



***Preliminary results:
Effects of Water-Management Scenarios on Water
Levels and Streamflow in the Carson River Basin***

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Modeling Purpose

- Simulate the effect of planned municipal pumping on water levels and streamflow
- Two groundwater models
 - Upper: Carson Valley
 - Middle: Eagle, Dayton, Churchill Valleys

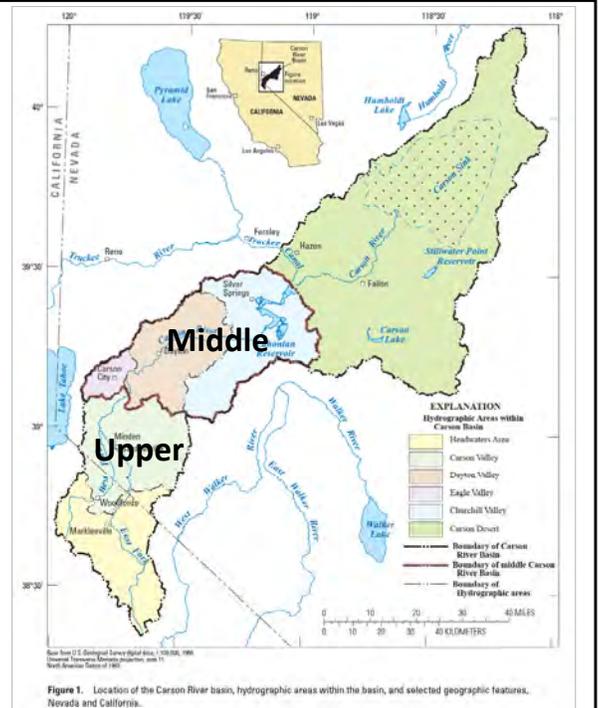
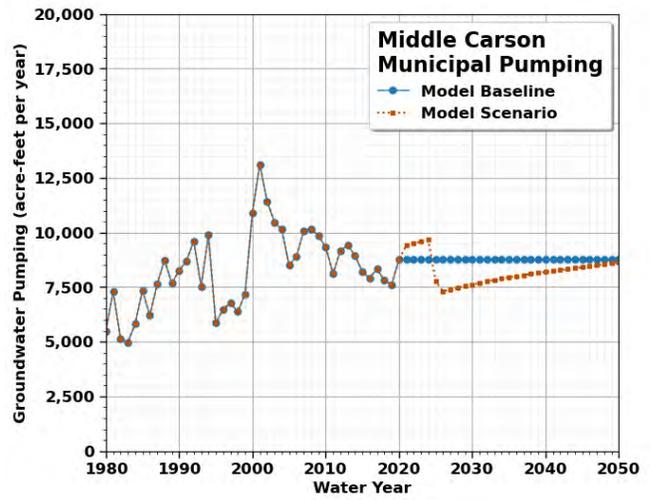
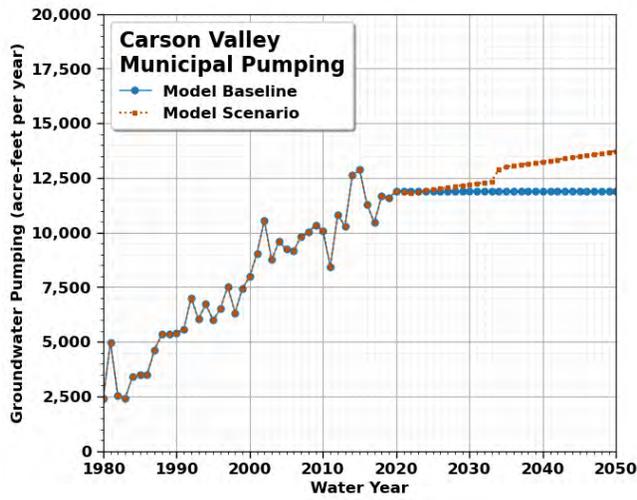


Figure from Maurer, 2011

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Anticipated Future Municipal Pumping

Planned municipal pumping data (wells and pumping volumes) provided by Lumos & Associates



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Upper Carson River Basin Model

- **Extent and framework from Kitlasten and others (2021)**
 - **Integrated MODSIM-MODFLOW model**
 - **Kitlasten simulated 1980 – 2015**
- **Updated Kitlasten model simulates:**
 - **40-year historical period 1980 – 2020 plus 30-year projection period 2010 – 2050**
 - **MODSIM determines surface water deliveries according to the Alpine Degree**
 - **MODFLOW simulated groundwater flow**
 - **Irrigation pumping calculated based on crop demand and surface water deliveries**

