Walker River Paiute Tribe

Climate Adaptation Plan

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Resolution No. WR- 22- 2018

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Dedication to Our Children

The Agai Dicutta Numu (Trout Eater People) otherwise known as the Walker River Paiute Tribe are a strong and resilient people. We have lived on the lands in western Nevada for countless generations. The Numu were made by the Creator and came from Kurunga, also known as Mt. Grant, the great mountain located next to Agai Pah (Walker Lake).

The Creator made all things - the earth, water, foods, medicine, trees, and plants. He made the animals and gave them their place here. All things natural upon the Earth are our relatives because the Creator made them, and a little piece of him is in all, as well as in each of us. From this we give thanks.

It is this belief, prayer, and in following our sacred ceremonies that a close relationship was created with these things, and they tell us when things are not right. Our people have noticed the great changes happening to the earth.

This Climate Adaption Plan is dedicated to you – our children – and to your children and all generations to follow. We hope this knowledge will help our people understand what it means to be subject to climate change. Using this knowledge we must begin preparations to sustain our culture and natural resources.

For many generations, you will be challenged with a changing climate. In the past two years we have seen you - the young people - called to action to protect the earth and its resources. "Water is Life" is the message and the message is finally being heard.

Within our children we will always see hope, and know we will continue to flourish on our homelands for countless generations to come.

Summary

This document is an acknowledgement that climate change is real and that it poses a threat to our children, grandchildren, our culture and our way of life. This document represents the first effort by our department to identify (1) important resources and cultural components most likely to be impacted by climate change, (2) work we are currently undertaking that will help to reduce climate change impacts, (3) recommendations for specific vulnerability assessments and (4) risks to our most important interests and adaptation actions we should implement now. Our work will never be complete but will be a continuing cycle for many generations. All climate change issues require innovation and increased resources.

This Plan has four sections:

1. **Introduction, Purpose and Goals:** Brief overview of our history, document purpose, and goals.
2. **Climate Change Drivers and Potential Impacts**: Provides a technical backdrop of climate change and expected regional impacts. We expect temperatures to increase and snow pack to diminish. We have observed that many of these changes are already being realized.
3. **Climate Adaptation Plan:** primary focus on reservation outlining concerns and potential impacts on six general areas: a) Culture and Traditional Foods b) Health and Public Safety, c) Tribal Infrastructure and Energy d) Agriculture and Irrigation e) Rangelands and f) Walker River and Wetlands. Major issues are excessive and increasing heat in the summer and differences in the seasonal cycles. We need planning for emergency management, infrastructure and health systems. Most important is the management and availability of water for cultural, domestic and agricultural use. This plan provides a broad view of the landscape including water, rangelands, wildlife, vegetation along with traditional uses and impacts.
4. **Planning Summary:** A summary and table of potential climate adaptation actions.

The Walker River Paiute Tribe Water Resources Department has been working on a climate change adaptation plan for the Walker River Paiute Tribe since 2013. This report summarizes the research completed, to October 2017, on 1) possible future climate changes, 2) climate change impacts, and 3) potential adaptation strategies for the Tribe. This is an on-going project. For additional information about this report, or the climate change adaptation planning process, please contact:

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Section 1 – Introduction, Purpose and Goals

The Walker River Paiute Tribal people are the Numu, meaning "People". The Walker River Paiutes live on a 330,000 acre reservation in western Nevada. We are located 100 miles south of Reno, Nevada in the high desert. The elevation is 4,120 ft. and the annual average rainfall is less than 5 inches per year. The original reservation included all of Walker Lake but the lake was taken away from the Tribe in 1906 under the allotment act.

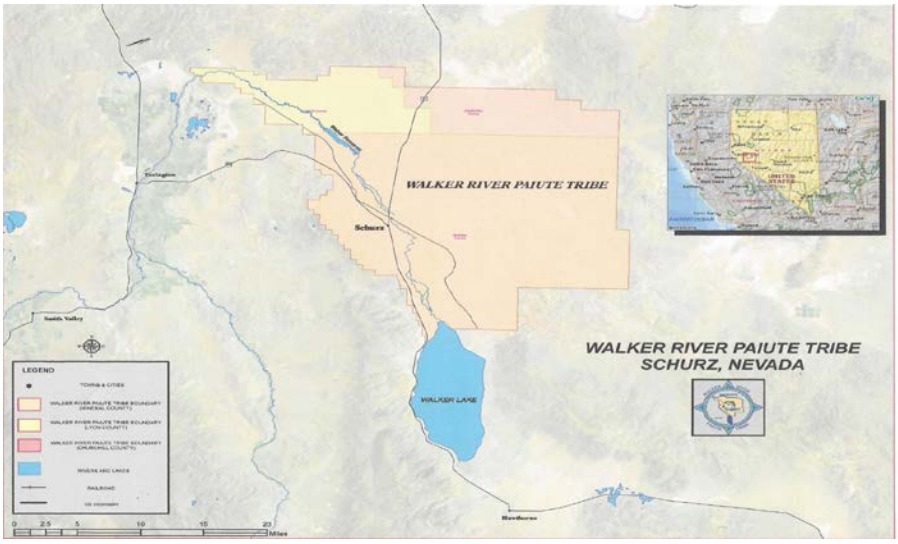

Figure 1: Walker River Paiute Tribe location map

The Numu concept of the universe can be summed up in one word, *nanumudooe*. This word means all of my relations. All of my relations encompass everything that the Creator has made upon the mother earth and in the universe. All things natural upon mother earth are our relatives because the Creator has made it.

Our world is a still pond. Human beings are the ones tossing stones into that still pond and creating the ripples that spread out and affect all living things. The human greed and quest for material wealth is throwing off the natural balance of our world and our Mother earth cannot heal or adapt quickly enough to rectify the damage and destruction we are causing. We have ceased to live in balance and harmony with all around us. In failing to respect our mother and all of our relations, we fail to respect ourselves. Our ancestors' spirits live on and guide us. Now is the time for us to listen to the cultural practices and knowledge passed down from generation to generation.

Climate Change is real and we are witness to the changes. Our pine nuts must be gathered sooner. Walker Lake, once rich with Lahontan cutthroat trout, can no longer sustain fish due to the salinity and lack of fresh water. Decreasing snowpack and lack of water has caused our river to run dry, and turned our wetlands turned into a desert. Extended drought and increased heat depletes the little surface water we have left. Noxious weeds are taking over the river corridor. More intense

wind storms bring up dust causing health problems. Where there was once abundant water and resources we have seen a significant decrease. We have already lost one of the main resources of our culture, the trout in Walker Lake. Our Tribe is the Agai Dicutta (Trout Eaters). The loss of the trout affects our very cultural identity. This loss may be irreversible.

Purpose: The purpose of this document is to begin the conversation about climate change and planning for adaptation for the Walker River Paiute Reservation. It is derived from the experience of our people and our tribal programs. This document is one way we can educate ourselves about current vulnerabilities and future risks and share ideas about actions that we may need to take to build climate resilience.

This document is an important step for the Walker River Paiute Tribe. It is a step in helping us prepare for an uncertain future where a rapidly changing climate will disrupt traditional cycles and ways of living. We cannot know and anticipate all changes at this time, but we can prepare. We must look ahead and blend our traditional and cultural knowledge with new ideas and technologies to sustain and enhance our community in the face of climate change. This document represents the beginning of a continued and meaningful conversation between tribal leadership, tribal programs, and tribal members. Our people must consider these questions:

1. How is climate change affecting our lives, environment and culture?
2. How will climate change affect future generations?
3. What can the Walker River Paiute Tribe do to prepare for and adapt to these changes?

