Valley Water

MEMORANDUM

FC 14 (01-25-23)

TO: Kirsten Struve, Assistant Officer

FROM: Samantha Greene, Ph.D.

SUBJECT: Valley Water's Consideration of Climate Change in its Water Supply Planning

DATE: December 15, 2023

Climate Change will have significant impacts on Valley Water's water supply resources. As a result, Valley Water has been working with experts and resources from across California to evaluate these impacts. Valley Water stays up to date on scientific research, evaluates data released by the State, and works with Dr. Ed Maurer from Santa Clara University (SCU). Dr. Maurer is a well-respected researcher and expert in climate change impacts on hydrology and downscaling methodology. Dr. Maurer is also the Department Chair of the Civil, Environmental, and Sustainable Engineering Department at SCU. The data developed by Dr. Maurer provides Valley Water the potential impacts to local temperature, precipitation, evaporation, and reservoir inflows. This data has been analyzed to understand changes in drought length and frequency and to determine climate change impacts to water supplies and demands into the future. For imported supplies, Valley Water relies on analyses completed by the Department of Water Resources (DWR). This memorandum summarizes Valley Water's analyses and findings of climate change impacts to demands and local supplies.

The memorandum primarily focuses on climate change impacts to demand and hydrological inputs to the water supply planning model. However, climate change can also impact other environmental characteristics that effect water supply, such as fire frequency and intensity and sea level rise. Climate change can increase wildfire risks, and wildfires can impact water supply by changing rain infiltration characteristics, evapotranspiration, sediment erosion, and surface albedo (a surface's ability to reflect incoming solar radiation). Sea level rise can impact Santa Clara County water supply by potentially causing the tidal flows to infiltrate through the soil and into the groundwater, decreasing groundwater quality. For a more complete description of climate change impacts to Valley Water operations and facilities, please see the Climate Change Action Plan: https://www.valleywater.org/your-water/water-supply-planning/climate-change-action-plan.

Downscaled Local Data

The climate change analysis completed with Dr. Maurer evaluated 16 global climate models (also referred to as General Circulation Models; GCM) to determine the range of potential impacts to forecasted water demands and local water supply availability. Dr. Maurer downscaled the GCMs so that Valley Water would have GCM-generated information on temperature and precipitation for our county. The downscaled temperature and precipitation data were then input into a watershed model to obtain climate change-impacted reservoir inflows. Valley Water used an empirical model to develop evaporation estimates from the downscaled data.

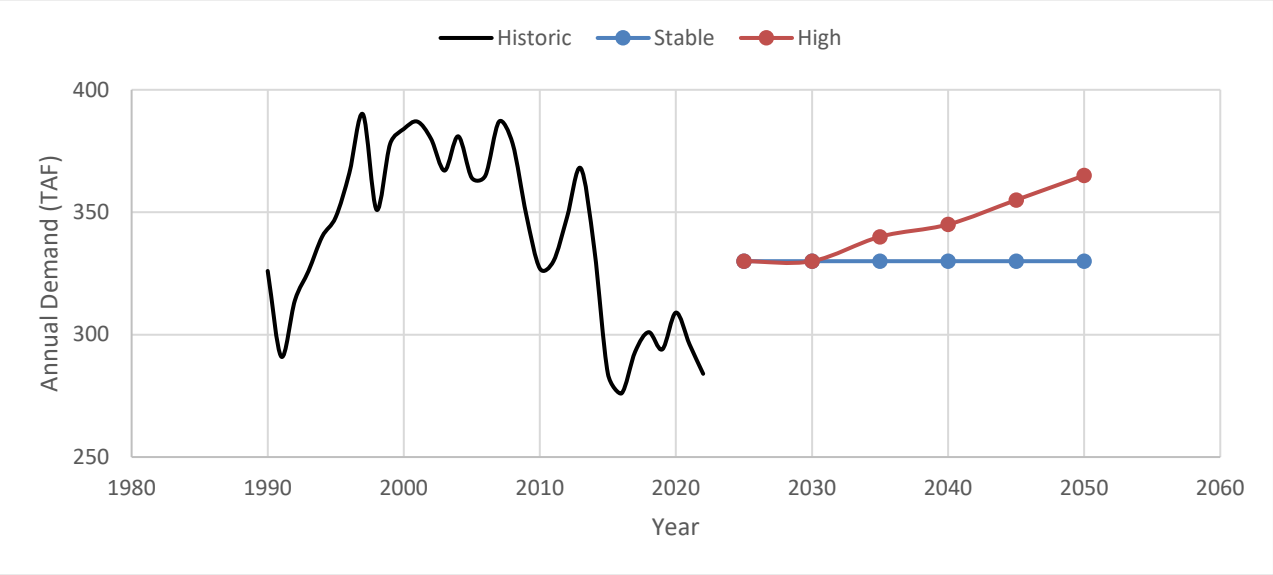
Valley Water has been using a subset of ten models that were recommended by the DWR Climate Change Technical Advisory Group (CCTAG) in their guidance document published in August 2015. CCTAG was a 14-member group of the leading California climate change scientists. The CCTAG group evaluated the available GCMs to determine which ones best represented the California climate system. While new GCMs have come out since the CCTAG analysis, not enough data is available from those GCMs to perform the downscaling necessary for Valley Water's water supply analyses. The findings reported hereafter are based on the downscaled data provided by Dr. Maurer from the CCTAG-recommended GCMs. When new the data Valley Water needs become available from the new GCMs, Valley Water will work with Dr. Maurer and other experts to update its analyses.

