Tuolumne River Water Quality Monitoring Project

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Executive Summary

As a WRPI Intern for the Tuolumne River Trust, my project was focused around the health of the Tuolumne River watershed in terms of water quality. The main objective for this internship was to refine a monthly surface water quality monitoring program, which included making the water quality information accessible for analysis and providing outreach to ensure safe surface water standards for habitat and recreational purposes.

Project Objectives

The Tuolumne River runs through a changing landscape from the headwater in the Sierra Nevada into California's Central Valley. Residential, agricultural, commercial and industrial land uses dominate the lower watershed. There is little to no public information about which pollutants from these land uses may be entering the untreated surface water. The Tuolumne River Water Quality Monitoring project strives to ensure safe water standards for recreational use and habitat for aquatic life. The parameters tested include water temperature, specific conductivity, pH, dissolved oxygen (measured as mg/L and percentage), turbidity, phosphates and nitrates.

By entering information regarding these parameters into an easily accessible database, patterns were detected to identify spatial and temporal areas of concern. This information is especially beneficial for advocating for higher flows in the river during dry seasons. The water quality information also provided insights on how to appropriately target and plan restoration efforts. Healthy riparian habitat protects surface water within rivers by filtering pollution from runoff. Part of this internship included the coordination of restoration days at the Dos Rios

ranch site. Dos Rios ranch is located where the San Joaquin River and Tuolumne River meet. The restoration objective at Dos Rios ranch is to convert former agricultural land back into a natural riparian habitat, which will not only minimize pollutant impacts to the river, but also provide habitat for aquatic species during flood events.

Lastly, the water quality program seeks to inform the public about potential threats to the river. Providing access to water quality data allows for communities to make informed decisions about how and where they recreate along the lower river. They may also use the information to advocate for healthier ecosystems and to plan for restoration events.

By understanding the importance of these parameters regarding the health of the ecosystem and human use, I was able to gain a broader understanding of the watershed as a whole. Understanding pollution patterns within the river can lead to questions regarding management of the watershed.

Project Approach

The project consisted of five monitoring sites throughout the lower Tuolumne watershed. All five sites are located within recreation parks, with easy access. The monitoring sites are ideal locations as these are places where the communities frequently access the river for recreation. The sites are as follows: Dry Creek- Modesto, River Park- Waterford, River Bluff Regional Park- Ceres (upstream of manmade wetland), River Bluff Regional Park- Ceres, (downstream of manmade wetland), and Riverdale- Modesto. Testing at the five locations

occurred every month, typically in the final week of the month. Gaps in the data occurred occasionally due to equipment complications or seasonal flooding of monitoring sites.

After completing data collection all data was entered into an Excel data base. Data analysis included identifying correlations between weather events and parameter readings. Data analysis also took into consideration location of the monitoring sites, which are representative of an urbanized stream. Seasonal aspects such as precipitation, temperature, and flows, are also recorded.

In the past, these data have contributed toward the development of outreach and educational programs focused on the river. During my internship, the data I collected and analyzed helped me to develop the educational materials for the Tuolumne River Youth Summer Camp, where kids between the ages of 4-14 spent time learning about the importance of a healthy river ecosystem.

Project Outcomes

Water Quality testing:

