

From: Austin Osborne [<mailto:aosborne@storeycounty.org>]
Sent: Tuesday, February 09, 2016 4:21 PM
To: 'Ed James'
Cc: Mike Nevin
Subject: 2016 Season Abatement

Hello Ed,

Attached is a letter from DVCD requesting \$14,000 for 2016 noxious weed abatement for the Carson River watershed area of Storey County. Do you know if the CWSD may be able to contribute \$5,000 to the project like last year? I am happy to discuss this with you anytime as you wish. Thank you and see you soon.

Austin

Austin Osborne, PHR, SHRM-CP
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Storey County Courthouse
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CARSON WATER SUBCONSERVANCY DISTRICT REQUEST FOR FUNDING

APPLICANT: Lahontan Conservation District
 Name
111 Sheckler Road
 Address
Fallon Churchill Nevada 89406
 City County State Zip Code

APPLICANT'S AGENT:
Bill Washburn – Chairman
 Name
111 Sheckler Road
 Address
Fallon Churchill Nevada 89406
 City County State Zip Code

PROJECT NAME: Lower Carson River Clearing and Snagging

PROJECT LOCATION: Lower Carson River below Diversion Dam

PROJECT DESCRIPTION: Briefly describe the project. Provide maps, drawings, photographs or other information. Additional sheets may be attached.

- Continue with a long-term monitoring program on the lower Carson River.
- Remove dead vegetation and debris restricting channel capacity.
- Beaver and beaver dam removal to improve water flow in the channel.

PROJECT BENEFITS: Briefly describe the benefits to be realized if the project is implemented. Additional sheets may be attached.

Having a steady stream flow will reduce any erosion and will help reduce the change of the water system caused by obstruction in the river. It will reduce the potential of flood, improve channel capacity, provide safety to the community in the flood zone, and improve the functionality and management of the lower Carson River.

TOTAL ESTIMATED PROJECT COST: \$40,000.00

AMOUNT REQUESTED FROM CWSD: \$20,000.00

SOURCE OF OTHER FUNDS: List all other sources of funds to be used to match funds requested from CWSD. List the provider of the matching funds and the amount requested from each provider.

Grant Funding:

Churchill County Grant Funding

\$ 5,000.00

In-kind Match:

Lahontan Conservation District Administration & Equipment	\$6,400.00
Landowners Equipment and Labor	\$8,600.00
TOTAL:	\$20,000.00

ESTIMATED DATE PROJECT TO BEGIN: July 1, 2016

ESTIMATED TIME TO COMPLETE PROJECT: June 30, 2017


REQUIRED APPROVALS: List all permits, licenses and approvals, if any, that are required to complete the project. Provide the current status of each approval required. If approval has not been requested or is in progress, provide the estimated date on which approval can be expected. Additional sheets may be attached.

Permit with the Nevada Division of Environment Protection.

- Permit/Invoice#: GNV980000260006
- Permit type: General Water way
- Valid from July 1, 2015 to June 30, 2016

OTHER INFORMATION: Provide any other information that may be important to the approval of this application.

The Lahontan Conservation District has continued with channel clearing, snagging and debris removal projects along the Carson River. The Lahontan Conservation District hired the Nevada Division of Forestry prison crews and Churchill County Mosquito and Weed Abatement to remove dead and fallen trees, remove beaver dams, and burn slash piles to improve river flow, along the lower Carson River.

SIGNED: 
NAME: Bill Washburn
TITLE: Chairman, Lahontan Conservation District
DATE: January 28, 2016

THE CARSON WATER SUBCONSERVANCY DISTRICT RESERVES THE RIGHT TO DENY ANY AND/OR ALL APPLICATIONS FOR FUNDING.

Crews Clearing Debris along River on Bell Property and Lovelock Hwy Bridge

2016



CARSON WATER SUBCONSERVANCY DISTRICT REQUEST FOR FUNDING

APPLICANT:			
<u>Fayth Ross Sierra Nevada Journeys</u>			
Name			
<u>190 East Liberty Street</u>			
Address			
<u>Reno</u>	<u>Washoe</u>	<u>NV</u>	<u>89501</u>
City	County	State	Zip Code
<u>Fayth@SierraNevadaJourneys.org</u>	<u>775.355.1688</u>		
Email	Telephone #		

APPLICANT'S AGENT (if different from Applicant):

Name _____

Address _____

City _____ County _____ State _____ Zip Code _____

Email _____ Telephone # _____

PROJECT NAME: Providing “Family Watershed Nights” for Carson River Watershed Communities

PROJECT LOCATION/ADDRESS: TBD / 5 schools in Carson City, Minden, and/or Douglas counties

PROJECT DESCRIPTION: Briefly describe the project. Provide maps, drawings, photographs or other information. Additional sheets may be attached.

Funding from the Carson Water Subconservancy District (CWSD) will serve over 500 children and their parents in communities within the Carson River Watershed with five community-building and educational events called “Family Watershed Nights.” Family Watershed Nights invite K-6 students, their parents, and siblings to attend a fun, family-friendly evening which provides watershed education at the family level and reinforces STEM concepts learned in the classroom. Through hands-on activities, participants will gain a sense of ownership and stewardship for the health of their community watershed.

See attached for further information.

PROJECT GOALS AND BENEFITS: Briefly describe the project goals and benefits to be realized if the project is implemented. Additional sheets may be attached.

Through programs led by SNJ's credentialed science teachers and with the assistance of our volunteer program, we will be successful in meeting the following goals:

1. Provide five watershed family events for five schools within the Carson River Watershed including Carson City, Minden, and/or Douglas counties;
2. Assess, evaluate, and refine watershed stations and develop a new station specific to the Carson River Watershed Map, which will also be provided to all participants;
3. Engage 500 individuals (students, parents, and siblings) in hands-on watershed-themed activities; and,
4. 100% of participants will gain hands-on experience with:
 - a. Various watershed models;
 - b. Defining current issues impacting the Carson River Watershed; and.

c. Identifying solutions and ideas for helping to protect local watersheds.

See attached for project benefits.

TOTAL ESTIMATED PROJECT COST: \$5,195

AMOUNT REQUESTED FROM CWSD: \$3,900

SOURCE OF OTHER FUNDS: List all other sources of funds to be used to match funds requested from CWSD. List the provider of the matching funds and the amount requested from each provider.

NV Energy Foundation: \$1,295

ESTIMATED DATE PROJECT TO BEGIN: August 2016

ESTIMATED TIME TO COMPLETE PROJECT: June 2017

(If completion date is greater than a year, please indicate how much funding is needed in each fiscal year.)

PERMIT REQUIREMENTS: If your project requires a permit, license and/or approval from a governmental agency to proceed, please provide the current status of each requirement. If approval has not been requested or is in progress, please provide the estimated date on which approval can be expected. Additional sheets may be attached.

N/A

OTHER INFORMATION: Provide any other information that may be important to the approval of this application.

If funded, the Carson Water Subconservancy District will be highlighted as the sole sponsor of the five Family Watershed Nights; the CWSD will be recognized by hundreds of school and community members. SNJ will also distribute the Carson River Watershed Map to all participating students and families. If interested, CWSD volunteers are needed and welcome to assist at the various activity stations during the evening. CWSD will be thanked publically from the podium and if an official representative is present, can join SNJ staff at the podium in welcoming students and their families to the event. If desired, CWSD can have a designated table and offer their own activity during the event.

SIGNED:



NAME: Fayth Ross

TITLE: Associate Director of Development

DATE: Feb. 7, 2016

THE CARSON WATER SUBCONSERVANCY DISTRICT RESERVES THE RIGHT TO DENY ANY AND/OR ALL APPLICATIONS FOR FUNDING.

Providing “Family Watershed Nights” for Carson River Watershed Communities

A Proposal to the Carson Water Subconservancy District

Project Description (continued)

Sierra Nevada Journeys (SNJ) respectfully requests funding from the Carson Water Subconservancy District (CWSD) in support of five “Family Watershed Nights” to select schools in Carson City, Minden, and/or Douglas counties. K-8 students and their families will participate in a two-hour event that fosters engagement, curiosity, innovation, and teamwork, all focused on the STEM fields and watershed education. Students and their parents and siblings attend this family event at no charge and enjoy various activity stations that include mini-challenges and family-based team projects.

Last year, CWSD funded the development and implementation of 3-4 watershed-focused mini-challenges for 3 “Family Watershed Nights.” This coming year, with continued support from CWSD, SNJ will work to serve an increased number of schools; assess, evaluate, and refine current watershed-focused stations; and, develop a new interactive station specifically related to the Carson River Watershed Map. This map will also be provided to all participants.

SNJ will measure the success of these “Family Watershed Nights” by the number of attendees, engagement of the participants, and feedback from the educators at the school sites. Students are evaluated by the worksheets they complete with their family during the event, often for extra credit by their teacher.

SNJ Family Nights are an established program offering. We have successfully conducted over 75 Family Nights over the last six years with participation ranging between 50-250 attendees at each event. Our program consistently receives high marks from parents, students, teachers, and principals for being fun, professional, and informative.

Project Benefits (continued)

Recent studies show that American children are only spending 30 minutes of unstructured time outdoors each week¹. The lack of exposure to the natural world negatively impacts our local environment. In fact, although Nevada has one of the largest public land systems in the nation, it also has the 4th most urban population base. Unfortunately, children’s experiences with nature have been radically reduced, decreasing the understanding of an individual’s role and impact in their environment. While people are more likely to care for the environment if they are exposed to it as children, youth exposure to the outdoors has decreased in recent years².

In our own pre-assessments, we have found that only 25% of students could list one way to protect their own watershed and describe why it would be helpful. This illustrates that children are not learning about local issues facing their local watersheds and what they can do to prevent further degradation of the river ecosystem.

