Nevada Irrigation District Water and Climate Change

Today, the Nevada Irrigation District (NID) faces the new challenge of planning for climate change impacts. This article, part of a four-part series, is our effort to explain, interpret and explore the implications of climate change for NID and for our customers.

This article is intended to also help educate our community on NID's operational and planning preparations to mitigate and adapt to a changing climate.

The Plan for Water

NID is already seeing the impacts of climate change through increased temperatures and changes in precipitation patterns. Understanding the potential impacts of climate change on future water supply is critical to ensuring a long-term reliable water supply. Given how much is at stake, NID is implementing the Plan for Water (PFW) project. The PFW is a long-range decision tool to guide NID's water management. The PFW is a public collaboration process to determine the best ways to meet the community's demand for water over the coming decades. The PFW is an open and comprehensive look between NID and the community at the potential limitations of its infrastructure and water availability in relationship to the impacts of new regulations, changes in land use, climate change and community values.

The PFW will develop a range of potential scenarios for the NID's Board of Directors and the public to consider when determining the best ways to meet the community's demand for water for the next 50 years while weighing the impact on NID, the community and the environment. When complete, the PFW will show how a variety of future water supply and demand scenarios could be integrated to ensure our community enjoys the same high-quality, reliable water system for the next 100 years.

Climate Change

Climate change refers to long-term alteration in temperatures and weather patterns, specifically it relates to temperature and precipitation. When discussing climate change due to the long-term warming of the planet's overall temperature, in this document we will refer to it as global warming. Due to NID's operational reliance on winter snowpack in the Sierra, climate change has potential for a profound affect NID's operations and water reliability.

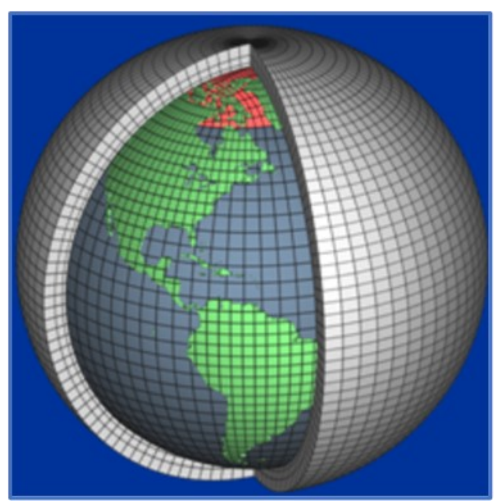


Figure 1 - GCMs are 3D global simulations of climate systems.

To study climate change impacts on NID's service territory and watershed, our expert scientific consultant team uses Global Climate Models (GCMs). GCMs are 3D mathematical representations of the major world-wide climate components such as the atmosphere, land surface, ocean, and sea ice. GCMs simulate how these components interact, resulting in scientifically based projections of how these climate interactions may happen. To make sure the models work, scientists have applied projections to past known conditions for accuracy.

For the PFW, the consultant team has selected seven GCMs that best represent the California climate. Each GCM simulated up to three different scenarios that examine potential pathways to projected future climate conditions. A total of eighteen different scenarios were analyzed. From these, three scenarios were identified for further analysis and understanding. Two of the selected scenarios represent hydrological bookends: the low bookend (dryer hydrology) and the high bookend (wet hydrology). The third scenario represents a median condition (a middle-of-the-road hydrologic climate. Hydrology data uses the "water year," which runs from Oct 1 to Sep 30. Therefore, the 2023 water year begins on Oct 1 of 2022 and ends on Sep 30 of 2023.

More information on these scenarios will be discussed in future articles.

When looking at climate data, it is important to differentiate between historical data and projected data. Historical data include observed data. These datasets are used to ensure the models are performing properly. Projected data are the results of the model simulations for future years under different potential scenarios. For now, let's look at just the historical and projected results of the median scenario to get a sense of the information these models will provide NID for planning.

Figure 2 shows how a global climate model may represent the atmosphere. For each location on Earth, the dynamic physical principles are simulated, and their interactions are captured through mathematical equations.

