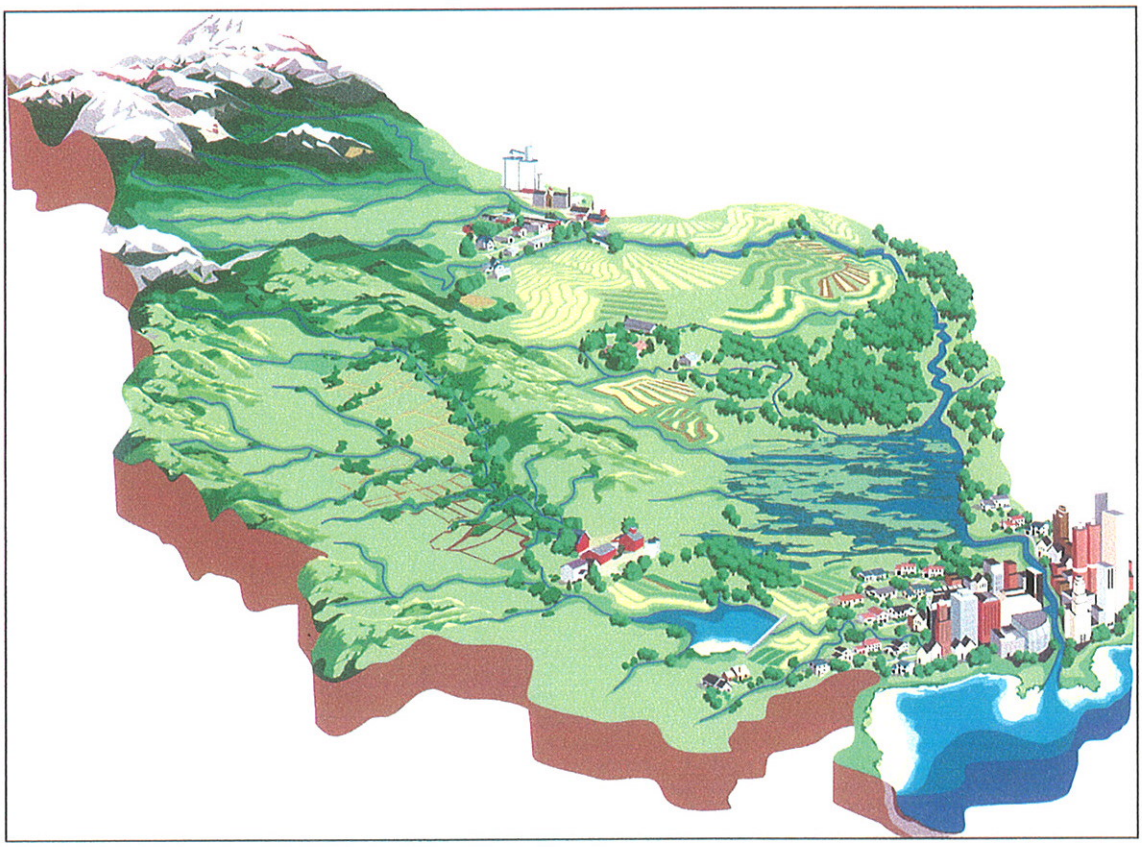
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WATERSHED MANAGEMENT and PROTECTION PLAN for TRIBUTARIES to the TRUCKEE RIVER

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Prepared for
Washoe County Regional Water Planning Commission

Prepared by
Washoe County Department of Water Resources
University Nevada Cooperative Extension
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Chapter 1

Introduction

Purpose of Watershed Management and Protection

This Watershed Management and Protection Plan is a strategy for effectively protecting or restoring stream corridors and drainages within the greater Truckee Meadows. This strategy has as its premise that many water quality and stormwater problems are best solved at the watershed level rather than at the Truckee River or at major tributary confluences. Maintaining or improving water quality and stormwater runoff in the Truckee Meadows is a concern, as water quality impairment detracts from our quality of life, damages our drinking water quality, and may result in costly fines or mitigation measures. This document prescribes a methodology for the community to focus upon in watershed management and protection. Sponsored by the Regional Water Planning Commission, Three agencies led the effort to write a Watershed Protection Plan for the Truckee Meadows: Washoe County Department of Water Resources, the University of Nevada Cooperative Extension and the Washoe-Storey Conservation District.

1.1 Watersheds and Non-Point Source Pollution

Nevada is the fastest growing, most urbanized state in the nation and the driest as well. In a rapidly urbanizing area, it becomes ever more important to maintain the quality and usability of available water supplies, which are directly related to the health of the watershed. A watershed is the land area that drains into a stream, river, lake or wetland. A typical watershed can cover tens to hundreds of square miles and several political jurisdictions, and incorporates both surface and groundwater. As watersheds are urbanized, the activities of people living in the watershed can have major effects on the health of both the urban watershed and its waterways.

In watersheds, water from precipitation in the form of rain and snowmelt runs off the land into streams or seeps into the soil, replenishing groundwater. As areas are urbanized, the increased impervious cover (see glossary) results in more runoff and higher flows. In the Truckee Meadows, this urban runoff travels through storm drains directly into streams untreated and ultimately makes its way into the Truckee River. As runoff moves through fields, streets, and suburban yards, it collects soil particles, pesticides, fertilizers, animal wastes and other pollutants such as road salt and oil. To distinguish such diffuse runoff from point sources such as factory pipes, contaminated runoff and recharge are referred to as "nonpoint source pollution".

Many detrimental water quality changes result from hydrologic modifications to the watershed and its streams. Changes in stream morphology and flow increase stream temperature by the elimination of trees and shrubs from the stream bank and by the widening of the stream. As water temperature rises, the amount of dissolved oxygen the stream can carry decreases thereby affecting the riparian habitat. Other water quality impacts are a result of the changing urban environment and increases in impervious surfaces, including pavement and rooftops that result in increase water pollution from storm events. With recharge areas diminished, runoff from impervious surfaces contributes flow to streams rapidly, resulting in higher peak flows that arrive in channels earlier and carry a wide variety of contaminants. Pollutants in urban stormwater runoff, including solids, oxygen-demanding substances, nutrients, pathogens, petroleum hydrocarbons, metals and synthetic organics, are often present in greater concentrations than might be found in domestic wastewater after secondary treatment. These pollutant loadings can have a significant impact on urban streams and watersheds.

Many point sources of pollution are effectively controlled and regulated through the Clean Water Act, and much progress has been made in controlling direct discharges into our water bodies. Nonpoint sources of pollution, however, are less easily identified, more difficult to control, and are now the focus of many water protection activities based on a watershed scale. Protecting watersheds provides economic benefits, recreation, flood prevention, scenery, and overall quality of life.

1.2 Vision of a healthy, functioning watershed

Many different attributes are needed to maintain a high quality, biologically rich, functioning watershed. Healthy watersheds provide stable habitats for both biological diversity and human recreational uses. These stable systems are capable of adapting to environmental changes over time and are good indicators of the quality of the surrounding habitat.

The following characteristics are critical to healthy streams in a healthy watershed:

- Healthy riparian habitat and buffers
- Sufficient flowing water in the stream to maintain habitat
- Adequate shade cools the water and prevents thermal pollution
- Low concentrations of undesirable pollutants
- Natural meanders and channel cross sections
- Biological diversity

Other components of a healthy watershed involve the people living in the watershed, and include:

- Informed residents making good choices
- Responsible government regulators protecting the area's water resources
- Open space and recreation opportunities
- Economic benefits to the community by avoiding costly mitigation measures
- A devotion to watershed stewardship

The vision of the watershed itself includes:

- Areas of active recharge where water soaks in and replenishes groundwater
- The watershed captures, stores, and safely releases water
- A safe place for people to live

1.3 Development of the Watershed Protection Planning Effort

During 2001, The Regional Water Planning Commission contracted an effort to develop a watershed protection program for the Truckee Meadows. The three agencies (Washoe County Department of Water Resources, University of Nevada Cooperative Extension and Washoe-Storey Conservation District) began that effort in December 2001. The objective was to determine the current health of streams through a water quality assessment process, set goals and objectives, and then develop a management plan with action items that are aimed at preserving or improving water quality throughout the watershed. Streams in urbanizing areas experience changes in stream morphology, loss of vegetation, erosion and sedimentation, organic and nutrient enrichment, and accumulations of trash and debris. These effects can contribute to low dissolved oxygen content, elevated temperatures, degraded habitats, degraded biological communities, and diminished flows during dry seasons. The degradation of water quality and water resources that accompanies urbanization drives the need to implement watershed protection programs focusing on the sub-watershed level.

Sub-watersheds, which generally include one main stream, are small enough to allow monitoring, mapping, and other watershed assessment processes within a reasonable amount of time. The streams themselves are often good indicators of water quality. The following sub-watersheds of the

Truckee River, encompassing the jurisdictions of Reno, Sparks, and Washoe County, were selected for this program, as depicted in Figure 1:

Northern Carson-Peavine Creeks: Hunter, Alum, Peavine, Unnamed (Mogul), Chalk, Evans, Dog, Sunrise, and Bull Ranch

Washoe Valley Creeks: Jumbo, Davis, Ophir, Winters, Lewers, Franktown, McEwen and Muskgrove

North Truckee Drain

South Truckee Meadows Creeks: Galena, Whites, Thomas, Bailey, and Browns

The development of the plan begins with a discussion of current watershed efforts. Although these efforts were not born out of strict watershed protection concerns, they are indeed watershed protection and management efforts. The foremost of these efforts are flood control, floodplain, and stormwater management. A concerted effort is being spent on Steamboat Creek restoration as this major tributary to the Truckee River is hampered by poor water quality. The identification and mitigation of non-point source pollution is an effort to improve on water quality in the Truckee River. The benefits of this program will buy this community significant cost savings to our largest water reclamation treatment plant, the Truckee Meadows Water Reclamation Facility or TMWRF. Other water quality efforts towards the Truckee River and watershed efforts are also discussed.

Chapter 3 discusses water quality, standards and goals as they pertain to the Truckee River and its tributaries. Water quality standards set by the Nevada Division of Environmental Protection are given as this community must live and abide by these standards. These standards can limit out community's growth through the cost of water quality treatment. In this chapter, water quality goals are proposed that, if met, should enable our community to continue to enjoy the benefits of stream habitats and functionality.

Stream functionality is discussed in Chapter 4 as a means of describing a stream's health in terms of development's impacts upon that watershed and stream. This chapter highlights the findings of an assessment made under this study entitled "Watershed Assessment for Tributaries to the Truckee River". This assessment report was accepted at a July meeting of the Regional Water Planning Commission and is available to the general public. Action items are presented that will improve water quality, stream functionality and preserve property.

Chapter 5 relates the public and goal setting process that this study followed. The format followed was to get as many agencies and individuals interested for input to the formation of the management plan. From that process came the development of a list of Management Objectives and proposed actions for the management plan that are found in Chapter 6.

Finally, Chapter 7 describes the Watershed Management and Protection Plan as proposed. The foundation of this management and protection plan is in providing a complimentary framework for present and future watershed efforts that include stormwater management and floodplain management. This framework will lead to a community wide platform for regional communication and resolve.

Please note that supporting information can be found in the appendices including a glossary in Appendix 1.

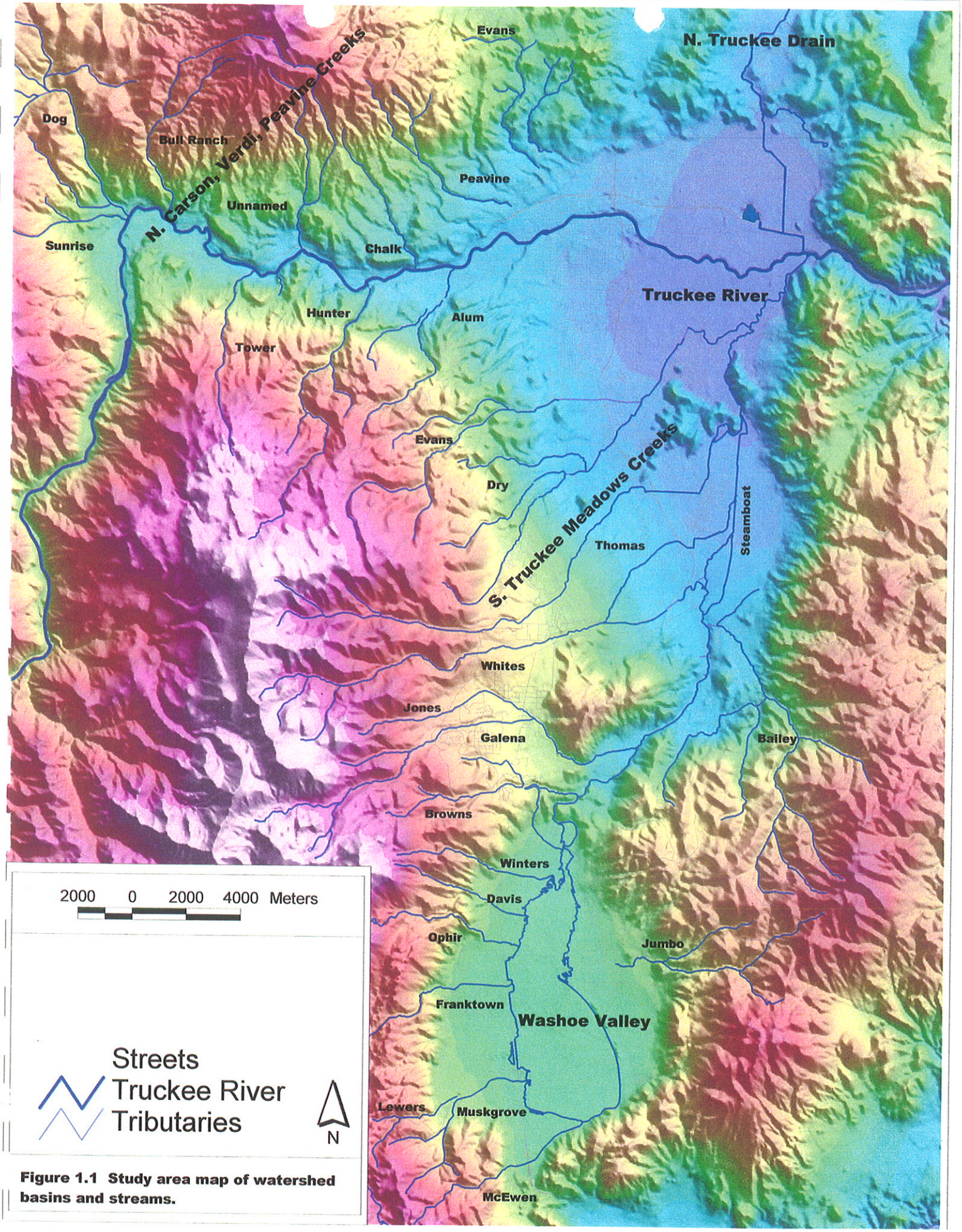


Figure 1.1 Study area map of watershed basins and streams.

Chapter 2

Current Watershed Efforts

Purpose and Scope

This chapter summarizes current efforts in surface water management that include flood control, floodplain management, stormwater quality management, Steamboat Creek restoration, TDS pollution trading efforts and the indirect efforts towards procuring conservation areas. With the exception of pollution trading, these efforts are subsets of watershed protection and management.

Summary of Current Efforts

A major reason for watershed protection is to insure the proper management of stormwater and floodwater. This community is currently investing significant monies and efforts towards constructing flood control works on the Truckee River. This effort is primarily being funded through the U.S. Congress. However, the US Army Corps of Engineers "mandate" that the community provide protection for the flood control program. This can be accomplished through floodplain management.

Currently, a Floodplain Management Plan is being formulated by a technical advisory committee, with input from interested parties. This plan address flood control and protection to the tributaries of the Truckee River through preservation of their floodplains. Likewise, this community has adopted a Stormwater Quality Management Plan to manage stormwater and the resultant quality impacts. This stormwater program is mandated by the US Environmental Protection Agency under Phase II of the National Pollutant Discharge Elimination System (NPDES), established by the Clean Water Act amendments of 1987.

This community is also actively engaged in restoration efforts within the Steamboat Creek watershed. Several studies based on water quality monitoring data have shown that Steamboat Creek is the major source of nonpoint source pollution to the Truckee River. The pollution contribution results from bank erosion, geothermal mineral deposits and the cumulative impacts of human activities throughout the watershed. Efforts to mitigate these effects will ultimately improve the water quality of not only Steamboat Creek, but of the Truckee River.

Efforts are currently underway to acquire lands that serve as scenic corridors and open space, preserve naturally occurring groundwater recharge areas, and provide recreational opportunities. They can also serve as conservation areas in the context of watershed protection. These activities are largely underway by the Regional Open Space Program, Washoe County Parks and Recreation, and the Regional Water Planning Commission.

2.1 Truckee River Flood Control

The Truckee River has had one major flood per decade, on average. Fourteen major floods have occurred in the Truckee Meadows since 1862 when records were first kept. The 1997 New Year's Day flood was greater that a 100-year flood and showed both the power of Mother Nature and the impact of building in the floodplain. The 1997 flood cost the area $500-$600

million. More than 800 people were laid off from their jobs and 15,000 additional jobs were affected. The flood damaged more than 7,000 acres of land.

The Truckee River links our natural and urban environments, providing a sense of place for the communities along its banks. To protect our most valuable natural resources—land and water—residents of Sparks, Reno and Washoe County undertook a complex challenge: implement a flood management program that restores the health and vitality of the Truckee River while protecting communities on the river.

Major Coalition Concept Plan Elements

In order to develop a consensus for a flood plan with public input, Reno, Sparks and Washoe County created a community-based group known as the Community Coalition for Truckee River Flood Management, which works in cooperation with the Army Corps of Engineers. The Coalition has the support of the community, including residents, businesses, 35 stakeholder organizations, 24 resource and regulatory agencies, and a range of technical consultants. The Coalition put in more than 9,000 hours over eight months to develop a consensus for a flood management plan. The Coalition Concept Plan recognizes four major elements:

- Structural solutions that return the river to a more natural state,
- Restoration to create a "living" river and river parkway areas in the Truckee Meadows,
- Mitigation of flood waters downstream of Sparks through river restoration, and
- Floodplain management to protect the flood control investment.

Flood Control and Watershed Management

The recommended Flood Management Plan will include measures to restore and revive the Truckee River as a "living" river. According to geomorphologists (surface water scientists), rivers can be revitalized using techniques that fit with their natural tendencies:

- Stable slopes, depths and widths throughout their course,
- Native riparian vegetation that reduces bank erosion and improves water quality,
- Habitats for river wildlife,
- River meanders that dissipate flood velocities,
- Natural channels that cools water for fish and increases water flows, and
- Natural pools, riffles, sandbars and gravel beds that build a naturally uneven river bottom for fish and aquatic life.

These are the geomorphic qualities envisioned for the Truckee River and also those sought after for the tributaries to the Truckee River.

Floodplain management protects our investment of flood control works. The US Army Corps of Engineers requires the community to provide protection for the flood control program. This can be accomplished through floodplain management. This type of management will:

- Reduce stormwater runoff to the river and thereby reduce flood impacts in the Truckee Meadows and downstream to Wadsworth,
- Control sediment accumulation to the Truckee River and its tributaries,
- Reduce erosion to the Truckee River and its tributaries, and
- Provide for flood protection upstream of the Truckee River.

Floodplain management is a focused component of watershed management as discussed below.

2.2 Floodplain Management

The Floodplain Management Planning Committee (a sub-committee of the Regional Water Planning Commission) is organized for the purpose of developing a plan to identify and assess flood hazards, and develop mitigation strategies that could include both structural and non-structural solutions. A structural solution would be a constructed flood control project. Non-structural solutions could include changes to the existing floodplain management ordinances that address development in the floodplain, acquisition of land in the floodplain, building code modifications, and others. This project is funded by a state Flood Mitigation Assistance grant, which is a pass-through grant from the Federal Emergency Management Agency (FEMA).

Benefits

Communities with Floodplain Management Plans in place as part of their overall Hazard Mitigation Plans can qualify for funding of flood mitigation projects through federal hazard mitigation and flood mitigation grant programs. Additionally, an adopted Floodplain Management Plan can qualify a community for extra points under the federal Community Rating System (CRS) program. The CRS is a system of classifying communities based on their pro-active flood mitigation policies. Communities that participate in the program can receive 5% - 45% reductions in the flood insurance premiums that their residents pay.

Philosophy

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, which is of even greater urgency since the 1997 flood event. Also of concern are Truckee River tributary flooding, alluvial fan flooding, sheet flooding, and playa/lake flooding. The Truckee River Flood Project Community Coalition has been working solidly for three years to develop a community concept for the river that minimizes flood damages while embracing the concept of a "Living River". There is recognition of the Truckee River as a natural system with beneficial functions that need to be restored and preserved. This concept of restoring and working with natural systems should be embraced throughout the watershed.

There are a couple of key points which must be recognized when planning for the management of stormwater: 1) Flooding is a regional phenomenon. It does not respect municipal or property boundaries, and 2) Every area has an INITIAL (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. Policy recommendations would be limited to areas within Washoe County. There will be ongoing coordination with downstream entities such as Storey County and the Pyramid Lake Paiute Tribe so that there is a regional understanding of the proposed flood mitigation policies.

During the Spring of 2003, the Floodplain Management Committee will publish four Committee Reports: 1) Hazard Inventory, 2) Assessment of At-Risk Properties, 3) Evaluation of Flood Mitigation Strategies, and 4) Summary Analysis and Recommendations.

Recommended Management Strategies

There are many strategies that can be used to manage the watershed for the reduction of flood damages. The following recommended 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:

- Floodplain management should embrace the concept of "No Adverse Impact" (NAI), a national policy recommendation supported by the Association of State Floodplain Managers.
- 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.
- Watershed-wide hydrologic modeling and masterplanning should be implemented in developed and developing areas County-wide.
- Watersheds with areas that are vulnerable to increased flood damages due to increases in the base flood elevation need to be proactively managed. In some cases this may mean regulating to a standard of zero allowable increase of the base flood elevation.
- 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 understood, and that potential negative impacts to other properties in the watershed are mitigated.
- 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.
- The regional stormwater masterplan 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.
- Management strategies should attempt to limit structural measures. 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.
- 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.
- When structural projects are necessary, design guidelines should encourage the use of alternative methods that support both aesthetic and ecological values such as bio-engineering techniques.
- When evaluating alternatives, it is important to include an analysis of the economic value of retaining as much as possible the functions of a natural drainage system.
- Pro-actively manage the transition of natural systems to a system with urban impacts to preserve as much of the natural functions as possible.
- 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.

Floodplain management is not just concerned with the Truckee River. Floodplain management can be applied to all streams within the Truckee Meadows. Besides development encroachment on floodplains, stormwater discharges are equally as devastating to our waterways.

2.3 Truckee Meadows Regional Stormwater Quality Management Program

In December 2001, the Truckee Meadows Regional Stormwater Quality Management Program (RSQMP) was published by Kennedy Jenks Consultants as a comprehensive program comprised of efforts by local governments and private citizens to reduce the pollution associated with urban runoff in the Truckee Meadows. This program was mandated by the USEPA and NDEP under Phase II of the National Pollutant Discharge Elimination System (NPDES), established by the Clean Water Act amendments of 1987. The nine program elements include:

- Intergovernmental Coordination to establish clear roles and responsibilities among the local jurisdictions for program development and implementation and to establish the relationship of the local program to the state program.
- Public Outreach to increase public awareness of the RSQMP as a whole, individual program elements and their components, and water quality issues related to stormwater runoff.
- Municipal Operations Program will improve existing maintenance activities such as street sweeping, catch basin cleaning, ditch cleaning, and storm drain line cleaning to better protect water quality.
- Stormwater Discharge Monitoring will establish automated monitoring stations to collect stormwater runoff samples to establish the effectiveness of the program.
- Land Use Planning in order to develop a set of land use planning BMPs that reduce runoff and protect water quality.
- Structural Control BMPs at areas of new development and significant redevelopment.
- Construction Site Discharge Management regulations that will eliminate construction site stormwater pollution.
- Illicit Discharge Detection and Elimination Program that will formalize an inspection and enforcement program for detecting and eliminating illegal discharges to and connections to stormwater drainage.
- Industrial Discharge Regulation Program that will build upon the existing wastewater pretreatment program, incorporating stormwater quality management into the regulatory program for industrial wastewater control.

These elements are currently underway and are expected to be fully integrated by 2004.

Stormwater Management and Watershed Management

Several elements in the RSQMP are elements of or compliment watershed management. The Watershed Plan can in fact help to sponsor RSQMP "Achievable Goals" such as:

- Public Outreach (PO-1, PO-4) with intergovernmental coordination in developing parallel programs, storm drain stenciling, and Advisory Board and school presentations.
- Municipal Operations (MO-1) with prioritizing maintenance and environmentally sensitive areas.
- Stormwater Discharge Monitoring (SWM-6,-8,-9) with monitoring the effectiveness of the program and additional public outreach.
- Land Use Planning (LU-1) with assisting in all phases of this element.

- Structural Controls (SC-8) in assisting with the development of alternatives to structural controls in existing or new developments.
- Illicit Discharge Detection and Elimination (IDDE-9,-10), with public outreach and developing free household hazardous waste programs.

By utilizing watershed management staff and efforts, the Stormwater Quality Management Program will realize time and cost savings.

2.4 Steamboat Creek Restoration

Several studies based on water quality monitoring data have shown that Steamboat Creek is the major source of nonpoint source pollution to the Truckee River. The pollution contribution results from bank erosion, geothermal mineral deposits and the cumulative impacts of human activities throughout the watershed. Steamboat Creek emanates from Washoe Lake flowing through Pleasant Valley, Steamboat Valley, and along the eastern edge the south and central Truckee Meadows before discharging to the Truckee River. The Steamboat Creek Restoration Master Plan (WSCD, 2000) is a guide for policy makers, landowners, developers, and citizens with interest in improving water quality and conserving riparian zones. The plan recommends Best Management Practices for specific reaches of Steamboat Creek and its tributaries, provides design recommendations to establish continuity between restoration projects, increases public awareness and also provides recommendations for public policies and implementation strategies for both developers and private property owners.

Currently, the Washoe-Storey Conservation District's (WSCD) main focus is to leverage state and private support to implement stream restoration projects in the Steamboat Creek/Truckee River Watershed. WSCD has already completed the planning and development of the Steamboat Creek Restoration Master Plan as well as securing the necessary permits and landowner participation to implement restoration projects. To date, several projects have been initiated or completed:

- Steamboat Creek Restoration at Andrew Lane,
- Evans Creek Restoration at Anderson/Bartley Ranch Park,
- Hidden Meadows/University Farms reach of Steamboat Creek,
- Proposed the UNR Farms Stream Restoration Project, and
- Public Outreach.

Full implementation of the Steamboat Creek Restoration Plan would have a significant effect on both the water quality and the flood control issues within the watershed. The plan includes a summary and analysis of both existing and planned land uses in the drainage area, a listing of different best management practices (BMPs) available to improve the quality of water within Steamboat Creek, and policy and implementation guidelines for planned and future development within the Steamboat Creek watershed. In addition to this information, the Steamboat Creek Restoration Plan also offers a reach-by-reach analysis of the individual sections of Steamboat Creek. These analyses offer a summary of the water quality concerns, opportunities, and constraints for each reach, and conclude with recommendations for possible restoration practices on each reach. As identified earlier in this section, two of the most important concerns on Steamboat Creek are flood control and dissolved solids concentration.

In it's current state much of Steamboat Creek is an incised straightened channel, acting as an unstable gully passing water and associated pollutants directly to the Truckee River. In many areas restoration of Steamboat will involve the excavation and re-vegetation of new floodplains. As pollutant-laden water spreads out across a restored vegetated floodplain at average annual

flows, it will slow down, sediment will settle out and more water will percolate into the ground, diminishing downstream peak flood flows and improving recharge. This process along with increased pollutant uptake by riparian floodplain vegetation acts as a bio-filtration process. TDS will be sequestered in the floodplain soils and vegetation, but more importantly, TDS stored in soils that would have been released by erosion or by leaching as water drains to a lower elevation will be retained in soil that does not erode nor leach. By creating riparian floodplain corridors, re-meandering and re-vegetating Steamboat the banks will erode less. A joint study between the University of Nevada, Reno, the City of Reno, the Washoe-Storey Conservation District and the U.S. Army Corps of Engineers located at the confluence of Steamboat and the Truckee is investigating the feasibility of such restoration. The design of this project will allow ordinary high water to access a vegetated floodplain annually for weeks or months in most years, thus improving wetland habitat, stabilizing stream banks, attenuating flood flows and reducing TDS, especially forms of nitrogen and phosphorus that contribute to excess algal growth in the Truckee River.

In addition to floodplain riparian vegetation, emergent standing water wetland plants are able to uptake significant amounts of dissolved salts without adversely affecting the health of the plant community. The Rosewood reach, between Pembroke Drive and Mira Loma Drive, has the potential to include a significant wetland area. The reach contains an existing degraded natural wetland area along the west side of the stream, which could potentially be utilized as a BMP to remove both suspended and dissolved solids from the stream.

For flood control concerns, the more urbanized reaches of the Steamboat Creek watershed are more significant than other areas. A developed watershed with high percentages of impervious cover will generate significantly greater runoff rates than an undeveloped area of similar slope and geology. Because much of the Steamboat Creek watershed falls into this category, it is important to consider flood control questions when evaluating and selecting restoration projects. Between Damonte Ranch and Curti Ranch, for example, much of the area is zoned high density suburban, low density urban, or commercial. The impervious surfaces created by the development in these zones can greatly increase runoff rates and result in higher peak flows from flood events. These areas are of the greatest concern for flood control.

Agricultural lands south and north of the Huffaker Hills stand poised for residential and commercial development. Steamboat Creek courses through these lands, often flooding them. On these lands there exists the opportunity to reshape the morphology of this creek to provide flood protection and water quality improvement, not only to Steamboat Creek, but to the Truckee River.