¹ Oliver R. W. Pergams and Patricia A. Zaradic. “Videophilia: Implications for Childhood Development and Conservation”, *The Journal of Developmental Processes* 2:1, 2007.

² Chawla, L. Cushing, D.F. “Education for strategic environmental behavior”, *Environmental Education Research*, 13:1. 2007.

Sierra Nevada Journeys' "Family Watershed Nights" provide a unique family-based watershed education program. We know that parent engagement is critical to student success, particularly in low-income homes. Children from diverse cultural backgrounds tend to do better when parents and professionals collaborate to bridge the gap between the culture at home and the learning institution. Schools and teachers need support in reaching out to the families of their students. This is where Sierra Nevada Journeys can help bridge the gap.

SNJ's "Family Watershed Nights" address a crucial concern and provide knowledge and awareness of water issues at the family level. Our initiative helps engage students and their families by encouraging them to adopt environmental stewardship practices aimed at reducing point-source water pollution. Through fun and hands-on activities, students and their families learn more about their local watershed and become better stewards of the Carson River. Beyond the environmental impact, SNJ's Watershed Family Nights also:

- Involve parents in their child's education, regardless of their own education level, ethnicity, and socio-economic status;
- Use hands-on science as the vehicle for exploration, which provides a language-neutral context;
- Provide a meaningful family activity that is linked to learning, building on parent's instinctual desire to help their child's academic success;
- Help forge a sense of trust between the school and the families, encouraging families to become involved in their child's school; and,
- Provide a means for the local community to engage in helping support low-income children and their success in learning.

In addition to our qualified staff with a combined teaching experience of over 23 years, we also have a volunteer model in place in which we can seamlessly integrate volunteers into our Family Watershed Night. A rich experience for the volunteers, assisting at an SNJ Family Night provides another interaction point between the community and the school.

Accomplishments through 2015 CWSD Funding

Thanks to funding from CWSD, SNJ has completed one Family Watershed Night with two more scheduled to be completed by the end of the grant period.

The event took place on November 19th, 2015 at JC Fremont Elementary, a low-income school in Carson City. SNJ, in accordance with Title I eligibility guidelines, defines low-income schools as having 40% of students qualifying for free and reduced lunch (FRL), a federally funded meal program that provides low-cost or free lunches to students from low-income families. Nearly 60% (59.68%) of the students from Fremont Elementary qualify for FRL.



During the "Family Watershed Night" students, their parents, and siblings participated in an interactive 1.5 hour event. The event included mini challenges (solved at family's own pace/interest level) and then a family-based competitive challenge. Attendees explored various watershed models and defined and discussed solutions for issues impacting the Carson River Watershed. Two-hundred people attended (which is a great turnout!). This included students, their parents, and any siblings that came along.

**CARSON WATER SUBCONSERVANCY DISTRICT
REQUEST FOR FUNDING**

APPLICANT: Churchill County, c/o Eleanor Lockwood, County Manager
Name
155 N. Taylor St., Ste 153
Address
Fallon Churchill NV 89406
City County State Zip Code
countymanager@churchillcounty.org (775) 423-5136
Email Telephone #

APPLICANT'S AGENT (if different from Applicant):
Chris Mahannah, P.E. Mahannah & Associates, LLC
Name
P.O. Box 2494
Address
Reno Washoe NV 89505
City County State Zip Code
chris@mah2o.com (775) 323-1804
Email Telephone #

PROJECT NAME: Dixie Valley Water Level Measurement & Precipitation Gage Monitoring Program

PROJECT LOCATION/ADDRESS: Dixie Valley – Churchill County

PROJECT DESCRIPTION: Briefly describe the project. Provide maps, drawings, photographs or other information. Additional sheets may be attached.

See attached Exhibit A & copy of Bureau of Reclamation Dixie Valley Plan of Study, dated May 2009

PROJECT GOALS AND BENEFITS: Briefly describe the project goals and benefits to be realized if the project is implemented. Additional sheets may be attached.

See attached Exhibit A & copy of Bureau of Reclamation Dixie Valley Plan of Study, dated May 2009

TOTAL ESTIMATED PROJECT COST (3 years): \$91,000.00
AMOUNT REQUESTED FROM CWSD (3 years): \$70,000

SOURCE OF OTHER FUNDS: List all other sources of funds to be used to match funds requested from CWSD. List the provider of the matching funds and the amount requested from each provider.

Dr. Justin Huntington with the DRI is currently investigating other funding or grant sources which may be leveraged to assist with project funding.

Churchill County will provide matching funds over the 3 year period in the amount of: \$21,000

ESTIMATED DATE PROJECT TO BEGIN: 7/1/16

ESTIMATED TIME TO COMPLETE PROJECT: 6/30/19

(If completion date is greater than a year, please indicate how much funding is needed in each fiscal year.)


FY16/17: \$31,000; FY17/18: \$28,000; FY18/19: \$32,000

PERMIT REQUIREMENTS: If your project requires a permit, license and/or approval from a governmental agency to proceed, please provide the current status of each requirement. If approval has not been requested or is in progress, please provide the estimated date on which approval can be expected. Additional sheets may be attached.

N/A

OTHER INFORMATION: Provide any other information that may be important to the approval of this application.

See attached Exhibit A & copy of Bureau of Reclamation Dixie Valley Plan of Study, dated May 2009

SIGNED: 
NAME: Eleanor Lockwood
TITLE: County Manager
DATE: _____

THE CARSON WATER SUBCONSERVANCY DISTRICT RESERVES THE RIGHT TO DENY ANY AND/OR ALL APPLICATIONS FOR FUNDING.

Exhibit A

Introduction: Churchill County's Water Resource Plans have identified Dixie Valley as a potential long term underground supply for Quasi-municipal purposes in the Lahontan Valley. This would involve a groundwater importation project which would represent the only supply to Lahontan Valley totally independent of the highly litigated and contested waters of the Truckee and Carson River watersheds and associated underground aquifers. Churchill County currently has the senior most priority pending applications before the State Engineer dating from the mid-1980's to appropriate all remaining underground waters in Dixie Valley for export to the Lahontan Valley.

The natural recharge in to the Carson Desert Hydrographic basin #101 has been estimated by the USGS at 1,300 afa from precipitation and 1,200 afa inflow from other basins for a total estimate of natural recharge of 2,500 afa. The committed underground water rights and domestic well use exceeds 21,000 afa, therefore the basin is over-appropriated without considering recharge from the Newlands Irrigation project. For this reason the State Engineer issued Order# 1116 in 1995 limiting any new underground appropriations to 4,000 gallons per day (4.48 afa) or less. There are significant losses from unlined canals/laterals and on-farm losses to deep percolation which recharge the shallow aquifer. The shallow aquifer recharges the intermediate aquifer in the western portion of the basin which is hydraulically connected to the Basalt aquifer in the central portion of the valley. Due to the drought and reduced Newlands Project allocations, many of the 5,000+ shallow aquifer domestic wells have gone dry or experiencing water level declines demonstrating the reliance of the valley on recharge from Newlands Project deliveries. CWSD and Churchill County are currently funding water level monitoring projects with the USGS and Churchill County to monitor water levels in the Shallow, Intermediate and Basalt Aquifers.

Recognizing the competing interests for Truckee and Carson River waters and potential for an independent supply, legislation was enacted and funds allocated under Public Law 110-161 (Sec. 208) to conduct a study to update and quantify the perennial yield or groundwater discharge from the Dixie Valley Flow System (DVFS) shown in Figure 1. This study is a component of the Bureau of Reclamation's (BOR) Desert Terminal Lakes Program, which is authorized by Public Law 107-171 (Sec. 2507). A copy of this Dixie Valley Export Study dated May, 2009 is attached to this application for reference which explains the study in detail. The detailed study was initiated in 2008 and is nearing completion in Spring, 2016. The study team consisted of an interdisciplinary team of experts from the BOR, USGS, Churchill County, State Engineer, DRI and several private consultants.

The study has identified a potential range of groundwater available for appropriation between 11,200 – 15,600 afa, which assumes a median estimate of groundwater discharge from the DVFS and a range of potentially committed existing underground water rights. Additional water could be available if existing water rights were acquired from unused rights or marginally economical agricultural operations currently pumping groundwater with diesel motors. A calibrated groundwater flow model has been constructed using data collected during the study. This model is also being used to test various pumping scenarios where rates and locations for withdrawal are being analyzed.

Project Description /Benefits: The Dixie Valley study included a significant amount of instrumentation and site specific data collection throughout the DVFS which is described in detail in the attached BOR plan of study. As part of this study (13) high altitude precipitation storage type gages were installed in watersheds surrounding the DVFS as shown in Figure 2. These gages were installed in 2008 and are monitored semi-annually to determine summer, winter and total water year precipitation volumes. It was always envisioned that maintenance and data collection from these gages would continue beyond the study period several decades to develop a long term period of record. Additionally a well inventory was conducted for the study and quarterly water level data collection is ongoing in approximately (25) wells shown in Figure 3. The water level data is important to continue to develop baseline data prior to a possible export project and to identify any current trends from anthropogenic stresses or natural climatic conditions. There were approximately 20 temporary stream gages installed during the study to quantify ephemeral and perennial streamflow at the mountain fronts and run-on to the playa. Two of these sites are still maintained to continue to develop baseline data from perennial mountain front streams. A complete weather station to collect meteorological data within Dixie Valley was installed and continues to be maintained. The primary purpose of this project and funding request is to maintain the ongoing semi-annual precipitation gage data collection and maintenance and quarterly water level data collection. Secondary benefits which do not add significant cost to the project are continued maintenance of the weather station and the perennial stream gages.

