

# Nevada Freshwater Ecosystems Conservation Action Plan

*February, 2016*



# **Nevada Freshwater Ecosystems: Conservation Action Plan**

## ***February 2016***

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## Executive Summary

Nevada is the driest state in the nation, but nevertheless ranks 11<sup>th</sup> in species diversity. Almost 80% of Nevada's endemic species (found nowhere else in the world) are dependent upon freshwater spring ecosystems. Nevada's freshwater wetlands host huge numbers of migratory bird species, and its mountain meadows provide vital habitat for sage-grouse and other species. Nevada's rivers, including those in northern Nevada emerging from the Eastern Sierra, and those in the Mojave Desert, provide critical habitat for native fish, as well as streamside riparian vegetation for resident and migratory birds. All told, these are Nevada's freshwater ecosystems, which not only sustain biodiversity, but also provide varied and abundant services for Nevada's people.

The Nevada Chapter developed a statewide Conservation Action Plan (CAP) for freshwater ecosystems and their associated species. The CAP's primary goal was to develop high-level strategies to restore the health of and abate priority threats to freshwater ecosystems across the state, and in doing so help inform the resources needed to implement the Chapter's strategies. The plan was conducted at a reconnaissance level, intended to provide a reasonable approximation of current condition and future threats. The staff developed the CAP over a two month period in early 2016.

Five major types of freshwater ecosystems were identified as conservation targets: Great Basin rivers flowing from the eastern Sierra; Mojave Desert rivers; desert springs; freshwater wetlands; and montane wet meadows. Each of these ecosystems supports focal species that are rare or threatened. A representative set of focal landscapes was selected for each target. Most of the landscapes had been previously identified as the Chapter's highest priority areas for conservation action. The 12 focal landscapes include: Lower Truckee River/Pyramid Lake; Middle Carson River; Lower Walker River/ Walker Lake; Upper Muddy River; Amargosa River/Oasis Valley; Virgin River; White River Valley; Pahrnagat Valley; Soldier Meadows; Lahontan Valley Wetlands; Argenta Marsh; and montane wet meadows in priority habitats for sage-grouse.

The health of each focal target was assessed by rating five key ecological attributes at the selected landscapes: flows, riparian vegetation, native aquatic animals, physical integrity and water quality. Ecological health was rated using a six-part grading scale, ranging from Poor to Very Good. Nevada's freshwater ecosystems, in general, need ecological restoration. 75% of the focal landscapes were rated at "Fair" health or lower, and almost half were rated "Fair –" or lower, a precarious condition (see Table 1). Each of the five key ecological attributes is impaired at many places.

The projected future condition of each ecosystem was also assessed, typically looking at a 10 year time horizon, assuming that current circumstances, management actions and expected trends continue (i.e., "business as usual," with no additional actions taken by the Chapter). A longer time horizon was used to assess some threats such as climate change.

Nevada's freshwater ecosystems face serious ongoing and future stress. Half of the landscapes are projected to face measurable declines (see Table 1). Over half of all key ecological attributes across the 12 landscapes were projected to have "High" stress.

## Summary of Health

Conservation Target	Current Rating	Projected Future Rating With No Action
Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/ Pyramid Lake	Fair	Fair -
Eastern Sierra Rivers - Middle Carson River	Fair -	Fair -
Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake	Poor	Fair -
Mojave Desert Rivers - Upper Muddy River	Fair	Fair -
Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows	Good -	Good -
Mojave Desert Rivers - Lower Virgin River	Fair -	Fair
Desert Springs - Soldier Meadows	Good -	Fair
Desert Springs - White River Valley	Good -	Fair
Desert Springs - Pahrnagat Valley	Fair -	Poor
Wetlands - Lahontan Valley Wetlands	Fair	Fair -
Wetlands - Argenta Marsh	Fair -	Fair -
Montane Wet Meadows - Sage-grouse habitat	Fair	Fair

Table 1. Summary of Current and Project Future Health

The current and projected future sources of the targets' impaired condition were rated in a threat assessment for each landscape. The sources of the ecological stress are the issues that need to be addressed by conservation strategies. Threats were found to be somewhat idiosyncratic to each landscape, but some common issues also emerged (See Table 2).

Summary of Threats	Eastern Sierra Rivers			Mojave Desert Rivers			Desert Springs			Wetlands & Meadows		
	Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/ Pyramid Lake	Eastern Sierra Rivers - Middle Carson River	Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake	Mojave Desert Rivers - Upper Muddy River	Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows	Mojave Desert Rivers - Lower Virgin River	Desert Springs - Soldier Meadows	Desert Springs - White River Valley	Desert Springs - Pahrnagat Valley	Wetlands - Lahontan Valley Wetlands	Wetlands - Argenta Marsh	Montane Wet Meadows - Sage-grouse habitat
Channel modification	Very High	High +	High +	High +	-	-	Medium	Medium	High +	High	High +	Low
Surface water diversion	High +	High +	High	Low	-	High	Medium	High	Very High	Low	Very High	Low
Excessive groundwater withdrawal	Medium	Medium	High	Medium	High	Low	-	High	Very High	-	High +	Low
Invasive species - aquatic animals	High	High	High	High	Medium	High	High	Medium	High	-	Medium	-
Warmer/ drier climate	High	Medium	Medium	Low	High	High	Low	Medium	High	Medium	Low	Low
Incompatible livestock grazing	Low	Low	Low	-	Low	Medium	Medium	Medium	High	Medium	High +	High
Invasive species - plants	Medium	High	Low	High	Medium	Medium	-	-	-	High	Low	Low
Incompatible forest management	High	High	Medium	-	-	-	-	-	-	-	-	Low
Incompatible development	Medium	High +	-	-	-	-	-	-	-	-	-	-
Water law/ changes	Low	Low	Low	Low	Low	-	Low	Medium	High	Low	Low	-
Incompatible agricultural practices	Low	Medium	Medium	-	-	-	-	-	-	High	-	Low
Wild horses and burros	Medium	-	-	-	Low	-	Medium	-	-	-	-	High
Presence/ operations of dams	Medium	-	Medium	-	-	-	Medium	-	-	-	-	-

Table 2. Summary of Projected Threats

Four threats were rated as “High” or greater at five landscapes: *channel modification; surface water diversion; excessive groundwater withdrawal; and invasive aquatic species*. Three of these mostly reflect continuing ecological stress as a result of historical actions or problems. In contrast, potential large-scale groundwater withdrawal reflects a significant future threat to many Mojave Desert rivers and springs. The likely prospect of a warmer and drier climate was considered a “High” ranked future threat at four landscapes, primarily as a result of its projected effect on reduced flows. Other high-ranked threats at two or more landscapes included *invasive plant species and incompatible forest management practices*. *Incompatible livestock grazing and wild horses & burros* were high threats to wet meadows. The near-term potential for significant *water law changes* in Nevada could have a serious possible impact on freshwater flows.

A set of high level conservation strategies was developed. In CAP, two types of strategies are required – *restoration* (addresses past stressors) and *threat abatement* (addresses future stressors). For a statewide CAP, two scales of operation are required – *site-based strategies* and *multi-site strategies*. Some multi-site strategies affect a few sites, some are statewide. The statewide Freshwater CAP was primarily focused on multi-site strategies, but site-based strategies at two new landscapes needing attention (Virgin River and Argenta Marsh) were also identified.

Conservation strategies consist of two elements: (1) objectives, which are measurable outcomes related to abating critical threats and/or restoring the health of a target; and (2) strategic actions, which are high-level activities designed to achieve an objective. Six multi-site conservation objectives were identified by the TNC staff. All objectives are intended to “change the colors on the scorecard” of projected future condition – e.g., improve a target’s flows from “Fair –” to “Fair.”

Broadly summarized, the multi-site objectives and associated strategic actions include:

- Maintain base flows in the Truckee & Carson Rivers, and prevent impaired water quality from excessive runoff, by improving upstream forest management at a watershed scale and utilizing TROA and other legal mechanisms.
- Ensure that potential large-scale groundwater withdrawal does not cause “unreasonable adverse effects” to freshwater ecosystems by continuing TNC’s constructive, science-based engagement with SNWA, federal and state agencies.
- Restore the most important montane wet meadows contributing to sage-grouse habitat suitability by promoting optimal management treatments.
- Ensure that any potential changes in Nevada water law do not adversely affect and if possible enhance surface water flows and groundwater levels for freshwater ecosystems by developing science-based methods for incorporating environmental standards.
- Restore flows, natural channel conditions, characteristic riparian vegetation, native aquatic animals and water quality across Nevada’s freshwater landscapes by developing a major statewide funding source for freshwater restoration.

If successfully implemented, these high-level strategies will significantly improve the health and resilience of Nevada’s freshwater ecosystems, for the long-term benefit of both people and nature.

A link to the Online CAP Workbook with all scorecards, detailed ratings, objectives and strategies can be found at <http://1drv.ms/1VUAyXJ>

## Purpose and Process

The Nevada Freshwater Ecosystems Conservation Action Plan (CAP) developed high-level strategies to restore the health of and abate priority threats to Nevada's freshwater ecosystems and their associated native species. The planning exercise also served to consolidate in one place the staff's knowledge, to facilitate a common understanding of the issues and opportunities for freshwater conservation, to build staff consensus on an overall course of action for freshwater conservation, and to reveal with more clarity what kinds of staff or consultant resources are needed to implement the freshwater conservation strategies.