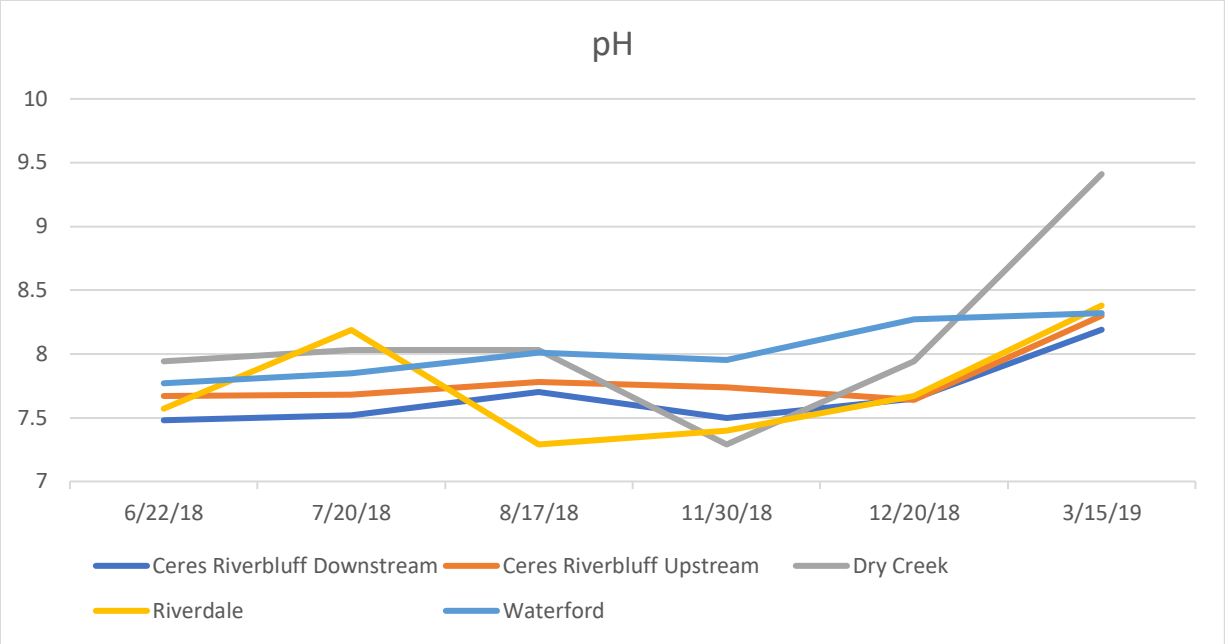

Figure 1

Figure 1 reports that the pH levels within the watershed are above neutral. Although most sites were fairly consistent in terms of pH, Riverdale Park and Dry Creek in Modesto had the widest range of pH levels. Dry Creek recorded the highest pH value of 9.41 which is well above the neutral level.

