



## **Monitoring in the Amargosa Watershed: Groundwater, Seeps/Springs, Precipitation, and Evapotranspiration**

The hydrology of the Wild and Scenic Amargosa River is complex and, although progress has been made, remains little studied. Over the past 5 years, collaborative studies funded by the USGS, BLM, Nye and Inyo Counties, The Nature Conservancy, Amargosa Conservancy, and the County of Inyo have made significant progress in understanding this groundwater-dependent system. The timing and need for additional work is critical—the solar renewables industry is planning to site numerous utility-scale plants in the bi-state Amargosa River drainage that will rely on groundwater, and the BLM is developing a Wild And Scenic River Comprehensive Management Plan for the California Amargosa River reaches where perennial flow supports a wide variety of rare and sensitive species including the critically endangered Amargosa Vole. This project will benefit the disadvantaged communities of Tecopa and Shoshone, California, by providing a more thorough understanding of the groundwater resources on which these communities depend. Besides these disadvantaged communities, the project will provide statewide benefits through compliance with the state-mandated groundwater basin monitoring program and will benefit recreation through protection of the Wild and Scenic portion of the Amargosa River. Furthermore, the work proposed here will improve knowledge about groundwater recharge in various situations and seasons, which in turn will provide information that can help in improved management of water resources in times of drought.

This request for funding will allow the expansion and continuation of this vital work to ensure that the groundwater system can be adequately understood and protected, renewables facilities are adequately sited and mitigated, and the BLM's plan asserts rights to the river and groundwater needed to protect this unique desert ecosystem. The proposed new wells will assist Inyo County to comply with mandates of the state to monitor the Amargosa Groundwater Basin (and surrounding basins) and will provide a much needed basis for groundwater management in the basin. A total of \$300,000 in new funds is requested for the work described in 1 and 2 below. These funds will be used to match USGS, BLM, and Nature Conservancy funding to support this work. An additional \$209,949 in new funds is requested to site, install and monitor the six new wells described in 3 below. The total amount sought is \$462,146. Each of these tasks (with the exceptions of Tasks 1 and 2 and the reporting task) are stand-alone items.

In summary, the work would consist of the following three main efforts:

1. Evapotranspiration (ET) work conducted by the USGS. ET towers would be purchased and erected. Data would be collected and analyzed, and a report prepared. These data will be used to refine previous estimates of annual groundwater discharge by ET which is essential to developing a water balance for the river. (\$200,000 in grant funds matched by \$200,000 of USGS funds.)



2. Continuation and extension of the work performed in the past sponsored by The Nature Conservancy and Amargosa Conservancy. This would include setting up a precipitation station in the Kingston Mountains and continuation of periodic spring and well monitoring, river gaging and analysis, and compilation of data.
3. Site, install, and develop up to six monitoring wells. Each monitoring well will be sampled for geochemical constituents and will be equipped with a pressure transducer and data logger. One year of data collection and reporting is included in this project. This well network will improve monitoring and understanding of regional groundwater flow in a region where data are sparse and numerous regulatory and scientific data gaps exist.

### **Detailed Tasks**

#### **SPRING SURVEY DATA COLLECTION EVENTS FOR ONE YEAR**

Periodic surveying of a select group of springs around the Amargosa River has been ongoing since May 2011, the goal of which is to identify trends in spring flow and water quality and condition potentially related to both environmental (e.g. seasonal changes) and anthropomorphic (e.g. groundwater pumping) changes. Additional data collected during these surveys include groundwater levels in wells, Amargosa River seepage runs within the perennial reach, and overall extent of River flow. Ideally, these survey events would take place quarterly so data can be collected during environmental extremes (i.e. summer and winter) and during the transition between them (i.e. spring and fall) as it is important to distinguish changes related to the environment vs. those that are man-made. These data then form the foundation for an identification or evaluation of impact due to future water development projects. (\$39,780 of grant funds requested).

#### **SHOSHONE RAIN GAUGE**

It is thought that a significant source of water to the Amargosa River is derived from precipitation falling on the Kingston Range. The water from the Kingston Range is potentially the source of water in China Ranch Wash and for the springs found along the eastern face of Amargosa Canyon. There is currently a weather station operated by Desert Research Institute operating in the Kingston Range; however, recharge estimation involves the relationships of precipitation and elevation. A weather station in Shoshone would provide needed low elevation data for the area. We propose to install a rain gauge which will capture rainfall volumes within the Range, and by extension allow the calculation of the potential volume of water available for flow to the Amargosa River. The gauge installed would be NOAA compliant-with automated data collection. (\$15,500 of grant funds requested)

#### **ESTIMATING EVAPOTRANSPIRATION DISCHARGE ALONG AMARGOSA RIVER (U.S.G.S. TASK)**

Base flow accounts for only about 20 percent of total groundwater discharge-evaporation from bare



soil surfaces, and evapotranspiration by phreatophytic vegetation consumes the remaining 80 percent. Federal, County, and conservancy organizations all have a resource management interest in the study area; each have recognized that a more accurate estimate of groundwater discharge by evaporation and evapotranspiration will improve 1) quantification of the water budget of the Amargosa River system; 2) characterization of groundwater flow patterns in the region; and 3) provide data to scientifically support a foundation for a federal reserved water right. Resource agencies or conservancies such as Inyo County, Nye County, The Nature Conservancy, Amargosa Conservancy, and the Bureau of Land Management can use these data and information to develop more representative monitoring networks and manage or mitigate up-gradient influences on the quantity and quality of discharge along the Wild & Scenic Amargosa River area and associated ecosystems.