Demands

If not mitigated through Valley Water's conservation program and other behavioral, technological, and regulatory changes, climate change may increase demands to approximately 365,000 acre-feet per year (AFY) by mid-century. This increase would be primarily from greater outdoor irrigation needs across all water use sectors and greater cooling needs in the commercial, industrial, and institutional sector. While this is approximately 65,000 AF per year greater than normal-year water use following the 2012-2016 drought, it is still within the range of historical water use. Prior to the 2012-2016 drought, historical water use was generally between 360,000-390,000 (Figure 1).

Demands are not projected to exceed historic water use by mid-century primarily because Valley Water continues to invest in conservation and Santa Clara County residents continue to make water conservation a way of life. For the Water Supply Master Plan analyses, Valley Water is evaluating a lower and higher water use scenario informed by the climate change modeling. The lower water use scenario (330,000 AFY) assumes demands stay stable into the future owing to Valley Water's conservation program, regulatory changes, and success in Santa Clara County making conservation a way of life. However, the lower demand scenario is higher than current demands since it assumes a drought rebound from the past two droughts (2012-2016 and 2020-2022). The higher water use scenario (370,000 AF) assumes severe impacts of climate change on temperature and precipitation and that Valley Water achieves its conservation goal but that climate change impacts on demands is otherwise unmitigated. This value is based on the data discussed above.

Figure 1. Historic and projected demands. Projected demands are being used for Water Supply Master Plan analyses.

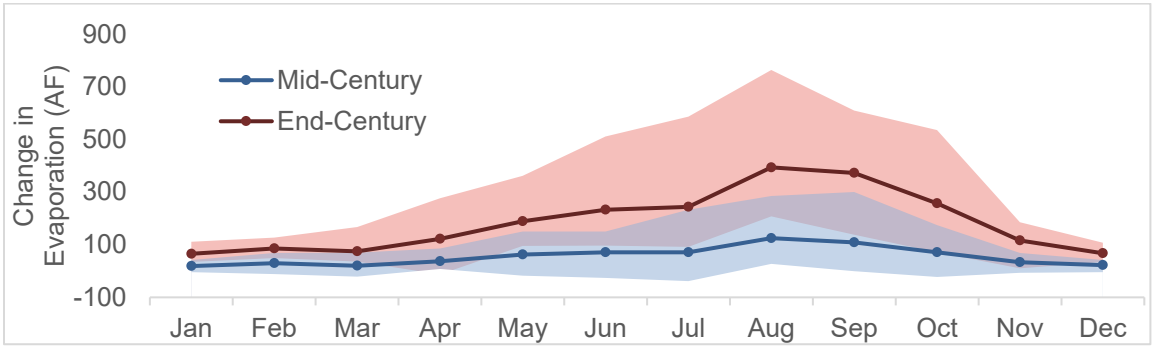


Local Supplies

The results of Valley Water's work with Dr. Maurer show that climate change will impact water supply through changing the volume, timing, and quality of water that is available. The Santa Clara University analysis shows the potential monthly increases in local reservoir evaporation due to increased temperatures (Figure 2). By mid-century, total annual evaporation could increase by 1,200 AF – 2,900 AF. In addition, increased temperatures could make surface reservoir water quality management more difficult as warmer temperatures tend to support greater algal growth and create other water quality issues. Degraded water quality is most common when reservoir storage is low; under that condition,

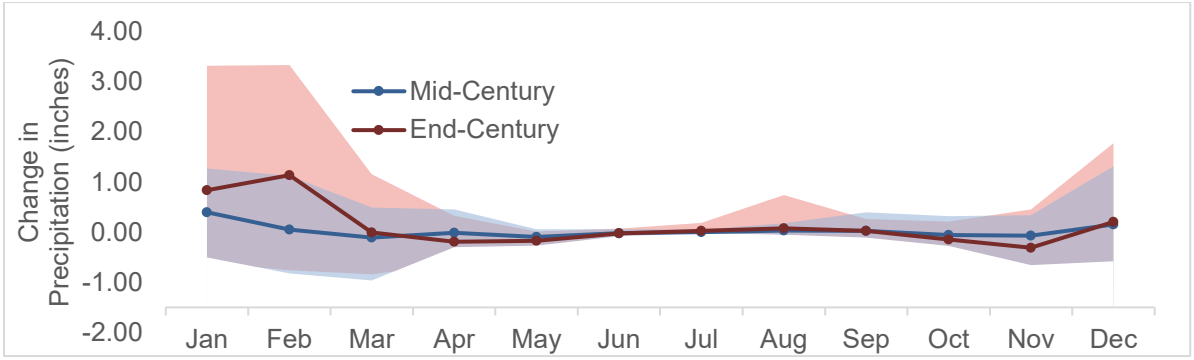
Valley Water blends water sources so that the water treatment plants can effectively clean the water and make it safe to drink.

