**Regional Water
Planning
Commission**

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Greg Dennis
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AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, September 16, 2002**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Clarification of U.S. Army Corps of Engineers' requirement for floodplain management as it relates to the Truckee River Flood Control Project.
2. Clarification of FEMA requirements for Floodplain Management Plan.
3. Discussion of refinements to floodplain management planning process, plan document format, and schedule.
4. Discussion of guiding principles and philosophy for Floodplain Management Plan.
5. Discussion of October 2, 2002 update to Regional Water Planning Commission.

ADJOURNMENT

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**PLEASE NOTE CHANGE
IN MEETING PLACE AND
TIME.**

AGENDA

MEETING OF THE REGIONAL WATER PLANNING COMMISSION Floodplain Management Planning Committee Red Hawk Golf Club Events Center 6600 N. Wingfield Parkway, Spanish Springs Monday, October 21, 2002

Washoe County Department of Water Resources

4930 Energy Way
Reno, NV 89502-4106
Tel: (775) 954-4600
Fax: (775) 954-4610

Regional Water Planning Commission

Voting Members:

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Steve Bradhurst
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Jim Smitherman
Water Management
Planner Coordinator

Department of



Water Resources

3:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

Floodplain Management Workshop:

"Preserving Quality of Life Through Floodplain Management"

Invited Speakers:

Doug Plasencia, P.E. – Vice President, Kimley-Horn, Phoenix, AZ

Ben Urbonas, P.E. – Chief of Masterplanning and South Platte River Programs, Urban Drainage and Flood Control District, Denver, CO

Julia Fonseca – Riparian Program Manager, Pima County, AZ

ADJOURNMENT

Directions to Red Hawk Golf Club Events Center:

From Interstate 80 take the Vista Blvd. exit. Travel 7 miles north on Vista Blvd. to Red Hawk at Wingfield Springs. Turn left on Wingfield Parkway. Follow the signs to Red Hawk Golf Club.

See http://www.wingfieldsprings.com/golf/golf_map.html for location map.

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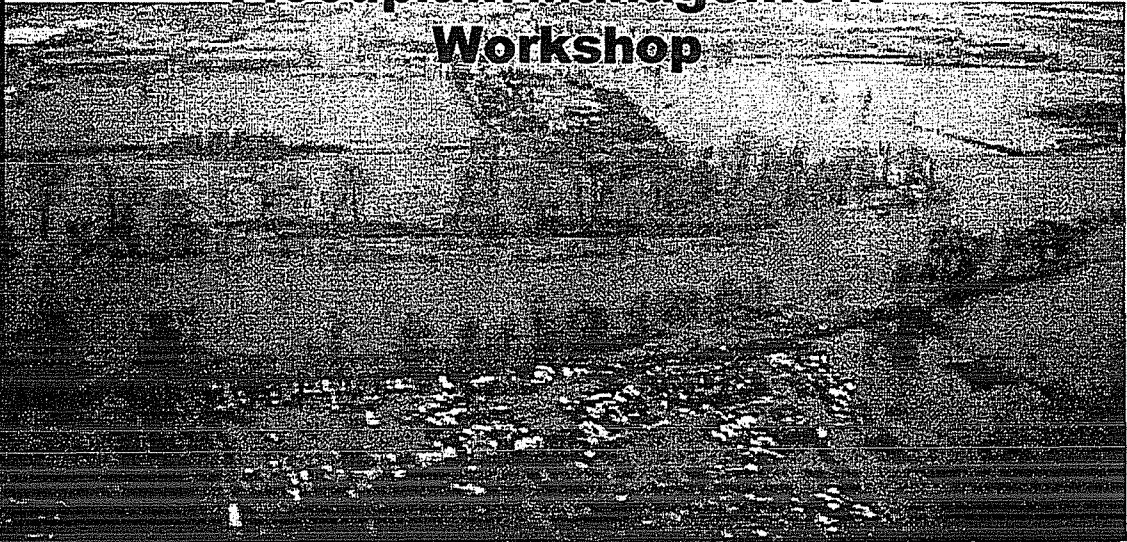
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Monday, October 21, 2002

3:00 p.m. to 7:00 p.m.

Red Hawk Golf Club Events Center

Mark Your Calendar for the "Preserving Quality of Life through Floodplain Management" Workshop



The workshop will address the following:

- ☒ Overview of Flooding Issues in Washoe County
--Presented by Jeanne Rueffer of the Washoe County Department of Water Resources
- ☒ Looking Beyond the National Flood Insurance Program Minimum Standards
--Presented by Doug Plasencia, Vice President, Kimley-Horn and Associates, Phoenix, Arizona
- ☒ Pima County Floodplain Management and Habitat Preservation Strategies
--Presented by Julia Fonseca, Pima County Flood Control District, Pima County, Arizona
- ☒ Watershed-based Masterplanning for Sustainable Development
--Presented by Ben Urbonas, Urban Drainage and Flood Control District, Denver, Colorado
- ☒ Audience participation and questions

The workshop will be held Monday, October 21, 2002 from 3:00 p.m. to 7:00 p.m. at the Red Hawk Golf Club Events Center. To find Red Hawk from Interstate 80 eastbound, take the Vista Blvd. exit. Travel 7 miles north on Vista Blvd. to Red Hawk Golf Club. The Events Center is adjacent to the Freddie's Roost restaurant.

For more information please contact Susan Lynn at 786-9955 or Lisa Haldane at 425-5777.



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AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, November 18, 2002**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Review Floodplain Management Workshop and discussion of ideas of interest for local floodplain management activities – Lisa Haldane
2. Discussion of relationship of Regional Plan Settlement Agreement and requirement for development of Interim Water Policies – Susan Lynn
3. Opportunity for Floodplain Management Planning Committee to provide input on Interim Water Policies – Lisa Haldane

ADJOURNMENT

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AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, December 16, 2002**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Review of Philosophy document, and classification of recommended management strategies as to whether they need to be included in interim policy recommendations to RWPC– Lisa Haldane
2. Presentation of short-term measures that could be implemented for review of projects until such time as the Regional Stormwater Masterplan project is complete.
– Mark Forest, WRC
3. Discussion and possible recommendation regarding floodplain management policy concepts to be forwarded to the Regional Water Planning Commission for consideration in the development of Interim Water Policies.

ADJOURNMENT

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AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, January 27, 2003**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Overview of Draft Watershed Protection Plan and Linkages to Floodplain Management Plan – Mike Widmer, Washoe County Department of Water Resources
2. Update on Regional Water Planning Commission Interim Water Policy Development – Lisa Haldane

ADJOURNMENT

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AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, February 24, 2003**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Discussion, recommendations and possible endorsement of draft Watershed Management Plan
2. RWPC Approved Interim Water Policies relating to flood control / floodplain management and next steps for protection of floodplain storage volumes
3. Schedule for completion of Floodplain Management Plan
4. Update on Regional Flood Control Masterplan

ADJOURNMENT

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AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Monday, March 31 2003**

4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Presentation and discussion of draft Regional Floodplain Management Plan.

ADJOURNMENT

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AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Tuesday, April 29 2003**



4:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Discussion of comments on draft Regional Floodplain Management Plan and direction on modifications to incorporate in the plan.

ADJOURNMENT

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AGENDA

**MEETING OF THE
REGIONAL WATER PLANNING COMMISSION
Floodplain Management Planning Committee
Washoe County Water Resources Department
Future Growth Room
4930 Energy Way, Reno, Nevada
Thursday, June 5 2003**

3:00 p.m.

APPROVAL OF AGENDA

PUBLIC COMMENT

(Three-minute time limit per person, limited to items not listed on the agenda.)

BUSINESS OF THE DAY

1. Update on plan approval process and schedule.
2. Update on upcoming flood management related activities.
3. Discussion of comments on draft Regional Floodplain Management Plan and direction on modifications to incorporate in the plan.

ADJOURNMENT

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Map MODERNIZATION

Federal Emergency Management Agency



FEMA's Flood Hazard Mapping Program

Guidelines and Specifications for Flood Hazard Mapping Partners

*Appendix G: Guidance for Alluvial Fan
Flooding Analyses and Mapping*



FEDERAL EMERGENCY MANAGEMENT AGENCY

www.fema.gov/mit/tsd/dl_cgs.htm

FINAL
February 2002

Appendix G

Guidance for Alluvial Fan Flooding Analyses and Mapping

G.1 Introduction

Alluvial fans, and flooding on alluvial fans, show great diversity because of variations in climate, fan history, rates and styles of tectonism, source area lithology, vegetation, and land use. Acknowledging this diversity, the Federal Emergency Management Agency (FEMA) developed an approach that considers site-specific conditions in the identification and mapping of flood hazards on alluvial fans. This approach, summarized herein, was first documented in Guidelines for Determining Flood Hazards on Alluvial Fans.

Investigation and analysis of the site-specific conditions may require knowledge in various disciplines, such as geomorphology, soil science, hydrology, and hydraulic engineering. Although the scope of study may constrain the degree of site-specific consideration undertaken, field inspections of the alluvial fan must be conducted.

As defined in Section 59.1 of the National Flood Insurance Program (NFIP) regulations, the current (1999) definition of “Alluvial Fan Flooding” means flooding that occurs on the surface of an alluvial fan or similar landform, originates at the apex, and is characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flowpaths.

FEMA will revise the current definition under Section 59.1 to be consistent with the approach described in this Appendix and specifically to eliminate reference to “similar landforms.” The process described in this Appendix is intended for flooding only on alluvial fans as described below.

As interim guidance in the determination of “similar landform,” unless the landform under investigation meets the three criteria under Stage 1 for composition, morphology, and location, the landform is not considered to be “similar.”

This Appendix provides guidance for the identification and mapping of flood hazards occurring on alluvial fans, irrespective of the level of fan forming activity. The term ***alluvial fan flooding*** encompasses both ***active alluvial fan flooding*** and ***inactive alluvial fan flooding***. Each type of alluvial fan flooding is described below.

Active alluvial fan flooding occurs only on alluvial fans and is characterized by flow path uncertainty so great that this uncertainty cannot be set aside in realistic assessments of flood risk or in the reliable mitigation of the hazard.

An active alluvial fan flooding hazard is indicated by the following three related criteria:

Guidelines and Specifications for Flood Hazard Mapping Partners

1. Flow path uncertainty below the hydrographic apex;
2. Abrupt deposition and ensuing erosion of sediment as a stream or debris flow loses its ability to carry material eroded from a steeper, upstream source area; and
3. An environment where the combination of sediment availability, slope, and topography creates an ultrahazardous condition for which elevation on fill will not reliably mitigate the risk.

Inactive alluvial fan flooding is similar to traditional riverine flood hazards, but occurs only on alluvial fans. Inactive alluvial fan flooding is characterized by flow paths with a higher degree of certainty in realistic assessments of flood risk or in the reliable mitigation of the hazard. Unlike active alluvial fan flooding hazards, an inactive alluvial fan flooding hazard is characterized by relatively stable flow paths. However, like areas of active alluvial fan flooding, inactive alluvial fan flooding may be subject to sediment deposition and erosion, but to a degree that does not cause flow path instability and uncertainty.

An alluvial fan may exhibit both active and inactive alluvial fan flooding hazards. The hazards may vary spatially or vary at the same location, contingent on the level of floodflow discharge. Spatially, for example, upstream inactive portions of the alluvial fan may distribute floodflow to active areas at the distal part of the alluvial fan. Hazards may vary at the same location, for example, with a flow path that may be stable for lower flows, but become unstable at higher flows.

An example of an alluvial fan that exhibits both active and inactive alluvial fan flooding is depicted in Figure G-1. In this example, the area between the topographic apex and the hydrographic apex (apex definitions will be discussed below) would be considered *inactive alluvial fan flooding* because this reach is characterized by a stable, entrenched channel which can convey the 1-percent-annual-chance (100-year) flood discharge without overbank flooding. The area below the hydrographic apex would be considered *active alluvial fan flooding* because this area is characterized by flow path uncertainty, abrupt deposition, and ensuing erosion of sediment as the channel loses its competence to carry material eroded from a steeper, entrenched upstream source area.

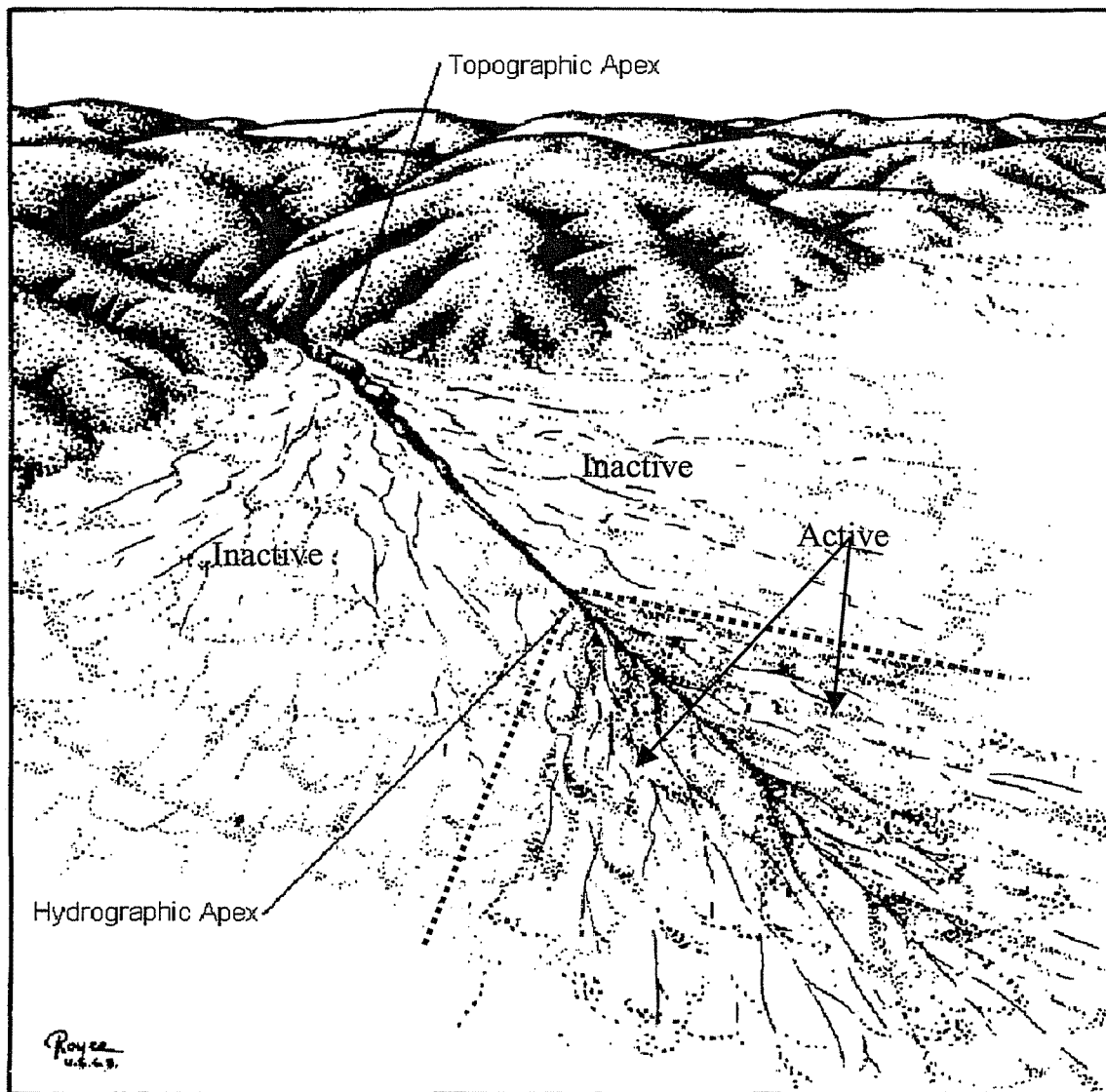


Figure G-1. Alluvial Fan With Entrenched Channel Leading To Active Deposition at Distal Part of the Fan. Original Published as Figure 3-2 in *Alluvial Fan Flooding* (National Research Council, 1996). Reproduced with Permission From the National Research Council; Annotations Added by FEMA.

[February 2002]

G.2 Analysis Approach

Through the approach for alluvial fan flooding identification and mapping documented herein, FEMA seeks to identify whether (1) the area under study is an alluvial fan and (2) which portions of this area, if any, are characterized by or subject to active alluvial fan flooding. After these steps, various methods unique to different situations can be employed to analyze and define the 100-year flood within the areas of alluvial fan flooding identified on the alluvial fan. Thus, the approach for the identification and mapping of alluvial fan flooding can be divided into three stages.

- Stage 1—Recognizing and characterizing alluvial fan landforms;
- Stage 2—Defining the nature of the alluvial fan environment and identifying active and inactive areas of the fan; and
- Stage 3—Defining and characterizing the 100-year flood within the defined areas.

Each of these stages is described in detail in this Appendix. Additional information also can be found in a National Research Council report entitled *Alluvial Fan Flooding* (National Research Council, 1996)

Each stage must be addressed and thoroughly documented during the analysis process. Because each stage builds on the previous stage and because of the complexity of many alluvial fans, the Mapping Partner who undertakes the analysis and mapping of alluvial fan flooding must coordinate closely with the FEMA Regional Project Officer (RPO) and FEMA Headquarters (HQ) from the onset of the study. The progression of the process is shown in Figure G-2.

Progression through each of the stages results in a procedure that narrows or divides the problem to smaller and smaller areas. In Stage 1, the landform on which the flooding occurs must be characterized. If the location of study is an alluvial fan, the Mapping Partner proceeds to Stage 2 to identify which parts of the alluvial fan are active or inactive. Finally, in Stage 3, the Mapping Partner performing the analysis must use various methods to define and analyze the 100-year flood within each identified area of alluvial fan flooding. Progression through these stages requires a variety of maps and photographs, as well as a significant amount of field work and analysis to fully understand the flood hazard. The Mapping Partner may need to consult with geologists, geomorphologists, and/or soil scientists during each stage.

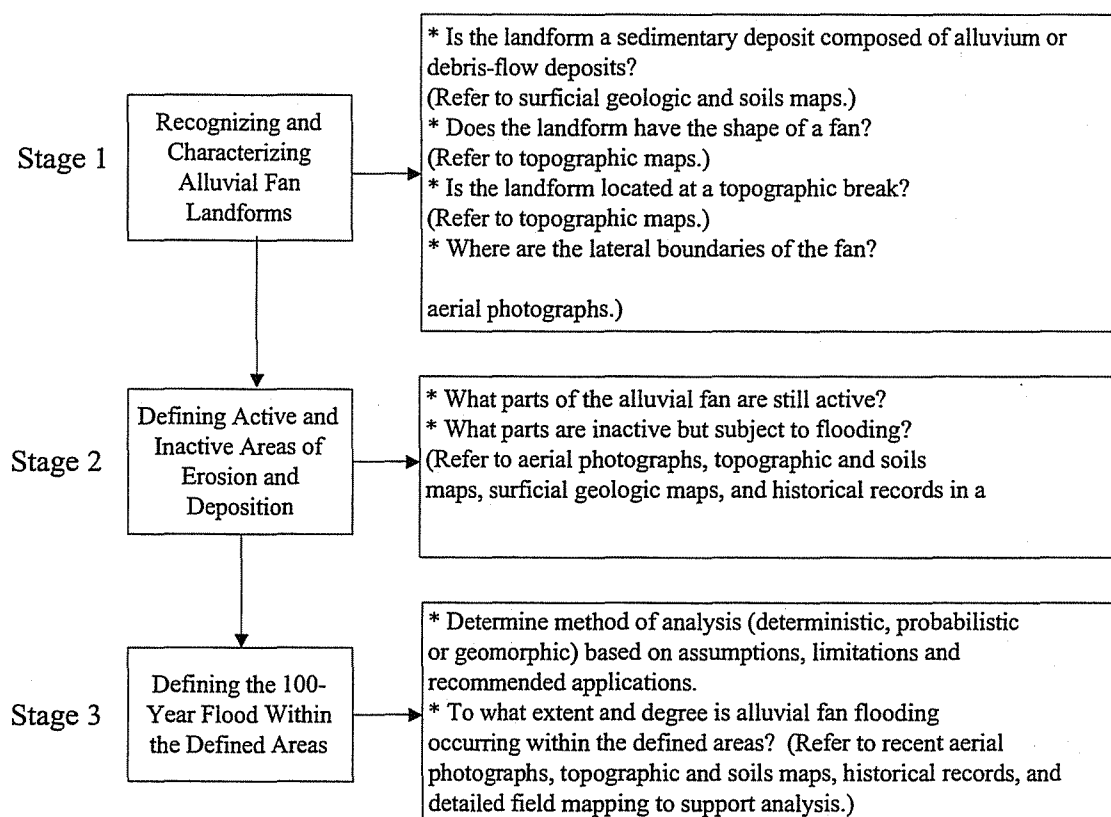


Figure G-2. Three Stages of the Process To Identify and Map Alluvial Fan Flooding. Original Published in National Research Council, 1996, Figure 3-1; Amended by FEMA.