Following are some of the regional and flow system benefits for maintaining the ongoing data collection and equipment maintenance. Precipitation models such as PRISM, developed at Oregon State University were used extensively on many components of this study provide predicted long-term average annual precipitation over the Great Basin and in Dixie Valley. The models have limited actual measurements sites to constrain and calibrate to, especially in central Nevada. If the Dixie Valley precipitation network can be maintained over the long-term (several decades) it will provide valuable information for refinement of long-term precipitation models in a geographic region with sparse data. High altitude precipitation measurements are even sparser in the Great Basin - almost all long-term precipitation stations are situated on low altitude valley floors. The majority of precipitation that becomes available to streams, springs and groundwater recharge to the Great Basin aquifers is actually derived from high altitude precipitation, not low-altitude (valley floor) precipitation. Maintaining the high altitude precipitation network in Dixie Valley provides valuable information where data are limited, and active data collection is even more limited. The lack of long-term high altitude precipitation data collection in the Great Basin is even more concerning given the acknowledged change in climate.

There is considerable geographic and temporal variability in precipitation in the Great Basin. Having basin-specific precipitation and complimentary hydrologic data (water level and stream/spring discharge) will provide needed data from which to define natural hydrologic responses to water resources. In Dixie Valley, a robust back-ground hydrologic baseline dataset will provide valuable information for long-term water resources management, and to identify current or future pumping effects, from potential fresh water development for export to Lahontan Valley and/or continued or expanded geothermal development within the basin. Use

of long-term precipitation data from outside the near proximity of a basin, or from low altitudes within a basin, always presents complications and lowers confidence when trying to differentiate natural climate responses from other potential causes to hydrologic changes such as pumping.

Such data collection will allow refinements to the groundwater flow model and other methods in this study used to estimate recharge and discharge. Annual precipitation measurements are needed to compare to annual precipitation products such as PRISM, DAYMET, NLDAS and other gridded climate products. These products (including PRISM) are not just long-term average, they are daily, monthly, and annual. Because of this we can easily compare measured monthly and annual totals with the product totals. This data can be used in the future to develop bias corrections if needed. The data can integrate with the PRISM process developed and maintained by Oregon State University which was done with all the USGS and State high elevation gauges, and now PRISM is using them. Currently we don't have any independent data to compare PRISM except this potential network, and all of Wynn Ross' network in Northern Washoe County.

We will work with Dr. Justin Huntington/DRI who is also affiliated with the Western Regional Climate Center (WRCC) to host the data so it is made publically available. Hosting the data is not that expensive, however efforts will need to be taken to set up the database, make all the linkages, and integrate the data within the mapping environment. This cost is included within the first year of the project. Dr. Huntington will also investigate other possible grant sources that could possibly be leveraged to help assist with funding.

This project is technically and environmentally sound and will assist the water users, managers, hydrologists and general public in understanding climate, water issues and the status of their aquifers. It will help identify potential areas where discharge exceeds recharge and aquifer storage change. The project has regional benefits to the Carson River watershed in that it is supporting data collection efforts for an importation project, which if constructed, would lessen the demand on the over allocated and contested waters of the Truckee and Carson River watersheds. There also exists the possibility of resource trading in the Carson watershed if the importation project were implemented, however this would require additional consideration of feasibility and investigation of possible legal/physical constraints that would need to be overcome. The project also has a larger regional benefit for the west-central portion of Nevada in helping define high altitude precipitation distributions with site specific data where virtually none exists now and reliance is currently on models such as PRISM.

This funding request is for an three year term, however it is anticipated for this program to be successful as a long term data collection and management tool, it be continued as an ongoing effort.

Figure 1. Dixie Valley Ground Water Export Study Area



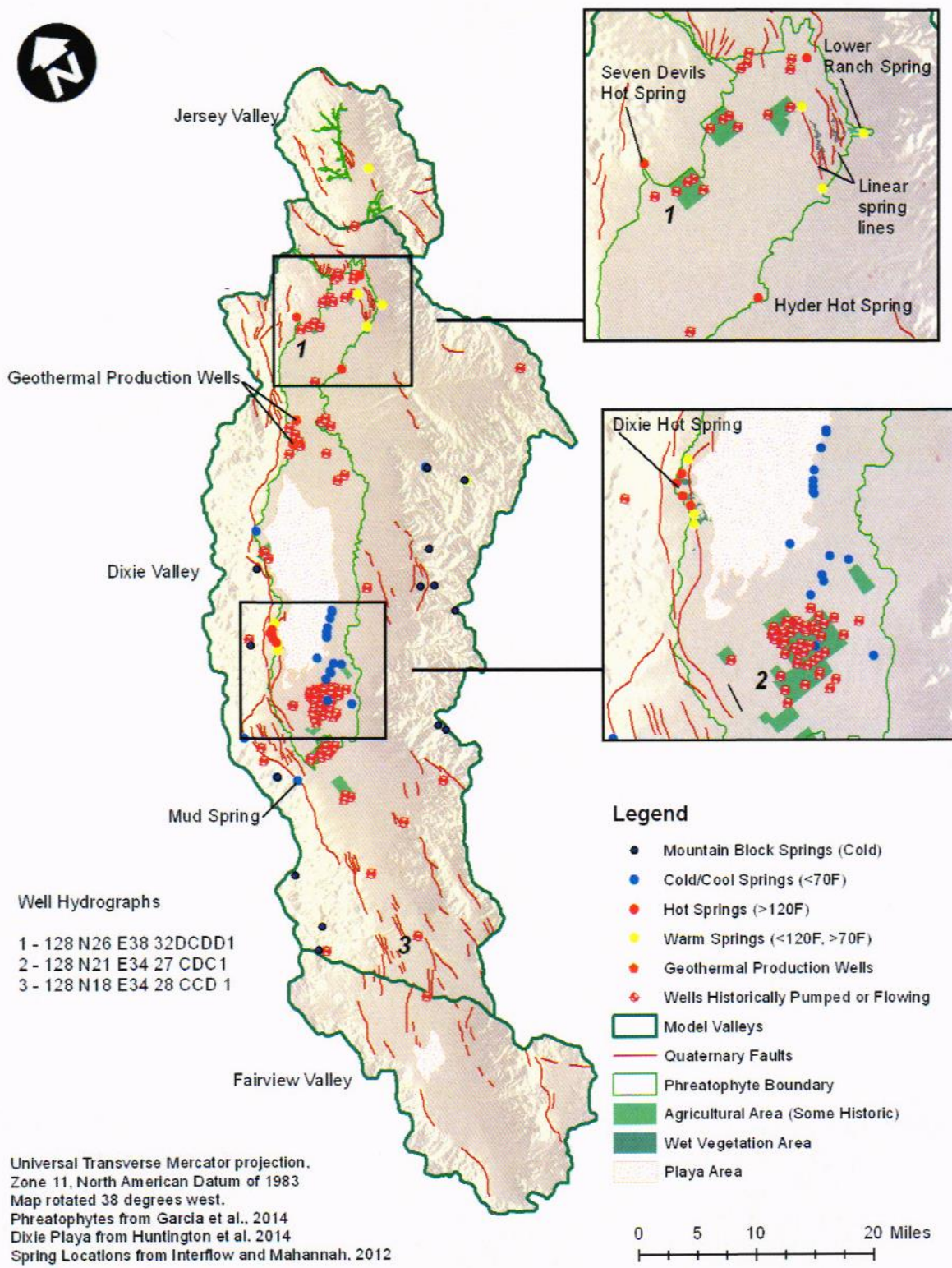


Figure 3. Springs and wells in Dixie Valley.

