

# NM WRRRI Student Water Research Grant Progress Report Form

Progress Report due Thursday, February 1, 2024

Draft Final Report due Monday, July 15, 2024

Final Report due Friday, August 30, 2024

1. Student Researcher: Dr. Sarah Cerra  
Faculty Advisor: Dr. Manoj Shukla

2. Project title: Monitoring of water quality, distance of flow, and biodiversity of Fairchild Spring at Oliver Lee State Park to engage Alamogordo youth education in water conservation

3. Description of research problem and research objectives.

Climate trends in New Mexico continue to show a decrease in surface water availability. Researchers across New Mexico are developing monitoring of surface and groundwater systems to work towards conservation solutions; however, the youth of our state will be the future of conservation of water in our state. Youth engagement in conservation, during a time of record youth apathy in education, is necessary to ensure students are driven to conserve water sources. Additionally, while the Next Generation Science Standards (NGSS) for science education in the state of New Mexico are phenomena based, many districts shy away from field trips, due to lack of funding. This research's objective is to allow youth to monitor a year-round flowing spring each month and determine changes in the spring given precipitation events and seasonal changes. Water quality testing of Fairchild Spring in Oliver Lee State Park occurs once a year. A second objective for this project is to collect monthly water quality and biodiversity data, giving state park officials a baseline for future research projects.

4. Description of methodology employed.

Once a month, 24 Advanced Placement (AP) Environmental Science students were taken to Oliver Lee State Park to collect water quality data, tracked the flow distance of water into Dog Canyon from Fairchild Spring, and observe flora and fauna in the riparian areas around the spring. Water quality data was tested in the field and included dissolved oxygen, pH, temperature, turbidity, nitrate, and phosphate levels using LaMotte Low-Cost Water Quality testing kits. The distance from the spring down the canyon creek was measured visually, by tracking where the surface water stopped in the canyon. Local weather data, including precipitation events were obtained from Alamogordo-White Sands Regional Airport through Weather Underground. Weather conditions on field trip days were recorded.

To further engagement of youth in Alamogordo, we invited two first grade classes (40 students) to join us on the April field trip and 16 AP Biology students joined the field trip in May. Two AP Environmental Science students participated in a STEM (Science, Technology, Engineering, and Math) summer camp, where 58 more students ranging from 6th to 11th grades could learn more about water testing at Oliver Lee State Park.

On June 8, 2024, two students collected samples from 6 locations at Oliver Lee State Park. On August 26, 2024, 43 new AP Environmental Science students collected samples from 11 locations along the stream. Students will continue to collect samples through the 2024-25 school year from these locations.

5. Description of results; include findings, conclusions, and recommendations for further research.

Student groups collected water samples from the same location each month through the study. Table one shows the average water quality of the 6 locations on the stream.

While air temperature and water temperature followed normal seasonal patterns, water quality did not fluctuate significantly, except on April 3<sup>rd</sup>, 2024. On March 30, 2024, a small wildfire (approximately 3 acres) occurred at the stream and surrounding canyon sides. We saw our water quality fluctuate due to the addition of pollutants from the fire, but the stream rebounded to its normal quality level by the next month, except electric conductivity.

**Table 1.** Average water quality from 6 locations along the stream from Fairchild Spring in Oliver Lee State Park. In August, 2024, sample locations increased from 6 to 11.