[February 2002]

G.2.1 Stage 1: Recognizing and Characterizing Alluvial Fan Landforms

As defined in this Appendix, alluvial fan flooding occurs only on alluvial fans. Therefore, the first stage of the process is to determine whether the landform in question is an alluvial fan. If, after following the guidelines in this subsection, the Mapping Partner concludes that the landform is not an alluvial fan, then the methods described in this Appendix are not intended for, or necessarily applicable to, the landform in question.

An alluvial fan is a sedimentary deposit located at a topographic break such as the base of a mountain front, escarpment, or valley side, that is composed of streamflow and/or debris flow sediments and has the shape of a fan, either fully or partially extended. These characteristics can be categorized by composition, morphology, and location as discussed in Subsections G.2.1.1, G.2.1.2, and G.2.1.3.

[February 2002]

G.2.1.1 Composition

Alluvial fans are landforms constructed from deposits of alluvial sediments or debris flow materials. These deposits, "alluvium", are an accumulation of loose, unconsolidated to weakly consolidated sediments. Alluvium refers to sediments transported by either streamflow or debris flows. Geologic maps and field reconnaissance can be used to determine whether the landform is composed of alluvium.

[February 2002]

G.2.1.2 Morphology

Alluvial fans are landforms that have the shape of a fan, either partly or fully extended. Flow paths may radiate outward to the perimeter of the fan; however, drainage may exhibit a range of patterns such as dendritic, anastomosing, and distributary. Topographic maps and aerial photos can be used to assess this criterion.

[February 2002]

G.2.1.3 Location

Alluvial fan landforms are located at a topographic break where long-term channel migration and sediment accumulation become markedly less confined than upstream of the break. This locus of increased channel migration and sedimentation is referred to as the alluvial fan apex.

The topographic apex is at the extreme upstream extent of the alluvial fan landform. The hydrographic apex is the highest point on the alluvial fan where there exists physical evidence of channel bifurcation and/or significant flow outside the defined channel; its location may be either coincidental with, or at a point downstream of, the topographic apex as seen in Figure G-1.

The hydrographic apex may depend on the discharge and may vary with the magnitude of the flooding event.

[February 2002]

G.2.1.4 Defining the Toe and Lateral Boundaries of an Alluvial Fan

The distal terminus, or *toe*, of an alluvial fan commonly is defined by:

- A stream that intersects the fan and transports deposits away from the fan;
- A playa lake;
- An alluvial plain; and
- Smoother, gentler slopes of the piedmont plain.

Such boundaries can often be identified on topographic maps by changes in contour lines or identified on aerial photographs or by field inspection as changes in vegetation as a result of sediment changes or increased water table depth.

Lateral boundaries of alluvial fans are the edges of deposited and reworked alluvial materials. The lateral boundary of a single alluvial fan typically is a trough, channel, or swale formed at the lateral limits of deposition. The lateral boundary also may be a confining mountainside.

Lateral boundaries of single alluvial fans can often be identified as a contact of distinct differences between light-colored, freshly abraded, alluvial deposits and darker-colored, weathered deposits with well-developed soils on piedmont plains. Care should be taken to ensure that the contact is not simply a divide between older and more recent deposits of the alluvial fan.

The lateral boundaries of alluvial fans that coalesce with adjacent alluvial fans are generally less distinct than those of single alluvial fans. These lateral boundaries may be marked by a topographic trough or ridge. It is sometimes possible to distinguish between surfaces of adjacent alluvial fans based on different source-basin rock types. Defining the lateral boundaries of coalescing fans will likely require additional fieldwork, use of surficial geologic and soils maps, and consultation with a geomorphologist or soil scientist.

[February 2002]

G.2.2 Stage 2: Defining Active and Inactive Areas

During Stage 1, the Mapping Partner conducting the analysis identified whether the landform in question is an alluvial fan. During Stage 2, the Mapping Partner will seek to delineate areas of the alluvial fan that are active or inactive in the deposition, erosion, and unstable flow path flooding that builds alluvial fans. The activities in Stage 2 have been designed to narrow the

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area of concern for Stage 3, which is the specific identification of the extent of the 100-year flood.

Although active alluvial fan flooding has occurred on all parts of an alluvial fan at some time in the geologic past in order to construct the landform itself, this does not mean that all parts are equally susceptible to active alluvial fan flooding now. Also, flooding may be occurring on inactive areas of the alluvial fan.

In most of the United States, it is possible to identify parts of alluvial fans that were actively constructed during the Pleistocene epoch (approximately 2 million to 10,000 years ago) and parts that have been active (i.e., flooded) during the Holocene epoch (the past 10,000 years). The reason that this broad distinction generally is possible is that the two epochs were identified and defined on the basis of climatic conditions. The Holocene epoch is a time of interglacial warm conditions, whereas the Pleistocene epoch was marked by repeated full glacial, cool conditions alternating with warm interglacials like that of the Holocene epoch. As a result of these climatic differences, flooding and sedimentation occurred at different rates and magnitudes during the Pleistocene and Holocene epochs. The impacts of these climatic changes on alluvial fan formation can be inferred from geologic, geomorphic, and soil data.

A change in the rate of tectonic uplift along a mountain front can also result in abandonment of parts of alluvial fans. For example, a decrease in the rate of uplift at a mountain front relative to the alluvial fan could result in stream channel downcutting at the mountain front/alluvial fan apex over a period of time. As a consequence, the upper part of the fan would become entrenched, and the active area of deposition would shift downfan.

[February 2002]

G.2.2.1 Identification of Active Areas

The term *active* refers to that portion of an alluvial fan where deposition, erosion, and unstable flow paths are possible. If flooding and deposition have occurred on a part of an alluvial fan in the past 100 years, clearly that part of the fan can be considered to be active. This conclusion may be supported by historic records, photographs, time-sequence aerial photography, and engineering and geomorphic information. If flooding and deposition have occurred on a part of an alluvial fan in the past 1,000 years, for example, that part of the fan may be subject to future alluvial fan flooding. This conclusion may only be supported by geomorphic information, however. It becomes more difficult to determine whether a part of the fan that has not experienced sedimentation for more than 1,000 years actually is active, that is, that there is some likelihood of flooding and sedimentation under the present climate conditions.

Because there is no clear analytical technique for making such projections of the estimates of the spatial extent of inundation, Stage 2 analysis involves systematically applied judgment and the combination of hydraulic computations and qualitative interpretations of geologic evidence concerning the recent history and probable future evolution of channel forms, as well as flooding and sedimentation processes. It must be kept in mind, however, that the intent of Stage 2 is to narrow the area of concern with regard to active deposition, erosion, and unstable flow paths over a period of time generally exceeding 100 years. Therefore, the combination of engineering

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and geomorphic analyses, both qualitative and quantitative, provide an indication of the approximate spatial extent of possible inundation over a relatively long time period (i.e., several thousand years). During Stage 3, the Mapping Partner that performs the detailed study shall will determine the floodplain limits associated with the 1-percent-annual-chance (100-year) flood.

[February 2002]

G.2.2.2 Identification of Inactive Areas

For a given area of the alluvial fan, if the situations described in Subsection G.2.2.1 do not exist, then the area is considered inactive and not subject to the deposition, erosion, and unstable flow path flooding that builds alluvial fans. Inactive areas may be subject to flooding though, most notably within entrenched channels.

Evidence of inactive areas may include armoring along the margin of the area bordering active areas, older vegetation, and the lack of change in flow paths viewed over the aerial photographic record. This evidence, though, does not preclude the area from possibly being classified as an active area as a result of changes in, or conditions within, adjacent active areas.

Older alluvial fan surfaces are considered active if any of the following are true:

- The recently active sedimentation zone is migrating into the older surface.
- The elevation difference between the recently active sedimentation zone and the older surface is small relative to flood, deposition, and debris depths conceivable in the current regime of climate, hydrology, or land use in the source area.
- Upstream of the site, there is an opportunity for avulsions that could lead channels or sheet floods across the older surface.

[February 2002]

G.2.2.3 Identification Process

Once a relative time period is chosen (e.g., <1,000 years) to help evaluate the active areas of an alluvial fan, the analyst must determine relative ages for the morphologic features on the alluvial fan. Indicators of land surface age for Stage 2 are based on relative age indicators. Absolute (numerical) dating techniques, such as radiocarbon dating, are generally beyond the scope of many studies.

Detailed soils and surficial geological maps, when available, provide useful delineation of soil types and surface ages. An examination of the historical record of flooding and deposition can enhance the information gained from the soils map. Aerial photographs from different years can be used to identify sites of deposition. Field examination of morphologic features on the alluvial fan surface, particularly noting evidence of human activity (recent or archaeological) or weathering characteristics such as desert pavement, rock varnish, B-horizon development in the

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soil profile, calcic-horizon development, and pitting and rilling of clasts may also provide relative age information.

Density and type of vegetation can provide useful clues to the age of an alluvial fan surface area. Texture and composition of the sediment, in addition to the water-holding capacity, relate to the surface vegetation. Fresh alluvial deposits contain little organic carbon or clay and, as a result, do not promote vegetation growth. Vegetation is limited on older surfaces because they receive only direct rain, are often erosional, and can be less fertile (carbonate soil cropping out at the surface, for example). Intermediate-age surfaces (middle to late Holocene) contain the most dense and diverse vegetation.

Use and interpretation of diagnostic vegetation, like the use and interpretation of desert pavement, varnish, or soil properties, are generally specific to the individual fan in question. Within a geographic region, however, surface characteristics of alluvial fans may be correlated from one fan to another.

Detailed topographic maps (i.e., 2-foot contour interval) are instrumental in identifying potential avulsion areas and in delineating the boundaries of areas subject to different flood, deposition and debris flow depths. Topographic maps also can be used to identify older alluvial surfaces within active zones that are not subject to flooding.

Areas of question noted during the analysis of maps and aerial photographs should be closely examined during the field inspection. All flow paths should be walked to verify the active and inactive areas that have been delineated. Stage 2 is complete when the analyst has defined and delineated all active and inactive areas of deposition, erosion, and unstable flow path flooding, as well as adjacent inactive fan areas. All inactive areas with stable flow path flooding and all active areas may be considered floodprone, but through Stage 2, the degree to which these areas are floodprone is not yet known. **The delineated floodprone areas of Stage 2 should approximate the largest possible extent of the 100-year flood.**

[February 2002]

G.2.2.4 Types of Alluvial Fan Flooding

Several types of flooding occur on alluvial fans. The most common ones are described in this subsection.

Flooding Along Stable Channels

A deeply entrenched channel or network of channels often is subject to inactive alluvial fan flooding. This type of flooding usually occurs within distributary flow systems that were formed during climatic or tectonic conditions different from the present. This flooding can occur at the head of the alluvial fan but become unstable downstream. Conversely, unstable channels can become stable in the downstream direction; this can occur because of headcutting into the toe as a result of changing hydraulic conditions downstream from the toe. Human intervention, directly by channel modification or indirectly by land-use change, can create stable channels.

Sheetflow

Some parts of alluvial fans are characterized by sheetflow, which is the flow of water as broad sheets that are completely unconfined by any channel boundaries. Sheetflow might occur where flow departs from a confined channel and no new channel is formed. It might also occur where several shallow, distributary channels join together near the toe of a fan and the gradient of the fan is so low that the flows merge into a broad sheet. Because such sheetflows can carry high concentrations of sediment in shallow water and follow unpredictable flow paths, they are classified as active alluvial fan flooding.

Sheetflows generally occur on downslope parts of fans, where channel depths are low and the boundaries of channels become indiscernible. They are also more common at distal locations because of the likelihood of fine-grained sediments and shallow groundwater; during prolonged rainfall, the ground can become saturated, resulting in extensive sheet flooding as runoff arrives from upslope. Fine-grained sediments can aggravate the likelihood of sheetflow because some clay minerals swell when wet, forming an impermeable surface at the beginning of a rainstorm.

Debris Flow

Some parts of alluvial fans are characterized by debris flows, flows with a very high concentration of sediment in relation to water. Debris flows pose hazards that are very different from those of sheetflows or water flows in channels. Identifying those parts of alluvial fans where debris flow deposition might occur requires the examination of deposits from past flows. Debris flow deposits can be distinguished from fluvial deposits by differences in morphology, depositional relief, stratigraphy, and clast fabric. Exposures in channel banks can be examined and can be supplemented with shallow trenches in different deposits.

Unstable Flow Path Flooding

Active areas of an alluvial fan will generally be characterized by unstable and uncertain flow path flooding. This type of flooding usually creates a single channel just below the apex, but splits into multiple channels as it proceeds down the alluvial fan. These channels are subject to deposition and bank or bottom erosion that cause channel migration, avulsion, and the formation of new channels. Areas subject to this type of flooding are characterized by shallow, braided or distributary, sand- to gravel-bed channels. Recently formed channels may have less established vegetation, such as trees, than older channels in the same general area.

[February 2002]

G.2.3 Stage 3: Defining the 100-Year Flood Within Defined Areas

FEMA uses the 100-year flood, the flood having a 1-percent chance of being exceeded in any given year, to delineate Special Flood Hazard Areas (SFHAs) on NFIP maps. In the preceding discussion of Stages 1 and 2, methods of identifying alluvial fan landforms and areas of active and inactive deposition, erosion, and unstable flow path flooding were described. During Stage 3, the Mapping Partner that performs the detailed study will determine the severity and will delineate the extent of the 1-percent-annual-chance (100-year) flood within any floodprone area identified during Stage 2.

The broad spectrum of alluvial fan landforms and types of flooding illustrates, as previously discussed, the futility of developing a “cookbook” method to apply to all fans in all geographic areas. The analysis of the flood hazards on alluvial fans therefore requires a flexible approach that is based on site-specific evaluations. Several methods for quantifying the 100-year flood are presented in the following sections and are summarized in Table G-1. Not all methods are appropriate for all situations. The assumptions and limitations of each should be carefully considered in deciding which methods to apply to particular areas of an alluvial fan.

Sample maps resulting from the application of some of the available methods are included as Figures G-5 through G-13 at the end of this Appendix.

[February 2002]

Table G-1. Methods for Defining the 1-Percent-Annual Chance (100-Year) Flood Within Floodprone Areas Defined During Stage 2

METHOD	ASSUMPTIONS	LIMITATIONS	RECOMMENDED APPLICATIONS	FIGURE NUMBER
Risk-Based Analysis	Refer to <i>Guidelines for Risk and Uncertainty Analysis in Water Resources Planning</i> (USACE, 1992).			
FAN Computer Program	Flooding in rectangular channel; critical depth, erosion of rectangular channel banks until the change in width divided by the change in depth equals -200; the probability density function of a discharge occurring at the apex is log-Pearson Type III; the frequency of flood events for various recurrence intervals, i.e., 2-year through 500-year, can be adequately defined; equal probability along contour arcs (random flow paths); (also provides for multiple channels at normal depth, assuming total width is 3.8 times the single-channel width)	Fluvial (as opposed to debris flow) formed fan, unstable flow paths	Highly active, conical fans	G-5
Sheetflow	Broad, unconfined, shallow flooding	Not for use in areas of undulating terrain	Shallow flooding across uniformly sloping surfaces	G-6
Hydraulic Analytical Methods	Stable flow path, uncertainty is to a degree that may be disregarded	Not for use with active alluvial fan flooding	Entrenched stable channel networks, constructed channels, urbanized areas	G-7 and G-13
Geomorphic Data, Post-Flood Hazard Verification, and Historical Information	Relies primarily on qualitative information, post-flood verification, historical data, and interpretive studies	Approximate method	Alluvial fans with little or no urbanization	G-8 and G-9
Composite Methods	As identified in the sections referring to the methods being applied	Must integrate multiple methods into one result	Floodprone areas that contain unique physical features in some locations or have areas varying in levels of erosion and migration activity	G-10, G-11, and G-12

G.2.3.1 Risk-Based Analysis

The U.S Army Corps of Engineers provided a framework that may be used to analyze flood hazards on alluvial fans using the principles of risk-based analysis in *Guidelines for Risk and Uncertainty Analysis in Water Resources Planning* (U.S Army Corps of Engineers, 1992). This method uses the total probability equation that will be discussed in detail in Subsection G.2.3.2. The degree of uncertainty associated with a prediction of a given flood scenario is assessed by bringing to bear evidence derived from geomorphologic and other studies. This method tracks the effects of the error associated with a calculation to provide a confidence band in ensuing predictions of flood-hazard severity.

[February 2002]

G.2.3.2 Analysis Using FAN Computer Program

Assumptions, limitations, and recommended applications for the FAN Computer program are as follows:

- Assumptions: flooding in rectangular channel; critical depth; erosion of rectangular channel banks until the change in width divided by the change in depth equals -200; the probability density function of a discharge occurring at the apex is log-Pearson Type III; the frequency of flood events for various recurrence intervals, i.e., 2-year through 500-year, can be adequately defined; equal probability along contour arcs (random flow paths); also provides for multiple channels at normal depth, assuming total width is 3.8 times the single channel width
- Limitations: fluvial (as opposed to debris flow) formed fan, unstable flow paths
- Recommended Applications: highly active, conical fans

The FAN computer program provides one method of analyzing the flood hazards on alluvial fans. The methodology used by the FAN program defines the risk of inundation at any particular location by applying the definition of the 1-percent-annual-chance (100-year) flood through the theorem of total probability. The methodology itself is broader than the use within the FAN program. Let **H** be a random variable denoting the occurrence of flooding at a particular location. That is:

1 if the location is inundated

H =

0 if the location is not inundated

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Then the probability of the location being inundated by a flood above a given magnitude, say q_0 , is:

$$P[H = 1 \cap Q > q_0] = \int_{q_0}^{\infty} P_{H|Q}(1, q) f_Q(q) dq \quad (1)$$

where

Q = random variable denoting the magnitude of the flood

$P_{H|Q}(1, q)$ = conditional probability that the location will be inundated, given that a flood of magnitude q is occurring

$f_Q(q)$ = probability density function (PDF) defining the likelihood that a flood of a magnitude between q and $q+dq$ will occur in any given year

Equation (1) only defines whether a location is within an SFHA and does so in terms of the parameter q_0 . For riverine flooding, q_0 represents an elevation, and $P_{H|Q}(1, q)$ is 1 if the elevation of the location is less than q_0 and 0 if it is greater than q_0 . At a given location (point on a cross section), there is a one-to-one relationship between the discharge being conveyed by the stream and the elevation of the surface of the floodwater (i.e., the rating curve for the cross section). For riverine flooding, solving Equation (1) reduces to defining the discharge-frequency relationship for the reach of the stream under consideration (hence the notation q_0 to denote magnitude).

As in riverine analysis, the PDF describing frequency of the magnitude of flooding for alluvial fan flooding is taken to be the discharge-frequency relationship of the contributing drainage basin. Unlike riverine analysis, $P_{H|Q}(1, q)$ does not simplify to 0 or 1, because there is uncertainty in the flow path. The FAN program provides energy depths and velocities relating to discharge for use in defining the flood hazard.

The FAN program uses the assumptions outlined below. Where noted with an asterisk (*), these assumptions may be adjusted for observed field conditions; however, the FAN program does not readily accommodate these adjustments.

This method's assumptions are as follows. Floods on alluvial fans are at liberty to expend energy to create the most efficient path to convey the water and sediment load. That path is shallow and approximately rectangular in cross section. Energy is expended through sediment movement until the minimum energy possible is reached. In short, the reasoning is that a flood flows at critical depth and is confined to a rectangular path. The flow path would not widen indefinitely but, instead, would reach a point where it would stabilize. From empirical data, of which there are very little, that point is taken to be where the rate of change of topwidth per change in depth (dW/dd) is -200 (* may be adjusted).

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The reasoning leads to the one-to-one relationships:

$$d = 0.106 q^{1/5} \quad (2)$$

$$v = 1.506 q^{1/5}$$

(3) where

d = specific energy in feet

v = velocity in feet per second

q = discharge in cubic feet per second (cfs)

The conditional probability in Equation (1) accounts for the uncertainty in the path of a flood with a given magnitude. Even if the path of the flood can be predicted with reasonable certainty, the magnitude of the flood at a particular location may not be so certain, as deposition or scour in shallow channels may greatly affect the direction of flow at channel splits. Many alluvial fans exhibit a channel network. The capacities of the individual channels as well as the capacities of the networks in aggregate vary from almost negligible to more than the 100-year flood discharge. The treatment of the uncertainty in a given discharge being exceeded at a particular location given the discharge somewhere else [$P_{H|Q}(1,q)$] varies.

The least complex treatment (used in the FAN program) follows from the reasoning that the topography of the area is the result of deposition that occurred during the past. If that process continues, then, over the long term, the probability of every point on a contour being inundated is the same. That is, $P_{H|Q}(1,q)$ is uniformly distributed and, for a given point, is approximately the width of the flood path divided by the width (the "contour width") of the area subject to flooding at the elevation of that point (* may be adjusted). This method assumes that all areas of the alluvial fan are subject to flooding and that there is a fixed relationship between flooding depth and discharge.