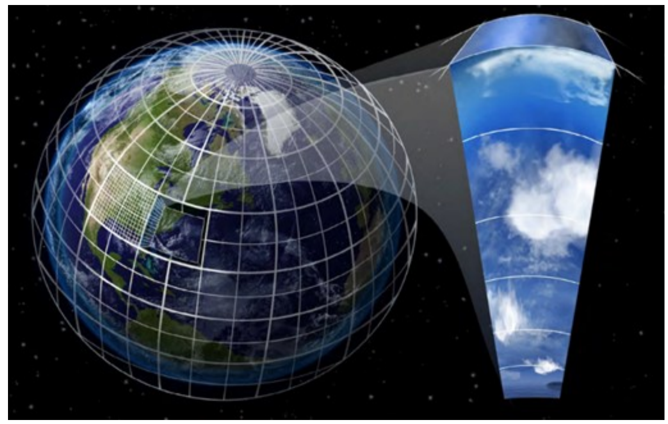


Figure 2 - Sample model grid for a GCM.
Source: Climate Change in Colorado.

Temperature

Global warming has raised global surface temperature about 2° F higher than those temperatures experienced in the 1900s, as shown in Figure 3.

The increase in temperatures will make the soils dryer and increase evapotranspiration resulting in higher water losses and reduced inflows.

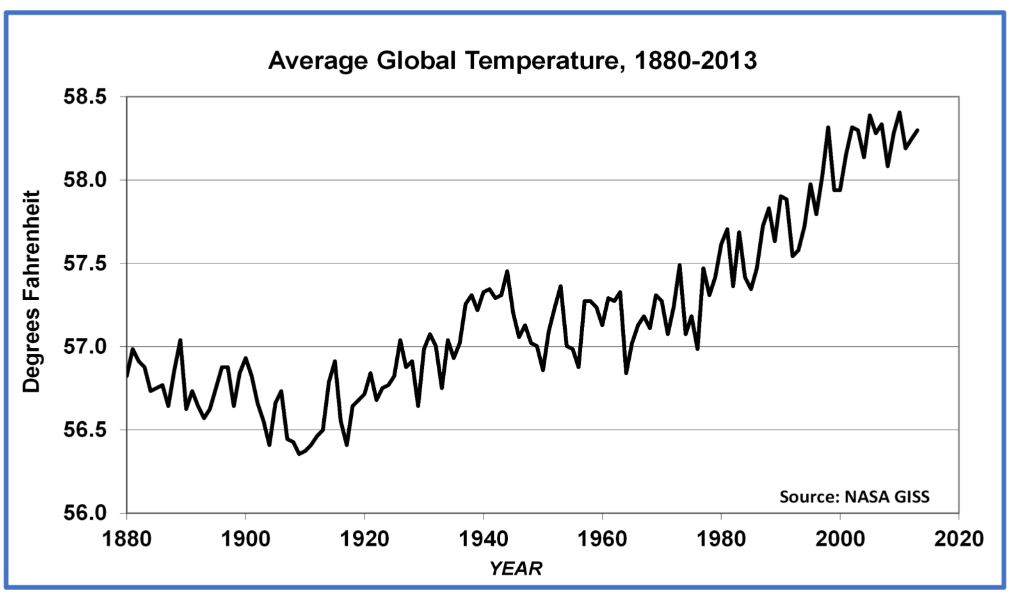


Figure 3 - Average global temperatures

Temperature (continued)

Figure 4 shows that the higher temperatures of global warming are also occurring in the NID watershed. Global warming is also local warming.