Goals

Our work must be guided by clearly stated and achievable goals. Our goals, listed below, call on all tribal members and tribal leadership to educate themselves and to act. Our future is dependent on the symbiotic relationship with the water and land of our reservation. **For our people to be healthy, our water and lands must be healthy.**

- The Tribe will develop and implement strategies for long-term resource utilization, habitat protection, and resources restoration in order to increase climate resilience.
- The Tribe will protect existing surface water rights and advocate for enforcement of those water rights in the context of a changing climate.
- The Tribe will protect, preserve, and enhance sources of fresh water, including groundwater, to meet the current and future needs of the reservation for:
    - Domestic
    - Agricultural
    - Economic
    - Homeland needs
- The Tribe will prepare for extreme weather events by planning in the areas of:
    - Land Use
    - Housing
    - Health
    - Emergency Management.
- The Tribe will be prepared for impacts on culturally significant plant and animal species on the reservation and advocate with federal agencies for the protection and restoration of these species located off the reservation.
- The Tribe will continue to develop and build renewable energy capacity, both for local use and commercial potential.
- Tribal members will be educated on the present and future effects of climate change on our homeland and will continue to be engaged in our progress to adapt to these new challenges.
- Tribal Youth and Elders will be involved in cultural education, and learn how to help the Tribe adapt to climate change impacts.

Section 2 - Climate Change Drivers and Potential Impacts

Climate Change Drivers: Global average temperatures are rising. Temperatures may not rise everywhere and every year in exactly the same amount but, overall, the world is warming. Figure 2 shows some of the changes climate scientists and other researchers have observed that indicate the earth's climate is changing. The white arrows indicate increasing trends, such as rising temperatures and sea levels. The black arrows indicate decreasing trends, such as the amount of snow in northern and mountain regions and the amount of ice covering the oceans in the Arctic and Antarctic.

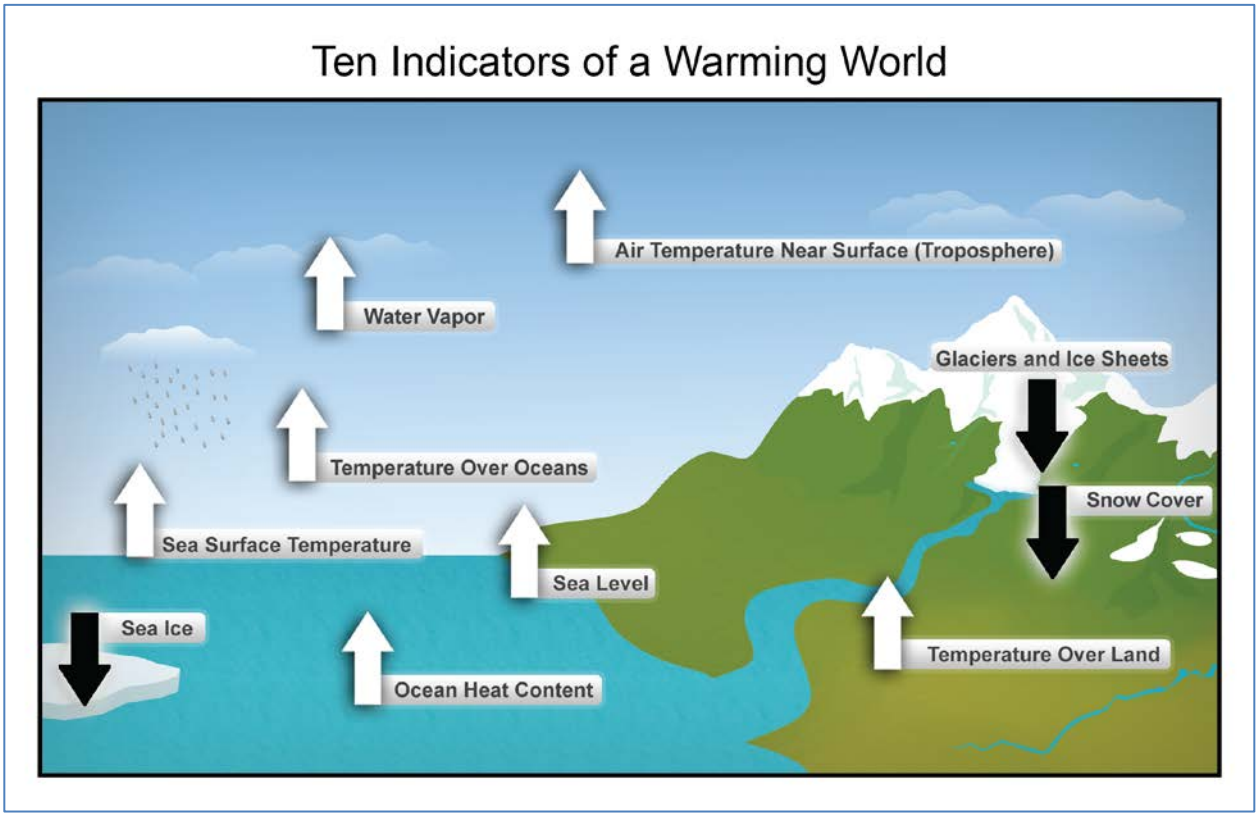

Figure 2: Ten Indicators of a Warming World. (Source: http://nca2014.globalchange.gov/report/our-changing-climate /observed-change#tab2-images).

The melting of the Arctic ice is impacting the jet stream so that storms are more unpredictable.

Figure 3 is a map of the United States (U.S.) that shows temperature changes from 1991 to 2012 compared to the average temperatures from 1901 to 1960. The darker the red color, the greater the difference between 1901–1960 and 1991–2012. These areas have experienced more warming.