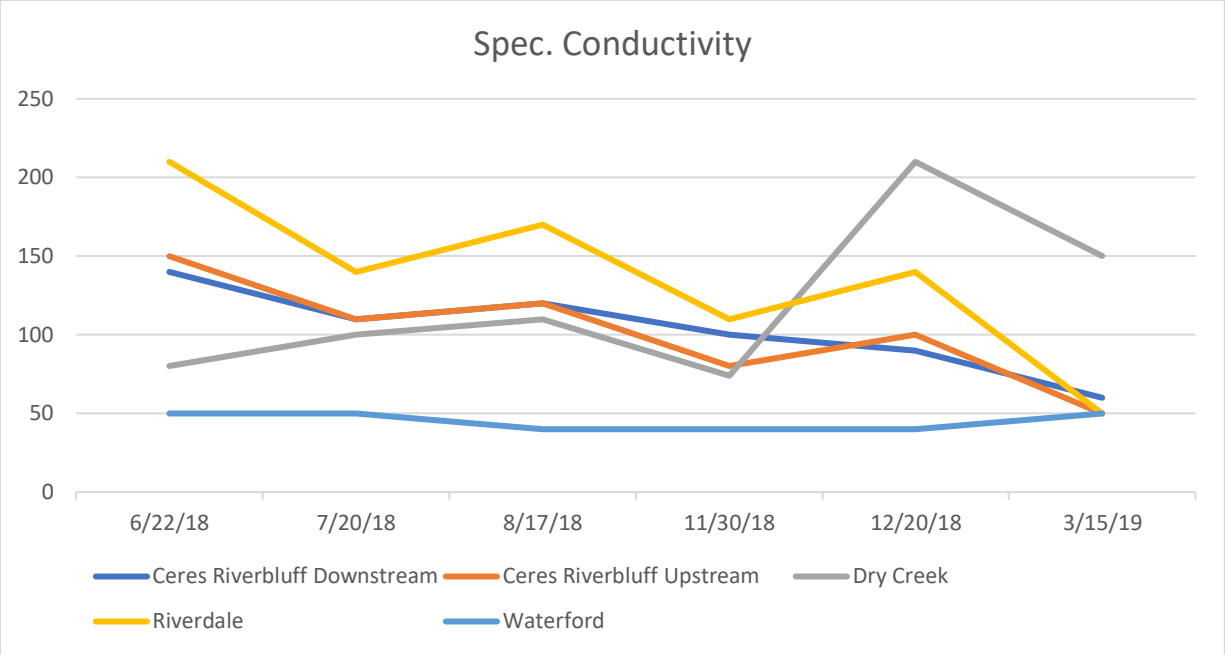

Figure 2

The specific conductivity of the sites increased from east to west. Specific conductivity indicates the presence of materials in the water capable of conducting electrical flow. Once again Riverdale Park and Dry Creek Modesto recorded the widest range and the highest specific conductivity levels.

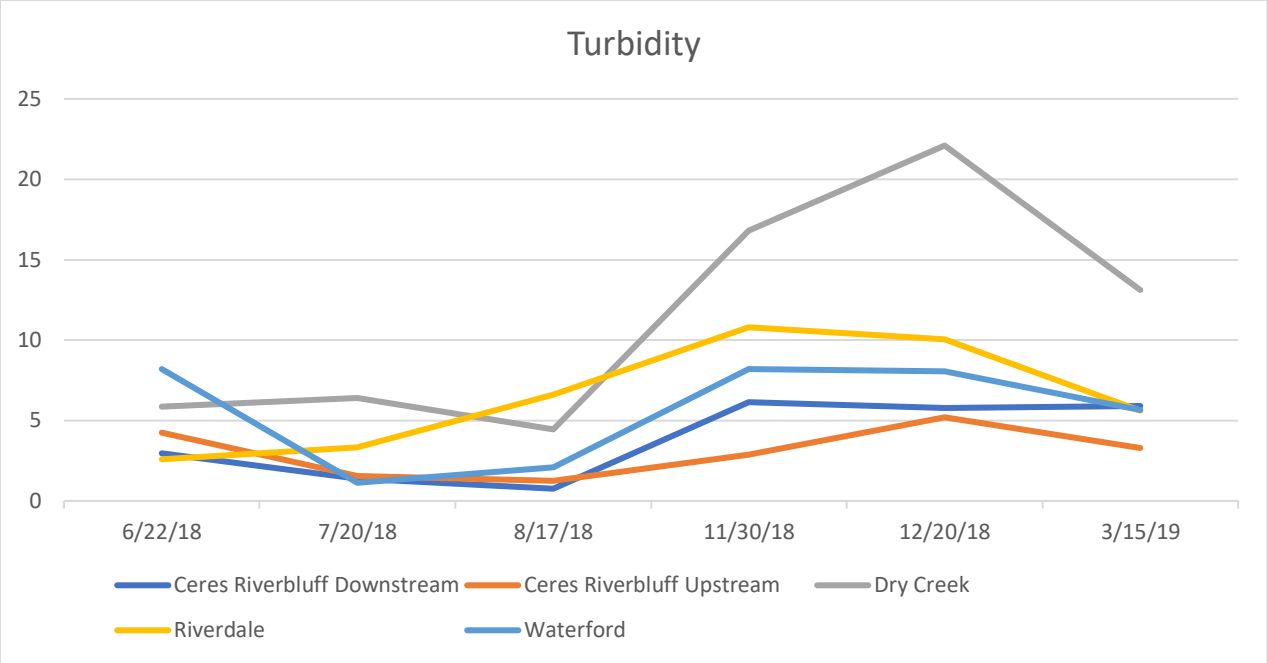

Figure 3

Turbidity is a measure of particles suspended in the water. Above is a representation of turbidity levels along the river. The turbidity levels remained relatively low in the drier part of the year and increased when the rains came. The highest report for turbidity remains at Dry Creek at 22.1.