Date	Weather	Air Temp (*C)	Water Temp (*C)	Nitrate (ppm)	Phosphate (ppm)	pH (pH)	Turbidity (JTU)	Dissolved Oxygen (ppm)	Electric Conductivity ( $\mu$ S/cm)
August 25th, 2023	Sunny	25.6	22.2	5	1	8	0	8	1904
September 27th, 2023	Sunny	22	18.6	5	1	9	0	8	1930
October 18th, 2023	Sunny	19.4	16.3	5	1	8	0	8	1862
December 6th, 2023	Partly Cloudy	10	9	5	1	8	0	8	1860
January 10th, 2024	Sunny, Cold	5	4.6	5	1	8	15	8	1868
February 7th, 2024	Rainy, Cold	6.7	8.9	5	1	7	0	6	1856
March 6th, 2024	Partly Cloudy	14	11.5	5	1	8	0	8	1844
April 3rd, 2024	Sunny	10.6	12.6	15	2	5	0	2	2087
May 1st, 2024	Sunny	18.9	15.7	5	1	7	0	8	2050
June 8th, 2024	Sunny	34.4	23.9	5	1	8	0	8	2005
August 26, 2024	Sunny	26.7	21.9	5	2	7.5	0	8	1255

The class of 24 junior and senior high school students were surveyed in August and only one planned a future in environmental science. At the end of the school year, four additional students claim to want to go to school for environmental science, specifically in water. One student would like to consider a career in water law, after attending the 68th Annual Water Conference and finding out how complicated the laws surrounding water in New Mexico can be. One student will be chartering an environmental science club (The Green Club) in the next school year so students who cannot take AP Environmental Science can still learn more about how to make changes in our community and state. All 24 students expressed a new understanding of water issues in New Mexico and feel they now need to have a role in helping to solve water challenges in our state. The 24 students of the class taught 40 first graders about water quality and water conservation in collaboration with a local elementary school (Table 2). They also taught an additional 16 AP Biology students during a field trip to Oliver Lee State Park (Table 2). On one of the field trips

second grade and fifth grade classes were present and while this was not a planned collaboration activity, the students did have an opportunity to share with these students the reasons we were in the location. Two students also volunteered at Alamogordo Public Schools STEM camp June 3-7th, teaching another 58 students water quality testing and water conservation in southern New Mexico (Table 2). The 24 AP Environmental Science students discussed with their friends regarding the class and next year's enrollment has nearly doubled with 44 students currently registered for the 2024-25 school year, because this class had an opportunity to go outside every month and discover the environment of New Mexico. The youth of our community will be the future water managers in our community so it is important for them to discover now how they can assist in water conservation and protection of water quality.

Through collaboration with Holloman Air Force K12 Air and Space STEM Outreach, the importance of water conservation and water quality in southern New Mexico will become part of a lendable library curriculum for teachers in Otero and Lincoln counties. There are plans to help educators to add a short unit of water conservation to their curriculum in Tularosa and Cloudcroft, as well as additional Alamogordo schools.

**Table 2.** The total number of impacted students in this project was 138, ranging from first grade through twelfth grade from August 2023 through June 2024.

<b>Impacted Students</b>		
AP Environmental Science	24	9 trips + conference
1st Grade	40	1 trip
AP Biology	16	1 Trip
STEM Camp	58	1 "trip"
<b>Total</b>	<b>138</b>	

6. Provide a paragraph on who will benefit from your research results. Include any water agency that could use your results.

The primary beneficiaries of this research are the students impacted by the study. This project allowed for student engagement during class and allowed for students to consider their place in water conservation in New Mexico for their future education and career paths. We created opportunities for implementation of water quality testing across our school district. Additionally, Tularosa High School has reached out to participate in this project in the 2024-25 school year through their biology classes.

The secondary beneficiary is the staff at Oliver Lee State Park. Data from this project gives the staff at the park a baseline for future research in water quality and flow.

7. Describe how you have spent your grant funds. Also provide your budget balance and how you will use any remaining funds. If you anticipate any funds remaining after August 30, 2024, please contact Carolina Mijares immediately. (575-646-7991; [mijares@nmsu.edu](mailto:mijares@nmsu.edu))

The funds spent to this point allowed the students to attend the 68<sup>th</sup> Annual New Mexico Water Conference. This included registration for 20 students and 4 adults, bus transportation, hotel for one night, and meals (one dinner and one lunch).