In general, these assumptions apply when there is absolute uncertainty regarding how floods will occur. Thus, for the FAN program, under the simple conditions,

$$P_{H|Q}(1,q) = \frac{w(q)}{W_{fan}} = \frac{9.408 q^{2/5}}{W_{fan}} \quad (4)$$

where

$w(q)$ = width of the path conveying q cfs

W_{fan} = contour width

The contour width, W_{fan} , is shown in Figure G-3. The resulting flood insurance risk zones are depicted in Figure G-4. The functional form of Equation (4) is a consequence of the reasoning

leading to Equations (2) and (3) and is presented here for demonstrative purposes, not as the only form possible.

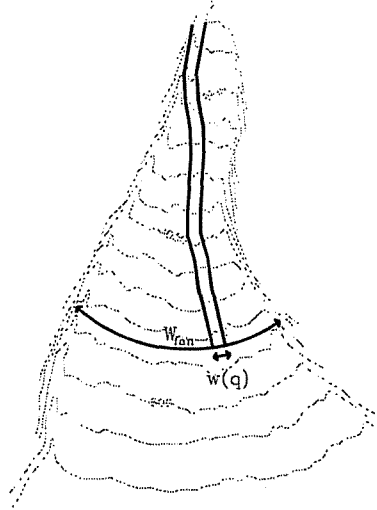


Figure G-3. Fan and Single-Channel Widths

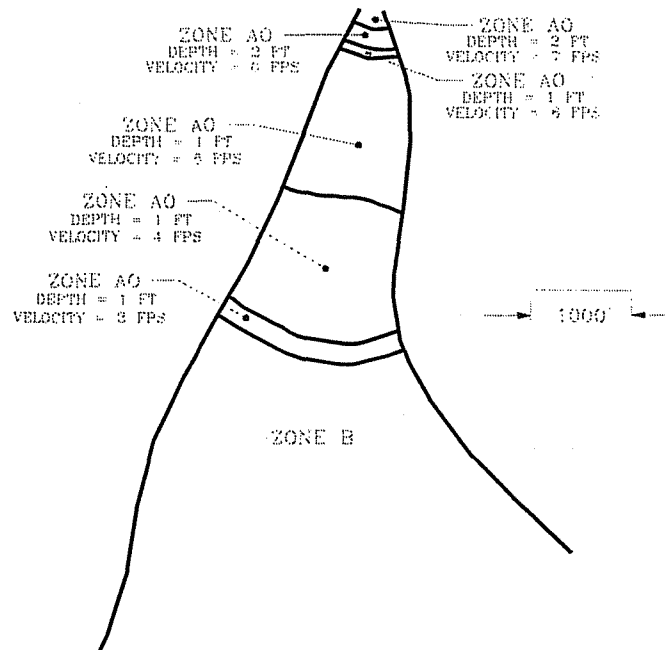


Figure G-4. Flood Insurance Risk Zones Respective to Figure G-3

The FAN program provides for the situation where flows are near normal depth in multiple channels. Program output includes results for this situation in addition to the single channel at critical depth. The results are then applied based on observed field conditions. More

information is provided in *FAN: An Alluvial Fan Flooding Computer Program User's Manual and Program Disk* (FEMA, 1990).

[February 2002]

G.2.3.3 Sheetflow Analysis Method

Assumptions, limitations, and recommended applications for the sheetflow analysis method are as follows:

- Assumptions: broad, unconfined, shallow flooding
- Limitations: not for use in areas of undulating terrain
- Recommended Applications: shallow flooding across uniformly sloping surfaces

Guidance on the analysis and mapping of shallow flooding is provided in Appendix E of these Guidelines. Although Appendix E indicates that Mapping Partners are not to use the procedures in that Appendix for the analysis of alluvial fan flooding, the approach established by this Appendix enables the use of those methods described in Appendix E, except for highly active conical fans that are studied using the FAN program.

[February 2002]

G.2.3.4 Hydraulic Analytical Methods

Assumptions, limitations, and recommended applications for hydraulic analytical methods are as follows:

- Assumptions: stable flow path, uncertainty is to a degree that may be disregarded
- Limitations: not for use with active alluvial fan flooding
- Recommended Applications: entrenched stable channels and channel networks, constructed channels, urbanized areas

For inactive, yet floodprone areas, the Mapping Partner that performs the alluvial fan analysis may use "riverine" hydraulic analytical methods. Where flow paths are stable and flow is reasonably confined, standard hydraulic engineering methods, such as backwater computations, may be used to define the elevation (or depth), velocity, and extent of the 1-percent-annual-chance (100-year) flood. Hydraulic methods may also be used for stable channel networks when applicable. For example, relict alluvial fans or inactive fans with stable channels, as determined by a geomorphic analysis, may be subject to flow splits throughout the distributary system that exists. Hydraulic modeling can generally handle split-flow analyses through stream junctions of this type.

In general, for stable channels on alluvial fans, physically based methods that consider site processes and hydraulics, such as channel geometry, grade and roughness, and channel bank and

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bed material are preferred. Where precise computations of water-surface profiles using energy and momentum based methods may not be feasible based on the scope of the study, the use of normal depth calculations for definition of approximate floodplain boundaries for the 1-percent-annual-chance (100-year) flood may be warranted.

Appendix C of these Guidelines provides guidance for hydraulic analytical methods. Several methods applicable to conditions found on alluvial fans are described. These methods include two-dimensional water-surface models, modeling techniques of streams with supercritical flow regimes, and split-flow analysis.

Two-dimensional models may be appropriate for determining flood hazards on an alluvial fan. Different two-dimensional models may be particularly useful in the analysis and modeling of some or all of the following situations: flows that contain a high amount of sediment, unconfined flows, split flows, mud/debris flows, and complex urban flooding. For use in defining flood hazards for the NFIP, all hydraulic models must meet the conditions of Paragraph 65.6 (a) (6) of the NFIP regulations.

One-dimensional sediment transport models or the methods described in Section G.3 are also useful for the analysis of conditions on alluvial fans.

[February 2002]

G.2.3.5 Analysis Using Geomorphic Data, Post-Flood Hazard Verification, and Historical Information

Assumptions, limitations, and recommended applications for alluvial fan flooding analyses performed using geomorphic, post-flood hazard verification, and historical information are as follows:

- Assumptions: relies primarily on qualitative information, post-flood hazard verification, historical data, and interpretive studies
- Limitations: approximate method
- Recommended Applications: alluvial fans with little or no urbanization

The geomorphic approach is for active alluvial fans where deposition, erosion, and unstable flow paths are possible. Traditional engineering methods, as described in Subsection G.2.3.4, generally are inappropriate for areas with these hydraulic characteristics. Probabilistic methods, as described in Subsection G.2.3.2 and contained in the FAN computer program, also contain inherent limiting assumptions that may not adequately represent field conditions and may not be applicable to many active alluvial fans.

In some situations, the Mapping Partner may use the information collected during Stage 2 to delineate an approximate floodplain on an alluvial fan. In situations where geomorphic field investigations, coupled with historical documentation, and documentation of hydrologic and

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hydraulic characteristics of flood event(s) (post-flood hazard verification) are available, an approximate flood hazard delineation is possible.

By combining quantitative data on an actual flood event, historical information and photographs of other flood events, time-sequence aerial photography documenting recent activity or inactivity, and field investigation of the morphologic characteristics and relative ages of the fan, an approximate (Zone A) flood hazard delineation may be warranted.

For many alluvial fans, the various flood indicators (Stage 2 information) provide limited or partial information. Because the flood assessment of active alluvial fans is more uncertain than more traditional flood assessment, the Mapping Partner that perform the analysis must document all assumptions and limitations well and consider these assumptions and limitations in the overall evaluation.

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G.2.3.6 Analysis Using Composite Methods

Assumptions, limitations, and recommended applications for alluvial fan flooding analyses performed using composite methods are as follows:

- Assumptions: as identified in the sections referring to the methods being applied
- Limitations: must integrate multiple methods into one result
- Recommended Applications: floodprone areas that contain unique physical features in some locations or have areas varying in levels of erosion and migration activity

Site-specific conditions on alluvial fans may lend themselves to the use of multiple or combined methods previously described for the determination of flood hazards. For example, in areas that contain manmade conveyance channels or deeply entrenched stable channels, the Mapping Partner can combine the results of traditional hydraulic computer programs with methods for analyzing active areas. The Mapping Partner that performs the analysis must coordinate with the FEMA RPO and with FEMA HQ staff during the development of the study plan.

[February 2002]

G.3 Additional Information on Sediment Transport

This section regarding sediment transport is included as supplemental information for the analysis of alluvial fans. Sediment transport analyses are generally required for alluvial fan studies and revisions.

The boundaries of the stream channel are usually soil material with a given resistance to erosion. Bed material can range from large boulders to very fine clay particles. In general terms, sediment can be cohesive, including clay, silt, and mixtures, or noncohesive, including sand, gravel, and larger particles. Transport of noncohesive materials is strongly dependent on particle size. The entire size distribution of the material is needed to ascertain its erodibility. The bond between particles in cohesive soil dictates its resistance to erosion and is far more important than size distribution. However, size becomes important once the material has been eroded and is transported by the flow.

An important sediment transport process is the development of an armor layer in beds containing gravel and cobbles. Water flowing over the mixture of sand and coarser material lifts the smaller grains and leaves an upper layer or armor of large particles. This armor protects the underlying sediment from further erosion and controls the subsequent behavior of sediment transport. A flood event of large magnitude can disturb the protective layer, and the armoring process will start again.

Sediment transport exerts substantial control over morphology and channel geometric configuration. An indicator of this influence is the sediment transport rate, which is the rate at which material moves in the stream as quantified in units of weight per unit time. The transport rate is closely dependent on the water discharge.

Two classification systems are used to describe the sediment load in a stream. The first classification system divides the load into ***bed load*** and ***suspended load***. The ***bed load*** is that portion of the sediment that moves along the bottom by sliding, rolling, or saltation. The ***suspended load*** is comprised of all of the material carried in suspension.

The second classification system divides the sediment load into ***wash load*** and ***bed-material load***. The ***wash load*** is comprised of very fine materials, clay and silt, rarely found in the bed. The wash load does not depend on the carrying capacity of the stream but on the amount supplied by the watershed. The ***bed-material load*** is comprised of all of the material found in the bed. Some of it will move very close to the bottom, but some may be found in suspension.

Quantification of sediment transport is fraught with uncertainty because of the complexity of the phenomenon and its inherent spatial and temporal variability. Existing mathematical representations have relied heavily on experimental results. The available sediment transport formulas have been grouped according to the approach used to derive them. Three major approaches have been used: shear stress, power, and parametric. Formulas also can be grouped according to the component of the total load they attempt to quantify: bed load, suspended load, or bed-material load. Table G-2 summarizes some of the more commonly used formulas; however, it is not intended to be a complete listing.

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Despite the intense efforts expended in the development of these formulas, evaluation against field data indicates that they commonly overpredict or underpredict sediment loads by orders of magnitude of actual measured sediment transport rates. This discrepancy is likely a result of imperfect knowledge of the physics of sediment transport and also of the extensive variability and heterogeneity in hydrologic and geologic factors.

For these reasons, no one formula is better than the others. Mapping Partners must select a sediment transport formula based on how well the conditions of the problem at hand match the assumptions underlying the formula. If possible, Mapping Partners should verify the applicability of the formula with site-specific field data.

Table G-2. Sediment Transport Formulas and Classifications

		Sediment Transport Formula										
Criteria	Grouping	DuBoys (1879)	Shields (1936)	Einstein Bed Load(1950)	Einstein Suspended Load (1950)	Meyer-Peter-Muller (1948)	Einstein-Brown (1950)	Parker et al. (1982)	Engelund-Hansen (1967)	Ackers-White (1973)	Yang (1972)	Colby (1964)
Approach	Shear Stress	X	X	X		X	X	X				
	Power								X	X	X	
	Parametric											X
Load Component	Bed Load	X	X	X		X	X	X				
	Suspended Load				X							
	Bed-Material Load								X	X	X	X

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G.4 References

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National Research Council, *Alluvial Fan Flooding*, National Academy Press, Washington, D.C., 1996.

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U.S. Department of the Army, Corps of Engineers, *Guidelines for Risk and Uncertainty Analysis in Water Resources Planning*, Report 92-R-1, Fort Belvoir, Virginia, 1992.

Yang, C. T., and S. Wan, "Comparison of selected bed-material formulas," *ASCE Journal of Hydraulic Engineering*, Vol. 117, p. 973-989, 1991.

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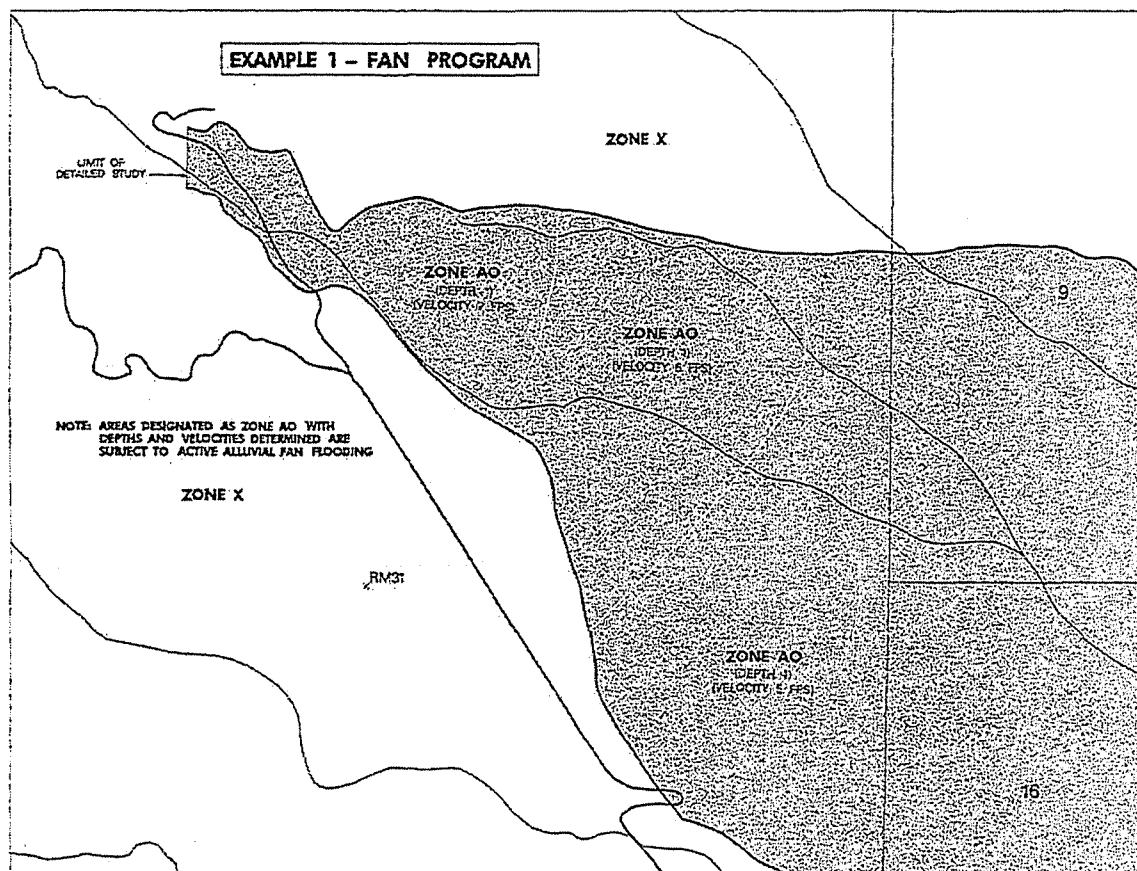


Figure G-5. Sample Map Generated From Alluvial Fan Analysis Using FAN Computer Program.

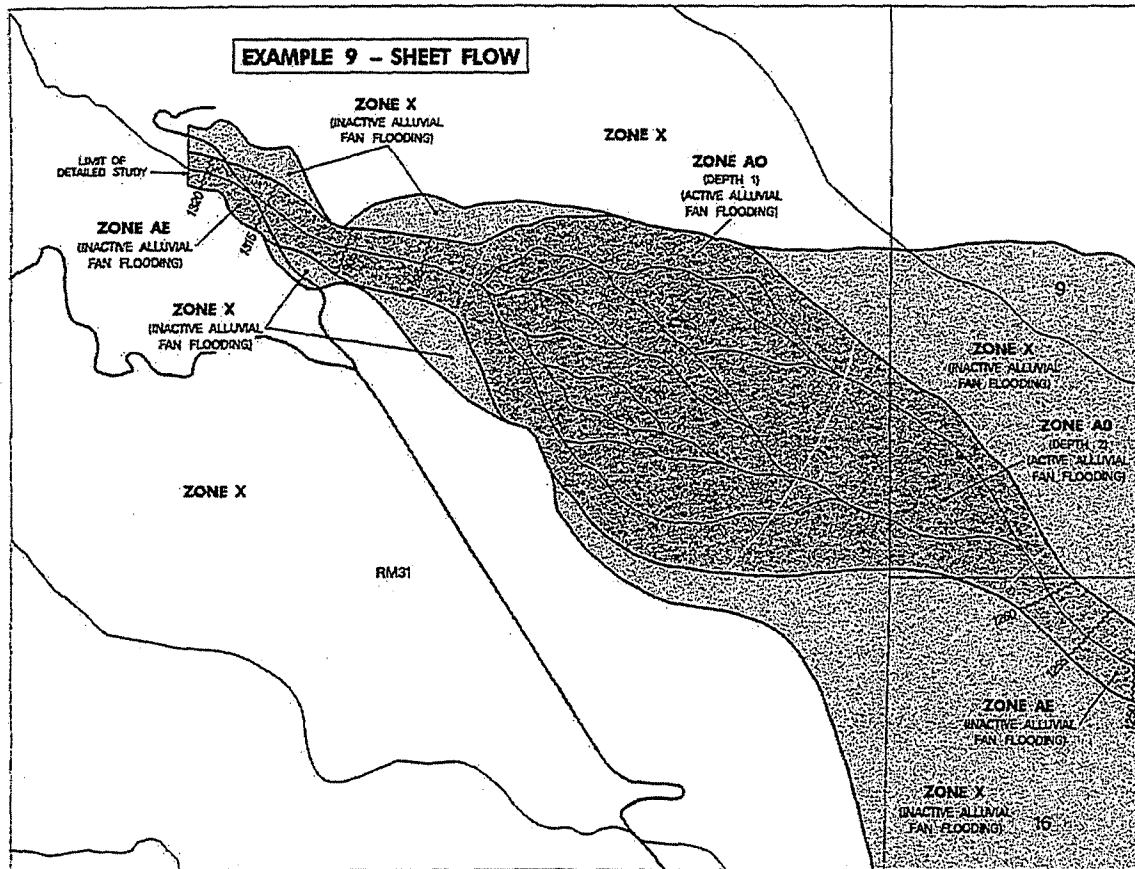


Figure G-6. Sample Map Generated From Alluvial Fan Analysis Using Sheetflow Analysis Methods.

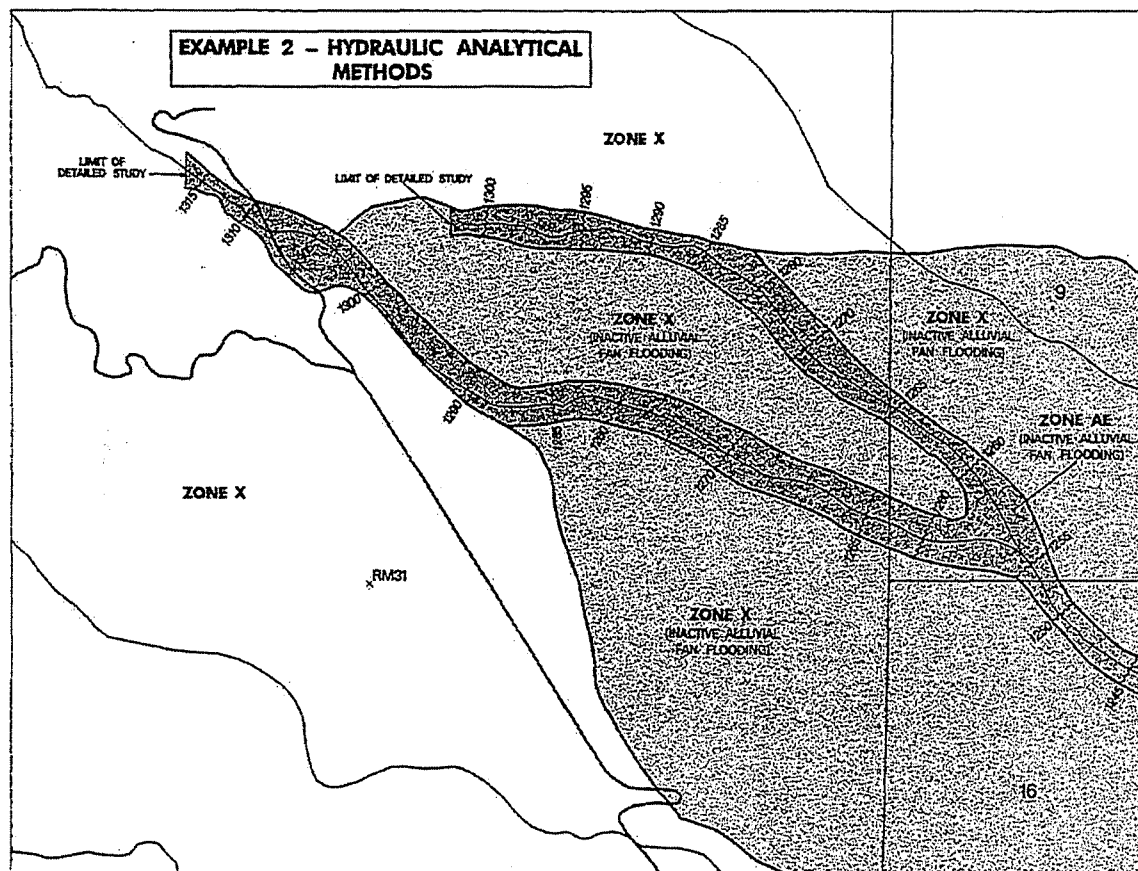


Figure G-7. Sample Map Generated From Alluvial Fan Analysis Using Hydraulic Analytical Methods.