The Freshwater Ecosystems CAP followed the longstanding CAP framework (i.e., targets, key attributes, threats). These elements were assessed at a reconnaissance level across the state, intended to provide a reasonable approximation of current conditions and future threats to the freshwater ecosystems at a representative set of focal landscapes. It was not intended to replace place-based CAPs that the Chapter has developed and deployed at several priority landscapes.

The CAP was developed by the TNC-Nevada conservation staff over a two-month period with assistance by Greg Low of Applied Conservation, a former TNC staff veteran and long-time CAP facilitator (10 years working in Reno with TNC-Nevada). TNC-Nevada staff worked in small teams to assess target health and threats, and collectively to review outcomes and develop strategies. A Microsoft Excel Online CAP Workbook, developed by Applied Conservation, was used throughout the process. The CAP drew substantively upon previously conducted freshwater assessments, specifically including the 2010 *Nevada Springs Conservation Plan*, the identification of focal freshwater targets and sites in the 2001 Great Basin and Mojave Desert ecoregional assessments, the Nevada chapter's 2005 assessment and identification of Nevada's top 23 priority landscapes, and previous CAPs developed for freshwater targets in several priority landscapes.

The key steps of the CAP process were as follows:

- **Determine Conservation Targets.** Determine focal freshwater ecosystems and their associated priority/representative landscapes, for a total of 12 conservation targets (system + landscape).
- **Develop Key Ecological Attributes (KEAs).** Develop and describe five key ecological KEAs that cross over all targets. Develop a set of qualitative but clear parameters for rating the KEAs.
- **Rate Current and Projected Future Condition.** Using the Excel Online CAP Workbook, rate the current condition of the KEAs for the targets.
- **Rate Threats.** Using the Excel Online CAP Workbook, rate the sources of stress (threats) to each target.
- **Draft Conservation Objectives.** Develop a set of conservation objectives with measurable outcomes to abate critical threats and/or restore the health of focal targets.
- **Develop Conservation Strategies.** Develop strategies for the conservation objectives. Strategies include high level strategic actions necessary to achieve the Objectives. All strategies are based on TNC values (science-based, non-confrontational) and a value-added proposition for the Nevada chapter (without TNC-NV, it is unlikely to happen or happen sufficiently well). A full-day staff meeting was held to develop the conservation strategies.

## Freshwater Conservation Targets

Nevada is the driest state in the nation, but nevertheless ranks 11th in species diversity. Found nowhere else in the world are 173 species – Nevada endemics. Almost 80% of these endemics are dependent upon freshwater spring ecosystems. Nevada's freshwater wetlands host huge numbers of migratory bird species, and its mountain meadows provide vital habitat for sage-grouse and other species. And Nevada's rivers, including those in northern Nevada flowing down from the Eastern Sierra, and those flowing in the Mojave Desert, provide critical habitat for native fish, as well as streamside riparian vegetation for resident and migratory birds. All told, these are Nevada's freshwater ecosystems, which not only sustain biodiversity, but also provide varied and abundant services for Nevada's people.

A total of 12 conservation targets were selected for the Freshwater CAP. In a conventional CAP, targets are typically the ecosystems (e.g., desert spring, montane meadows) at a given site or landscape. For the Nevada Freshwater CAP, all freshwater ecosystems were also linked with a priority landscape in the state – that is, for each ecosystem type, a set of 2 or 3 representative landscapes was selected. Rather than try to assess the ecosystems' health and threats on a theoretical basis, the associated places served to make the ecological targets and their threats "real". The Nevada Freshwater CAP targets are therefore a selection of 12 systems + landscapes (see Appendix A).

### A. Freshwater Ecosystems

Five major types of freshwater ecosystems, intended to capture the spectrum of freshwater biodiversity, were identified as the statewide conservation targets:

- **Great Basin Rivers/Terminal Lakes**

Aquatic ecosystems and desert riparian systems were identified as focal targets in TNC's comprehensive 2001 Great Basin ecoregional blueprint. Other targets associated with the rivers include freshwater and brackish marshes, as well important desert riparian shrublands for breeding and migratory birds. The Great Basin rivers flowing from the eastern Sierra have lost large percentages of their riparian habitat and native fish, such as Lahontan cutthroat trout. Terminal lakes are unique to the Basin and Range, and the largest are found in the Great Basin.

- **Mojave Desert Rivers**

Aquatic ecosystems and riparian systems were also identified as focal targets in TNC's 2001 Mojave Desert ecoregional assessment. These ecosystems capture a number of globally imperiled aquatic species found in the Mojave Desert. Intact riparian corridors provide critical nesting area and foraging site for migratory birds and other wildlife.

- **Desert Springs**

Springs and springbrooks were identified as high priority targets in both the Great Basin and Mojave Desert ecoregional blueprints. Almost 80% of Nevada's 173 endemic species are dependent upon spring ecosystems.

- **Freshwater Wetlands**

Freshwater marsh ecosystems were identified as focal targets in TNC's Great Basin ecoregional blueprint. Birds and amphibian species are especially dependent upon this system, which consists of permanently flooded and permanently saturated wetlands.

- **Montane Wet Meadows**

Wet meadows were identified as a focal target in TNC's Great Basin ecoregional blueprint. This ecological system consists of herbaceous vegetation on seasonally saturated to temporarily flooded areas. Montane meadows across the Great Basin provide vital habitat for sage-grouse in mid to late summer, when sage grouse hens and their growing broods head to wet areas to find plants and insects that thrive in the wet places.

## B. Priority Landscapes

In 2005, the Nevada Chapter conducted an assessment to determine its highest priority landscapes for conservation action. 23 priority landscapes were identified, as shown on the map in Appendix B. These landscapes collectively capture high quality examples of virtually all ecological systems in the state. Half of these 23 priority landscapes are represented in the focal landscapes selected for the Nevada Freshwater CAP.

The 2005 priority landscapes were selected through an analysis of two ecoregional assessments previously completed by the Nevada Chapter -- Great Basin Ecoregion-Based Conservation Blueprint (2001) and Ecoregion-Based Conservation in the Mojave Desert (2001). The hundreds of generally smaller sites identified in the two ecoregional plans were analyzed to identify a set of large functional landscapes that captured: (1) all major terrestrial and freshwater ecological systems; (2) large numbers of imperiled terrestrial and freshwater species and natural communities; (3) places where targets were generally in better condition; and (4) places where there seemed to be higher feasibility of successfully abating threats or restoring ecosystem health.

In selecting the focal landscapes for the 2016 Nevada Freshwater CAP, the 2005 priority landscape assessment was used as a starting point, along with the two ecoregional plans and the 2010 Nevada Springs Conservation Plan.

All of the 12 focal freshwater landscapes selected in the Nevada Freshwater CAP are contained, all or in part, in the 23 priority landscapes. The freshwater landscapes are:

- Lower Truckee River – Pyramid Lake
- Middle Carson River
- Lower Walker River – Walker Lake
- Amargosa River/Oasis Valley
- Upper Muddy River
- Virgin River
- Pahrnagat Valley
- White River Valley



- Soldier Meadow
- Argenta Marsh
- Lahontan Valley Wetlands

The 12th focal freshwater landscape, Montane Wet Meadows – Sagebrush Habitat, is not related one-to-one with any given landscape, but rather is representative of a priority freshwater ecosystem across a wide geographic range. However, at least 8 of the chapter's 23 priority landscapes include important occurrences of montane wet meadows.

## Key Ecological Attributes

How do we know if a target is “conserved” or facing a high degree of threat? In 2003 three TNC scientists published a seminal paper in *BioScience*, “Are We Conserving What We Say We Are? Measuring Ecological Integrity within Protected Areas.” The Nature Conservancy and its partners developed a “Measures of Success” framework with four core components: (1) identifying a limited number of focal conservation targets, (2) identifying key ecological attributes (KEAs) for these targets, (3) identifying an acceptable range of variation for each attribute; and (4) rating target health based on whether or not the target’s key attributes are within or outside their acceptable ranges. This framework was immediately adopted as a foundational element of Conservation Action Planning (CAP).

For the Nevada Freshwater CAP, five key ecological attributes were selected that applied to virtually all of the conservation targets:

- **Flows** - amount, timing, and duration of freshwater flows (surface water and/or groundwater)
- **Riparian Vegetation** - composition, structure and extent
- **Native Aquatic Animals** (fish, springsnails, amphibians) - composition and abundance
- **Physical Integrity** - degree of physical alteration of river, streambank, wetland or spring; natural channel morphology
- **Water Quality** - dissolved oxygen, sediment, nutrients, toxins

*Note: Many other attributes could describe some characteristic of an ecosystem. The conservation planning task is to identify a small number of critical attributes that will capture the target’s health (i.e., likelihood to persist and to support its native species for a century or longer).*

In CAP, a simple but longstanding grading scale is used to assess the current status (and projected future health status) of the key ecological attributes -- **Very Good, Good, Fair or Poor**. A description of the ratings is as follows:

- **Very Good:** The factor is functioning at an ecologically desirable status, and requires little human intervention.
- **Good:** The factor is functioning within its range of acceptable variation; it may require some human intervention
- **Fair:** The factor lies outside of its range of acceptable variation & requires human intervention. If unchecked, the target will be vulnerable to serious degradation

- **Poor:** Allowing the factor to remain in this condition for an extended period will make restoration or preventing extirpation practically impossible.