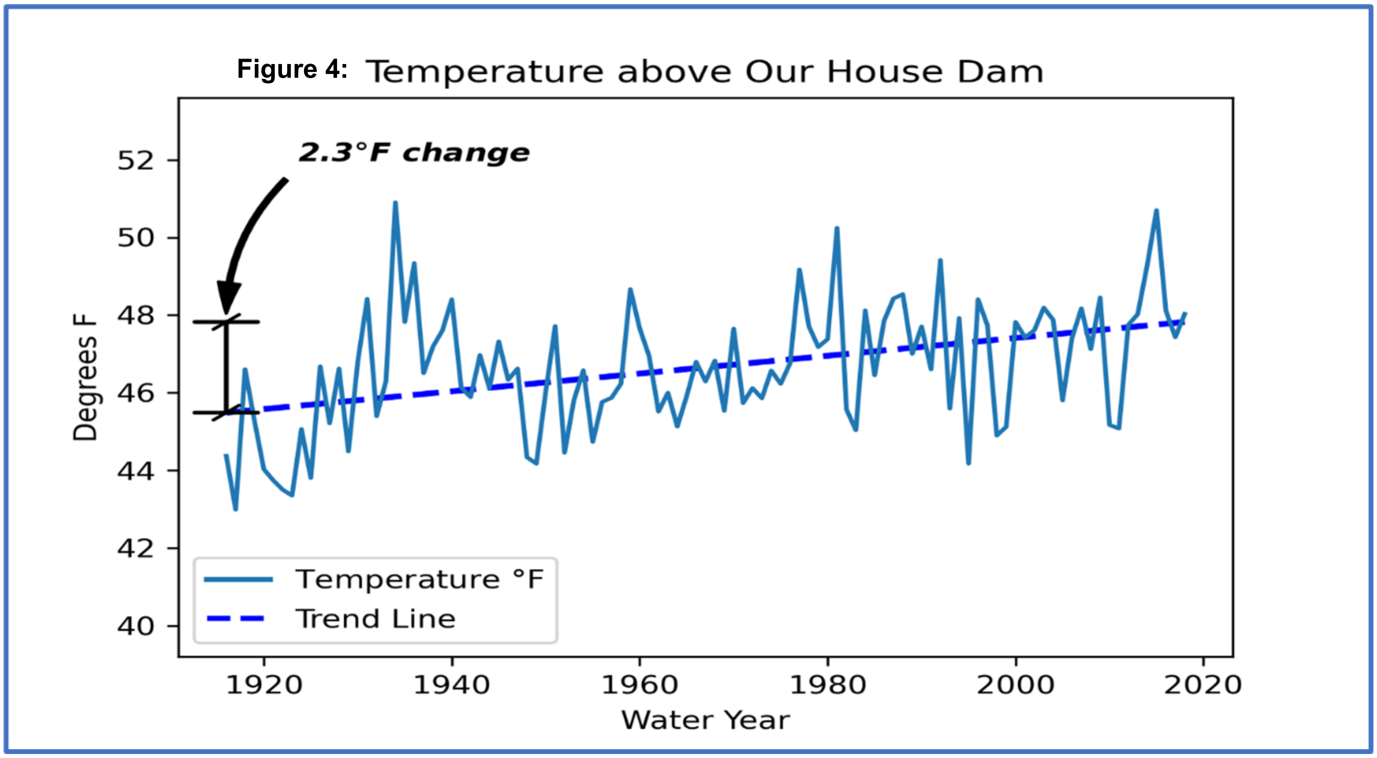
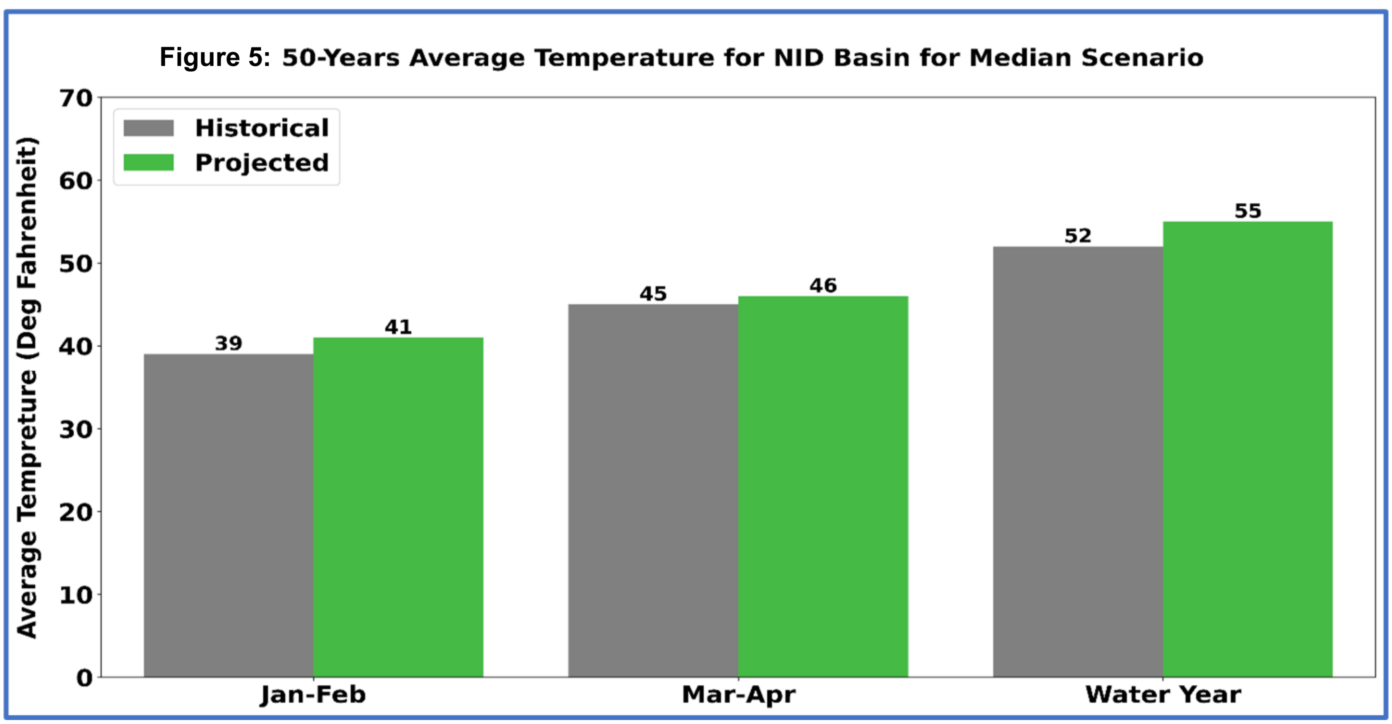