Groundwater discharge rates will be quantified with concurrent measurements of evapotranspiration, precipitation, and soil moisture for two years using two micrometeorological stations consisting of eddy-covariance and energy-balance sensors. The operational duration for each site will depend on first year results. High-resolution remotely-sensed multispectral imagery will be used to define the extent, density, and diversity of riparian vegetation within groundwater discharge areas, and will be used to up-scale measured groundwater discharge rates to the entire National Wild and Scenic Amargosa River area. (\$200,000 of grant funds requested)

### **REGIONAL MONITORING WELL INSTALLATIONS**

This project will construct and monitor for one year a network of six groundwater monitoring wells in the southeast portion of Inyo County. These wells will be located in the Middle Amargosa, Pahrump, Mesquite, and California groundwater basins. Groundwater flow in this region is complicated by the presence of interbasin flow through the mountain blocks between basins, and these wells will aid in understanding groundwater flow in the region. These wells will also assist in implementing the state-mandated California State Groundwater Elevation Monitoring Program; they will monitor regional groundwater flow that is tapped in the Tecopa/Tecopa Hot Springs area for water supply; they will assist in monitoring groundwater flow that supplies water to the federally-designated Amargosa Wild and Scenic River Corridor; they will assist the numerous parties in monitoring the increase in groundwater use by anticipated solar power generating facilities; and they will assist in monitoring the affect that overdraft in the Nevada portion of Pahrump Valley is having on California. Because of the multiple stakeholders with interest in groundwater monitoring in this area, it is anticipated that the initial one year of monitoring provided for in this proposal will lead to a long-term monitoring program that includes these wells. (\$201,866 of grant funds requested)

### **ADDITIONAL INFORMATION**

- CASGEM is the only required element from the Prop. 84 IRWM Guidelines that applies to this project. Inyo County is the lead agency for CASGEM in the Amargosa Basin and



surrounding basins, and the work proposed here will help the County move towards compliance in these basins.

- If needed, the main elements of this proposal could be separated into individual projects (or “phased”).
- The Amargosa Conservancy received a Round 1 Implementation Grant in 2011 for the Tecopa Water Feasibility Study, which provided information about groundwater immediately under the town of Tecopa (including Tecopa Hot Springs) and developed a list of options for treating the water to drinking water standards.
- The work proposed here will help the communities of the Amargosa Watershed by providing more information about the amount and quality of the groundwater resources on which they depend for everyday water use. If this project helps to ensure the sustainability of these groundwater resources, then it will help the IRWM region to meet the Human Right to Water.

### **SCHEDULE**

All work exclusive of the evapotranspiration investigation would begin by April 1, 2016 and be completed by May 31, 2017. The evapotranspiration investigation could begin by April 1, 2016 and would be completed (inclusive of preparation of a report) during fiscal year 2020.



**BUDGET**

<b>Project Budget</b>					
<b>Amargosa Basin Water, Ecosystem Sustainability and Disadvantaged Community</b>					
<b>Project _____</b>					
Project serves a need of a DAC?: Yes					
Funding Match Waiver request?: <b>Yes</b>					
		(a)	(b)	(c)	(d)
Category		Requested Grant Amount	Cost Share: Non-State Fund Source* (Funding Match)	Cost Share: Other State Fund Source*	Total Cost
<b>(a)</b>	Direct Project Administration				
	Task 1: Administration	\$23,107	\$0		\$23,107
	Task 2: Labor Compliance Program	\$4,000	\$0		\$4,000
	Task 3: Reporting	\$14,810	\$0		\$14,810
<b>(b)</b>	Land Purchase/Easement	\$0 (1)	\$0	\$0	\$0
<b>(c)</b>	Planning/Design/Engineering/Environmental Documentation				
	Task 4: Assessment and Evaluation	0 (2)	\$0	\$0	\$0
	Task 5: Permitting and Environmental Documentation (3)	\$10,426	\$0	\$0	\$10,426
<b>(d)</b>	Construction/Implementation Contingency				
	Task 6: Hydrologic Monitoring (springs/river/water levels/Shoshone station)	\$55,280	\$0	\$0	\$55,280
	Task 7: Groundwater Monitoring Wells	\$176,630	\$0	\$0	\$176,630
	Task 8: Evapotranspiration Investigation (inc. separate report)	\$200,000	\$200,000	\$0	\$400,000
<b>(e)</b>	Environmental Compliance/Mitigation/Enhancement	\$0 (2)	\$0	\$0	\$0
<b>(f)</b>	Construction Administration	\$0 (2)	\$0	\$0	\$0
<b>(g)</b>	Proposal Costs inclusive of Program Office Proposal Coordination	\$12,800	\$0	\$0	\$12,800
<b>(h)</b>	Construction/Implementation Contingency	\$0 (2)	\$0	\$0	\$0
<b>(i)</b>	<b>Grand Total</b> (Sum rows (a) through (h) for each column)	<b>\$497,053</b>	<b>\$200,000</b>	<b>\$0</b>	<b>\$697,053</b>

(1) No tasks under this budget category

(2) No costs for this task, completed as part of grant application process.

(3) Permitting costs for evapotranspiration study included in budget category (d).