In recent CAPs two additional rating grades (Good – and Fair –) have been added to allow teams to assess target health with slightly greater nuance, given that there are often very wide ranges of condition within the conventional Good and Fair rating categories.

The current health of the 12 focal freshwater landscapes was assessed by scoring the status of the five KEAs for each landscape: flows; riparian vegetation; native aquatic animals; physical integrity; and water quality. Each KEA for each landscape was rated on a six-part grading scale ranging from “Very Good” to “Poor.” A consistent definition and rating scale was applied for the five KEAs across all landscapes (see Appendix C). The overall health for each landscape was then scored by a weighted average of the KEA ratings, with a higher weight assigned to any “Poor” rating.

## Current Health

Nevada’s freshwater ecosystems, in general, need ecological restoration. 75% of the focal landscapes were rated at “Fair” health or lower, and almost half we rated “Fair –” or lower, a precarious condition (see Table 3). Each of the five key ecological attributes is impaired at many places.

Summary of Health	
Conservation Target	Current Rating
Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/ Pyramid Lake	Fair
Eastern Sierra Rivers - Middle Carson River	Fair -
Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake	Poor
Mojave Desert Rivers - Upper Muddy River	Fair
Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows	Good -
Mojave Desert Rivers - Lower Virgin River	Fair -
Desert Springs - Soldier Meadows	Good -
Desert Springs - White River Valley	Good -
Desert Springs - Pahrnagat Valley	Fair -
Wetlands - Lahontan Valley Wetlands	Fair
Wetlands - Argenta Marsh	Fair -
Montane Wet Meadows - Sage-grouse habitat	Fair

Table 3. Summary of Current Health

For further analysis, the 12 freshwater landscapes were divided into four freshwater target groups, each with three landscapes. The four groups were: Eastern Sierra Rivers; Mojave Desert Rivers; Desert Springs; and Wetlands and Meadows. A detailed breakout of the ratings with each group is shown is Appendix D.

In general, the Eastern Sierra River landscapes had the lowest overall health, and the Desert Spring landscapes had the highest overall health. However, the ratings among the landscapes were highly idiosyncratic, and there were meaningful differences in the ratings within all four groups. For example, two Desert Springs landscapes were rated “Good—”, whereas one (Pahrnagat Valley) was rated only “Fair –.” The Lower Truckee River rated higher than the Carson and Walker Rivers. In the Mojave Desert, the Amargosa River rated higher than the Upper Muddy and Virgin Rivers.

On a positive note, the Conservancy’s longstanding work on the Lower Truckee River and elsewhere has shown that progress in restoring ecosystem health can indeed be made, but it is a “marathon race” requiring focus of purpose and continuity of effort, and must be crafted and accomplished place by place.

## Threats

In addition to assessing current condition (and hence a need for restoration strategies), CAP also assesses the future threats that might make conditions worse (and hence a need for threat abatement strategies).

Threats were assessed via a two-step process. First, a forecasted future rating was made for each KEA for each freshwater landscape. This shows the degree of stress that a freshwater ecosystem is facing now and in the future. Typically, a 10 year time horizon is used for the future forecast, and the forecast is based upon the likely expected continuation of current circumstances and current management practices (i.e., “business as usual”), as well as reasonably expected future trends. However, for certain future threats – specifically including climate change, invasive species, and large-scale groundwater withdrawal – a longer time horizon was used (e.g. 40 to 50 years); for these particular threats, actions and events are expected to be occurring within the next 10 years that may not have ecological effects until future decades.

### **The Stress Ranking**

The combination of the Current Rating and the Forecasted Future Rating yields an overall Stress rating for each KEA, ranging from “Very High” to “Low” on a four-part grading scale. The stress rating represents a combination of expected *ongoing stresses from historical sources* (e.g., channel modification or surface water diversion) as well as *reasonably expected increased stresses from future sources* (e.g., large-scale groundwater withdrawals).

A list of potential future threats to the freshwater ecosystems – *sources of stress* – was developed. A total of 13 projected sources of stress were identified, as follows:

- Presence/ operations of dams
- Surface water diversion
- Excessive groundwater withdrawal
- Invasive species - aquatic animals
- Invasive species - plants
- Channel modification
- Incompatible development
- Incompatible livestock grazing
- Wild horses and burros
- Incompatible agricultural practices
- Incompatible forest management
- Warmer/ drier climate
- Water law/ changes

### **The Source Ranking**

A Contribution rating was assigned for each potential source of stress (threat) at each landscape, whenever a threat was relevant to a KEA. Contribution was rated on a four-part grading scale from “Very High” to “Low.”

The combination of the Stress rating and the Source rating results in an overall Threat rating, using a longstanding CAP rating system.

### **The Threat Ranking**

The Threat ranking for a given source of stress to a target is a function of the combination of the Stress rank and the Source rank. *The Threat ranking can never be higher than the Stress rank.* For example a Very High source of a Medium stress results in a Threat rank of only Medium (i.e., the Stress rank is a ceiling).

Often, a given source affects more than one KEA for a target, which can result in it being assigned a higher overall Threat ranking. If a source ranked as “High” for two High ranked Stresses, it was assigned an overall rating of “High +.” If a source ranked as “High” for three High ranked Stresses, it was assigned an overall rating of “Very High.”

## **Findings**

Nevada’s freshwater ecosystems, most of which already need ecological restoration, face ongoing and future stress. Half of the landscapes are projected to have measurable declines in health. Across all of the 12 freshwater landscapes, most KEAs were projected to remain at or fall to a “Fair –” rating (i.e., precarious condition), thereby resulting in a High stress rating. Over half of all KEAs across the targets (28 out of 55) were projected to be “High” stress (or “Very High” in one instance), and 17 were projected to decline. Overall, the KEAs facing the greatest stress were: flows, native aquatic animals and physical integrity.

The *overall health* – based upon the five KEA ratings for each landscape, is projected to be measurably worse for half of the freshwater landscapes (see table below). Two landscapes are projected to improve due to currently ongoing conservation efforts.

## Summary of Health

Conservation Target	Current Rating	Projected Future Rating With No Action
Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/ Pyramid Lake	Fair	Fair -
Eastern Sierra Rivers - Middle Carson River	Fair -	Fair -
Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake	Poor	Fair -
Mojave Desert Rivers - Upper Muddy River	Fair	Fair -
Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows	Good -	Good -
Mojave Desert Rivers - Lower Virgin River	Fair -	Fair
Desert Springs - Soldier Meadows	Good -	Fair
Desert Springs - White River Valley	Good -	Fair
Desert Springs - Pahrnagat Valley	Fair -	Poor
Wetlands - Lahontan Valley Wetlands	Fair	Fair -
Wetlands - Argenta Marsh	Fair -	Fair -
Montane Wet Meadows - Sage-grouse habitat	Fair	Fair

The sources of the ecological stress are the issues that need to be addressed by conservation strategies. Threats were found to be somewhat idiosyncratic to each landscape, but some common issues also emerged (See table below).

Summary of Threats	Eastern Sierra Rivers			Mojave Desert Rivers			Desert Springs			Wetlands & Meadows		
	Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/ Pyramid Lake	Eastern Sierra Rivers - Middle Carson River	Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake	Mojave Desert Rivers - Upper Muddy River	Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows	Mojave Desert Rivers - Lower Virgin River	Desert Springs - Soldier Meadows	Desert Springs - White River Valley	Desert Springs - Pahrnagat Valley	Wetlands - Lahontan Valley Wetlands	Wetlands - Argenta Marsh	Montane Wet Meadows - Sage-grouse habitat
Channel modification	Very High	High +	High +	High +	-	-	Medium	Medium	High +	High	High +	Low
Surface water diversion	High +	High +	High	Low	-	High	Medium	High	Very High	Low	Very High	Low
Excessive groundwater withdrawal	Medium	Medium	High	Medium	High	Low	-	High	Very High	-	High +	Low
Invasive species - aquatic animals	High	High	High	High	Medium	High	High	Medium	High	-	Medium	-
Warmer/ drier climate	High	Medium	Medium	Low	High	High	Low	Medium	High	Medium	Low	Low
Incompatible livestock grazing	Low	Low	Low	-	Low	Medium	Medium	Medium	High	Medium	High +	High
Invasive species - plants	Medium	High	Low	High	Medium	Medium	-	-	-	High	Low	Low
Incompatible forest management	High	High	Medium	-	-	-	-	-	-	-	-	Low
Incompatible development	Medium	High +	-	-	-	-	-	-	-	-	-	-
Water law/ changes	Low	Low	Low	Low	Low	-	Low	Medium	High	Low	Low	-
Incompatible agricultural practices	Low	Medium	Medium	-	-	-	-	-	-	High	-	Low
Wild horses and burros	Medium	-	-	-	Low	-	Medium	-	-	-	-	High
Presence/ operations of dams	Medium	-	Medium	-	-	-	Medium	-	-	-	-	-

Four threats were rated as “High” or greater at five landscapes: *channel modification; surface water diversion; excessive groundwater withdrawal; and invasive aquatic species*. Three of these mostly reflect continuing ecological stress as a result of historical actions or problems: channel modification, surface water diversion, and invasive aquatic animals which have already become established. For example, the large-scale surface water diversion at Derby dam significantly affects the flows at the Lower Truckee River/Pyramid Lake and large Humboldt River water diversion dams, beginning in the late 1800s, significantly affect flows into Argenta Marsh.