Figure 2 Projected Increase in Santa Clara County Monthly Reservoir Evaporation due to Climate Change. The bands represent the range of projected evaporation change from current based on downscaled climate models while the lines represent the average across models. Blue lines and shading represent mid-century and red lines and shading represent end of century conditions.



Per the climate change analysis, droughts and wet periods are expected to become more severe. Future precipitation is likely to come as large storm events. Droughts will likely be more severe due to increased temperature and the potentially reduced prevalence of storm events compared to past droughts. There is significant uncertainty whether average precipitation is expected to increase or decrease since it will depend on the future storm tracks (e.g., will storms tend to track to the north and cover the Pacific Northwest or to the south and cover California more consistently). Figure 3 shows the potential change in local precipitation based on the downscaled global climate models.

Figure 3 Change in Average Santa Clara County Monthly Precipitation due to Climate Change. The bands represent the range of projected precipitation change from current based on downscaled climate models while the lines represent the average across models. Blue lines and shading represent mid-century and red lines and shading represent end of century conditions.

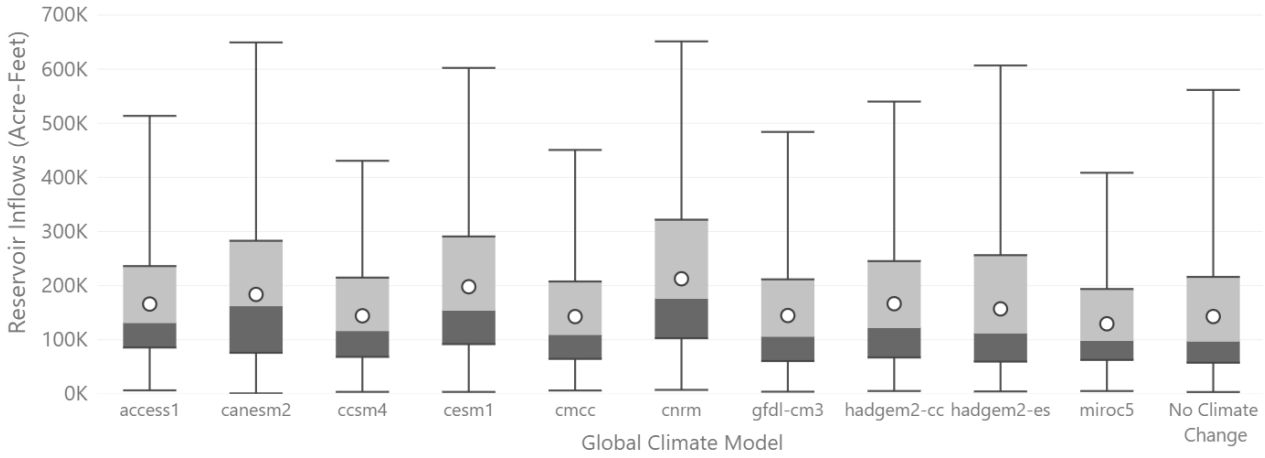


The changes in mid-century precipitation will most likely result in changes in reservoir inflows. Figure 4 shows how annual reservoir inflows could change based on each downscaled GCM. Half of the GCMs indicate the average inflow (white circle in each bar) could increase while the other half indicate it be similar to historic annual inflows. In contrast, 70% of the GCMs indicate median flows will increase while the other 30% indicate minimal change. However, 40% of the GCMs indicate there could be greater variability in annual inflows in the future. Timing and volume of runoff into reservoirs impacts water supply operations and reliability. The Water Supply Master Plan analysis evaluates how the

changes in volume and timing may impact Valley Water's ability to meet its level of service goal and is evaluating investments that could mitigate any negative impacts.

Valley Water is also evaluating how climate change may impact local drought frequency and length. Eighty percent of GCMs indicate that the very wet years will become more common and below normal, normal, and above normal years will become less common. There is significant uncertainty among the GCMs whether the very dry years will become more or less common or stay the same. The analysis also indicates that drought lengths in the future will be similar to the past, with most droughts ranging from 1-4 years and one- and two-year droughts being the most frequent.

Figure 4 Modeled reservoir inflows under different downscaled GCMs (first ten box plots) compared to no climate change (the final box plot). The circle within the box represents the average, the bar represents the median, and the box ends represent the 25th and 75th percentiles.



Next Steps

Valley Water will continue to work with internal and external experts to evaluate impacts of climate change on Valley Water's mission. As new science becomes available, Valley Water will update and expand its analyses on water supply impacts. For the Water Supply Master Plan 2050, Valley Water is working with Dr. Mike Anderson, the DWR State Climatologist, to ensure its analyses are robust.