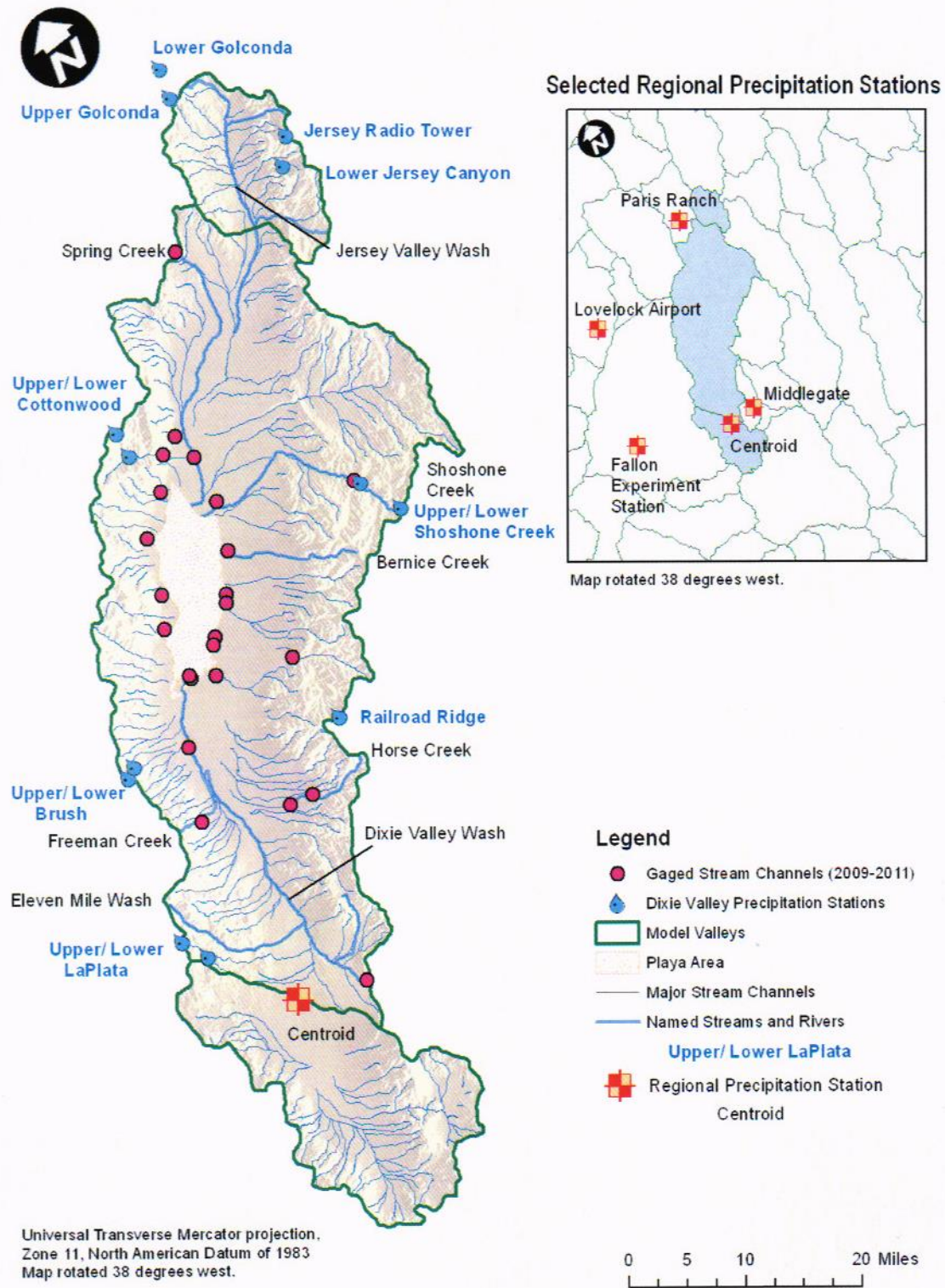


Figure 2. Stream flow and high-altitude precipitation networks within the study area.

RECLAMATION

Managing Water in the West

PLAN OF STUDY

Dixie Valley, Nevada Ground Water Export Study



Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

PLAN OF STUDY

Dixie Valley, Nevada Ground Water Export Study

prepared by:

**Technical Service Center
Water Resources Planning and Operations Support Group
Water Resources Division
Mark Spears and Joe Lyons (Peer Reviewer)**

reviewed by:

Dixie Valley Interagency Study Team Members

prepared for:



**U.S. Department of the Interior
Bureau of Reclamation
Lahontan Basin Area Office
Carson City, Nevada**

May 2009

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This document describes the overall study plan for the Dixie Valley Ground Water Export Study. It focuses on the 3-year first phase of the 5-year planned study effort. The study is being conducted by the Bureau of Reclamation's (Reclamation) Lahontan Basin Area Office as a component of the Desert Terminal Lakes Program. Reclamation's Technical Service Center is leading an interagency study team that includes staff from the Nevada Division of Water Resources (NDWR) and U.S. Geological Survey (USGS) and staff and representatives of Churchill County. Churchill County representatives include a remote sensing consulting company, HydroBio Advanced Remote Sensing, and the civil engineering and hydrology consulting team of Mahannah and Associates LLC and InterFlow Hydrology Inc. Attachment 1 is a list of the study team members and their contact information.

The overall study plan described in this document is based on individual study plans previously prepared by Churchill County, Reclamation and USGS during initial scoping activities, and only a limited number of minor deviations from the individual work plans exist.

Study Purpose and Objectives

The primary purpose of the study is to quantify the amount of ground water that could be exported from Nevada's Dixie Valley and develop pipeline designs and cost estimates to convey the exported water to locations within or nearby Churchill County.

Study objectives include quantifying the valley's perennial yield based on ground-water discharge evaluations, analyzing the impacts of exporting specific quantities of ground water, and performing economic analyses of various water export scenarios.

Authorization and Funding

This study is authorized and funded by Public Law 110-161 (Sec. 208). The study is a component of Reclamation's Desert Terminal Lakes Program, which is authorized by Public Law 107-171 (Sec. 2507).

Study Area

Dixie Valley is located mostly within Churchill County in west central Nevada (Figure 1). The county population of approximately 30,000 is centered around the City of Fallon, which is the county seat. It is a primarily agricultural area and Reclamation's Newlands Project provides irrigation water for about 50,000 acres around Fallon. The Naval Air Station Fallon (home of "Top Gun") is located a few miles southeast of the center of Fallon.

The southern end of Dixie Valley is located about 30 miles east of Fallon in the adjacent drainage basin. Dixie Valley has an area of about 1,300 square miles with the Stillwater Mountains on the west side of the valley and the Clan Alpine Mountains on the east. There are only a few people that reside in Dixie Valley (current estimate is 5).

The study area includes Dixie Valley and the six other NDWR administrative ground-water basins that are considered to be part of the same ground-water flow system and contributory to the Dixie Valley ground-water basin. The northern portion of the Dixie Valley ground-water basin is in Pershing County, and the southern portion of the adjacent Fairview Valley ground-water basin is in Mineral County. The remainder of the study area is in Churchill County.



Previous studies indicate that ground water flows into Dixie Valley from all of the adjacent basins (Cohen and Everett, 1963 and Harrill and Hines, 1995). Dixie Valley is a closed basin and all discharge is by evapotranspiration (ET) and evaporation. A large source of evaporation is from the playa located in the central portion of the valley which is known as the Humboldt Salt Marsh. The surface area of the playa is approximately 44,000 acres. Based on a cursory review of satellite imagery, it appears the playa is typically covered with water during winter months and although the standing water evaporates during late-spring, the center portion of the playa surface remains moist year-round.

Background

Fallon's municipal water supply is ground water pumped from a basalt aquifer. Although past problems with arsenic levels have been remedied with a new water treatment facility, there are concerns about the long-term viability of this water supply source due to reduced aquifer levels and increases in chloride concentrations (USGS, 2002). Most Churchill County residents outside the city limits get water from shallow individual wells, many of which provide poor quality water. The county's new water system provides treated water from the extensive intermediate aquifer that exceeds all state and federal drinking water standards, though less than 500 residents and businesses are currently served.

Prior to commencement of the Naval Air Station Fallon's flight training in Dixie Valley, an irrigated agriculture settlement area had become established in the south-central portion of the valley. The Navy purchased these irrigators' lands and acquired the associated water rights during the 1980s. Since this time, the Navy has attempted to lease these lands for irrigated agricultural purposes and protect the water rights. These efforts have been generally unsuccessful and some of the water rights have been forfeited or cancelled in recent years.

The potential export of Dixie Valley ground water to the Fallon area has been studied for over 30 years. Study findings reports include Westpac Utilities (1987), WRD (1992), Reclamation (1993), SPPCo (1994), WRD (1996) and WRD (2003). The USGS has completed two Dixie Valley hydrogeologic studies that yielded estimates of perennial yield; Cohen and Everett (1963) and Harrill and Hines (1995).

Churchill County has pending water rights applications for 56,472 acre-feet of ground water with 1985 priority dates. Churchill County's current Water Resource Plan (WRD, 2003) identifies the need for a rural water supply and distribution system, and it identifies Dixie Valley exported ground water as a potential supply source. As mentioned above, future City of Fallon water supply needs are in question. In the event a Dixie Valley ground water export supply exceeded these needs, the surplus water could potentially meet other demands outside of the county (Lyon County, Fernley and Carson City areas).

There is also extensive geothermal resource development underway in Dixie Valley. This area is home to one of the most important geothermal resources in the U.S.

If this study shows an adequate quantity of ground water can be exported without negative impacts to environmental or geothermal conditions, it is anticipated that Churchill County will

seek approval for all or a portion of its water rights applications and secure funding to finalize planning and engineering and construct the export project.

Study Description

The study consists of three phases to be completed over a five-year period ending in September 2013. The remaining sections of this document describe the planned Phase 1 activities. In general, the Phase 1 tasks cover research, data collection and analyses to estimate perennial yield and develop the hydrogeologic framework necessary to develop ground-water models and analyze the proposed export project. Ground-water modeling and environmental and economic analyses will be done during Phase 2, and project design and cost estimating will be done during Phase 3.

It has been proposed that the Phase 2 ground-water modeling work be done by InterFlow Hydrology with Environmental Simulations Inc. acting as a subcontractor. Interflow Hydrology / Environmental Simulations have submitted a preliminary proposal and cost estimate and a more detailed proposal and cost estimate has been requested by the study team. In the event Interflow Hydrology / Environmental Simulations performs the modeling work, it has been proposed USGS provide review and oversight during model development. An alternative would be for USGS to do the modeling. Regardless of the entity that performs the modeling, the study team will collaborate and provide input to model development and participate in final and interim reviews of all model products. At this time, it is anticipated the modeling work will include the development of a calibrated steady state model and calibrated transient model to be used in forward simulations and to analyze solute transport under various ground water withdrawal scenarios. If the ground water export project moves forward, it is assumed the ground water models would be used for further analysis as part of the National Environmental Policy Act (NEPA) compliance process that would be led by the Bureau of Land Management (BLM).

Reclamation will perform the Phase 2 environmental and economics analyses beginning in 2011.

The previous project design and cost estimating work by WRD (2003) is similar in effort and scope to what Reclamation defines as an appraisal level design. A feasibility level design and cost estimating effort by Reclamation can not be accomplished within the existing budget. As the study moves forward and the Phase 3 budget is better understood, the level of design study will be agreed upon and a strategy to complete Phase 3 will be developed. The work could be done by Reclamation, or it could be done by others with Reclamation oversight and review. Regardless, the design product must meet appropriate Reclamation standards.