2.5 Truckee River Operating Agreement (TROA)

The task undertaken by the TROA is to set forth actual operational guidelines to accomplish the goals specified in PL 101-618 and to abide by its and other constraints. Such procedures as how to calculate and assign evaporative losses, setting of sequences of who may store when in each reservoir, and whose water will spill first, as well as higher-level policy matters, are being defined. The final resolution of TROA provisions is proceeding concurrently with development of the Draft EIS/EIR required under federal and California law, respectively. Completion is expected in 1998. A few of the future improved operations of the Truckee River under TROA can be exemplified in a few typical scenes:

- A flow of water in the river representing irrigation rights that were converted to municipal use is not needed at a particular time to meet customer needs. Under pre-TROA operation, this water would flow through Reno/Sparks without serving those rights to downstream water users, resulting in a loss to the community of beneficial use of its rights. Under TROA, the consumptive use portion of this water would be captured upstream in a reservoir and retained for future drought protection.

- Water sometimes flows into Pyramid Lake after all other water users have been satisfied, but at a time of year when no spawning is occurring and the volume of flow water is not needed in the stream. Under TROA, the Fish and Wildlife Service could retain that flow upstream and release it during the spring or at other times when it would benefit the fish more. Although this type of flexibility in operation does not provide more or less water to any party on the river, the improved timing of flows can be very beneficial.
- Water could be managed and exchanged among reservoirs to enhance instream flows and reservoir pools for recreation, environment, and aesthetics.
- TROA negotiators are considering provisions for "Secondary Stored Water" that would allow water for other purposes besides municipal and fisheries use to be credit stored. This would make it possible to purchase water rights, store the water under the rights upstream when available, and release the water during low-flow periods for instream and water quality benefit. A variation on this concept would be to retain the stored water for recreational use in the reservoir.

Once an operating agreement is signed and environmental analyses completed, any adverse environmental effects must be mitigated by the parties.

2.6 Water Quality Settlement Agreement

The Truckee River Water Quality Agreement of 1996 settled longstanding litigation between the Pyramid Lake Paiute Tribe and the U.S. EPA, State of Nevada and the Cities of Reno and Sparks, respectively. A key element of this agreement was a commitment by the Cities and the Department of Interior to spend up to $24 million to purchase water rights from the Truckee River, particularly within the State of Nevada. Purchased water would subsequently be stored in upper Basin reservoirs for release under low flow conditions to help the Cities meet water quality objectives, particularly those related to nutrients and dissolved oxygen. As of April 2003, 4,150 AF of Truckee River water rights have been purchased.

2.7 Source Water Assessment for the Truckee River and Lake Tahoe in Northern Nevada

According to the 1996 amendments to the Safe Drinking Water Act, every public water system (PWS) serving more than 20,000 residents must complete a source water assessment. These assessments are meant to provide opportunities and tools to protect drinking water at its sources through the identification of contaminants and activities that potentially threaten public drinking water systems.

Recently, an assessment was made on the Truckee River from Lake Tahoe to the Reno-Sparks corporate boundary. The study results indicated that a contaminant spill from either the railroad or highway poses the most significant threat to both the Truckee River and Lake Tahoe drinking water sources. Other potential sources of contamination (PCAs) observed include stormdrains, sewage transfer stations and businesses. The report will soon be released from the State of Nevada Bureau of Health Protection Services in Carson City.

2.8 Non-Point Source Pollutant Trading

Non-Point Source Pollution Trading is a concept being promoted by the USEPA and the State of Nevada. The main thrust of this concept, for the Truckee Meadows, is for future TMWRF discharges. If pollution sources to the Truckee River can be mitigated, there is the potential for

TMWRF to be credited with higher discharge concentrations such at total dissolved solids (TDS). There would be a net benefit to the river by this action.

Current investigations are being directed to the Wadsworth area where groundwater discharges have been identified that are relatively high in TDS (DRI, 2001). This project is currently investigating other pollutant sources within the Wadsworth area as well as within the Truckee Meadows. Potential sources of TDS trading are Steamboat Creek, North Truckee Drain, and Chalk Creek. Watershed Management efforts may also assist in securing cost savings to TMWRF in the future.

2.9 Conservation Areas

The preservation of undeveloped natural landscapes is an integral part of watershed protection and also serves dual roles. These areas can serve as scenic corridors and open space, preserve naturally occurring groundwater recharge areas, and provide recreational opportunities. They can also serve as conservation areas in the context of watershed protection.

Regional Open Space Program

The Regional Open Space Program is a cooperative effort designed to benefit the entire region by preserving the highly valuable open space in our area. Several agencies and groups took the lead in developing and approving a program that met the requirements of the Truckee Meadows Regional Plan that included Washoe County, the Cities of Reno and Sparks, Parks and Recreation Commissions, and Citizen and Neighborhood Advisory Boards.

Basically, open space is undeveloped land with significant natural, scenic and cultural resources that are important to the community and the wildlife of this area. The Regional Open Space Program has identified the natural, scenic and cultural resources in Washoe County that should be preserved and has developed a plan to make it happen. The Regional Open Space Plan targets numerous resources that need protection in the rapidly developing southern portion of the County.

- Truckee River corridor,
- valuable wetlands,
- lakes, streams, playas and riparian corridors,
- sensitive species habitats,
- trails and bike paths,
- wildlife habitat and migration corridors,
- visual and scenic areas,
- visually important ridge lines, hills, mountains and canyons,
- historic and prehistoric cultural resources,
- agricultural lands with open space significance,
- watershed recharge and protection areas, and
- other open space lands

The Regional Open Space Program has also performed functions to coordinate open space uses on additional lands in the community having open space significance, but not receiving acquisition or maintenance funding through the Regional Open Space Program. They are:

- Flood plains, floodways and flood control facilities
- Treated effluent land application areas

- Community parks, neighborhood parks and developed areas in regional parks
- Significant open space within developments
- Public lands with open space significance

There are several means of funding the acquisition of open space, through public and private sources that include 1991 State Legislature authorized tax increase option, public/private partnerships, matching grants, land trusts, volunteer and fundraising efforts, and Financial assistance from foundations for specific projects. Federal programs also are available to help designate and fund open spaces in Washoe County. Other land management and preservation options include conservation easements, existing easements, and coordination with general improvement districts and special assessment districts. Preservation can also be accomplished through regulation and incentives such as land use regulations, cluster development, and the transfer of development credit and transfer of development rights.

Local funds to support open space acquisitions are critical to the implementation of the Regional Open Space Plan. In 1991, the Nevada State Legislature passed legislation that enables Washoe County to solicit voter approval of tax increases to help fund the acquisition and maintenance of open space land. The 1991 Nevada State Legislature also authorized several options for taxation on a local level that could help fund open space preservation. Before any of these tax increases may be imposed, the Regional Open Space Plan had to be adopted, and taxpayers must approve any increase by a majority vote during a general or special election. The three authorized types of increases are:

- A sales tax increase of up to 1/4 of 1 percent for land acquisition and maintenance. This type of funding is ideal because it not only obtains funds to acquire the land, but also to maintain it in the future.
- A real estate transfer tax increase of up to 1/10 of 1 percent to be used for land acquisition only.
- A property tax increase of up to one cent on each $100 of assessed valuation to be used for maintenance of open space only.

Funds raised from these taxes cannot be used for any neighborhood or community park or facility, but may be used for undeveloped portions of regional parks.

Regional Parks, Trails and Open Space Bond Issue.
In 2000 the citizens of Washoe County successfully passed a $28 million dollar Parks/Trails and Open Space Bond issue. Approximately $12 million of the total bond amount will be spent on the acquisition of open space in and around the Truckee Meadows.

The Southern Nevada Public Lands Management Act was created to dispose of Bureau of Land Management land adjacent to the rapidly growing Las Vegas area. The majority of the money received from the sale of these lands to private individuals is spent in Clark County, but a portion is available statewide to acquire "environmentally sensitive" lands. Washoe County has been working closely with the Bureau of Land Management and the United States Forest Service from the inception of this program to acquire open space in and around the Truckee Meadows. Some of the desired open space is in the middle to upper elevations of our local watersheds. Additionally, the Bureau of Land Management and the United States Forest Service combined manage over 300,000 acres of land surrounding the Truckee Meadows. These two agencies have successfully completed major land exchanges in recent years adding to the total acreage of public lands that are included in our regional open space system.

Groundwater Recharge Areas

Kennedy/Jenks Consultants (2001) evaluated groundwater recharge in southern Washoe County. Various types and locations of groundwater recharge in southern Washoe County were identified. Recommendations were then made for protecting the undeveloped recharge areas and natural water courses and also for enhancing groundwater recharge in existing developed areas (RWPC, 2003).

A combination of natural and incidental recharge occurs throughout southern Washoe County and provides most of the region's groundwater recharge. Natural recharge describes the infiltration of precipitation and surface water into groundwater aquifers. This occurs in the mountainous and alluvial fans areas. In contrast, incidental recharge describes the infiltration that occurs as a secondary result of human use of water and from structures designed to convey, store or dispose of water and wastewater.

Areas of southern Washoe County that currently support natural and incidental recharge are rapidly being developed. Increased areas of impermeable surfaces due to urbanization and high-density rural development have lead to a trend of diminishing groundwater recharge in these areas. To mitigate the reduction in natural and incidental recharge, new policies, procedures and programs will need to be developed and implemented to optimize and balance the use of surface water and groundwater resources of the Truckee Meadows.

2.10 Existing Code, Ordinance, and Policy

Reno and Washoe County have enacted public laws to protect and preserve streams, wetlands and drainages. Their full content can be found in Appendix 4.

- Reno Municipal Code Chapter 18.06.806: Drainageways - according to Reno staff, this section applies to both ephemeral and perennial drainageways with a tributary area of 100 acres or more.
- Reno Municipal Code Chapter 18.06.805: Wetlands and Stream Environments
- Reno Municipal Code Chapter 18.06.449, Section b: Significant Hydrologic Resources: - This section was added to the Reno Municipal Code on February 25, 2003 and applies to Cooperative Planning Overlay District.
- Washoe County Development Code Article 418: Significant Hydrologic Resources

The Regional Water Planning Commission has adopted Interim Water Policies and Criteria that specifically address:

- Protection and Enhancement of Groundwater Recharge (Policy 1.3.b.)
- Regional Floodplain Management (Policy 3.1.a.,b.,c.,and i.)
- Regional Flood Control (Policy 3.1.a.)
- Truckee River Restoration (Policy 3.1.d.)
- Watershed Protection (Policy 3.1.e.)
- Stormwater (Policy 3.1.f.)

2.11 Washoe-Storey Conservation District

The Washoe-Storey Conservation District is currently conducting two citizen outreach initiatives. The Adopt A Watershed program is a K-12 school-community learning experience. Adopt-A-Watershed (AAW) uses a local watershed as a living laboratory in which students engage in hands-on-activities, making science applicable and relevant to their lives. It weaves education with the community developing collaborative partnerships and reinforcing learning through community service. WSCD initiated the first AAW program in the Truckee Meadows in the spring of 2002, being the first AAW program in the State of Nevada. Community members and school classes engage in science-based learning experiences that utilize existing educational materials and curriculum, participate in community service projects and reflect upon their learning experiences in an educational setting.

WSCD joined forces with a number of other non-profit, private and public organizations to expand the implementation of a watershed-wide citizen monitoring event of the Truckee River watershed during a one-day event called Snapshot Day. Snapshot Day is a citizen monitoring event to collect baseline data for the Truckee River while educating the public. WSCD trains and coordinates volunteers from the Truckee Meadows in water and habitat quality monitoring. Snapshot Day is an educational service opportunity for the community to learn more about the Truckee River Watershed its water quality, and their impacts to the watershed. The purpose of this effort is to 1)promote environmental awareness and knowledge of the Truckee River watershed and 2) to collect valuable water quality information that will allow for protection and enhancement of existing resources. This project will create community understanding and ownership of the watershed they reside in. This type of education will enhance the attitude and efforts of citizens through exposure to their impacts on this precious resource.

2.12 South Truckee Meadows General Improvement District

Washoe County and the South Truckee Meadows General Improvement District have recognized that surface water supply for municipal purposes is necessary in the near term. Two surface water treatment plants are being sited and will treat water from Galena, Whites and Thomas creeks for public consumption. The South Truckee Meadows General Improvement District began source water protection programs in 1996 beginning with their wellhead protection plan (Widmer, 1998). The development of their watershed protection plan began in 2000 and has been incorporated in this current plan. Efforts are underway to further investigate potential sources of pollutants to these waters that may affect water treatment.

CHAPTER 3

Water Quality, Standards and Goals

Purpose and Scope

Water quality data is presented for the Truckee River and its tributaries. Although State water quality standards are set for the Truckee River, few are set for the tributaries. This chapter gives background information on state water quality objectives and proposes a set of water quality goals for the Truckee River tributaries.

Summary of Findings

The Nevada Division of Environmental Protection has set Total Maximum Daily Loads for the Truckee River. These are total phosphorus, total nitrogen and total dissolved solids. These load allocations are currently being met. Water quality goals are also set for the tributaries Steamboat Creek, Whites Creek, Hunter Creek, Franktown Creek and Galena Creek. Future class water designations will be set for the creeks Thomas, Alum, Dry, Evans, Browns and Muskgrove. This Plan sets water quality goals for the other tributaries based upon the State's class water designations. The Management Objectives discussed in Chapter 6 can be used to meet or maintain all of these standards. Failure to meet these standards may impact TMDLs for the Truckee River and result in substantial costs to the community.

3.1 Pollutants and TMDLs

The effort to protect local sub-watersheds is driven, in large part, by the need to protect and improve water quality in the Truckee River, which serves as a source of drinking water for the cities of Reno and Sparks, as a source of irrigation water to water rights holders, and is home to one threatened and one endangered fish species.

The Truckee River is currently subject to NDEP Total Maximum Daily Load (TMDL) regulations. Established by Section 303(d) of the Clean Water Act, the TMDL program is a process that requires the state to apply water quality standards to impaired waters. The process consists of three steps: the state identifies waters that are not expected to meet standards, prioritizes the selected watersheds, and establishes quantitative limits on the amount of contamination that each water body may receive.

TMDLs are determined by the state, based on the specific concerns in each water body. Available historical data, the beneficial uses of the lake or river, and land uses in the watershed all contribute to the assessment of the water body. Once this assessment is complete, a TMDL for each pollutant is established. This TMDL (usually expressed in mass/time) is the maximum amount of the pollutant that can be added to a water body while still supporting its beneficial uses. The TMDL is allocated between the different sources of that pollutant in the watershed, including natural background sources and nonpoint sources. Once the TMDLs are set and allocated, the water body is monitored to ensure compliance and to evaluate the success of the standard. Standards that do not result in improved water quality may be made more stringent in the future.

TMDLs were established in 1994 for nitrogen, phosphorus, and total dissolved solids over 32.3 miles of the Truckee River, from East McCarran Boulevard to the Pyramid Lake Reservation. At some time in the future TMDLs will be set for the upper Truckee River (temperature between

Idlewild and East McCarran), Steamboat Creek (iron, mercury, total phosphorus, boron, and arsenic) and lower Franktown Creek (dissolved oxygen).

In addition to these TMDLs, some water bodies are subject to additional Requirements to Maintain Higher Quality Water (RMHQs). If the water quality in a given stream is significantly higher than the state standards, RMHQs are implemented to prevent deterioration of this quality. The Truckee River has RMHQs for total nitrogen between Stateline and East McCarran Boulevard, and for turbidity between Lockwood and Derby Dam. Further information about TMDLs, RMHQs, and other state water quality issues can be found on NDEPs web site http://ndep.nv.gov/bwqp/bwqp01.htm. The 2002 NDEP TMDL list can be found at http://ndep.nv.gov/bwqp/303list.pdf.

3.2 Priority Pollutants

Based upon the previous discussion and the need to meet established TMDLs for the Truckee River, the following four pollutants have been prioritized for purposes of the watershed protection plan. The individual priorities are based on the need to meet beneficial uses in the Truckee River, and the ability of watershed protection planning to mitigate the sources.

Table 3.1
Priority Pollutants for Truckee River

Pollutant	Priority	Nevada TMDL	Major Sources
Total Dissolved Solids (TDS)	1	900,528 lbs/day	▪ Natural groundwater discharge ▪ Road salts and uncovered salt storage ▪ Irrigation practices ▪ Treatment difficult to impossible by TMWRF
Total Suspended Sediment (TSS)	1	Allocation proposed but not set	▪ Sediment from construction activities ▪ Streambank erosion from channel encroachment ▪ Disturbed and/or non-vegetated lands ▪ Road sanding
Total Phosphorus (P)	2 (addressing TSS will decrease P)	214 lbs/day	▪ Soil erosion and sediment; correlated to TSS ▪ Fertilizers ▪ Animal wastes ▪ Septic systems
Total Nitrogen (N)	3	1000 lbs/day	▪ Fertilizers ▪ Agricultural and residential runoff ▪ Animal wastes ▪ Septic systems ▪ Plant litter

With respect to the Truckee Meadows Water Reclamation Facility (TMWRF), the most critical pollutant is total dissolved solids (TDS). The facility is the major wastewater facility for the community and is somewhat constrained by this limitation. Phosphorus and nitrogen are also of concern to the community as these pollutants are responsible for algal growth in the Truckee River that significantly affects water quality and fish habitat. Total suspended sediment, particularly silt, can reduce the river's vitality and also provides a source of phosphorus and nitrogen.

Considerable expense has been directed towards improving the water quality of the Truckee River by Reno, Sparks and Washoe County. Currently these entities are engaged in studying the potential for pollutant trading particularly for nitrogen and TDS. Proper watershed management can improve on pollutant discharges to the Truckee River and may provide another opportunity for pollutant trading as discussed in section 2.5.

3.3 Water Quality Standards

Water quality standards are set by the Nevada Division of Environmental Protection and can be found in Nevada Administrative Code Chapter 445A-Water Controls. Recommended water quality criteria for the different designated beneficial uses are published in NAC 445A.119. The criteria are water quality characteristics based upon available scientific and technical information and are provided for use as guidelines in establishing water quality standards. Designated beneficial uses can include agricultural use (irrigation and watering of livestock); aquatic life (cold and warm water propagation); water contact recreation; non-contact recreation; municipal or domestic supply; industrial supply; and propagation of wildlife. All beneficial uses listed above do not apply to all waterbodies.

Per NAC 445A.122, certain standards are intended to protect both existing and designated beneficial uses as follows:

- Watering of livestock. The water must be suitable for the watering of livestock without treatment.
- Irrigation. The water must be suitable for irrigation without treatment.
- Aquatic life. The water must be suitable as a habitat for fish and other aquatic life existing in a body of water. This does not preclude the reestablishment of other fish or aquatic life.
- Recreation involving contact with the water. There must be no evidence of manmade pollution, floating debris, sludge accumulation or similar pollutants.
- Recreation not involving contact with the water. The water must be free from:
  - Visible floating, suspended or settled solids arising from man's activities;
  - Sludge banks;
  - Slime infestation;
  - Heavy growth of attached plants, blooms or high concentrations of plankton, discoloration or excessive acidity or alkalinity that leads to corrosion of boats and docks;
  - Surfactants that foam when the water is agitated or aerated; and
  - Excessive water temperatures.
- Municipal or domestic supply. The water must be capable of being treated by conventional methods of water treatment in order to comply with Nevada's drinking water standards.
- Industrial supply. The water must be treatable to provide a quality of water which is suitable for the intended use.
- Propagation of wildlife. The water must be suitable for the propagation of wildlife and waterfowl without treatment.
- Waters of extraordinary ecological or aesthetic value. The unique ecological or aesthetic value of the water must be maintained.
- Enhancement of water quality. The water must support natural enhancement or improvement of water quality in any water which is downstream.

Specific standards of water quality for the Truckee River at various locations from the state line to the Lockwood Bridge can be found in NAC 445A.184-187. Values for this study's priority pollutants (total nitrogen, total phosphorus, total suspended solids, and total dissolved solids) by reach can be found in the following table. These standards provide a benchmark against which the water quality of the tributaries discussed in this study can be assessed. This can be accomplished by applying class water descriptions to existing development within their respective drainages and consideration of their existing water quality. However, extensive water quality data does not exist for all tributaries.

Table 3.2
Standards of Water Quality Truckee River
From NAC 445A.184-187

Sampling Point	Parameter	Requirements to Maintain Existing Higher Quality	Water Quality Standards for Beneficial Uses	Beneficial Uses
Truckee River at the state line	Total Phosphates (as P) - mg/l	A-Avg[a].: ≤0.03	A-Avg.: ≤0.10	Aquatic life[b], water contact recreation[b], municipal or domestic supply and noncontact recreation.
	Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg.: ≤0.3 S.V.: ≤0.43	Nitrate S.V.: ≤2.0 Nitrite S.V.: ≤.04 Ammonia S.V.: ≤.02 (un-ionized)	Aquatic life[b], water contact recreation[b], municipal or domestic supply and noncontact recreation.
	Total Dissolved Solids - mg/l	A-Avg.: ≤70.0 S.V.: ≤85.0	A-Avg.: ≤500	Municipal or domestic supply[b], irrigation and stock watering.
	Suspended Solids - mg/l	A-Avg.: ≤15.0	S.V.: ≤25	Aquatic life[b].
Truckee River at Idlewild	Total Phosphates (as P) - mg/l	A-Avg.: ≤0.05	A-Avg.: ≤0.10	Aquatic life[b], water contact recreation[b], municipal or domestic supply and noncontact recreation.
	Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg.: ≤0.3 S.V.: ≤0.43	Nitrate S.V.: ≤2.0 Nitrite S.V.: ≤.04 Ammonia S.V.: ≤.02 (un-ionized)	Aquatic life[b], water contact recreation[b], municipal or domestic supply and noncontact recreation.
	Total Dissolved Solids - mg/l	A-Avg.: ≤80.0 S.V.: ≤95.0	A-Avg.: ≤500	Municipal or domestic supply[b], irrigation and stock watering.
	Suspended Solids - mg/l	A-Avg.: ≤15.0	S.V.: ≤25	Aquatic life[b].
Truckee River at East McCarran	Total Phosphates (as P) - mg/l	A-Avg.: ≤0.05	A-Avg.: ≤0.10	Aquatic life[b], water contact recreation[b], municipal or domestic supply and noncontact recreation.
	Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg.: ≤0.3 S.V.: ≤0.43	Nitrate S.V.: ≤2.0 Nitrite S.V.: ≤.04 Ammonia S.V.: ≤.02 (un-ionized)	Aquatic life[b], water contact recreation[b], municipal or domestic supply and noncontact recreation.
	Total Dissolved Solids - mg/l	A-Avg.: ≤90.0 S.V.: ≤120.0	A-Avg.: ≤500	Municipal or domestic supply[b], irrigation and stock watering.
	Suspended Solids - mg/l	A-Avg.: ≤15.0	S.V.: ≤25	Aquatic life[b].
Truckee River at Lockwood Bridge	Total Phosphates (as P) - mg/l	--	A-Avg.: ≤0.05	Aquatic life[b], water contact recreation[b], municipal or domestic supply and noncontact recreation.
	Nitrogen Species (N) - mg/l	--	TN A-Avg.: ≤0.75 TN S.V.: ≤1.2 Nitrate S.V.: ≤2.0 Nitrite S.V.: ≤.04 Ammonia S.V.: ≤.02 (un-ionized)	Aquatic life[b], water contact recreation[b], municipal or domestic supply and noncontact recreation.
	Total Dissolved Solids - mg/l	A-Avg.: ≤210.0 S.V.: ≤260.0	A-Avg.: ≤500	Municipal or domestic supply[b], irrigation and stock watering.
	Suspended Solids - mg/l	A-Avg.: ≤25.0	S.V.: ≤50	Aquatic life[b].

a. A-Av. = annual average; S.V. = single value.
b. The most restrictive beneficial use.

Certain of the tributaries included in this plan have been designated as class waters. There are four levels of classification provided in NAC455A.124.

- Class A waters include waters or portions of waters located in areas of little human habitation, no industrial development or intensive agriculture and where the watershed is relatively undisturbed by man's activity. The beneficial uses of class A waters are municipal or domestic supply, or both, with treatment by disinfection only, aquatic life, propagation of wildlife, irrigation, watering of livestock, recreation including contact with the water and recreation not involving contact with the water.
- Class B waters include waters or portions of waters which are located in areas of light or moderate human habitation, little industrial development, light-to-moderate agricultural development and where the watershed is only moderately influenced by man's activity. The beneficial uses of class B water are municipal or domestic supply, or both, with treatment by disinfection and filtration only, irrigation, watering of livestock, aquatic life and propagation of wildlife, recreation involving contact with the water, recreation not involving contact with the water, and industrial supply.
- Class C waters include waters or portions of waters which are located in areas of moderate-to-urban human habitation, where industrial development is present in moderate amounts, agricultural practices are intensive and where the watershed is considerably altered by man's activity. The beneficial uses of class C water are municipal or domestic supply, or both, following complete treatment, irrigation, watering of livestock, aquatic life, propagation of wildlife, recreation involving contact with the water, recreation not involving contact with the water, and industrial supply.
- The lowest standards are reserved for Class D waters, which include waters or portions of waters located in areas of urban development, highly industrialized or intensively used for agriculture or a combination of all the above and where effluent sources include a multiplicity of waste discharges from the highly altered watershed. The beneficial uses of class D waters are recreation not involving contact with the water, aquatic life, propagation of wildlife, irrigation, watering of livestock, and industrial supply except for food processing purposes.

Water quality standards for this study's priority pollutants for class waters include total phosphate and total dissolved solids. Tables 3.3 and 3.4 summarize the classification of waterbodies included in this study and the applicable standards for the priority pollutants. Additional standards are provided in NAC 445A.

Currently, the Nevada Division of Environmental Protection (NDEP), as required by the Clean Water Act, is reviewing the water quality standards for the Class Waters, generally the smaller streams. Class waters in the Steamboat watershed include Steamboat, Whites, Galena, Ophir and Franktown creeks, and Washoe and Davis lakes. Alum, Evans, Dry, Thomas, Browns, Davis, and Muskgrove (Lewers) Creeks are not included in the Nevada Administrative Code (NAC) covering water quality standards. These creeks would have water quality standards set under the "Tributary Rule", which assign the same standards that the water is a tributary to, i.e.. Steamboat Creek or Washoe Lake. NDEP plans on adding these creeks to the NAC in 2003 as either class or designated waters and plan on conducting workshops in the summer and fall of 2003. A draft rational will be available for public review prior to the workshops, and the proposed regulation changes will then be submitted to the State Environmental Commission and later to the USEPA for final adoption. NDEP is presently reviewing the process that it uses to establish antidegredation water quality standards (RMHQs). Once this review is completed, probably the summer of 2004, NDEP will look to establish RMHQs on Steamboat, Whites, Galena, Ophir and Franktown creeks.

Table 3.3
Water Quality Standards for Class Waters

Class	Item	Specifications
A	PO4- Orthophosphate	Must not exceed 0.15 mg/l in any stream at the point where it enters any reservoir or lake, nor 0.075 mg/l in any reservoir or lake, nor 0.30 mg/l in streams and other flowing waters.
	Total dissolved solids.	Must not exceed 500 mg/l or one-third above that characteristic of natural conditions (whichever is less).
B	PO4-Orthophosphates.	Must not exceed 0.3 mg/l.
	Total dissolved solids.	Must not exceed 500 mg/l or one-third above that characteristic of natural conditions (whichever is less).
C	PO4-Orthophosphates.	Must not exceed 1.0 mg/l.
	Total dissolved solids.	Must not exceed 500 mg/l or one-third above that characteristic of natural conditions (whichever is less).
D	PO4-Orthophosphates.	No standard
	Total dissolved solids.	No standard

Table 3.4
Class Waters Within Study Area

Class	Water	HR	HA	Description of Area Classified
A	Franktown Creek	6	89	From its origin to the first irrigation diversion.
	Galena Creek	6	88	From its origin to the east line of section 18, T. 17 N., R. 19 E., M.D.B. & M.
	Hunter Creek	6	91	From its origin to Hunter Lake.
	Ophir Creek	6	89	From its origin to old U.S. Highway 395.
	White's Creek	6	87	From its origin to the east line of section 33, T. 18 N., R. 19 E., M.D.B. & M.
B	Franktown Creek	4	89	From the first irrigation diversion to Washoe Lake.
	Galena Creek	6	88	From the east line of section 18, T. 17 N., R. 19 E., M.D.B. & M. to gaging station number 10-348900 located in the SW 1/4 SW 1/4, section 2, T. 17 N., R. 19 E., M.D.B. & M.
	Hunter Creek	6	91	From Hunter Lake to its confluence with the Truckee River.
	Ophir Creek	6	89	From old U.S. Highway 395 to Washoe Lake.
	White's Creek	6	87	Below the east line of section 33, T. 18 N., R. 19 E., M.D.B. & M.
C	Galena Creek	6	88	From gaging station number 10-348900 located in the SW 1/4, SW 1/4, sec-tion 2, T. 17 N., R. 19 E., M.D.B. & M., to its confluence with Steamboat Creek.
	Steamboat Creek	6	87, 88, 89	From Little Washoe Lake to gaging station number 10-349300 located in the S 1/2, section 33, T. 18 N., R. 20 E., M.D.B. & M.
	Washoe Lakes	6	89	The entire lakes.
D	Steamboat Creek	6	87	From gaging station number 10-349300 located in S 1/2, section 33, T. 18 N., R. 20 E., M.D.B. & M. to its confluence with the Truckee River.

HR = hydrographic region
HA = hydrographic area

3.4 Current Water Quality

A common focus of watershed protection and management is in maintaining or improving upon the water quality of streams and rivers. Within this community the primary focus has been on the Truckee River. Indeed, the community has already spent substantial dollars on improving the quality of the Truckee and is prepared to spend much more. However, the efficiency of this effort could be jeopardized by poor water quality from the tributaries. The following sections describe the existing water quality of the Truckee River and the major tributaries.

