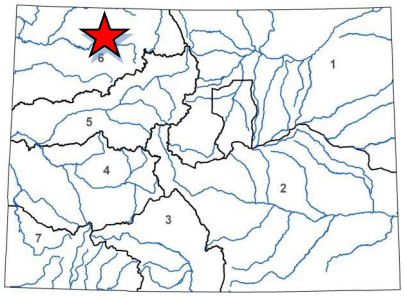
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Water Plan Grant Application

Enhancing Soil Moisture Observations to Support Water Resource Management in the Upper Yampa River Basin
The Regents of the University of CA, UCSD

March 2023 Board Meeting

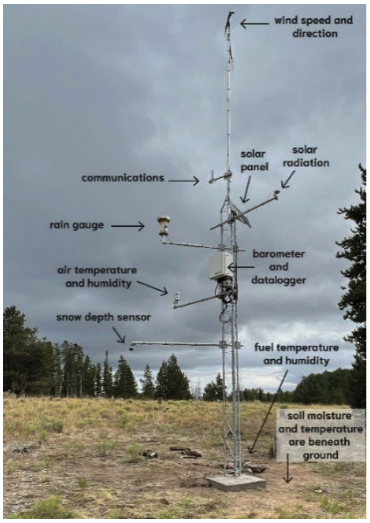
Lat: 40.485000
Long: -106.831700



LOCATION	
County/Counties:	Routt
Drainage Basin:	Yampa/White/Green

DETAILS	
Total Project Cost:	$864,980
Water Plan Grant Request:	$560,400
Funding Recommendation	**$560,400**
Other CWCB Funding:	$0
Other Funding Amount:	$304,580
Applicant Match:	$0
Project Type(s):	Study, Implementation, Capacity Building
Project Category:	Supply & Demand Gap, Conservation & Land Use
Measurable Result:	Eight soil moisture stations across the Yampa River basin, Soil moisture network data distribution

The Center for Western Weather and Water Extremes (CW3E) (a Center within Scripps Institute of Oceanography/ UCSD) in collaboration with local and regional partners is requesting funding to establish a soil moisture monitoring network in the Upper Yampa River Basin (YRB). In recent years, impacts of low reservoir levels in the basin are heightened due to the low accuracy of April-July inflow forecasts, making it difficult for resource managers to plan for supply. In snowmelt-dominated basins like the YRB, it is possible that dry soils are uptaking the snowmelt happening at the soil surface that otherwise would be observed as runoff. CW3E has experience developing soil moisture monitoring to understand these conditions and give tools to managers to mitigate the risks.



In 2021-2022 the Upper Yampa Water Conservancy District initiated a pilot project with and the Yampa Valley Sustainability Council and CW3E to identify data gaps and created a framework for building out a soil moisture monitoring network. A pilot monitoring station was installed in 2022 and continues to provide data.

This project will site and install eight new soil moisture stations. The stations will fill observation gaps while capturing a range of landscape and hydroclimate characteristics throughout the Upper Yampa watershed. CW3E will expand the YRB stakeholder network, set up user friendly data dissemination pathways, and work with partners to maximize station data utility. CW3E will provide the data in real-time and support integration of the information into stakeholder-operated management systems. A cross basin college intern program and annual stakeholder summits will share data, lessons learned, and best practices beyond the basin boundary.

Water Plan Support: *Action Areas*- Resilient Planning- Conduct integrated planning, Robust Agriculture- Support storage, Vibrant Communities- increase efficiency and conservation; *BIP IPP*- Yampa White Green Basin BRT Education Action Plan Implementation; *Supporting Plans*- Yampa River Integrated Water Management Plan

WPG Request: 65%
Matching funds: Colorado River District: $140,000; Yampa Valley Sustainability Council: $23,220; Upper Yampa Conservancy District: $100,000; Colorado Mountain College: $14,360; CW3E: $27,000

Funding Recommendation: Staff recommends Board approval of $560,400 to The Regents of the University of CA, USCD for the Enhancing Soil Moisture Observations to Support Water Resource Management of the Upper Yampa River Basin project.