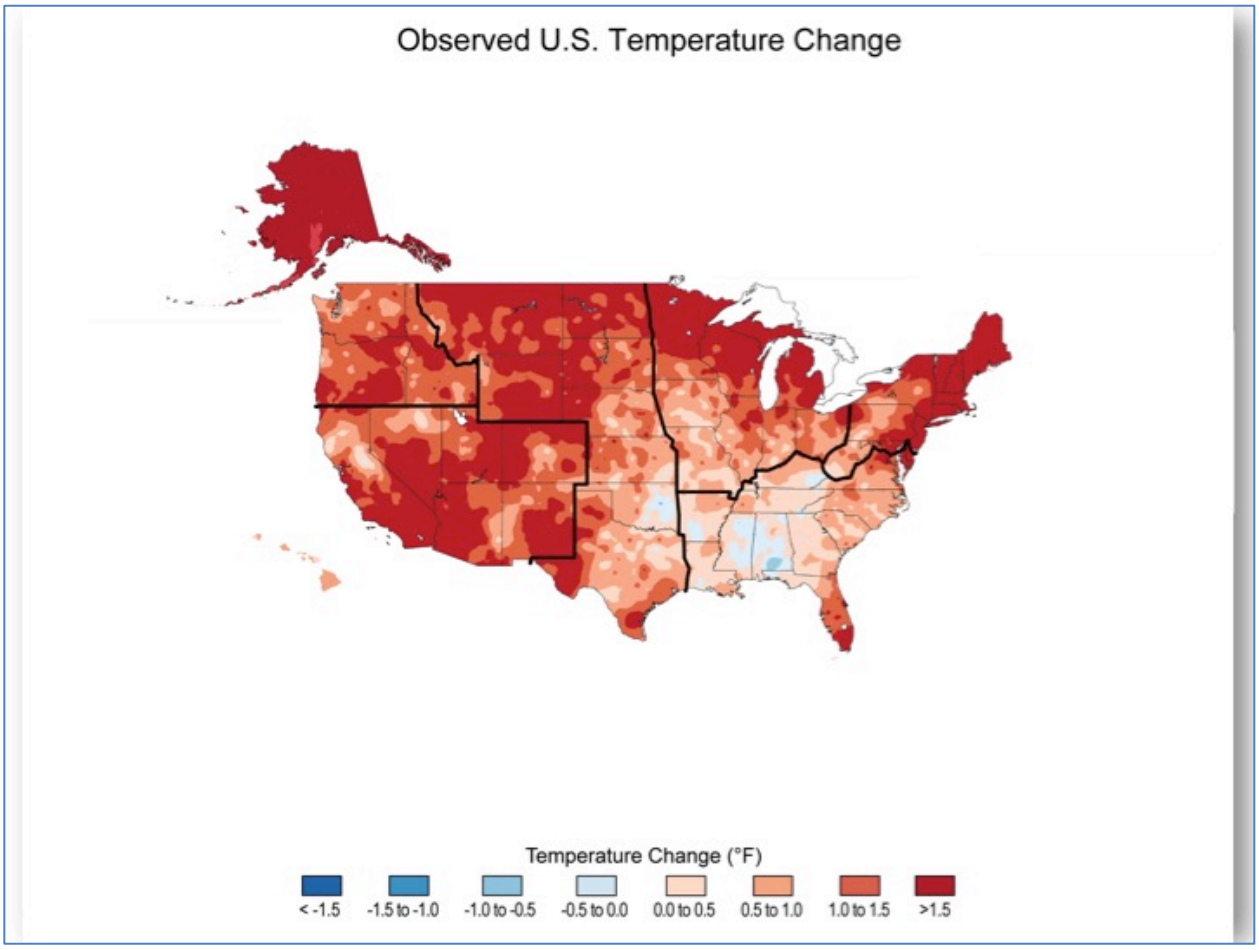

Figure 3: Observed U.S. Temperature Change 1991–2012. (Source: http://nca2014.globalchange.gov/report/our-changing-climate/recent-us-temperature-trends#tab2-images).

When a naturally low precipitation year occurs in a warmer climate, greater drought impacts may be observed. This means that even without changes in precipitation, increasing temperatures could mean more drought because higher temperatures produce higher evaporation and evapotranspiration rates for surface water and plants.

Why is the climate changing?

Most of the sun's energy passes through the earth's atmosphere while some is reflected back out to outer space (Figure 4). As the sun's energy warms the earth's surface, heat is radiated back towards outer space. Greenhouse gases (GHGs) in the atmosphere, including carbon dioxide, methane, and nitrous oxide, trap some of the heat. It is similar to a hot and cloudy summer night in which the cloud cover traps heat and does not allow the earth's surface to cool down. As more GHGs are produced by human activities, more of the heat is trapped in the atmosphere. The increased heat increases the global temperature, which in turn affects climate.

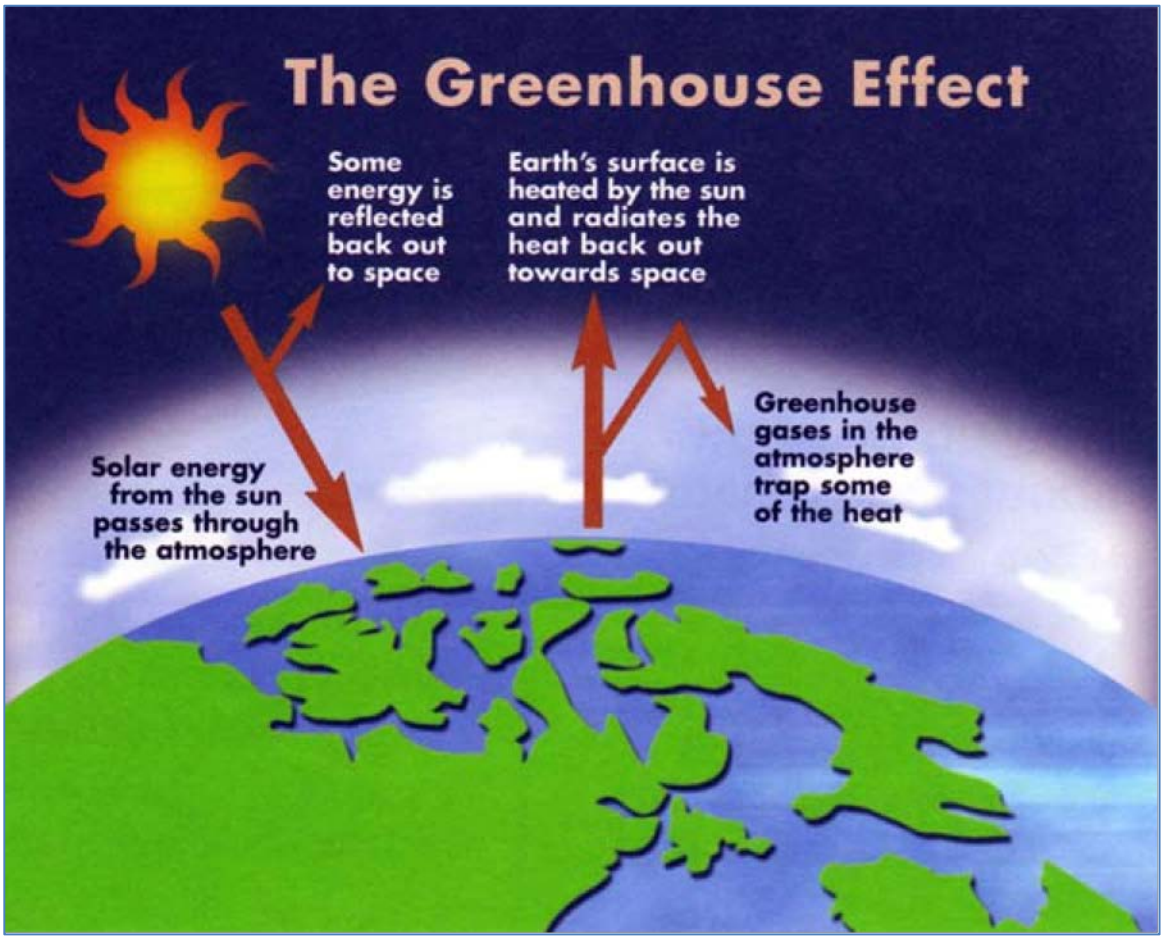

Figure 4: The Greenhouse Effect. (Source www.climatechange.gc.ca).

The rising global temperature can be attributed to the impacts of GHGs by comparing the amount of carbon dioxide in the atmosphere to changes in temperatures. In Figure 5, the blue bars represent years with an average temperature below the long-term global average of 57°F and the red bars are years in which the temperature was above average. The black line traces the amount of carbon dioxide in the atmosphere (in parts per million or ppm). As the black line rises, global average temperatures follow. The year-to-year variations in temperature are due to natural processes such as the effects of El Niño and La Niña events and volcanic eruptions.