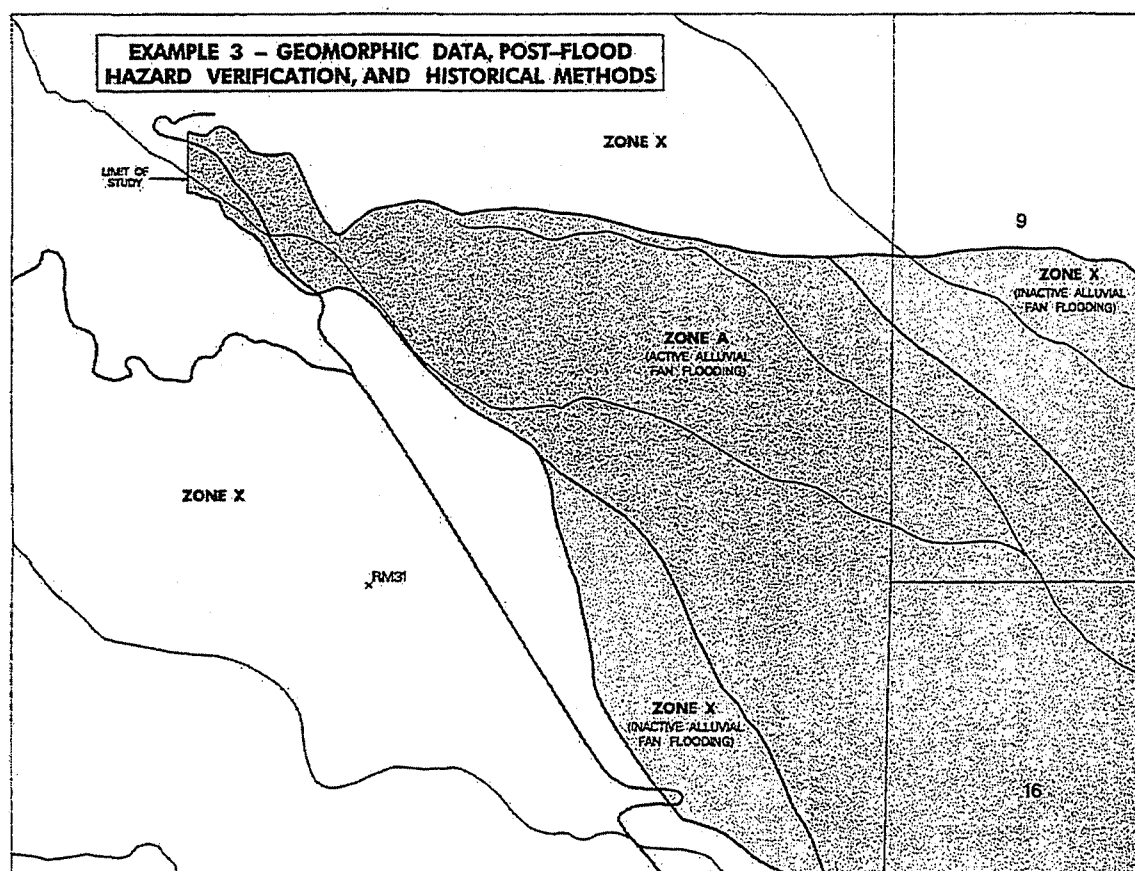


Figure G-8. Sample Map Generated From Alluvial Fan Analysis Using Geomorphic Data, Post-Flood Hazard Verification Data, and Historic Information.

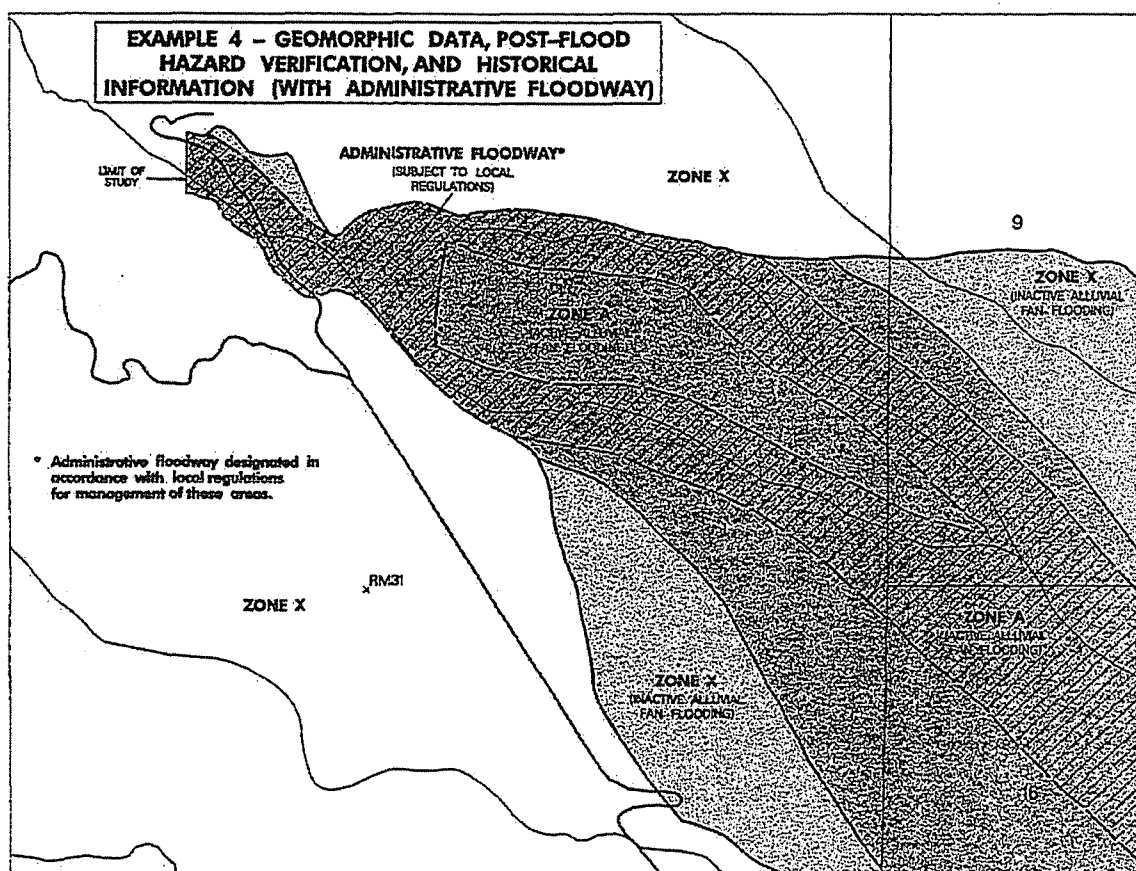


Figure G-9. Sample Map Generated From Alluvial Fan Analysis Using Geomorphic Data, Post-Flood Hazard Verification, and Historic Information (Administrative Floodway Shown).

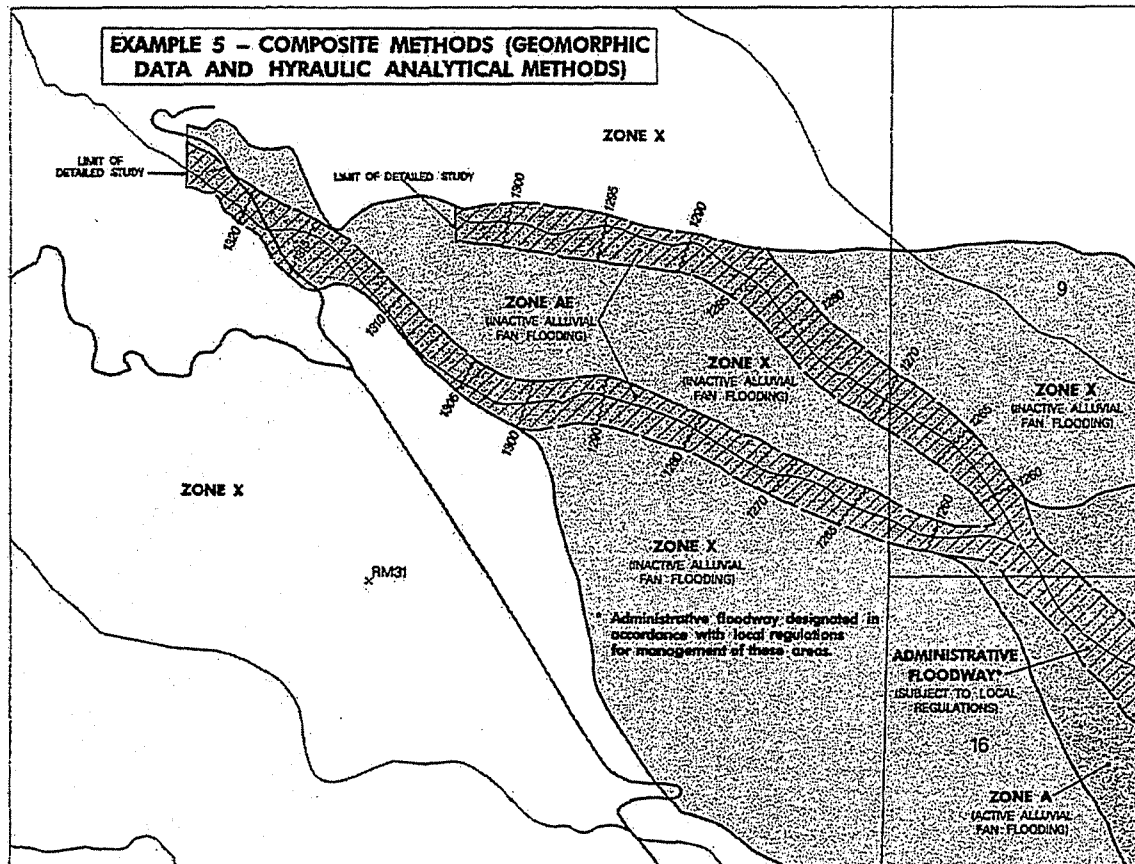


Figure G-10. Sample Map Generated From Alluvial Fan Analysis Using Composite Methods (Geomorphic Data and Hydraulic Analytical Methods).

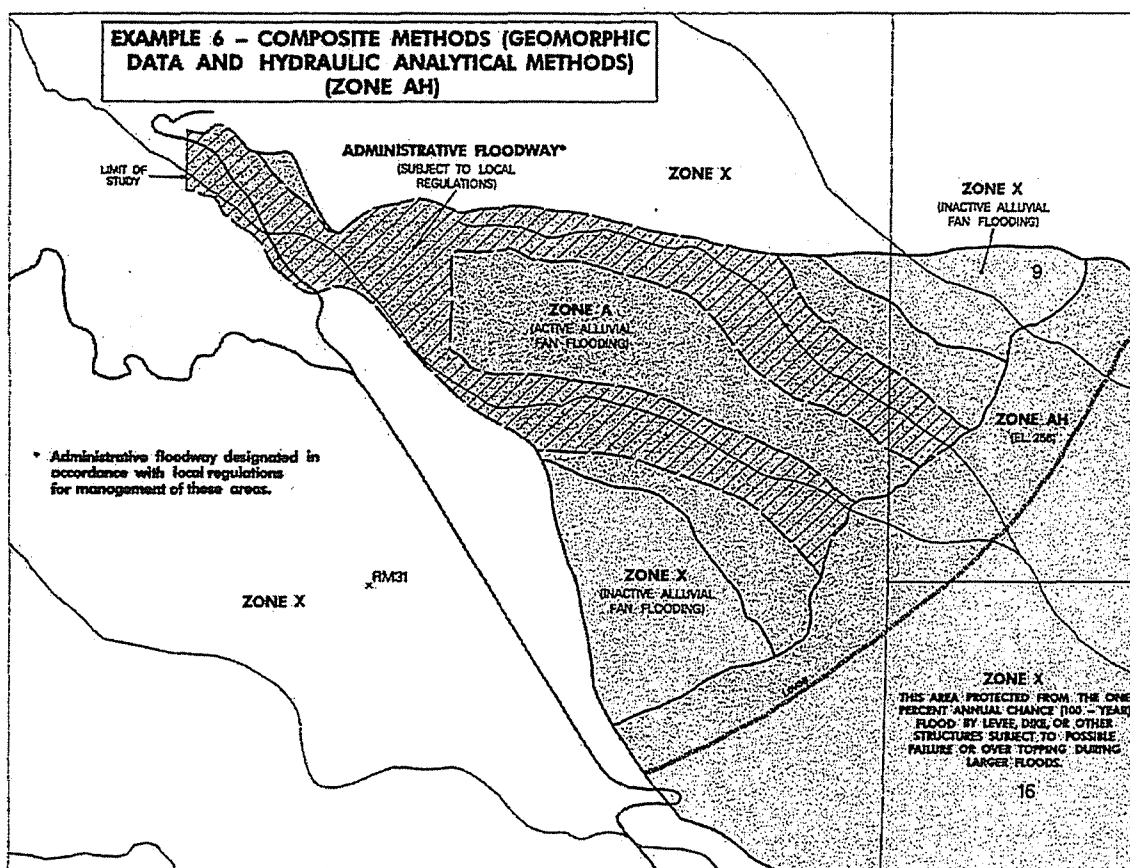


Figure G-11. Sample Map Generated From Alluvial Fan Analysis Using Composite Methods (Geomorphic Data and Hydraulic Analytical Methods); Zone AH Shown.

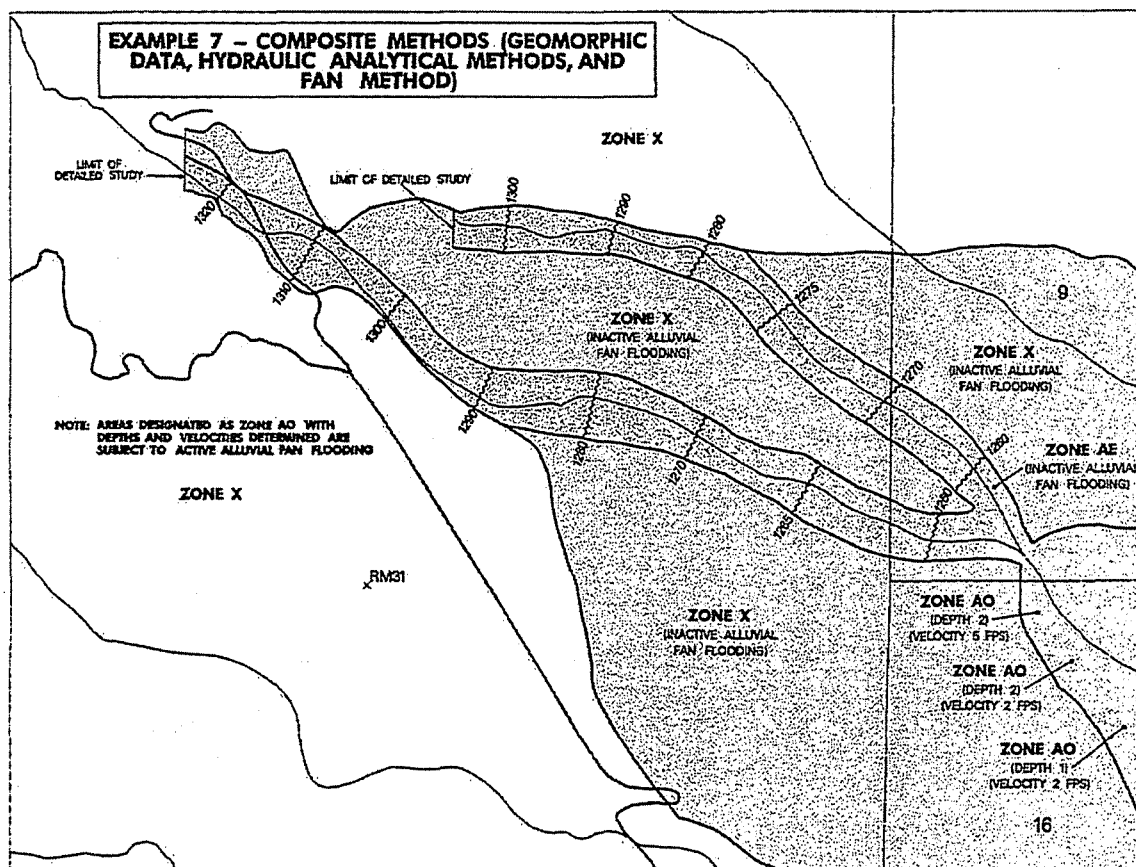


Figure G-12. Sample Map Generated From Analysis Using Composite Methods (Geomorphic Data, Hydraulic Analytical Methods, and FAN Computer Program).

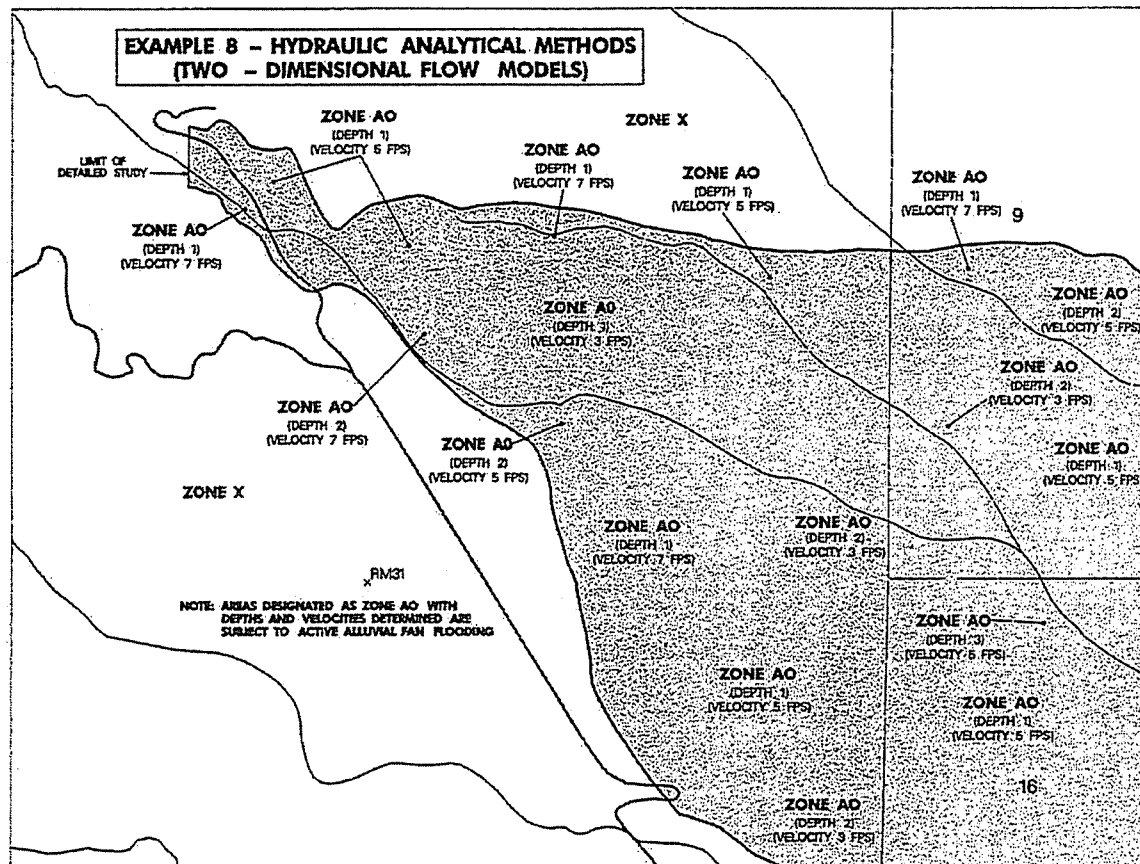


Figure G-13. Sample Map Generated From Alluvial Fan Analysis Using Hydraulic Analytical Methods (Two-Dimensional Flow Model).