In contrast, potential large-scale groundwater withdrawal reflects a significant future threat to many Mojave Desert rivers and springs. The likely prospect of a warmer and drier climate was considered a “High” ranked future threat at four landscapes, primarily as a result of its projected effect on reduced flows. Because there is no ready means of directly mitigating climate change over the next few decades, mitigation of the climate change-related stress can best be achieved by reducing pressures from other threats and by increasing resilience through restoration.

Other high-ranked threats at two or more landscapes included *invasive plant species and incompatible forest management practices*. *Incompatible livestock grazing and wild horses & burros* were high threats to wet meadows. The near-term potential for significant *water law changes* in Nevada, while uncertain, could have a serious possible impact on freshwater flows.



## Strategies

A set of high level conservation strategies was developed to address critical threats and restore the health of the freshwater targets.

In CAP, two types of strategies are required – *restoration* strategies (which address past stressors) and *threat abatement* strategies (which address future stressors).

For a statewide CAP, two scales of operation are required – *site-based strategies* and *multi-site strategies*. Some multi-site strategies affect a few sites, some are statewide. The Nevada Freshwater Ecosystems CAP was primarily intended to develop multi-site strategies. The Chapter has previously developed and is implementing site-based CAPs at five priority landscapes (the Truckee, Carson, Walker, Virgin, and Amargosa Rivers). However, key site-based strategies were identified for two new landscapes (Virgin River and Argenta Marsh).

In the longstanding CAP approach, conservation strategies consist of two elements: (1) objectives, which are measurable outcomes related to abating critical threats and/or restoring the health of a target; and (2) strategic actions, which are high-level activities designed to achieve an objective.

### A. Objectives

In CAP, each conservation strategy must be grounded and defined by an **objective**, which clearly describes an outcome related to abating a critical threat and/or restoring the health of a target's key ecological attributes. To provide focus for its strategic actions, a project team must define specific, measurable objectives for significantly degraded KEAs (e.g., rated "Fair" or lower) — and/or critical threats (e.g., rated "High" or higher). These outcomes must be accomplished in order to achieve conservation success. In CAP parlance, the objectives "should change the colors on the scorecards."

Each conservation objective that "changes a color" invariably is a difficult outcome to accomplish, and usually takes many years of concerted effort. Again, the Conservancy's work on the Truckee River is illustrative. The conservation objective pursued over a decade was to restore riparian condition and physical integrity on 16 miles of the Lower Truckee back to a "Good" condition.

Six "stretch" multi-site objectives were developed where the chapter could make a meaningful and measureable impact towards freshwater ecosystem conservation over the next decade.

TNC's multi-site objectives for Nevada's Freshwater Ecosystems were as follows:

<b>Sites</b>	<b>Objectives</b>
Truckee River & Carson River	<p>By 2025, ensure that base flows in late-summer/early fall are generally sufficient to support native aquatic species over many reaches of the rivers (i.e. Fair to Good-)</p> <p>By 2025, ensure that water quality is not highly impaired over many reaches by runoff from catastrophic wildfires</p>
White River Valley Pahranagat Valley Upper Muddy River	Ensure that potential large-scale groundwater withdrawal does not cause “unreasonable adverse effects” to flows and other associated key ecological attributes for priority freshwater ecosystems in southern and eastern Nevada.
Montane Wet Meadows	By 2025, restore the most important montane wet meadows contributing to sage-grouse habitat suitability to at least “Good –” overall condition, including no adverse impacts from grazing by livestock or wild horses/burros.
All Freshwater Landscapes	Ensure that any potential changes in Nevada water law and policy do not adversely affect and if possible enhance surface water flows and groundwater levels for sustaining freshwater ecosystems.
All Freshwater Landscapes	By 2025, develop major funding resources to restore flows, natural channel conditions, characteristic riparian vegetation, native aquatic animals and water quality to increase resilience and health of Nevada's freshwater landscapes – for people and nature.

Objectives were also developed for TNC-Nevada action at two new landscapes:

Virgin River	By 2025, Ensure adequate flows in key reaches at key times to safeguard health of the rare fish species in Virgin River
Argenta Marsh	By 2025, secure phased increase in surface water flows sufficient to support native fish and waterfowl over portions of the original aerial extent

## B. Strategies

In CAP, staff are encouraged to probe the situation, develop their underlying hypotheses, and consider the array of strategic actions that collectively might potentially accomplish the objective. A strategic action is a high-level of action that is critical to accomplish the objective. Some typical strategic actions include: acquiring interests in land or water rights; managing land and water for ecological outcomes; restoring the condition of key ecological attributes, such as removing invasive weeds or planting riparian vegetation; encouraging compatible development or land management practices; and forging sound public policies and funding sources.

The Nature Conservancy's role in developing strategies must always be carried out within the organization's values. In particular, the Conservancy has a long tradition of being *non-confrontational* in all of its conservation actions and words. The Conservancy seeks to be constructive, science-based and solution-oriented. Strategies are also selected where the Conservancy can uniquely add value.

For each of the objectives, a set of strategic actions was developed, which are shown in detail in the Strategy Table in Appendix F. These strategies represent the best collective thinking of the staff at the time of the CAP, but strategies will inevitably be dynamic as new information becomes available and conditions change on the ground.

Broadly summarized, the associated strategic actions for the objectives include:

- Maintain base flows in the Truckee & Carson Rivers, and prevent impaired water quality from excessive runoff, *by improving upstream forest management at a watershed scale* and utilizing TROA and other legal and policy mechanisms.
- Ensure that potential large-scale groundwater withdrawal does not cause “unreasonable adverse effects” to freshwater ecosystems *by continuing TNC's constructive, science-based engagement with SNWA, federal and state agencies.*
- Restore the most important montane wet meadows contributing to sage-grouse habitat suitability *by promoting optimal management treatments.*
- Ensure that any potential changes in Nevada water law do not adversely affect and if possible enhance surface water flows and groundwater levels for freshwater ecosystems *by developing intra- and inter-basin science-based methods for incorporating environmental standards.*
- Restore flows, natural channel conditions, characteristic riparian vegetation, native aquatic animals and water quality across Nevada's freshwater landscapes *by developing a major statewide funding source for freshwater restoration.*

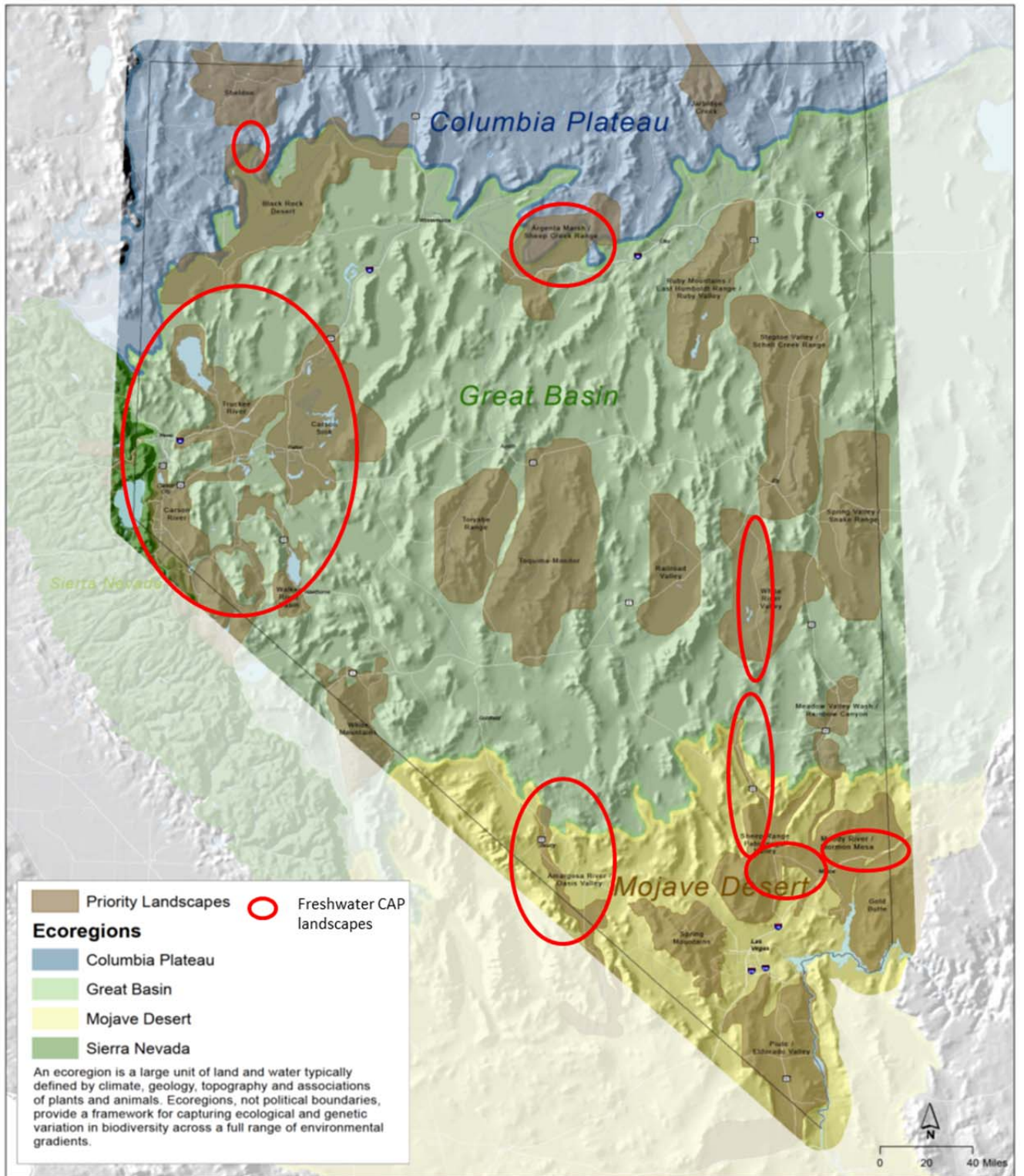
If successfully implemented, these high-level strategies will significantly improve the health and resilience of Nevada's freshwater ecosystems, for the long-term benefit of both people and nature.