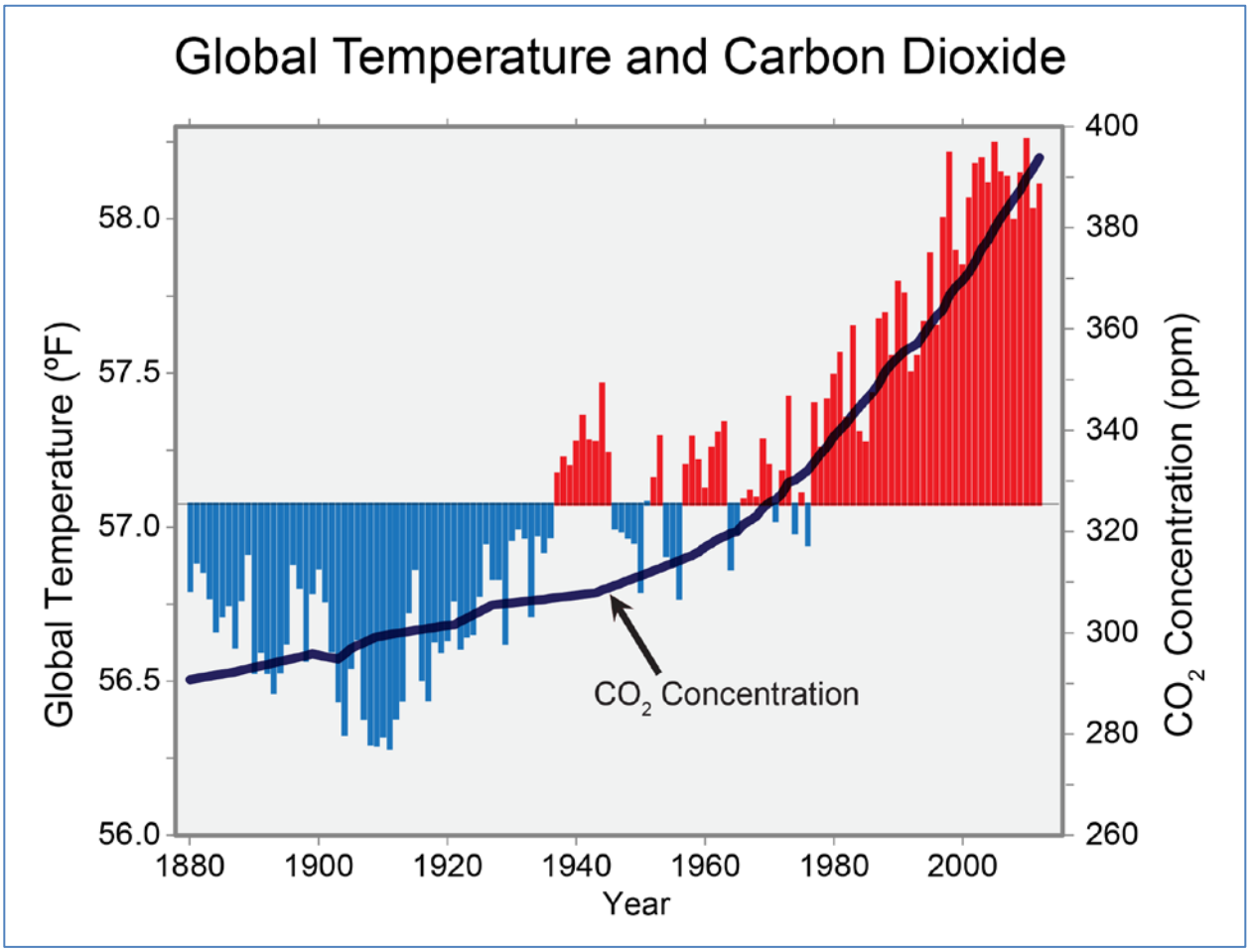

Figure 5: Global Temperature and Carbon Dioxide. (Source: http://nca2014.globalchange.gov/report/our-changing-climate/observed-change#tab2-images).

Although there is a correlation between temperature and amount of carbon dioxide, climate scientists have been unable to conduct experiments to confirm that the GHGs are causing global warming. Since scientists cannot experiment with the real world, they developed mathematical computer models of the earth's systems to simulate what happens when GHGs are increased or reduced. Figure 8 illustrates the results of an experiment with this type of model. The scientists compared natural warming factors such as solar radiation and volcanic eruptions with the temperatures observed since 1895. They found that the natural warming factors (the green shaded area) do not match up with the observed temperatures. When human generated GHG emissions were added to the natural processes (the blue shaded area), the scientists found the GHG emissions and natural processes matched very well with the observed temperatures.

Climate Change Impacts: What to expect in the future

Scientists are able to project anticipated future climate conditions using the same kind of computer models as they used to determine the source of the warming. Different amounts of GHGs released into the atmosphere will have different impacts on warming temperatures. In order to show a range of possible outcomes, climate scientists now use Representative Concentration Pathways (RCPs), which are scenarios of different levels of GHG emissions. These scenarios are then used to estimate

future global average temperatures. In Figure 6 below, the green and red lines represent the average of 15 climate models projecting the temperature and precipitation into the future for the Walker River Paiute Tribe. The green lines represent the average or moderate changes while the red line projects the extreme changes. There will be variability from year to year, but the overall average temperatures could increase 2 °F to 11°F by 2100.

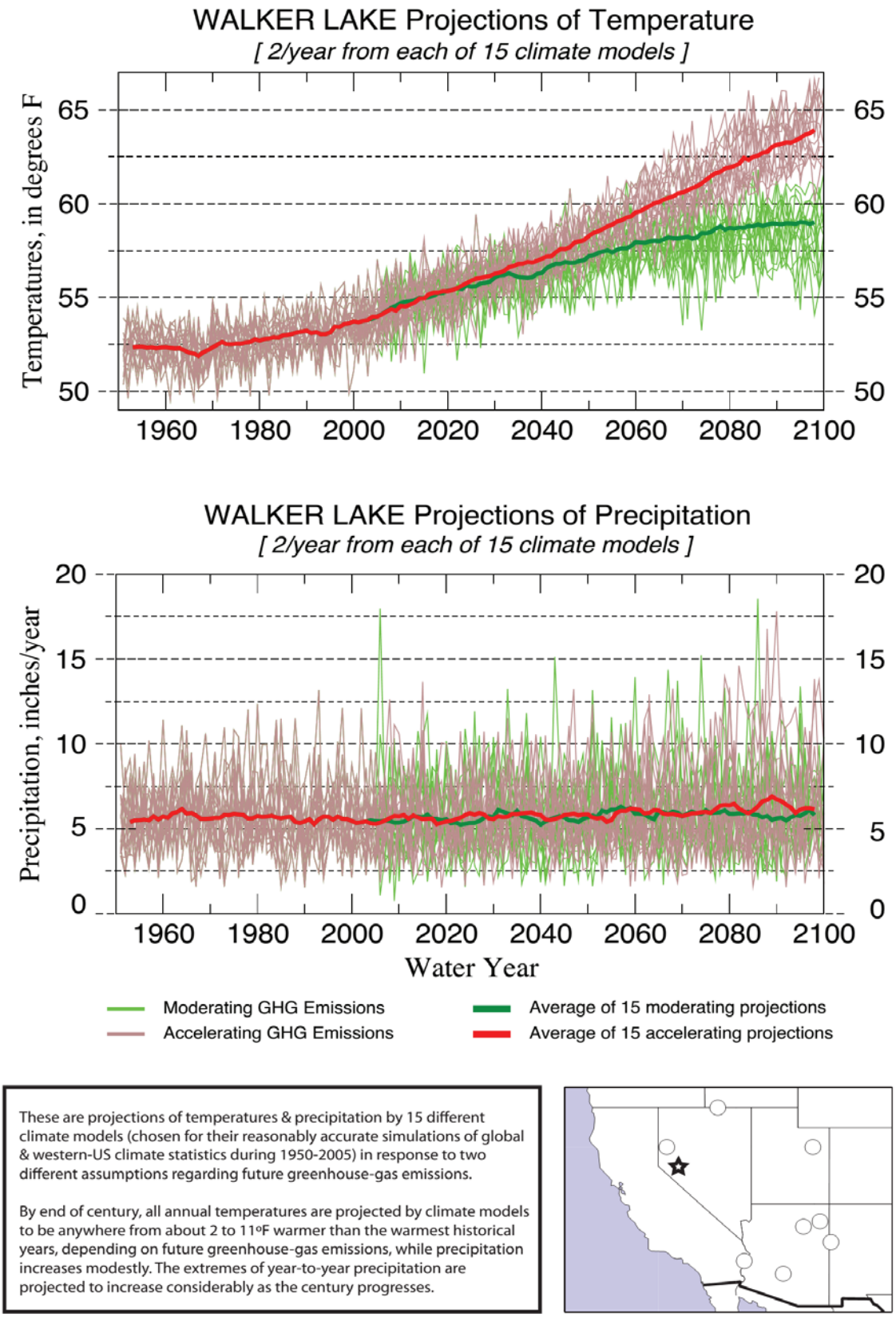

Figure 6: Projections of temperatures and precipitation for the Walker River Paiute Tribe for the period 1950 to 2100. (Native Waters on Arid Lands Conference Document 2016).

Just as precipitation in the past has always varied from year-to-year, the climate model projections indicate that precipitation will continue to vary year to year. The average rain and snowfall totals, however are likely to stay about the same – around 11 inches per year. Although the overall amount of precipitation may remain relatively constant, higher temperatures will increase the rate of water evaporation and evapotranspiration from plants. This could result in less water availability for plants and groundwater recharge. Precipitation in the future could come in the form of fewer but larger storms because warmer air can hold more water vapor than cooler air. There could be longer stretches without storms, followed by larger storm events – which could mean that flooding becomes more of a concern, particularly in places that are already experiencing flooding during large storms.