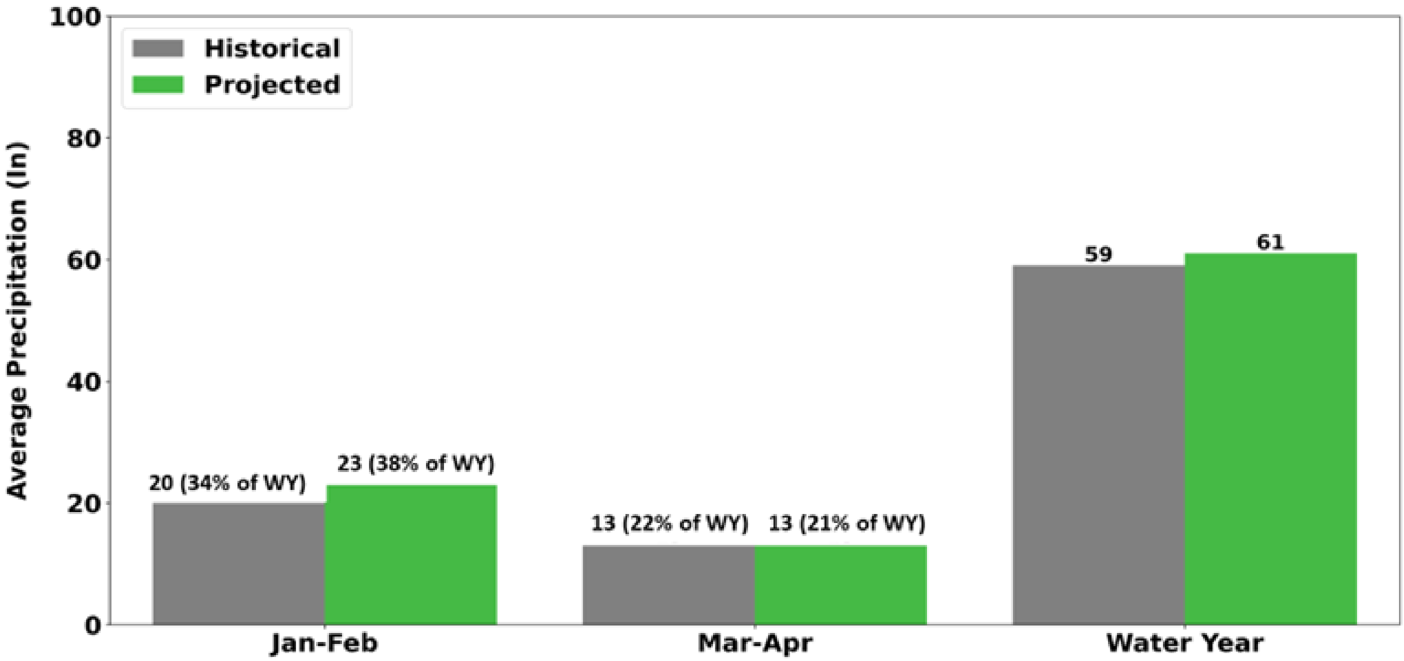
Figure 5 shows that the average temperatures are projected to increase in the rainy season and remain higher than historical temperatures throughout the entire year.