Truckee River

A substantial effort has been in place for at least two decades on water quality monitoring of the Truckee River. This is in part due to TMDLs, listed in Table 3.1 that have been placed upon this river since 1994. Failure to meet these TMDLs will result in significant costs to improve on the water quality. Table 3.5 is an attempt to show the range in TDS loading from various sources during low flows (2001) and high flows (1998). The reader must understand that the values listed in concentrations (grab samples), flows (averaged daily averages) and loadings (calculated) have uncertainties that may exceed 20%. Flows and loadings do not add up to those calculated at Lockwood. Values used for 2001 represent low flow conditions (34% of normal precipitation) and values used for 1998 represent high flow years (118% of normal precipitation). This data is taken from TMWRF's database found online.

Table 3.5
Example of Average Total Dissolved Solids Loading to Truckee River

Truckee River or tributary discharge site	average TDS concentration mg/l		average flow cfs		average loading lbs/day		range in percentage of loading	
	2001	1998	2001	1998	2001	1998	low flow	High flow
Truckee River at E. McCarran	76	73	412	1267	169,000	499,000	46	45
N. Truckee Drain	471	392	9	9.3	23,000	20,000	6	2
Steamboat Creek	394	364	29	179	62,000	351,000	17	32
TMWRF*	330	370	25	30	45,000	60,000	12	5
Truckee River at Lockwood	145	124	467	1636	365,000	1,094,000	81	84

This figure indicates that the TDS loading to the Truckee River doubles between McCarran and Lockwood in large part due to Steamboat Creek (17-32% of increase), the North Truckee Drain (2-6% of increase), and TMWRF (5-12% of increase). Clearly Steamboat Creek is the largest contributor of "pollutants" to the Truckee River.

Table 3.6 displays TMDL constituents for various reaches of the Truckee River[1]. This Table further illustrates the impact of water quality degradation to the Truckee from various "pollutant" sources between Farad and Lockwood. The TDS concentration doubles at Lockwood from the average value found at E. McCarran due to Steamboat Creek, the North Truckee Drain and TMWRF discharges. Total phosphorus and total nitrogen increase an order of magnitude. It should be clear that while TMDLs are still being met, non-point and point sources of nitrogen, phosphorus and TDS need to be controlled.

Table 3.6
Water Quality for Truckee River

	Minimum, mg/l	Date of Minimum	Maximum, mg/l	Date of Maximum	Annual Average, 1988 – 2000, mg/l
Truckee River at Farad					
TN	0	9/3/97	1.08	12/6/95	0.32
TP	0.005	3/1/95	0.101	6/28/97	0.02
TDS	48	6/5/91	148	11/2/94	75
Truckee River at E. McCarran Blvd.					
TN	0.003	10/16/00	1.78	3/5/91	0.32
TP	0.001	12/4/01	0.036	3/5/91	0.03
TDS	44	7/11/95	175	12/5/90	84
Truckee River at Lockwood					
TN	0.2	3/10/99	11.72	9/22/88	1.16
TP	0.03	5/16/95	0.58	9/4/90	0.11
TDS	63	6/16/95	440	9/19/94	160

Steamboat Creek

Within Washoe County, Steamboat Creek is the largest tributary to the Truckee River. It is also the major source of pollution to the Truckee River. The quality of Steamboat Creek degrades from relatively clean water to relatively polluted water along its fifteen mile course from Washoe Lake to the Truckee River. This is shown in the following table by tracking TDS downstream from Washoe Lake.

Table 3.7
Bimonthly Water Quality Data for Steamboat Creek, Above and Below Confluence with Galena, White's and Thomas Creeks

	Minimum, mg/l	Date of Minimum	Maximum, mg/l	Date of Maximum	Annual Average, 1988 – 2000, mg/l
SB3: Steamboat Creek in Pleasant Valley upstream of confluence with Galena Creek (Class C)					
TN	0.14	8/16/94	1.8	8/8/00	0.632
TP	0.04	12/7/93	0.8	8/8/00	0.183
TDS	121	12/5/98	372	8/8/00	209
TSS	1	12/5/89, 2/13/01	90	4/10/00	14.7
SB7: Steamboat Creek at Geiger Grade downstream of confluence of Galena Creek and upstream of confluence with White's and Thomas Creeks (Class D)					
TN	0.19	8/14/01	2.05	10/6/93	0.610
TP	0.11	6/13/95	0.88	8/14/91	0.304
TDS	111	6/13/95	1871	10/13/92	518
TSS	0	8/14/01	86	10/6/93	16.6
SB11: Steamboat Creek at Short Lane downstream of confluence with White's and Thomas Creeks (Class D)					
TN	0.3	6/10/97	2.8	6/5/90	0.989
TP	0.12	10/13/98	0.96	6/5/90	0.351
TDS	151	6/13/95	1362	2/10/98	646
TSS	3	6/7/94	238	6/5/90	40.1
Steamboat Creek upstream of Truckee Meadows Water Reclamation Facility (class D)					
TN	0.228	11/08/88	4.06	1/09/95	1.30
TP	0.134	10/13/86	0.799	3/25/98	0.27
TDS*	173*	7/11/95	674*	10/14/92	360*
TSS	NA	NA	NA	NA	NA

*This row uses 1992 to 2000 data only whereas other data from 1988 to 2000.

TDS increases from Pleasant Valley (209 mg/l) to Geiger Grade (518 mg/l). An increase continues through the South Truckee Meadows to Short Lane Road (646 mg/l), and along the

eastern edge of the Central Truckee Meadows to the confluence with the Truckee River (360 mg/l). The sources of the pollution are farming and livestock activities adjacent to the creek, poor quality groundwater and geothermal discharges to the creek, and discharges from Yori, Rio Poco and Boynton drains.

North Truckee Drain

The North Truckee Drain originates in Spanish Springs. Well over 100 years of farming with Orr Ditch water created the need for the drain. The City of Sparks has used the drain for stormwater discharges and has developed the drain as a public amenity. However, water quality could be improved upon, especially in the reach south of Interstate 80. Table 3.8 lists the water quality of the drain at the confluence of the Truckee River where the TDS average is 390 mg/l. Flows average 15-25 cfs.

Table 3.8
Water Quality of North Truckee Drain[2]

	Minimum, mg/l	Date of Minimum	Maximum, mg/l	Date of Maximum	Annual Average, 1985 – 2001, mg/l
TN	0.608	9/22/98	3.48	4/21/98	1.63
TP	0.01	11/13/00	0.413	1/21/97	0.144
TDS	149	09/15/97	1039	2/8/99	390

[2] Date taken from TMWRF data set.

Steamboat Tributaries

In addition to the one-time samples collected for this study (see assessment), limited water quality data is available for most of the tributaries. Bimonthly sampling data from Nevada Division of Environmental Protection is available for Galena Creek, Whites Creek and Thomas Creek. Data from samples collected at the mountain front from October 1987 to April 2001 are presented in Table 3.9. The data can be used to compare water quality in these three creeks at this relatively "pristine" point to water quality standards for class waters and water quality standards for the Truckee River.

Average annual values of total nitrogen (TN), total phosphorus (TP) and total dissolved solids (TDS) are highest for Galena Creek; average annual total suspended solids (TSS) is highest for White's Creek. While all values conform with the Class A waters standards, as a point of comparison, average annual TN for Galena Creek and Thomas Creek exceeds the requirements to maintain existing higher quality for the Truckee River at East McCarran (≤0.3 mg/l). The single value is also exceeded (≤0.43 mg/l) in all three creeks.

Table 3.9
Bimonthly Water Quality Data, Mountain Front Sampling Points

	Minimum, mg/l	Date of Minimum	Maximum, mg/l	Date of Maximum	Annual Average, 1988 – 2000, mg/l
Galena Creek					
TN	0.17	6/5/91, 9/8/93, 6/13/00	1.14	2/2/99	0.45
TP	0.02	12/2/91, 7/7/93, 4/9/97	0.12	8/10/99	0.04
TDS	49	6/15/99	147	2/15/95	97
TSS	0	12/7/93, 4/14/98, 10/10/00	40	4/9/96	7

	Minimum, mg/l	Date of Minimum	Maximum, mg/l	Date of Maximum	Annual Average, 1988 – 2000, mg/l
White's Creek					
TN	0.08	10/13/92	0.67	6/8/93	0.27
TP	0.02	Numerous	0.19	6/15/99	0.04
TDS	37	6/10/97	85	4/8/89	62
TSS	0	2/12/97, 8/12/97, 4/14/98	131	6/15/99	13
Thomas Creek					
TN	0.1	10/9/90	1.02	8/13/96	0.32
TP	0.04	numerous	0.12	9/8/93	0.06
TDS	55	6/15/99	107	2/15/99, 8/11/98	88
TSS	0	2/12/97	32	8/7/90	9.5

Other Tributaries

There is little water chemistry data for any of the creeks not already discussed. During the autumn of 2001, water chemistry samples were taken at the confluences with the Truckee River for the creeks listed in the table below. These data represent low flow conditions. Because of the limited size of the data set, more aggressive surveys should be undertaken to better sample normal flow and stormwater runoff. Until this is accomplished, the effects of urbanization upon the creeks will be poorly understood. However, the data to date are illustrative of the magnitude of the existing water quality.

Table 3.10
Single Sample Water Quality Data for Creeks Tributary to the Truckee River

Creek	Total Nitrogen mg/l	Total Phosphorus mg/l	Total Suspended Solids mg/l	Total Dissolved Solids mg/l
lower Dog	0.2	0.03	3	172
lower Hunter	0.15	0.05	5	116
lower Alum	0.58	0.11	16	740
lower Chalk	3.35	0.26	<1	3,080
Dry-Boynton	2.12	0.14	16	374
lower Thomas	0.78	0.1	21	172
lower Whites	0.26	0.02	<1	62

Data for this table are found in the report "Watershed Assessment for Tributaries to the Truckee River", see references in this volume.

From this table it is seen that Alum Creek and particularly Chalk Creek add significant concentrations of TDS to the Truckee River. This is the result of changes in land use to agricultural (Alum Creek), residential and commercial development. Differences in land use are also seen in comparing Whites and Thomas creeks where TDS and TSS are much higher at Thomas. Both of these creeks have identical water quality upstream of developed lands. The quality of Boynton Slough is the result of land development drainage to this water body.

3.5 Water Quality Goals

Existing water quality should be improved or maintained for several reasons. First and foremost is that the Truckee River is our main source of public drinking water. Any water quality degradation should not be acceptable for obvious reasons. Second, to meet the water quality standards or TMDLs set for the Truckee River. If the water quality of tributaries to the Truckee River degrade, the Truckee River also degrades and TMDLs could be seriously

impacted. Exceeding TMDLs could result in this community having to construct and operate expensive water quality treatment plants in order to meet the TMDLs. Conversely, improving the water quality in the Truckee River, especially near Steamboat Creek and North Truckee Drain confluences with the Truckee River, could result in renegotiations of the TMWRF discharge permit in terms of pollutant trading. This could significantly reduce future costs at TMWRF. Third, there is increasing pressure from the US EPA to meet water quality standards for these tributaries. By meeting these standards or goals, the community can avoid having TMDLs set for these tributaries. Fourth, aquatic and riparian habitats are negatively impacted by the degradation of water quality. An increase in algal growth will occur with increases in nutrients (nitrogen and phosphorus) that can overwhelm the creek channel. Algal growth is not only unsightly, but destroys the natural aquatic life. Fifth, the fact that we can improve the water quality makes it a good reason.

Table 3.11 lists water quality values of the study area tributaries for total dissolved solids (TDS), total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS). A water quality goal is also stated. Most of these creeks have had very limited sampling, but the values listed, particularly for phosphorus and total dissolved solids, give a good first order of their average concentrations during non-storm periods. The water quality values shown are representative of the lower reaches of each tributary and are not representative of the entire stream reach. For tributaries emanating from the mountain blocks, water quality is low in TDS and nutrients (see Table 3.9). The criteria for setting these qualitative goals is based upon the upper watershed chemistry and the assessment survey (Widmer and Jesch, 2002). Figure 3.1 shows sites where water quality sampling should be taken to monitor future improvements.

A goal of "Maintain" implies that water quality does not degrade from the mountain block to a confluence. Conversely "Improve or reduce" goals indicate that water quality does degrade and that it can be improved and specific constituents are consequently listed. Where water quality does not exist goals are set based upon the assessment report. Numeric goals were not set because there wasn't any justification for setting absolute goals or if they were attainable. In terms of reducing TDS concentrations, prioritization should be given to Chalk Creek, Alum Creek, the North Truckee Drain, Steamboat Creek, Boynton Slough, Dry Creek, and Evans Creek. Chapter 4 discusses methodologies that, if employed, can be used to maintain water quality. Other methods to improve on water quality should be employed where water quality does not currently meet these goals.

Nitrogen and phosphorus, or nutrients, are found in creeks as a result of over fertilization of lawns and from farming and livestock practices near creeks. Areas of concentrated septic tanks can also influence water quality downstream of these areas where groundwater seeps into the creek channels. Total Suspended Solids result due to sediment loading from unstable banks sloughing into the stream channels. Total Dissolved Solids are the result of natural occurrence from the decomposition of organic material, groundwater discharge to the creeks, nutrients as stated above, trash, and excessive sediment.

Water quality degradation also occurs due to storm events because the runoff ends up in our tributaries. Some of this is naturally occurring, but the greater contributor is the result of changes in land use. For example, stormwater runoff from streets and parking areas results in suspended sediment loads and increases in pollutants. Stormwater runoff from lawns increases nutrients and other pollutants. And increases in stream flow due to stormwater discharge increases the erosive nature of these events upon the creek channels themselves, destroying their ability to function properly.

In conclusion, water quality degradation is the result of man's influence upon the watershed. By changing the way we alter or maintain the land, we can improve or maintain the quality of our waters. In many cases, this should not be viewed as expensive or difficult. Chapter 4 discusses methods to improve the condition of certain tributary reaches and to improve their

water quality. Chapter 6 discusses management techniques to improve the overall watershed condition.

Table 3.11
Water Quality and Proposed Goals for Tributaries to the Truckee River (mg/l)

Creek (State designated class water)	# samples (record)	TDS avg. value of record	TP avg. value of record	TN avg. value of record	TSS avg. value of record	water quality goal
Dog	1	172*	0.03*	0.2*	3*	maintain
Sunrise	none	na	na	na	na	improve
Tower	none	na	na	na	na	maintain
Hunter (B)	3	109	0.04	0.24	3	maintain
Alum (**)	4	400	0.16	0.61	34	reduce TDS, TN, TSS, TP
Bull Ranch	none	na	na	na	na	maintain
Unnamed	none	na	na	na	na	maintain
Chalk	1	3,080*	0.26*	3.35*	<1*	reduce TDS, TN, TP
N.Truckee Drain	(1988-2002)	149-1039	0.01-0.4	0.6-3.5	na	reduce TDS, TN
Upper Steamboat	(1987-2002)	111-1871	0.1-0.9	0.19-2.0	0-86	reduce TDS, TSS, TN
Lower Steamboat (D)	(1987-2002)	173-674	0.13-0.8	0.23-4.1	na	reduce TDS, TP, TN
Boynton	1	374*	0.14*	2.12*	16*	reduce TDS, TN
Dry (**)	3	228	0.23	1.3	35	reduce TDS, TN, TP, TSS
Evans (**)	3	193	0.14	0.76	22	reduce TN, TSS
Thomas (**)	4	160	0.1	0.72	11	maintain
Whites (B)	1	62*	0.02*	0.26*	<1*	maintain
Galena (C)	(1987-2002)	49-147	0.02-0.12	0.17-1.1	0-40	maintain
Browns (**)	3	89	<0.01	0.26	4	maintain
Ophir (B)	1	60*	0.02*	0.26*	4*	maintain
Franktown (B)	3	69	0.03	0.32	8	maintain
Muskgrove (**)	1	146*	0.12*	0.88*	10*	maintain or improve
Jumbo	none	na	na	na	na	improve

* indicates from single sample

**Class water designation to be set in 2003

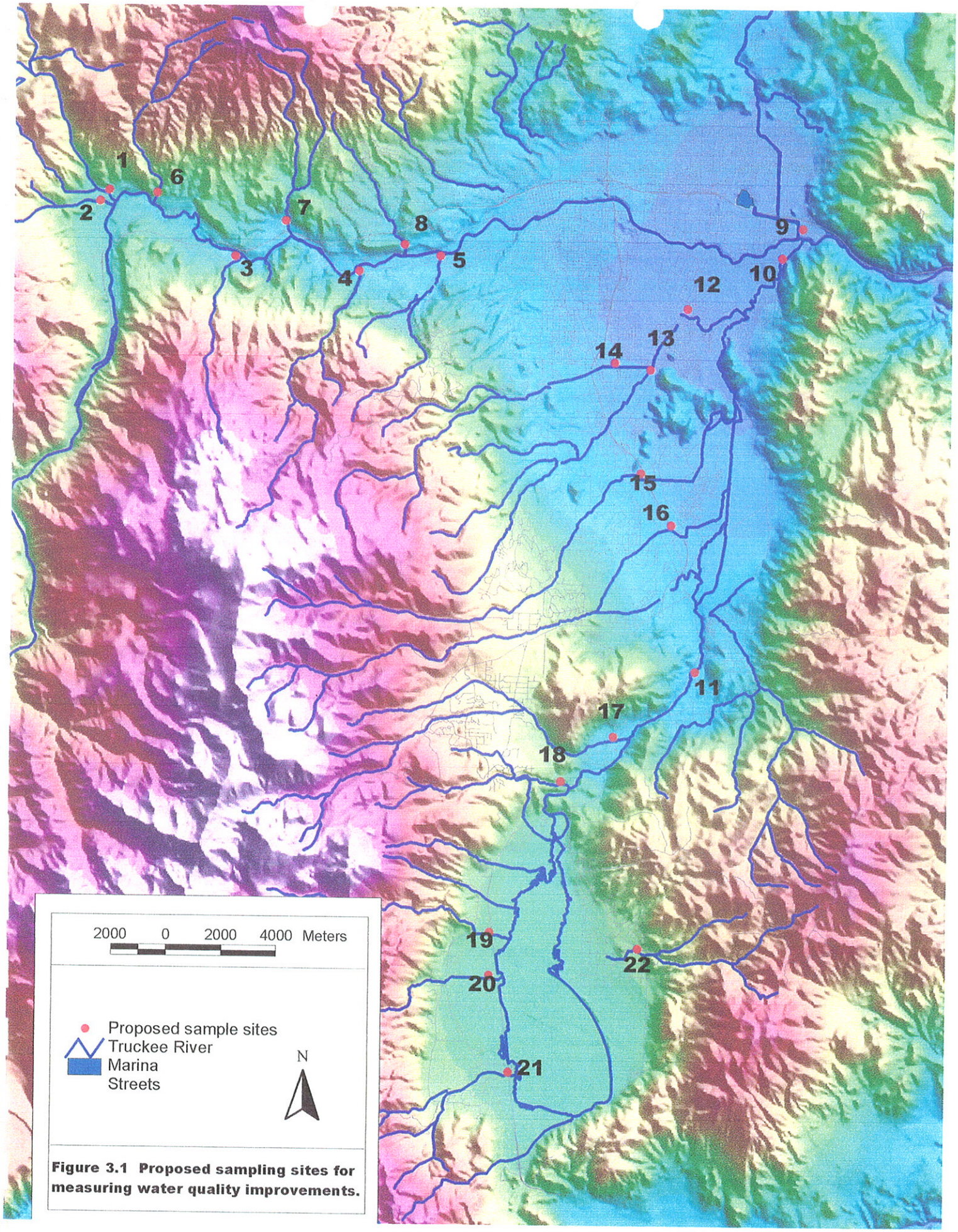


Figure 3.1 Proposed sampling sites for measuring water quality improvements.

Chapter 4

Assessment of Tributaries

Purpose and Scope

Monitoring and assessment provide information on which to base plans for effective actions. This chapter summarizes the assessments made for the watersheds listed in Chapter 1. Most attention was given to the larger, perennial streams. The assessment included geographic and hydraulic descriptions of the streams, physical descriptions in terms of the geology soils, slope, wetlands, areas prone to flooding, vegetative cover, and land use. Sanitary surveys were conducted to locate, within 300 feet of streams, potential sources of pollution to the streams such as hazardous material, landfills, road de-icing material, pesticides and herbicides at golf courses, and large concentrations of septic tanks. Limited water quality sampling was also undertaken. A more detailed summary for each sub-watershed can be found in Appendix 2.

Summary of Findings

General recommendations and specific areas of concern were identified through the watershed assessment process. The general recommendations can be addressed through cooperative efforts with the stormwater and floodplain management implementation plans and assistance from the Washoe-Storey Conservation District and the University of Nevada Cooperative Extension. Management and restoration methodologies are described to address the specific areas of concern. Many of the management techniques are essentially educational and require changes in land use practices. Restoration techniques range from re-establishing habitat buffers that are relatively inexpensive to streambed reconfigurations that are relatively expensive. Action items to maintain or improve water quality and to protect steams, road infrastructure, and property are proposed.

4.1 Assessments

The Regional Water Planning Commission published an assessment report "Watershed Assessment for Tributaries to the Truckee River" on July 30, 2002 (Widmer and Jesch, 2002). This was done to provide the community a report card on the urban effects upon our watersheds. While this report contains substantial mapping of geographical information, stream surveys provided a first hand accounting of the condition of the watersheds. These noted the conditions of the stream reaches and should be used to trace the sources of watershed problems.

Stream Surveys

During the months of January and February 2002, field surveys of the streams were conducted. These surveys made assessments of the "functionality" of these streams. A properly functioning stream, as described by the US Bureau of Land Management (1988), can:

- dissipate stream energy associated with high water flow, thereby reducing erosion and improving water quality;
- filter sediment, capture bedload, and aid floodplain development;
- improve flow-water retention and ground water recharge;
- develop root masses that stabilize streambanks against cutting action;

- develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding and other uses; and
- support greater biodivesity.

The assessment format was adapted from the US Bureau of Land Management (BLM, 1998). Several reaches of each stream were assessed for its functionality based upon loss of habitat, excessive erosion and water quality degradation, development encroachment, and invasive plant species such as Tall Whitetop.

The stream reaches were then rated as "Properly Functioning", "Functioning at Risk", and "Non-Functional" based upon loss of habitat, excessive erosion and water quality degradation, development encroachment, and invasive plant species (Tall Whitetop). Impacted stream zones deemed "Critical" for this report reflect where the stream is no longer functioning properly. "Sensitive" sections refer to a "Properly Functioning Stream at Risk" whereby the stream could easily be rendered "Critical" through improper land use. The results were mapped for individual study areas in Figures 4.1 - 4.4 and the descriptions can be found in Appendix 2. The following General Recommendations for the study area are made.

General Recommendations

The results of these stream assessments are to be used to help develop sub-watershed management programs. The findings were shared with the Watershed Protection Planning Group as a starting point for the development of this plan. The recommendations made are based upon maintaining or improving the functionality of each stream. These general recommendations are further in Chapter 6, Management Objectives.

1. A more detailed erosion and sediment source survey should be made for each creek. This will help identify areas where improvements to water quality and sediment transport can be made. The surveys can be conducted at a very low cost. (support for stormwater monitoring efforts.)
2. Conduct water quality monitoring in association with the stormwater management program. This would include sediment loading sources, construction site erosion, urban runoff, and golf course management of chemicals. (Help satisfy stormwater NPDES element.)
3. Increase construction site erosion control through enforcement and education in association with the stormwater quality program. Currently, erosion control measures at construction sites near streams and drainages are not always effective. (Help satisfy stormwater NPDES element)
4. Expand existing water quality data collection to include sampling of several reaches of priority streams to reflect impacts of changing land use. To date there is little or no information on water quality for several of these creeks. This type of program would be effective in periodically assessing the condition of the watershed. The sampling should be conducted during wet and dry conditions. This could be done two or three times a year for three years followed by periodic sampling. (Assists stormwater group in meeting measurable goals.)
5. Each creek should be analyzed for increased management or restoration potential, if needed. Analysis' needed include project description, feasibility, limitations and first approximation cost estimates. This type of work can be as simple as re-vegetating the creek with native plants, fencing reaches for livestock control, or allowing the creek access to a natural flood plain. It could also be expensive such as redesigning and constructing culverts at major road crossings.
6. A public education program on the Stream Ordinance is strongly recommended for unincorporated area residents. This may also include a survey of individual lots and communication with these owners. (CAB/NAB effort w/ Coordinator)
7. A regional stream ordinance policy is needed in Washoe County, Reno and Sparks. This is to help restrict development's encroachment upon creeks and the North Truckee Drain. It could also be used to bring these water features to the public's attention and thereby increase public

support for access, enhancement and/or restoration. An active public education program is also needed. (Coordinator effort)

8. The City of Sparks and Washoe County should explore recreational development of the Orr Ditch and North Truckee Drain throughout its course in Spanish Springs. This could entail the same type of design the City of Sparks has done for the drain south of Shadow Lane. The design might actually increase the drain width, develop room for more flood plain, and increase native vegetation. This would provide wildlife habitat and result in a water feature that increases the quality of life for the City of Sparks community.
9. A Tall Whitetop Eradication program is strongly recommended for the flood plain area of the South Truckee Meadows, generally east of US 395, Chalk Creek and the North Truckee Drain. Programs for eradication are available. Because this invasive plant is so wide spread, total eradication would be relatively expensive and lengthy. (UNCE effort, but needs funding.)
10. Restoration efforts on Jumbo Creek should be undertaken to eliminate erosion, restore the creek to its natural state and to create improved flood protection. (CAB/Washoe County/BLM effort)
11. Ranching operations are potential sources of nutrient (nitrogen and phosphate) loading to the Truckee River, particularly for Thomas, Evans and Sunrise Creeks. Effective land management practices and education should be used to alleviate this problem. (Coordinator/UNCE)
12. Although not discussed in detail, natural groundwater recharge sites should be identified and prioritized to avoid loss of these essential areas to urbanization such that development does not "pave over" these sites. This can be achieved through a land use reclassification. To be effective there should be a "communication" effort between land owners, planners and future developer activity towards preservation of these lands. (Land use planning)
13. Finally, on site stormwater retention for individual homes should be pursued through current and innovative architectural designs. (Land use planning)

4.2 Management and Restoration Approaches

The results of the stream surveys, as detailed in the Watershed Assessment Report (Widmer and Jesch, 2002) were compiled into Tables 4.1 and 4.2 with the locations shown in Figures 4.1 – 4.4. The tables list the reaches for which management and restoration efforts are needed. Management efforts are those that require changes in practices on adjacent lands. Restoration efforts require actual changes in the stream itself. These can often be extensive and long-term efforts. This section explains the action item methodologies listed in Tables 4.1 and 4.2.

Management

Effective watershed management prevents watershed degradation, improves habitat for wildlife and helps the region meet water quality standards. Effective management policies are very economical when compared to stream and wetland restoration. Management efforts can be accomplished through ordinance enforcement, construction practices, re-construction work, land use changes, and public education. For example, Washoe County has recently adopted the "Significant Hydrologic Resources" ordinance (Article 418) that requires construction setbacks from perennial streams. However, many examples of violations to this ordinance were found. It was obvious that knowledge of this ordinance within the construction permitting process, enforcement and public education are lacking or non-existent. This will continue to be a problem especially as the Cities of Reno and Sparks incorporate undeveloped lands. Indeed, effective efforts towards re-establishing vegetative buffers along our creeks would do much in reducing stormwater quality impacts as well as erosional impacts and floods.

Another example of management efforts includes more effective stormwater management. Currently, there is a substantial stormwater management and quality effort being conducted by Reno, Sparks and Washoe County. Stormwater discharges have the most negative effect upon our streams and drainages. It is expected that this watershed protection plan will be incorporated into those stormwater efforts. The following description of Table 4.1 management methodologies follows.

- **Public education and outreach:** Educational material that describes the impact of polluted storm water and describes steps to reduce pollution can be distributed. This may include information about proper septic tank maintenance, livestock management on small ranches, limiting use and runoff of garden chemicals, and storm drain stenciling. Public education efforts occur at several levels. Public schools are primary locations for educating our young citizens who one day will be land owners, public officials and developers. Advisory Boards must be made aware of and indeed play an active and pronounced role in watershed protection efforts. This is a reasonable expectation because these boards have vested and special interests in protecting their immediate environment. "Grass Root" efforts have been proven time and again as effective in producing long term preservation.
- **Planning:** Policies and ordinances should limit growth to identified locations that protect sensitive areas such as wetlands and riparian zones. Proper planning minimizes disturbance of soil and vegetation and encourages development to install structural controls such as detention/retention basins, infiltration facilities, and develop in ways that reduce impervious cover by utilizing narrow streets and porous pavement.
- **Chemical controls:** Golf courses and parks contribute significant quantities of fertilizer and pesticides to the watershed. Vegetated buffer zones that include native grasses and woody vegetation should be established along water ways where fertilizer and pesticides are applied. Developers should be required to develop and implement chemical application plans that minimize impacts to water quality. Plans should include inspections, monitoring and self reporting.
- **Illicit discharge controls:** Storm water system maps should be prepared and updated periodically. Municipalities should implement plans to detect illicit discharges and dumping and an education system should be incorporated that informs the public and business of the hazards of illegal discharges
- **Buffer Zones:** Strips of undisturbed vegetation along wetlands and riparian zones that filter suspended solids, nutrients and dissolved solids in stormwater runoff should be encouraged. Existing buffer zone codes should be enforced and regional standards should be established that require buffer zones along wetlands and streams throughout the region.
- **Control storm water pollution from construction sites:** Effective Storm Water Pollution Prevention Plans (SWPPPs) should be developed for construction sites that disturb more than one acre. The plans should be reviewed and approved by local jurisdictions and effective monitoring and enforcement programs should be developed both locally and at the state level to ensure the SWPPPs are properly implemented.
- **Reduce Animal Impacts:** Only a few reaches of streams were significantly affected by livestock impacts. Educational programs can be practiced to reduce or eliminate these impacts. Monies for some capital expenses can be obtained through grants. However, private land management changes must be palatable to ranchers for any effective change to occur, thus difficult to achieve. In the long term, these lands may become residentially developed in which case livestock problems can be eradicated.