[February 2002]

2. Section 70.2 is amended by revising paragraph (2)(xxvii) of the definition of "major source" to read as follows:

§ 70.2 Definitions

* * * * *

Major source * * *

(2) * * *

(xxvii) Any other stationary source category, which as of August 7, 1980 is being regulated under section 111 or 112 of the Act.

* * * * *

[FR Doc. 01-29383 Filed 11-26-01; 8:45 am]

BILLING CODE 6560-50-P

FEDERAL EMERGENCY MANAGEMENT AGENCY

44 CFR Parts 59 and 64

RIN 3067-AD18

Changes to General Provisions and Communities Eligible for the Sale of Insurance Required To Include Future- Conditions Flood Hazard Information on Flood Maps

AGENCY: Federal Emergency
Management Agency (FEMA).

ACTION: Final rule.

SUMMARY: This Final Rule revises the National Flood Insurance Program (NFIP) regulations to include definitions for future-conditions hydrology and for the floodplains that may be shown on Flood Insurance Rate Maps (FIRMs), for informational purposes at the request of the community, to reflect future-conditions hydrology; and establish the zone symbol to be used to identify future-conditions flood hazard areas on FIRMs.

DATES: This Final Rule is effective December 27, 2001.

FOR FURTHER INFORMATION CONTACT: Matthew B. Miller, P.E., Chief, Hazards Study Branch, Hazard Mapping Division, Federal Insurance and Mitigation Administration, FEMA, Washington, DC 20472, (202) 646-3461.

SUPPLEMENTARY INFORMATION:

Background

It was the expressed intent of the U.S. Congress, in enacting the Housing and Urban Development Act of 1968 (commonly referred to as the National Flood Insurance Act of 1968), to "encourage State and local governments to make appropriate land use adjustments to constrict the development of land which is exposed to flood damage and minimize damage caused by flood losses, and guide the development of proposed future

construction, where practicable, away from locations which are threatened by flood hazards * * *" 42 U.S.C. 4001(e). The revisions to the NFIP regulations documented in this Final Rule are a result of the continuing reappraisal of the NFIP for the purpose of encouraging sound floodplain management to reflect that intent.

Historically, flood hazard information presented on NFIP flood maps has been based on the existing conditions of the floodplain and watershed. When the mapping of flood hazards was initiated under the NFIP, the intent was to reassess each community's flood hazards periodically and, if needed, revise the flood map for that community. Flood hazards may change significantly in areas experiencing urban growth. The FEMA document entitled *Flood Insurance Study Guidelines and Specifications for Study Contractors* (FEMA 37, January 1995) specifies that flood hazard determinations should be based on conditions that are planned to exist in the community within 12 months following completion of the draft Flood Insurance Study (FIS). Examples of future conditions to be considered in the context of FEMA 37 are public works projects in progress, including channel modifications, hydraulic control structures, storm-drainage systems, and various other flood protection projects. These are projects that will be completed in the near future for which completion can be predicted with a reasonable degree of certainty and their completion can be confirmed prior to the new or revised flood map becoming effective. By contrast, future land-use development, such as urban growth, is uncertain and difficult to predict, and has not been considered in the context of the FEMA guidelines.

Communities experiencing urban growth and other changes have expressed a desire to use future-conditions hydrology in regulating watershed development. While some communities do regulate based on future development, others are hesitant to enforce more restrictive standards without Federal support.

From a floodplain management standpoint, future-conditions floodplains can be used, and are being used, by communities to enforce more stringent floodplain management policies than those required by FEMA. By displaying future-conditions floodplains on the FIRM, the community and FEMA are alerting the public that flood hazards may increase in the future due to urban development. Many progressive communities throughout the United States develop

future-conditions hydrology and create their own maps to regulate floodplain development. This has resulted in two sets of maps being produced for a community: future-conditions maps for local floodplain management and existing-conditions FIRMs for flood insurance determinations. As a result, these progressive communities have not had a sense of ownership for the FIRMs, and their resources have been directed toward maintaining their own future-conditions maps.

Recent Evaluation and Conclusions

To assist officials in such progressive communities, FEMA undertook an evaluation to determine whether future-conditions flood hazard information could and should be placed on FIRMs and in the accompanying FIS reports. The results of that extensive evaluation are documented in a FEMA report entitled "Modernizing FEMA's Flood Hazard Mapping Program: Recommendations for Using Future Conditions Hydrology for the National Flood Insurance Program" (see www.fema.gov/mit/tsd/FT_hydro.htm). The specific conclusions reached in the report are as follows:

- The local community should determine the future-conditions land-use and hydrology.
- If the community chooses to adopt a regulatory floodway based on future-conditions hydrology, the use of this floodway should be supported by local ordinances.
- If the community requests that FEMA do so, the future-conditions 1-percent-annual-chance (100-year) floodplain should be shown on the printed FIRM and be designated as Zone X with no base (1-percent-annual-chance) flood elevations (BFEs) shown.
- When possible, three floodplains should be shown on the FIRM: existing-conditions 1-percent-annual-chance (100-year) floodplain, existing-conditions 0.2-percent-annual-chance (500-year) floodplain, and future-conditions 1-percent-annual-chance (100-year) floodplain. However, when the future-conditions 1-percent-annual-chance (100-year) floodplain and the existing-conditions
 - 0.2-percent-annual-chance (500-year) floodplain are so close together as to be confusing if both are shown on the printed FIRM, the future-conditions 1-percent-annual-chance (100-year) floodplain should be shown in lieu of the existing-conditions 0.2-percent-annual-chance (500-year) floodplain. When this occurs, appropriate reference should be made to the existing-conditions 0.2-percent-annual-chance

(500-year) floodplain information being shown in the FIS report. For a Digital Flood Insurance Rate Map (DFIRM), appropriate reference also should be made to the existing-conditions 0.2-percent-annual-chance (500-year) floodplain information being included in an associated database.

- BFEs should be shown on the FIRM only for the existing-conditions 1-percent-annual-chance (100-year) floodplain. The future-conditions BFEs should be included in the FIS report (on the Flood Profiles and in the Floodway Data Table), thus providing necessary information to the community to meet their local floodplain management needs. The existing-conditions 0.2-percent-annual-chance (500-year) flood elevations also should be shown on the Flood Profiles in the FIS report to meet the requirements of Executive Order No. 11988 and to provide Federal agencies with information to evaluate the potential effects of any actions they may take in a floodplain.

- The community may choose to show the existing-conditions 0.2-percent-annual-chance (500-year) floodplain on the FIRM and to include the future-conditions.

- 1-percent-annual-chance (100-year) flood elevations only on the Flood Profiles in the FIS report. Various other combinations to display the flood hazard data also are possible. FEMA and the community should work together to produce the most useful FIRM and FIS report for the community.

- From a floodplain management standpoint, FEMA should continue to require regulation of floodplain development based on the existing-conditions data, while local floodplain managers can regulate development based on the future-conditions data.

- From a flood insurance standpoint, FEMA must continue to require flood insurance for structures shown in the existing-conditions 1-percent-annual-chance (100-year) floodplain, or Special Flood Hazard Area (SFHA). Showing the future-conditions floodplain as Zone X should avoid any confusion regarding the mandatory flood insurance requirement. It also will allow insurance policies to be purchased at a reduced rate, as insurance is currently available for structures in the existing-conditions 0.2-percent-annual-chance (500-year) floodplain.

As recommended in the previously referenced FEMA report, FEMA intends to show future-conditions flood hazard information on FIRMs and in collateral FIS reports. This information will be for informational purposes only. No change will be made in the use of existing-conditions data for establishing risk

premium rates. Through community participation in the Community Rating System, however, reduced risk premium rates will be available as they are for those communities that enforce more stringent regulatory standards than required by the NFIP.

Synergy With Other FEMA Programs

The inclusion of future-conditions data on FIRMs and related products for communities that request that such data be included is part of a larger FEMA plan to modernize the Flood Hazard Mapping Program and thereby reduce the burden on taxpayers for disaster relief and improve flood hazard mitigation. FEMA plans to facilitate ownership of the flood maps by State and local entities through greatly increased involvement in the flood mapping process through cooperative agreements. FEMA will provide flood mapping funds, technical assistance, and mentoring to partners—termed “Cooperating Technical Partners”—and those partners will then develop and maintain the flood maps or components thereof. The proposed cooperative agreements recognize that hazard identification and mapping must go hand-in-hand with the responsibility of managing floodplains locally. By creating a strong local program that maintains the connection between mapping and managing flood hazard areas, the NFIP also is strengthened in its ability to reduce the loss of property and life.

FEMA recognition of future-conditions data will be a key factor in the State and local communities assuming increased ownership in the process. By mapping locally pertinent information, local ownership of the flood maps will increase. Because flood conditions and hazards vary locally and regionally, inclusion of those unique local conditions on the flood maps may be warranted. For example, a community may find it useful to identify areas on the FIRM with floodplains based on developed/future hydrologic conditions in addition to the standard features already depicted. In effect, FEMA will maintain national standards while at the same time providing a useful tool to the community. Because the public and the development community will be more aware of future flood hazard conditions, communities will now be more able to implement proactive mitigation measures to address these potential hazards.

In sum, the use of future-conditions hydrology is consistent with modernizing the FEMA Flood Hazard Mapping Program; with promoting

better proactive mitigation measures; and with FEMA's desire to be flexible with, and supportive of, those progressive communities that would like to implement stricter land-use regulations.

Planned Implementation

The FEMA plans for implementing the presentation of future-conditions flood hazard information on NFIP flood maps are summarized below.

Map Specifications. The new DFIRM product specifications that are being developed by FEMA will include options that can be invoked depending on the available flood hazard data. This new DFIRM product will include certain basic features and meet certain minimum mapping requirements. Additional options will be included to meet community needs, provided that sufficient funding is available. A review of needs and available data will lead to an estimate of the time and costs and a recommendation on which options to exercise for the final DFIRM product. Procedures for displaying future-conditions floodplains on the new DFIRM will be included in the new FEMA mapping specifications.

Cooperating Technical Partners Activities. As a part of the mapping activities undertaken by communities participating in the Cooperating Technical Partners initiative, an option could be for communities to show the future-conditions 1-percent-annual-chance (100-year) floodplain on the FIRM in addition to the existing-conditions 1-percent-annual-chance (100-year) floodplain. The communities would develop and map existing and future conditions and provide the new floodplain mapping and supporting data to FEMA; in turn, the communities would receive a FIRM that shows both floodplain and is thus a more useful tool for risk assessment and flood hazard mitigation.

Revisions. Because mapping of the future-conditions 1-percent-annual-chance (100-year) floodplains would be implemented on a community level, the flood maps will maintain consistency within community boundaries, regardless of how many map panels the community encompasses. When FEMA receives future-conditions data from communities, FEMA could incorporate the data easily at the time of the conversion to the DFIRM product. Alternatively, communities that require flood hazard updates can submit future-conditions data to be incorporated with the existing-conditions data updates for the DFIRM conversion. Displaying future-conditions data will increase community involvement in the NFIP

and help FEMA build stronger partnerships with communities. If these communities are involved at the beginning of the digital conversion process, they will have a stronger sense of ownership of the DFIRMs, because they will have input on the kind of flood hazard information shown on the maps.

Once FEMA has included future-conditions 1-percent-annual-chance (100-year) floodplains on a flood map, all FEMA- or community-initiated studies, restudies, and revisions will incorporate the future-conditions hydrology that the community has determined. FEMA will perform a technical review of the locally developed data and will include the data in all map updates. Additionally, FEMA will continue to make determinations on whether structures and parcels of land are in or out of the existing-conditions 1-percent-annual-chance (100-year) floodplains shown on the FIRM or DFIRM, and will issue Letters of Map Amendment and Letters of Map Revisions Based on Fill based on these determinations.

Scope of Public Participation

On June 14, 2001, FEMA published a Proposed Rule in the *Federal Register*, at 66 FR 32293. On that date, FEMA invited interested parties to submit written comments to the Rules Docket Clerk, Office of General Counsel, on or before August 13, 2001.

During the comment period provided for in the Proposed Rule, FEMA received letters or e-mail messages from 20 respondents. All of the respondents supported the FEMA decision to include the future-conditions 1-percent-annual-chance (100-year) floodplains on the FIRM. In fact, 30 percent of the respondents recommended that FEMA proceed with finalizing the Proposed Rule without any changes. Other respondents provided multiple recommendations for how FEMA could change and improve the Proposed Rule before finalizing it. Those submitting formal comments on the Proposed Rule included one U.S. Senator; one member of the U.S. House of Representatives; community officials and representatives of local and regional government agencies; representatives of the business community; and representatives of professional environmental and floodplain management associations.

Summary of Comments and FEMA Responses

The comments and recommendations submitted by the respondents to the Proposed Rule may be separated into eight categories. Summaries of each

category of comments and FEMA's responses to those comments are summarized below.

Insurance Applications. Several respondents recommended that FEMA establish risk premium rates and mandatory flood insurance purchase requirements for buildings located in the future-conditions floodplains that will be shown on a FIRM or DFIRM when requested by a community.

Risk premium rates are based on accepted actuarial principles. Several factors are considered in establishing risk premium rates, including amount of coverage purchased; location, age, occupancy, and design of the building to be insured; and, for buildings in the SFHA, elevation of the building in relation to the existing-conditions 1-percent-annual-chance (100-year) flood elevation. The current procedure for risk premium rating is consistent with the statutes governing the NFIP. Under the current procedure, structures shown within the SFHA, the area that would be inundated by the 1-percent-annual-chance (100-year) flood based on existing conditions hydrology, are subject to a mandatory flood insurance purchase requirement. FEMA decided to show future-conditions 1-percent-annual-chance (100-year) floodplains on Flood Insurance Rate Maps to support the floodplain management practices of those progressive communities that choose, voluntarily, to implement more restrictive requirements than those required for participation in the NFIP. Because of the uncertain nature of the future-conditions data and the relatively limited number of participating communities that have opted to implement these more restrictive development requirements, it is not practicable to establish risk premium rates and mandatory flood insurance purchase requirements for buildings located in the future-conditions floodplains. Further, we do not plan to require that all communities use future-conditions data to regulate development as a condition of participating in the NFIP. While the Federal mandatory flood insurance purchase requirement will continue to apply only to buildings in SFHAs based on existing-conditions hydrology in participating communities, flood insurance is available in all areas of a participating community, including the area that will be shown as within the future-conditions 1-percent-annual-chance (100-year) floodplain. This is important because approximately 25 percent of the flood insurance claims paid by the NFIP have been for buildings outside the existing-conditions 1-percent-annual-chance (100-year) floodplain, or SFHA. It also is

important to note that a lender may determine, on its own as a business decision, that it wishes to require flood insurance for buildings located outside the SFHA to protect its financial risk on the loan.

Expanded Floodplain Management Requirements. Several respondents recommended that FEMA require regulation of development within the future-conditions 1-percent-annual-chance (100-year) floodplain, primarily to support local floodplain administrators in their efforts to discourage unwise floodplain development.

The FEMA decision to show the future-conditions 1-percent-annual-chance (100-year) floodplain was made precisely to support the floodplain management practices of those progressive communities that choose, voluntarily, to implement more restrictive requirements than those required for participation in the NFIP. Through this change and other recent initiatives, FEMA is emphasizing the need for decision-making authority to be at the local level. However, because of the uncertain nature of the future-conditions data and the relatively limited number of participating communities that have opted to implement these more restrictive development requirements, FEMA does not plan to require that communities use future-conditions data to regulate development.

Expanded Definition of "Future-Conditions Hydrology." Some respondents recommended that FEMA expand and clarify the definition of future-conditions hydrology. Specifically, these respondents recommended the following: (1) add clarification that planned structural modifications that would reduce peak flood discharges are not to be included in the community's determination of future conditions; (2) include "approved development" as an example of future conditions; (3) include number of units, unit density, and square footage of impervious surface in the definition; and (4) include expected changes in frequency and severity of precipitation events in the definition.

FEMA is implementing the presentation of future-conditions 1-percent-annual-chance (100-year) floodplains on FIRMs to support floodplain management decisions made locally to address land-use changes that will affect hydrology. To ensure maximum flexibility for local community officials, FEMA does not want to be too restrictive in defining future-conditions hydrology. However, as indicated in the previously

referenced FEMA report entitled "Modernizing FEMA's Flood Hazard Mapping Program: Recommendations for Using Future Conditions Hydrology for the National Flood Insurance Program," the future hydrology conditions defined in this Final Rule do not include future construction of flood detention structures or hydraulic structures for the reasons cited below.

The construction of flood detention structures can significantly affect the flood frequency characteristics of a watershed, and the hydrologic effects of flood detention structures are very site specific and difficult to evaluate. Likewise, the effects of projected future hydraulic modifications—changes within a stream or other waterway, such as bridge and culvert construction, fill, and excavation—on flood frequency are site specific and difficult to predict and are considered beyond the scope of this discussion.

Therefore, FEMA revised the definition of future-conditions hydrology presented in Section 59.1 of the NFIP regulations to clarify that the effects of future construction of flood detention structures or hydraulic structures are not to be considered by a community in establishing future-conditions hydrology.

Expanded Depiction of Future-Conditions Floodplains. One respondent recommended that FEMA include the area that would be affected by projected sea level rise in the depiction of the future-conditions 1-percent-annual-chance (100-year) floodplain on the FIRM. As justification, this respondent cited the requirement in the Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et. seq.), that " * * * coastal states must anticipate and plan for such an occurrence."

As cited above, FEMA is implementing the presentation of future-conditions 1-percent-annual-chance (100-year) floodplains on FIRMs to support local floodplain management decisions to address land-use changes that will affect hydrology. As FEMA and its community and State partners together move forward with the digital conversion of flood hazard data and production of DFIRMs, greater consideration will be given to including advisory information, such as the project sea level rise. However, inclusion of project sea level rise is outside the scope and intent of this rule change.

Use of Distinctive Screen and Zone Designation for Portraying Future-conditions Floodplain on Maps. Several respondents suggested that FEMA establish a new premium rate zone designation for the future-conditions 1-

percent-annual-chance (100-year) floodplain, with a distinctive screen, to differentiate this hazard area from the existing-conditions 0.2-percent-annual-chance (500-year) floodplain. The zone designations that were recommended were Zone F–X, Zone F, Zone AF, Zone U, and Zone D.

FEMA opted to use the Zone X (shaded) screen to depict the future-conditions 1-percent-annual-chance (100-year) floodplain to minimize confusion by users in the lending and insurance industries that use the map to make determinations regarding whether the Federal mandatory flood insurance purchase requirements apply to a particular building. Those users now recognize that areas designated as Zone X (shaded) are subject to some flood hazard, but that the mandatory flood insurance purchase requirement does not apply. Because the risk premium rates for buildings located in the future-conditions 1-percent-annual-chance (100-year) floodplain will be the rate comparable to other areas outside the SFHA, FEMA believes designating these areas as "Zone X (Future Base Flood)" will be sufficient distinction.

This presentation decision notwithstanding, two of the recommended zone designations—Zone AF and Zone D—could not be used on the map anyway. The former is likely to be confused with the zone designation used for SFHAs, in which the mandatory flood insurance purchase requirement does apply, and the latter is already used to designate areas of possible, but undetermined flood hazards.

Presentation of Existing- and Future-Conditions Floodplains on Maps. Some respondents suggested that FEMA show the future-conditions 1-percent-annual-chance (100-year) floodplain on the FIRM at all times, even when the boundaries of the future-conditions 1-percent-annual-chance (100-year) floodplain and the existing-conditions 0.2-percent-annual-chance (500-year) floodplain are too close together to be distinguished.

FEMA plans to take a much more flexible approach to the presentation of the existing- and future-conditions floodplains on the FIRM. Because inclusion of this information on the FIRM is voluntary, the community will have the decision-making authority for determining whether to show the future-conditions 1-percent-annual-chance (100-year) floodplain, the existing-conditions 0.2-percent-annual-chance (500-year) floodplain, or both on the FIRM.

Inclusion of Future-Conditions Flood Elevations on Maps. One respondent

recommended that FEMA include future-conditions 1-percent-annual-chance (100-year) flood elevations, rounded to the nearest tenth of a foot, adjacent to the BFEs shown in the existing-conditions future-conditions 1-percent-annual-chance (100-year) floodplain on the FIRM.

To minimize confusion and enhance the usability of the FIRM, FEMA plans to include the future-conditions 1-percent-annual-chance (100-year) flood elevations only in the FIS report that will accompany the FIRM. As with the existing-conditions 1-percent-annual-chance (100-year) flood elevations (i.e., BFEs), local floodplain management officials should consult the Flood Profiles included in the FIS report and other available technical support data for more complete elevation data.

Presentation of Future-Conditions Floodplains for Flooding Sources Studied by Approximate Methods. One respondent recommended that FEMA clarify whether the future-conditions 1-percent-annual-chance (100-year) floodplain could be shown on the FIRM for flooding sources that FEMA analyzed using approximate-study methods. The existing-conditions 1-percent-annual-chance (100-year) floodplains for flooding sources studied by approximate methods are designated as Zone A on the FIRM.