Walker Lake 2017

Section 3 - Climate Adaptation Plan

Council Directive: ***To protect our cultural and natural resources as well as the health and sustainability of our people in the face of climate change, the Tribal Council directs that the following actions be evaluated and that recommendations for future actions be provided. Additional items may be included during the next step of Climate Change planning as new information becomes available.***

CULTURE AND TRADITIONAL FOODS

Anticipated climate impacts and vulnerability

It is difficult to predict exactly how climate change may affect our cultural resources. We have reason to be concerned, however, about the potential increases in wildfire and drought. Wildfire can inhibit and may destroy culturally important sites. Drought dries out the land bringing dust and increase in wind frequency and sandstorms which are already limiting access to important cultural sites and burying artifacts. Ceremonial and ancestral use of areas may be limited due to a lack of water during the summer months. The lack of water has impacts on the ceremonial and medicinal plants. Willows are being contaminated by pesticides and the lack of water has greatly diminished the population. Also, lack of water has caused movement of wildlife to areas closer to water.

Traditional Foods

There are several potential climate impacts to traditional food sources for the Walker River Paiute Tribe. The cultural keystone species include Lahontan cutthroat trout, buck berries (buffalo berries), willows, cattails and pine nuts. These species are central to Paiute culture due to their central place in diet, culture, and community history. ***Cultural keystone species are culturally salient species that shape the cultural identity of a people and the fundamental roles these species have in diet, materials, medicine, and/or spiritual practices.***

The Walker River which once ran full of water through the reservation from one end of the reservation to the south of the reservation ending at Walker Lake was once abundant in Lahontan cutthroat trout. Due to over-allocation of water rights upstream, Walker River is now depleted and Walker Lake has declined to levels unable to sustain any fish. The Tribe has lost one of the main cultural foods we depended on.

Traditional foods should be incorporated into the broader discussion of food security and climate impacts on food systems. A full assessment of the climate impacts to the keystone species should

be a major part of the Tribe's Climate Action Plan. The assessment of potential climate impacts to these culturally important foods would be greatly strengthened by incorporating traditional knowledge from the Tribe's community members. Future efforts to better understand the role of traditional foods in the Tribe's food system could be included in a survey of food security and food systems on the Nation. One resource is the Native American Food Sovereignty Alliance (***nativefoodsystems.org***), which works to build food sovereignty, community capacity, and global awareness of the benefits of Native food systems.

With the loss of traditional food sources comes the loss of traditional knowledge tied to those food sources.

Management and Implementation

1. **Develop outreach and education materials** that will inform the tribal community about near-term and longer-term climate change threats and way that we can prepare and build resilience to these changes.
2. **Identify, Protect and Enhance wetlands, riparian areas, and other ecosystems** in order to conserve culturally important foods and medicines that could be adversely impacted by climate change.
3. **Conduct an Assessment of Traditional Food Sources**
4. **Develop a Traditional Knowledge library of traditional foods and plants**
5. **Consider a native plant nursery and seed bank** to support long-term restoration efforts. Identify important species such as willows, trees, grasses, and plants that are important to ecosystem health as well as sources of cultural foods and medicines.
6. **Examine the possibility of restoration of Lahontan cutthroat trout** to the reservation or work with another Tribe to provide access to fishing on their reservation.
7. **Conduct a Vulnerability Assessment of Keystone Big Game Wildlife species on the reservation.** Deer, Antelope, Big Horn Sheep and Mountain Lions are the species present.

HEALTH AND PUBLIC SAFETY

Anticipated climate impacts and vulnerability

The well-being, health and safety of the people of the Walker River Paiute Reservation will be at greater risk due to climate change. Some of our tribal members may be more vulnerable than others; the elders, the very young, the sick, the low income, and those who work outdoors. Increased risks come from longer and more intense periods of heat, decreased air quality, decreased water quality, insect-borne disease, allergens, and increased drought. Our preparations must include response training for emerging and continuing threats. Emergency Management preparedness is important, now is the time to prepare and act to address these new challenges.

Rising Temperatures

Based on the climate science available for Nevada, heat will be the main climatic change of concern on the reservation. Annual average temperatures have been above the long-term average almost every year since the early 1980s. Average annual temperatures are projected to continue to increase through 2100. Increased heat will impact the landscape, wildlife habitat, and the health of ecosystems. High heat will have a direct impact on human health because it places greater stress on the body. Rising temperatures will bring an increase in the potential for heat-related illnesses like heat rash, heat exhaustion, and heat stroke. Because we have air conditioning in many of our homes and workplaces, we may be reasonably equipped to deal with some of these heat-related illnesses. However, for people working or spending a lot of time outdoors, exposure is more of a concern. Pollen-borne allergens could increase due to a longer pollination season. Heat waves, which are prolonged periods of well above-average temperatures, can increase the number of cases of heat-related mortality and morbidity.

Increased heat can result in larger and more frequent wildfires. Wildfires can elevate the air pollutant PM 2.5 (particulate matter smaller than 2.5 microns). High levels of PM 2.5 are associated with mortality related to cardiovascular problems, particularly among the elderly, and reduced lung function and growth, increased respiratory stress, and asthma in children. Wildfires located to the west of the reservation often bring in smoke.

Increased temperatures will increase ground-level ozone pollution in many areas of the U.S. Ground-level ozone is produced through chemical reactions when nitrogen oxides and hydrocarbons from automobile exhaust, power plant and industrial emissions, gasoline vapors, chemical solvents, and some natural sources react in heat and sunlight. Exposure to ground-level ozone is linked to reduced lung function and respiratory problems such as pain associated with deep breathing, coughing, and airway inflammation.

Monitoring

1. **Establish an air monitoring/weather station on the reservation** to monitor air quality, especially smoke-related air quality issues, to track temperatures and predict heat waves.

Work with EPA and tribal air and water quality programs to collect data on air and water quality and temperatures to plan for weather trends.

Management and Implementation

1. **Assess the capacity of tribal clinic and EMS** to respond to emerging health threats and to integrate climate preparedness into their hazard response plans and daily operations. Talk to doctors and nurses about climate change can affect allergen abundance and disease vectors and what they will need to be prepared.
2. **Evaluate drinking water management plans** in terms of long-term climate adaptation.
3. **Evaluate the need to improve or retrofit tribal housing**, especially for those must vulnerable to temperature extremes.
4. **Assess current emergency management preparedness plan** and expand plan to include training, equipment, exercises, evaluations, and corrective measures. Include fire department in planning.
5. **Develop local committees to help proactively implement climate change adaptation measures** for the most vulnerable.
6. **Develop outreach and education materials** that will inform the tribal community of the real and potential dangers of climate change and help the community prepare for these changes. For example, these materials could include information to help people know how they can protect their homes and property in the face of increased wildfire threats. Develop and implement a public awareness campaign that notifies people how to prepare for, and respond to extreme heat and wildfire smoke events.
7. **Establish cooling centers** for use on extreme heat days by community members who don't have air conditioning at home.
8. **Establish shade and cooling areas** for outdoor play and recreation for children. For example, have drinking fountains available and benches in shade.

TRIBAL INFRASTRUCTURE AND ENERGY

The Walker River Paiute reservation spans approximately 325,000 acres. Much of our land is high desert with the Walker River running through the reservation for approximately 21 miles. Approximately 2,100 acres of tribal allotments are farmed, mainly growing alfalfa. Tribal enterprises consist of a small convenience store and farming 40 acres of alfalfa. We need to continue to evaluate how climate change impacts could affect our enterprises and community infrastructure.

Anticipated climate impacts and vulnerability

One of the most direct anticipated climate change impacts in our region is on water availability. From an infrastructure perspective, water supply is important for fire management and road construction; the reservation is mainly rural and spread over a mix of range, riparian and desert landscapes. We need to have water available to enable fire response as well as dust prevention.