A comprehensive USGS Scientific Investigations Report synthesizing data collection, analysis, and interpretation will be published at the end of the 5-year study. The report production period is January 2012 through March 2013.

Phase 1 Tasks

Each of the Phase 1 task descriptions are based on the respective individual workplan(s) produced by the study team agency responsible for completing the task. Any future changes to the scope of work and schedules associated with these tasks will be approved by the interagency

study team. All currently identified Phase 1 tasks are summarized in the table below and detailed descriptions follow.

Summary of Phase 1 Tasks

Task No.	Task Description	Performed by:
1	Develop and manage Geographic Information System (GIS) database (8/08-9/12)	Reclamation
2	Install high-altitude precipitation gages and water sample collectors and perform data collection, quality assurance and reporting (12/09-6/12)	Churchill County
3	Install streamflow measurement instruments, perform data collection, quality assurance, analysis and reporting (1/09-6/12)	Churchill County
4	Implement ground water discharge quantification plan (1/09-9/12)	All Agencies
5	Perform wells and springs inventories, associated water quality sampling and reporting and collaborate with USGS to develop and implement ground-water level monitoring plan (4/09-6/12)	Churchill County
6	Evaluate existing well and geophysics data, collect well data and develop and implement well drilling and aquifer testing program to develop hydrogeologic framework (1/09-9/10)	USGS
7	Evaluate existing ground water quality and geochemistry data, coordinate with Churchill County and sample for additional water quality data (4/09-6/12)	USGS
8	Complete water rights abstract (4/12-6/12)	Churchill County
9	Research and collaborate with geothermal industry information sources and report findings (1/09-6/10)	Churchill County

Task 1- Develop and manage GIS database

The Reclamation Technical Service Center's Remote Sensing and Geographic Information Group will develop and manage the studies GIS database using data and information provided by USGS, NWDR, Churchill County, and others. All data collected and appropriate information from reviews and research will be incorporated into the GIS. Various layers will be developed to support Phase 2 model development, evaluation of the ground water flow system, mapping, and ground water discharge remote sensing work. This work began during scoping activities in August 2008 and will be ongoing through September 2012.

Task 2 - Install high-altitude precipitation gages and perform data collection, data quality assurance and reporting

This task is being performed by Mahannah and Associates / InterFlow Hydrology to establish a precipitation station network in the mountains surrounding Dixie Valley. The network will provide data to associate climate related effects to key hydrologic resources in the valley. It will be maintained through the study period and kept in place for continued data collection after the study.

Once a long-term precipitation dataset is developed, short-term and long-term water level, spring discharge, and stream flow trends that are climate-related can be more conclusively identified and segregated from potential effects of well field pumping. The precipitation data should also be of value in assessing any variances observed in spring flows, runoff, and groundwater level fluctuations observed during the study period.

This task includes site reconnaissance, installation of precipitation storage gages, and data collection and gage maintenance twice a year during the study period. Pre-winter measurements

coincident with the beginning of the water year and another measurement following the majority of winter precipitation events in April will be conducted. This will allow for winter versus summer precipitation totals. A total of nine (9) Sacramento type storage gages having a minimum capacity of approximately 1.5 times the average annual anticipated volume for a particular elevation were installed during December 2008. The gages were placed in Dixie Valley proper in the Stillwater, Augusta, Tobin, Clan Alpine Ranges at various elevations.

As a separate subtask, water samples from the precipitation gages will be analyzed for chloride content in precipitation and dry-fall. These data will provide a means to make independent recharge computations, using the chloride-mass balance technique. These computations could provide an independent means to examine the water budget from the recharge side, rather than the discharge side (ET/Evap studies). The chloride mass-balance computations may also be used to derive spatial distributions of recharge in the planned numeric ground water flow model.

Data collection will be semi-annually for five years, including precipitation quantities, chloride and stable isotope contents of precipitation with Churchill County funding long-term data collection starting in April 2012.

All Task 2 data will be distributed to the study team and will be reported on an annual basis, in the first fiscal quarter of the next year (fourth quarter of the calendar year).

Task 3 - Install streamflow measurement instruments, perform data collection, data quality assurance, data analysis and reporting

Streamflow measurements will be made by Mahannah and Associates / InterFlow Hydrology using various methods in order to collect data on stream discharges at the mountain front, from tributary basins, and into the playa. These data will be evaluated in an attempt to quantify the amount of surface water that runs on to the playa. Stream flow losses on the alluvial fans and valley floor will also be evaluated

An initial canvass was made to inspect major drainages, identify perennial stream segments, and identify suitable gage locations. The primary drainages for gaging activities are Dixie Valley Wash, Horse Creek, Shoshone Creek, Spring Creek, Cottonwood Canyon, and Freeman Creek.

Methods being used for stream gaging include rating channel sections equipped with continuous stage recorders, miscellaneous measurements by current-velocity meters, and indirect computations using channel geometry for high flow events.

Stage recorders were set at locations in ephemeral stream beds, including 13 at or near the playa edge and 10 locations near the mountain front boundaries to the basin, at major drainages into the valley, and at lower alluvial fan locations. Installations were made in March and April 2009. As runoff events occur in the ephemeral drainages, the stage recorders will capture the height of water. Channel cross-sections and gradients were surveyed at the stage recorder sites, and discharge hydrographs will be developed and volumetric discharge computed using the Manning equation. Field observations will be made during significant runoff events, if possible.

Continuous recording gages on perennial streams will be maintained monthly, including miscellaneous current-velocity measurements to develop rating curves for the sites. Stage height data will be downloaded at least quarterly. Continuous recording gages have been installed on Horse Creek, Cottonwood Creek, and Freeman Creek. .

Samples for general water chemistry, bromide, silica, and stable isotopes (oxygen-18 and deuterium) will be collected and analyzed twice a year, once in winter and once in summer, at continuous flow gage sites to provide data for groundwater source and flow system evaluations. When possible, samples of ephemeral run-on to the playa will be sampled for stable isotope content.

Data will be collected through June 2012 and will be compiled and interpretations of annual playa runoff will be prepared and distributed to the study team in report format and will be reported on an annual basis, in the first fiscal quarter of the next year.

Task 4 - Implement ground-water discharge quantification plan

Dixie Valley perennial yield is equal to the amount of ground water that evaporates from the playa combined with the ground water consumed by phreatophyte ET minus the quantity of ground water from the contributory basins. All study team entities are involved in this task and various methods will be used to develop estimates of the ground-water discharge components.

The study team will collaborate to define the two primary ground-water discharge areas (playa and phreatophyte). USGS and Reclamation will independently calculate discharge for the phreatophyte area by two different methods using a combination of onsite and remote sensing data. USGS and HydroBio will independently calculate discharge for the playa area by two different methods also using a combination of onsite and remote sensing data.

A total of four eddy covariance (EC) type micrometeorological stations were installed in March 2009 (two playa sites and two phreatophyte sites) to measure real time evaporation and ET and data collection will occur continuously for three years. The USGS will perform station maintenance, data collection, and data analysis through March 2012.

The EC stations will provide information about the magnitude and spatial and temporal variability of evaporation and ET. Precipitation and ground-water levels will be monitored at each EC station. Periodic portable chamber (ET dome) measurements of bare-soil evaporation by USGS will further capture spatial variability across the playa surface and provide insight into the bare-soil contribution to ET measured in vegetated areas. Matric potential profiles determined using heat dissipation sensors will be used by USGS to evaluate seasonal water flow directions throughout the unsaturated zone beneath vegetation and within the playa at each EC site. Stable isotopes analyses will be used by USGS to quantify the relative proportions of source waters in plants and playas at each site. In vegetated areas, plant-stem water from dominant species, ground water, shallow soil water, and recent precipitation will be sampled during the spring, summer, and fall seasons and analyzed by USGS for oxygen-18 and deuterium (approximately 12 samples per event). In playa areas, soil water profiles, ground water, recent precipitation, and existing surface water will be sampled quarterly (approximately 18 samples

per event) by USGS for isotopic composition to determine the source water near the evaporating surface and the evaporation extinction depth. Simple mixing models will be used by USGS to partition source water.

USGS will delineate the primary discharge areas into ET units distinguished by vegetation type and density, and soil properties. ET units will be delineated from Landsat imagery based on Modified Soil Adjusted Vegetation Index (MSAVI) values in vegetated areas and Tasseled Cap Transformation values in playa areas. ET unit boundaries determined from remotely sensed data will be refined using field observations. Reclamation will assist with discharge area delineation field work and will process the Landsat imagery. This image processing, analyses and associated field work will occur during the period June 2009 to September 2011.

Reclamation will calculate discharge for the phreatophyte area using a method developed by HydroBio that is known as NDVI*. This method is based on a “stretched” form of the normalized density vegetation index (NDVI) and reference ET. The NDVI* method will be applied to a series of historical Landsat images representing wet, dry and normal conditions. Calibration of the NDVI* based ET values will be necessary in the shallow ground water phreatophyte areas surrounding the playa. This will be done with EC station and ET dome data and possibly using another remote sensing technique (Landsat Band 5 discussed below) with the assistance of HydroBio. The NDVI* analysis and associated findings report will be completed by September 2011.

HydroBio will quantify playa evaporation with a new method using Landsat Band 5 data from a series of images representing wet, dry and normal conditions. The data will be evaluated to calculate playa evaporation as a factor of the incident light absorbance by water at the soil surface. An index value is calculated for each image pixel, similar to the NDVI* method, that is applied to reference ET. HydroBio will partition the total evaporation quantity into surface and ground water by evaluating precipitation and playa runoff relationships using remote sensing data. As mentioned above, the Landsat Band 5 method may coupled with NDVI* for the shallow ground water areas of the phreatophyte zone.