		Amount Requested	Spent
Salary		\$0.00	0
Fringe		\$0.00	0
Insurance		\$0.00	0
Travel	WRRI 68th Conference- With Students 25 students and 2 chaperones	\$3,500.00	4015.76
	(includes hotel rooms [x10], bus and meals		
	A second conference during summer (AZ?)	\$1,000.00	0
Supplies	Poster for PI (one for each conference)	\$150.00	0
	Posters for youth (1/groupX8groups)	\$600.00	0
	LaMotte Water Monitoring Kits (8 kits)	\$480.00	0
	Measuring tape (x2)	\$40.00	0
Services		\$0.00	0
Equipment		\$0.00	0
Other		\$0.00	0
	TOTAL	\$5,770.00	1754.24

DOD STEM funding paid for the remainder of the supplies initially requested. Discussions to use the remaining funds to restock for the upcoming school year to continue the project were denied due to funds coming from another source.

8. List presentations you have made related to the project.
  - 68<sup>th</sup> Annual New Mexico Water Conference, Albuquerque NM, Poster presentation
  - APS School Board Presentation 11/15/2023
  - *In planning- School board presentation in October 2024*
  - *In planning- Poster Presentation at Water Innovations and Networking Workshop, October 2024*
  
9. List publications or reports, if any, that you are preparing. For all publications/reports and posters resulting from this award, please attribute the funding to NM WRRI and the New Mexico State Legislature by including the account number: NMWRRI-SG-FALL2023.
  
10. List any other students or faculty members who have assisted you with your project. In addition to the assistance by Dr. Manoj Shukla, Mrs. Heather Kangas (Holloman Air Force Base Air and Space STEM K12 Outreach Coordinator) collaborated in this project, by providing water quality kits to start the project and EC/pH monitors, and by accompanying the students on

each field trip. Additionally, Mrs. Jourjine Sab (Biology, Alamogordo High School), Mrs. Bonnie Onate (First Grade, Buena Vista Elementary School) and Ms. Misty Ferguson (First Grade, Buena Vista Elementary School) collaborated to ensure the lab testing we completed fit the NGSS or College Board standards for their students. Mrs. Jessica Lopez (Coordinator of Innovation and Learning Tech, Alamogordo Public Schools) assisted in collaboration for STEM camp through Alamogordo Public Schools.

11. Provide special recognition awards or notable achievements as a result of the research including any publicity such as newspaper articles, or similar.
12. Provide information on degree completion and future career plans. Funding for student grants comes from the New Mexico Legislature and legislators are interested in whether recipients of these grants go on to complete academic degrees and work in a water-related field in New Mexico or elsewhere.

My PhD in Water Science and Management from NMSU was completed in December 2023. This research was not in relation to my degree or the research of my degree, however, it is research I am very passionate about. The current New Mexico science standards for high school students include one standard that could pertain to water as a limited resource in New Mexico (HS-ESS-3.1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity). Teachers across our state could choose any way to teach this standard and may not consider the importance of the unsustainable water use in our state over the other also important issues involved in mineral and oil mining. Many of our students stay in New Mexico after graduation. Our school system does not give them a good basis of problems in New Mexico they will be inheriting. Currently, by providing high school students an opportunity to discover water quality and conservation issues in Alamogordo, I am helping these students consider their place in water conservation in New Mexico in the coming years. I do not plan to continue to teach high school. I would like to work at the state level, in the Office of the State Engineer to impact entire communities of people in their understanding of water conservation in New Mexico. I would also like to assist NMPED in developing additional standards or revamping current standards to better address the environmental and social problems New Mexico faces. While I would like to leave the teaching career path, I do to continue to advise our school's Green Club, which was started in the 2024-25 school year by a former AP Environmental Science Student.

