Identifying Factors Controlling Flow Conveyance Losses in the Middle Rio Grande

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Introduction

The Middle Rio Grande experiences significant water losses from San Acacia to Fort Craig. While the quantity of flow loss has been defined in previous studies the relative contribution of the various mechanisms of loss have not been closely studied. It is our goal to investigate the interactions of the topography, hydrological conditions, weather, and vegetation to better define the processes that contribute to this conveyance loss. We plan to use several techniques in our research, such as water table monitoring, by using data loggers in wells, soil moisture monitoring using probes, water quality and field chemistry parameters from surface and ground waters, and vegetation surveys. We intend to deliver information to the Middle Rio Grande Conservancy District that will aid their water management decisions, in particular, what conditions lead to maximum conveyance of flow releases through the reach with minimal transmission losses.

Figure 1: Location map of transects being evaluated in the study area

Biology Partnership

This project is in collaboration with the biology department here at New Mexico Tech. Marina Hein, the biology graduate student plans to conduct a transect based vegetation survey this summer that will better inform our understanding of different types of plant communities in our area.

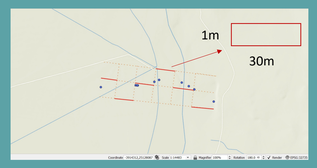

Figure 2: example of vegetation survey line at South Bosque Boundary. Blue dots are wells and red lines are survey areas

Four Dominant Stands

In this reach of the Rio Grande we have identified four major vegetative stand's that we are interested in, cottonwood galleries, meadows, tamarisk stands, and burned tamarisk stands. We have placed soil moisture probes and data loggers in wells located in these stands, and plan to closely monitor them over the summer to observe the connection between diminishing surface water, a declining water table, and evapotranspirative demands in these different plant stands .

Figure 3 (left): Live tamarisk (HWY E03A)
Figure 4 (top right): Healthy meadow (BRN E03)
Figure 5 (bottom left): Burned Tamarisk (SMC W01)
Figure 6 (bottom right) : Cottonwood Gallery

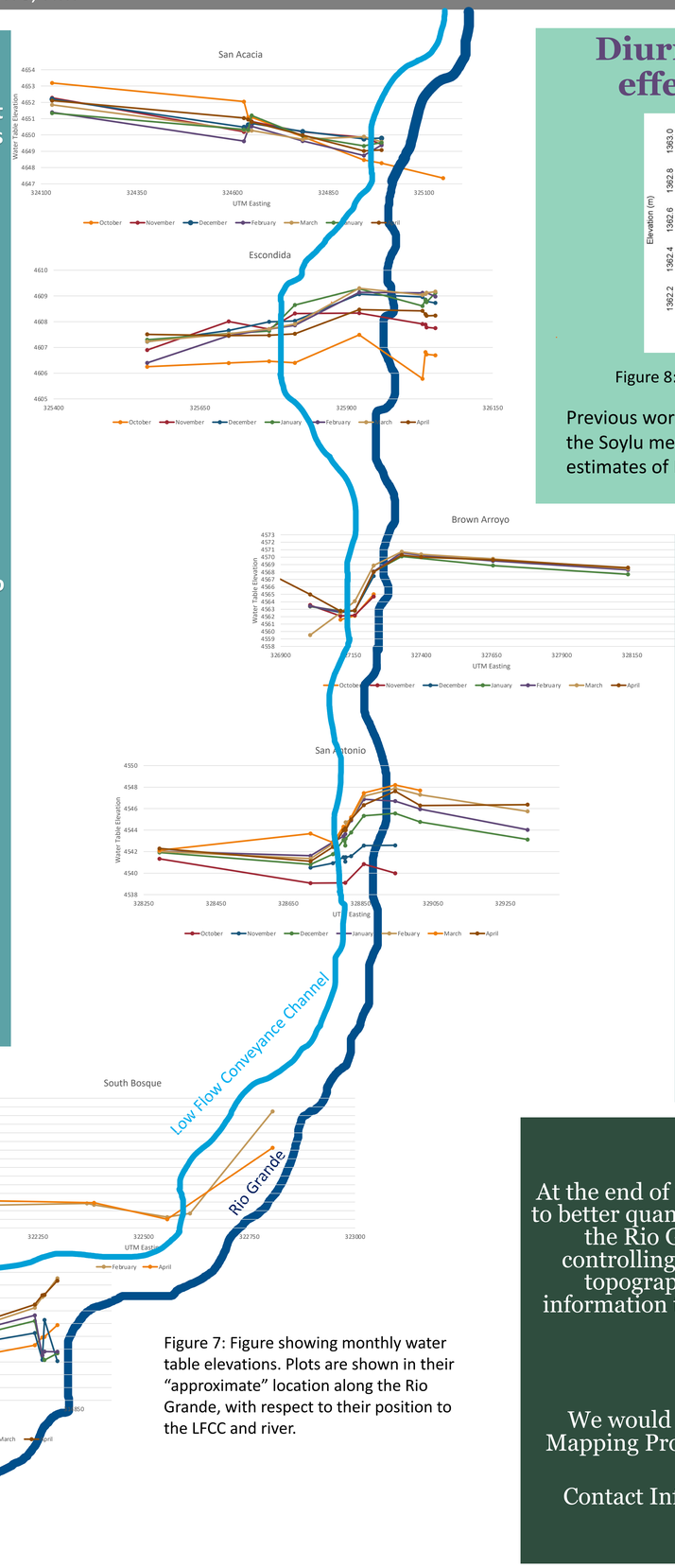

Figure 7: Figure showing monthly water table elevations. Plots are shown in their "approximate" location along the Rio Grande, with respect to their position to the LFCC and river.

Diurnal Fluctuations showing effects of ET on water table

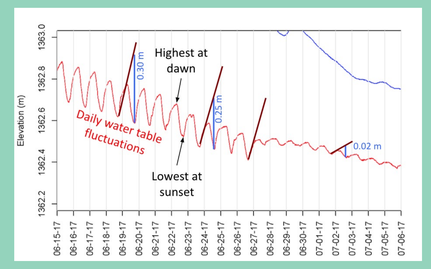

Figure 8: Image showing Diurnal Fluctuations in the water table

Previous work by graduate student Stephanie Roussel shows that the Soylu method of fitting sine curves yields reasonable estimates of ET, and will be replicated in this study.

Current Results

- **7 months of head data shown in figure 6, only A well data being displayed for clarity**
- **San Acacia transect shows water table dipping from West to East, across the river**
- **Brown Arroyo and San Antonio show the water table dipping sharply away from the river on West and slight away on East**
- **Steady rise in head from October to March likely due to a near complete absence of transpirative demand on the water table during wintertime.**
- **Once spring comes into full swing we expect to see the opposite begin to happen again, with peak values being in either March or April, and each month after having a lower water table.**

Field Methods

- 100 ISC wells along seven transects are the focus of this study
  - Each transect has wells to the West of the Rio Grande, some between the LFCC and the River, and all but the two southernmost transects have Eastern wells
- Monthly water table measurements
- Data loggers are strategically placed in about 20 of the wells
- Water Quality data (temperature, conductivity, DO, pH, ORP) will be collected monthly in select wells
- Soil Moisture probes will be installed in four locations
- Transect vegetation survey in summer 2021

Expected Outcomes

At the end of this study we are hopeful that we will be able to better quantify the hydraulic gradient driving flow out of the Rio Grande. By correlating these gradients to controlling factors such as Et., river stage, flood plain topography we hope to provide the MRGCD with information to assist with flow conveyance management.

Acknowledgments

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