Table 4.1

Stream Management Action Items

	Functional Rating	Trend	Stormwater runoff treatment	Reduce chemical applications	Encourage riparian buffers	Public education	Reduce animal impacts	Enforce construction site BMPs	Control vehicle impacts	Control building site encroachment	Control road encroachment	Invasive weeds, others
N. Carson-Peavine-Verdi												
Hunter Creek	PFC											
Alum Creek 1	F-AR	D		X	X	X		X				
Alum Creek 2	PFC	NA										
Alum Creek 3	F-AR	NA		X	X	X						
Dog Creek	F-AR	U										
Dog Creek 2	F-AR	D				X				X	X	X
Sunrise Creek	PFC											
Unnamed (Llama Ranch)	NF	D	X		X	X	X				X	X
Chalk Ck/Rainbow Ck	F-AR	NA										X
Chalk Ck/Rainbow Ck 2	F-AR	NA		X		X					X	
Unnamed Channel 2	F-AR	D	X	X	X	X		X		X	X	
North Truckee Drain												
North Truckee Drain 1	F-AR	U	X		X			X		X		
North Truckee Drain 2	F-AR	NA	X				X	X				
North Truckee Drain 3	F-AR	NA	X									
North Truckee Drain 4	NF	NA	X	X		X		X				X
South Truckee Meadows												
Evans Creek 1	PFC											
Evans Creek 2	NF	D				X	X					
Evans Creek 3	NF	D	X				X	X		X		
Dry Creek 1	PFC											
Dry Creek 2	NF	D	X		X	X	X	X				
Dry Creek 3	F-AR	U										X
Dry Creek 4	NF	NA										
Thomas Creek 1	F-AR	NA			X	X		X		X		
Thomas Creek 2	PFC	NA										
Thomas Creek 3	PFC	NA										
Thomas Creek 4	F-AR	U			X	X	X	X		X	X	
Thomas Creek South Fork	NF	D			X					X		

PFC = Proper functioning condition F-AR = Functional - at risk NF = Nonfunctional

U = Upward trend D = Downward trend NA = Not apparent (trend)

Stream reaches may be numbered from most upstream location (1) to downstream locations (2 or 3)

Table 4.1 (cont.)

Stream Management Action Items

	Functional Rating	Trend	Stormwater runoff treatment	Reduce chemical applications	Encourage riparian buffers	Public education	Reduce animal impacts	Enforce construction site BMPs	Control vehicle impacts	Control building site encroachment	Control road encroachment	Invasive weeds, Other
Whites Creek 1	F-AR	D	X		X	X		X		X		
Whites Creek South Fork 1	F-AR	NA			X	X				X		
Whites Creek South Fork 2	F-AR	D			X					X		
Whites Creek South Fork 3	F-AR	U						X				X
Whites Creek North Fork 1	F-AR	D						X				X
Whites Creek North Fork 2	NF	D	X	X	X	X		X		X	X	X
Whites Creek North Fork 3	F-AR	U	X			X		X				
Jones Creek 1	F-AR	D	X									
Jones Creek 2	NF	D										
Galena Creek 1	PFC											
Galena Creek 2	PFC											
Galena Creek 3	F-AR	NA			X		X					
Galena Creek 4	F-AR	U			X	X	X					
Browns Creek 1	PFC											
Bailey Creek 1	F-AR	D								X		
Washoe Valley												
Ophir Creek 1	F-AR	U										
Franktown Creek 1	PFC											
Franktown Creek 2	PFC											
Musgrove Creek 1	F-AR	NA	X	X	X	X	X		X			
Musgrove Creek 2	NF	NA		X	X	X	X			X		
Jumbo Creek 1	NF	D				X			X		X	
Jumbo Creek 2	NF	D								X	X	

PFC = Proper functioning condition
F-AR = Functional - at risk
NF = Nonfunctional
U = Upward trend
D = Downward trend
NA = Not apparent (trend)
Stream reaches may be numbered from most upstream location (1) to downstream locations (2 or 3)

Restoration

Stream and wetland restoration can range from expensive projects that require extensive grading and structural controls to inexpensive efforts that involve simple revegetation projects that utilize volunteer labor. Restoration planning and project coordination can be complex in some cases, especially if multiple property owners are involved. In almost all cases preserving riparian areas through proper management is preferred. However, Citizen/Neighborhood Advisory Boards may be very effective in conducting smaller restoration efforts with volunteer work. And there may be tax incentive opportunities for contractor volunteer efforts. The following description of Table 4.2 restoration action item methodologies follows.

- **Biotechnical stream stabilization:** These systems use vegetation alone or in combination with structural and mechanical components to stabilize soils. Biotechnical systems are strong initially and grow stronger with time as vegetation becomes established. These systems can successfully stabilize shallow slopes; however, they are not suitable to resist large lateral pressure.
- **Modify storm water runoff and sediment loads:** Installation of retention/detention basins remove sediment and reduce peak storm flows. Storm water conveyance systems are often a source of sediment. Drainage swales should be armored with vegetation, turf reinforcement mat or rock rip rap. Energy dissipation should be installed at culvert outfalls especially where they enter riparian areas.
- **Structural grade controls:** Channel incision often results from urbanization and encroachment by development. Incised channels continue to erode, inhibiting vegetation and contributing sediment to the watershed. Grade control structures are series of small dams, often rock or concrete, that create drop-pool features which effectively raise the stream channel bottom. This reduces stream velocity, reduces erosion, allows the stream to access the floodplain during high flows and encourages revegetation.
- **Excavate to reestablish floodplain:** Incised channels will continue to down cut and widen until they reach equilibrium. At equilibrium the channel develops into a meandering stream with accesses to the floodplain during high flows. Excavation to create a natural appearing and natural functioning floodplain mimics the rejuvenation process.
- **Reshape banks:** Eroding vertical banks of incised channels are a source of sediment and can cause property damage. Reducing the steepness of stream banks reduces scour and erosion. The shaped banks can be replanted to increase resistance to erosion. Mechanical Toe protection, such as rock rip rap, in combination with revegetation is often used to further stabilize reshaped stream banks.

4.3 Specific Areas of Concern

From the assessment report (Widmer and Jesch, 2002) certain stream reaches were rated critical or sensitive. Descriptions of these reaches can be found in Appendix 2. This section generally describes their problems in terms of stream functionality (at risk or non-functional) and water quality. Section 4.4 proposes specific actions that can be taken to improve their condition.

Northern Carson-Peavine-Verdi Creeks

Only one creek has been rated critical within this sub-basin, drainage from the Sunrise Watershed in Verdi that flows off a llama ranching operation. Land use from this operation is causing erosion and pollution to the Truckee River. Unless livestock management improvements are made, the problem will become worse. The Truckee River is directly impacted by water quality degradation with the

Table 4.2

Stream Restoration Action Items

	Functional Rating	Trend	Modify SW runoff & sed loads	Raise channel bottom	Establish structural grade controls	Improve riparian vegetation	Create floodplain (excavate)	Shape banks	Install toe protection	Implement soil bioengineering	Other
Northern Carson-Peavine-Verdi											
Hunter Creek	PFC										
Alum Creek 1	F-AR	D				X					
Alum Creek 2	PFC	NA									
Alum Creek 3	F-AR	NA									
Dog Creek	F-AR	U							X		X
Dog Creek 2	F-AR	D							X	X	X
Sunrise Creek	PFC										
Llama Ranch	NF	D	X		X	X					X
Chalk Ck/Rainbow Ck	F-AR	NA									
Chalk Ck/Rainbow Ck 2	F-AR	NA									
Unnamed Channel 2	F-AR	D				X		X	X	X	
North Truckee Drain											
North Truckee Drain 1	F-AR	U	X			X	X				
North Truckee Drain 2	F-AR	NA	X			X	X				
North Truckee Drain 3	F-AR	NA	X			X	X				
North Truckee Drain 4	UK	NA	X			X	X	X			
South Truckee Meadows											
Evans Creek 1	PFC										
Evans Creek 2	NF	D				X	X	X		X	
Evans Creek 3	NF	D	X			X		X		X	X
Dry Creek 1	PFC										
Dry Creek 2	NF	D				X		X		X	
Dry Creek 3	F-AR	U									
Dry Creek 4	NF	NA				X	X	X			
Thomas Creek 1	F-AR	NA									
Thomas Creek 2	PFC	NA				X					X
Thomas Creek 3	PFC	NA									
Thomas Creek 4	F-AR	U				X				X	
Thomas Creek South Fork	NF	D				X	X	X		X	

PFC = Proper functioning condition
F-AR = Functional - at risk
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U = Upward trend
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NA = Not apparent (trend)
Stream reaches may be numbered from most upstream location (1) to downstream location (2 or 3)

Table 4.2 (cont)

Stream Restoration Action Items

	Functional Rating	Trend	Modify SW runoff & sed loads	Raise channel bottom	Establish structural grade controls	Improve riparian vegetation	Create floodplain (excavate)	Shape banks	Install toe protection	Implement soil bioengineering	Other
Whites Creek 1	F-AR	D									
Whites Creek South Fork 1	F-AR	NA				X		X			
Whites Creek South Fork 2	F-AR	D				X	X	X		X	
Whites Creek South Fork 3	F-AR	U				X					
Whites Creek North Fork 1	F-AR	D	X								
Whites Creek North Fork 2	NF	D	X			X	X	X		X	
Whites Creek North Fork 3	F-AR	U	X			X					X
Jones Creek 1	F-AR	D				X					
Jones Creek 2	NF	D				X	X	X		X	
Galena Creek 1	PFC										
Galena Creek 2	PFC										
Galena Creek 3	F-AR	NA				X	X	X		X	
Galena Creek 4	F-AR	U				X	X	X		X	
Browns Creek 1	PFC										
Bailey Creek 1	F-AR	D									
Washoe Valley											
Ophir Creek 1	F-AR	U									
Franktown Creek 1	PFC										
Franktown Creek 2	PFC										
Musgrove Creek 1	F-AR	NA	X			X				X	
Musgrove Creek 2	NF	NA				X	X	X			
Jumbo Creek 1	NF	D		X	X	X	X	X	X	X	
Jumbo Creek 2	NF	D		X	X	X	X	X	X	X	

PFC = Proper functioning condition

F-AR = Functional - at risk

NF = Nonfunctional

U = Upward trend

D = Downward trend

NA = Not apparent (trend)

Stream reaches may be numbered from most upstream location (1) to downstream location (2 or 3)

expectation that it will worsen. Tables 4.1 and 4.2 list specific methodologies that can be imposed to eliminate the livestock pollution and erosion. While the creek itself is still functional, it is at risk due to the erosion caused by the llama operation and stormwater from those lands that pass beneath Hill Lane.

Dog Creek water quality is expected to maintain its current water quality although septic tank effluent may become a problem if development increases upstream (no new development is currently proposed). The creek is functional, but at risk within the last 100 yards upstream of the Truckee River due to road impacts. Structural efforts will be necessary in order to minimize erosional damage to Dog Valley Road from flooding events.

The lower reaches of Alum Creek are rated as sensitive and water quality is expected to remain the same or degrade further. The creek itself is functional and can remain so, but alteration of the vegetation, development and road encroachment puts the creek at risk. Sediment control from new development must be enforced. A road maintenance plan for the Hunter Creek Road needs to be implemented for the upper drainage as increased stormwater flows will render lower Alum Creek nonfunctional over time. Water quality improvements can be made to the developed portions of the creek by replacing sod with native vegetation and creating a buffer between this sod and the creek. Currently, fertilization of the sod results in nutrient loading to the creek immediately upstream of the Truckee River.

Chalk Creek (a.k.a. Rainbow Creek) has very poor water quality and should be a high priority for improving. The quality is the result of urban development within the middle reaches where infiltration of irrigation water dissolves salts in the underlying sediments and discharges downstream to the drainage. Elimination of irrigation infiltration may not be possible as there are thousands of homes and several schools and parks. While Tables 4.1 and 4.1 list management and restoration efforts, a water quality treatment plant may be the only viable solution to improving this highly concentrated source of TDS pollution to the Truckee River. The creek is functional and not at risk until the lowest reach south of Interstate 80. This lower reach is subject to frequent flooding and structural flood control efforts should be implemented.

North Truckee Drain

The North Truckee Drain is not a natural stream. It was created decades ago to drain irrigation runoff and wetlands. It is rated sensitive throughout its course and it is rated as critical south of Interstate 80. Water chemistry degrades throughout its course, particularly in the lower reach. This is due to the erosion of the stream banks, the proliferation of Tall Whitetop, suspended sediment (transported to the Truckee River), the risk from various sources of pollution, and the lack of native vegetation. A significant effort would be required to restore the lower reach. Water quality is not expected to improve. Water quality improvements can be made, but are limited due to groundwater discharge to the drain that contains relatively high concentrations of dissolved solids (TDS). The Truckee River Flood Control Project has proposed to alter the course of the North Truckee Drain from its present location south of Interstate 80. If this proposal is implemented, the condition of the lower reach of the drain could improve substantially.

Urban development on the upper reach could help to restore or maintain functional sections of the drain. The City of Sparks intends to develop the drain as a water amenity or park, much like the drain is developed in the central reaches along Sparks Boulevard. Water quality can improve within the upper reaches if the drain is allowed an adequate floodplain, native vegetative buffers are planted and maintained, and if stormwater treatment is implemented prior to discharging to the drain.

Washoe Valley Creeks

Jumbo Creek, ephemeral in nature, is rated non-functional (critical) throughout its course. This is due to encroachment of the road paralleling most of its middle reach and encroachment from suburban development. Water quality has not been sampled as the creek is commonly dry.

During spring runoff, the creek probably carries a high sediment load. The functionality of the creek is expected to remain nonfunctional without significant restoration. Recommended restoration efforts should include excavation to create floodplain, grade control structures combined with bioengineering solutions that use vegetation to stabilize the channel, and re-routing drainage from the road. Re-vegetation is highly recommended throughout channel. The US Bureau of Land Management is considering a land use management plan that should help restore this watershed (USBLM, 2003).

Muskgrove (Lewers) creek is non-functional east of old US 395 due to its straight alignment and channelization through the suburban development. Water quality is degraded by nutrient loading (nitrogen and phosphorus) and suspended solids from erosion, livestock and the suburban encroachment (golf course and septic tanks). It is not expected to improve on its own. The functionality of this creek can be restored by widening the channel to provide sinuosity and a floodplain to the creek and by creating a re-vegetated buffer along the creek. On the Lightening W golf course, sod should be eliminated from the stream banks and replaced with native vegetation. Water quality can be improved through golf course and livestock management. However, septic tank effluent will continue to pollute this creek.

South Truckee Meadow Creeks

The South Truckee Meadows creeks all suffer from water quality degradation and stream functionality downstream of the mountain block. Generally these problems have mounted due to urban development, livestock grazing, and from the encroachment of properties that bound the creeks. Additionally, the effects from stormwater pollution and the erosion from culverts and drains have degraded these channels to some extent. They have largely been ignored as natural hydrologic amenities. East of South Virgina Street, the creeks have been realigned and entrenched for flood control or from the historical irrigation that occurred throughout the valley floor over the last 100 years. Water quality degrades downstream to the valley floor where groundwater discharge increases the TDS. Suspended sediment increases also from the steep sidebanks that have been constructed or developed through headcutting episodes (Whites Creek). However, advances are being made in new developments to correct these problems.

Galena Creek's functionality is at risk in the middle and lower reaches. The greatest risk on the Galena Fan (middle reach) is from stormwater events that provide erosion and sediment loads particularly at undersized culverts (Callahan Ranch Road). Unless structural changes are made, the functionality of this creek will deteriorate. Water quality is not endangered until the lower reaches where agricultural and livestock practices, as well as septic tank effluent, provide nutrients and suspended solids. Here water quality can be improved by implemented a change in land use management.

Whites Creek and Thomas Creek are at risk west of US Highway 395 where water quality degrades particularly on Thomas Creek due to livestock management and agricultural encroachment. Public education and management would greatly improve the water quality and prevent further degradation of these creeks. Mismanagement of fertilizers or effluent irrigation is impacting the water quality (algal blooms and nutrients) of Whites Creek immediately downstream of the Wolf Run Golf Course. This reach of Whites Creek is also severely impacted from erosion that has caused headcutting and slope instability of the stream channel. Erosion of private lands will continue to occur and this reach will continue to be a source of suspended sediment to Whites Creek. Along these middle reaches of Whites and Thomas creeks, private land encroachment will also be a source of sediment and urban pollution unless a significant public education program is implemented.

Whites, Thomas and Galena creeks will become sources for public water supply within the next five to ten years. Water Quality protection from urban development will need to be enforced

through ordinance. There may be a need to install new stormwater quality protection structures as well.

Evans and Dry creeks are largely nonfunctional in their middle reaches as they have been realigned and channelized for flood protection. Water quality is not expected to improve. Public education and restoration efforts are needed in order to improve their functionality and status as a community ammenity. Improvements could occur by restoring the creeks to a more natural state- creating floodplain and sinuosity, and improving the native vegetation. Keeping livestock out of the creeks would also have to occur, but this would appreciatively improve water quality. Pre-treatment of stormwater discharge would help prevent pollution and sediment loads from urban runoff.

The lower reaches of Whites Creek, Thomas Creek, Dry Creek and the Boynton Slough are used for drainage and flood control. This condition renders them nonfunctional in the sense of streams. However, restoration efforts could improve their functionality as stream amenities. This would include developing floodplain and sinuosity, reducing the slope of the banks, eradicating the Tall Whitetop, and replanting native vegetation and cottonwood trees. Water quality is not expected to significantly improve because of the relatively high TDS groundwater that discharges to these water bodies. Stormwater treatment also needs to be implemented. Eradication of Tall Whitetop is important over these areas.

Steamboat Creek

The Steamboat Creek Restoration Plan (Washoe-Storey Conservation District, 2000) addresses how and where to focus attention on Steamboat Creek for water quality and stream functionality improvements. Full implementation of this plan will help to improve water quality, particularly decreasing sediment loads (TSS) and nitrogen and phosphorus (nutrients) loadings to the creek. Currently, large-scale attention is being focused in two areas. One area is in the South Truckee Meadows south of the Huffaker Hills on the Bella Vista Ranch. Flood control discussions indicate that constructed wetlands would help to store and dissipate flood waters and improve the water quality (TSS and nutrients). The second area is near the confluence with the Truckee River. A proposal is being presented to move the creek channel west and to construct meanders and wetlands. This will also help to improve water quality (TSS and nutrients) and flood control.

4.4 Action Items to Improve Water Quality

The purpose of this section is to summarize, by subheading, specific stream reaches where water quality can be improved. These subheadings group common problem areas as identified in Table 3.11 (water quality improvements) and Tables 4.1 and 4.2 (sensitive and critical reaches, see Figures 4.1 - 4.4). Table 4.3 lists the specific stream reaches. These subheadings are discussed in the following text. This section can give the implementation process (Chapter 7) guidance and funding justification in the context of water quality improvement.

Water quality that directly impacts the Truckee River

The Truckee River has Total Maximum Daily Loads (TMDL) imposed upon it by NDEP and consists of the constituents total dissolved solids, total suspended solids, nitrogen and phosphorus. In Table 4.3 tributaries are listed as contributing water quality impacts to the Truckee River with respect to these TMDLs. Improvements to these tributaries would make significant improvements to the water quality of the Truckee River and could be considered for pollution trading credits. These creeks are Steamboat, the North Truckee Drain and Chalk Creek. While Steamboat and the North Truckee Drain have expensive and constrained

solutions, Chalk Creek may have an economical solution and could qualify for non-point pollution trading credits for TMWRF.

Nutrient loading
These reaches are listed as water quality polluters to the lower reaches of Steamboat Creek and or the Truckee River. They have been identified by their nutrient (nitrogen and phosphorus) concentrations. Management efforts could reduce this pollutant source that ultimately reaches the Truckee River. Table 4.3 lists most of the tributaries to Steamboat Creek as well as Lower Alum, Lower Sunrise and Lower Muskgrove creeks. These sources of nutrients are largely from agricultural and livestock land use practices.

Stream restoration from critical to functional status
These reaches are listed that could potentially be restored from a critical condition to a functional condition. This would improve TSS loads, stream habitat, afford some flood protection, and improve or maintain water quality. Most of these reaches would require moderate to expensive restoration efforts that range from replacing culverts to land acquisition, excavation and re-vegetation.

Erosion and sediment loads
These reaches are listed as significant sources of sediment loading and where severe erosion occurs. Figures 4.1 to 4.2 show these locations as green dots. Additional sites are shown as critical sections, for example, lower Whites Creek. Many of these sites would require reconstructing culverts at road crossings, but also changes in private land use management.

Flood control to functional status
Many of the tributaries become flood control conveyance structures particularly in the South Truckee Meadows. These structures are important. With limited to great expense, they could be reconstructed to also serve in a stream functional way. This could be accomplished by developing flood plains, allowing for the sinuosity of the stream to occur and re-grading stream banks, and re-vegetating with native plants and cottonwood trees. This would improve the riparian habitat, control invasive weeds, provide for better flood control, and greatly enhance their quality of life amenity to the general public. These reaches generally involve Boynton Slough, lower Dry, lower Thomas and lower Whites creeks, and Steamboat Creek

Structural items
These reaches are specific sites where stormwater or flood events will cause public damage. They represent sites where structural controls on stream banks should be constructed in order to protect roads, property or homes. Three sites in particular are cited in Verdi on Dog and Sunrise creeks.

Preserve and enhance
Stream reaches described in the Assessment Report (Widmer and Jesch, 2002) as functional and at risk are listed in Table 4.3. Education or small restoration efforts are encouraged to maintain water quality and to preserve or improve their stream functionality. This will also maintain and preserve their wildlife habitat, provide flood protection and enhance the public quality of life.

Table 4.3
Priority List for Stream Restoration Opportunities

Creek reach	Protect Truckee River water quality	Reduce nutrient loading	Restore critical reach to functional	Reduce erosion and sediment loads	Restore as functional/flood control	Prevent structural or property damage	Preserve or enhance reach	Additional monitoring	Remarks
Chalk 3	X							X	Control TDS and nutrient loads to Truckee River
Alum 3	X	X						X	Control TDS and nutrient loads to Truckee River
Alum 2				X				X	Control construction/development activities
Sunrise		X		X				X	Livestock pollution, erosion to road bank
Dog 2						X			Erosion to road bank
Unnamed			X	X		X		X	Control construction/development activities
N. Truckee Drain 4	X			X	X				Extensive restoration
Whites N. Fork 2		X	X	X		X			Severe erosion, nutrient loading
Jones 2			X	X					Culvert erosion
Galena 4		X		X				X	Control suburban and agricultural impacts
Whites S. Fork 2				X			X	X	Control suburban and stormwater impacts
Thomas 4							X	X	Control suburban, agricultural stormwater impacts
Thomas S. Fork			X	X	X		X	X	Extensive restoration
Evans 2, 3		X	X	X			X	X	Extensive restoration
Dry 2		X	X	X			X	X	Extensive restoration
Dry 4				X	X			X	Moderate restoration
Boynton	X	X		X	X		X		Moderate restoration
lower Steamboat	X				X		X		Extensive restoration
Jumbo			X	X		X			Extensive restoration
Muskgrove 2		X	X	X				X	Control suburban and agricultural impacts

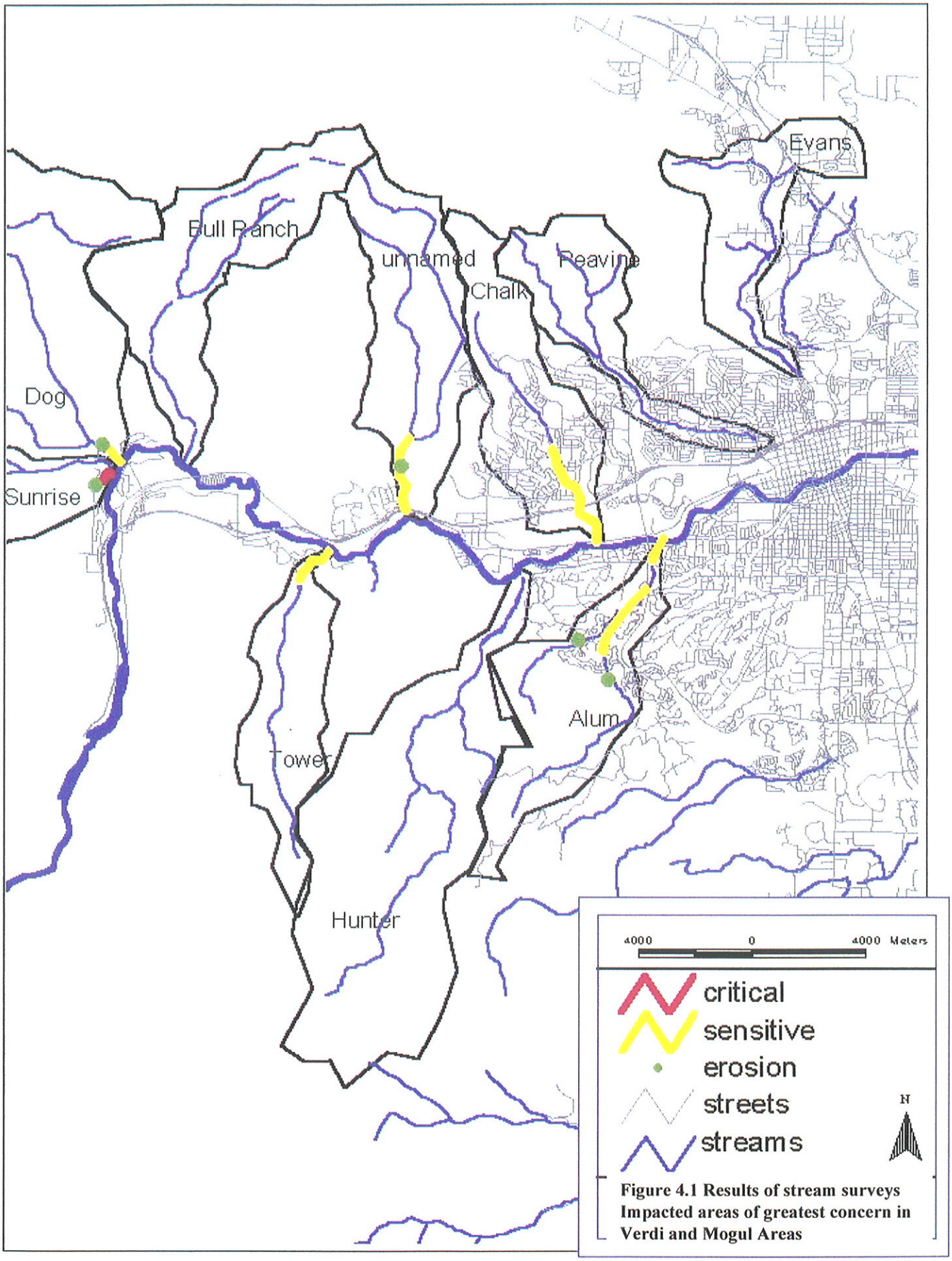


Figure 4.1 Results of stream surveys
Impacted areas of greatest concern in Verdi and Mogul Areas

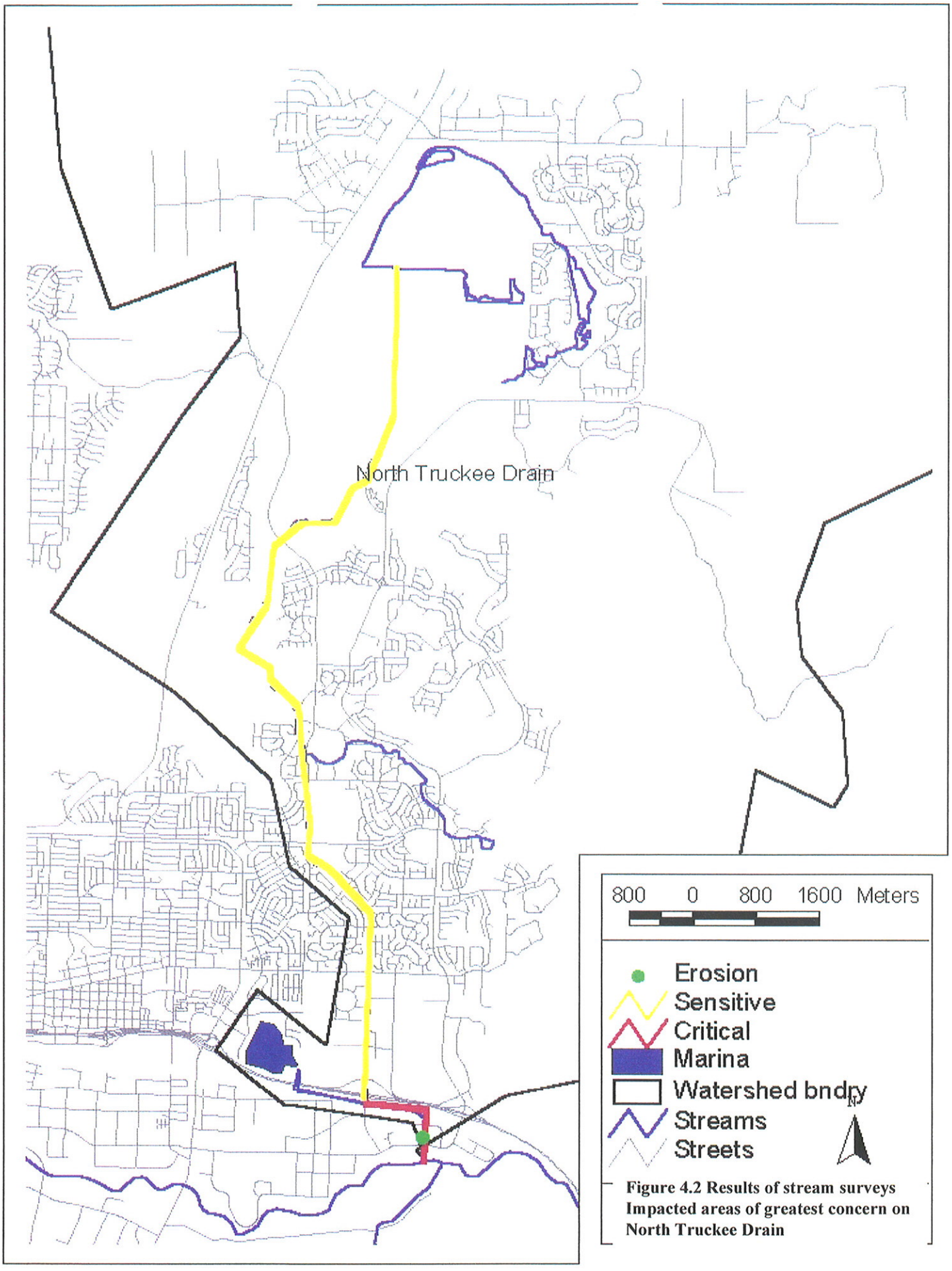


Figure 4.2 Results of stream surveys Impacted areas of greatest concern on North Truckee Drain