HydroBio will complete its work and publish playa ground water discharge related findings in a series of three journal articles prior to October 2010.

All USGS ground water discharge findings will be included in the overall scientific investigations report, and preliminary data collected by USGS (EC stations and ET domes) will be reported to the team annually.

Task 5 - Perform wells and springs inventories, associated water quality sampling and reporting and develop and implement ground-water level monitoring plan

This task will be performed by Mahannah and Associates / InterFlow Hydrology and the resulting data will be used to update potentiometric mapping, interpret subsurface flow systems, understand seasonal water level variations, and identify long-term water level trends. It will also provide data for future model calibration and document pre-development baseline water level conditions.

Existing information on all known wells and springs located in the Dixie Valley and adjacent basins will be compiled and physical inventories will be conducted. The sources of existing information include NDWR (State Engineer's Office), USGS National Water Inventory System (NWIS), Navy Air Station Fallon and the BLM. Examples of existing information to be compiled are water right applications, well permits, well drilling logs, proofs of completion, proofs of beneficial use (PBU), certificates, PBU and permit maps, rulings and orders, and historical water level measurements.

These documents may contain information useful in characterizing aquifer properties, depth and extent of subsurface aquifers, perforated intervals, historical water levels, irrigated acreages, locations of historical use, etc. Drilling logs and PBUs may have flow rates and draw-down measurements from which aquifer parameters could be estimated. Since nearly all of the irrigated rights were certificated before the Navy buy-out, PBU maps should provide a good historical irrigated acreage to which consumptive use estimates can be applied to arrive at historical net irrigation pumping demand.

Depth to groundwater measurements will be made at those sites in the NWIS database that can be identified in the field, with supplemental measurements from other wells located via the NDWR database. Field measurements will include static water, measurement point reference height, well diameter and handheld global positioning system (GPS) location coordinates. For flowing wells, a discharge rate and shut-in pressure head will be obtained, to the extent that casing and ground conditions support. Field parameters of temperature, conductivity and pH will be made with a multi-probe, and samples will be collected and delivered to an analytical laboratory for general mineral content, Profile I metals, and radioactivity parameters, bromide, silica and stable isotopes (oxygen-18 and deuterium).

Once the well inventory is done, a subset of wells will be identified for ongoing monitoring of water levels and flow rates. It is anticipated the monitoring subset will include approximately 20 wells. Quarterly measurements will be made through FY2011 and semi-annual water level monitoring will continue through FY2013.

Mahannah and Associates / InterFlow Hydrology will coordinate with USGS to avoid duplication of efforts since USGS will research and inventory certain wells under Tasks 6 and 7 as discussed below. They will work together during the research phase and identify the wells to be inventoried by USGS. Further coordination will occur once the inventories are completed to develop the ongoing ground-water level monitoring plan.

Additionally, Mahannah and Associates / InterFlow Hydrology have constructed four nested piezometers on the playa to compliment those installed at the EC stations. An additional 2-3 playa piezometer sites are contemplated. The deep and shallow piezometers will allow vertical gradients to be measured and to assist in quantifying playa evaporation and depth to water.

The ground water well related documents review and initial inventory will occur during April 2009 to September 2009, and the monitoring program will continue through June 2012.

The springs inventory will be conducted during July 2009 to September 2009 prior to any significant winter-time precipitation. Summer-time sampling is desired to avoid potential comingling of deep versus perched or shallow groundwater sources that may be ephemeral in nature. The inventory will include flow rate, general conditions, and field parameters (pH, conductivity and temperature), and samples will be collected for minerals and stable isotopes analyses. Most BLM springs of significance will be inspected (approximately 30). These springs include primary geothermal springs in the study area, and significant valley floor and mountain front springs that have historically provided water sources for wildlife, stock, and other purposes. The BLM springs of significance typically represent the largest discharge springs in the region. Following the inventory, discharge will be monitored quarterly at 6 selected springs through June 2012.

In order to perform the chloride mass-balance evaluation previously mentioned under Task 2, additional spring water chemistry data are needed. Spring data collected at the mountain front from BLM springs of significance will provide some data on groundwater chloride content, however, additional samples from mountain-block springs will be collected and analyzed for general chemistry including chloride, along with bromide, silica, and stable isotopes (oxygen-18 and deuterium). Approximately 20 additional mountain block spring samples are anticipated.

Task 5 data will be compiled and distributed to the study team and will be reported on an annual basis, in first fiscal quarter of the next year.

Task 6 - Evaluate existing well and geophysics data, collect well data and develop and implement well drilling and aquifer testing program to develop hydrogeologic framework

USGS will develop the framework of the Dixie Valley subsurface flow system by identifying structural features, delineating the three-dimensional geometry of the subsurface basin fill aquifer(s), determining the hydraulic properties of the major hydrogeologic units, and identifying data gaps. Structural features controlling ground-water flow such as fracture networks will be identified using existing geologic data and geophysical surveys. The three dimensional geometry of the Dixie Valley flow system will be evaluated using existing geophysical data. The thickness, geometry, and structural disruption of the water bearing units will be mapped using existing gravity and aeromagnetic data. Hydraulic properties will be determined using lithologic logs, borehole logs, and aquifer test data. A detailed plan for aquifer testing will be developed once existing data are compiled and evaluated. It is assumed that up to four deep wells will be drilled for aquifer testing.

Ground-water levels in existing wells will be compiled, collected, and evaluated to determine the direction and gradient of ground-water flow, with careful consideration to the distribution of geologic features that may act as conduits or barriers to ground-water flow. A current potentiometric-surface map showing ground-water flow will be developed for the basin fill aquifer(s) and compared with historical maps to evaluate potential changes in ground-water flow and storage changes related to ground-water level trends.

Subsurface flow entering Dixie Valley from Pleasant, Jersey, Stingaree and Fairview Valleys will be estimated by applying Darcy's Law and estimates of transmissivity, the effective width of

unconsolidated sediments through which flow takes place, and the gradient of the water table perpendicular to the outflow cross section. Isotopic samples of ground water, precipitation and springs will help constrain the estimated subsurface inflow. Ground-water samples will be collected both up-gradient and down-gradient from each of the six contributing valley outlets into the Dixie Valley basin. Analysis of isotopic data using binary mixing will help determine the fraction of subsurface inflow from each of the six contributing valleys. Monitoring wells will be installed in areas where water-level measurement and/or hydrologic properties are pertinent to the comprehensive study. The hydrogeology of the Dixie Valley flow system will provide the foundation for conceptual model development and potential creation of a ground-water flow and transport model.

Existing wells research and data collection will begin in April 2009 leading to the development and implementation of the aquifer testing program by September 2009. Development of the potentiometric-surface map and the inter-basin ground water flow analyses will be completed by September 2010. The overall hydrogeologic framework will be described in the final report. USGS will provide annual reports including Task 6 preliminary findings to the study team.

Task 7 - Evaluate existing ground water quality and geochemistry data, coordinate with Churchill County and sample for additional water quality data

Water quality of the basin fill aquifers will be characterized by USGS using existing chemical data and by collecting and analyzing major ions, silica and other important constituents from ground water and springs as needed throughout the basin. Initial water sampling will include large suite of chemical constituents from approximately 40 sites. A subset of these constituents and sites (approximately 15) will be monitored on a biannual basis. Constituent concentrations will be compared with National primary and secondary drinking water standards to evaluate the potability of the ground water. Geothermometry with major ions and silica will be used to estimate temperatures throughout the basin and identify geothermal contributing zones. (USGS will coordinate with Mahannah and Associates / InterFlow Hydrology and its geothermal subcontractors on this component of the task.) Past investigations have documented high levels of dissolved solids and fluoride. Characterization of ground-water quality will also provide a basis for conceptual model development and offer insight into appropriate ground-water modeling methods.

Ground water quality sampling will occur during April 2009 to December 2009. Geochemistry data collection will occur during July 2009 to March 2012. Ground water characterization analyses will occur during October 2009 to June 2012. USGS will provide annual reports including Task 7 preliminary findings to the study team.

Task 8 - Complete water rights abstract

Mahannah and Associates / InterFlow Hydrology will update the water rights abstract performed by Water Research & Development (WRD) in 2005 to determine the location, status and amount of spring, underground and surface water rights in Dixie Valley and the Tributary basins. This task will be completed near the end of the study period (April 2012 to June 2012) so as to provide the most recent analysis of committed rights verses un-appropriated ground water which

will aid in determining the duty of water for the State Engineer to consider regarding issuing permits under Churchill County's pending applications to appropriate.

All active spring, surface and underground water rights will be reviewed at the State Engineer's Office. Summary tables will be prepared by manner of use and source type for all water rights. Locations of points of diversion for each right will be incorporated into the GIS.

Task 9 - Research and collaborate with geothermal industry information sources and report findings

The objective of this task is to understand the extensive geothermal systems in Dixie Valley and how they may or may not interact with the non-thermal ground water systems. A good understanding of the geothermal hydrologic framework will be essential for the ground-water flow modeling and how the thermal component is incorporated.

Mahannah and Associates / InterFlow Hydrology have subcontracted with Dick Benoit and Ted DeRocher for assistance with this task. These individuals have extensive experience working with geothermal resources world-wide and have spent a considerable portion of their careers working in Dixie Valley managing the geothermal powerplant. They have been involved in numerous studies and published papers on the resource.