Precipitation

Precipitation is either rain or snow that falls to the ground within the NID watershed. Figure 6 shows that precipitation is not really projected to change significantly. The Jan–Feb precipitation is similar in both the historical and the projected simulations. A similar result is shown for the Mar–Apr and for the entire water year. This means that the models do not show a significant change in precipitation within the NID basin.

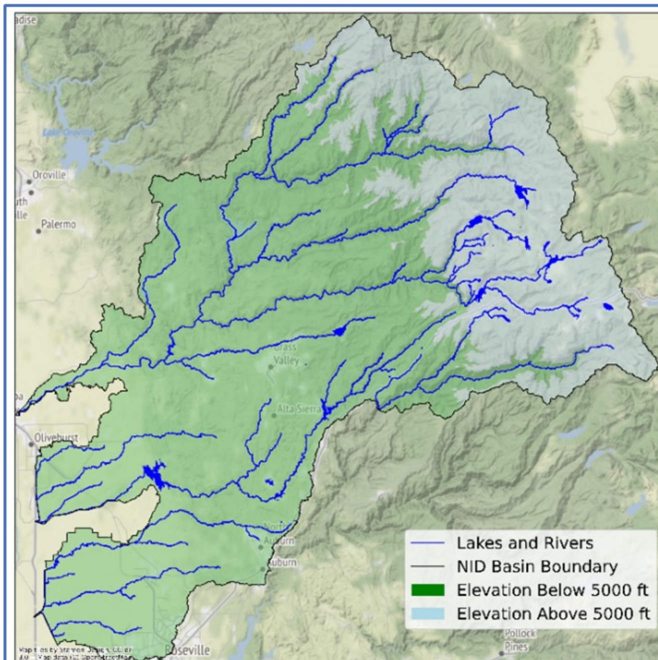
Figure 6: 50-Years Average Precipitation for NID Basin for Median Scenario



Snow

NID's mountainous upper watershed acts as a natural reservoir, releasing snowmelt runoff during the spring and summer months. Climate change impacts will result in less snowpack and faster melting of the snowpack. The NID system was designed and is currently operated to take advantage of the snow cycle and the timing of the resulting runoff.