## Appendix A – Focal Conservation Targets & Landscapes

Focal Conservation Targets	Target Description	Landscape Description
Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/ Pyramid Lake	Aquatic systems and desert riparian systems identified in TNC's Great Basin ecoregional blueprint. Great Basin rivers have lost large percentages of their riparian habitat and native fish. Terminal lakes are unique to the Basin and Range, and the largest are found in the Great Basin.	Longstanding priority landscape of TNC-Nevada and major restoration initiative. Excellent examples of remaining cottonwood forests; important riparian habitats for breeding and migratory birds. Pyramid Lake is premier example of terminal lake with fish, including endemic cui-ui. While the Freshwater target for this CAP is the lower river, TNC watershed-scale conservation efforts include meadows, streams and forests in the upper reaches, which also have beneficial effects downstream.
Eastern Sierra Rivers - Middle Carson River	Aquatic systems and desert riparian systems identified in TNC's Great Basin ecoregional blueprint. Great Basin rivers have lost large percentages of their riparian habitat and native fish.	Longstanding priority landscape of TNC-NV. Excellent examples of spring-fed freshwater marsh systems. Meadows, wetlands and riparian habitat from NV/CA state line to Lahontan delta support a rich assemblage of avian species including migratory and nesting shorebirds, waterfowl and raptors.
Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake	Several targets identified in Great Basin Ecoregional Plan: Terminal lakes are unique to the Basin & Range; freshwater and brackish marshes; important desert riparian shrublands for breeding and migratory birds; Lahontan cutthroat trout river system.	Priority site in Great Basin Ecoregional Assessment. Most of Walker River streamflow is consumed by irrigation before reaching Walker Lake. The diversions have caused the level of Walker Lake to drop substantially. Substantial restoration efforts now underway.

Mojave Desert Rivers - Upper Muddy River	Aquatic systems and riparian systems identified in TNC's Mojave Desert ecoregional assessment. Globally imperiled species.	Longstanding priority landscape of TNC-Nevada. Endemic fishes and springsnails. Large, functionally intact linear riparian corridor, critical nesting area and foraging site for birds and other wildlife.
Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows	Aquatic systems and riparian systems identified in TNC's Mojave Desert ecoregional assessment. Globally imperiled species.	Longstanding priority landscape of TNC-Nevada and California. High concentration of biodiversity, including endemic Amargosa toad, Oasis Valley Speckled Dace, Oasis Valley Springsnail, and Devil's Hole pupfish. Assessment area includes both Nevada & California sections of the river.
Mojave Desert Rivers - Lower Virgin River	Aquatic systems and riparian systems identified in TNC's Mojave Desert ecoregional assessment. Globally imperiled species.	Along with the Muddy River, the Virgin River is the Mojave's only significant perennial and continuous riverine system. Endangered fish (woundfin and Virgin River chub) and riparian bird species (southwestern willow flycatcher, Yuma clapper rail) utilizing the Lower Virgin River and its floodplain
Desert Springs - Soldier Meadows	Springs and springbrooks identified in TNC's Great Basin ecoregional blueprint. Almost 80% of Nevada's 173 endemic species are dependent upon spring ecosystems.	One of seven priority landscapes identified by Nevada Springs Conservation Plan. The desert dace, a rare desert fish, is found only in Soldier Meadows' hot spring outflows. Creeks provide critical spawning habitat for the Lahontan cutthroat trout.
Desert Springs - White River Valley	Springs and springbrooks identified in TNC's Great Basin ecoregional blueprint. Almost 80% of Nevada's 173 endemic species are dependent upon spring ecosystems.	One of seven priority landscapes identified by Nevada Springs Conservation Plan and one of 22 TNC-Nevada priority landscapes. Potentially impacted by large-scale southern Nevada groundwater withdrawals

Desert Springs - Pahrnagat Valley	Aquatic systems and riparian systems identified in TNC's Mojave Desert ecoregional assessment. Almost 80% of Nevada's 173 endemic species are dependent upon spring ecosystems.	One of seven priority landscapes identified by Nevada Springs Conservation Plan and one of 22 TNC-Nevada priority landscapes. Potentially impacted by large-scale southern Nevada groundwater withdrawals
Wetlands - Lahontan Valley Wetlands	Freshwater marsh identified as focal target in TNC's Great Basin Ecoregional Conservation Blueprint.	Wetlands complex including Stillwater Wildlife National Wildlife Refuge, Stillwater Wildlife Mgmt Area and Carson Lake. Area consists mainly of fresh and alkaline marshes varying from several centimeters to a meter in depth. Dependent upon return flows from irrigation projects. Western Hemisphere Shorebird Reserve Network - the area can host up to 250,000 shorebirds
Wetlands - Argenta Marsh	Freshwater marsh identified in TNC's Great Basin Ecoregional Conservation Blueprint. Birds and amphibian species are especially dependent upon this system. This ecological system consists of permanently flooded and permanently saturated wetlands.	Once held one of the largest wetlands in Nevada, but largely dewatered by channelization. Opportunities for restoration. Identified as one of 22 TNC-Nevada priority landscapes.
Montane Wet Meadows	Wet meadows identified in TNC's Great Basin ecoregional blueprint. This ecological system consists of herbaceous vegetation on seasonally saturated to temporarily flooded areas.	Opportunities for conservation and restoration on Barrick and Newmont privately held lands as part of sage grouse conservation program.



## Appendix C -- Key Ecological Attributes Ratings Table

Key Attribute	Rating Scale					
	Poor	Fair -	Fair	Good -	Good	Very Good
<b>Flows</b> - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Flows are highly altered and are insufficient to support native aquatic species (e.g., virtually no base flow in summer) and riparian/wetland habitats (e.g. no inundation) over most reaches/aerial extent	Flows are highly altered and are insufficient to support native aquatic species OR to maintain riparian/wetland habitats over many reaches/aerial extent	Flows are substantially altered and may not be sufficient to support native aquatic species or to maintain riparian/wetland habitats over many reaches/aerial extent	Flows are substantially altered but generally sufficient to support native aquatic species over many reaches/aerial extent; some loss of riparian/wetland habitats from altered flow regime	Flows are moderately altered but sufficient to support native aquatic species along most reaches/aerial extent; low loss of riparian/wetland habitats due to altered flow regime	Flows approximate the natural range of variability over most reaches/aerial extent most of the time; no significant loss of riparian/wetland habitats
<b>Riparian Vegetation</b> - composition, structure and extent	Invasives dominant and/or removal of riparian vegetation has taken place along most reaches/aerial extent and have significantly impacted recruitment and survival of native vegetation	Invasives and/or removal of vegetation widespread but characteristic communities with limited recruitment still present along some reaches/aerial extent	Invasives and/or removal of vegetation present in many areas, but characteristic communities with some recruitment still present along many reaches/aerial extent	Invasives present in some areas but manageable; characteristic communities with varied age classes and recruitment along many reaches/aerial extent	Invasives present but manageable; characteristic communities with varied age classes along most reaches/aerial extent with good recruitment	No invasives (or very limited and manageable); characteristic communities with varied age classes along most reaches/aerial extent with good recruitment
<b>Native Aquatic Animals</b> (fish, springsnails, amphibians) - composition and abundance	Invasive aquatic animal species are dominant	Invasive aquatic animal species are widespread, or one or more highly invasive species is present; characteristic aquatic animal species are still present but in substantially reduced numbers or extent	Invasive aquatic animal species are present but no highly invasive species; characteristic aquatic animal species are still present but in reduced numbers or extent	Invasive aquatic animal species are present but manageable; characteristic aquatic animal species are present but in moderately reduced numbers or extent	Non-native aquatic animal species are present but are either non-invasive or manageable (if invasive); characteristic aquatic animal species are abundant	No non-native aquatic animals are present (or very limited and manageable); characteristic aquatic animal species are abundant
<b>Physical Integrity</b> - degree of physical alteration of river, streambank, wetland or spring; natural channel morphology	Natural physical characteristics no longer exist along most of the waterbody (e.g., bank hardening, dredging, entrenchment)	Natural physical characteristics <i>no longer exist</i> along much of the waterbody (e.g., bank hardening, dredging, entrenchment)	Natural physical characteristics exist along much (e.g. 50%) of the waterbody; <i>substantially</i> impaired conditions on most other portions	Natural physical characteristics exist along much (e.g. 50%) of the waterbody; <i>somewhat</i> impaired conditions on most other portions	Natural physical characteristics exist along most (e.g. 75%) of the waterbody (e.g., channel can naturally meander; little entrenchment)	Natural physical characteristics exist along almost all (e.g. 90%) of the waterbody (e.g., channel can naturally meander; little entrenchment)
<b>Water Quality</b> - dissolved oxygen, sediment, nutrients, toxins	Water quality is highly impaired and insufficient to support native aquatic species in most of the waterbody most of the time	Water quality is highly impaired and insufficient to support native aquatic species in much (e.g. 50%) of the waterbody much of the time	Water quality is somewhat to substantially impaired, but generally sufficient to support native aquatic species in much (e.g. 50%) of the waterbody much of the time	Water quality is slightly impaired in much (e.g. 50%) of the waterbody or much of the time, somewhat to substantially impaired in other portions, but generally sufficient to support native aquatic species in MOST portions most of the time	Water quality is unimpaired in most (e.g. 75%) of the waterbody most of the time, and sufficient to support native aquatic species	Water quality is unimpaired in almost all (e.g. 90%) of the waterbody almost all of the time and sufficient to support native aquatic species