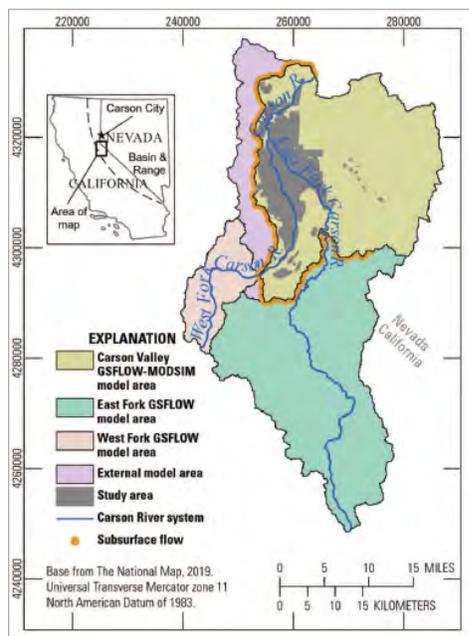


Figure from Kitlasten and others, 2021

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- MODSIM allocates surface water to each demand based upon water availability throughout the Carson Valley irrigation system
- Model parameters were held constant during 2021-2050
 - **Annual East & West Fork river inflows repeat 2010 – an average year (345K AFY)**

Upper Carson River Basin 2021 - 2050 change in streamflow

- Although the model is complete, due to the lapse in appropriations, this plot could not be produced in time for this presentation.
- The plots will be very similar to those provided for the Middle Carson model.
- It will be generated and provided ASAP following our return to work.

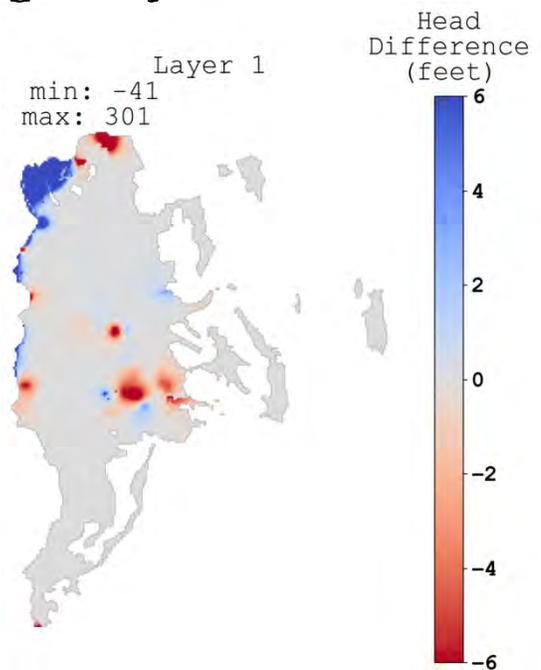


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This plot should show the monthly change in streamflow at USGS stream gage 10311000 at Carson City on the Carson River.

Upper Carson River Basin model change in hydraulic head

- Anticipated municipal pumping from 46 wells from 2021 – 2050.



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Map shows simulated water level changes in the upper Carson River Basin as a result of the Lumos-projected pumping for water years 2021-2050. Negative values (red colors) indicate areas where simulated water levels are lower as a result of the Lumos-projected pumping, and positive values (blue colors) are areas where simulated water levels are higher as a result of the Lumos-projected pumping.

Middle Carson River Basin model: *baseline simulation*

- Extent and framework from Morway and others (2023)
 - Only simulated 1980 – 2010
- New MODFLOW model simulates:
 - 40-year historical period 1980 – 2020
 - 30-year projection period 2021 – 2050

