Climate Change, Turley-Manzanares Acequia Rehabilitation Project, San Juan County, NM
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Appendix A

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The Turley-Manzanares Acequia (irrigation ditch) is located in San Juan County, NM, east of Farmington. The ditch diverts water from the San Juan River below Navajo Dam, and runs generally west along the south bank of the San Juan River. Improvements in 2008 installed a gated heading, 1200 linear feet of 36-inch reinforced concrete pipe starting from the headgate, and wire-wrapped riprap on the south side river bank to protect the pipe for 103 linear feet near the headgate.

The proposed project is located immediately downstream of the 2008 improvements. It consists of installation of an additional 2750 linear feet of 36-in diameter concrete pipe followed by 1225 linear feet of concrete-lined channel. The improvements are entirely within the existing acequia right-of-way, mostly within the existing acequia footprint. No part of the current project touches the wetted perimeter of the river. The purpose of the project is to improve water transmission through the acequia and reduce water losses from evaporation and seepage.

The project area is located in the northwestern corner of NM within the Colorado Plateau physiographic province. Located almost a mile above sea level, it has a temperate desert climate characterized by cool summers (mean maximum temperatures below 90°F), mild winters (average temperature of the coldest month is 30.5°F) and mean annual precipitation of 8.6 inches (NCDC 1981-2010 Monthly Normals for the Farmington Agricultural Science Center Cooperative Observer site (https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm3142)). During the July-October wet season, monthly precipitation averages about one inch, typically falling during localized convective storms; winter precipitation is generally sparse. Stream flow in the San Juan River originates as snowmelt runoff in the San Juan Mountains to the north. Navajo Reservoir, impounded behind Navajo Dam, provides flood risk management functions and water storage as part of the larger seven-state Colorado River Compact Agreement area.

Observed and Projected Changes in Climate

Temperatures in the San Juan Basin have risen over 1°C (1.8°F) between 1910 and 2009, mostly occurring after 1993, consistent with trends across the Western U.S. (Nydick et al. 2012). Warming is greater in the spring and summer months, and is more robust for the minimum temperature than the maximum (Nydick et al. 2012). Projected increases in temperature occur in all seasons, with increases in daytime high temperatures of approximately 6°F in summer daytime high temperatures projected for the mid 21st Century, and a similar magnitude rise in winter nighttime minimum temperatures. Precipitation has showed no trend, and projected changes diverge among models (Bennett et al. 2019).

Warmer winter and spring temperatures (Nydick et al. 2012), and increases in late-spring dust on snow (Painter et al. 2007) have contributed to a 40% reductions in snowpack snow water equivalence (SWE) in the San Juan Mountains from 1995 to 2005. The timing of snowmelt and peak spring runoff has shifted earlier into the spring by two weeks (Clow 2010, Nydick et al. 2012).

This trend is anticipated to continue, with projected future spring melt occurring two weeks to one month earlier (peaking in May) and reductions in projected annual flow volumes of 14% below the historical mean (Bennett et al. 2019). Winter half-year flows may increase, reflecting more precipitation as rain and earlier snowmelt at lower elevations (Bennett et al. 2019). Taking into account future full use of water rights not currently being fully utilized, future flows in the San Juan may be 33% lower than historical values; water shortages may intensify across the basin, and water deliveries to municipalities, electric power plants and agriculture may decline by 25% to 50% (Bennett et al. 2019).

Analysis of the San Juan River near Archuleta, NM stream gage, upstream of the project site and below Navajo Dam, shows a slight long term rise in annual peak stream flow (14.5471* water year -25556, R sq = 0.0151542, p-value = 0.375173) for the period of record following closure of the Dam in 1962 (Figure 1). This change is not statistically-significant. Spring peak flows are regulated to benefit native fish populations in downstream reaches.

