From DWR Climate Change Handbook for Regional Water Planning, Appendix B: Checklist

Prioritizated List of Climate Change Vulnerabilities The Tahoe-Sierra IRWM has as its high priorities, climate change vulnerabilities related to:
2. Water Supply,
3. Water Quality, and
6. Ecosystem and Habitat Vulnerability.

1. Water Demand

1.1 Are there major industries that require cooling/process water in your planning region?

There are no major industrial or commercial users within the Region that require cooling water. However, the recreation sector includes golf courses that need water for irrigation and ski resorts that need water to make snow.

1.2 Does water use vary by more than 50% seasonally in parts of your region?

Yes, there is a high degree of seasonal fluctuation in municipal use in the Region. The maximum and minimum municipal water use vary by as much as 100% (West Yost and Associates 2012). A major contributing factor to this variability is the seasonal variations in the tourism and recreation industry. Agriculture is not a significant water user in the Region.

1.3 Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?

No, irrigated agriculture is a very minor sector within the Region. Most agriculture in the Region is unirrigated rangeland. (El Dorado County Department of Agriculture 2013).

1.4 Do groundwater supplies in your region lack resiliency after drought events?

No, groundwater supplies have been reliable even in times of drought and are forecast to continue as such even during multiple dry year scenarios.

1.5 Are water use curtailment measures effective in your region?

Yes, water use curtailment measures have been demonstrated to be effective in the Region. All major water suppliers have water shortage contingency plans in place, and are implementing demand management measures. The installation of water meters has resulted in decreased water usage in the Tahoe and Truckee areas. The effectiveness of restrictions on water use were demonstrated when several of South Tahoe PUD's groundwater supply wells were impacted by MTBE and restrictions were emplaced to reduce demand in the face of the reduced supply.

1.6 Are some instream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?

No. Instream flow requirements in the Truckee River are sufficient to support aquatic life. Met? Instream flow requirements for the Carson River? As interstate rivers, the waters of the Truckee and Carson Rivers are entirely adjudicated through the Truckee River Operating Agreement (TROA) and the Alpine Decree. The TROA includes defined minimum

flows with consideration of the fisheries in the Truckee River and Pyramid Lake.

2. Water Supply

2.1 Does a portion of the water supply in your region come from snowmelt?

Yes, snowmelt provides most surface water supply in the Region, and is the primary source of infiltration for groundwater.

2.2 Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?

No, all water supplies originate within the Region.

2.3 Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?

No, the Region is not located near the coast and has no problem with salt intrusion.

2.4 Would your region have difficulty in storing carryover supply surpluses from year to year?

Not in the Tahoe or Truckee areas, as there are several reservoirs on the Truckee River or its tributaries that could store surpluses. Outflow from Lake Tahoe into the Truckee River is controlled by the Federal water master and the release rates are based on flooding concerns and downstream demands. Storage and releases in other reservoirs are managed together to meet the required flows and vary by the surface elevation in Lake Tahoe. There is capacity for additional storage of supply surpluses, especially in Martis Reservoir.

There is no way to store carryover supply surpluses along the East or West Forks of the Carson River within California. There are no major water users along the East Fork Carson River in California, but the communities of Markleeville and Woodfords community are located in the West Fork Carson River watershed.

2.5 Has your region faced a drought in the past during which it failed to meet local water demands?

No. Although historically the surface elevation of Lake Tahoe has occasionally dropped below the natural rim during prolonged dry periods.

2.6 Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?

Yes, invasive species of concern in the Region are discussed in Section 2. Aquatic invasive species of concern that are present in the Region include large mouth bass, Asian clam, bluegill, goldfish, bull frogs, curly leaf pondweed, and Eurasian watermilfoil. Efforts are in place to prevent the encroachment of zebra mussels, quagga muscles, and New Zealand mudsnails into waterbodies in the Region. Terrestrial invasive species of concern include spotted knapweed, yellow starthistle, purple loosestrife, various thistles, and cheatgrass.

3. Water Quality

3.1 Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?

Yes, the Region has high vulnerability to wildfires due to the amount of forested land throughout. Wildfire risk is projected to increase as a result of changes to temperatures, evapotranspiration, and snowmelt. All reservoirs in the Region are surrounded by fire-susceptible vegetation and many are also surrounded by steep slopes increasing the erosion risk. The risks and impacts of wildfires in the Region were highlighted by the Angora fire in the Tahoe Basin in 2007. The Angora fire burned over 3,000 acres, and raised significant concerns about the potential for increased erosion and sedimentation of Lake Tahoe as well as potentially hazardous impacts to Lake Tahoe from the debris of the hundreds of structures that were burned in the fire.

3.2 Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?

Yes. Most surface water bodies in the Region have very good water quality and do not currently have issues related to eutrophication. However, some surface water bodies including Lake Tahoe do have water quality issues related to high nutrient levels in runoff contributing to algal growth. Warming surface temperatures in Lake Tahoe may also reduce deep mixing in the lake, which would effectively increase nutrient loadings due to upwelling from the deep water. As an Outstanding National Resource Water, Lake Tahoe is subject to a non-degradation standard for water quality.

3.3 Are seasonal low flows decreasing for some waterbodies in your region? If so, are the reduced low flows limiting the waterbodies' assimilative capacity?