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Water Plan

Water Project Summary

Name of Applicant	The Regents of the University of CA, Univ of CA San Diego
Name of Water Project	Enhancing Soil Moisture Observations to Support Water Resource Management in the Upper Yampa River Basin
Grant Request Amount	**$560,400.00**
Primary Category	$560,400.00
Conservation & Land Use Planning	
Total Applicant Match	**$0.00**
Applicant Cash Match	$0.00
Applicant In-Kind Match	$0.00
Total Other Sources of Funding	**$304,580.00**
Colorado River District	$140,000.00
YVSC	$23,220.00
Upper Yampa	$100,000.00
CMC	$14,360.00
CW3E - unrestricted funds	$27,000.00
Total Project Cost	**$864,980.00**

Applicant & Grantee Information

Name of Grantee: The Regents of the University of CA, Univ of CA San Diego
Mailing Address: 9500 Gilman Drive, Mailcode 0210 La Jolla CA 92093-0210
FEIN: 956,006,144

Organization Contact: April Fink
Position/Title:
Phone: (858) 534-1876
Email: afink@ucsd.edu

Organization Contact - Alternate: Fred Martin Ralph
Position/Title:
Phone:
Email: mralph@ucsd.edu

Grant Management Contact: April Fink
Position/Title:
Phone: (858) 534-1876
Email: afink@ucsd.edu

Description of Grantee/Applicant

Scripps Institution of Oceanography

Type of Eligible Entity

☐ Public (Government)
☐

- [ ] Public (District)
- [ ] Public (Municipality)
- [ ] Ditch Company
- [ ] Private Incorporated
- [ ] Private Individual, Partnership, or Sole Proprietor
- [ ] Non-governmental Organization
- [ ] Covered Entity
- [x] Other

Category of Water Project

- [ ] Agricultural Projects
  Developing communications materials that specifically work with and educate the agricultural community on headwater restoration, identifying the state of the science of this type of work to assist agricultural users among others.
- [x] Conservation & Land Use Planning
  Activities and projects that implement long-term strategies for conservation, land use, and drought planning.
- [ ] Engagement & Innovation Activities
  Activities and projects that support water education, outreach, and innovation efforts. Please fill out the Supplemental Application on the website.
- [ ] Watershed Restoration & Recreation
  Projects that promote watershed health, environmental health, and recreation.
- [ ] Water Storage & Supply
  Projects that facilitate the development of additional storage, artificial aquifer recharge, and dredging existing reservoirs to restore the reservoirs' full decreed capacity and Multi-beneficial projects and those projects identified in basin implementation plans to address the water supply and demand gap.

Location of Water Project

Latitude	40.485000
Longitude	106.831700
Lat Long Flag	
Water Source	
Basins	Yampa/White/Green
Counties	
Districts	

Water Project Overview

Major Water Use Type	
Type of Water Project	Capacity Building
Scheduled Start Date - Design	5/1/2023
Scheduled Start Date - Construction	

Description

The Center for Western Weather and Water Extremes (CW3E), Yampa Valley Sustainability Council (YVSC), Upper Yampa Water Conservancy District (UYWCD), and Colorado Mountain College (CMC) propose to work closely with local and regional water managers to add eight stations to a soil moisture monitoring station network in the Upper Yampa River Basin. The major objective of this network is to reduce uncertainty in seasonal snowmelt runoff predictions in the Upper Yampa by directly observing soil moisture in areas responsible for much of the runoff. This data collection will support water supply planning in a changing climate. For communication

and decision-making, we will partner with UYWCD, Colorado Water Trust, and Friends of the Yampa on including real-time data from these stations in a coordinated data dashboard under development for the Yampa River Basin. Data will also be used to conduct process-based studies for longer-term model and forecast improvement.