APPENDIX I. Field trip photographs

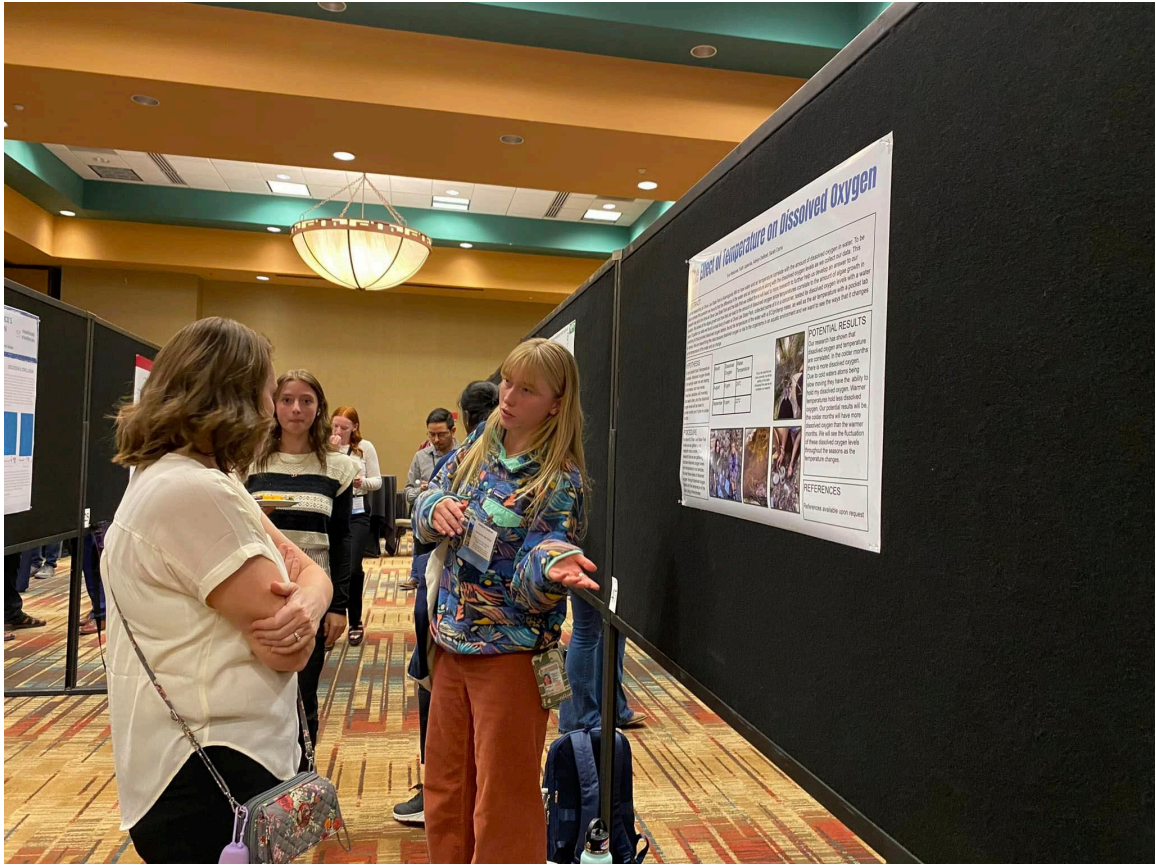


Figure 1. Students Adelynn DeBeof and Faith Laperuta explain their project at the 68th Annual NM Water Conference.





*Figure 2. 20 Alamo High School students attended and participated in the 68th Annual NM Water Conference*



*Figure 3. Students, Ryne Cerra and Abigail Anderson presented their group project at the 68th Annual NM Water Conference*



*Figure 4. Student, TeAnna Cordova asked questions during presentations at the 68th Annual NM Water Conference*





*Figure 5. 24 Alamogordo High School AP Environmental Science students went to Oliver Lee State Park 9 times throughout the school year to collect water quality data*





*Figure 6. Students, Charlotte Gross, Ryan Potchebski, Ryne Cerra and Abigail Anderson collected water quality data*





*Figure 7. AHS students, Sativa Vierra, Jay Amaya and Derian Sims teach first graders from Buena Vista Elementary to test water quality*