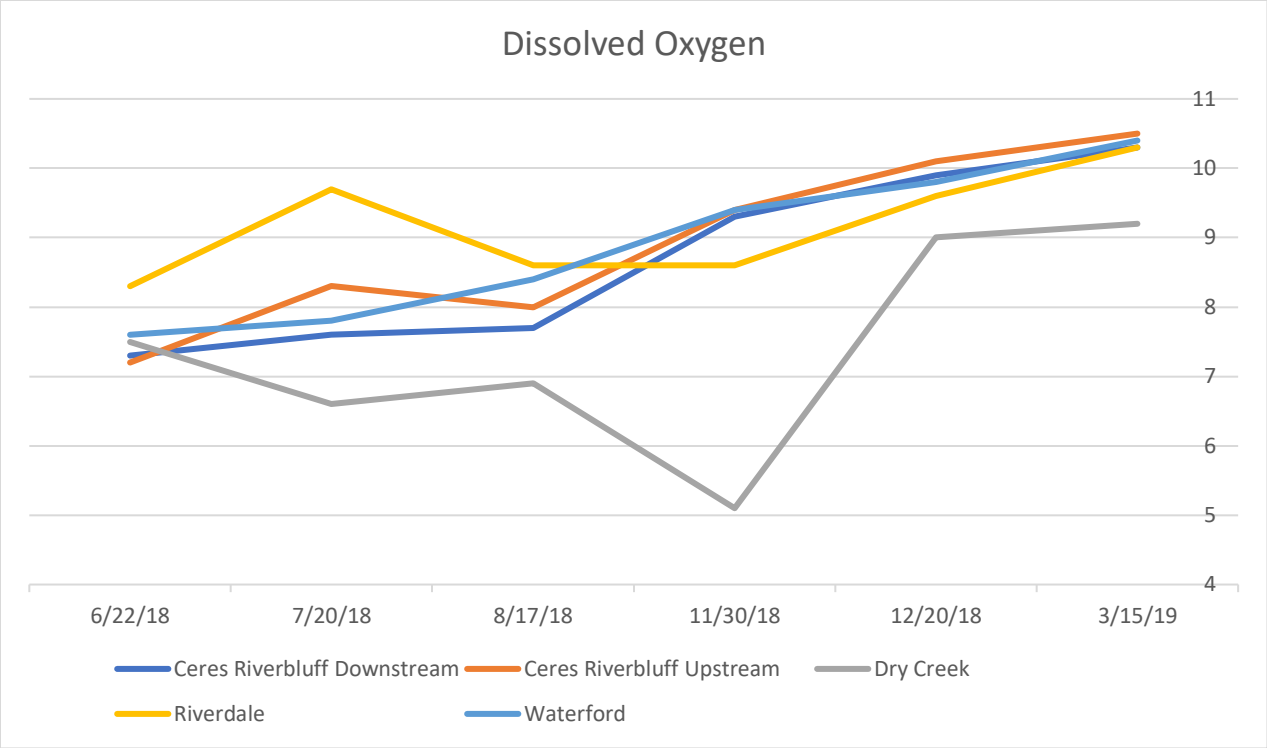

Figure 4

Dissolved oxygen represents the amount of oxygen present in the water. The chart above represents dissolved oxygen measured in Mg/L. The levels of dissolved oxygen were fairly consistent along the lower Tuolumne. Dry Creek's lower values are especially alarming. The lack of dissolved oxygen over a prolonged period of time can be problematic for aquatic life at this location.