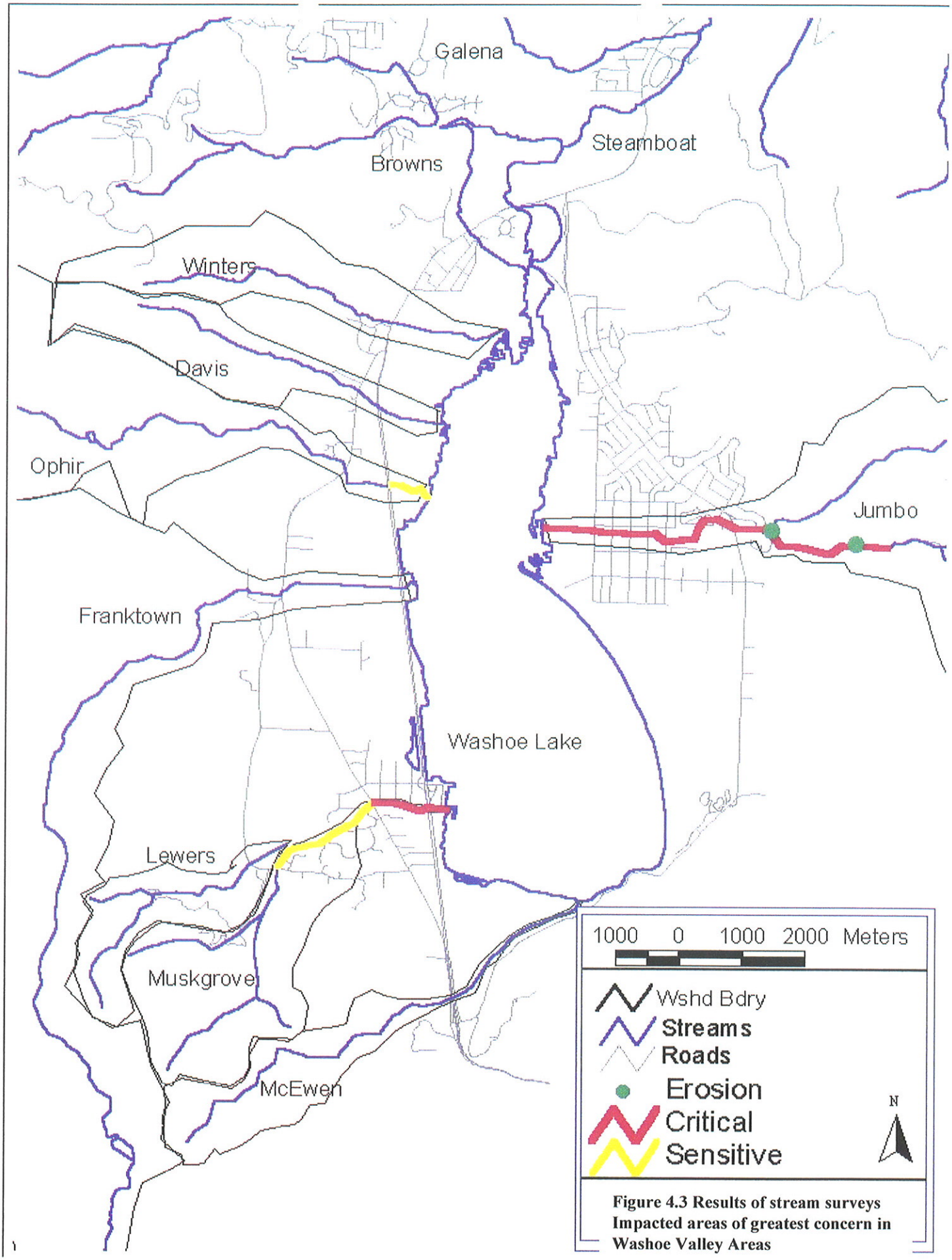


Figure 4.3 Results of stream surveys Impacted areas of greatest concern in Washoe Valley Areas

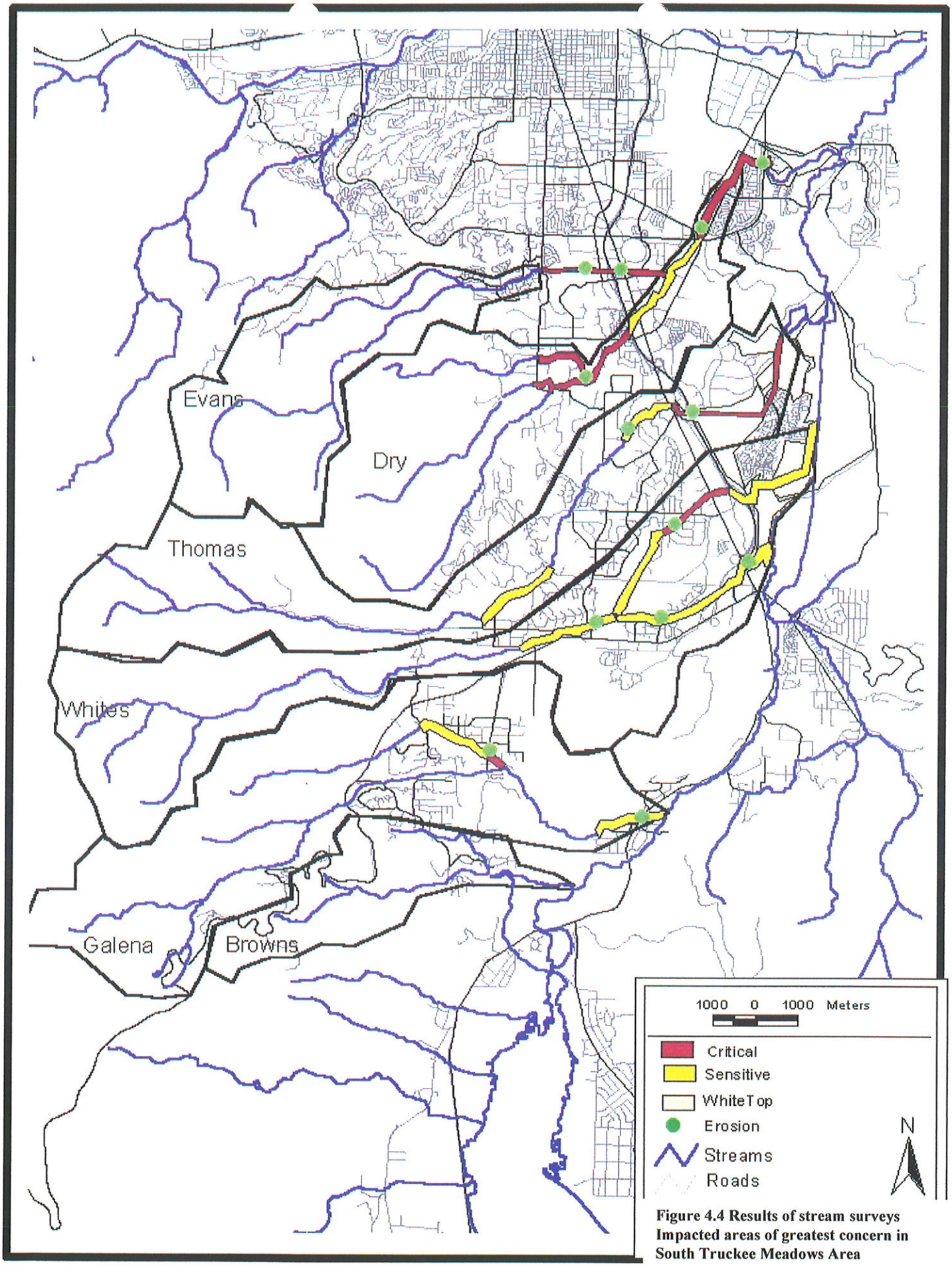


Figure 4.4 Results of stream surveys Impacted areas of greatest concern in South Truckee Meadows Area

Chapter 5

Public Involvement and Goal Development

Purpose and Scope

The purpose of this chapter is to provide an overview of the process used to identify and invite participation by stakeholders and the public, development of goals and objectives for the watershed plans, and setting of water quality goals.

Summary of Findings

A public involvement process was followed, as described, to gather participation of local, state and federal agencies; private interest groups, and the general public. This group met to develop specific goals for this watershed management and protection plan as well as in the development of the plan's format and content. These goals and recommendations are described herein.

5.1 General Comments on Group Process

Watershed plans require approval and personal commitment from stakeholders to be successfully implemented. By involving people who have widely varying interests and knowledge early in the planning process, we increase the likelihood that the plans will gain broad support. By including those who have a personal stake in conserving our water resources, we can help ensure that the watershed management plan the group develops will not simply gather dust on a shelf, but will be a living, feasible plan.

Building a watershed planning team involves identifying and engaging people who have a stake in the watershed, defining an organizational structure, and defining the purpose and strategy for the watershed planning effort. The following section of this document outlines the formation of the watershed planning committee and its approach to developing goals and objectives for the plan.

5.2 Formation of the Watershed Planning Committee

Introduction

Stakeholders representing agencies, tribes, state and local government, business, citizens and the environment were invited to participate on a watershed planning committee to assist in the development of watershed management plans for tributaries to the Truckee River. Citizen's Advisory Board members and Neighborhood Advisory Board members were also invited to attend, and were notified when assessments of their local streams were available for discussion. A list of stakeholders is provided in Table 1.

At the first meeting of the planning group, an introduction to the need for watershed protection plans was presented. Training on the impacts of urbanization, the tools of watershed protection, and lessons learned by others were also provided. The South Truckee Meadows sub-watershed assessment was presented to the group for comment, and a group process was

Table 5.1
Stakeholders Invited to Participate in Plan Development

Federal Government
- Bureau of Land Management
- Environmental Protection Agency, Region 9
- Fish & Wildlife Service
- Forest Service
- Natural Resources Conservation Service

Tribal Representatives
- Pyramid Lake Paiute Tribe
- Washoe Tribe

State of Nevada
- Bureau of Health Protection Services
- Division of Environmental Protection
- Division of Wildlife
- Farm Bureau

Local Government and Agencies
- Citizen's Advisory Boards
- City of Reno, Community Development
- City of Sparks, Community Development
- Neighborhood Advisory Boards
- Truckee Meadows Wastewater Reclamation Facility
- Truckee Meadows Water Authority
- Washoe-Storey Conservation District
- University of Nevada Cooperative Extension
- Washoe County Community Development
- Washoe County Environmental Health
- Washoe County Water Resources

Business Representatives
- Kennedy/Jenks Consultants
- Reno-Sparks Realtor's Association

Environmental
- Truckee River Yacht Club

used to develop goals and objectives for the sub-watershed. The goals and objectives were determined by the group to be sufficiently broad as to apply to all sub-watersheds. They can be found in Section 3.2. The remaining sub-watershed assessments were reviewed by the group at two subsequent meetings, and action items were developed and prioritized.

Concurrent with the planning group meetings, presentations were made to all citizen's advisory boards and neighborhood advisory boards to introduce the concept of watershed planning and invite their participation in the planning process and in reviewing the draft plan. Copies of the appropriate assessment documents and comment reply cards were also provided at the meeting. Once the draft plan had been released, a second visit was made to each of the boards to describe the contents and invite comment and feedback. A list of the boards to which presentations were made follows:

Citizen's Advisory Boards

- East Washoe Valley
- Galena-Steamboat
- Southeast Truckee Meadows
- Southwest Truckee Meadows
- Verdi Township
- West Washoe Valley
- Sparks

Neighborhood Advisory Boards (Reno)

- Downtown/Southwest
- Central
- Southeast
- West University
- Northwest

5.3 Goals and Recommendations

Introduction

Development of watershed goals and objectives is described above. These goals and objectives can be broadly applied to all sub-watersheds within the study area. They were accepted by consensus by the planning group. Numerous objectives support two or more goals.

Goal #1: Maintain or Improve Water Quality

1. Gather and assess existing data and current monitoring programs.
2. More accurately quantify and characterize pollutants of concern; prioritize data-gathering efforts.
3. Identify existing codes, ordinances, and laws that affect water quality. Review and determine if improvement is appropriate, necessary and achievable.
4. Develop and provide a public outreach program to educate residents about their role in preventing water pollution.
5. Determine if water quality standards are being met.
6. Design and apply management practices to improve water quality to meet standards; perform cost/ benefit analysis or feasibility study on restoration practices/projects.
7. Design a comprehensive monitoring program to quantify water quality and measure success.
8. Maintain some level of instream flow to support beneficial uses.
9. Protect the upper watershed from degradation.
10. Promote infiltration of stormwater and runoff.

Goal #2: Gain Regional Acceptance of Land Use Planning on a Watershed Scale

1. Gain public acceptance and approval for protection actions.
2. Develop a database and provide educational programs to multiple audiences:
    - CABs,
    - NABs,

- politicians,
- government land use planners,
- and private land use planners and engineers.

3. Integrate jurisdictional responsibilities and provide adequate funding (Reno, Sparks, Washoe County).
4. Develop and fund a watershed coordinator position.
    - Seek grants and partnerships for restoration and educational programs.
    - Ensure the public process continues.
5. Incorporate volunteer monitoring on a regional scale.
6. Develop and implement an educational media campaign for print, television, and other outlets.
7. Incorporate elements of watershed science into elementary school teaching.

Goal #3: Achieve a Functional, Healthy Watershed

1. Collect pertinent data, including resource, land use, and so forth.
2. Identify problem areas, including erosion, pollution, habitat degradation, invasive species.
3. Quantify and model hydrologic properties.
4. Initiate planning to prevent further degradation, including ordinances, conservation, etc.
5. Explore alternatives to current engineering or development practices.
6. Influence the project review and approval process to link land use planning to water quality.

Goal #4: Integrate Flood Control into Watershed Planning

1. Convey a 100-year storm without damage.
2. Control development in watershed to minimize runoff.
3. Maintain the water conveyance capabilities of streams and channels.

Goal #5: Protect the Watershed from Urban Stormwater and Runoff Pollution

1. Establish multiple water quality monitoring stations.
2. Implement Best Management Practices (BMPs).
3. Design BMPs (storm drain detention basins, etc.) to meet both water quality and flood control purposes.
4. Incorporate land use planning into stormwater management.
5. Achieve compliance with Washoe County Stream Buffer Ordinance.
6. Develop a public outreach program.

Goal #6: Preserve or Improve Habitat

1. Maintain no net loss of riparian habitat.
2. Preserve both aquatic and terrestrial habitats.
3. Establish and maintain minimum in-stream flow requirements.
4. Identify and pursue potential watershed restoration projects.
5. Implement wildlife monitoring programs.
6. Ensure fuel management techniques are consistent with watershed protection.
7. Maintain public access to streams.
8. Integrate recreational opportunities into the watershed plan.

Chapter 6

Management Objectives

Purpose and Scope

The purpose of this chapter is to describe a series of management objectives or alternatives that can be used to achieve the goals identified in Section 5.2. These management objectives are meant to provide a format for efficient implementation.

Summary of Findings

The goals and objectives developed by the planning group overlap in a number of cases. For example, education and outreach activities are listed as objectives under four of the six goals. For this reason, the objectives have been reorganized under a series of six headings that capture their overall intent. These include:

- Stormwater Management
- Watershed Maintenance
- Land Use Planning
- Habitat and Stream Restoration
- Monitoring and Assessment
- Education

These can then be thought of as management objectives or alternatives - the long list of potential activities or tools that can be used to accomplish watershed protection. In each section below, we describe the category and list proposed alternatives as well as selected web resources (Appendix 3) for further information.

6.1 Stormwater Management

Runoff from construction sites and developed areas associated with urban growth constitutes a major source of water pollution. According to the 1996 National Water Quality Inventory, 13% of impaired rivers and 21% of impaired lake acres are affected by urban/suburban storm water runoff and 6% of impaired rivers and 11% of impaired lake acres are affected by construction site discharges. The U.S. EPA's National Pollutant Discharge Elimination System (NPDES) Phase II Final Rule expands the Phase I program by requiring additional operators of municipal separate storm sewer systems (MS4s) in urbanized areas and operators of small construction sites, through the use of NDPES permits, to implement programs and practices to control polluted storm water runoff. Phase II is intended to further reduce adverse impacts to water quality and aquatic habitat by instituting the use of controls on the unregulated sources of storm water discharges that have the greatest likelihood of causing continued environmental degradation. The Truckee Meadows Interlocal Stormwater Committee and the Regional Stormwater Quality Management Program are actively involved in planning strategies to address the requirements of Phase II.

Uncontrolled runoff from construction sites poses a water quality concern because of the devastating effects that sedimentation can have on local water bodies, particularly on small streams. The land-disturbing activities performed during construction leave the soil on the site unprotected and much more vulnerable to erosion than undisturbed areas. Numerous studies have shown that the amount of sediment transported by storm water runoff from construction sites with no controls is

significantly greater than from sites with controls. This occurs because increases in runoff flow rate that result from these activities reduce infiltration, reduce interception capacity and storage, and create soil compaction which all increase the amount of runoff leaving a site. In addition to sediment, pollutants such as pesticides, petroleum products, solvents, asphalts, and acids from construction activities can contaminate storm water runoff. During storms, construction sites may be a source of sediment-laden runoff, which can overwhelm a small stream channel's capacity. The increased runoff volume results in streambed scour, streambank erosion, and destruction of near-stream vegetative cover. The increased sediment load results in choking benthic populations, providing soils for plants in the channel and obstructing streamflow passages. When left uncontrolled, sediment-laden runoff has been shown to result in the loss of in-stream habitats for fish and other aquatic species, an increased difficulty in filtering drinking water, and the loss of drinking water reservoir storage capacity. Phase I NPDES permits were required for construction sites that disturbed a land area greater than five acres. Phase II permits are now required for any site that disturbs more than one acre of land.

If stormwater runoff is not addressed, we can expect growing problems from sediment, bacteria, nutrients, metals and other pollutants associated with urban runoff. Effective stormwater management seeks to:

- Maintain groundwater recharge and quality
- Reduce stormwater pollutant loads
- Protect stream channels
- Prevent increased overbank flooding
- Safely convey extreme floods.

Treatment practices can be used to delay, capture, store, treat, or infiltrate stormwater runoff. Broad categories of structural stormwater management practices include:

- Ponds
- Wetlands
- Infiltration
- Filtering systems
- Open channels
- Low Impact Development methodologies
- Maintaining natural channels when possible

The following Stormwater Management Objectives were identified by the watershed planning group:

Stormwater Management Objectives:

Objective	Time Frame
1. Support and coordinate watershed protection efforts with the Truckee Meadows Interlocal Stormwater Quality Management Program.	Immediate
2. Participate in monitoring and enforcement of sediment control on construction sites.	Within 1 to 3 years
3. Provide adequate numbers of field inspectors, enforcement authority, and an on-site Erosion and Sediment Control specialist.	Within 1 to 3 years
4. Identify and reconstruct road crossings and culverts that are generating sediment and erosion problems in watershed.	Within 5 to 10 years
5. Construct erosion control measures for stream banks and slopes within watersheds.	Within 3 to 5 years
6. Incorporate stormwater detention, containment and infiltration into development projects with LID methodologies.	Within 1 to 3 years
7. Build maintenance costs into stormwater utility budgets.	Immediate

6.2 Watershed Maintenance

Critically important but frequently ignored, best management practices will be ineffective if not maintained on a regular basis. Watershed maintenance functions include such elements as management of conservation areas and buffer networks, and maintenance of stormwater management practices, sewer networks, and septic systems. Maintenance schedules will vary greatly, depending on BMP location, surrounding land use, precipitation patterns and soil stability in the watershed.

The following Watershed Maintenance Objectives were identified by the watershed protection planning group:

Watershed Maintenance Objectives:

Objective	Time Frame
1. Design and apply management practices to meet both water quality and flood control purposes on stream channels.	Immediate
2. Provide adequate BMP maintenance inspections; require redundant BMPs; maintain and repair existing BMPs	Within 1 to 3 years
3. Implement stream and stormwater facilities maintenance programs on a scheduled basis. Fund and staff through stormwater programs.	Within 1 to 3 years
4. Perform cost/benefit analysis or feasibility studies on restoration practices/projects and prioritize for funding.	Within 1 to 3 years
5. Design and fund noxious weeds management and vector maintenance programs.	Immediate
6. Promote on-site agricultural management practices including nutrient management, manure handling, and restricting livestock from stream channels.	Immediate

6.3 Land Use Planning

As development proceeds, changes in land use affect water quality. The conversion of farmlands, wetlands, and meadows to rooftops, roads, and lawns creates a layer of impervious surface in the urban landscape. Impervious cover is a measurable indicator that can be used to assess impacts of land development on water quality. Impervious cover directly influences urban streams by substantially increasing surface runoff during storm events by as much as two to 16 times its predevelopment rate (see Figure 6.1). This results in reductions in infiltration and groundwater recharge. Baseflow to streams is reduced due to decreases in water storage.

Figure 6.1
Impacts from Increases in Impervious Surfaces

Increased imperviousness leads to:	Resulting Impacts				
	Flooding	Habitat Loss	Erosion	Channel Widening	Streambed Alteration
Increased volume	*	*	*	*	*
Increased peak flow	*	*	*	*	*
Increased peak flow duration	*	*	*	*	*
Increased stream temperature		*			
Decreased base flow		*			
Changes in sediment loadings	*	*	*	*	*

From: Urbanization and Streams: Studies of Hydrologic Impacts, U.S. EPA, www.epa.gov/owow/nps/urbanize/report.html

A direct result of stormwater runoff from impervious surfaces to storm drains is the loss of this water that would normally infiltrate and become groundwater recharge or as a source of soil moisture

replenishment. This can be significant in areas that depend on groundwater for public water supply. The percentage of impervious surface is directly related to the percentage of groundwater recharge lost. Today there are other alternatives to storm drains that retain stormwater for direct infiltration.

Development plans can be designed to reduce the amount of impervious cover, protect sensitive areas, and improve stream water quality. A basic strategy to protect streams by better site design might include the following elements:

1. Watershed-based zoning to assess the impact of future development on streams and groundwater recharge areas during the zoning or master planning process.
2. Modify the subdivision code to reduce creation of impervious cover. Less impervious cover translates into less stormwater runoff and lower pollutant loadings.
3. Protect sensitive areas from development by adopting and enforcing ordinances that prevent development from occurring in key natural areas such as streams, wetlands, floodplains, steep slopes, mature forests, and critical habitat areas.
4. Establish a stream buffer network adjacent to stream channels to provide shade, woody debris, leaf litter, streambank protection, pollutant removal, and other stream functions.
5. Limit the disturbance and erosion of soils during construction.
6. Treat the quantity and quality of stormwater runoff by installing urban stormwater BMPs.
7. Maintain stream protection infrastructure such as stormwater BMPs, enforcement of buffers, or restoration of streams.
8. Use Low Impact Development for stormwater and groundwater recharge benefits.

The following Land Use Management Objectives were identified by the watershed protection planning group:

Land Use Management Objectives:

Objective	Time Frame
1. Coordinate efforts and adopt a regional stream buffer ordinance by cities and county.	Within 1 to 3 years
2. Improve coordination among public works and community development departments or reviewing agencies on permitted projects to ensure water quality protection.	Immediate
3. Identify existing codes, ordinances, and laws that affect water quality. Review and determine if improvements are appropriate and achievable.	Within 1 to 3 years
4. Incorporate land use planning into watershed management.	Immediate
5. Require construction phasing to minimize long-term bare ground. A model may exist at Lake Tahoe.	Within 1 to 3 years
6. Require pumping of septic tanks when properties are sold.	Immediate
7. Institute new health regulations regarding septic system maintenance.	Within 1 to 3 years
8. Require all new development projects to document that BMPs are capable of removing the target pollutants of concern (TDS, TSS, N, P) and protecting stream channels from accelerated erosion.	Within 1 to 3 years
9. Require all new development to incorporate LID methodologies for stormwater and groundwater recharge benefits.	Within 1 to 3 years
10. Protect critical reaches of streams by ordinance or zoning.	Immediate
11. Develop a communications network among municipalities to share planning and zoning strategies. Consider standardizing guidelines within the Truckee River watershed.	Immediate

6.4 Habitat and Stream Preservation and Restoration

After many years of neglect and abuse, urban streams and rivers have recently become the focus of restoration efforts throughout much of the country. Communities increasingly recognize the value of healthy aquatic systems within urban areas and are taking steps to improve the quality of degraded streams. The motivating factors underlying each program vary. For some, the goal is to improve water quality to receiving waters. In others, the objective is to enhance the urban environment and provide recreational areas. Others seek to recover aquatic diversity within urban streams.

There are essentially three types of urban stream restoration possible. The first is in a watershed where it is feasible to at least partially restore a native biological community within the stream. The second occurs in a watershed that acts primarily as a conduit for stormwater runoff, where it is only possible to reduce pollutants to the receiving water body, and few opportunities exist to restore the stream. The third is a watershed where both pollutant load reductions and stream restoration are not feasible, and restoration is limited to stream corridor management.

Stream restoration often involves streambank stabilization measures. Before implementing streambank stabilization, it is important to understand the cause of the streambank erosion problem in order to design a sustainable restoration project.

The stream assessments revealed that erosion and sedimentation due to development upon or alteration of the creeks and stormwater discharges to the creeks cause water quality impairment. The stream health ratings in the table below summarizes opportunities for restoration. The stream assessments most commonly identified the need for improvements in riparian vegetation, creation of floodplains, bank shaping, and soil bioengineering techniques. It is important to note that successful restoration projects will also require changes in the management practices that are contributing to the stream's degradation. Finally, there is a need to identify and preserve existing pristine stream habitat to ensure that no future degradation occurs and protective actions can be taken.

Stream Health Ratings

Creek	Mid-Reach	Lower-Reach
N. Carson, Verdi, Peavine		
Tower	Good	Sensitive
Hunter	Good	Good
Alum	Sensitive	Sensitive*
Dog	Good	Sensitive
Sunrise	Good	Critical*
Bull Ranch	Good	Good
Unnamed	Good	Sensitive
Chalk	Good	Sensitive
Peavine	Good	None
Evans	Good	None

S. Truckee Meadows	Upper-Mid	Lower-Mid	Lower-Reach
Evans	Good	Critical*	Critical*
Dry	Good	Critical*	Critical to sensitive*
Thomas	Sensitive*	Sensitive*	Sensitive to critical*
South Fork, White's	Sensitive*	Sensitive*	Sensitive*
North Fork, White's	Sensitive*	Critical*	Sensitive*
Galena	Good	Good	Sensitive
Jones	Sensitive*	Critical*	None
Browns	Good	Good	Good

* Restoration efforts are needed and may be successful in these reaches.

The following Habitat and Stream Restoration Management Objectives were identified by the watershed protection planning group:

Habitat and Stream Restoration Management Objectives

Objective	Time Frame
1. Identify and pursue potential watershed restoration projects. (The watershed assessment phase has identified a number of potential watershed restoration/streambank stabilization needs.)	Ongoing
2. Improve structure and function of stream reaches where watershed assessments identified critical and sensitive conditions (includes water flow, floodplain, riparian vegetation, and channel form/restoration).	Within 1 to 3 years
3. Establish and maintain minimum instream flow requirements to support beneficial uses.	Within 1 to 3 years
4. Enforce stream buffer ordinances.	Immediate
5. Preserve or improve riparian, aquatic and terrestrial habitats.	Ongoing
6. Integrate appropriate recreational opportunities into the watershed planning.	Ongoing
7. Ensure fire prevention techniques are consistent with watershed protection. Educate fire prevention personnel to recognize and protect desirable vegetation.	Within 1 to 3 years

6.5 Monitoring and Assessment

Watershed monitoring is a comprehensive approach to data collection that incorporates water quality as well as watershed conditions. For example, water quality monitoring conducted on a watershed basis would include monitoring physical, chemical, and/or biological condition of the water body as well as specific watershed characteristics (e.g. stream corridor traits and functionality, wetlands, and watershed land use/land cover patterns) that may be related to observed water quality. Monitoring of macroinvertebrates (cadisflies and mayflies), wildlife and invasive weeds in another example. Watershed monitoring therefore evaluates the condition of the water resource while also providing valuable watershed information to help establish cause-and-effect relationships. The information collected can support sound decision-making by identifying high quality waters and tracking their condition over time, by providing insight into the sources and levels of pollution for waters that are impaired or threatened, by helping managers understand the impacts of human activities within the watershed, and by providing input data used in water quality models.