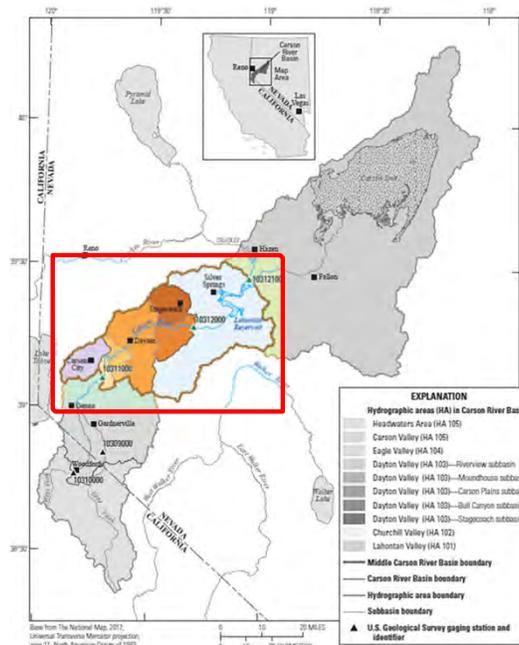
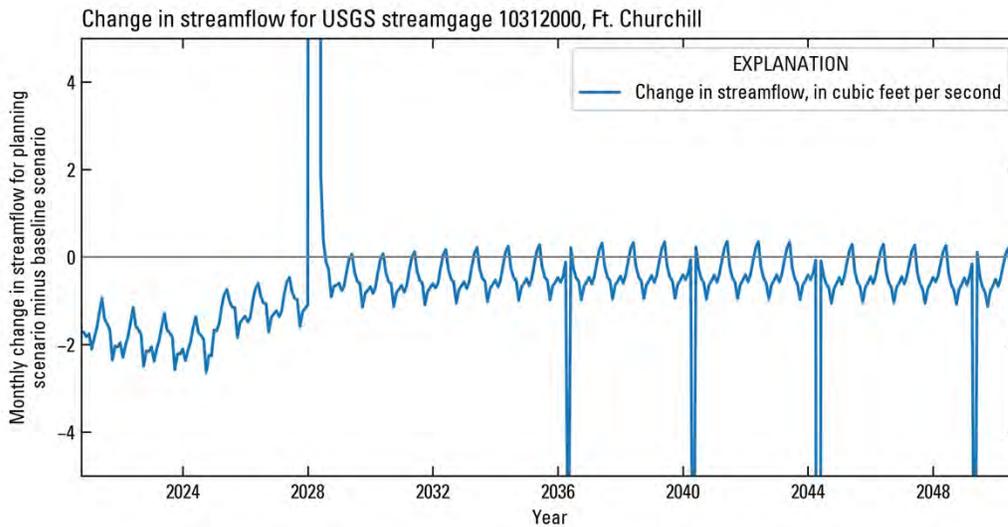


Figure from Morway and others, 2023
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- Model parameters were held constant during 2021-2050
 - Monthly streamflow from WY 2010 from Carson at Carson City gage
 - Monthly streamflow diversions from WY2010
- Baseline –
 - monthly municipal pumping for WY2020
- Planning scenario
 - Monthly Lumos municipal pumping

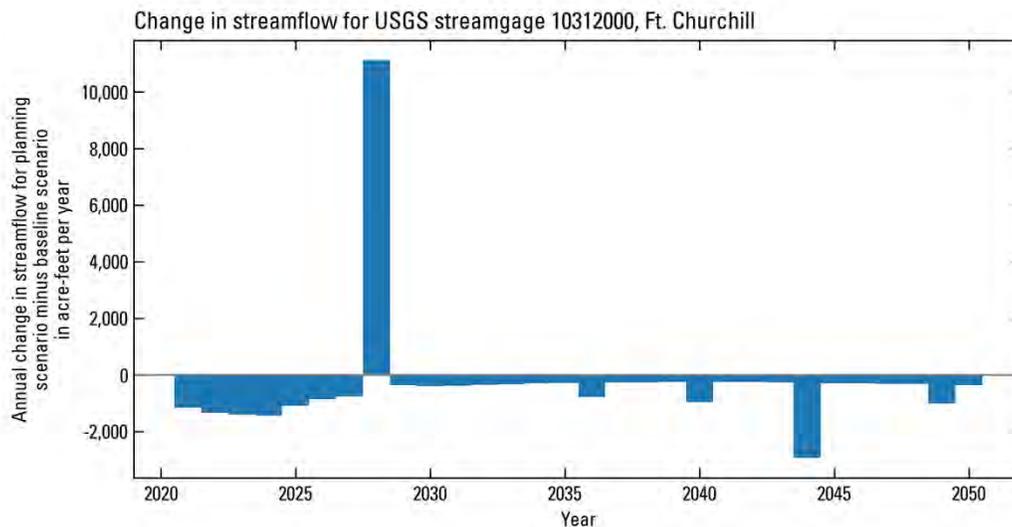
Middle Carson River Basin 2021 - 2050 change in streamflow



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Plot shows the monthly change in streamflow at USGS streamgage 10312000 at Ft. Churchill on the Carson River in cubic feet per second. Negative values represent lower streamflow as a result of the Lumos-projected pumping in the middle Carson River Basin. Initially, streamflow is lower by about 2 cubic feet per second due to the increase in projected pumping. After about water year 2025, the streamflow decrease becomes less resulting from the decrease in pumping as projected by Lumos from the Quill treatment plant coming online. Monthly streamflow decreases after 30 years of projected pumping are generally lower compared to baseline on average by about 0.5 cubic feet per second in 2050. Large positive and negative “spikes” in the resulting monthly streamflow changes are likely in error and a result of model convergence issues. These erroneous “spikes” will be resolved when USGS is operational after the government shutdown.