There are several geothermal systems in Dixie Valley including the Eleven Mile Canyon and Pirouette Mountain geothermal systems in the southern part of Dixie Valley; the Dixie Hot Springs and Dixie "South" geothermal systems in the central part of Dixie Valley; the Dixie Valley geothermal field and Dixie Caithness fields in the northern part of the valley; and the Sou, Hyder, McCoy, Lower Ranch, and Jersey Valley geothermal systems in the northern part of the valley. All published geological, geochemical, and geophysical reports and papers will be incorporated into an overall synthesis of the geothermal systems in the area. Additionally, any privately held data, reports, analysis, etc. which can be released will be made available and incorporated into the analysis and report. There are widely differing amounts of information available on the differing geothermal systems, with the cooler systems having undergone much less exploration activity. A report on the geologic framework associated with the geothermal resources in Dixie Valley, including interpretations of fault structures, flow systems, water origin, quantity of resource, quality, etc, will be produced and submitted to the study team. This report will help the study team understand the potential connections or lack thereof with basin fill aquifers and flow systems, and be used in ground water modeling effort to be used for simulations of potential impacts to or from the geothermal resources by proposed.

The geothermal research is underway and the report of findings will be completed in September 2009.

References Cited

- Cohen, Phillip and D.E. Everett, 1963. Ground-water Resources-Reconnaissance Series Report 23, A Brief Appraisal of the Ground-water Hydrology of the Dixie-Fairview Valley Area, Nevada.
- Harrill, James R. and Lawrence B. Hines, 1995. Estimated natural Ground-Water Recharge, Discharge, and Budget for the Dixie Valley Area, West-Central Nevada, U.S. Geological Survey Water-Resources Investigations Report 95-4052
- U.S. Geological Survey (USGS), 2002. Results of Test Drilling in the Basalt Aquifer Near Fallon, Nevada, USGS Fact Sheet 048-02
- Bureau of Reclamation (Reclamation), 1993. Northern Nevada Water Augmentation Study Summary of Findings
- Sierra Pacific Power Company (SPPCo), 1994. 1995-2015 Water Resource Plan
- Water Research & Development Inc. (WRD), 1992. Dixie Valley Water Project
- WRD, 1996. Dixie Valley Ground Water Importation Project, Churchill County, Nevada
- WRD, 2003. Churchill County Water Resource Plan 25 Year (2000-2025) 50 year (2000-2050)
- Westpac Utilities, 1987. Preliminary Evaluation of Transporting Water from Dixie Valley to the Fallon – Stillwater Area

Attachment 1- Interagency Study Team Roster

Name	Title	Agency / Company	Phone	Email
Berger, David	Chief, Hydrologic Studies	USGS ^{1/}	775-887-7658	dlberger@usgs.gov
Eckhardt, David	Remote Sensing Specialist	Reclamation ^{2/}	303-445-2273	deckhardt@do.usbr.gov
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Goetsch, Brad	County Manager	Churchill County	775-423-5136	countymanager@churchillcounty.org
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Johnson, Mike	Hydrologist	USGS ^{1/}	775-887-7646	johnsonm@usgs.gov
Knockenmus, Lari	Deputy Director, Nevada Water Science Center	USGS ^{1/}	775-887-7613	lari@usgs.gov
Mahannah, Chris	Civil Engineer	Mahannah and Associates, LLC	775-323-1804	chris@gbis.com
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Welborn, Toby	Geographer	USGS ^{1/}	775-887-7671	tlwelbor@usgs.gov
Wright, Joe	Hydraulic Engineer	Reclamation ^{2/}	303-445-2463	jmwright@usbr.gov

1/ Nevada Water Science Center, Carson City, Nevada

2/ Technical Service Center, Denver, Colorado

3/ Lahontan Basin Area Office, Carson City, Nevada

4/ Nevada Water Science Center, Henderson, Nevada

5/ Interagency Team Leader

**CARSON WATER SUBCONSERVANCY DISTRICT
REQUEST FOR FUNDING**

APPLICANT: Lyon County Utilities Department (LCUD)

Name

PO Box 1699

Address

Dayton

Lyon

NV

89403

City

County

State

Zip Code

mworkman@lyon-county.org

(775) 246-6220 x3

Email

Telephone #

APPLICANT'S AGENT (if different from Applicant):

Mike Workman, Utilities Director

Name

Same as above

Address

City

County

State

Zip Code

Email

Telephone #

PROJECT NAME: USGS Maintenance costs for new 2nd River Gauge in Dayton (#10311750)

PROJECT LOCATION/ADDRESS: Dayton - Carson River Segment 7B - above Six Mile Canyon Crk.-
below LCUD's Induction Well 20.

PROJECT DESCRIPTION: Briefly describe the project. Provide maps, drawings, photographs or other information. Additional sheets may be attached.

Over the last decade, there has been discussion about the need for a second USGS gaging station in the Dayton area. In 2015, LCUD staff worked collaborative with Vidler Water and the USGS to identify an appropriate location for a second gage. A site near the LCUD Rolling A Induction Well 20 was found. LCUD worked with USGS in an effort to get the gage installed before the Spring season runoff. The gage has been installed and is reporting as of January 30, 2016. It is currently in the calibration phase of the start up process.

In December, LCUD entered into a Funding Agreement with the USGS to provide annual maintenance costs for the gage. *LCUD is requesting funding from CWSD in the amount of \$10,750 for half of the annual maintenance fee that USGS charges which is currently \$21,500 per year.*

At this time, the USGS does not have any Cooperative Matching Funds available to apply to the maintenance portion of this project.

PROJECT GOALS AND BENEFITS: Briefly describe the project goals and benefits to be realized if the project is implemented. Additional sheets may be attached.

Having a second gaging station in the Dayton area will provide a more accurate current data for the river flows through this reach of the river. The older gage near the Dayton bridge, can be influenced by backwatering from the various irrigation diversion points in the area causing inaccurate measurements. Due to that accuracy issue, that gage has been downgraded.

This new gage is in a location that will not be effected by irrigation diversions or any other activity. The new gage is designed to measure not only higher flows but also medium to low flows. This will be beneficial for the refinement of the operation of LCUD's seasonal Conjunctive Use Plan. Having accurate medium to low flow measurements will allow LCUD to better manage seasonal municipal surface water rights pumping and will also benefit the Federal Water Master and Division of Water Resources staff in their efforts to manage their respective programs.

TOTAL ESTIMATED PROJECT COST: \$21,500

AMOUNT REQUESTED FROM CWSD: \$10,750 (or 1/2 the annual maint. cost)

SOURCE OF OTHER FUNDS: List all other sources of funds to be used to match funds requested from CWSD. List the provider of the matching funds and the amount requested from each provider.

Lyon County Utilities – Operating Budget

ESTIMATED DATE PROJECT TO BEGIN: March 1, 2016

ESTIMATED TIME TO COMPLETE PROJECT: Ongoing

(If completion date is greater than a year, please indicate how much funding is needed in each fiscal year.)

PERMIT REQUIREMENTS: If your project requires a permit, license and/or approval from a governmental agency to proceed, please provide the current status of each requirement. If approval has not been requested or is in progress, please provide the estimated date on which approval can be expected. Additional sheets may be attached. **None**

OTHER INFORMATION: Provide any other information that may be important to the approval of this application.

SIGNED: 

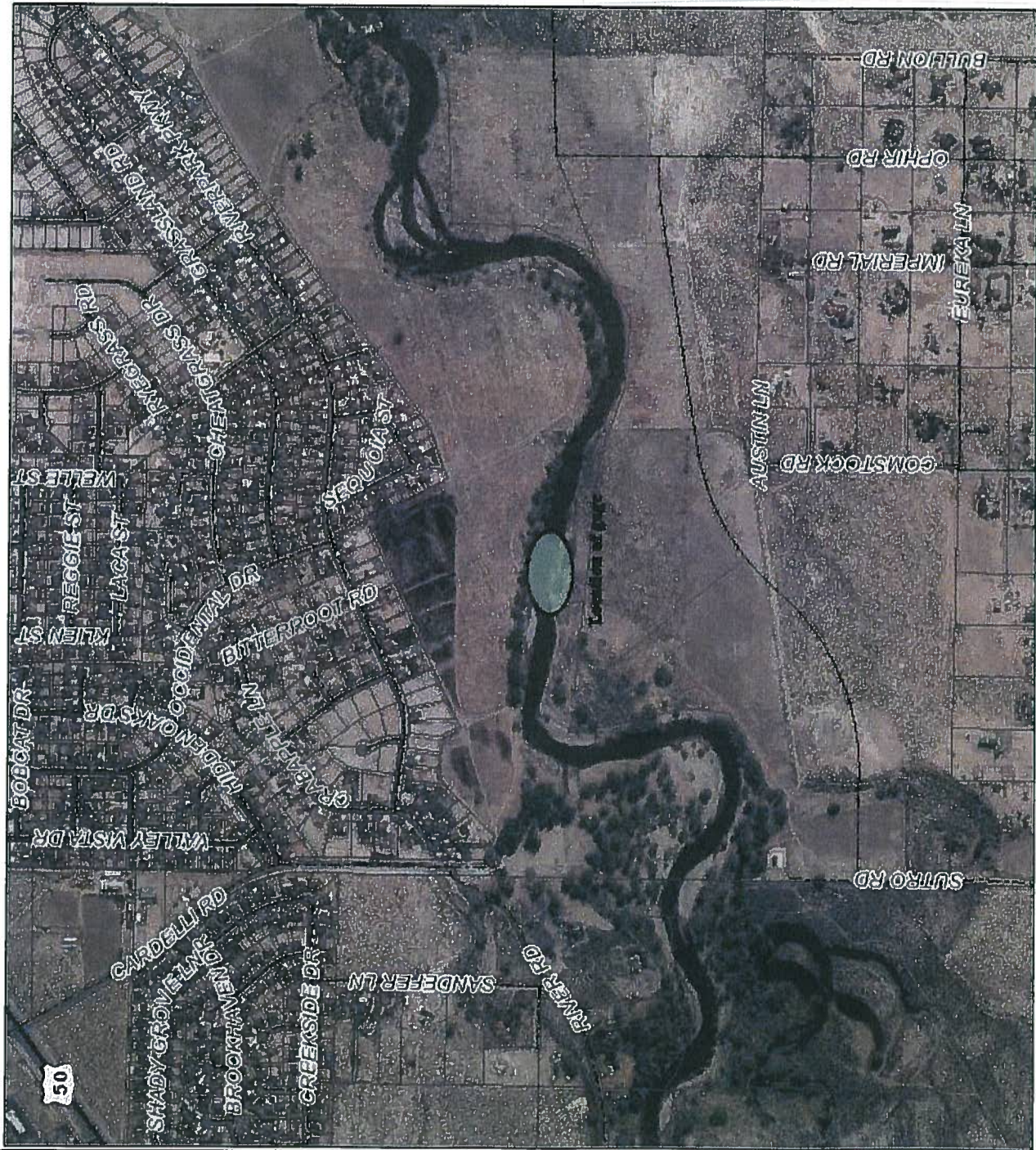
NAME: Mike Workman

TITLE: Utilities Director

DATE: 2/2/16

THE CARSON WATER SUBCONSERVANCY DISTRICT RESERVES THE RIGHT TO DENY ANY AND/OR ALL APPLICATIONS FOR FUNDING.