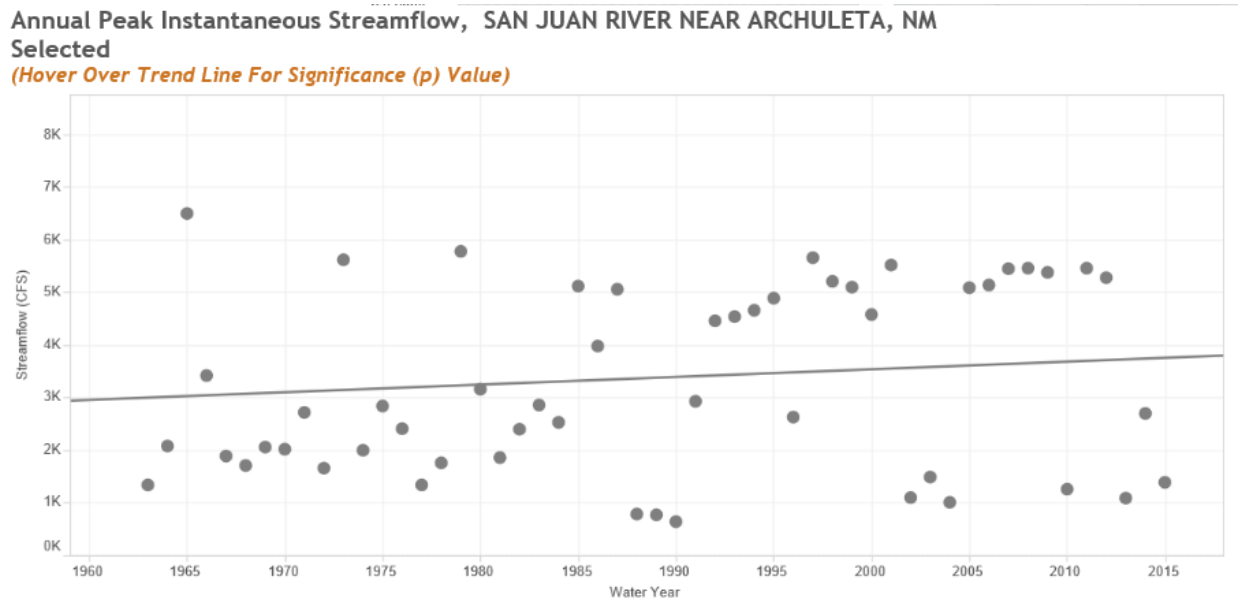

Figure 1 Observed change in annual peak instantaneous stream flow, USGS gage San Juan River near Archuleta,, NM.

Changes to flood risk, and therefore flood damage to acequia intake structures, may occur in the future but are highly uncertain because the causal mechanisms other than snowmelt runoff (changes to summer convective precipitation, changes to eastern Pacific hurricane characteristics) are parameterized in climate models. However, these impacts are likely to be felt most keenly at the ditch intake, located to the east of the project area. These events could result in disruption of water to the proposed piped portions of the ditch, but are unlikely to physically impact the project area.

Project Area Vulnerability

The USACE Civil Works Vulnerability Assessment Tool was used to further investigate projected climate change impacts to the project area (Figure 2). The data indicate that flood magnification (the increase in flood size compared to present) is the leading risk related to future flooding, both locally (flash flooding due to direct precipitation) and regionally to be the biggest concern for the San Juan basin as a whole.

However, given the project area is several miles from the diversion, damage to the project from flooding is unlikely to be significant. Reductions in water supply over time due to climate change is likely to be the dominant concern.

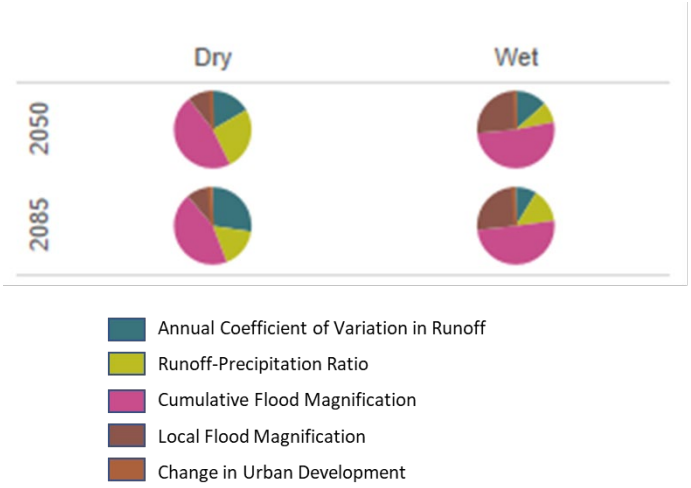

Figure 2 Hydrologic vulnerabilities related to flood risk in the project area.

Conclusion

Given projected reductions in water availability in the San Juan Basin, the proposed project will contribute significantly to regional economic resilience by minimizing water loss in the capture and transmission of water through the irrigation ditch to consumers.

References

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