**Appendix D**  
**Health and Threat Ratings by Target Groups**

Eastern Sierra Rivers  
Mojave Desert Rivers  
Desert Springs  
Wetlands and Meadows

## Current and Future Health Ratings – Eastern Sierra Rivers

Key Attributes	Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/ Pyramid Lake			Eastern Sierra Rivers - Middle Carson River			Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake		
	Current	Future Forecast 10 Years	Stress Ranking	Current	Future Forecast 10 Years	Stress Ranking	Current	Future Forecast 10 Years	Stress Ranking
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Fair	Fair -	High	Fair -	Fair -	High	Poor	Fair	Low
Riparian Vegetation - composition, structure and extent	Fair	Fair -	High	Fair -	Fair	Medium	Fair	Fair	Medium
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair -	Fair -	High	Fair -	Fair -	High	Poor	Poor	High
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring; natural channel	Fair -	Fair -	High	Fair -	Fair -	High	Fair	Fair -	High
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Good -	Fair	Medium	Fair -	Fair -	High	Fair -	Fair	Medium
<b>Overall Health Score</b>	36	24		20	24		14	23	
<b>Overall Health Rating</b>	Fair	Fair -		Fair -	Fair -		Poor	Fair -	

## Mojave Desert Rivers

Key Attributes	Mojave Desert Rivers - Upper Muddy River			Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows			Mojave Desert Rivers - Lower Virgin River		
	Current	Future Forecast 10 Years	Stress Ranking	Current	Future Forecast 10 Years	Stress Ranking	Current	Future Forecast 10 Years	Stress Ranking
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good -	Fair	Medium	Good	Fair	High	Fair -	Fair -	High
Riparian Vegetation - composition, structure and extent	Fair -	Fair -	High	Fair	Fair	Medium	Fair -	Fair	Medium
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair -	Fair -	High	Fair	Fair	Medium	Fair -	Fair -	High
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring; natural channel	Fair -	Fair -	High	Good -	Good	-	Good	Good	-
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Good	Good	-	Good	Good	-			
<b>Overall Health Score</b>	40	36		60	56		35	40	
<b>Overall Health Rating</b>	Fair	Fair -		Good -	Good -		Fair -	Fair	

## Desert Springs

Key Attributes	Desert Springs - Soldier Meadows			Desert Springs - White River Valley			Desert Springs - Pahrnatag Valley		
	Current	Future Forecast 10 Years	Stress Ranking	Current	Future Forecast 10 Years	Stress Ranking	Current	Future Forecast 10 Years	Stress Ranking
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good	Good -	Medium	Good	Fair	High	Fair -	Poor	Very High
Riparian Vegetation - composition, structure and extent	Good	Good -	Medium	Good	Good -	Medium	Fair -	Fair -	High
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair	Fair -	High	Good	Good -	Medium	Fair -	Fair -	High
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring; natural channel	Good	Good -	Medium	Fair	Fair	Medium	Fair -	Fair -	High
Water Quality - dissolved oxygen, sediment, nutrients, toxins									
<b>Overall Health Score</b>	70	50		70	50		20	12	
<b>Overall Health Rating</b>	Good -	Fair		Good -	Fair		Fair -	Poor	

## Wetlands and Meadows

Key Attributes	Wetlands - Lahontan Valley Wetlands			Wetlands - Argenta Marsh			Montane Wet Meadows - Sage-grouse habitat		
	Current	Future Forecast 10 Years	Stress Ranking	Current	Future Forecast 10 Years	Stress Ranking	Current	Future Forecast 10 Years	Stress Ranking
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good -	Fair	Medium	Fair -	Fair -	High	Good -	Good -	Low
Riparian Vegetation - composition, structure and extent	Fair	Fair -	High	Good -	Good -	Low	Fair	Fair	Medium
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance				Fair	Fair	Medium			
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring; natural channel	Fair -	Fair -	High	Fair -	Fair -	High	Fair -	Fair -	High
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Fair	Fair -	High	Fair -	Fair -	High	Good	Good	-
<b>Overall Health Score</b>	40	25		32	32		50	50	
<b>Overall Health Rating</b>	Fair	Fair -		Fair -	Fair -		Fair	Fair	

Summary of Threats	Eastern Sierra Rivers		
	Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/ Pyramid Lake	Eastern Sierra Rivers - Middle Carson River	Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake
Channel modification	Very High	High +	High +
Surface water diversion	High +	High +	High
Excessive groundwater withdrawal	Medium	Medium	High
Invasive species - aquatic animals	High	High	High
Warmer/ drier climate	High	Medium	Medium
Incompatible livestock grazing	Low	Low	Low
Invasive species - plants	Medium	High	Low
Incompatible forest management	High	High	Medium
Incompatible development	Medium	High +	-
Water law/ changes	Low	Low	Low
Incompatible agricultural practices	Low	Medium	Medium
Wild horses and burros	Medium	-	-
Presence/ operations of dams	Medium	-	Medium

15 High ranked threats

Summary of Threats	Mojave Desert Rivers		
	Mojave Desert Rivers - Upper Muddy River	Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows	Mojave Desert Rivers - Lower Virgin River
Presence/ operations of dams	-	-	-
Surface water diversion	Low	-	High
Excessive groundwater withdrawal	Medium	High	Low
Invasive species - aquatic animals	High	Medium	High
Invasive species - plants	High	Medium	Medium
Channel modification	High +	-	-
Incompatible development	-	-	-
Incompatible livestock grazing	-	Low	Medium
Wild horses and burros	-	Low	-
Incompatible agricultural practices	-	-	-
Incompatible forest management	-	-	-
Warmer/ drier climate	Low	High	High
Water law/ changes	Low	Low	-

8 High ranked Threats

Summary of Threats	Desert Springs		
	Desert Springs - Soldier Meadows	Desert Springs - White River Valley	Desert Springs - Pahrnagat Valley
Channel modification	Medium	Medium	High +
Surface water diversion	Medium	High	Very High
Excessive groundwater withdrawal	-	High	Very High
Invasive species - aquatic animals	High	Medium	High
Warmer/ drier climate	Low	Medium	High
Incompatible livestock grazing	Medium	Medium	High
Invasive species - plants	-	-	-
Incompatible forest management	-	-	-
Incompatible development	-	-	-
Water law/ changes	Low	Medium	High
Incompatible agricultural practices	-	-	-
Wild horses and burros	Medium	-	-
Presence/ operations of dams	Medium	-	-

10 High ranked threats

Summary of Threats	Wetlands & Meadows		
	Wetlands - Lahontan Valley Wetlands	Wetlands - Argenta Marsh	Montane Wet Meadows - Sage-grouse habitat
Channel modification	High	High +	Low
Surface water diversion	Low	Very High	Low
Excessive groundwater withdrawal	-	High +	Low
Invasive species - aquatic animals	-	Medium	-
Warmer/ drier climate	Medium	Low	Low
Incompatible livestock grazing	Medium	High +	High
Invasive species - plants	High	Low	Low
Incompatible forest management	-	-	Low
Incompatible development	-	-	-
Water law/ changes	Low	Low	-
Incompatible agricultural practices	High	-	Low
Wild horses and burros	-	-	High
Presence/ operations of dams	-	-	-

9 High ranked threats

## Overall Threat Summary

Summary of Threats	
	Overall Threat Rank
Channel modification	Very High
Surface water diversion	Very High
Excessive groundwater withdrawal	Very High
Invasive species - aquatic animals	Very High
Warmer/ drier climate	High +
Incompatible livestock grazing	High +
Invasive species - plants	High +
Incompatible forest management	High
Incompatible development	High
Water law/ changes	Medium
Incompatible agricultural practices	Medium
Wild horses and burros	Medium
Presence/ operations of dams	Medium