The community may establish a future-conditions 1-percent-annual-chance (100-year) floodplain for any flooding source in the community, regardless of the type of study performed by FEMA. If the community performed a detailed study to establish the future-conditions 1-percent-annual-chance (100-year) floodplain, FEMA may request the supporting data for the detailed study and revise and, based on available funding, redesignate the existing-conditions 1-percent-annual-chance (100-year) floodplain as Zone AE. If the community performed an approximate study, FEMA would show the future-conditions 1-percent-annual-chance (100-year) floodplain, designated as Zone X (Future), adjacent to the existing-conditions 1-percent-annual-chance (100-year) floodplain. The designation for the existing-conditions 1-percent-annual-chance (100-year) floodplain would continue to be Zone A.

Timing of Revisions to Mapping and Implementation of Local Regulations. One respondent requested that FEMA clarify when and if local floodplain management regulations must be implemented when FIRM is revised to show the future-conditions 1-percent-annual-chance (100-year) floodplain.

FEMA will revise the FIRM to add the future-conditions 1-percent-annual-chance (100-year) floodplain when requested to do so by the community. FEMA is showing this information on the FIRM for informational purposes only. FEMA will require written assurance from the Chief Executive Officer or other community official that the community has or will proceed with adoption of the future-conditions information. Such assurance is generally in the form of an adopted local ordinance or resolution. The community will have the authority to decide when to implement changes to local floodplain management regulations, which is true with any change that will result in making the local regulations more stringent than the minimum required under the NFIP.

National Environmental Policy Act

This Final Rule is categorically excluded from the requirements of 44 CFR Part 10.8 (d)(2)(ii), Environmental Consideration. No environmental impact assessment has been prepared.

Regulatory Flexibility Act

The Acting Administrator of the Federal Insurance and Mitigation Administration certifies that this Final Rule does not have a significant economic impact on a substantial number of small entities in accordance with the Regulatory Flexibility Act, 5 U.S.C. et seq., because it is not expected (1) to have significant secondary or incidental effects on a substantial number of small entities, nor (2) to create any additional burden on small entities. A regulatory flexibility analysis has not been prepared.

Executive Order 12612, Federalism

This Final Rule involves no policies that have federalism implications under Executive Order 12612, Federalism, dated October 26, 1987.

Executive Order 12778, Civil Justice Reform

This Final Rule meets the applicable standards of Section 2(b)(2) of Executive Order 12778, Civil Justice Reform.

Executive Order 12866, Regulatory Planning and Review

Promulgation of this Final Rule is required by statute, 42 U.S.C. 4014(f), which also specifies the regulatory approach taken in this Final Rule. To the extent possible under the statutory requirements of 42 U.S.C. 4014(f), this Final Rule adheres to the principles of regulation as set forth in Executive Order 12866, Regulatory Planning and Review.

List of Subjects in 44 CFR Parts 59 and 64

Administrative practice and procedure, Flood insurance, Floodplains, and Reporting and record-keeping requirements.

Accordingly, amend 44 CFR Parts 59 and 64 as follows:

PART 59—GENERAL PROVISIONS

1. The authority citation for Part 59 continues to read as follow:

Authority: 42 U.S.C. 4001 *et seq.*; Reorganization Plan No. 3 of 1978, 43 FR 41943, 3 CFR 1978 Comp., p. 329; E.O. 12127 of Mar. 31, 1979, 44 FR 19367; 3 CFR 1979 Comp., p. 376.

2. Section 59.1 is amended by adding three definitions to read as follows:

§ 59.1 Definitions.

* * * * *

Area of future-conditions flood hazard means the land area that would be inundated by the 1-percent-annual-chance (100-year) flood based on future-conditions hydrology.

* * * * *

Future-conditions flood hazard area, or future-conditions floodplain—see Area of future-conditions flood hazard.

Future-conditions hydrology means the flood discharges associated with projected land-use conditions based on a community's zoning maps and/or comprehensive land-use plans and without consideration of projected future construction of flood detention structures or projected future hydraulic modifications within a stream or other waterway, such as bridge and culvert construction, fill, and excavation.

* * * * *

PART 64—COMMUNITIES ELIGIBLE FOR THE SALE OF INSURANCE

3. The authority citation for Part 64 continues to read as follow:

Authority: 42 U.S.C. 4001 *et seq.*; Reorganization Plan No. 3 of 1978, 43 FR 41943, 3 CFR 1978 Comp., p. 329; E.O. 12127 of Mar. 31, 1979, 44 FR 19367; 3 CFR 1979 Comp., p. 376.

4. Amend § 64.3 as follows:

a. Revise the introductory text of paragraph (a)(1).

b. In the table in paragraph (a)(1), revise the entry for the zone symbol for Zones B,X.

c. Revise the closing text to paragraph (a)(1).

The revisions read as follows:

§ 64.3 Flood Insurance Maps.

(a) * * *

(1) Flood Insurance Rate Map: This map is prepared after the flood hazard study for the community has been completed and the risk premium rates have been established. The FIRM indicates the risk premium rate zones applicable in the community and when those rates are effective. The FIRM also may indicate, at the request of the community, zones to identify areas of future-conditions flood hazards. The symbols used to designate the risk premium rate zones and future-conditions zones are as follows:

Zone symbol

B, X Areas of moderate flood hazards or areas of future-conditions flood hazard.

* * * * *

Areas identified as subject to more than one hazard (flood, mudslide (i.e., mudflow), flood-related erosion) or potential hazard (i.e., future-conditions flooding) will be designated on the FIRM by use of the proper zone symbols in combination.

* * * * *

Dated: November 20, 2001.

Robert F. Shea,

Acting Administrator, Federal Insurance and Mitigation Administration.

[FR Doc. 01-29474 Filed 11-26-01; 8:45 am]

BILLING CODE 6718-04-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 300

[I.D. 110801F]

Fraser River Sockeye and Pink Salmon Fisheries; 2001 Inseason Orders

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Inseason orders.

SUMMARY: NMFS publishes the Fraser River salmon inseason orders regulating salmon fisheries in U.S. waters. The orders were issued by the Fraser River Panel (Panel) of the Pacific Salmon Commission (Commission) and subsequently approved and issued by NMFS during the 2001 sockeye and pink salmon fisheries within the U.S. Fraser River Panel Area. These orders established fishing times, areas, and types of gear for U.S. treaty Indian and all-citizen fisheries during the period the Commission exercised jurisdiction over these fisheries. Due to the frequency with which inseason orders are issued, publication of individual orders is impracticable. The 2001 orders are, therefore, being published in this document to avoid fragmentation.

DATES: Each of the following inseason actions was effective upon announcement on telephone hotline numbers as specified at 50 CFR 300.97(b)(1); those dates and times are listed herein. Comments will be accepted through December 12, 2001.

ADDRESSES: Mail comments to D. Robert Lohn, Regional Administrator, Northwest Region, NMFS, 7600 Sand Point Way N.E., BIN C15700-Bldg. 1, Seattle, WA 98115-0070. Information relevant to this document is available for public review during business hours at the office of the Regional

Administrator, Northwest Region, NMFS.

FOR FURTHER INFORMATION CONTACT: David Cantillon, 206-526-4140.

SUPPLEMENTARY INFORMATION: The treaty between the Government of the United States of America and the Government of Canada Concerning Pacific Salmon was signed at Ottawa on January 28, 1985, and subsequently was given effect in the United States by the Pacific Salmon Treaty Act (Act) at 16 U.S.C. 3631 *et seq.*

Under authority of the Act, Federal regulations at 50 CFR part 300 subpart F provide a framework for implementation of certain regulations of the Commission and inseason orders of the Commission's Panel for U.S. sockeye and pink salmon fisheries in the Fraser River Panel Area.

The regulations close the Fraser River Panel Area (U.S.) to U.S. sockeye and pink salmon fishing unless opened by Panel regulation or by inseason regulations published by NMFS that give effect to Panel orders. During the fishing season, NMFS may issue regulations that establish fishing times and areas consistent with the Commission agreements and inseason orders of the Panel. Such orders must be consistent with domestic legal obligations. The Regional Administrator, Northwest Region, NMFS, issues the inseason orders. Official notification of these inseason actions of NMFS is provided by two telephone hotline numbers described at 50 CFR 300.97(b)(1). Inseason orders must be published in the **Federal Register** as soon as practicable after they are issued. Due to the frequency with which inseason orders are issued, publication of individual orders is impractical. Therefore, the 2001 orders are being published in this document to avoid fragmentation.

The following inseason orders were adopted by the Panel and issued for U.S. fisheries by NMFS during the 2001 fishing season. The times listed are local times, and the areas designated are Puget Sound Management and Catch Reporting Areas as defined in the Washington State Administrative Code at Chapter 220-22.

Order No. 01-01: Issued 3 p.m., July 24, 2001.

Treaty Indian Fisheries

Areas 4B, 5 and 6C: Open for drift gillnets from 12 p.m. (noon) Wednesday, July 25 until 12 p.m. (noon) Saturday, July 28, 2001.

Order No. 01-02: Issued 3 p.m., July 27, 2001.

Treaty Indian Fisheries

Areas 4B, 5 and 6C: Extended for drift gillnets from 12 p.m. (noon) Saturday, July 28 until 12 p.m. (noon) Tuesday, July 31, 2001.

Order No. 01-03: Issued 3 p.m., July 30, 2001.

Treaty Indian Fisheries

Areas 4B, 5 and 6C: Extended for drift gillnets from 12 p.m. (noon) Tuesday, July 31, 2001, until 6 a.m. Wednesday, August 1, 2001.

Areas 6, 7 and 7A: Open to net fishing from 4 a.m. Tuesday, July 31, 2001, until 6 a.m. Wednesday August 1, 2001.

All-Citizen Fisheries

Areas 7, and 7A Purse Seine: Open from 6 a.m. until 9 p.m. Wednesday, August 1, 2001.

Areas 7 and 7A Gillnet: Open from 8 a.m. until 11:59 p.m. Wednesday, August 1, 2001.

Areas 7 and 7A Reef Net: Open from 5 a.m. until 9 p.m. Thursday, August 2, 2001.

Order No. 01-04: Issued 3 p.m., August 3, 2001.

Treaty Indian Fisheries

Areas 4B, 5 and 6C: Opened for drift gillnets from 6 p.m. Friday, August 3, 2001, until 6 p.m. Saturday, August 4, 2001.

Areas 6, 7 and 7A: Remain closed to fishing.

All-Citizen Fisheries

Areas 7, and 7A Purse Seine: Remain closed to fishing.

Areas 7 and 7A Gillnet: Remain closed to fishing.

Areas 7 and 7A Reef Net: Open from 5 a.m. until 9 p.m. Sunday, August 5, 2001.

Order No. 01-05: Issued 5 p.m., August 17, 2001.

Treaty Indian Fisheries

Areas 4B, 5, 6C, 6, 7 and 7A: Remain closed to fishing.

All-Citizen Fisheries

Areas 7, and 7A Purse Seine: Remain closed to fishing.

Areas 7 and 7A Gillnet: Remain closed to fishing.

Areas 7 and 7A Reef Net: Open from 5 a.m. until 9 p.m. Saturday, August 18, 2001, and from 5 a.m. until 9 p.m. Monday, August 20, 2001.

Order No. 01-06: Issued 1 p.m., August 19, 2001.

Treaty Indian Fisheries

Areas 4B, 5, 6C, 6, 7 and 7A: Remain closed to fishing.

Modernizing FEMA's Flood Hazard Mapping Program: Recommendations for Using Future-Conditions Hydrology for the National Flood Insurance Program (Final Report)

Introduction

The Federal Emergency Management Agency (FEMA) has designed a plan to modernize the Flood Hazard Mapping Program that will reduce the burden on taxpayers for disaster relief and maintain the maps as valuable resources for flood hazard mitigation. One of the most exciting and revolutionary aspects of the Map Modernization Plan is that it will facilitate ownership of the flood maps by State and local entities through greatly increased involvement in the flood mapping process. This will be achieved through cooperative agreements with State or local partners whereby FEMA will provide flood mapping funds, technical assistance, and mentoring to the State or local partner, which will then develop and maintain all or a component of its flood map. The proposed community agreements recognize that hazard identification and mapping must go hand-in-hand with the responsibility of managing floodplains at the local level. By creating a strong local program that maintains the connection between mapping and managing flood hazard areas, the National Flood Insurance Program (NFIP) is likewise strengthened in its ability to reduce the loss of property and life.

Many communities have promoted the use of future land-use conditions in defining hydrology and floodplains that represent stricter land-use regulations than the minimum requirements of the NFIP. The use of future-conditions hydrology is consistent with cooperative agreements, modernizing the Flood Hazard Mapping Program, and FEMA's desire to be flexible and supportive of those communities that would like to implement stricter land-use regulations.

Role of State and Local Partners

FEMA's goals are best accomplished through partnerships with State, regional, and local community agencies under the NFIP and within other hazard mitigation programs and activities. With over 19,000 communities participating in the NFIP, FEMA faces a challenge in trying to monitor floodplain development activities and conduct the necessary flood data updates in a timely manner. Thus, FEMA must rely on local entities, with their unique knowledge of flooding conditions and control over permitting processes, to enhance the process of flood hazard identification. However, State and local involvement in the flood mapping process has been somewhat limited. FEMA has, in many cases, produced the NFIP flood maps with little community input. The responsibility to administer the NFIP regulations based on those same maps, however, is left entirely up to the community. The result is that the flood maps are often viewed as "FEMA maps" that often do not meet community needs. Therefore, many communities have no sense of ownership in the maps, and they are reluctant to assume responsibility for them.

In developing the Map Modernization Plan, FEMA recognized this limitation was recognized and devised a strategy designed to increase community involvement. Specifically, the Map Modernization Plan will proactively pursue strong Federal-State-Local partnerships through a variety of cooperative programs. Many States, communities, and other local entities, at their own expense, have furthered the partnership in recent years by investing considerable resources in identifying and updating flood hazard information. The intent of the Map Modernization Plan is to facilitate and capitalize on these efforts and coordinate them with FEMA's flood mapping efforts rather than on an ad-hoc basis. This will result in strengthened mapping and floodplain management programs and, thus, should reduce flood losses and disaster assistance.

Emphasis on Local Mapping Needs

The identification of local mapping needs beyond what is currently being done will also be an important aspect of the cooperative agreements. By mapping locally pertinent information, local ownership of the maps will be increased. Because flood conditions and hazards vary locally and regionally, inclusion of those unique local conditions on the flood map may be warranted. For example, a community may find it useful to identify areas on the flood hazard maps with high erosion hazards or floodplains based on developed/future hydrologic conditions in addition to the standard features already depicted on the flood map.

In effect, the cooperative agreements will help FEMA maintain national standards while at the same time providing a useful tool to the community. When communities enter into cooperative agreements with FEMA, it will be the beginning of their acceptance of responsibility for maintenance of the maps in the future.

Historical Perspective on Future Conditions

Historically, flood hazard information presented on NFIP maps has been based on the existing conditions of the floodplain and watershed. When the mapping of flood hazards was initiated under the NFIP, the intent of the Program was to reassess each community's flood hazards periodically and, if needed, revise the NFIP maps. Flood hazards may change significantly in areas experiencing urban growth or changes in physical conditions caused by such geologic processes as subsidence and erosion. Budgetary constraints prevent initiating actions to update NFIP maps with sufficient frequency to reflect the changing flood hazards brought about by natural and man-made changes (approximately 45 percent of the NFIP maps are at least 10 years old, and 70 percent are 5 years or older).

As discussed in *Flood Insurance Study Guidelines and Specifications for Study Contractors*" (FEMA 37, January 1995), flood hazard determinations should be based on conditions that are planned to exist in the community within 12 months following completion of the draft Flood Insurance Study (FIS) report. Examples of future conditions to be considered in the context of FEMA 37 are public works projects in progress, including channel modifications, hydraulic control structures, storm-drainage systems, and other flood protection projects. These are changes that will be completed in the near future for which completion can be predicted with a reasonable degree of certainty and their completion can be confirmed prior to the NFIP map

becoming effective. By contrast, future land-use development, such as urban growth, is uncertain and difficult to predict, and is not to be considered in the context of the FEMA 37 guidelines.

Communities experiencing urban growth and other changes have expressed a desire to use future-conditions hydrology in regulating watershed development. While some communities do regulate based on future development, others are hesitant to enforce more restrictive standards without Federal support. In order to assist officials in such progressive communities, FEMA could place future-conditions flood risk data on the NFIP maps for informational purposes.

FEMA completed a study in 1989 (FEMA, 1989) to examine the use of future floodplain conditions on flood hazard maps. For this study, the advantages and disadvantages of several options were explored. The recommended option was for FEMA to incorporate future-conditions data prepared by the communities into NFIP maps for regulatory and insurance purposes with reduced insurance rates within the future-conditions floodplain. The choice of using future-conditions floodplains was up to the community that would be expected to use the future-conditions data for floodplain management and to defend their data in case of legal challenges. This option was never initiated possibly due to administrative and legal problems associated with insurance rates within future-conditions floodplains. The recommendations described later in this report avoid this problem.

Defining Future Conditions

In considering watershed development, the term "future" itself can be defined in several different ways: 10 or 20 years projected into the future, for example, or the maximum development planned for a given watershed. For the purposes of this discussion, we will consider future conditions to be those land-use conditions shown on the current zoning maps or comprehensive land-use plans. Future-conditions hydrology is then defined as the flood discharges that would occur if the land-use conditions shown on the current zoning maps or comprehensive land-use plans were realized. There are two instances where existing conditions are equivalent to future conditions (1) no significant development is planned for an area, and (2) areas currently developed to the extent shown on the current zoning maps or comprehensive land-use plans of local governments within the watershed. Under these conditions, no additional hydrologic analyses are needed.

Watershed development can include hydrologic as well as hydraulic modifications. The changes in the watershed that can influence the hydrology and flood discharges are the increase in impervious area and the improvements in the drainage network that accompany urbanization. For example, as buildings and parking lots are constructed, the amount of impervious land within the watershed increases, which increases the amount or volume of direct runoff. The construction of storm sewers and curb and gutter streets usually cause an increase in the peak rate of direct runoff. These modifications can have dramatic effects on the flood frequency characteristics of a watershed, resulting in significantly increased base flood discharges and elevations. For example, Sauer and others (1983) indicate that if a watershed is fully developed,

the 1-percent-annual-chance (base) flood discharge is about 2.5 times the base flood discharge under rural or undeveloped conditions.

The construction of flood detention structures can also significantly effect the flood frequency characteristics of a watershed. Because the hydrologic effects of flood detention structures are very site specific and difficult to evaluate, future conditions as defined herein do not include the construction of flood detention structures.

Hydraulic modifications are changes that are within a stream or other waterway, such as bridge and culvert construction, fill, and excavation. Similar to flood detention structures, the effects of projected future hydraulic modifications on flood frequency are site specific and difficult to predict and are considered beyond the scope of this discussion. Therefore, the future hydrology conditions discussed herein are based on future land-use conditions of the watershed, and do not include future construction of flood detention structures or hydraulic structures.

Future land-use conditions will be based on current zoning maps or comprehensive land-use plans and it will be the responsibility of the community to determine the level of future development. These zoning maps or comprehensive land-use plans should go through the normal review process and be adopted as part of the ordinances of the community. The community will be responsible for defending the determination of the future land use and future-conditions hydrology.

Once the future land-use conditions are determined, the future-conditions hydrology based on these projections will be determined by the community as part of their stormwater-management programs. There are several hydrologic procedures for making these calculations including the use of gaging station data, regional regression equations and rainfall-runoff models. These hydrologic procedures are briefly discussed in Appendix 1.

For those communities using future-conditions hydrology, a regulatory floodway could be developed and adopted for floodplain management. The use of a future-conditions floodway should be described and backed by local ordinances. The future-conditions floodway would also exceed the minimum NFIP criteria of the floodway based on existing conditions. This is similar to the use of an "administrative floodway" that FEMA currently map choose to map based on the desire of the local community. The use of a future-conditions floodway will not impact insurance ratings since the floodway is specifically a floodplain management tool to be adopted by the community.

Uses of Flood Hazard Maps

The different uses of FEMA's flood hazard maps should be considered if floodplains based on future-conditions hydrology are to be used in the NFIP. Currently, two of the primary uses of the flood hazard maps are floodplain management and flood insurance rating. If future-conditions hydrology is shown on the NFIP maps, we must determine how these and other purposes will be impacted.