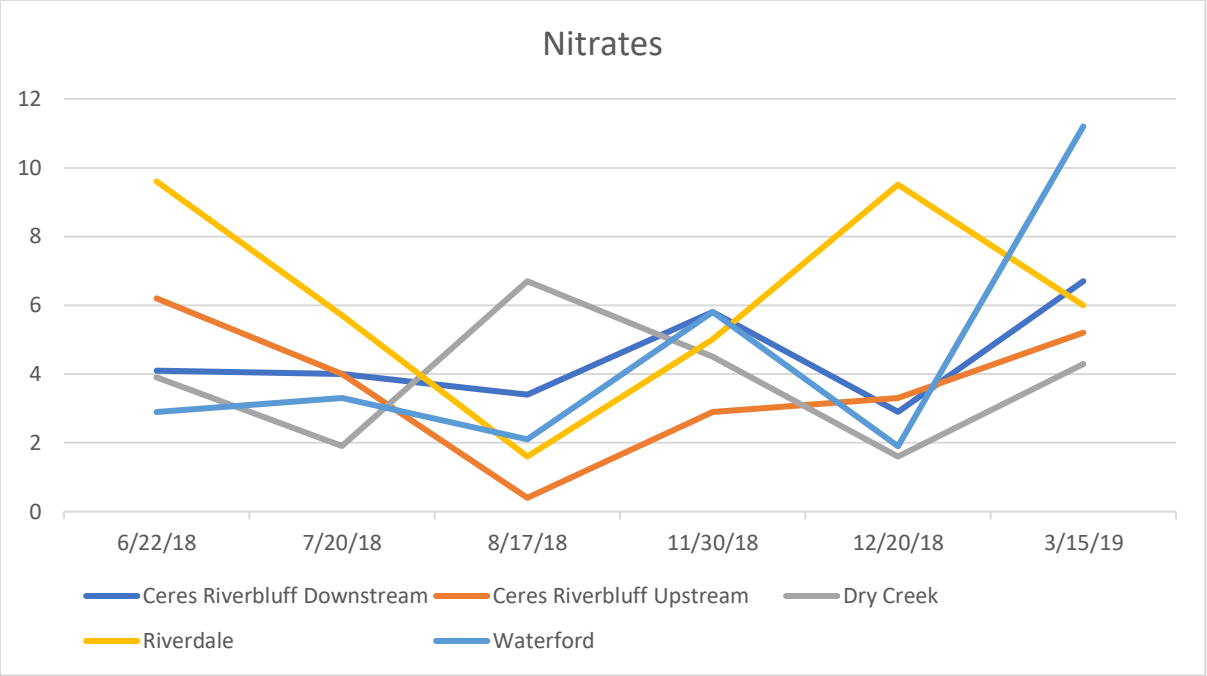

Figure 5

As seen in figure 5 the nitrate levels vary. Nitrates are typically the result of human activity. In order to fully understand the cause of varying nitrate levels, surrounding land use needs to be identified. The presence of nitrates is harmful for aquatic life as it can lead to algal blooms.