Currently, limited data are available to support quantitative goals for the tributary watersheds. As discussed in section 3.3, bimonthly sampling at a single location on several tributaries was conducted from 1987 to 2001. Some sampling sites have been deleted, others moved, and some added. Data from new quarterly sampling sites provided by NDEP will better document the degree of water quality degradation occurring as a result of urbanization. However, with such limited data, it will continue to be difficult to set meaningful targets or goals for water quality improvement, and to prioritize sub-watersheds and individual stream reaches for restoration.

The following Monitoring and Assessment Management Objectives were identified by the watershed protection planning group:

Monitoring and Assessment Management Objectives:

Objective	Time Frame
1. Update and more accurately quantify and characterize TMDL pollutants to streams and the Truckee River; set target goals for water quality improvement and TMDL compliance.	Within 1 to 3 years as data becomes available
2. Gather existing water quality data and improve or initiate monitoring programs for watershed management.	Immediate
3. Monitor and maintain functionality of streams and associated infrastructure for ongoing water quality protection.	Immediate
4. Continue to identify watershed problem areas (non-functionality, erosion, pollution, habitat degradation, invasive weeds, etc.).	Ongoing
5. Monitor attainment of objectives for stream and watershed management practices and restoration projects, and report results to governing bodies.	Within 5 years

6.6 Education

A strong, well-designed and ongoing education program will be needed to build support for the watershed protection program and to make citizens aware of the changes they can and must make to reduce unnecessary water quality impairment. Educational programs help increase public understanding and awareness about watersheds, and promote better stewardship of private lands. They also help teach residents about the individual role they play in the watershed, and how their behaviors affect water quality. Watershed awareness programs raise basic watershed awareness by involving the public in hands on service projects that have direct impacts on watershed improvement. These programs often lead to a volunteer coalition that collects baseline data that otherwise would be time consuming and expensive for state agencies to obtain. Special training can also be provided for developers and land use planners to promote alternative strategies for water quality protection and flood reduction through improved site design. Watershed educators can utilize a variety of educational tools and strategies to assist in the teaching of watershed stewardship, including:

- Publications, brochures and posters
- Displays and interactive kiosks
- Conferences, workshops and training sessions
- In-school programs
- Publicity
- Storm drain stenciling
- Watershed signs
- Watershed cleanups or stream cleanups
- Watershed or stream tours or walks
- Public involvement in data collection and restoration projects

Local educational efforts in development include an K-12 Adopt-a-Watershed program strategy sponsored by the Washoe-Storey Conservation District in which students engage in service-learning projects to gain an appreciation for their watershed while mentoring younger students. In May, 2002, the Clean Water Team linked agencies across state lines to host watershed-wide volunteer stream monitoring during the Second Annual Snapshot Day event. This event in the Lake Tahoe and Truckee River Watersheds had more than 310 committed volunteers. They worked closely with many water quality agencies to gather water quality information in the form

of visual assessments, photos, and water quality data at 117 different watershed locations. A variety of educational materials and trainings are available through the University of Nevada Cooperative Extension and other venues.

The following Education Management Objectives were identified by the watershed protection planning group:

Education Management Objectives:

Objective	Time Frame
1. Develop and implement educational programs for residents on watershed protection and pollution prevention.	Within 1 to 3 years
2. Develop and implement educational program for land use planners and developers on watershed protection and pollution prevention.	Within 1 to 3 years
3. Develop and implement educational program for elected officials on watershed protection and pollution prevention.	Within 1 to 3 years
4. Provide regular feedback to governing bodies on successes of watershed protection programs	Ongoing
5. Design and implement "Watershed" week in schools.	Within 1-3 years
6. Implement an "adopt-a-stream" or "adopt-a-watershed" programs for selected watersheds.	Immediate
7. Plan and install demonstration projects for watershed education.	Within 1-3 years
8. Promote community clean-up days.	Ongoing

Chapter 7

Watershed Management Plan

Purpose and Scope

This chapter proposes an organization, methodology and scope for the implementation of this Watershed Management and Protection Plan.

Summary of Plan Elements

Effective implementation of this plan will require the assistance of local jurisdictions, agencies, and the community as a whole. Much of the work can be accomplished through educational efforts, changes in development practices, and integrating this plan with stormwater management. A key finding is that watershed management, stormwater management and floodplain management cannot be effective without the inclusion of land use planning efforts.

A watershed management framework is presented wherein roles and responsibilities are discussed. Management Objectives are listed in terms of which objectives need to be implemented and by which party. Key to this plan's implementation is the contracting of a Watershed Facilitator for a period of one to three years and the first year's scope of work is presented. Water Quality improvements are listed and prioritized for consideration by suggested agencies and jurisdictions. Priorities are listed that are consistent with Management Objectives that largely reflect regional watershed management. Lastly, potential funding sources are listed and discussed.

7.1 Effective Management

As stated in previous sections, protecting, improving or restoring our watershed is a necessary action for this community. It is necessary in the context of:

- proper stewardship for our present and future generation,
- meeting Federal and State water quality mandates,
- providing for wildlife and aquatic habitat, and
- maintaining or improving our quality of life.

This Watershed Protection and Management Plan has been recommended through the leadership of the Regional Water Planning Commission and the Comprehensive Regional Water Management Plan. This Plan will only be successful if mandated by the elected or public officials who have the authority to implement this plan. The Development Community must also be willing to implement this Plan. City and County Planning departments must rethink development codes in order to incorporate watershed protection. Public Works departments must be willing to adopt new stormwater design criteria and provide proper inspections. Finally, Citizen and Neighborhood Advisory Boards must be willing to embrace these actions with self-imposed actions. These boards should be directly involved in activities such as restoration plans. They can lead the way for prioritizing and activating funding sources and/or volunteer programs.

One of the most critical problems for our watershed is stormwater runoff and its erosive effects on our stormwater drainage system. Equally important is the control of pollution caused by stormwater runoff. By improving our drainage to eliminate unnatural erosion and increase the transit time of

runoff to reduce the volume rate, we can control pollution and the degradation of our watershed. Through this program the community can meet TMDL restrictions, eliminate the need for future TMDL restrictions, and witness nutrient and TDS reductions in the Truckee River. The watershed protection program incorporates the stormwater program as the single most effective effort towards preventing watershed degradation.

A second critical problem is the effects of flooding upon our watersheds. Encroachment of development upon floodplains, whether the Truckee River's or a small tributary's, reduces flood protection and increases erosion, sedimentation and pollution to our waters. Effective floodplain management, in concert with stormwater management, can mitigate many of the effects of floodwaters. Indeed, stormwater, floodplain, and watershed management planning all have similar goals and all are equally important within the three jurisdictions. All three planning efforts speak to land use planning to reduce the effects of stormwater and flooding. All three efforts are directed to the management of erosion and sediment in order to preserve natural stream environments. This can be done, in part, through advanced methodologies in stormwater infrastructure.

To be effective, a watershed facilitator should be contracted to implement the initial aspects of the plan in concert with the stormwater quality management program, the floodplain management plan and the four land use planning agencies. Watershed Management Objectives should be organized and implemented by appropriate authorities. Finally, water quality improvements to specific stream reaches need to be addressed by local jurisdictions.

7.2 Regional Watershed Management Framework

In order to succeed, this protection plan requires five components. First, watershed recommendations must be incorporated into city and county policies. Second, the Interlocal Stormwater Committee must accept and incorporate aspects of the plan into stormwater management actions. Third, the four land use planning agencies (Regional, Sparks, Reno, Washoe County) must incorporate development policies that parallel watershed protection and management philosophies. Fourth, a Watershed Facilitator is needed to help implement this Plan, apply for grants to help fund plan objectives and coordinate efforts with advisory boards that implement this plan with actions that are specific within their boundaries. Fifth, Neighborhood and Citizen Advisory boards must be willing to participate in this plan.

Regional Actions by Government

The Regional Water Planning Commission will provide Watershed Protection and Management policies and recommendations to the cities of Reno and Sparks and Washoe County. The cities of Reno and Sparks, and Washoe County should act upon the recommendations through policy, land use planning efforts and directions to their respective staff. The cities of Reno and Sparks, and Washoe County should consider acting upon the Management Objectives listed below for long-term watershed protection. The Regional Planning Commission can provide direction to their staff to help coordinate and facilitate land use decisions that are consistent with the objectives of stormwater, floodplain and watershed planning.

Interlocal Stormwater Permit Coordinating Committee

Because their current responsibilities are similar in nature to those provided in this Plan. The Interlocal Stormwater Committee is proposed as the agency to oversee the implementation of this plan. Care must be taken to ensure that watershed objectives are consistent with the stormwater objectives in order to preserve the budgetary intent of the Interlocal Stormwater Committee. The following criteria are proposed to serve as a framework for incorporation into the Interlocal Stormwater Permit Coordinating Committee Agreement.



1. Any incorporation of Watershed Management and Protection Plan activities into the purview of the Interlocal Stormwater Committee should be formally specified and prioritized.
2. Priorities should be listed, sequentially, by their relevance to stormwater objectives and mandates.
3. The Regional Water Planning Commission should contract a Watershed Facilitator for three, one-year contracts. The major components of the scope of work, to be completed in the first year, should contain watershed objectives that are consistent with stormwater objectives.
4. A subcommittee should be formed to discuss and make watershed management recommendations that are relevant to stormwater to the Interlocal Stormwater Committee.
5. Sources of funding for additional work or services outside the current mandate of the Stormwater Quality Permit Coordinating Committee must be pursued. These include funding from the Regional Water Planning Commission, grants or donations, and/or specific local jurisdictional budget requests.
6. Additional staff from Reno, Sparks and/or Washoe County may be called upon to complete Watershed Management and Protection Plan activities that are deemed unrelated to specific stormwater objectives.
7. Annual reviews by the Stormwater Quality Permit Coordinating Committee will be undertaken to determine the effectiveness of including watershed activities under their purview. Annual recommendations will be made to the local jurisdictions and the Regional Water Planning Commission.

Land Use Planning Agencies

Watershed management, stormwater management and floodplain management cannot be effective without the inclusion of land use planning efforts. While existing infrastructure can be retrofitted and best management practices can be implemented, a remaking of future development policies and conditions must be embraced for long term watershed goals to be effective. The four land use planning agencies are encouraged to bring their perspective and knowledge into stormwater, floodplain and watershed planning efforts. These four land use planning agencies are the link to developers, at any scale, and their respective private consulting land use planners. In this context, land use planners would be asked to incorporate "low impact development" policies into development codes. These policies could provide cost savings to the development community. Stormwater operational and maintenance cost savings to the community could also be realized. These policies should be consistent on a regional basis.

Watershed Facilitator

The primary purpose of the Facilitator is to coordinate and enhance efforts among different entities involved with watershed management. The Regional Water Planning Commission and grant opportunities could fund this contract position for a period of up to three years. The Watershed Facilitator would meet regularly with the Interlocal Stormwater Committee for the purpose of implementing complimentary watershed and stormwater efforts.

Duties would include:

- Implementing of the Plan for the first 3-years.
- Assisting in the coordination of cooperative planning efforts of various watershed programs (Flood Control Project, Floodplain Management Plan, Stormwater Quality Management, Land Use Planning efforts, and Steamboat Restoration Plan).

- Providing coordination and education to Advisory Boards for the purpose of watershed stewardship.
- Providing private, public and civic education in watershed management and restoration.
- Enlisting support from local, state, and federal conservancy groups in restoration and preservation efforts.
- Assisting in monitoring efforts to assess effectiveness of stormwater mitigation and other water quality programs. These efforts may assist in obtaining future grant proposals and fulfilling EPA mandated requirements.

Local Actions by Advisory Groups

Local Actions include education, passive monitoring efforts, and small restoration or mitigation efforts directed to specific problem areas within a single sub-watershed. Local Actions require the efforts and coordination of the appropriate Neighborhood or Citizen Advisory Board. These Boards provide the local stewardship roles for their respective watersheds and streams. Their knowledge and "long-term memory" of local watershed conditions can function in a variety of ways. Grassroots efforts can stimulate volunteer work such as water quality monitoring, prioritizing restoration sites and passive monitoring of construction activities. An example of their efforts would be habitat restoration of a reach of a stream achieved through community involvement, volunteer work parties and charitable contributions. Citizen involvement can assist in stream habitat or monitoring projects that are consistent and key to the Interlocal Stormwater Management Plan in attaining "Measurable and Achievable Goals". And certain projects can be accomplished through community service programs. The Watershed Coordinator would work closely with these groups to effectively manage their efforts.

Annual reviews of plan

The Interlocal Stormwater Permit Coordinating Committee will be asked to perform annual reviews of the progress of this plan and make that review and any recommendations to the Regional Water Planning Commission.

7.3 Implementation of Management Objectives

As discussed in Chapter 5, the Watershed Protection Group derived various watershed goals. These were then reconfigured into Management Objectives as described in Chapter 6. The purpose of these Objectives is to protect the watershed as a whole. These can be considered long term accomplishments. The following objectives are grouped as recommendations for the appropriate listed agency. The status column shows that the objective is already being implemented ("ongoing") or that it needs to be "initiated". On an annual basis, these objectives should be reviewed as to their progress in full implementation and their success in fulfilling their intent. The Regional Water Planning Commission or its subcommittee should accomplish this task and reported to the local jurisdictions.

Local Government

The cities of Reno and Sparks, Washoe County, and Washoe County District Health will be called upon to consider and support the following Watershed Management Objectives. These objectives are consistent with the intent of local governmental management. Washoe County District Health could work towards Objectives 6 and 7 concerning septic tank maintenance requirements.

Stormwater Management Objectives	Status
1. Support and coordinate watershed protection efforts with the Truckee Meadows Interlocal Stormwater Quality Management Program.	ongoing
5. Construct erosion control measures for critical stream banks and slopes within watersheds.	initiate
7. Build maintenance costs into stormwater budgets.	initiate
Watershed Maintenance Management Objectives	
3. Implement stream and stormwater facilities maintenance programs on a scheduled basis. Fund and staff through stormwater programs.	initiate
6. Require pumping of septic tanks when properties are sold. DONE	initiate
7. Institute new health regulations regarding septic system maintenance.	initiate
10. Protect critical reaches of streams by ordinance or zoning.	initiate
11. Develop a communications network among municipalities to share planning and zoning strategies. Consider standardizing guidelines within the Truckee River watershed.	initiate
Habitat and Stream Restoration Management Objectives	
4. Develop and enforce stream buffer ordinances.	initiate
5. Preserve or improve riparian, aquatic and terrestrial habitats.	initiate
7. Ensure fire prevention techniques are consistent with watershed protection. Educate fire prevention personnel to recognize and protect desirable vegetation.	Initiate

Land Use Planning Objectives

These objectives would largely be achieved through the various Community Development Departments, with overlap from the other watershed participants. For example, land use planners could coordinate with the Watershed Facilitator to achieve Objective 1, "Coordinate efforts and adopt a regional stream buffer ordinance by cities and county" and Objective 3, "Identify existing codes, ordinances, and laws that affect water quality. Review and determine if improvements are appropriate and achievable."

Stormwater Management Objectives:	Status
6. Incorporate stormwater detention, containment and infiltration into development projects with LID methodologies.	initiate
Land Use Management Objectives:	
1. Coordinate and adopt a regional stream buffer ordinance by cities and county.	initiate
2. Improve coordination among public works and community development departments or reviewing agencies on permitted projects to ensure water quality protection.	Ongoing
4. Incorporate land use planning into watershed management.	initiate
9. Require all new development to incorporate LID methodologies for stormwater and groundwater recharge benefits.	initiate
Habitat and Stream Restoration Management Objectives:	
6. Integrate appropriate recreational opportunities into watershed planning.	Initiate

Interlocal Stormwater Quality Management Objectives

These objectives would largely stem from existing efforts of the Interlocal Stormwater Committee with assistance from the Watershed Facilitator. These objectives compliment current goals of the

Interlocal Stormwater Management Plan. For example, the Stormwater Management Objective 3 "Provide adequate numbers of field inspectors and enforcement authority." is currently underway. Also underway are the Watershed Maintenance Objectives 2 and 3 that "Provide adequate BMP maintenance inspections" and "Implement stream, storm drain and detention basin maintenance programs".

Stormwater Management Objective	Status
2. Participate in monitoring and enforcement of sediment control on construction sites.	ongoing
3. Provide adequate numbers of field inspectors, enforcement authority, and an on-site Erosion and Sediment Control specialist.	ongoing
Watershed Maintenance Objectives	
1. Design and apply management practices to meet both water quality and flood control purposes on stream channels.	initiate
2. Provide adequate BMP maintenance inspections; require redundant BMPs; maintain and repair existing BMPs	Initiate
Land Use Management Objectives	
5. Require construction phasing to minimize long-term bare ground.	ongoing
8. Require all new development projects to document that BMPs are capable of removing the target pollutants of concern (TDS, TSS, N, P) and protecting stream channels from accelerated erosion.	ongoing

Watershed Facilitator Objectives

As stated earlier, a Watershed Facilitator, in concert with Washoe-Storey Conservation District, the University of Nevada Cooperative Extension, and Advisory Boards is key to implementing this Watershed Plan. A significant effort on their part would be directed to the Education Objectives. These Objectives are also key to the Stormwater Quality Management Plan and could be key to the Floodplain Management Plan. It is therefore recommended that the Watershed Facilitator focus on these efforts: the development and implementation of educational programs for residents, land use planners and developers, and elected officials (Education Objectives 1, 2, 3 and 4) and regular feedback to governing bodies on their success.

Stormwater Management Objectives	Status
4. Identify and reconstruct road crossings and culverts that are generating sediment and erosion problems in watershed.	initiate *
Watershed maintenance Objectives	
4. Perform cost/benefit analysis or feasibility studies on restoration practices/projects and prioritize for funding.	initiate *
5. Design and fund noxious weeds management programs.	initiate
6. Promote on-site agricultural management practices including nutrient management, manure handling, and restricting livestock from stream channels.	initiate *
Land Use Management Objectives	
3. Identify existing codes, ordinances, and laws that affect water quality. Review and determine if improvements are appropriate and achievable.	initiate *
Habitat and Stream Restoration Management Objectives	
1. Identify and pursue potential watershed restoration projects.	initiate

Monitoring and Assessment Management Objectives	
1. Update and more accurately quantify and characterize TMDL pollutants to streams and the Truckee River; set target goals for water quality improvement and TMDL compliance.	initiate *
2. Gather existing water quality data and improve or initiate monitoring programs for watershed management.	initiate *
3. Monitor and maintain functionality of streams and associated infrastructure for ongoing water quality protection.	initiate *
4. Continue to identify watershed problem areas (non-functionality, erosion, pollution, habitat degradation, invasive weeds, etc.).	initiate *
5. Monitor attainment of objectives for stream and watershed management practices and restoration projects, and report results to governing bodies.	initiate
Education Management Objectives	
1. Develop and implement educational programs for residents on watershed protection and pollution prevention.	initiate *
2. Develop and implement educational program for land use planners and developers on watershed protection and pollution prevention.	initiate *
3. Develop and implement educational program for elected officials on watershed protection and pollution prevention.	initiate *
4. Provide regular feedback to governing bodies on successes of watershed protection programs	initiate *
5. Design and implement "Watershed" week in schools.	initiate
6. Implement "adopt-a-stream" or "adopt-a-watershed" programs for selected watersheds.	initiate
7. Plan and install demonstration projects for watershed education.	initiate
8. Promote community clean-up days.	Initiate

*First year Watershed Facilitation effort

7.4 Watershed Facilitator

A common problem in the United States in watershed management implementation is the lack of communication and coordination between the several related community agencies in meeting water quality standards and goals. In the Truckee Meadows, several watershed planning efforts have recently been completed as discussed in Chapter 2. Because these have largely been independent efforts, there is a need to facilitate these efforts in the context of land use planning, public education, and a framework for long-term implementation. This plan considers contracting for a Watershed Facilitator to complete an assortment of tasks. These include inter-agency activities, land use planning activities, public education activities, field studies, and completion of a watershed manual. In this manner, the Truckee Meadows can implement cost effective measures to meet and maintain water quality standards. And through this effort, the Truckee Meadows will be correcting the extent and causes of water quality problems in our area.

A primary focus of this contract would be to promote watershed management and protection into land use planning and development practices. The facilitator will research and recommend implementation of "Low Impact Development" (LID) methodologies suitable for urban development in the Truckee Meadows. This focus will require effective communication between land use professionals, both public and private; local public works and engineering agencies, and the general public. By doing so, future urban development and maintenance costs can be reduced as well as negative stormwater effects upon the watershed. Equally

important is to focus on the preservation of groundwater recharge areas that are slated for development. Another component of this focus is the strengthening and compliance of existing policies and ordinances for stream and drainage protection on a regional basis. This component can be accomplished largely through a public education format.

A second focus will be the development of two watershed monitoring programs. The first is to begin collecting water quality data and instantaneous flow rates where little or no information exists on certain perennial creeks. The data collection would begin with four seasonal water quality "grab" samples and four additional stormwater "grab" samples taken. The stormwater sample collection would be coordinated with local stormwater monitoring programs. This data would be used to help set the baseline for existing watershed conditions from which to measure the effectiveness of future stormwater and watershed practices. This program provides a means of determining where efforts should be directed with respect to stormwater runoff, where drainage problems might be improved, and where LID efforts could be directed. Future funding of this program would be sought through other sources. The program will compliment three other water quality monitoring programs being conducted by the Interlocal Stormwater Quality Management Plan, the Truckee Meadows Water Reclamation Facility, and the Nevada Division of Environmental Protection.

In addition to water quality data collection is the design of a system to monitor the condition of streams and riparian habitat as set forth in this Plan. This is done through stream functionality assessments (BLM, 1998) that should be performed every three to five years. The premise for this program is that properly functioning streams reflect good land use practices and good water quality. The program would be able to measure the improvement of sensitive and critical stream reaches already identified. Both of these programs will be used to determine if watershed and stormwater quality goals are being met (Kennedy/Jenks, 2002).

The third focus of this contract will be the documentation of a "Watershed Manual" that can be considered a final report. The manual will function in four ways. First, LID methodologies will be detailed for urban development implementation. Second, stream restoration sites will be identified and restoration methodologies will be detailed. These methodologies will be general enough for usage throughout the Truckee Meadows at sites with common problems. Third, the manual will detail the water quality monitoring network and sampling schedule/protocol. Fourth, the manual will provide a methodology for future, regularly scheduled, watershed assessment protocol. This program will be used for determining the long-term successes of stormwater and watershed management efforts.

Scope of Work

Specific work efforts to complete during this contract period will include the following.

1. Research LID methodologies as to their applicability in the Truckee Meadows for stormwater and groundwater recharge benefits. Describe methodologies (include drawings) and recommend for urban development practices.
2. Identify groundwater recharge protection areas on lands designated for future development (RWPC, 2003). Coordinate groundwater recharge protection for these areas with public and private land use planners.
3. Promote watershed management and protection into Truckee Meadows land use planning. This involves a communicative and educational effort with jurisdictional land use planning agencies and their respective commissions. This effort will compliment the University Nevada Cooperative Extension NEMO program currently in progress (Donaldson, 2003).
4. Provide feedback to governing bodies on stormwater and watershed programs.

5. Coordinate with Washoe County, Reno and Sparks to modify or adopt existing codes and ordinances that affect water quality as recommended by the recent Floodplain Management Plan.
6. Promote on-site agricultural management practices including nutrient management, manure handling, and restricting livestock from stream channels. Target critical and sensitive areas identified in Watershed Assessment Report in cooperation with University Nevada Cooperative Extension programs currently in progress.
7. Develop and present educational programs for residents, advisory boards, land use planners, and elected officials on watershed protection and pollution prevention. Program would target sensitive and critical stream areas identified in the Watershed Assessment Report (Widmer and Jesch, 2002).
8. Investigate specific road crossings and culverts that appear to be generating sediment and erosion problems to perennial streams as identified in the Watershed Assessment Report. Investigate and report on the source areas.
9. Develop a stormwater quality monitoring program as recommended in the watershed management plan. Initiate a long-term water quality database where insufficient data currently exists. Program will be coordinated with existing programs (Interlocal Stormwater Quality, NDEP class waters, TMWRF).
10. Develop a long-term program to monitor the functionality of streams and buffer areas for ongoing water quality protection. The methodology will be used to assess the effectiveness of management objectives and restoration/mitigation actions on water quality goals. Program should be consistent with this Plan and should provide regular feedback to local governments.
11. Document recommended LID designs applicable to the Truckee Meadows development community. Applicable designs should be consistent with other work efforts listed above.
12. Describe applicable stream restoration or mitigation methodologies. These methodologies should be generic, but detailed enough for general use throughout the Truckee Meadows.
13. Document stormwater and watershed monitoring networks and their respective protocols.

7.5 Meeting Water Quality Goals

Degradation of water quality begins in the developed upper portions of our watersheds and continues downstream to and including the Truckee River. It begins with stormwater and floodwaters that overwhelm natural drainages with greater and more frequent flows. It begins with natural riparian buffers that are altered or destroyed. And it begins with drainage morphologies that are altered by current development practices.

Section 4.4 discusses action items (see also Table 4.3) to improve tributary conditions and to improve water quality (Widmer and Jesch, 2002). Table 7.1 is a list of priority water quality and stream restoration projects. It is reformatted from Tables 4.1 - 4.3 and recommends potential lead agencies to restore these site specific reaches. Priorities are subjectively given as high, moderate and low. A high priority considers the immediate water quality impact to the Truckee River or future drinking water sources such as Thomas and Whites creeks. Moderate priorities are given to concentrated sources of Total Suspended Solids and nutrient loads to tributaries. Low priorities are given to projects that restore stream functionality to streams that have been altered for flood control and drainage.

Table 7.1
Priority List of Water Quality and Stream Restoration Projects

Creek reach	Priority	Stormwater runoff treatment	Reduce chemical applications	Encourage riparian buffers	Public education	Reduce animal impacts	Enforce construction site BMPs	Control building encroachment	Control road encroachment	Create floodplain (excavate)	Shape banks	Install toe protection	Implement soil bioengineering	Potential Lead Agency
Chalk 3	H	X	X		X				X					TMWA, TMWRF
Whites S Fork 2	H			X				X		X	X		X	Washoe Co
Thomas 4	H			X	X	X	X	X	X				X	Wa Co, RWPC
Alum 3	H		X	X	X									TMWRF, RWPC
Alum 1	M		X	X	X		X							ISC
Sunrise	M	X			X	X						X		RWPC, NDEP, WaCo, TMWRF
Dog 2	M				X			X	X			X	X	Washoe Co
Jones 2	M									X	X		X	Washoe Co
Galena 4	M			X	X	X				X	X		X	WaCo, RWPC
Muskgrove 2	M		X	X	X	X		X		X	X			WaCo, RWPC
N. Truckee Drain 4	M	X	X		X		X			X	X			US ACE, Sparks
Dry 2	M	X		X	X	X	X				X		X	Reno
Steamboat	M	X		X	X					X	X	X	X	US ACE
Jumbo	M				X			X	X	X	X	X	X	WaCo, US BLM
Whites N. Fork 2	M	X	X	X	X		X	X	X	X	X		X	Washoe Co, Reno
Evans 2, 3	L	X			X	X	X	X		X	X		X	Reno
Thomas S. Fork	L			X				X		X	X		X	Reno
Boynton	L	X		X	X			X		X	X		X	Reno
Dry 4	L			X						X	X			Reno
Unnamed (Mogul)	L	X	X	X	X		X	X	X		X	X	X	ISW

Stream reaches may be numbered from most upstream location (1) to downstream location (2 or 3)
ISW: Interlocal Stormwater Committee
NDEP: Nevada Division of Environmental Protection
RWPC: Regional Water Planning Commission (through Facilitator)
TMWA: Truckee Meadows Water Authority
TMWRF: Truckee Meadows Water Reclamation Facility
US Army Corps of Engineers
US BLM: US Bureau of Land Management
WaCo: Washoe County

H: High Priority **M: Moderate Priority** **L: Low priority**

Stream management and restoration methods are summarized for each of the priority reaches. Further detail and explanation can be found in Section 4.2. The final column lists potential lead agencies that could provide project management as well as exploring federal and state grant opportunities. These items have neither a funding mechanism nor are they all considered "inexpensive". However, funding many of these action items are important in terms of improving water quality, protecting road infrastructures, protecting land from further erosion, and protecting residences from flooding.

Chalk Creek represents a water quality problem as its TDS level is 3,000 mg/l and flows regularly at one cfs. This is an excellent site for non-point pollution trading for the benefit of Truckee Meadows Water Reclamation Facility (TMWRF) and this community. Chalk Creek also becomes a flood control problem for the Truckee Meadows Water Authority (TMWA) and their facilities. Therefore these two agencies are listed as potential lead agencies.

Whites and Thomas creeks will soon become sources of drinking water supply. Washoe County is listed as the potential lead agency as it the Regional Water Planning Commission through public education efforts led by the Watershed Facilitator. Alum Creek is listed as a high priority because of its relatively poor water quality (nutrient loads) that can be improved for the benefit of the Truckee River. Reductions in nutrient loads helps TMWRF in their efforts to meet TMDLs to the Truckee River.

Nutrient loads to the Truckee River as well as total suspended solids (TSS) are found from the Sunrise watershed, lower Galena Creek in Pleasant Valley, and Muskgrove Creek. Washoe County and the Watershed Facilitator (RWPC) could work together in an effort to mitigate this problem. Private property and roads are threatened on Dog, Jones, and Whites creeks that are rated moderate. Washoe County and Reno are proper lead agencies as improvements to these creeks will reduce this risk. Jumbo Creek is subjected to stormwater and road encroachment problems that are currently being addressed by the US Bureau of Land Management and Washoe County. Jumbo Creek could become a local water amenity through restoration efforts and reduce the detrimental effects from storm events.