### High Rankings at 25% or more of 12 Landscapes

- Channel Modification 6 targets (mostly historical, but presents ongoing stress)
- Surface Water Diversion 7 targets (mostly historical, but presents ongoing stress)
- Excessive Groundwater W/D 5 targets (mostly future)
- Invasive aquatic animals 7 targets (mostly already established)
- Warmer/drier climate 4 targets (future)
- Incompatible livestock 3 targets (historical and current)
- Invasive plant species 3 targets (mostly already established)



## Appendix E – Detailed Ratings for All Targets

### Truckee

Key Attributes	Eastern Sierra Rivers/Terminal Lakes - Lower Truckee River/Pyramid Lake			Contribution to Stress - Rate Source Where Applicable <i>Note: Rate the absolute contribution of a source, not relative to other sources (e.g. there might be 2 High contributors to degraded water quality)</i>												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/drier climate	Water law/changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Fair	Fair -	High	Low	High	Medium			Low					High	High	
Riparian Vegetation - composition, structure and extent	Fair	Fair -	High	Low	Medium	Low		Medium	High	Medium	Low	Medium	Low		Medium	
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair -	Fair -	High	Medium	High	Medium	High	Medium	High						Medium	
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Fair -	Fair -	High	Low	Medium	Low			High	Medium			Low	Low		
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Good -	Fair	Medium		Low	Low			Medium	High				Very High	High	Low
Overall Health Score	36	24														
Overall Health Rating	Fair	Fair -														
Threat to Target Rank				Medium	High +	Medium	High	Medium	Very High	Medium	Low	Medium	Low	High	High	Low

### Carson

Key Attributes	Eastern Sierra Rivers - Middle Carson River			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Fair -	Fair -	High		Very High	Medium								Medium	Medium	
Riparian Vegetation - composition, structure and extent	Fair -	Fair	Medium		High	Medium		High	Very High	High	Medium					Low
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair -	Fair -	High		Medium	Low	High	Medium	Very High	Very High						
Physical integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Fair -	Fair -	High						Very High	Very High						
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Fair -	Fair -	High		High	Medium		High					Medium	High	Medium	
Overall Health Score	20	24														
Overall Health Rating	Fair -	Fair -														
Threat to Target Rank				-	High +	Medium	High	High	High +	High +	Low	-	Medium	High	Medium	Low

### Walker

Key Attributes	Eastern Sierra Rivers/Terminal Lakes - Lower Walker River/ Walker Lake			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatibl e development	Incompatibl e livestock grazing	Wild horses and burros	Incompatibl e agricultural practices	Incompatibl e forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Poor	Fair	Low	Low	Very High	Very High			Low					High	High	Medium
Riparian Vegetation - composition, structure and extent	Fair	Fair	Medium	Low	Medium	Medium		Low	Very High		Medium		Medium		Medium	
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Poor	Poor	High	Medium	Very High	Very High	High		High						Medium	
Physical integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Fair	Fair -	High	Low	Medium	Medium			Very High		Low			Medium		
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Fair -	Fair	Medium		Very High	Very High			Medium				Very High	Very High	Medium	
Overall Health Score	14	23														
Overall Health Rating	Poor	Fair -														
Threat to Target Rank				Medium	High	High	High	Low	High +	-	Low	-	Medium	Medium	Medium	Low

## Muddy

Key Attributes	Mojave Desert Rivers - Upper Muddy River			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good -	Fair	Medium		Low	Very High									Medium	Medium
Riparian Vegetation - composition, structure and extent	Fair -	Fair -	High					High	Very High							
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair -	Fair -	High				Very High		Medium							
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring; natural channel	Fair -	Fair -	High						Very High							
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Good	Good	-													
Overall Health Score	40	36														
Overall Health Rating	Fair	Fair -														
Threat to Target Rank				-	Low	Medium	High	High	High +	-	-	-	-	-	Low	Low

## Amargosa

Key Attributes	Mojave Desert Rivers - Amargosa River/ Oasis Valley/ Ash Meadows			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good	Fair	High			Very High									High	Low
Riparian Vegetation - composition, structure and extent	Fair	Fair	Medium					Very High			Low	Medium			Medium	
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair	Fair	Medium			High	Very High								Medium	
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring; natural channel	Good -	Good	-						High			Medium				
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Good	Good	-								Medium	Medium				
Overall Health Score	60	56														
Overall Health Rating	Good -	Good -														
Threat to Target Rank				-	-	High	Medium	Medium	-	-	Low	Low	-	-	High	Low

## Virgin

Key Attributes	Mojave Desert Rivers - Lower Virgin River			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Fair -	Fair -	High		High	Low		Medium							Medium	
Riparian Vegetation - composition, structure and extent	Fair -	Fair	Medium					Very High			High				Medium	
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair -	Fair -	High				Very High								High	
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring; natural channel	Good	Good	-													
Water Quality - dissolved oxygen, sediment, nutrients, toxins																
Overall Health Score	35	40														
Overall Health Rating	Fair -	Fair														
Threat to Target Rank				-	High	Low	High	Medium	-	-	Medium	-	-	-	High	-

## Soldier Meadows

Key Attributes	Desert Springs - Soldier Meadows			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good	Good -	Medium		High										Medium	Low
Riparian Vegetation - composition, structure and extent	Good	Good -	Medium								High	High				
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair	Fair -	High	Medium			Very High		Medium							
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Good	Good -	Medium						Medium		High	High				
Water Quality - dissolved oxygen, sediment, nutrients, toxins																
Overall Health Score	70	50														
Overall Health Rating	Good -	Fair														
Threat to Target Rank				Medium	Medium	-	High	-	Medium	-	Medium	Medium	-	-	Low	Low

## White River Valley

Key Attributes	Desert Springs - White River Valley			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good	Fair	High		High	High									Medium	Medium
Riparian Vegetation - composition, structure and extent	Good	Good -	Medium		Medium				Medium		High					
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Good	Good -	Medium				Very High									
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Fair	Fair	Medium						Very High		Very High					
Water Quality - dissolved oxygen, sediment, nutrients, toxins																
Overall Health Score	70	50														
Overall Health Rating	Good -	Fair														
Threat to Target Rank				-	High	High	Medium	-	Medium	-	Medium	-	-	-	Medium	Medium

## Pahranagat Valley

Key Attributes	Desert Springs - Pahranagat Valley			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Fair -	Poor	Very High		High	High									Medium	Medium
Riparian Vegetation - composition, structure and extent	Fair -	Fair -	High		Medium				Medium		Very High					
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair -	Fair -	High				Very High		High							
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Fair -	Fair -	High		High				High							
Water Quality - dissolved oxygen, sediment, nutrients, toxins																
Overall Health Score	20	12														
Overall Health Rating	Fair -	Poor														
Threat to Target Rank				-	Very High	Very High	High	-	High +	-	High	-	-	-	High	High

## Lanhontan Valley

Key Attributes	Wetlands - Lahontan Valley Wetlands			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good -	Fair	Medium		Medium									Very High	High	Medium
Riparian Vegetation - composition, structure and extent	Fair	Fair -	High					High			Medium					
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance																
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Fair -	Fair -	High						Very High							
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Fair	Fair -	High								Medium		High		Medium	
Overall Health Score	40	25														
Overall Health Rating	Fair	Fair -														
Threat to Target Rank				-	Low	-	-	High	High	-	Medium	-	High	-	Medium	Low

## Argenta Marsh

Key Attributes	Wetlands - Argenta Marsh			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Fair -	Fair -	High		Very High	High			Very High		Low					Low
Riparian Vegetation - composition, structure and extent	Good -	Good -	Low		High	Medium		Medium	High		Medium				Low	
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance	Fair	Fair	Medium		High	Medium	Very High		High		Low				Low	
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Fair -	Fair -	High		High	Medium			Very High		High					
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Fair -	Fair -	High		Very High	High			Medium		High				Low	
Overall Health Score	32	32														
Overall Health Rating	Fair -	Fair -														
Threat to Target Rank				-	Very High	High +	Medium	Low	High +	-	High +	-	-	-	Low	Low

## Montane Wet Meadows

Key Attributes	Montane Wet Meadows - Sagegrouse habitat			Contribution to Stress - Where Applicable												
	Current	Future Forecast 10 Years	Stress Ranking	Presence/ operations of dams	Surface water diversion	Excessive groundwater withdrawal	Invasive species - aquatic animals	Invasive species - plants	Channel modification	Incompatible development	Incompatible livestock grazing	Wild horses and burros	Incompatible agricultural practices	Incompatible forest management	Warmer/ drier climate	Water law/ changes
Flows - amount, timing, and duration of freshwater flows (surface water and/or groundwater)	Good -	Good -	Low		Medium	Low		Low	Low		High	Medium	Low	Medium	High	Low
Riparian Vegetation - composition, structure and extent	Fair	Fair	Medium		Medium	Low		Low	Low		Very High	High	Low		Low	
Native Aquatic Animals (fish, springsnails, amphibians) - composition and abundance																
Physical Integrity - degree of physical alteration of river, streambank, wetland or spring: natural channel	Fair -	Fair -	High		Low	Low			Low		Very High	Very High		Low		
Water Quality - dissolved oxygen, sediment, nutrients, toxins	Good	Good	-		High	Low				Low	Very High	Medium	Medium			
Overall Health Score	50	50														
Overall Health Rating	Fair	Fair														
Threat to Target Rank				-	Low	Low	-	Low	Low	-	High	High	Low	Low	Low	-