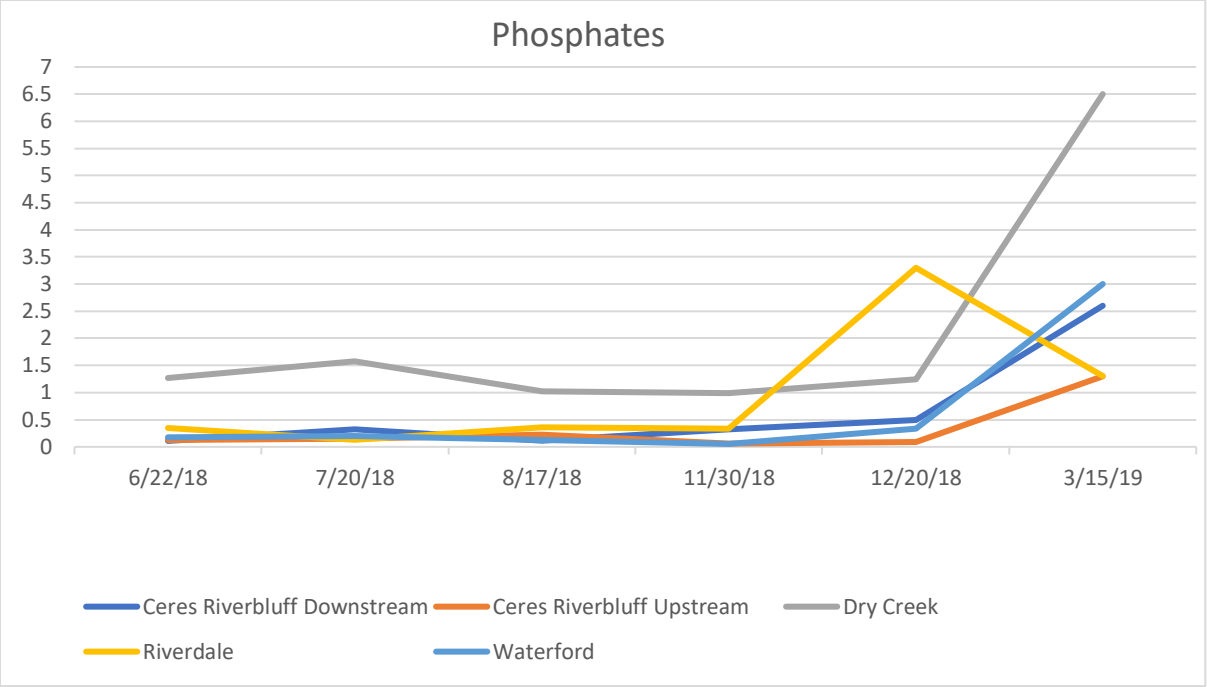

Figure 6

Figure 6 reports low levels of phosphate in the lower watershed through the end of the sampling dates. Like nitrates, phosphates are also linked to human use. The sharp increase in phosphates is similar to the increase in nitrates, with higher levels recorded near urban areas. This information indicates the need for land use maps, recording of weather events, and accurate flow data to identify the cause.

Community Outreach:

The Dos Rios days were successful. Over the course of two separate days,70 individuals gathered together to serve the river by restoring a natural floodplain habitat. Weeds were pulled around 40 juvenile Valley Oak trees which are native to the region but have declined in population due to land conversion. During the second restoration day, milkweed was planted at

a nesting site to encourage the return of monarch butterflies. Milkweed is typically removed from landscapes as it competes for space and nutrients from desired plants, such as crop products.

The increase in public awareness of the river in terms of recreation safety and habitat health has been positively impacted by this project. A five-day summer camp for riverside community youth was dedicated to river education. A river clean-up was conducted to minimize the amount of trash entering the watershed. Flora and fauna of the watershed were introduced while informing children of ideal conditions for their survival. The return of volunteers and questions asked during restoration events was an indicator of concern for the watershed.

This internship has taught me several skills that pertain to my USDA career path. The organization and management of this project has prepared me for planning complex projects throughout regions. I've understood the importance of adapting plans to fit regional needs so that the information collected is representative of the locations. By applying the data to an education program, I've understood the impact of outreach. Resources management is only effective if populations also change their approach to the watershed. Lastly, I've learned how complex watershed management can be with many different stake holders involved. The most valuable lesson this internship has taught me is how to be inclusive in terms of education and planning when planning and advocating for any type of resource management.

Conclusion

This project informs the public that the river impacts increase as the Tuolumne River moves west toward the confluence with the San Joaquin River. This information should be made available to the public so communities may make informed decisions on when and where

they should recreate. The establishment of a consistent surface water monitoring program would be extremely beneficial to the communities along the lower Tuolumne River.

Continuous data should be collected to monitor shifting pollution levels. With the placement of permanent monitoring structures, the data would yield an accurate representation of the lower watershed. Dry Creek and Riverdale park in Modesto should be especially monitored for future research as they report the highest impact. Both Dry Creek and Riverdale park are located within neighborhoods that have a playground as a park component. The importance to have water information available at these parks is of the most importance as they are frequently visited throughout the year regardless of changing seasons.

The data should also be used to begin conversations with stake holders concerning mitigation techniques. By informing entities that rely on a healthy river, such as irrigation districts and the agricultural community, strategic planning can begin to improve the conditions along the lower watershed.

Lastly, an updated land use map should be created of the Tuolumne River. The changing landscape from the Sierra Nevada, through the Central Valley, and into the San Francisco bay would provide insight as to what is contributing toward pollution. This map would help to identify what neighboring land is consistently associated with concentrated levels of pollution so that appropriate mitigation techniques could be applied. A land use map paired with the water quality data would also aid in all future planning for the Tuolumne River region in order to ensure safe surface water levels for current and future generations.

Image 1 Dos Rios Restoration Workday

Image 2 Dos Rios Restoration Workday

Image 3 Tuolumne River Community Recreation Canoeing Trip

Image 4 Youth Summer Camp River Clean Up

Image 5 Youth Volunteer During River Clean Up

Image 6 Youth Summer Camp Water Quality River Talk