Changes in precipitation and streamflow could lead to increased flash flooding and erosion. Stress from higher temperatures may reduce the lifespans of some infrastructure assets; thermal stress may also degrade asphalt pavements more rapidly and slow asphalt curing time, increasing the time needed to perform road repairs.

Demand for electricity is likely to go up in the summer as more intense heat leads to a need for more cooling capacity; this could increase operations costs at tribal facilities and higher electricity costs for tribal homeowners. As the demands for electricity increases off reservation, the Tribe is often faced with power outages, brown-outs and power surges as we are located at the end of an energy grid.

Management and Implementation

1. **Assess community water and sewer system**. Need a hydraulic analysis including a hydraulic model of the water system to adequately plan for population growth, distribution piping and facility upgrades to improve fire hydrant flows, water pressures and reliability in the system. Complete Preliminary Engineering Report (PER) and Engineering Report(ER) as required by USDA for funding water system expansion and improvements.
2. **Identify and encourage water conservation measures**. Water conservation measures may include, but are not limited to, establishing policies to encourage or require native and/or drought=tolerant landscaping, including replacing lawns.
3. **Consider climate change impacts when planning new assets or rehabilitating existing assets.** For example, use green energy such as solar in new buildings. Use materials and/or designs that perform well under higher temperatures.
4. **Update operations and maintenance strategies.** For example, conduct more frequent cleaning of air conditioner filters, removal of dead trees, monitoring of roofs for wind damage. Budget for extra costs of arsenic treatment plant if additional water has to be run through the plant.
5. **Develop redundant power, communication (internet & phone) and transportation services** to accommodate system disruptions due to power outages from more frequent and severe storms. Alternate power systems are essential to the community water and sewer system.

6. **Include climate change considerations when proposing or assessing the viability of new ventures and current enterprises.** Consider whether the proposed enterprise or infrastructure asset can reasonably be anticipated to be viable and sustainable in the coming decades as the climate changes, and plan for measures to increase its resilience.
7. **Factor climate change considerations into planned operations and management budgets for enterprises and assets that are expected to be vulnerable**. Plan for alternate power sources including emergency generators for tribal enterprises and tribal government buildings.
8. **Develop long-term power sources such as solar, wind and geothermal** to serve the reservation population. This would serve several purposes; 1) the Tribe would not be dependent on an outside energy source and 2) Tribal community would have a stable stand-alone energy supply and 3) tribe may be able to sell excess energy as a revenue source.
9. **Conduct Energy Audits on all Tribal buildings.** Evaluate the costs of installing renewable energy or alternative energy sources.

AGRICULTURE AND IRRIGATION

The Walker River Paiute people, while living in a high desert environment still maintain a living farming and ranching. Our lands have always provided sustenance to our people.

While the Walker River through the reservation is virtually dry, the Tribe has been able to sustain agriculture on the reservation. Tribal members farm over 2,100 acres of land through an irrigation system built and managed by the Bureau of Indian Affairs. Agricultural activities on the reservation continue to be essential to the economy of the reservation.

Anticipated climate impacts and vulnerability

For these lands to continue to be productive and profitable, they must have a reliable and adequate supply of water. Climate change is likely to shift the patterns of rain and snow in the mountains. All of our irrigation water comes from the Sierra Nevada Mountains located to the west of the reservation. Changes in snowpack accumulations and melt rates, timing of runoff, streamflow, summer drought, winter flooding, changes in water temperature, and water quality are all important issues that must be considered. Irrigation water shortages are likely to worsen.

Regulatory policies will become even more important and may have pronounced effects. Establishment and enforcement of a tribal water code, particularly in light of changes in water supply will require careful planning and implementation. The drought of the last 5 years has shown the problems exacerbated by the inefficient irrigation distribution system on the reservation. The irrigation project infrastructure is antiquated and in great need of updating to be able to use the limited amount of water in an efficient manner. Certainly, tribal members have dealt with drought previously and have adapted. However, a prolonged exposure to reduced water supplies and higher temperatures will necessitate changes in annual water management practices and water use efficiencies. Water-thirsty crops may need to be exchanged for others that are more drought-tolerant. If water shortages are pronounced enough, it is possible that croplands will come out of production causing economic consequences throughout the reservation. Another variable is the extended growing season caused by warmer temperatures. However, the Tribe may not have enough water to apply to crops for the extended season.

Management and Implementation

1. **Work with BIA and other partners to evaluate the long-term adequacy of the Walker River Indian Irrigation Project (WRIIP).** Assess irrigation canals and ditches and explore opportunities for increasing irrigation efficiency.

2. **Assess Weber Reservoir** storage capacity and possible dredging. Identify problems that might occur with respect to contaminated sediments deposited behind the dam
3. **Consider developing a plan to obtain funding** to address inadequacies of the WRIIP.
4. **Develop Water Code to address water management practices for the WRIIP.** Include surface water, groundwater and storage.
5. **Consider evaluating the costs and benefits associated with implementing technological improvements that would automate the WRIIP** to improve delivery timing, water conveyance, and use efficiency.
6. **Consider collecting baseline data on aquifer recharge on the reservation.** Collecting baseline data on aquifer recharge rates is important because there is some indication that recharge rates could decline due to climate change. The projected increase in temperatures for the region mean higher evaporation rates, which will result in lower recharge rates.
7. **Develop a plan to use the network of real-time water and weather stations,** which are fundamental for drought and flood warning and forecasting, water supply forecasting and monitoring, evapotranspiration and water planning.
8. **Develop a Drought Management Plan for the reservation.**
9. **Study the potential for increases in pests, diseases, or invasive species** that could affect crops, livestock and wildlife.
10. **Engage farmers in research and outreach efforts and develop educational programs and materials** that can be distributed to members of the tribal and agricultural communities to provide information about potential climate change vulnerabilities or opportunities. These materials should include water conservation practices and sources of funding from various agencies such as USDA.

RANGELANDS

Anticipated climate impacts and vulnerability

Tribal members graze cattle on over 100,000 acres of high desert rangeland. We have a limited understanding of how climate change may affect the rangelands but we have seen the impacts of a long-term drought on the land. However in the past two years, we have seen an increase in rain as weather patterns change. In general, we can expect that there will be a change in species composition, distribution, and abundance; changes in habitat suitability and invasive species; and an increase in frequency of disturbance (such as fire). It is possible that climate change impacts on our rangelands will be minimal. Many of the vegetative species may already be well-adapted for the warmer conditions, however it is unknown whether we will face more drought or more rain. Future conditions are unknown and there is much to learn and prepare for.

The Bureau of Indian Affairs administers grazing permits; currently the only grazing on the reservation is by the Walker River Livestock Cattlemen's Association.

Management and Implementation

1. **Work with BIA on Grazing Plan for reservation**. Complete an inventory of grazing areas on the reservation.
2. **Consider implementation of known rangeland best management** practices such as preventing livestock from unplanned entry into riparian, wetland, and natural spring sites; providing designated water sources in suitable areas; and increase protection measures and enhancements that will increase climate resiliency (such as solar wells).
3. **Prioritize and develop livestock water sources away from riparian, wetland, and other vulnerable and important areas.**
4. **Update and implement an Integrated Weed Management plan** to account for potential changes or increases in invasive species due to climate change impacts.
5. **Identify appropriate public outreach approaches** and related materials to inform stakeholders of the rationale behind improved rangeland practices that account for future climate change.
6. **Develop appropriate materials to inform the tribal community and tribal leadership** of the vulnerabilities of tribal rangeland and natural resources, climate change risks, and potential consequences of management decisions.
7. **Update Range Inventory.** Consider studying how vegetation and wildlife patterns in our

region are changing. Use findings to adjust rangeland management practices.

8. **Continue to work to address the issues associated with uncontrolled wild horse populations** on reservation lands, as these are an additional stressor that interacts with climate change pressures on vegetation and habitat.