Floodplain Management

From a floodplain management standpoint, future-conditions floodplains can be used by communities to enforce a more stringent floodplain management policy than required by FEMA. By displaying future-conditions floodplains on FEMA maps, the community and FEMA are alerting the public that flood hazards may increase in the future due to urban development. Currently, many communities throughout the country develop future-conditions hydrology and create their own maps to regulate floodplain development. This has resulted in two sets of maps being produced for a community: future-conditions maps for local floodplain management and FIRMs for flood insurance determinations. As a result, these progressive communities do not have a sense of ownership for the FIRMs and their resources are directed toward the future-conditions maps. Generally, the communities are in areas that are experiencing rapid urban growth and development, including Tucson, Arizona; Denver, Colorado; Las Vegas, Nevada; Charlotte, North Carolina; Tulsa, Oklahoma; Dallas/Fort Worth, Texas; and the Washington, DC metropolitan area. Details on the use of future-conditions hydrology are provided for three communities in Appendix 2.

From the community perspective, the future-conditions data would be used for mandatory floodplain management regulations. The display of future-conditions data on FEMA maps should provide additional support for the local community in adopting more stringent floodplain management guidelines. The enforcement of more stringent floodplain ordinances is just one of the ways that communities can earn credit through the Community Rating System. Details of the Community Rating System are given in Appendix 3.

From FEMA's perspective, the future-conditions data would be shown for informational purposes only; FEMA's floodplain management compliance requirements would still be based on existing-conditions data as described in 44CFR 60.3. In addition, 44CFR 65.6(a)(3) of the NFIP regulations states, "Revisions cannot be made based on the effects of proposed projects or future conditions." However, 44CFR 60.1 provides encouragement to communities to adopt more stringent floodplain ordinances through the statement "Therefore, any flood plain management regulations adopted by a State or a community which are more restrictive than the criteria set forth in this part are encouraged and shall take precedence." The decision to show future conditions on the FIRM would be based on the request of the community and not by FEMA.

Flood Insurance Rating

The current procedure for flood insurance rating is that structures shown within the existing-conditions 1-percent-annual-chance (100-year) floodplain are subject to a mandatory purchase requirement. Due to statutory constraints at this time, FEMA can not use future-conditions data for flood insurance purposes. Therefore, there will be no change in the use of existing-conditions data for establishing flood insurance rates. Through community participation in the CRS, reduced flood insurance rates are available for those communities that enforce more stringent regulatory standards than required by the NFIP.

Other Uses

In addition to the two primary uses discussed above, several other uses of the FEMA flood hazard maps exist, as discussed below.

- Real estate professionals and property owners use the maps to determine the flood risk status of properties.
- Flood map determination firms use the maps to specify the location of properties relative to the SFHA.
- The land development industry use the maps to aid in designing developments that will be safe from flood hazards.
- Surveyors use the maps to prepare elevation certificates for structures.
- Engineers use the maps to consider the flood risk when designing flood mitigation projects, such as structure elevation and relocation, buyouts, and culvert and bridge replacements.
- Disaster and emergency response officials use the maps to prepare for flood-related disasters; to issue warnings to those in danger of flooding; and, after a flood has occurred, to implement emergency response activities and to aid in the rebuild and reconstruction phase.

Federal agencies use the FEMA flood maps to meet the requirements of Executive Order No. 11988 to evaluate the potential effects of any actions they may take in a floodplain. As stated in Executive Order No. 11988, "Each agency shall provide leadership and shall take actions to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities."

Federal agencies typically use the existing-conditions 0.2-percent-annual-chance (500-year) flood to plan activities in the floodplain. The proposal to include future-conditions floodplains on FIRMs is consistent with the intent of Executive Order No. 11988, because the existing-conditions 0.2-percent-annual-chance (500-year) flood profile and/or floodplain boundaries will still be published by FEMA.

Constraints and Benefits of Using Future-Conditions Data

Many constraints and benefits of mapping floodplains based on future-conditions hydrology must be considered in evaluating present mapping policies. Some of the principal constraints and benefits of using future-conditions data are briefly listed below.

Constraints

The following are constraints of using future-conditions data on FEMA flood maps:

- A rational and reasonable link between the public health and safety and the resultant land-use regulations and flood insurance rates may not exist; as a result, property owners may object to land-use regulations and flood insurance rates based on a condition that does not currently exist.
- Greater uncertainty in predicting future land-use conditions and the associated 1-percent-annual-chance (100-year) flood elevation, floodplain, and floodway may make the regulatory data based on future conditions more subject to challenge.
- An increase in appeals of future-conditions 1-percent annual chance (100-year) flood elevations is likely and they will be more difficult to address because of the uncertainty in determining future land-use conditions and the associated hydrology.
- Greater effort and expense will be needed in gathering data, calibrating, and using statistical and watershed models for future conditions.
- Methodologies used to determine future-conditions flood discharges will likely differ between communities, resulting in a less consistent and uniform nationwide program.
- Projections for land-use development may change over time, making the future-conditions floodplain data on NFIP maps inaccurate.
- NFIP regulations may need to be updated to describe the use of future-conditions data.
- More resistance to the NFIP may result because of the perception that the Federal government is seeking more restrictions on land-use regulations and infringing on land development.

Benefits

The following are benefits of using future-conditions data on FEMA flood maps:

- Future damage to structures and loss of life may be reduced because flood hazard areas would be increased and less development would likely occur in the floodplain.
- Communities would be supported by FEMA in their use of stricter floodplain management regulations.
- More informed decisions could be made on where to locate structures near the floodplain; for example, placing structures in an area that may eventually be in the 1-percent-annual-chance (100-year) floodplain may be discouraged.
- Subsidies for structures constructed on risk conditions that are out of date may be reduced.
- Fewer revisions to NFIP maps would be needed, thereby reducing FEMA costs in the long term.
- The Community Rating System could be used to reduce flood insurance rates in communities that use future-conditions data.
- Greater opportunities exist for increasing the partnership between FEMA and communities through the FEMA Cooperating Technical Partners (formerly Cooperating Technical Communities) initiative, given that future land-use conditions will be determined by the communities.

Conclusions

An evaluation of the constraints and benefits for mapping floodplains based on future-conditions hydrology suggests the best approach is to display the future-conditions floodplains on the NFIP maps for informational purposes. The future-conditions land use and hydrology should be determined by the local community. This option uses the benefits of displaying future-conditions data while minimizing many of the constraints. If a community chooses to adopt a regulatory floodway based on future-conditions hydrology, the use of this floodway must be supported by local ordinances.

Specifically, the future-conditions 1-percent-annual-chance (100-year) floodplain can be shown on the FIRM in lieu of the existing-conditions 0.2-percent-annual-chance (500-year) floodplain and labeled as Zone X (Future Base Flood) if the community desires, with no Base Flood Elevations (BFEs) shown. BFEs would only be shown for the existing-conditions 1-percent-annual-chance (100-year) floodplain, or the Special Flood Hazard Area (i.e., the area inundated by the base flood and labeled Zone AE on the flood map). The future-conditions 1-percent-annual-chance (100-year) flood elevations would be included in the FIS report on the Flood

Profiles and in the Floodway Data Table, thus providing necessary information to the community to meet their local floodplain management needs. The existing-conditions 0.2-percent-annual-chance (500-year) profile would also be shown in the FIS report to meet the requirements of Executive Order No. 11988 and provide Federal agencies information to evaluate the potential effects of any actions they may take in a floodplain. Conversely, the community may choose to show the existing-conditions 0.2-percent-annual-chance (500-year) floodplain on the map and include the future-conditions 1-percent-annual-chance (100-year) flood profile in the FIS report. Various other combinations to display the flood hazard data are also possible. The main point is that FEMA and the community work together to produce the most useful maps for the community.

An example FIS report with Flood Profile and associated FIRM is included in Appendix 4. In this example, the future-conditions 1-percent-annual-chance (100-year) floodplain is shown on the FIRM and the future-conditions 1-percent-annual-chance (100-year) flood profile and existing-conditions 0.2-percent-annual-chance (500-year) flood profile are included in the FIS report. In general, it will not be feasible to show both the future-conditions 1-percent-annual-chance (100-year) floodplain and the existing-conditions 0.2-percent-annual-chance (500-year) floodplain on the FIRM because these boundaries are usually very close and could not be adequately distinguished on the same map.

From a floodplain management standpoint, FEMA will continue to require regulation of floodplain development based on the existing-conditions data, while local floodplain managers can regulate development based on the future-conditions data. From a flood insurance standpoint, FEMA will continue to require flood insurance for structures shown in the existing-conditions floodplain. By labeling the future-conditions floodplain as "Zone X (Future Base Flood)," FEMA should avoid any confusion regarding the mandatory flood insurance requirement, and will allow insurance policies to be purchased at the reduced rate currently available for structures in the existing-conditions 0.2-percent-annual-chance (500-year) floodplain.

The FEMA Map Modernization Plan includes state-of-the-art engineering, mapping, information management, and communication technologies. Given the substantial benefits of using future-conditions data, FEMA should begin to display floodplains based on future-conditions hydrology on its flood maps. The user-community developed data, such as future-conditions data, will further enhance stronger FEMA, State, and local partnerships. Clearly, mapping floodplains based on future-conditions hydrology is an important option for participating CTPs, and it can easily be implemented as the inventory of FIRMs are converted to digital format as new DFIRM products. Mapping floodplains based on future-conditions hydrology is an important step to take for FEMA to successfully modernize its mapping program.

Implementation

Map Specifications

As part of the FEMA Map Modernization Plan, a new digital FIRM product is being developed. The new digital FIRM product will include options that can be exercised depending on the available data. This new digital FIRM product will include certain basic features and meet certain minimum mapping requirements. Additional options will be included depending on the community needs and available funding. A review of needs and available data will lead to a time and cost estimate and a recommendation on which options to exercise. Procedures for displaying future-conditions floodplains on this digital product should be included in these new mapping specifications, such as the appropriate layer/level to store the data, line code and weight and other specifications described in FEMA 37.

Cooperating Technical Partners

CTP agreements provide an opportunity for communities to get involved with the development, review, and update of the flood hazard information shown on NFIP maps. These agreements will allow for varied levels of community involvement, depending on the level of responsibility the community is capable of and wishes to undertake. Several options that FEMA plans to present to communities include: digital base map sharing; digital FIRM preparation and maintenance; hydrologic and hydraulic data development, mapping and review; and risk assessment. As a part of these agreements, an option could be for communities to show the future-conditions 1-percent-annual-chance (100-year) floodplain on the NFIP flood map in addition to the existing-conditions 1-percent-annual-chance (100-year) floodplain. The communities would develop and map the data, provide it to FEMA; in turn, they would receive a useful tool for risk assessment and flood hazard mitigation. FEMA supports the use of future-conditions floodplains for floodplain management within the community.

Revisions

Because mapping future-conditions floodplains would be implemented on a community level, the maps will maintain consistency within community boundaries, regardless of how many map panels the community encompasses. When FEMA receives future-conditions data from communities, the data could be easily incorporated at the time of the digital conversion to the new digital FIRM product. Alternatively, communities that require flood hazard updates can submit future-conditions data to be incorporated with the existing-conditions data updates for the digital FIRM conversion. Displaying future-conditions data will increase community involvement in the NFIP and help FEMA build stronger partnerships with communities. If these communities are involved at the beginning of the digital conversion process, they will have a stronger sense of ownership of the maps, since they will have input to what kind of data are shown on their maps.

Once the future-conditions floodplains have been included on a community's flood hazard maps, all flood insurance studies, restudies, and revisions will incorporate the future-conditions hydrology that the community has determined. FEMA will minimally review these locally developed data and will include the data in all map updates. FEMA will continue to issue Letters of Map Amendment and Letters of Map Revisions Based on Fill for structures and parcels of land to determine whether they are in or out of the existing-conditions floodplain. This procedure can be expanded to determine if they are in or out of the future-conditions floodplain when that data are shown on the NFIP maps.

Rule Making

Before future-conditions data and floodplains may be displayed on FIRMs and in FIS reports, FEMA must modify pertinent sections of the NFIP regulations to incorporate several new definitions. To begin with, Section 59.1, entitled, "Definitions" must be modified to include "future-conditions hydrology," which would be defined as

...the flood discharges associated with projected land-use conditions based on a community's zoning maps and/or comprehensive land-use plans and without consideration of projected future construction of flood detention structures or projected future hydraulic modifications within a stream or other waterway, such as bridge and culvert construction, fill, and excavation.

In Section 59.1, "future-conditions flood hazard area," or "future-conditions floodplain," would be defined as "the land area that would be inundated by the 1-percent-annual-chance (100-year) flood based on future-conditions hydrology."

Finally, Paragraph 64.3(a)(1) of the NFIP regulations, entitled "Flood Insurance Maps," includes a list of flood insurance zone designations shown on FIRMs. FEMA must modify the list to expand the definition of Zone X to include "areas of future-conditions flood hazard."

All of these changes to the regulations are necessary in the implementation of displaying the future-conditions floodplains on the FIRMs.

Outreach

An initial draft of this report was sent for review to approximately to FEMA Headquarters and Regional Office staff, the Technical Mapping Advisory Council, and the Association of State Floodplain Managers. We incorporated the comments received from these reviewers in a revised version of the draft report, which was posted on the FEMA Flood Hazard Mapping website and referenced in the Proposed Rule published in the *Federal Register* on June 14, 2001, at 66 FR 32293. On that date, FEMA invited interested parties to submit written comments to the Rules Docket Clerk, Office of General Counsel, on or before August 13, 2001. All comments submitted during that comment period were considered in preparing this final version.

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Appendix 1

Procedures for Determining Future-Conditions Hydrology

Although it is our recommendation to use future-conditions data developed by communities, FEMA should provide guidelines and specifications for the development of future-conditions hydrology to be used by communities and/or study contractors that are not currently using such data. General guidelines are described below; in addition, appropriate appendices will be developed for FEMA 37 to document these procedures.

To begin with, engineers should work with planners and local officials and use local zoning maps and comprehensive land-use plans to estimate the amount and types of future development within a given watershed. The most significant factors that will affect hydrologic calculations is the amount of impervious area and the improvements in the drainage network that are expected to eventually exist within the watershed. These two factors generally increase flood discharges. After carefully determining the projected development factors, engineers should generally follow the guidelines currently provided in FEMA 37.

FEMA 37 outlines procedures for determining flood discharges for gaged and ungaged watersheds. For ungaged watersheds, both regional regression equations and rainfall-runoff models are considered reasonable methods.

Ungaged Streams

Regional Regression Equations

For ungaged streams, study contractors and revision requestors can use published regional regression equations, such as those developed by USGS, to determine base flood discharges where the equations are applicable. Regression equations have been developed by USGS for urban areas in about a dozen states. The most frequently-used measure of urbanization in these regression equations is the percentage of impervious area in the watershed. The current USGS regional regression equations, for rural and urban areas, are given in the USGS National Flood Frequency (NFF) Program (Jennings and others, 1994).

For those areas of the country that do not have locally-developed urban regression equations, engineers may use methods described in Sauer and others (1983) to adjust for the effects of urbanization. These urban regression equations, which are applicable nationwide, are included in the NFF program and are based on seven watershed parameters. These parameters are contributing drainage area, channel slope, 2-year 2-hour rainfall, basin storage, basin development factor, percentage impervious area, and peak discharge for an equivalent rural drainage area in the same hydrologic area. The urbanization factors are the basin development factor, a measure of improvements in the drainage system, and impervious area measured as the percentage of the watershed that is impervious to infiltration. The equivalent rural peak discharge is estimated from the applicable rural regression equations described by Jennings and others (1994). The percentage of impervious area and the basin development factor for future conditions can be estimated and input to equations developed by Sauer and others (1983) to obtain flood discharges for future land-use conditions.

Rainfall-Runoff Models

Several different rainfall-runoff modeling techniques can also be used to determine future-conditions hydrology. For example, HEC-1 and TR-20 are two frequently-used computer programs that are used to develop flood frequency estimates for the NFIP. These models consist of many hydrologic and hydraulic components, most importantly, the percentage of impervious area and the loss rate. The percentage impervious area in a watershed is the amount of land that is covered by rooftops, parking lots, and sidewalks, for example, where rainfall loss is the amount of rainfall that does not produce runoff. In urban watersheds, for instance, losses occur as a result of several processes, including interception, depression storage, and infiltration. Interception is the part of the rainfall that is blocked by such things as trees, vegetation, and buildings. Depression storage occurs as rainfall is trapped in small puddles by surface depressions; it eventually evaporates into the atmosphere. Infiltration occurs as water passes through the ground surface and fills the pores of the underlying soils. Impervious areas and runoff losses are important factors in hydrologic calculations.

The HEC-1 hydrologic computer model simulates a rainfall event for a given watershed and determines the amount of rainfall runoff produced. To calculate losses, the model has four methods to choose from: uniform loss rate, the Holtan formula, the Green and Ampt model, and the Soil Conservation Service (SCS) curve number technique. The TR-20 computer model uses the SCS curve number technique to calculate runoff. This technique is an empirical method that separates total losses from rainfall, based on soil types, hydrologic conditions, and land-use practices, such as commercial, industrial, and residential areas. HEC-1 and TR-20 are both single event models that compute direct runoff hydrographs resulting from any synthetic or actual rainstorm. Runoff hydrographs are routed through stream channels, reservoirs, and combined at sub-watershed confluences to determine the discharge for a watershed. By varying the input data based on projected development, engineers can use any of these rainfall-runoff models to determine future-conditions discharges.

McCuen (1989) describes a procedure for adjusting peak discharges for given future conditions based on changes in runoff curve number, percentage of impervious area and percentage of hydraulic channel length modified. This procedure is part of the chart method described in the 1975 version of Technical Release 55 (TR-55) of the Natural Resources Conservation Service (formerly the Soil Conservation Service).

Gaged Streams

Bulletin 17B, Guidelines for Determining Flood Flow Frequency (IACWD, 1982) can be used to determine flood discharges for existing conditions (both rural and urban conditions). For watersheds subject to urbanization, one must determine that the annual peak discharges were collected during reasonably constant land-use conditions before applying Bulletin 17B techniques. McCuen (1993) describes several statistical tests for determining whether flood data are homogeneous and suitable for frequency analysis. Various approaches for adjusting flood discharges for gaged streams are discussed below.

Rural flood discharges estimated using Bulletin 17B can be adjusted to future conditions by using the regression equations developed by Sauer and others (1983) that were described earlier. If the annual peak discharges were collected prior to any urbanization, then the flood discharges estimated from Bulletin 17B can be input to the equations developed by Sauer and others (1983) as the equivalent rural discharge.

McCuen (1989) describes a procedure for adjusting a flood record where the data were collected during changing land-use conditions. This procedure consists of first adjusting each annual peak discharge to rural conditions and then adjusting each discharge to current urban conditions based on the percentage of the watershed urbanized. This procedure could be used to adjust each annual peak discharge to some future urbanization condition. Bulletin 17B procedures could then be applied to the peak discharges that were adjusted to future conditions to get the flood frequency estimates.

Use of Confidence and Prediction Limits

There is uncertainty associated with flood discharges for a given frequency from any hydrologic procedure and confidence and prediction limits are used to quantify this uncertainty. Different approaches are used in defining these limits depending on whether the frequency estimates are made using gaging station data, rainfall-runoff models or regional regression equations. Confidence limits are used with gaging station data and rainfall-runoff models and prediction limits are used in regression analysis. Confidence and prediction limits define an interval that will enclose the true flood discharge a given percent of the time. For example, there is a 50 percent chance that the true flood discharge will lie between the upper and lower 50-percent confidence or prediction limits.

Because some communities prefer to use future-conditions hydrology to regulate development in the floodplain, confidence and prediction limits can be used to determine if there are significant differences between existing- and future-conditions flood discharges. If there are no significant differences, then use of future-conditions hydrology can be justified within the existing regulatory constraints of the NFIP. Guidelines on determining what constitutes a significant difference need to be defined.

Procedures for defining confidence limits for flood discharges from analyses of gaging station data are given in Appendix 9 of Bulletin 17B. Confidence coefficients defining the confidence limits for flood discharges are approximated by the non-central t distribution based on the exceedance probability, confidence level, weighted skew coefficient, systematic record length and the standard normal deviate. The confidence coefficients define the number of standard deviations that the upper and lower confidence limits are above the mean of the logarithms of the annual peak discharges.

Procedures for defining confidence limits for rainfall-runoff models, such as HEC-1 and TR-20, are given in the U.S. Army Corps of Engineers EM 1110-2-1619 dated August 1, 1996. For these models, Bulletin 17B procedures are used for defining confidence limits with the systematic record length estimated on the basis of engineering judgement. For example, rainfall-runoff models calibrated to several events recorded at gaging stations in the watershed are assumed to have an equivalent record length of 20 to 30 years. Given the equivalent record length, the procedures described above for gaging station data can be applied to flood discharges estimated from rainfall-runoff models.

Procedures for defining both confidence and prediction limits for regression equations are described in several textbooks, such as Montgomery and Peck (1982). Confidence limits as defined in regression analysis pertain to an interval about the mean response from the regression equation for an observation used to calibrate the equation. Prediction limits pertain to an interval about a prediction for a future observation. Therefore, prediction limits are more appropriate for measuring the uncertainty when estimating flood discharges for an ungaged site.