Based on gauge data, some streams and rivers in the Region including the Truckee River and the East Fork Carson River have a decreasing trend in the seasonal low flows. Diminished snow pack will change the flow curve of Sierra streams for spring runoff. If snow packs decline sufficiently low flow conditions will be reached earlier in the calendar year, resulting in potential adverse effects to aquatic species.

3.4 Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?

Yes. TMDLs are being set or have been set for several bodies of water in the Region. The listed waterbodies and TMDLs are discussed in Section 2 and Appendix 2-B.

3.5 Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?

Unknown.

4. Sea Level Rise – Not Applicable

5. Flooding

5.1 Does critical infrastructure in your region lie within the 200-year floodplain? DWR's best available floodplain maps are available at:
http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/best_available_maps/.

Most critical infrastructure is not located within the 100-year or 500-year floodplains. The 200-year floodplain has not been developed for the east face of the Sierra Nevada Mountains. The Lake Tahoe Airport outside of South Lake Tahoe is in the 500-year floodplain, and partially in the 100-year floodplain. The South Tahoe PUD wastewater treatment plant is partially in the 100-year flood plain.

5.2 Does part of your region lie within the Sacramento-San Joaquin Drainage District?

No, the Region is not located within the Sacramento-San Joaquin Drainage District.

5.3 Does aging critical flood protection infrastructure exist in your region?

No, however while the dams on the Truckee River were primarily constructed for irrigation water storage they do provide some flood protection for downstream users outside of the Region. The dams were originally constructed between forty and seventy years ago. The Lake Tahoe Dam was modified and repaired in 1988, and repairs have also been performed on the Boca, Stampede, and Prosser Creek Dams since construction.

5.4 Have flood control facilities (such as impoundment structures) been insufficient in the past?

No, not within the Region. Most flooding concerns along the Truckee River have been downstream in the Reno, Nevada area.

5.5 Are wildfires a concern in parts of your region?

Yes, wildfires are a concern throughout the Region. See the response to item 3.1.

6. Ecosystem and Habitat Vulnerability

6.1 Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?

Yes, erosion and sedimentation are problems for aquatic habitats in the Region. Several creeks in the Region, the Truckee River, and Lake Tahoe have or require TMDLs for sedimentation. High flow years can add large volumes of sediment to Lake Tahoe.

6.2 Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?

The Region includes only freshwater habitats, however riparian, meadow, and aquatic habitats in the Region rely on the current seasonal freshwater flow patterns.

6.3 Do climate-sensitive fauna or flora populations live in your region?

Yes. The Region includes significant areas with high elevation alpine and subalpine ecosystems that include both plants and

animals that are sensitive to climate variations and have limited abilities to shift their ranges.

Shorter winters would likely reduce seed germination for plants that need a long cold stratification period to prepare seeds for germination. Plants may be stressed by changes in soil moisture throughout the year, and may also be subjected to greater threats from pests and diseases as the insects and diseases may not be killed during milder winters, with fewer and shorter frost periods and warmer temperatures. Some high elevation mammals, like pika, cannot tolerate warm temperatures, and the plants that they rely on for food and shelter may be affected by climate change. Aquatic ecosystems are generally sensitive to increases in water temperature, and changes to the volume and timing of runoff in streams and rivers in the Region may also affect foraging, migration, and spawning of fish.

6.4 Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?

Yes, a list of endangered or threatened species in the Region is included in Section 2. Some of these species are particularly susceptible to the potential effects of climate change. The Sierra Nevada yellow-legged frog and Yosemite toad are dependent on the snowpack and quantity of water in alpine ponds and lakes. The pika cannot tolerate warm temperatures, and warming temperatures would also contribute to reductions in habitat for the Sierra Nevada red fox. The Lahontan and Paiute cutthroat trout are adapted to the historical stream flow patterns and temperatures from snowmelt for spawning.

6.5 Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?

Yes, water-dependent recreation is the major economic activity in the Region. Recreation opportunities include rafting, kayaking, boating, fishing, and swimming in the lakes and rivers; and camping, hiking, and biking in the state parks and other publicly accessible open space. In addition, ski areas rely on snow-making using groundwater.

6.6 Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?

Yes, as discussed in item 1.6, the Truckee River and Carson River are entirely adjudicated, including quantified flow requirements for fisheries. Also, surface water contamination from mine drainage has occurred in parts of the watershed for the East Fork Carson River, especially downstream of Leviathan Mine.

6.7 Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?

No, the Region is not located near the coast.

6.8 Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change *(http://www.itsgettinghotoutthere.org/)*?

Yes, the Region is in the Sierra Nevada.

6.9 Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?

Native fish habitat has been fragmented by dams on the Little Truckee River and Truckee River tributaries. No infrastructure projects are planned that might further preclude species movement; and some stretches of the East Fork Carson River and Upper Truckee River are in consideration as Wild and Scenic Rivers, which would prohibit construction of dams in those stretches of river.

7. Hydropower

7.1 Is hydropower a source of electricity in your region?

No, there is one hydropower facility, Stampede Powerhouse, which generates electricity to operate Stampede Dam. The total generating capacity of Stampede Powerhouse is 3.65 megawatts. Excess electricity sold on the open market by the Stampede Powerhouse is not a significant source of electricity for the Region or surrounding areas.

7.2 Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?

No, there are no plans for new hydropower generation facilities in the Region. Projected growth in the Region is low.