Middle Carson River Basin 2021- 2050 change in streamflow

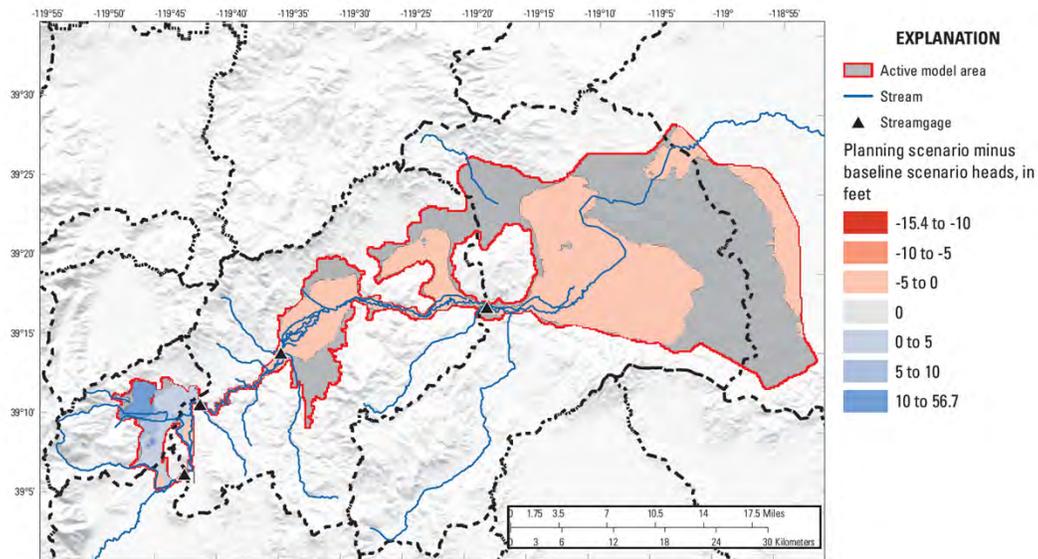


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Plot shows the annual change in streamflow at USGS streamgage 10312000 at Ft. Churchill on the Carson River in acre-feet per year. Negative values represent lower streamflow as a result of the Lumos-projected pumping in the middle Carson River Basin. Initially, annual streamflow is lower by about 1,400 acre-feet per year in water year 2024 due to the increase in projected pumping. After about water year 2025, the streamflow decrease becomes less resulting from the decrease in pumping as projected by Lumos from the Quill treatment plant coming online. Annual streamflow decreases after 30 years of projected pumping are generally lower compared to baseline on average by about 370 acre-feet per year in 2050. Large positive and negative “spikes” in the resulting annual streamflow changes are likely in error and a result of model convergence issues. These erroneous “spikes” will be resolved when USGS is operational after the government shutdown.

Middle Carson River Basin model change in hydraulic head

- Anticipated municipal pumping from 36 wells from 2021 – 2050.



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Map shows simulated water level changes in the middle Carson River Basin as a result of the Lumos-projected pumping for water years 2021-2050. Negative values (red colors) indicate areas where simulated water levels are lower as a result of the Lumos-projected pumping, and positive values (blue colors) are areas where simulated water levels are higher as a result of the Lumos-projected pumping.

References

- Maurer, D.K., 2011, Geologic framework and hydrogeology of the middle Carson River Basin, Eagle, Dayton, and Churchill Valleys, West-Central Nevada: U.S. Geological Survey Scientific Investigations Report 2011–5055, 62 p.
- Kitlasten, W., Morway, E.D., Niswonger, R.G., Gardner, M., White, J.T., Triana, E., and Selkowitz, D., 2021, Integrated hydrology and operations modeling to evaluate climate change impacts in an agricultural valley irrigated with snowmelt runoff, Water Resources Research volume 57, Issue 6.
- Morway, E.D., Buto, S.G., Niswonger, R.G., and Huntington, J.L., 2023, Assessing potential effects of changes in water use in the middle Carson River Basin with a numerical groundwater-flow model, Eagle, Dayton, and Churchill Valleys, west-central Nevada: U.S. Geological Survey Scientific Investigations Report 2023–5008, 112 p., <https://doi.org/10.3133/sir20235008>.



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