Appendix 2

Selected Communities Using Future-Conditions Hydrology

Three communities in particular that are regulating floodplain development based on future-conditions hydrology are Fairfax County, Virginia; Plano, Texas; and the Denver Urban Drainage and Flood Control District, Colorado. These communities have proven to be proactive in managing their floodplains and are regulating to several other higher standards than the NFIP requires, in addition to future-conditions hydrology. They are all participants in the CRS and are receiving credit for their activities by reduced flood insurance premiums. A detailed discussion of the actions of these communities follows.

Fairfax County, Virginia

Fairfax County is an example of a metropolitan area that has experienced significant urban development due to its proximity to Washington, D.C. The population of Fairfax County has grown tremendously over the years: 41,000 in 1940; 360,000 in 1966, and is estimated at approximately 800,000 today. In the late 1960s, the foreseen urban growth of the county led officials to be concerned with carefully planning future development to ensure optimum land use. The County also recognized the significance of flooding risks in developing land-use plans. They were specifically concerned with the increased flooding risks associated with rapid land development. In an effort to establish guidelines to develop optimum land-use plans, Fairfax County, in cooperation with the City of Alexandria, Virginia, supported a study by the U.S. Geological Survey (USGS) entitled, "Effects of Urban Development on Floods in Northern Virginia", USGS Water-Supply Paper 2001. This study provided an engineering methodology for estimating the increase in flood probabilities as watersheds change from natural conditions to fully developed areas. This tool gave the community a reasonable technological basis for controlling land development in the floodplain.

USGS Water-Supply Paper 2001, written by Daniel G. Anderson, explains the methodologies used to develop 1-percent-annual-chance (100-year) flood discharges for future watershed conditions. The "Anderson Method," as it has been coined, explains that there are five independent variables required to perform the calculations: the size, length, and slope of the watershed, which can be measured from maps; and the percentage of impervious area and type of drainage system, which is estimated for future conditions. This method provides the procedure that can be used to calculate 1-percent-annual-chance (100-year) flood discharges based on future watershed conditions. In fact, the USGS used this methodology in Fairfax County's initial Flood Insurance Studies to produce flood maps in the 1970s.

Since the late 1970s, when floodplain management ordinances were adopted, Fairfax County has been regulating development based on future-conditions hydrology. The maps that were produced by the Anderson Method take future watershed development into account; today, developers are given their choice of methodologies to calculate 1-percent-annual-chance (100-year) flood discharges and delineate the associated floodplains. The Anderson Method, the SCS method, and the Rational formula (for small watersheds) are the different methods that the County allows. The "future" development is based on the County's Comprehensive Plan

Density, the master land-use plan for the County that was developed in accordance with Virginia law.

For floodplain management purposes, Fairfax County uses the maps that were produced by the USGS and others, rather than the NFIP maps; they only consult the FIRM for insurance rating purposes. Additionally, the County maps provide a much better level of detail than the FIRMs do—with 2-foot contour interval and 1" = 100' horizontal scale, floodplain management is much more efficient.

In addition to future-conditions hydrology, many of Fairfax County's other floodplain management regulations exceed the minimum standards set forth by the National Flood Insurance Program. For example, a minimum vertical elevation of 18" above the BFE, and a 15' horizontal setback from the floodplain is required for new construction. In addition, the County is a Level C community (no defined floodway or V Zone) in their floodplain management ordinances; however, they have a more restrictive 0.1' allowable rise in BFE for fill placed anywhere in the floodplain, rather than the 1.0' allowable rise criteria for a floodway delineation (Level D). Finally, FEMA guidelines currently direct that floodplains be developed for watersheds that are one square mile (640 acres) in area or larger; Fairfax County, on the other hand, regulates watershed development and establishes floodplains for watersheds 70 acres in area or larger. All of these factors illustrate the County's commitment to sound floodplain management and land-use practices.

An example of increased flooding hazards as a result of watershed development is Four Mile Run in the adjoining Arlington County. Contributing drainage areas that discharge into Four Mile Run fall within the corporate limits of Fairfax and Arlington Counties, as well as the Cities of Falls Church and Alexandria, Virginia. Recognizing the increasing flooding risks associated with the rapid development of the metropolitan area, the Army Corps of Engineers designed a flood control project, consisting mainly of concrete channels. The project was federally funded, in exchange for a regional flood control plan that prohibited any new construction within the contributing watersheds that would increase the base flood elevations at all.

Fairfax County, within the Washington, DC metropolitan area, is a community that has developed rapidly and continues to do so. The County has proven to be proactive in floodplain management, recognizing that urbanization greatly influences flooding conditions. By regulating to higher standards than the NFIP requires, including future-conditions hydrology, they have proven to establish a successful floodplain management program with the goal of protecting its citizens from the disaster of flooding. By participating in the CRS, they are additionally benefiting the citizens by qualifying for reduced flood insurance rates to reflect their floodplain management activities.

City of Plano, Texas

The City of Plano is a rapidly developing suburb of Dallas, Texas: in 1990, the population was 100,000 and it is approximately 210,000 today. The City began regulating floodplain development based on higher standards than the NFIP requires in the late 1970s. During the 1980s, Flood Insurance Studies were performed for many of the City's large streams. Following that, the consultant that performed those studies provided calculations for future-conditions hydrology based on master land-use plans to the City, and those discharges were used to regulate floodplain development by the City. Today, developers are required to use the future-conditions discharges in the analysis of their projects, and must provide the associated floodplain to the City.

Using the maps that developers provide, the City regulates floodplain development based on future-conditions hydrology. Remarkably, they do not allow any new construction in the floodplain at all. For new construction, the City requires a minimum of 2 feet of freeboard between the future-conditions flood elevation and the first floor of a structure, located outside the floodplain. For new subdivisions, for example, the City requires all of the lots that are in or partially in the floodplain to be dedicated to the City as part of an open-space agreement, or it can be dedicated to the Homeowners' Association. There is no private ownership of the floodplains in the City of Plano.

The City of Plano is a Level C community in floodplain management ordinances. However, the City regulates floodplain development with a no-rise requirement: any new development in the floodplain must not cause any rise in flood elevation. An exception to this requirement is containment on the property of the developer. The new construction can cause a rise in flood elevation, but only if it is mitigated within the developers' property boundaries.

Interestingly, the City places a restriction on channel construction as well. For the major streams, including White Rock Creek, Rowlett Creek, and Spring Creek, any project must preserve flood storage at any given cross section. Therefore, the cross sectional area can not be decreased at all for any project. For the smaller tributaries within the City, a 15% reduction in storage is allowed. Additionally, channels can not be constructed with complete concrete lining; however, concrete bottom lining with earthen sides is permitted.

The City of Plano is another example of a community that is regulating floodplain development to higher standards than the NFIP requires. Future-conditions hydrology, no-rise in flood elevations for new construction, additional freeboard requirements, and restrictions on channel designs are several examples of activities that the City has undertaken to protect its citizens from flood losses, while benefiting them financially through the CRS.

Urban Drainage and Flood Control District, Denver, Colorado

The Denver, Colorado metropolitan area is another example of a region that has experienced significant urban growth throughout the past several decades. Since 1969, the population has grown by about 800,000 people, and the total population today is estimated to be 2.2 million.

The Urban Drainage and Flood Control District (UDFCD) was established by the Colorado State Legislature in 1969, for the purpose of assisting local governments in the Denver, Colorado metropolitan area in assessing their drainage and flood control problems. UDFCD has jurisdiction over a 1,600 square mile area, which includes the City of Denver, as well as parts of 5 surrounding counties and all or parts of 33 incorporated cities and towns.

UDFCD has been developing flood hazard information based on future-conditions hydrology since the early 1970s, as a response to the rapid growth of the area. Future conditions of the watersheds are determined by the master land-use plans for the areas. In its Master Planning Program, UDFCD develops hydrology for both existing and future conditions, but maps only the future-conditions 1-percent-annual-chance (100-year) floodplain. In its Flood Hazard Area Delineation Program, UDFCD develops and maps future-conditions hydrology only. The maps produced by the UDFCD have considerable detail: 1" = 100' horizontal scale, with two-foot contour intervals, allowing communities to manage their floodplains effectively.

For recent and future studies, UDFCD requires that the Colorado Unit Hydrograph Procedure (CHUP) be used in determining the existing-conditions 1-percent-annual-chance (100-year) flood discharges and the future-conditions 1-percent-annual-chance (100-year) flood discharges for individual subbasin analyses. The CUHP is a hydrologic method that was developed based on data collected in Colorado. For subbasin combination and flow routing, the SWMM model is used.

UDFCD has the authority to regulate floodplain development through its Floodplain Management Program; however it has chosen not to do so. Instead, it encourages communities in its jurisdiction to adopt their own floodplain management ordinances, with assistance provided by UDFCD. UDFCD provides model ordinances to the communities and encourages floodplain management to higher standards than the NFIP requires, including future-conditions hydrology.

Most communities served by UDFCD have adopted floodplain management ordinances based on future-conditions hydrology. Furthermore, UDFCD encourages new construction to be elevated 12 to 18 inches above the future-conditions base flood elevation. Some communities have additionally implemented stricter floodway standards, for example, a 0.5-foot allowable increase in water surface elevation.

UDFCD has allowed each community to successfully use future-conditions hydrology for floodplain management purposes. By providing technical assistance to local governments, UDFCD has proven to be a great benefit to this urbanizing area.

Appendix 3

Description of the Community Rating System.

The NFIP provides federally backed flood insurance to property owners in communities that participate in the Program. Upon entering the Program, communities are required to adopt and enforce floodplain management ordinances with minimum standards for construction in flood hazard areas. The standards were established to provide guidance to community officials to ensure that any new construction will not cause flooding hazards to increase. Throughout the history of the NFIP, we have found that most communities follow these minimum standards to regulate floodplain development; however, many place higher restrictions on development in the floodplain, and exceed the minimum requirements set forth by the NFIP.

The Community Rating System (CRS) was established to recognize these communities that are regulating to stricter standards than the NFIP requires. In addition, the CRS provides an incentive for communities to do more than fulfill the minimum requirements because it reducing flood insurance premium rates based upon ratings for different activities. It is a voluntary program and was established to support communities by accounting for activities that: (1) reduce flood damage to existing structures, (2) manage areas of flood hazard that are not mapped in the NFIP, (3) protect new buildings to standards that exceed minimum NFIP requirements, (4) help insurance agents obtain flood data, and (5) help people obtain flood insurance.

By reducing the communities' insurance premium rates, the CRS rewards communities that are doing more than meeting the minimum NFIP requirements to help their citizens prevent or reduce losses from floods. Additionally, the CRS provides financial incentives for communities to initiate new flood protection activities. The goals of the CRS are to prevent or reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood hazards.

The CRS Schedule is broken down into four categories of floodplain management activities for which communities can receive credit. These categories include: (1) Public Information, (2) Mapping and Regulations, (3) Flood Damage Reduction, and (4) Flood Preparedness.

Under Category 2, Mapping and Regulations, activities are credited that provide increased flood hazard protection against new development. Such activities include providing additional flood hazard data than what is shown on FIRMs, preserving open space, enforcing higher regulatory standards, and managing stormwater. These activities all work toward the CRS goals of reducing flood damages and facilitating accurate flood insurance rating.

In providing additional flood data, there are many activities for which a community can receive credit. These include: providing a floodplain for streams that are unstudied by FEMA, providing base flood elevations for areas that are shown on the FIRM as unnumbered A or V zones, or mapping floodplains based on techniques that exceed FEMA's guidelines, such as by future-conditions hydrology, among others.

Appendix 4

Example Flood Insurance Study Report and Map Materials

The following example materials are included in this Appendix:

- FIS Report Narrative – Only those sections of narrative and tables that change due to inclusion of future-conditions 1-percent-annual chance (100-year) flood information is shown. The parts of sections of narrative that change as a result of including future-conditions information are shown in bold and underlined.
- Table 2 – Summary of Discharges
- Table 7 – Floodway Data
- Flood Profiles
- Flood Insurance Rate Map

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 1-percent-annual-chance (100-year) flood in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analysis reported herein reflects flooding potentials for the flood events stated above based on conditions existing in the community at the time of completion of this study. **In addition, the future-conditions 1-percent-annual-chance (100-year) flood is reflected in this study. The future-conditions floodplain is based on land use described in community zoning ordinances and delineated on community zoning maps.** Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analysis

Hydrologic analysis for existing conditions were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the county. **In addition, hydrologic analysis was carried out for the future-conditions 1-percent-annual-chance (100-year) flood.**

The hydrologic model for the Perkeonin Creek and its tributaries in Sample County was developed using the NRCS Technical Release 20 (TR-20) (Reference 2). An existing condition TR-20 model was first developed using the current landuse/land cover conditions in the watershed. The existing-condition database was obtained by digitizing data supplied by local planning agencies into a Geographic Information System (GIS). In addition, a future condition database for land use was developed for the watershed based on community zoning maps supplied by the local planning agencies. Aerial photography and field investigations were also used to verify the database.

The TR-20 existing-condition model was calibrated by reproducing flood hydrographs for four historical events at the stream gage. Peak rate of discharge, runoff volume, and hydrograph shape were the parameters used for calibration and verification. In addition, TR-20 simulated flows compared

within 10% to discharge from the frequency analysis based on procedures in the Interagency Advisory Committee for Water Data Bulletin 17B (Reference 3).

After calibration, The TR-20 existing-condition model was run for the 2-, 10-, 50-, 100-, and 500-year events using 24 hour rainfall values from the National Weather Bureau Technical Paper No. 40 (Reference 4). In addition the future-conditions 1-percent-annual-chance (100-year) flood event was run through TR-20. The future watershed condition was based on land-use conditions in the watershed reflected in the community zoning maps. Land cover was determined from field investigations. The resulting flood discharges were then used in USACE HEC-RAS (Reference 30) to generate water-surface profiles.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods are shown in Table 2, "Summary of Discharges."

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, for each study, FEMA generally provides existing-conditions 1-percent-annual-chance (100-year) flood elevations and delineations of the existing-conditions 1-percent-annual-chance (100-year) and 0.2-percent-annual-chance (500-year) floodplain boundaries and regulatory floodway to assist in developing floodplain management measures. **For this study, in response to request by the community, the future-conditions 100-year floodplain boundary was delineated on the FIRM (Exhibit 2) instead of the existing-conditions 0.2-percent-annual-chance (500-year) floodplain boundary. However, in order to comply with Executive Order No. 11988, the existing-conditions 0.2-percent-annual-chance (500-year) flood elevations are available from the Flood Profiles (Exhibit 1).**

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the existing-conditions 1-percent-annual-chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. **For this study, the future-conditions 1-percent-annual-chance (100-year) flood was employed instead of the existing-conditions 0.2-percent-annual-chance (500-year) flood** to indicate additional areas of flood risk in the community. For the streams studied by detailed methods, **the existing- and future-conditions 1-percent-annual-chance (100-year)** floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps, photogrammetric methods and previously printed FISs (References 41, 116, 117 and 130).

For the flooding sources studied by approximate methods, the boundaries of the existing-conditions 1-percent-annual-chance (100-year) floodplain were delineated using the previously printed FISs (References 28 and 29).

The existing- and future-conditions 1-percent-annual-chance (100-year) floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the **existing-conditions 1-percent-annual-chance** (100-year) floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE) and the **future-conditions 1-percent-annual-chance (100-year)** floodplain boundary corresponds to the boundary of areas of **projected special flood hazards (Zone X)**. In cases where the **existing- and future-conditions 1-percent-annual-chance** (100-year) floodplain boundaries are close together, only the **existing-conditions 1-percent-annual-chance** (100-year) floodplain boundary has been shown on the FIRM (Exhibit 2). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the **existing-conditions 1-percent-annual-chance** (100-year) floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the **existing-conditions 1-percent-annual-chance** (100-year) floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance (100-year) flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this study is presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodway presented in this study was computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 7). The computed floodway is shown on the FIRM (Exhibit 2). In cases where the floodway and existing-conditions 1-percent-annual-chance (100-year) floodplain boundaries are either close together or collinear, only the floodway boundary is shown. **In addition to the existing-conditions 1-percent-annual-chance (100-year) flood elevations and floodway, the future-conditions 1-percent-annual-chance (100-year) elevations without the floodway is shown in Table 7.**

5.0 INSURANCE APPLICATIONS

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the existing-conditions 0.2-percent-annual-chance (500-year floodplain), **areas between the existing-conditions and future-conditions 1-percent-annual-chance (100-year) floodplain boundaries**, and to areas of 1-percent-annual-chance (100-year) flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance (100-year) flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance (100-year) flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the **existing-conditions 1-percent-annual-chance (100-year)** floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations **for existing conditions** in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by **cross-hatching** and symbols, the **existing- and future-conditions 1-percent-annual-chance (100-year)** floodplains. Floodways for the **existing-conditions 1-percent-annual-chance (100-year)** flood event and the locations of selected cross sections used in the hydraulic analysis and floodway computations are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Sample County. Previously, separate Flood Hazard Boundary Maps and/or FIRMs were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. This countywide FIRM also includes flood hazard information that was presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community are presented in Table 8, "Community Map History."

TABLE 2. SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
		EXISTING		FUTURE	

PERKIOMEN CREEK

At confluence with The Schuylkill River						
At a point approxi- mately 0.63 mile upstream of con- fluence of Norma Run	362.0	29,350	41,600	47,000	54,000	59,700
At confluence of Tributary A to Perkiomen Creek	293.9	27,550	38,250	42,700	48,200	52,500
At USGS gage No. 01473000 at Graterford	291.2	27,550	38,250	42,700	48,200	52,500
Downstream of confluence of Swamp Creek	279.0	25,500	38,000	41,000	47,200	52,500
Upstream of confluence of Swamp Creek	206.0	17,500	29,000	35,850	44,200	52,500
At a point approxi- mately 350 feet upstream of Kratz Road	150.6	13,000	21,300	26,800	36,000	45,750
Upstream of confluence of Unami Creek	142.8	13,000	21,300	26,000	35,500	45,000
Upstream of confluence of Deep Creek	95.0	7,000	12,150	15,650	22,000	29,100
Upstream of confluence of Macoby Creek	89.0	6,200	10,850	14,100	19,200	24,700
Upstream of Church Road	71.0	5,000	8,800	11,450	15,600	20,100
Upstream of confluence of Hosensack Creek	37.8	4,250	8,000	10,150	13,400	16,800
	17.0	2,220	4,350	5,600	7,500	9,50

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)				
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE	FUTURE CONDITIONS
Perkiomen Creek									
A	430	452	7,956	5.91	96.9	96.9	97.9	1.0	99.7
B	1,000	489	8,648	5.43	97.0	97.0	98.0	1.0	99.8
C	1,615	410	7,372	6.38	97.2	97.2	98.2	1.0	100.0
D	2,635	369	6,185	7.60	97.8	97.8	98.7	0.9	100.6
E	2,960	412	6,864	8.65	97.9	97.9	98.9	1.0	100.7
F	3,925	537	9,740	5.38	98.0	98.0	99.0	1.0	100.8
G	5,380	736	11,375	4.13	99.0	99.0	100.0	1.0	101.9
H	5,800	680	11,105	4.23	99.1	99.1	100.0	0.9	102.0
I	6,825	630	10,033	4.68	99.2	99.2	100.2	1.0	102.1
J	7,805	528	8,810	5.30	99.4	99.4	100.3	0.9	102.3
K	8,850	505	8,760	5.33	99.5	99.5	100.4	0.9	102.4
L	9,495	406	7,936	5.88	100.0	100.0	101.0	1.0	102.9
M	10,315	366	7,281	6.41	100.3	100.3	101.2	0.9	103.3
N	11,255	378	7,350	6.35	100.8	100.8	101.8	1.0	103.8
O	12,255	387	7,227	6.46	101.3	101.3	102.3	1.0	104.3
P	13,130	378	6,409	7.28	101.8	101.8	102.8	1.0	104.7
Q	14,360	330	6,907	8.76	103.4	103.4	104.4	1.0	106.3
R	14,670	314	6,704	8.97	103.7	103.7	104.6	0.9	106.6
S	15,275	349	6,628	6.53	104.2	104.2	105.0	0.8	107.2
T	15,800	398	6,959	6.22	104.5	104.5	105.5	1.0	107.5
U	16,715	484	8,104	5.34	105.2	105.2	106.2	1.0	108.2
V	17,625	530	8,889	4.88	106.0	106.0	107.0	1.0	108.9
W	18,545	470	9,415	4.60	107.8	107.8	108.8	1.0	110.8
X	19,085	437	8,837	4.90	108.0	108.0	109.0	1.0	111.0
Y	20,130	388	8,360	5.18	108.5	108.5	109.5	1.0	111.4
Z	20,685	368	7,212	6.00	108.8	108.8	109.8	1.0	111.5
AA	21,120	317	6,729	6.43	108.9	108.9	109.9	1.0	111.9
AB	21,980	235	4,678	9.28	109.5	109.5	110.3	0.8	112.4

*Feet above confluence with the Schuylkill River

TABLE 7	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	SAMPLE COUNTY, AS (ALL JURISDICTIONS)	PERKIOMEN CREEK