WALKER RIVER AND WETLANDS

Water is the very fabric of life for the Walker River Paiute Tribe. Water is central to our culture and our health, our community and our very lives. The snow in the mountains feeds our river and wetlands, which sustain our fish, wildlife, foods and medicines. Water is all things to all that are living and its importance cannot be overstated.

In January 2015, Otis Bay Consultants under contract with the U.S. Fish and Wildlife Service and in collaboration with the Tribe completed a report titled: ***Walker River Paiute Tribe River Restoration Planning Report***. The report presents riparian enhancement designs and recommendations to improve ecological function on a segment of the Walker River Paiute Reservation. This segment is located along the lower Walker River and extends from the upper reservation boundary downstream to approximately three miles below Weber Dam.

The greater Walker River Basin is currently the focus of much research, restoration, and coordinated adaptive management efforts concerning the treat of ecosystem collapse in Walker Lake.

> *The Walker River is the key to species survival in Walker Lake. The river, not the lake is the stable ecosystem that many taxa require in a highly variable environment such as Walker Lake and the river should be the focus of restoration efforts. As river health is restored, lake health will follow. The river is the lifeline Walker Lake taxa need to survive unfavorable lake conditions and it has served as such for many tens of thousands of years.-Otis Bay Consultants*

Anticipated climate impacts and vulnerability

Over the next 10 to 20 years and beyond, we could see many important changes to our water resources as a result of climate change. Increasing temperatures, reduced snowpack, and earlier snowmelt will elevate peak stream flows in the winter months while leaving the Walker River shallow and warm in the summer months. The river and associated wetlands may be dry when water is needed the most. Low flows put stress on fish, wildlife and plants along the river corridor and can increase the concentrations of contaminates from agrochemicals, wastewater, pollutants and other runoff in the river. Stream flows are dependent upon winter snowpack. As temperatures warm and mountain systems become rain-dominated, late summer flows decrease to the point of no flows.

Lahontan cutthroat trout (agai) is perhaps the most important of our Traditional foods. When we think about the trout in our cultural context, it is the one food that would the most important to restore on our reservation.

Wetland plants and animals are particularly sensitive to small, permanent changes in conditions because they are located in a transition zone between aquatic and terrestrial environments. As the climate changes, higher temperatures can lead to drying that reduces wetland size.

On the rangelands, precious water remaining in the river and wetlands will be a magnet to unmanaged livestock, causing increasing use of fragile aquatic and riparian ecosystems through overgrazing and trampling of the stream banks and wetlands.

Meanwhile, higher winter flows could produce more flooding and increase erosion and sedimentation.

Still, we must remember that climate change impacts are not the only pressures on our natural resources. Since the inception of our reservation, there have been many changes. Land management practices, irrigation facilities and reservoirs, and over allocation of surface water rights have completely altered natural streamflow patterns and amounts well beyond what might be expected from climate change. For example:

- Large reservoirs have long been developed in the headwaters of the Walker River, significantly changing natural flow patterns and severely damaging our natural resources.
- The over allocation of surface water rights for irrigation has greatly decreased the natural flow of the Walker River.
- The over allocation of groundwater rights and drilling upstream of the reservations has resulted in depletion of groundwater aquifers to the point that any water flowing in the river is first used to recharge aquifers. River flows are decreasing due to recharging the groundwater upstream.

Management and Implementation

1. **Continue to inventory, identify, and prioritize stream reaches, floodplains, riparian areas, and wetlands for protection and for restoration** in collaboration with water and wildlife experts. Take into account areas that are expected to be particularly resilient or particularly vulnerable in the context of a changing climate.
2. **Aggressively seek funding to implement the restoration actions** that focus on holistic measures to protect and restore habitats and the riverine ecosystem. Use the plan developed by Otis Bay, Inc.
3. **In restoration projects, emphasize the use of plant species that will be robust**, in the face of climate change.
4. **Assess the possibility of trout recovery and restoration.** Assess the possibility of small scale fishery/hatchery on the reservation. Collaborate with other agencies on the feasibility of such.
5. **Continue to develop management actions to control the abundance of excessive predators and invasive plants,** non-native fish, or other aquatic organisms or aquatic plant species that thrive in warmer waters.

6. **Purchase land from willing landowners along the river corridor to convert to natural riparian habitat, etc.**
7. **Update Integrated Weed Management Plan** to include a long-term strategy to deal with extensive salt cedar (tamarisk) infestation along the river corridor**.**
8. **Assess the impacts of groundwater use upstream of the reservation on Tribal Water Rights.**

Section 4: Planning Summary

Climate Change Impacts, Risks, and Actions

On the following pages we present a set of tables that summarize the basic information contained in this report. We identify:

- The climate drivers (what is changing in the climate system).
- The potential impacts of those changes in the Tribe and the surrounding region.
- Any additional stressors that may add to the impact.
- The consequences of those impacts, such as who is likely to be affected and in what way.
- The probability of the impact occurring (how likely or unlikely it is that the Tribe will experience this impact).
- A set of short-, medium-, and long-term strategies that may help the Tribe adapt to or mitigate the effects of the impact.

At this stage in the planning process, these strategies are simply suggestions or examples of strategies used by other communities who are facing similar impacts. In the next phase of the climate change adaptation planning process, we will conduct workshops and discussions with representatives from the Tribe's management departments, elected officials, tribal members and community to identify a more detailed set of adaptation strategies that are best suited to the Tribe, achieve the goals of the people, and will have the largest positive impact on the reservation and its people.

Potential Actions Table

Water Resources

Climate Driver	Potential Climate Impacts	Other Stressors	Consequences of Impact	Probability of Impact	POTENTIAL Adaptation Actions		
					Short Term[1]	Medium Term[2]	Long Term[2]
Changes to precipitation patterns	Reduced recharge of aquifers if winter rains and snow are not as plentiful	Off-reservation pumping, impacts on groundwater Arsenic present in aquifers	Less sustainable groundwater supplies	Uncertain – recharge study is needed.	Monitor off-reservation wells within the Walker River corridor for increased pumping Install weather monitoring system on reservation	Secure funding for arsenic treatment plant upgrades, maintenance and solar Develop an environmental trust fund to cover costs associated with climate impacts	Continue to monitor groundwater usage Continue arsenic treatment of domestic water (partner: IHS)

Climate Driver	Potential Climate Impacts	Other Stressors	Consequences of Impact	Probability of Impact	POTENTIAL Adaptation Actions		
					Short Term[1]	Medium Term[2]	Long Term[2]
Changes to precipitation patterns	Increased flooding impacts current water control measures (dikes, berms, and dams)		Water control measures fail, potential flood risk to communities in floodplains		Continue floodplain mapping Investigate possibility of flood plain insurance for homeowners	Purchase additional heavy equipment for emergency response to flooding Conduct pre-disaster mitigation planning and surveys, partner with FEMA and USACE	
Long-term drought reducing Walker River flow	Less surface water available for irrigation, shorter irrigation season	Upstream pumping depleting underground aquifers	Reduced availability of water in the region generally.	Uncertain-depending on drought/flood water supplies	Explore options for regional water conservation.	Cost-benefit analysis of alfalfa and other crops Drill irrigation wells to deliver groundwater to farming operations	Identify crops that have high-value and low-water use Develop a marketing strategy for high-value crops

Climate Driver	Potential Climate Impacts	Other Stressors	Consequences of Impact	Probability of Impact	POTENTIAL Adaptation Actions		
					Short Term[1]	Medium Term[2]	Long Term[2]
Drought (higher heat plus precipitation changes)	Less surface water available for livestock and wildlife	Use of streams and wetlands (including repairs to streambanks and livestock ponds) requires USACE permits (404 and 401), a time-consuming process	Greater stress on livestock Ranchers may have to sell livestock	Uncertain	Install and/or update wells to deliver water to livestock on rangelands	Ranchers apply to NRCS Emergency Programs	