## Appendix F – Strategy Table

Sites	Objectives	Strategies	Hypotheses
Truckee River & Carson River	<p>By 2025, maintain sufficient late season base flows to support native riparian habitats over many reaches</p> <p>By 2025, maintain good water quality over many reaches by reducing runoff from catastrophic wildfires</p>	<ul style="list-style-type: none"> <li>• Determine minimum environmental flows, conduct threat analysis (policy, economic and natural resource trends), and develop strategic engagement with TROA scheduling parties and other legal interests.</li> <li>• Determine sediment budget/long-term downstream impacts relating to closed forests and large forest fires. If forest management holds form vs. other alternatives, develop 1st approximation watershed-scale water budget and sediment budget relating to forest management</li> <li>• Determine best opportunities to decrease water resource losses and prevent sedimentation, including forest and source-water (e.g. roads, meadows) land management</li> <li>• Model downstream flows and sediment resulting from altering forest management practices from closed to open forest; determine scale needed to significantly reduce downstream water quality impacts (ROI).</li> <li>• Demonstrate “proof of concept” of forest</li> </ul>	<ul style="list-style-type: none"> <li>• Forests uptake ~50% of the precipitation in the eastern Sierra; the current, unnatural, highly closed forest structure exacerbates uptake/loss to evaporation, and more appropriately managed forest would decrease water resource losses.</li> <li>• “Catastrophic” fires resulting from closed forest conditions are much more likely to occur and would create new forest structures that would have measurable negative affects to downstream flows.</li> <li>• High severity fires resulting from out of whack forest conditions would contribute high levels of sediment and debris that would measurably affect downstream water quality and M&amp;I operations/infrastructure.</li> <li>• TNC can take I-Lake success and find a way to increase open forest structure at a large enough scale</li> </ul>

		<p>management program on USFS lands at intermediate scale (through existing local examples, literature search, existing USFS projects, etc.)</p> <ul style="list-style-type: none"> <li>• Mobilize a viable policy vehicle, political support, funding, and NEPA efficiencies to increase pace and scale of restoration on National Forest lands (e.g., revised Forest Management Plans, organized constituency and a dedicated funding source)</li> </ul>	
White River Valley Pahranagat Valley Upper Muddy River	<p>Ensure that potential large-scale groundwater withdrawal does not cause "unreasonable adverse effects" to flows and other associated key ecological attributes for priority freshwater ecosystems in southern and eastern Nevada.</p>	<ul style="list-style-type: none"> <li>• See water law strategy below</li> <li>• Develop science-based approach, based on the "3M" agreement and endangered species act, to help determine the ecological standard(s) for what constitutes an "unreasonable adverse impact" to the groundwater-dependent ecosystems and endangered species</li> <li>• Use 3M predictive groundwater model to forecast impacts from various pumping scenarios (need to resolve if the groundwater basins are "permeable")</li> <li>• Develop science-based approach/tools (including predictive ecological and</li> </ul>	<p><u>Hypotheses</u></p> <ul style="list-style-type: none"> <li>• Unsustainable groundwater withdrawals are already occurring and could increase substantially. Long-term impacts could be severe</li> <li>• Change in water law could have real impact.</li> <li>• SNWA-DOI Stipulation Agreement (for Monitoring, Management &amp; Mitigation) remains an important vehicle to ensure sustainability and need to be effectively implemented.</li> <li>• TNC needs to take a lead on the science, get the science back on the table &amp; influence the outcome</li> </ul>

		<p>hydrologic models) to establish surface water thresholds required to meet ecological standards (see above), and linkages to when pumping would cross those thresholds.</p> <ul style="list-style-type: none"> <li>• Encourage agencies and SNWA to incorporate these approaches into binding agreements like the 3M agreement</li> </ul>	
Montane Wet Meadows	<p>By 2025, restore the most important montane wet meadows contributing to sage-grouse habitat suitability to at least “Good –” overall condition, including no adverse impacts from grazing by livestock or wild horses/burros.</p>	<ul style="list-style-type: none"> <li>• Determine the method and selection criteria to locate target meadows that make the biggest impact to GSG suitability and other priority species (e.g. amphibians and LCT). Establish target percentage/number that will make high impact.</li> <li>• Determine optimal management treatments that can be implemented to address specific causes of degradation. Highest likely impact strategies: adaptive grazing management; wild horse management; check dams to reverse incision; fencing; water delivery systems; rehydration with guzzlers</li> <li>• Proof of restoration concepts beyond the mining companies lands for livestock operations</li> <li>• Secure a funding source and delivery system</li> <li>• Develop outreach</li> </ul>	<p><u>Hypotheses</u></p> <ul style="list-style-type: none"> <li>• A relatively small percentage of the large number of meadows will make a disproportionate impact on sage-grouse habitat suitability (i.e., 80-20 rule)</li> <li>• We can develop/capture a funding source(s) and delivery vehicle for implementation at sufficient scale</li> <li>• Lower implementation barrier is necessary for propagation of restoration actions</li> </ul>

		program supported by project design expertise to lower barriers to implementation	
All Freshwater Landscapes	Ensure that any potential changes in Nevada water law and policy do not adversely affect and if possible enhance surface water flows and groundwater levels for sustaining freshwater ecosystems.	<ul style="list-style-type: none"> <li>• Establish best science-based methods for setting environmental standards (water flows and levels) for priority freshwater ecosystems</li> <li>• Identify possible legal and regulatory mechanisms for ensuring standards are adopted and enforced, inter- and intra-basin</li> <li>• Ensure necessary financial resources are committed for application of methodology and enforcement of standards</li> <li>• Develop science-based tools for evaluating and increasing visibility of the consequences of alternative water use scenarios: reveal what amount of water different human uses consume relative to perennial yield in single or multiple basins (some portion of perennial yield is need for the environment)</li> <li>• Develop outreach and coalition-building strategy to develop support for environmental standards. Will require polling, message development and dedicated government relations resources</li> </ul>	<p><u>Hypotheses</u></p> <ul style="list-style-type: none"> <li>• The possibility of a major change in NV water law is uncertain, but activity is afoot (legislative commission; Australian model); environmental standards are being discussed</li> <li>• If it were to occur, could have far-reaching and long-term impacts on environmental flows</li> <li>• Under current water law, environmentally beneficial uses for instream flows are wildlife (primarily fish) and recreation</li> <li>• TNC can constructively influence the inclusion of good environmental standards in a revised law</li> </ul>



All Freshwater Landscapes	By 2025, develop major funding resources to restore flows, natural channel conditions, characteristic riparian vegetation, native aquatic animals and water quality to increase resilience and health of Nevada's freshwater landscapes – for people and nature	<ul style="list-style-type: none"> <li>• Conduct needs assessment for conservation funding</li> <li>• Assess and pursue currently available federal funding sources to meet these needs</li> <li>• Establish new statewide natural resource funding source</li> <li>• Develop outreach and coalition-building strategy to develop support for new state funding. Likely requires polling and message development.</li> <li>• Position TNC as one of lead implementers of restoration projects</li> </ul>	<u>Hypotheses</u> <ul style="list-style-type: none"> <li>• Historic threats and prospective climate change require investment to restore habitat functionality and resilience</li> <li>• The limiting factor is insufficient funding</li> <li>• TNC played a major role in securing Question 5 in 1990 and Question 1 in year 2000 and has positive reputation and standing to provide leadership</li> </ul>
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#### New Site-Based Strategies

Sites	Objectives	Strategies	Discussion
Virgin River	By 2025, increase flows to sufficient levels in key reaches at key times to ensure health of the rare fish species in Virgin River	<ul style="list-style-type: none"> <li>• Model/map water flows/withdrawals by reaches</li> <li>• Determine key flow needs for fish survival</li> <li>• Determine instream flow targets by reach</li> <li>• Figure out how to get the water (e.g., SNWA, water fund, new water rights purchase program)</li> </ul>	<ul style="list-style-type: none"> <li>• Main issue is instream flow restoration</li> <li>• Getting water in certain reaches at certain times for rare fish is key</li> </ul>
Argenta Marsh	By 2025, secure phased increase in surface water flows sufficient to support native fish and waterfowl over portions of the original aerial extent	<ul style="list-style-type: none"> <li>• Confirm that co-management agreement of Barrick and Newmont allows for renegotiation and flexibility to redirect water to marsh.</li> <li>• Establish desired future conditions, including identification of water budget and understanding of water rights context</li> </ul>	<ul style="list-style-type: none"> <li>• Barrick Gold and Newmont Mining control significant water rights that could be reallocated to Argenta Marsh.</li> <li>• TNC has strong relationships with both companies.</li> </ul>

		<ul style="list-style-type: none"> <li>• Develop a stakeholder process and political strategy for identifying alternative allocations of water, and phased implementation, that achieves broad support. Possible proof of concept pilot project.</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple stakeholders have an interest in restoring the marsh, and funding sources are available to support the initiative</li> </ul>
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