Measurable Results

New Storage Created (acre-feet)
New Annual Water Supplies Developed or Conserved (acre-feet), Consumptive or Nonconsumptive
Existing Storage Preserved or Enhanced (acre-feet)
New Storage Created (acre-feet)
Length of Stream Restored or Protected (linear feet)
Efficiency Savings (dollars/year)
Efficiency Savings (acre-feet/year)
Area of Restored or Preserved Habitat (acres)
Quantity of Water Shared through Alternative Transfer Mechanisms or water sharing agreement (acre-feet)
Number of Coloradans Impacted by Incorporating Water-Saving Actions into Land Use Planning
Number of Coloradans Impacted by Engagement Activity

Other

No additional measurable results provided

Water Project Justification

Colorado Water Plan and the applicable Roundtable Basin Implementation Plan and Education Action Plan. The Applicant is required to reference specific needs, goals, themes or Identified Projects and Processes (IPPs), including citations (e.g. document, chapters, sections or page numbers):

Overall, our justification centers on the CO Water Plan and the Roundtable's foundational interest in better understanding and communicating what is happening to water in the Basin in the face of climate change, which is the ultimate goal of our work.

Specifically, the Yampa White Green (YWG) Roundtable Basin Implementation Plan (BIP) identifies climate change as one of the biggest challenges facing the Basin. In the conclusions, they stress that climate change is a global challenge with the potential for significant local impacts. Already the YWG Basin may be experiencing warmer and drier conditions due to a shift in climatic conditions. A warmer and drier future will place more demands on the YWG Basin's water resources to sustain its people, plants, and animals, and require increasingly adaptive strategies and long-term resiliency. This challenge points out the importance to the Basin of understanding the impacts of climate change on water resources. In particular, our proposed work investigates the role soil moisture plays in regulating streamflow and annual water supply.

Similarly, the 2015 Colorado Water Plan acknowledges that "because of climate change, previous assumptions used for planning purposes are no longer sufficient." The Action Plan of the CWP specifically includes a step to "support innovative and collaborative science… [that will] lead to accurate quantification of the snowpack and runoff, regardless of the scenario." Changes in timing of melt and volume of snowpack are already apparent in Colorado mountain watersheds, and the CWP acknowledges the potential of these changes to impact water storage, diversions, and reservoir management. There are also several mentions of this in the Draft 2023 plan. First, as in Cross Sector Challenges: Since 2000, the Colorado Basin has been experiencing historic extended drought. The effects of drought and climate change affect water supply availability, ecosystems, industry, and agriculture. There are concerns with dry soil moisture conditions, earlier runoff, and aridification.
Also, Recommended Action 1.8 describes the development of a statewide spatial landscape feasibility

assessment for supply and demand drivers and mentions regional soil moisture measurement specifically as something that shows promise to significantly improve the reliability of water supply forecasts across Colorado. These types of tools have been used successfully at a regional scale but could potentially be even more useful if deployed on a statewide scale.

The Roundtable BIP also emphasizes increasing awareness of water challenges in the Basin. We specifically would like to cite New Objective 1 under Goal 8 (GOAL 8: Develop an integrated system of water use, storage, administration, and delivery to reduce water shortages and meet environmental and recreational needs.) This includes to foster public awareness of water scarcity challenges associated with climate change, and aligns with leveraged components in our project including the Yampa Basin Rendezvous, funded through other sources but participated in by all project partners, and the Annual Met Tech Summit.

Finally, the Roundtable has just adopted a more focused action plan under the BIP, called the Integrated Water Management Plan. This plan frames the challenges for the river in the context of climate change and warmer and drier conditions. Two recommendations in this plan relate to our proposal: 1) Form Yampa River dashboard & information database: Develop a “Yampa River Dashboard” for use by stakeholders as a one stop location for information related to water management such as: status of snowpack, current climate conditions, soil moisture data, gage data, water quality data, etc. Our project will increase near real time availability of soil moisture and other climate data for inclusion on the Dashboard; and 2) Implement hydrology monitoring plan: Work to install high priority gauging stations by confirming partners, identifying funding, and pursuing needed permits While this recommendation is specific to stream gauges, it does speak to the interest of the Roundtable in better understanding hydrological conditions to support decision making, which will be supported by our stations.