Human Health - Heat

Climate Driver	Potential Climate Impacts	Other Stressors	Consequences of Impact	Probability of Impact	POTENTIAL Adaptation Actions		
					Short Term[1]	Medium Term[2]	Long Term[2]
Higher annual average temperatures	Heat-related human mortality	Cost of household cooling Evaporative coolers causing mold and water damage Maintenance requirements for evaporative cooling systems	Vulnerable populations (elderly, sick, very young) are at increased risk of heat-related illnesses.	High	Continue to replace older evaporative coolers with A/C units Continue to open cooling centers during extreme heat events Monitor elders during heat waves	Consider placing indoor monitoring thermometers in key locations to provide additional information about heat-stress thresholds	Adopt building codes that prioritize energy efficiency to reduce cooling costs and maintain a healthier indoor environment (partners: HUD
Changes in temperature and seasonal weather patterns	Increased exposure to vector-borne diseases.		Human and animal health at greater risk from disease.	Medium	Put in place mosquito control measures throughout the community. Educate community on vector-borne diseases (partner: Indian health		

Climate Driver	Potential Climate Impacts	Other Stressors	Consequences of Impact	Probability of Impact	POTENTIAL Adaptation Actions		
					Short Term[1]	**Medium Term[2]**	**Long Term[2]**
					Service)		
More frequent extreme temperatures	Heat-related human mortality	A/C can reduce risk, but may not be available to everyone; evaporative coolers may decline in effectiveness as heat and humidity increase	Vulnerable populations (elderly, sick, very young) are at increased risk of heat-related illnesses,	High	Continue to replace older evaporative coolers with A/C units Continue to open cooling centers during extreme heat events Monitor elders during heat waves		
Drought and extreme heat	Larger, faster-moving fires; earlier start to fire season		Vulnerable populations may be at risk due to reduced air quality Buildings and people at the wildland interface may be at risk	Uncertain	Educate homeowners about clearing a defensible space around home	Participate in Firewise community activities (www.firewise.org) and other wildfire prevention programs. Develop Drought Management Plan for the reservation	Conduct ecological restoration, such as removing invasive grasses, particularly taking advantages of cold snaps that weaken cold-intolerant grasses.

Human Health – Food Security

Climate Driver	Potential Climate Impacts	Other Stressors	Consequences	Probability Of Impact	POTENTIAL Adaptation Actions		
					Short term[1]	Medium term[2]	Long term[2]
Climatic changes nationally and internationally (heat, precipitation)	Changes in agricultural regions could result in periodic price shocks	Existing food security concerns	Increased periods of food insecurity Increased reliance on lower-quality, but accessible, food could lead to more health concerns	Uncertain		Assess and monitor key elements of current reservation food system; include use of traditional foods in assessment	Build partnerships with programs outside of reservation that might support local food security efforts. Investigate food storage systems for reservation to support community members in case of short-term food access emergency.
Rising temperatures Changes in precipitation patterns	Climatological thresholds for some cultural keystone food sources could be exceeded.		Loss of traditional food sources Loss of traditional knowledge tied to food sources	Uncertain	Continue assessment of climate impacts on cultural keystone species.		

Emergency Management

Climate Driver	Potential Climate Impacts	Other Stressors	Consequences	Probability of Impact	POTENTIAL Adaptation Actions		
					Short term[1]	Medium term[2]	Long term[2]
Changes in precipitation patterns that lead to larger storms	Flooding magnitude increases with bigger storms		Loss of housing and other structures Loss of infrastructure Threat to human health and safety Greater costs for emergency management	Medium	Continue to invest in updated floodplain mapping Assess current homes for ability to withstand more frequent and severe storms.	Explore funding sources for additional heavy equipment (and operators) so Tribe is able to respond quickly and efficiently to floods. Consider changes to development standards to mitigate against larger and/or more frequent floods.	Consider participation in the National Flood Insurance Program.

Climate Driver	Potential Climate Impacts	Other Stressors	Consequences	Probability of Impact	POTENTIAL Adaptation Actions		
					Short term[1]	**Medium term[2]**	**Long term[2]**
Rising temperatures Changes in precipitation patterns	Fires spread more quickly with hotter weather and less frequent storms Earlier start to fire season because of heat and drought Fires spread more easily in invasive grasses	Invasive grasses act as a conduit for fire in non-fire-adapted ecological communities	Potential loss of life and infrastructure Air quality issues Firefighting costs increase	High	Continue Fuels Management efforts Continue training for local fire and EMS. Work with BIA on Fire Management plan. Research funding to purchase equipment and vehicles for local fire department and EMS	Explore opportunities to hire additional/ seasonal firefighters Participate in Firewise community activities (www.firewise.org) and other wildfire prevention programs.	Conduct ecological restoration, such as removing invasive grasses, particularly taking advantages of cold snaps that weaken cold-intolerant grasses

Appendix: Key Terms

Adaptation: Actions in response to actual or expected climate change and its effects, that lessen harm or exploit beneficial opportunities. It included reducing the vulnerability of people, places, and ecosystems to the impacts of climate change.

Climate: The average pattern for weather over a period of months, years, decades, or longer in a specific place. Climate is defined not only be average temperature and precipitation but also by the type, frequency, duration, and intensity of weather events such as heat waves, cold spells, storms, floods and droughts.

Climate Change: Any significant change in measures of climate (such as temperature, precipitation, or wind) lasing for an extended period of time (decades or longer). Climate change my result from natural factors and processes from human activities that change the atmosphere's composition and land surface.

Climate-resilient community: A community that takes proactive steps to prepare for (i.e., reduce the vulnerabilities and risks associated with) climate change impacts.

Exposure: The nature and degree to which a system is exposed to significant climate variations.

Greenhouse Gas (GHG): Any gas that absorbs infrared radiation in the atmosphere; examples include carbon dioxide, methane, nitrous oxide, ozone, and water vapor.

Measure of Resilience: A quantitative or qualitative judgment that you make and track over time to determine how well your actions meet the preparedness goals you have set.

Peak Streamflow: The maximum instantaneous discharge of a stream or river at a given location.

Planning Areas: The areas in which a government or community manages, plans, or makes policy affecting the services and activities associated with built, natural, and human systems. Planning areas can be as broad or as specific as necessary.

Preparedness Action: The activity or activities that you government or community undertakes to achieve its preparedness goals.

Preparedness Goal: What you want to accomplish in your priority planning areas through preparedness action.

Priority Planning Areas: The planning areas which your community or government determines to be most important for focusing your preparedness efforts, based on your community's vulnerabilities to climate change and associated risks.

Projection: A potential future evolution of a quantity or set of quantities, often computed with the aid of a model. Projections are different from predictions in that projections involve assumptions

concerning, for example, future socioeconomic and technological developments that may or may not be realized.

Resilience: The ability of a system and its component parts to anticipates, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

Sensitivity: The degree to which a built, natural, or human system is directly or indirectly affected by changes in climate conditions (e.g., temperature and precipitation) or specific climate change impacts (e.g., sea level rise, increased water temperature). If systems in a planning area are likely to be affected as a result of projected climate change, then that system should be considered sensitive to climate change.

Systems: The built, natural, and human networks that provide important services or activities within a community or region. Built systems are networks of facilities, building, and transportation infrastructure like roads and bridges. Natural systems are ecological networks of fish, wildlife, and natural resources like water. Human systems are networks of public health clinics, courts, and government.

Traditional Ecological Knowledge (TEK): The evolving knowledge acquired by indigenous and local peoples over hundreds or thousands of year through direct contact with the environment. This knowledge is specific to a location and includes the relationships between plants, animals, natural phenomena, landscapes, and timing of events that are used for lifeways, including but not limited to hunting, gathering, fishing, trapping, agriculture, and forestry.

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. It is a function of the sensitivity of a particular system to climate changes, its exposure to those changes, and its capacity to adapt to those changes.

Weather: The atmospheric conditions at a specific place at a specific point in time. Familiar aspects of weather include temperature, precipitation, clouds, and wind that people experience throughout the day. Severe weather conditions include hurricanes, tornadoes, blizzards, and droughts.