Stream restoration efforts are needed on Evans Creek (2, 3), Dry Creek (2), and the north fork of Whites Creek in order to protect private property and to reduce sediment loads (TSS). These represent difficult challenges because of the encroachment of buildings and roads, but solutions are proposed in Chapter 4.

Moderate priorities are given to the realignment of the lower reaches of the North Truckee Drain and Steamboat Creek. These projects will require extensive restoration and represent large community challenges. However, they represent the biggest sources of nutrient, TDS and TSS to the Truckee River. Efforts to reduce these pollutant loads can clear many hurdles for the future growth of the community in terms of wastewater discharge to the Truckee River.

Finally, low priority is given to restoring the flood and drain conveyance structures of Boynton Slough, Dry Creek, and Thomas Creek. These drainages are located in the valley floors and are viewed, by some, as eye sores particularly where Tall Whitetop has completely enveloped them. A long term, visionary program to restore a dual functionality as streams and flood conveyance could have large appeal to the community. Rather than eyesores, they could become natural resource amenities lined with native vegetation and cottonwood canopies. Such projects would also increase property values and attract commercial investment. However, funding for this type of restoration represents a big challenge to the community.

7.6 Priorities

This Watershed Management and Protection Plan can be implemented by the following steps.

1. The first priority is jurisdictional approval of this Watershed Management and Protection Plan. This is accomplished through recommendation of the Regional Water Planning Commission and the Regional Planning Commission, and through adoption by the Cities of Reno and Sparks and Washoe County. The Nevada Division of Environmental Protection should recognize this Plan as a community effort of providing water quality improvements to the Truckee River.

2. A Watershed Facilitator should be contracted, annually, for a period of three years. The first year's assigned tasks are stated in this Chapter. This contracted position is not envisioned to be permanent, but rather as a means to coordinate this plans implementation. Funding should be through the Regional Water Planning Commission and through state or national grant opportunities.

3. The Interlocal Stormwater Quality Committee should integrate this plan into their purview. The Watershed Facilitator would work under this committee and concentrate on congruent objectives.

4. The enlistment of Citizen and Neighborhood Advisory Boards is key for the benefits they can provide in the management and monitoring process. This will be a lengthy and time-consuming effort in the early stages, but could become streamlined and efficient in the long term. Incorporating the public into watershed management and protection can only present to the community a better sense of stewardship, pride and commitment to the preservation of our watersheds.

5. Funding opportunities through federal and state grants should be pursued immediately as discussed in the following section. Key opportunities may be found in the recently adopted US Congressional Farm Bill Act and the recently approved State Bond Issue "Conservation and Natural Resource Protection (Question 1)".

6. Coordinate water quality monitoring with the stormwater management plan. Research sources for funding such as NDEP 319 grants.

7. A concerted effort should be given to publicly recognizing stream buffers for their benefits to water quality, flood control, riparian habitation, and as public amenities.

8. Educational programs should be developed and implemented through the Watershed Facilitator, the Washoe-Storey Conservation District and the University of Nevada Cooperative Extension. Programs should include those listed in the Education Management Objectives and those recommended by the stormwater and floodplain management plans.

9. Management and restoration efforts on the specific areas of concern should be researched by the Watershed Facilitator for feasibility and cost. A priority list should be prepared and discussed by Advisory Boards and the proper municipality for possible action.

10. Low Impact Development methodologies should be researched and, where applicable, be considered by land use planners and the development community for inclusion in development codes.

7.7 Costs and Funding

By implementing low cost educational programs and policies today, future watershed restoration costs are minimized. This is the intent of the Watershed Management and Protection Plan. It can be accomplished at a relatively low cost to this community as long as the community embraces this plan. Much of the effort can be accomplished through a Watershed Facilitator and through public education. However, currently there are restoration projects that need to be managed and funded as previously discussed in section 7.5.

Watershed Facilitation and Education

The cost of contracting the Watershed Facilitator should be borne by the Regional Water Planning Commission as it is their responsibility to implement this plan. State and federal funding can be applied for to augment this cost. The expected time frame is three years and the approximate annual cost is:

First year	$120,000
Second year	$60,000
Third year	$30,000

Currently, a $66,000 grant is being sought from the Nevada Division of Environmental Protection to help fund the first year's effort. The scope of this effort is discussed in section 7.4.

Capital Improvements

As was discussed in section 7.5 and shown in Table 7.1, there are "capital improvement" projects that are recommended. High priority projects should be pursued. Projects that require engineering to prevent damage to roads, buildings and property should be brought before appropriate public works departments for possible budget authorization. To date there have not been any estimates on the costs of these projects. Low priority projects should be investigated for their cost, tax benefits and the desire of the community to fund as community amenities. Local bond issues may be required to adequately fund restoration projects for the lower North Truckee Drain re-alignment and Steamboat, Dry, Thomas, Evans and Boynton Slough areas on the valley floors.

State and Federal Funding Sources

At the time of this draft report, a full list of possible funding sources and requirements for funding had not been completed although the list is substantial. This will be completed for the final report.

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APPENDIX 1

Glossary and Acronyms of Watershed Management Terms

Aquifer - A geologic formation, group of formations, or part of a formation capable of storing, receiving and transmitting water. The formation is capable of yielding enough water to support a well or spring.
Bankful Flow - The condition where streamflow fills a stream channel up to the top of the bank and at a point where the water begins to overflow onto a floodplain.
Baseflow - The amount of water in a stream that results from ground water discharge, and not from surface runoff.
BMP- Best Management Practice - A structural or non-structural device designed to temporarily store or treat urban stormwater runoff in order to mitigate flooding, reduce pollution and provide other amenities.
Basin - The largest single watershed management unit for water planning, that combines the drainage of a series of subbasins. Often have a total area more than a thousand square miles.
Buffer - An area adjacent to a shoreline, wetland or stream where development is restricted or prohibited.
Channel - The bed of a river, stream, drainage ditch, or other waterway that transports a concentrated flow of water.
Channel Stabilization - Erosion prevention and stabilization of velocity distribution in a channel using jetties, drops, revetments, structural linings, vegetation and other measures.
CAB- Citizens Advisory Board - A group of citizens that oversee and make suggestions to the implementation of proposed activities in their boundary area and ensure that all citizens are able to provide input to the decision-making authorities.
Cluster or Open Space Development - The use of designs that incorporate open space into a development site. These areas can be used for either passive or active recreational activity or preserved as naturally vegetated land.
Conservation Easement - A legal agreement through which a landowner retains title to a given property while voluntarily restricting certain uses of the property to protect and conserve natural areas in perpetuity.
CRS- Community Rating Management System Program
Disturbed Area - An area in which the natural vegetative soil cover has been removed or altered and, therefore, is susceptible to erosion.
Diversion - A channel constructed across the land slope to intercept surface runoff and to conduct it to an outlet.
Drainage - The removal of excess water from the land surface and/or from the soil profile.
Surface Drainage The diversion or orderly removal of excess water from the surface of the land by means of improved natural or constructed channels, supplemented when necessary by the sloping and grading of land surfaces to these channels.
Drainage Area - A general term for the land area drained by a ditch, creek, stream, or river. When reference is made specifically to a large surface water body like a river, the term Drainage Basin is used.

Drainage Basin - The land area drained by a river.
EIS/EIR – Environmental Impact Statement/Environmental Impact Review- Federally mandated resource investigations.
Erosion - The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. 2. Detachment and movement of soil or rock fragments by water, wind, ice or gravity. The following terms are used to describe different types of water erosion:

Accelerated erosion: Erosion much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of the activities of man or, in some cases, of other animals or natural catastrophes that expose base surfaces, for example, fires.
Gully erosion: The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 1 or 2 feet to as much as 75 to 100 feet.
Rill erosion: An erosion process in which numerous small channels only several inches deep are formed.
Sheet erosion: The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles may or may not subsequently be removed by surface runoff.

FEMA – Federal Emergency Management Agency
Filter Strips - A vegetated area that treats sheetflow and/or interflow by removing sediment and other pollutants. The area may be grass-covered, forested or of mixed vegetative cover (e.g. wildflower meadow).
Floodplain - Areas adjacent to a stream or river that are subject to flooding or inundation during severe storm events (often called a 100 year floodplain, it would include the area or flooding that occurs, on average, once every 100 years).
Floodplain Management - A process to limit flood damage by prohibiting new development within the boundaries of the 100-year floodplain. In existing developments within the floodplain, management includes maintaining and increasing open space areas along waterways.
Gaining Stream A stream that receives ground-water discharge. The flow increases as one moves downstream.
Green Space - The proportion of open space that is retained in an undisturbed vegetative state.
Greenway - A planning study that creates a linked and linear network of trails, accesses, passive and possibly active recreational facilities along an aquatic corridor.
Groundwater - All subsurface water that fills the pores, voids, fractures, and other spaces between soil particles and in rock strata in the saturated zone of geologic formations.
Groundwater Discharge Point - A place where ground water flows out from an aquifer and into a surface water body.
Habitat – A place within an ecosystem occupied by an organism, population, or community that contains living and nonliving elements with specific characteristics including basic life requirements of food, water, and shelter.
Hydrologic Cycle - The constant process of water movement from the Earth to the atmosphere by evaporation and transpiration, and from the atmosphere to the Earth in various forms of precipitation. This term includes movement of water on and beneath the Earth's surface. Sometimes the term Water Cycle is used.
Impermeable Layer - A layer that does not permit water to flow through it.
Impervious - The characteristic of a material which prevents the infiltration or passage of liquid through it. This may apply to roads, streets, parking lots, rooftops and sidewalks.

Impervious Cover - Any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall.
Industrial Stormwater Permit - An NPDES permit issued to a commercial industry or group of industries which regulates the pollutant levels associated with industrial storm water discharges or specifies on-site pollution control strategies
Incised - Term used to refer to the banks of a stream or creek that have steeply cut straight banks.
Infiltration - The downward entry of water into the Earth's surface. Infiltration usually refers to water movement into a soil or rock surface while the terms hydraulic conductivity, percolation, and permeability usually relate to water movement within a soil or rock layer.
Jurisdictional Wetland - A wetland which is regulated by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.
Leaching - The natural process by which salts and other soluble materials are removed from the soil by percolating water.
LID- (Low Impact Development) – Residential and commercial development of property that encompasses methodologies to reduce stormwater discharge, largely through on-site infiltration.
Memorandums of Understanding (MOU's) - Agreements by local government agencies and other local stakeholders to work together in exploring solutions/alternatives to water quality issues and the creation of a watershed planning strategy.
MS4 - Municipal separate storm sewer system. A separate drainage system for stormwater runoff that discharges to a body of receiving water and that is not combined with a sanitary sewer.
Municipal Stormwater Permit - An NPDES permit issued to municipalities to regulate discharges from municipal separate storm sewers for compliance with EPA established water quality standards and/or to specify specific stormwater control strategies.
N – (Nitrogen) - a chemical element that is one of two macronutrients required by plants. Nitrogen may be found in nitrates, nitrites, ammonia, or organic compound forms. Sources of nitrogen include leaking septic systems, fertilizers, animal wastes, industrial wastewaters, and atmospheric deposition. Increasing concentrations of phosporus in water bodies can result in algal blooms and subsequent decreases in dissolved oxygen concentrations.
NAB - Neighborhood Advisory Board– A group of citizens that oversee and make suggestions to the implementation of proposed activities in their boundary area and ensure that all citizens are able to provide input to the decision-making authorities.
NDEP- Nevada Division of Environmental Protection. Division of the Nevada Department of Conservation and Natural Resources
NEMO- (Non-Point Source Education for Municipal Operations) - National program to incorporate low impact development methodologies to reduce stormwater runoff.
Nitrate - the oxidized and soluble form of organic nitrogen. High nitrate levels can be toxic to both aquatic life and humans. Nitrates are contributed by septic systems, animal feed lots, agricultural fertilizers, manure, industrial waste waters, sanitary landfills, and garbage dumps.
Nonpoint Source Pollution – pollutants that enter water bodies in a diffuse pattern – through land runoff, leaching of wastes, run-off of pesticides, dumping of chemicals, etc. – rather than from a specific, single source. It is considered the main source of water quality degradation today.
NPDES - National Pollutant Discharge Elimination System - Established by Section 402 of the Clean Water Act, this federally mandated system is used for regulating point source and stormwater discharges.

Nutrient - A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to eutrophication.
Open Space - A portion of a development site, which is permanently set aside for public or private use and will not be developed with homes. The space may be used for passive or active recreation, or may be reserved to protect or buffer natural areas.
Open Space Development - The use of designs, which incorporate open areas into a development site. These areas can be used for either passive or active recreational activity or preserved as naturally vegetated land.
Open Space Management - The legal and financial arrangements needed to manage open space according to its prescribed use (i.e., natural areas, recreation).
Ordinance - A law, a statute, a decree enacted by a municipal body, such as a city council or county commission. Ordinances often govern matters not already covered by state or federal laws (such as local zoning, safety and building regulations), but may also be used to require stricter standards in local communities than those imposed by state or federal law.
Overland Flow The quantity of water that moves across the land surface. Contributions to overland flow result from runoff and from the surfacing of subsurface flows before they reach a receiving stream or a defined drainage channel.
P – (Phosphorus) - Phosphorus, a chemical element that is a macronutrient required by plants. Phosphorus may be found in phosphate compounds, organic compounds, or particulate forms adsorbed (attached) to sediment particles. Common sources of phosphorus include fertilizers, animal wastes, detergents and other chemicals. Increasing concentrations of phosporus in water bodies can result in algal blooms and subsequent decreases in dissolved oxygen concentrations.
Peak Discharge (Flow Rate) - The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.
Perennial Stream - A stream channel that has running water throughout the year.
Permeability - The rate of water movement through the soil column under saturated conditions.
pH - A number denoting the common logarithm of the reciprocal of the hydrogen ion concentration. A pH of 7.0 denotes neutrality, higher values indicate alkalinity, and lower values indicate acidity.
Point Source Pollution - Contamination that occurs at a specific location, such as a spill, leaking storage tank, or city wastewater facility.
Polluted Water - Water containing a natural or human-made impurity. The water is classified as polluted when the concentration of the pollutant exceeds the acceptable standard for a particular use. Water that contains disease-causing or toxic substances is said to be contaminated.
Pollution Prevention Plan - A requirement for some land uses or activities (e.g., industrial sites) that outlines techniques to prevent pollutants from being washed off in stormwater runoff (e.g., spill response, material handling, employee training, etc.)
Potable Water - Water that is safe and palatable for human consumption.
Precipitation - The process by which water vapor condenses in the atmosphere or onto a land surface in the form of rain, hail, sleet or snow.
Receiving Waters - All distinct bodies of water that receive runoff, including channels, streams, rivers, ponds, lakes, estuaries, and in some cases, groundwater.
Recharge - The replenishment of groundwater by seepage (deep percolation) of precipitation and runoff, adding water to the saturated zone.
Restorable Stream or Subwatershed - Stream classification that is impacted or non-supporting but has high retrofit or stream restoration potential.

Return Flow - The amount of water that reaches a surface or groundwater source after it has been released from the point of use and thus becomes available for further reuse. Also called return water.
Rip-Rap - Broken rock, cobbles, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection against the action of water (waves); also applies to brush or pole mattresses, or brush and stone, or similar materials used for soil erosion control.
Riparian - The land area which borders a stream or river and which directly affects and is affected by the water quality. This land area often coincides with the maximum water surface elevation of the 100-year storm.
RMHQ - Requirement to Maintain Higher Quality. If the water quality in a class water is significantly better than the class requires for a particular constituent, Nevada regulations require the existing water quality to be maintained, even though the class standards may permit lower quality water.
RSQMP- Regional Stormwater Quality Management Program.
Runoff - The portion of precipitation or irrigation water that moves across land as surface flow and enters streams or other surface receiving waters. Runoff occurs when the precipitation rate exceeds the infiltration rate.
Sediment – fragmented material from weathered rocks and organic material that is suspended in, transported by, and eventually deposited by water or air.
Sedimentation - Soil particles suspended in stormwater that can settle in stream beds and disrupt the natural flow of the stream.
Sensitive Stream or Subwatershed - Stream classification for a subwatershed with less than 10% impervious cover, that is still capable of supporting stable channels and has good to excellent biodiversity.
Side Slopes - The slope of the sides of a channel, dam or embankment. It is customary to name the horizontal distance first, as 1.5 to 1, or frequently, 1 ½: 1, meaning a horizontal distance of 1.5 feet to 1 foot vertical.
Stabilization - Providing adequate measures, vegetative and/or structural that will prevent erosion from occurring.
Stormwater Management - The programs to maintain quality and quantity of stormwater runoff to pre-development levels.
Stream Buffers - Zones of variable width, which are located along both sides of a stream and are designed to provided a protective natural area along a stream corridor.
Subwatershed - A smaller geographic section of a larger watershed unit with a drainage area of between 2 to 15 square miles and whose boundaries include all the land area draining to a point where two second order streams combine to form a third order stream.
Surface Water - The water from all sources that occurs on the Earth's surface either as diffused water or as water in natural channels such as streams, rivers, lakes, and oceans, or in artificial surface water bodies.
SWPPP – Surface Water Pollution Prevention Plan
TMDL (Total Maximum Daily Load) - A tool for establishing the allowable loadings of a given pollutant in a surface water resource to meet predetermined water quality standards.
TDS (Total Dissolved Solids) - All material that passes the standard glass river filter; now called total filtrable residue. Term is used to reflect salinity.
TMWRF – Truckee Meadows Water Reclamation Facility- The main wastewater (sewer) treatment plant serving the Truckee Meadows.
TN – (Total Nitrogen), includes Kjeldahl, nitrate and nitrite compounds of nitrogen
TP – (Total Phosphorus), includes organic (orthophosphate) and inorganic compounds of phosphorous
TROA – Truckee River Operating Agreement

TSS (Total Suspended Solids) - The total amount of soils particulate matter which is suspended in the water column.
Tributary – streams that flow into larger streams or channels.
UNCE – University of Nevada Cooperative Extension
USEPA- United States Environmental Protection Agency
WSCD - Washoe-Storey Conservation District
Water Rights - The legal rights to the use of water.

Prior Appropriation A concept in water law under which users who demonstrate an earlier use of the water from a particular source are said to have rights over all later users of the water from the same source.

Riparian Rights A concept of water law under which authorization to use water in a stream is based on ownership of the land adjacent to the stream.

Water Quality - The chemical, physical, biological, and radiological condition of a surface or ground water body.
Watershed - An area of land from which all water drains to a common location.
Water Table - The upper boundary or top surface of the zone of saturation in a soil profile or geologic formation.
Waterway - Any channel, natural or constructed, in which water flows.
Wellhead Protection Area - A designated surface and subsurface area surrounding a well or well field that supplies a public water supply and through which contaminants or pollutants are likely to pass and eventually reach the aquifer that supplies the well or well field. The purpose of designating the area is to provide protection from the potential for contamination of the water supply. These areas are designated in accordance with laws, regulations, and plans that protect public drinking water supplies.
Wetland - A land area that wet at least for part of the year, are poorly drained, and are characterized by the existence of plants that grow well in water or saturated soils. Examples include swamps, marshes, bogs, sloughs, streams, creeks, wet meadows, river overflow areas, mud flats, and natural ponds.

APPENDIX 2

Watershed Assessment Summaries

Northern Carson, Peavine, Verdi Creeks

Tower, Hunter, Alum, Dog, Sunrise, Bull Ranch, Unnamed, Chalk, Peavine, Evans

These creeks flow directly to the Truckee River and drain the northern Carson Range (Hunter and Alum), Dog Valley (Dog) and the Verdi Range (Sunrise), and the southern flanks of Peavine Mountain (Bull Ranch, Peavine, Chalk, Evans) as seen in Figure 1.1. Most of these creeks are ephemeral with the exception of Dog Creek and Hunter Creek. The creeks are fed from snowmelt in their respective ranges and from groundwater base flow. Their drainages are orientated north or south towards the Truckee River. While these creeks are mostly ephemeral, their drainages can easily generate large flood flows in excess of 100 cfs or even 1,000 cfs (USGS, 1998).

General

Low-permeability soils are mapped throughout the Chalk, Peavine and Evans watersheds, and the middle to lower watersheds of Bull Ranch, Unnamed, Tower, Alum and Hunter creeks. This is the result of outcropping rocks or the clayey nature of sediments derived from volcanics. Slopes within these watersheds are generally greater than 15 percent. Flooding does not appear to be a problem other than areas adjacent to the Truckee River and the creeks. Within the Carson-Peavine-Verdi Tributaries study area few areas are mapped as wetlands. Large-scale residential development of the Peavine and lower Alum Creek area has occurred such that small wetlands have been drained over the last forty years. Land use within these watersheds is diverse ranging from national forest to areas of high-density residential, commercial and industrial use. Since data for the Truckee River are excluded in this assessment, no known hazardous materials are found within 150 feet of the creeks. A sanitary survey of the Truckee River has been conducted by the University of Nevada, Reno and is currently being finalized (Dean Adams, personal communication).

Overall the water quality is diverse (Table 1). While Dog and Hunter creeks show good quality water, Alum, and in particular Chalk, show very high total dissolved solids (TDS). The Alum water is high in sulfate (420 mg/l), probably derived from the hydrothermally altered volcanics, and calcium (100 mg/l). Chalk water has an alarmingly high level of TDS. The main constituents are sulfate (1800 mg/l), calcium and manganese (360 and 240 mg/l respectively), sodium (236 mg/l) and bicarbonate (344 mg/l). Suspended sediment loads are mostly very low. Nitrogen and bacterial counts are relatively low, exceptions being the bacterial count for Alum and the nitrate concentration for Chalk.

Table 1

General water chemistry

creek/reach	TDS	TSS	TP	NO3	TKN	Fecal Coli	Fecal strep	coli/strep Ratio
	mg/l	mg/l	mg/l	Mg/l	mg/l	Count	count	
Dog	172	3	0.03	0.0*	0.2	<1	11	<0.1
Hunter	116	5	0.05	0	0.15	2	20	0.1
Alum	740	16	0.11	0	0.58	30	350	0.08
Chalk	3,080	<1	0.26	3.0	0.35	<10	50	<0.2

TDS= total dissolved solids (inorganic chemistry)
TSS= total suspended solids (sediment)
TP = total phosphate (organic phosphate)
TKN=total Kjeldahl nitrogen (organic nitrogen)

Coli= coliform (fecal coliform is feces derived bacteria)
Strep=streptococci (fecal bacteria)
Coli/Strep ratio is feces origin indicator where >1 is human source

Conclusions

Table 2 lists the ratings for each creek, based upon the assessments. Sensitive and critical reaches are mapped on Figure 2.9. The most obvious problem for these creeks is erosion and sedimentation. This is due to development encroaching upon or alteration of the creek channels and stormwater discharges to the creeks. However, most of the degrading activities are located in active construction areas such that the effects are generally temporary problems. An exception is the sewer line above Mogul. Reclamation efforts will alter the stream channel and if not effective, will cause sediment to be transported to the Truckee River. Restoration efforts can be successful for many of the reaches listed critical and or sensitive and are marked with an asterisk.

Table 2
Stream Health Ratings

Creek	reach	
	mid	lower
Tower	good	sensitive
Hunter	good	good
Alum	sensitive	sensitive
Dog	good	sensitive
Sunrise	good	critical
Bull Ranch	good	good
Unnamed	good	sensitive
Chalk	good	sensitive
Peavine	good	none
Evans	good	none

During the field inspections and stream assessments note was made of areas where moderate to significant erosion was occurring. Particular note is made of the following areas as shown on Figure 2.9. Construction site sediment is being discharged to Alum Creek during storm events along Caughlin Parkway. Construction of the sewer line above Mogul in the "unnamed" drainage is built in the channel flood plain placing significant sediment in the channel. This will be carried to the Truckee River during moderate storm events. Erosion of a small drainage channel in Verdi along Hill Lane will jeopardize this road and will discharge animal waste and sediment into the Truckee River as well. Other construction sites within the Chalk Creek drainage are also discharging sediment into the drainage that will eventually be carried to the Truckee River. Only two watersheds harbor invasive plant species. These are Chalk Creek where Tall Whitetop and Scotch Thistle are found and an unnamed drainage near Sunrise Creek where Scotch Thistle is found.

North Truckee Drain

There are no perennial streams in this watershed (Figure 1.1). Truckee River water was imported into Spanish Springs through the Orr Ditch beginning in 1878. Tail water from flood irrigation and springs were collected through the North Truckee Drain and exported back to the Truckee River. This drain is perennial. However, as residential development replaces irrigated lands, the need for the drain may diminish over the next twenty to thirty years.

General

Low-permeability soils dominate this watershed as a result of the clayey nature of sediments derived from the surrounding volcanic laden mountains. Slopes within this watershed are generally low, but development east of the drain ranges up to greater than 15 percent. These areas will also generate

substantial runoff during high intensity precipitation events. Natural flooding occurs throughout most of the North Truckee Drain area within Spanish Springs and the lower lands near the Truckee River. Washoe County and the City of Sparks are currently working on flood management programs to help solve this problem (Parsons, 2002; Kennedy Jenks Consultants, 2000). The greatest concentrations of wetlands are within the "headwaters" of the drain, the reason the drain was constructed in the first place. These encompass the northern half of the drain's length within Spanish Springs proper. As development increases within this area, the wetland areas will decrease.

The entire study area is within the City of Sparks. The land in the northern half of the watershed area is a mixture between agricultural lands, brushland and residential development. The southern portion of the watershed is fully urbanized. The northern portion of the study area is currently zoned for single family residences with the commercial properties, mostly golf courses. The southern portion of the drain is zoned single family residential with some commercial properties as is the central portion of the drain. The last 1.5 miles of the drain are zoned commercial and industrial.

Septic tank effluent, as groundwater, may flow to the drain in the northern portions of the study area given the density of septic tanks within the immediate area. The Red Hawk golf course is located within the northeastern portion of the drain, using it for a water feature. Downstream commercial properties are primarily retail stores. At the southern end of the drain, industrial and commercial sites are shown to border the drain. This includes aboveground and underground storage tanks as well as three Resource Conservation and Recovery Act (RCRA) sites. RCRA sites are those that store, use, or generate toxic chemicals and are required to adhere to local, state and federal storage and handling regulations.

As listed in Table 3, the total dissolved solids concentration in the North Truckee Drain (728 mg/l) and the Marina discharge (496 mg/l) to the Drain are relatively high. The

Table 3
General water chemistry

creek/reach	TDS	TSS	TP	NO3	TKN	Fecal coli	Fecal strep	coli/strep Ratio
	Mg/l	mg/l	mg/l	mg/l	Mg/l	Count	count	
N Truckee Drain								
Shadow Lane	728	52	0.18	1.8	1.15	na	800	na
Marina discharge	496	65	0.4	0.1	0.47	1100/100	90/100	12.2/1
@ Truckee	532	6	0.28	0.6	0.53	150/100	180/100	0.8/1

TDS= total dissolved solids (inorganic chemistry)
TSS= total suspended solids (sediment)
TP = total phosphate (organic phosphate)
TKN=total Kjeldahl nitrogen (organic nitrogen)
Coli= coliform (fecal coliform is feces derived bacteria)
Strep=streptococci (fecal bacteria)
/ = analyzed at two dilutions
Coli/Strep ratio is feces origin indicator where >1 is human source

lower concentration in the Marina discharge dilutes the upstream concentration that eventually flows into the Truckee River. However, this concentration (532 mg/l) is much higher compared to the Truckee River, estimated at 100-150 mg/l.

Nitrogen does not appear to be a problem at the concentrations sampled. The fecal sampling shows high values at Shadow Lane and in the Marina discharge, but rather dilute at the Truckee River. The coliform to streptococci ratio is generally one, meaning that the source is a mixture of livestock and human. However, the Marina sample was analyzed at two different solutions (1:1 and

10:1) and the fecal coliform results were different by an order of magnitude. This may reflect the uncertainty in the analysis procedures. Noteworthy is the fact that during an inspection of the Drain at the confluence with the Truckee River a sediment plume discharging to the Truckee River from the Drain was obvious (see stream assessment dated February 6, 2002).

On January 16, 2002 water from the North Truckee Drain was sampled above the confluence with the Sparks Marina discharge during a moderate rainstorm. The sample was analyzed for total hydrocarbons (oil = 71 mg/l), total suspended solids (232 mg/l), total dissolved solids(312 mg/l), total phosphates (0.36 mg/l), nitrate (0.9 mg/l), and kjeldahl nitrogen (1.6 mg/l). While there is not a November 2001 sample at this location to compare to, it is instructive to compare these concentrations to the Shadow Lane concentrations listed in Table 3. The TDS is one half that found at Shadow Lane as is the nitrate concentration (although the nitrate is low in both samples). Total suspended solids is four times that found in the November 2001 sample which was sampled during dry and low flow conditions. Kjeldahl nitrogen and total phosphate are also elevated, but not significantly. These results mostly show the increase in total suspended solids and oil/grease found in the drain waters as a result of storm drain effects.

Conclusions

During the stream assessment it was noted that the most southern portion of the drain, south of Interstate 80, was being eroded. This is most likely due to lack of a flood plain and excessive flows during storm events. It will be difficult to control further erosion and a source of sediment to the Truckee River without reconfiguring this channel. The invasive plant Tall Whitetop is found in the drain throughout the portion that parallels Sparks Boulevard.

Figure 3.9 shows the results of the drain assessment whereby most of the drain is rated sensitive. This rating is imposed because the drain is at risk from encroachment by present and future development. The drain is at risk from increased stormwater discharge that could result in erosion of the channel, loss of riparian vegetation (for better flood conveyance), and loss of flood plain within the channel. The most southern portion of the drain is rated as critical. This is due to the erosion of the stream banks, the proliferation of Tall Whitetop, sediment being transported to the Truckee River (Marina discharge?), at risk from various sources of pollution, and lack of native vegetation.