Related Studies

Hatch, T., Garlick, C and Macfarlane W.W. Predictions for 2020 and 2100 hydrologic regimes: Yampa River Basin, Colorado. Prepared for Sponsor. Utah State University Wheaton Ecogeomorphology & Topographic Analysis Lab. Logan, UT. (2020) 13 Pages.

Ralph, F., Dettinger, M., White, A., Reynolds, D., Cayan, D., Schneider, T., Cifelli, R., Redmond, K., Anderson, M., Gherke, F., Jones, J., Mahoney, K., Johnson, L., Gutman, S., Chandrasekar, V., Lundquist, J., Molotch, N., Brekke, L., Pulwarty, R., & Wick, G. (2014). A Vision for Future Observations for Western U.S. Extreme Precipitation and Flooding. Journal of Contemporary Water Research & Education, 16–32. https://doi.org/10.1111/j.1936-704X.2014.03176.x

Sumargo, E., Wilson, A. M., Ralph, F. M., Weihs, R., White, A., Jasperse, J., Asgari-Lamjiri, M., Turnbull, S., Downer, C., & Delle Monache, L. The Hydrometeorological Observation Network in California’s Russian River Watershed: Development, Characteristics, and Key Findings from 1997 to 2019, Bulletin of the American Meteorological Society, 101(10), E1781-E1800. (2020) https://journals.ametsoc.org/view/journals/bams/101/10/bamsD190253.xml

Ficklin DL, Stewart IT, Maurer EP (2013) Climate Change Impacts on Streamflow and Subbasin-Scale Hydrology in the Upper Colorado River Basin. PLoS ONE 8(8): e71297. https://doi.org/10.1371/journal.pone.0071297

Milly, P. C. D., & Dunne, K. A. (2020). Colorado River flow dwindles as warming-driven loss of reflective snow energizes evaporation. Science, 367(6483), 1252–1255. https://doi.org/10.1126/science.aay9187

Li, D., M. L. Wrzesien, M. Durand, J. Adam, and D. P. Lettenmaier (2017), How much runoff originates as snow in the western United States, and how will that change in the future?, Geophys. Res. Lett., 44, 6163–6172, https://doi:10.1002/2017GL073551

Williams, A.P., Cook, B.I. & Smerdon, J.E. Rapid intensification of the emerging southwestern North American megadrought in 2020–2021. Nat. Clim. Chang. 12, 232–234 (2022). https://doi.org/10.1038/s41558-022-01290-z

Esit, M., Kumar, S., Pandey, A. et al. Seasonal to multi-year soil moisture drought forecasting. npj Clim Atmos Sci 4, 16 (2021). https://doi.org/10.1038/s41612-021-00172-z

Koster, R., Mahanama, S., Livneh, B. et al. Skill in streamflow forecasts derived from large-scale estimates of soil moisture and snow. Nature Geosci 3, 613–616 (2010). https://doi.org/10.1038/ngeo944
Penna, D., Tromp-van Meerveld, H. J., Gobbi, A., Borga, M., and Dalla Fontana, G.: The influence of soil moisture on threshold runoff generation processes in an alpine headwater catchment, Hydrol. Earth Syst. Sci., 15, 689–702, (2011). https://doi.org/10.5194/hess-15-689-2011
Lukas, Jeff, and Elizabeth Payton, eds. Colorado River Basin Climate and Hydrology: State of the Science. Western Water Assessment, University of Colorado Boulder. (2020). https://doi.org/10.25810/3hcv-w477

Taxpayer Bill of Rights

No Tax Bill of Rights provided