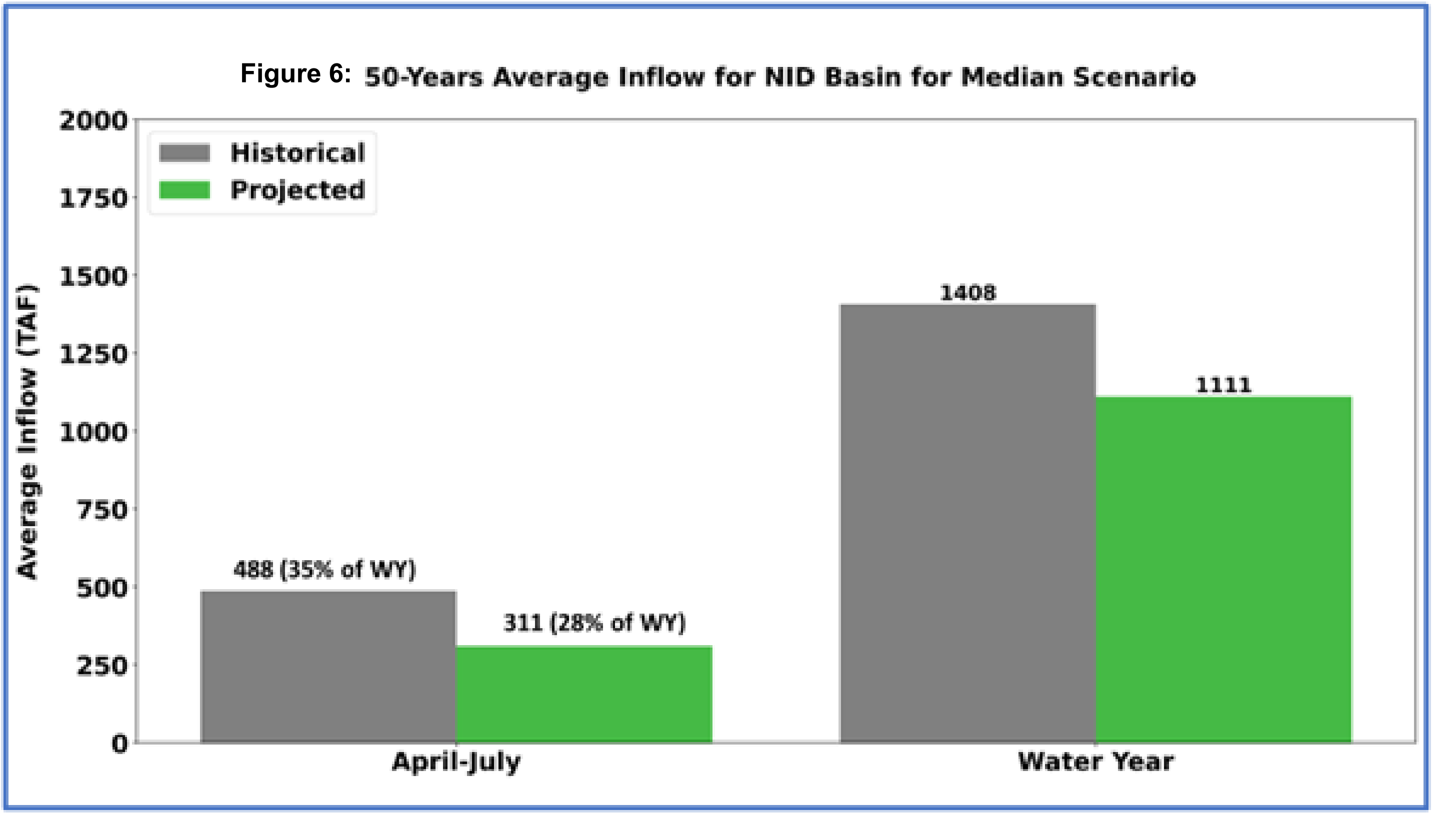
A large portion of the NID watershed is above the 5,000-foot elevation where snow falls during winter storms. This area is impacted by higher winter and spring temperatures. Projections indicate that some of what currently falls as snow will fall as rain, reducing the future average snowpack and snowmelt. This reduction in annual average snowmelt is an important consideration because historically, NID has used this snowmelt runoff to meet client demands. The combination of reduced snowpack and prolonged dry periods exacerbates future water scarcity issues.



Inflows

One particularly important impact may be the decrease in surface water availability for irrigated agriculture. Figure 8 shows that over the next 50 years for the median scenario, available water (inflows) on average will be reduced in both the snowmelt season (Apr–Jul) and the full year.

The simulations indicated that reduced inflows are a result of warmer temperatures, reduced snow, and dryer soils, but not a result of changes in precipitation quantities. The reduction of inflows can result in increased frequency and duration of drought conditions.



Future Articles

The next article will focus on the technological tools used to analyze potential strategies for the PFW. The third article will discuss how NID is looking at climate change hydrology, water supply, and demands for both historical and projected conditions. The final article will focus on potential solutions the PFW may use.

Planned Articles

- Article 1 – NID Water and Climate Change
- Article 2 – Technological Tools
- Article 3 – Learning from the Past and Projecting to the Future
- Article 4 – The Strategic Plan to a Dependable Water Supply