Washoe Valley

Winters, Davis, Ophir, Franktown, Lewers, Muskgrove, Jumbo

The perennial creeks of Washoe Valley flow from the Carson Range eastward and discharge into Washoe Lake (Figure 1.1). Jumbo Creek is ephemeral and originates in the Virginia Range, also flowing to Washoe Lake. Outwash from the creek drainages has formed alluvial fans where they emanate from the mountain block canyons. Below the alluvial fans, or where the fans coalesce to form a bajada, the creek waters often disperse into wetlands or infiltrate into the coarse, granitic soils. Historically, the western side of Washoe Valley was irrigated with these waters. Today, residential development and one golf course have only marginally changed the manner of use of these creeks.

General

Soils within this watershed are largely composed of granitic origin and are medium to coarse grained and free of volcanic silts and clays. These types of soils show moderate to very high permeability of infiltration of surface waters. Almost all of the valley floor is from 0 to 5% in slope and immediately becomes greater than 15% above the valley floor boundary. There are few residential areas at risk to flood damage except in the Bellevue area, southwest of the lake, which is prone to flooding. Most of the potential wetland areas are east of Franktown Road and "Old" US 395 and most of the area between "Big" Washoe Lake and Little Washoe Lake. The upper watersheds of the west valley creeks are in forested and brush/shrub lands. Agriculture predominates east of

Franktown Road and south of Washoe Lake. On the valley floor, the lake and wetlands dominate the landscape.

Most of the watershed land is under residential development, used for agriculture or is public land (US Bureau of Land Management and US Forest Service). There are very few lands used for retail purposes and one parcel for industrial purposes. The agricultural parcels are used mostly for pasture, hay crops or livestock. Septic systems represent the largest single source of potential pollution to the watershed. The largest concentration of septic systems are located on the eastside of Washoe Lake (New Washoe City) within the Jumbo Creek drainage. There is potential for fertilizers, herbicides and pesticides to be washed into Muskgrove Creek from the golf course.

Conclusions

Invasive plants, such as Tall Whitetop, were not noted during the stream surveys. The upper and middle reaches of Jumbo Creek, upstream of East Lake Blvd, suffer from erosion. This is especially true where a dirt road parallels the creek causing sheet flow into the creek during runoff events. The incision of the creek has created unstable and easily eroded banks without vegetation. Jumbo is considered "non-functional" as a stream (Figure 4.9) and is rated Critical. Restoration efforts should be undertaken to eliminate this erosion and to create better flood protection.

Muskgrove Creek below the Lightening W Golf Course suffers from erosion because of residential encroachment, a straightened alignment and periodic dredging of the channel. Muskgrove Creek is rated Sensitive through the Lightening W Golf Course due to the removal of native vegetation for sod (Figure 4.9). It becomes Critical below Old US 395 due to residential encroachment and erosion. Restoration efforts should also be undertaken to eliminate this problem. Ophir Creek, east of US Highway 395 suffers from alteration of the stream channel and livestock trampling the creek bed and the elimination of vegetation.

South Truckee Meadows Tributaries

Evans, Dry, Thomas, Whites, Galena, Browns and Bailey

These creeks are the largest tributaries to Steamboat Creek, which emanates from Washoe Lake in Washoe Valley (Figure 1.1). These creeks drain the east slope of the Carson Range, Sierra Nevada Mountains. Bailey Creek drains a portion of the Virginia Range on the east side of the South Truckee Meadows. Their primary source of water is snowmelt in the Carson Range during the winter and spring months and groundwater supplied base flow from the Carson Range in the late summer and fall. These creeks represent some of the largest flowing creeks in the community with average flows ranging from 1 to 32 cfs (Widmer, 2000). Flood flows on any of these creeks can easily reach 100 cfs or greater.

General

Soils within these watersheds are composed primarily of fine-grained, volcanic sediments (Bailey, Evans, Dry and Thomas) and coarse-grained, granitic sediments (Galena and Browns). The volcanic rich soils have a greater potential to generate stormwater runoff than the granitic soils. These potentially high runoff soils are located on mid to lower reaches of Evans, Dry and Thomas creeks. Within the Steamboat Tributaries study area the highest density and areal extent of the wetlands are located east of US Highway 395 on the South Truckee Meadows proper. This area is also a groundwater discharge area. Large-scale residential, and commercial and industrial development of this area is occurring such that the wetlands are being drained or condensed.

Flooding is a problem in the Plumas and Lakeside Dr. area south of McCarran in the Evans watershed. In the Dry Creek watershed flooding is a problem throughout much of its watercourse particularly east of US 395 and north of Longley Lane. Flooding on Thomas Creek occurs downstream of the Foothill road crossing in the Thomas Creek road and Holcomb Lane areas. Whites Creek flooding occurs near US 395, but recent work has lessened much of the problems.

Major flood problems have occurred on Steamboat Creek at the Thomas and Whites confluences, but development work continues to alleviate these problem areas. Flood prone areas on Galena Creek occur on the alluvial fan and throughout its course in Pleasant valley.

Land use within these watersheds is diverse ranging from federally designated wilderness to areas of high-density commercial and industrial use. Galena, Whites, Thomas and Dry creeks flow through rural, single family residential developments, and golf courses (ArrowCreek, Montruex, Wolf Run) upon their middle reaches. Thomas and Dry also flow through small ranch lands upon the lower-mid reaches. These ranch lands are mostly used to raise livestock that impact the creeks. Upon reaching US 395 the creeks (excluding Galena, Browns, and Bailey) flow through commercial and industrial properties. The most intense industrial properties are on Dry Creek east of US 395. Near the confluences with Steamboat Creek, Dry, Thomas and Whites flow again through agricultural, residential and golf course properties (Hidden Valley and Rosewood Lakes).

Table 4 shows that the overall water quality is very good with suspended sediment loads, nitrogen, and bacterial counts relatively low. The constituents in this table show relatively low and stable values for Galena Creek. Whites Creek TDS concentration was also found to be relatively stable with very low values. This indicates that urban development near these creeks is not having much effect during this low flow period.

Table 4
General water chemistry

creek/reach	TDS	TSS	TP	NO3	TKN	Fecal coli	Fecal strep	coli/strep Ratio
	Mg/l	mg/l	mg/l	mg/l	mg/l	count	count	
Galena								
upper	87	4	0.02	0.1	0.33	51	>60	<0.85
mid	134	5	0.04	1	0.21	14	22	0.64
lower	99	3	0.09	0	0.26	34	22	1.5
Whites								
Upper*	55	2	0.03	0	0.1	10	NA	NA
mid	64	2	0.02	0.7	0.18	29	>60	0.5
lower	62	<1	0.02	0	0.26	50	80	0.62
Thomas								
upper	96	2	0.06	0.1	0.19	8	34	0.24
mid	133	62	0.12	0.4	0.62	20	110	0.18
lower	172	21	0.1	0.1	0.68	50	130	0.4

TDS= total dissolved solids (inorganic chemistry)
TSS= total suspended solids (sediment)
TP = total phosphate (organic phosphate)
TKN=total Kjeldahl nitrogen (organic nitrogen)
Coli= coliform (fecal coliform is feces derived bacteria)
Strep=streptococci (fecal bacteria)
* sampled Oct 2000
Coli/Strep ratio is feces origin indicator where >1 is human source

As surface water flows downstream in Thomas Creek, TDS levels increase. This may be the results of livestock activities in the mid reaches and groundwater influx at the lower reaches. The suspended sediment load increased significantly from the upper to mid section and decreased at the confluence with Steamboat Creek (lower reach). The lower sediment load at the confluence is probably due to the substantial decrease in the streamflow velocity such that some of the suspended load settled to the creek bed. Bacterial levels increased downstream, but the coliform ratio remained relatively stable.

During a four-hour moderate rainstorm in January, 2002, water samples were taken at South Virginia street on Evans and Thomas creeks. The creeks were sampled for total hydrocarbon products, total suspended solids, total dissolved solids, nitrogen and phosphate. Dilute levels of oil were found in both Evans (0.64 mg/l) and Thomas (0.71 mg/l) creeks. Although the suspended sediment load in both of these creeks was visibly noticeable and of concern, the lab results showed that the TSS levels rose only slightly from the measurements taken earlier in the year.

Conclusions

The most obvious problem for these creeks is erosion and sedimentation. This is due to development encroaching upon or alteration of the creeks and stormwater discharges to the creeks. Table 5 lists the ratings for the three reaches on each creek, based upon the assessments.

Table 5
Stream Health Ratings

Creek	mid-reach		lower-reach
	upper	lower	
Evans	good	critical*	critical*
Dry	good	critical*	critical to sensitive*
Thomas	sensitive*	sensitive*	sensitive to critical
south fork Whites	sensitive*	sensitive*	sensitive*
north fork Whites	sensitive*	critical*	sensitive*
Galena	good	good	sensitive
Jones	sensitive*	critical*	none
Browns	good	good	good

East of Lakeside Drive ranching activities have degraded Evans, Dry and Thomas creeks. The alteration of these streams by man and livestock cause an increase in erosion, increased sediment load and degradation of water quality. Encroachment by residential development on Jones and Whites creeks on the lower mid-reaches have created excessive erosion, head cutting, steep banks and therefore increased sediment loads as well as a loss in flood protection. East of US 395, the creeks Dry, Evans, Thomas, and Whites have, for the most part, been altered for flood control. As a result these creeks no longer function properly as streams. However, they do function well as flood control works. It is possible to restore these creeks to serve both purposes. Restoration efforts can be successful for many of the reaches listed critical and or sensitive and are marked with an asterisk (*).

APPENDIX 3

Watershed Management Websites

Stormwater Management

Stormwater Manager's Resource Center

http://www.stormwatercenter.net/

National Storm Water BMP Database

http://www.epa.gov/OST/stormwater/#nsbd

Planning and Cost Estimating Criteria for Best Management Practices

http://www.rougeriver.com/pdfs/stormwater/sr25.pdf

National Stormwater Best Management Practices Database

http://www.bmpdatabase.org

Model Ordinances

http://www.epa.gov/owow/nps/ordinance/stormwater.htm

Preliminary Data Summary of Urban Stormwater BMPs

http://www.epa.gov/OST/stormwater/

Watershed Maintenance

Planning and Cost Estimating Criteria for Best Management Practices
www.rougeriver.com/pdfs/stormwater/sr25.pdf

Housekeeping BMP Maintenance
http://www.metrocouncil.org/environment/Watershed/bmp/CH3_RPPHousBMPMaint.pdf

Maintaining Your BMP: A Guidebook for Private Owners and Operators in Northern Virginia
http://www.novaregion.org/pdf/Maintaining_BMPs.pdf

Center for Watershed Protection
http://www.cwp.org/

Land Use Planning

Smart Communities Network

http://www.sustainable.doe.gov/landuse/luintro.shtml

Key planning principals

http://www.sustainable.doe.gov/landuse/lukey.shtml

American Planning Association

http://www.planning.org/policyguides/smartgrowth.htm

Sample codes and ordinances

http://www.sustainable.doe.gov/landuse/lucodtoc.shtml

The Oregon Land Use Information Center

http://www.uoregon.edu/~pppm/landuse/land_use.html

Codes and ordinances worksheet

http://www.cwp.org/COW_worksheet.htm

Sustainable Communities Network

http://www.sustainable.org/

Model Open Space Ordinance

http://www.epa.gov/owow/nps/ordinance/openspace.htm

Model Erosion and Sediment Control Ordinance

http://www.epa.gov/owow/nps/ordinance/erosion.htm

Low Impact Development

http://www.lid-stormwater.net

http://www.nemo.uconn.edu

Habitat and Stream Preservation and Restoration

Stream Corridor Restoration: Principles, Processes and Practices

http://www.usda.gov/stream_restoration/

Stream Restoration References

http://water.nr.state.ky.us/dow/streamrf.htm

Model Buffer Ordinance

http://www.epa.gov/owow/nps/ordinance/buffers.htm

Urbanization and Streams: Studies of Hydrologic Impacts

http://www.epa.gov/owow/nps/urbanize/report.html

Monitoring and Assessment

Overview of Watershed Monitoring

http://www.epa.gov/watertrain/monitoring/

Watershed Assessment and Monitoring

http://ceres.ca.gov/watershed/assessment_monitoring.html

Education

Watershed Science for Educators

http://www.dnr.cornell.edu/ext/youth/sample%20watershed%20science.PDF

Water Education Foundation

http://www.water-ed.org/

Project WET

http://www.projectwet.org/

USGS Water Education Resources

http://water.usgs.gov/education.html

Watershed Academy

http://www.epa.gov/owow/watershed/wacademy/

Adopt-a-Watershed

http://www.adopt-a-watershed.org/

EPA's Water Education page

http://www.epa.gov/water/kids/watered2.html

Give Water a Hand

http://www.uwex.edu/erc/gwah/

Educating Young People About Water

http://www.uwex.edu/erc/eypaw/

Appendix 4

Existing Code, Ordinance and Policy

This appendix contains existing code, ordinance and policy germane to watershed management and protection.

Regional Water Planning Commission Interim Water Policies and Criteria

City of Reno Municipal Code 18.06.805 (wetlands and stream environments) and 18.06.806 (drainageways)

Washoe County Ordinance 418 Significant Hydrologic Resources

INTERIM WATER POLICIES AND CRITERIA

February 25, 2003

RWPC

Policy 1.3.b: Protection and Enhancement of Groundwater Recharge

(Approved 02 12 2003 – 6th Version)

Policy Statement: Natural recharge areas shall be defined and protected for aquifer recharge. Proposed projects and proposed land use changes in areas with good recharge potential shall be encouraged to include project features or adequate land for passive recharge.

Criteria to implement policy:

Natural recharge in drainageways:
Local governments shall enforce existing ordinances referenced below. Local governments will protect the natural recharge and flood protection functions of the drainageways shown on USGS 7.5 minute Quad maps.

Undeveloped areas with recharge potential:

- Local governments shall perform a review of lands within proposed project or proposed land use change area and rank suitability for passive recharge based on site evaluation criteria: see RWPC Southern Washoe County Groundwater Recharge Analysis (January 2001). Sites with a Hydrology/Geology matrix score of 2.2 or higher are considered to be sites with "good recharge potential."
- If a site is determined to have "good recharge potential," local governments shall, to the extent practicable, work with the project developer or land use change proponent to explore development features or configurations that maximize recharge while meeting other obligations regarding stormwater quality and flood control needs.
- Passive recharge elements shall be designed such that they are consistent with water quality, environmental, stormwater and flood control policies or regulations.

Discussion:

Natural recharge in drainageways:
When combined, the requirements of the City of Reno Major Drainageways Ordinance and the Washoe County Development Code Article 418 "Significant Hydrologic Resources" provide for the protection of groundwater recharge in most natural drainageways. There are additional drainageways not identified in the two ordinances that are shown on USGS 7.5 Minute Quad maps as blue solid or dot-dash lines that represent perennial and ephemeral drainageways. The intent of this policy is to protect the natural recharge and flood protection functions of these additional drainageways.

Natural recharge through unlined irrigation ditches:
Insufficient information is available to develop policies at this time.

Areas with recharge potential:
The RWPC strongly encourages incorporation of passive groundwater recharge and/or stormwater infiltration project components (infiltration basins or trenches, open space, meandering stream channels) when proposed projects or land use changes are considered on sites that have good recharge potential and the water to be recharged can meet water quality standards. An initial identification of 30 such sites is included in the RWPC Southern Washoe County Groundwater Recharge Analysis (January 2001). No funding source is currently in place to develop particular locations as passive recharge sites.

Policy 3.1.a: Regional Floodplain Management Plan and Regional Flood Control Master Plan

(Approved 02 14 2003 – 6th Version)

Policy Statement: The RWPC will, after its review and approval of the Regional Floodplain Management Plan and Regional Flood Control Master Plan, recommend that local governments adopt and implement those plans. Local governments are encouraged to cooperate and coordinate implementation.

Criteria for Policy Implementation: Until such time as the plans are adopted and implemented by local governments, proposed projects and proposed land use changes will follow the Criteria for Policy Implementation in Policies 3.1.b and 3.1.c.

Discussion: The Community Coalition has spent over two years developing the Truckee River Flood Management project alternatives. The alternatives being evaluated in the Corps of Engineers' (COE) integrated General Re-evaluation Report and Environmental Impact Statement were designed according to the Corps of Engineers regulations and address only current 100-year flood conditions. The project alternatives do not account for full development of the urbanizing watersheds. It is anticipated that the Regional Floodplain Management Plan and the Regional Flood Control Master Plan will address future development.

The Truckee River Flood Management project was designed based on the assumption that future conditions in the region would not cause a net loss of floodplain storage volumes and would not cause an adverse change to the base flood elevation in the project's hydrology. The COE will require that the local sponsors agree to *maintain* the protection level provided by the Truckee River Flood Management project; this protection level will be maintained by implementation of the Regional Floodplain Management Plan and the Regional Flood Control Master Plan.

The RWPC is undertaking flood damage reduction planning efforts that will work together to provide guidance at the regional level on what needs to be done to 1) protect the flood damage reduction benefits that will be provided by the Truckee River Flood Management project, and 2) plan for full development of the urbanizing watersheds in southern Washoe County to maintain the protection level provided by the Truckee River Flood Management project. These planning efforts also address areas outside of the Truckee River watershed.

The first planning effort is the Regional Floodplain Management Plan. The Regional Floodplain Management Plan will provide guidance from a policy level on items such as identification of flood hazard areas, strategies to mitigate different types of flood hazards, strategies to reduce flood damages in already developed areas, and strategies to manage future development in a way that doesn't increase flood damages.

The second planning effort is the Regional Flood Control Master Plan. This plan is intended to complement the Regional Floodplain Management Plan. It is much more specific in terms of recommended facilities and development of hydrologic and hydraulic models of the watersheds. The Regional Flood Control Master Plan takes guidance in terms of philosophical approach and flood damage reduction strategies from the Regional Floodplain Management Plan.

The Regional Floodplain Management Plan and the Regional Flood Control Master Plan also cover areas outside of the Truckee River watershed.

Policy 3.1.b: Floodplain Storage within the Truckee River Watershed

(Approved 02 14 2003 – 9th Version)

Policy Statement: Until such time as Reno, Sparks, and Washoe County adopt and begin to implement the Regional Floodplain Management Plan and the Regional Flood Control Master Plan, the local flood management staff[1], using the best technical information available, will work with a proposed project applicant or a proposed land use change applicant to determine the appropriate level of analysis required in order to evaluate and mitigate the impacts to 100-year flood peaks and floodplain storage volumes. On an annual basis, all three local flood management agencies shall jointly agree on and adopt the "best technical information" available for use in implementation of the Regional Water Management Plan policies relating to flooding. The local flood management staff would be responsible for coordinating with the other appropriate local government agencies.

Criteria for Implementation: The local flood management staff shall evaluate impacts using qualitative or quantitative analysis, and the evaluation may be uncomplicated and brief. If a more in-depth analysis is appropriate, a "tiered" approach and criteria shall be used:

a. Current ordinance requires that a project not increase the 100-year peak flow at the boundary of the property. If the project can also demonstrate no increase in volume of 100-year runoff at the boundary of the property, the analysis is complete.

b. If there is an increase in 100-year volume of runoff at the boundary of the property, the project may demonstrate either:

   i. The increase in volume of runoff will have no adverse impact to downstream properties and no adverse impact[2] to hydrologically connected properties, or
   ii. The increase in volume of runoff will be mitigated in a regional project without adverse impact to hydrologically connected and downstream properties. (Until a storage mitigation plan is in place with respect to b.ii, no floodplain storage mitigation will be required.)

- Impacts of a proposed project will be evaluated by comparing conditions without project (current conditions) and conditions with the proposed project.
- Impacts of a proposed land use change will be evaluated by comparing conditions without the proposed land use change (current conditions) and conditions with the build out of the reasonable development potential of the proposed land use change.

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[1] Each local government has assigned one or more staff members the responsibility of designing and reviewing flood management projects. These staff members are also responsible for reviewing certain proposed projects to address concerns of drainage and flooding.

[2] See Glossary for definition of "no adverse impact".

The watershed is divided into four zones with different project size thresholds for the purposes of review (See Exhibit A):

Zone 1: Critical flood pool – all proposed land use changes and proposed projects will be reviewed for their impact on hydrologically connected and downstream properties
Zone 2: Existing flood pool that will be removed from the flood pool by the proposed Truckee River Flood Management project – proposed land use changes and proposed projects 5 acres and larger will be reviewed
Zone 3: Adjacent sheet flow areas not part of the flood pool – proposed land use changes and proposed projects 5 acres and larger will be reviewed
Zone 4: Remainder of the Truckee River Watershed – proposed land use changes and proposed projects 10 acres and larger will be reviewed

Policy 3.1.c: Floodplain Storage outside of the Truckee River Watershed

(Approved 02 14 2003 – 5th Version)

Policy Statement: As appropriate, the local flood management staff[3] will work with the proposed project applicant or proposed land use applicant to identify the best approach to mitigate the impacts of changes to 100-year flood peaks and floodplain storage volume that are a result of proposed land use changes or proposed projects.

Criteria for Implementation: The local flood management staff shall evaluate impacts using qualitative or quantitative analysis. A more in-depth analysis and a tiered approach will be required when significant impacts must be mitigated. Local flood management staff will develop guidelines for evaluation and mitigation of impacts in specific closed basins. In multi-jurisdictional basins such guidelines will be developed with the concurrence of all responsible agencies.

a. Current ordinance requires that a project not increase the 100-year peak flow at the boundary of the property. If the project can also demonstrate no increase in volume of 100-year runoff at the boundary of the property, the analysis is complete.

b. If there is an increase in 100-year volume of runoff at the boundary of the property, the project may demonstrate either:

   i. The increase in volume of runoff will have no adverse impact[4] on other properties within the basin or
   ii. The increase in volume of runoff will be mitigated in a regional project without adverse impact to hydrologically connected and downstream properties. (Until a

[3] Each local government has assigned one or more staff members the responsibility of designing and reviewing flood management projects. These staff members are also responsible for reviewing certain proposed projects to address concerns of drainage and flooding.
[4] See glossary for definition of "no adverse impact"

storage mitigation plan is in place with respect to b.ii, no floodplain storage mitigation will be required.)

- Impacts of a proposed project will be evaluated by comparing conditions without project (current conditions) and conditions with the proposed project.
- Impacts of a proposed land use change will be evaluated by comparing conditions without the proposed land use change (current conditions) and conditions with the build out of the reasonable development potential of the proposed land use change.
- Impacts to perennial and ephemeral streams and playas must be included in the evaluation.

Policy 3.1.d: Truckee River Restoration

(Approved 02 14 2003 - 7th Version)

Policy Statement: In review of proposed projects and proposed land use changes within the areas identified for restoration in Exhibit A, the local governments shall make findings supporting the implementation of potential restoration projects as identified in the Lower Truckee River Restoration Plan or the Truckee River Flood Management project being developed in conjunction with the Corps of Engineers.

Discussion: There is a regional collaborative effort to restore the lower Truckee River below Vista. The three local governments and the Pyramid Lake Paiute Tribe have signed a Memorandum of Understanding supporting the multiple goals to be achieved through river restoration.

The Memorandum of Understanding generally describes the benefits, goals and management principles that the major stakeholders agree are necessary to develop a comprehensive program to restore the lower Truckee River. The lower river, running from the Truckee Meadows metropolitan area to Pyramid Lake, is a vital natural resource that serves multiple public and private purposes. An unprecedented opportunity exists for interagency collaboration to achieve multiple public goals. The lower river falls under the jurisdiction of multiple local, state, and federal agencies and units of government, and involves multiple private landowners. To successfully take advantage of this opportunity, public agencies and private landowners need to cooperate and coordinate their river restoration activities. This statement of public benefits, goals, and management principles agreed upon by key lower-river stakeholders, represents a common understanding and foundation from which more detailed work programs may be pursued with a high likelihood of success.

Public Benefits

- Water quality, and tied to it, the wastewater treatment capacity of the region, which is fundamental to economic growth;
- Accommodation of increased flood flows;
- Parks, open space, fishing, canoeing and activities that are fundamental to the region's quality of life;
- Habitat and wildlife benefits for fish, birds, mammals and plant communities that are part and parcel of our region's natural heritage.

Public Goals

- Cost-effective wastewater treatment via a natural process;
- A stable and energy-dissipating channel, achieved through re-establishment of river meanders and reconnection of river to floodplain, to accommodate increased flood flows;
- Enhancement of parks system, preservation of open space, enhancement of public recreation opportunities that are high quality, easy to access and ample in number;
- Preservation and restoration of aquatic and terrestrial habitat in the river corridor;
- Environmental enhancement of the river will favorably affect adjoining properties.

Policy 3.1.e: Watershed Protection

(Existing policy 21, approved without modifications)

Policy Statement: Watershed protection programs shall be implemented for the Truckee River, its tributaries, and other perennial streams in the region.

Policy 3.1.f: Adoption of Uniform Storm Drainage Programs

(Existing policy 17, approved with modifications)

Policy Statement: A uniform storm drainage program shall be implemented regionwide, including the continuation and/or enhancement of existing programs in Reno/Sparks/Washoe County, such as the Truckee Meadows Regional Stormwater Quality Management Program, to address not only urban runoff but also other non-point source contributions.

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 alterative 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)

18.06.805. Wetlands and stream environments.

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 avail 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.

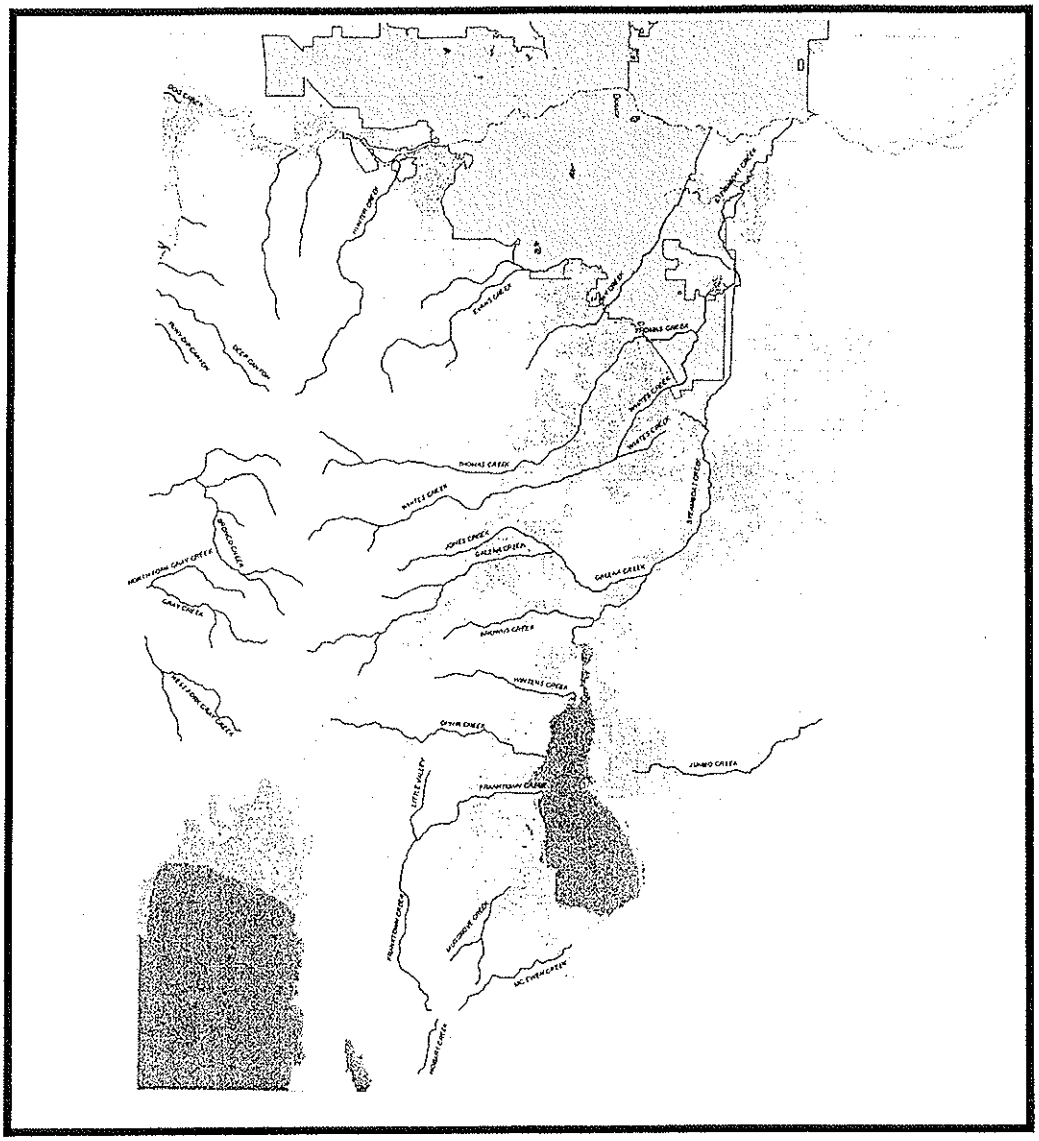
(c) Application of this Article to the Tahoe Planning Area. The provisions of this article may be waived by the Department of Community Development for development in areas under the jurisdiction of the Tahoe Regional Planning Agency (TRPA) as long as "stream environment zones" are regulated by TRPA.

(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

PERENNIAL STREAMS (WCDC ARTICLE 418)

PARCELS

WATER BODIES

RENO - SPARKS CITY LIMITS

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

DATE : NOVEMBER 2000

Note: The scale and configuration of all information shown hereon is 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 Community Development.

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SCALE IN FEET

Department of Community Development

WASHOE COUNTY NEVADA

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

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 steam 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.