NEW USGS GAGE LOCATION



DISCLAIMER: The data contained herein does not represent survey delineation and should not be construed as a replacement for the authoritative source. No liability is assumed by Fair West Engineering as to the sufficiency or accuracy of the data.

CARSON WATER SUBCONSERVANCY DISTRICT

**777 E. William St., #110A
Carson City, NV 89701
775/887-7450, fax 775/887-7457**

SCHEDULE AND CRITERIA FOR FUNDING REQUESTS

SCHEDULE:

The completed application must be submitted to Carson Water Subconservancy District (CWSD) by February 8, 2016. In late February CWSD Finance Committee will review all funding requests. From that meeting a proposed tentative budget will be sent to the full board for consideration at the March meeting. In May, the Board will review any changes to the tentative budget and adopt a final budget.

Funding for projects that are approved by the CWSD Board will become available on July 1, 2016. A summary report is due to CWSD within 30 days of project completion.

CRITERIA FOR EVALUATING FUNDING REQUESTS:

- A. All funding requests shall meet all of the following criteria:
 - 1. CWSD can legally participate in the funding of the project.
 - 2. CWSD finds the project to be technically and environmentally sound.
 - 3. CWSD finds that the project can be permitted within a reasonable period of time.

- B. All funding requests should be consistent with the Carson River Stewardship Plan (copy of the plan can be found on CWSD web site) and meet one or more of the following criteria:
 - 1. The project will provide regional benefits within the Carson River Watershed.
 - 2. The project will improve water quality.
 - 3. The project will in the long term prevent further stream bank erosion.
 - 4. The project will reduce flooding along the Carson River.
 - 5. The project will improve the administration and management of river and stream systems.
 - 6. The project will assist water users and/or the general public in understanding current water issues.

CWSD's goal is to leverage our funding as much as possible. Although matching funds for projects are not required, those projects that can provide match will be given greater consideration.

CARSON WATER SUBCONSERVANCY DISTRICT REQUEST FOR FUNDING

APPLICANT: Name: David Smith - U.S. Geological Survey Hydrologist
Address: 2730 North Deer Run Road
City: Carson City County: Carson State: NV Zip: 89701
Email: dwsmith@usgs.gov Telephone #: 775-887-7616

APPLICANT'S AGENT (if different from Applicant):

Name

Address

City County State Zip Code

Email Telephone #

PROJECT NAME: Middle Carson River Groundwater Monitoring

PROJECT LOCATION/ADDRESS: **Carson City, Mound House, Dayton, Carson Plains,
Stagecoach and Silver Springs**
Eagle Valley, Dayton Valley, and Churchill Valley

PROJECT DESCRIPTION: Briefly describe the project. Provide maps, drawings, photographs or other information. Additional sheets may be attached.

Problem Statement

Residents in the middle Carson River area, which includes Eagle, Dayton and Churchill Valleys, depend on groundwater for domestic supply. Since the 1970's the U.S. Geological Survey (USGS) has monitored groundwater levels and water quality in these basins (Glancy and Katzer, 1976; Arteaga and Durbin, 1979; Berger, 1987; Harrill and Preissler, 1994; Jeton and Maurer, 2007, Maurer and others, 2009). Currently, monitoring objectives are to collect water-level measurements at spatial locations required to reliably calibrate a groundwater-model in development. Monitoring also includes quarterly bulk precipitation measurements and annual groundwater quality monitoring in areas of dense septic tanks (figure 1). Prior to model development, groundwater-levels were lacking in areas close to the Carson River, thus current monitoring is focused on wells near the river, and at high (monthly) frequencies to gain a better understanding of surface water and groundwater interactions.

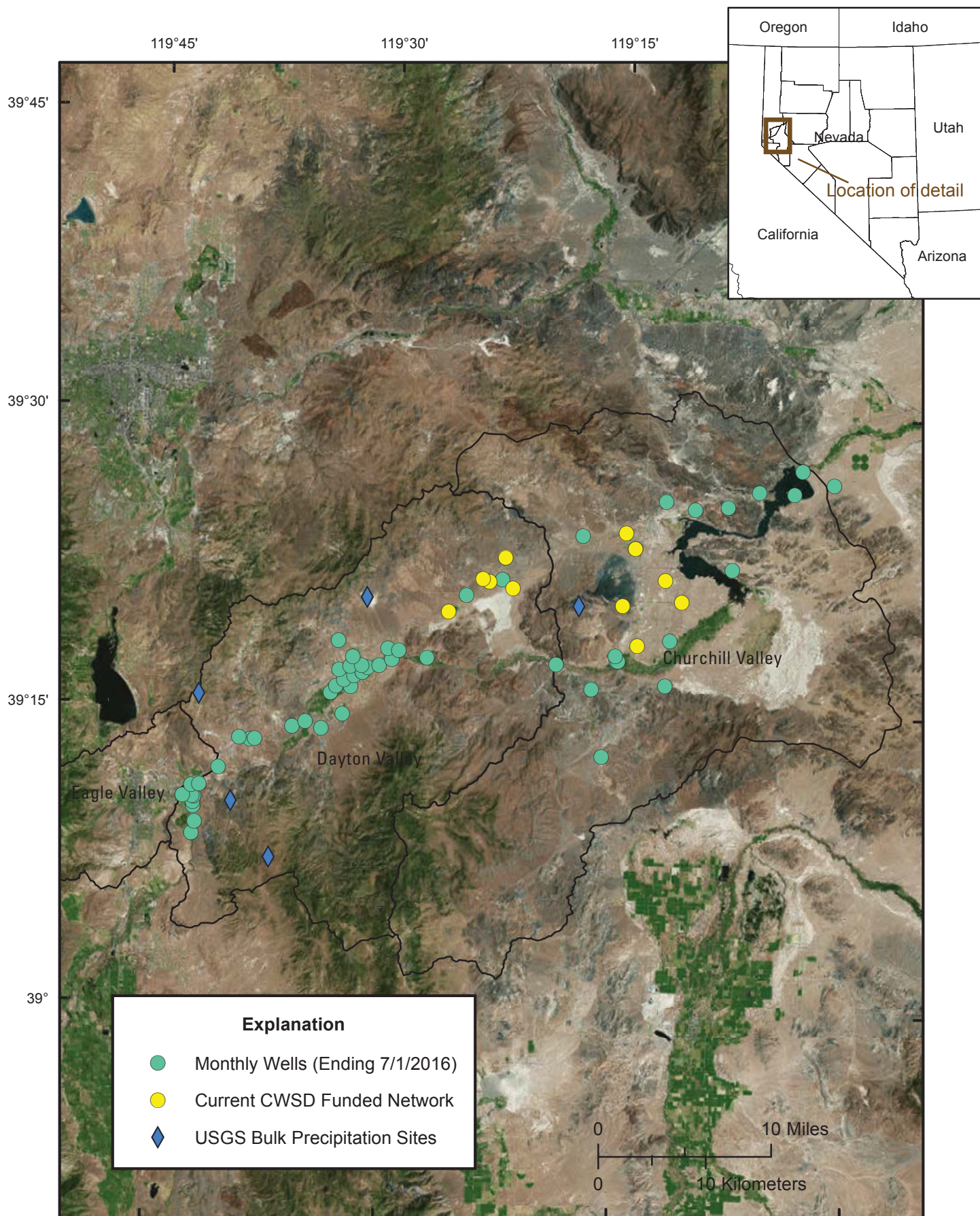


Figure 1. Current groundwater monitoring wells and bulk precipitation gages in the Middle Carson River area, 2016.

Groundwater monitoring in the Eagle, Dayton, and Churchill Valleys is scheduled to end in of June, 2016, leaving a potential gap in data collection. However, the frequency and spatial distribution of current monitoring wells does not include many subdivisions that rely on groundwater from domestic wells as the only drinking water source. In subdivisions, groundwater-levels and long-term trend analysis may be helpful in future water-resource management decisions. For example, residents in the Mark Twain Estates have recently cited declining groundwater levels as a cause for deepening wells and concern over long-term water supply (Woodmansee, 2015). The current monitoring network (figure 1) spatially is about 1 mile away from the Mark Twain Estates, missing the potential declining water-table. New monitoring wells have been added in the Mark Twain Estates area, however more are needed to gain an understanding of groundwater-levels and pumping trends in the subdivision area.

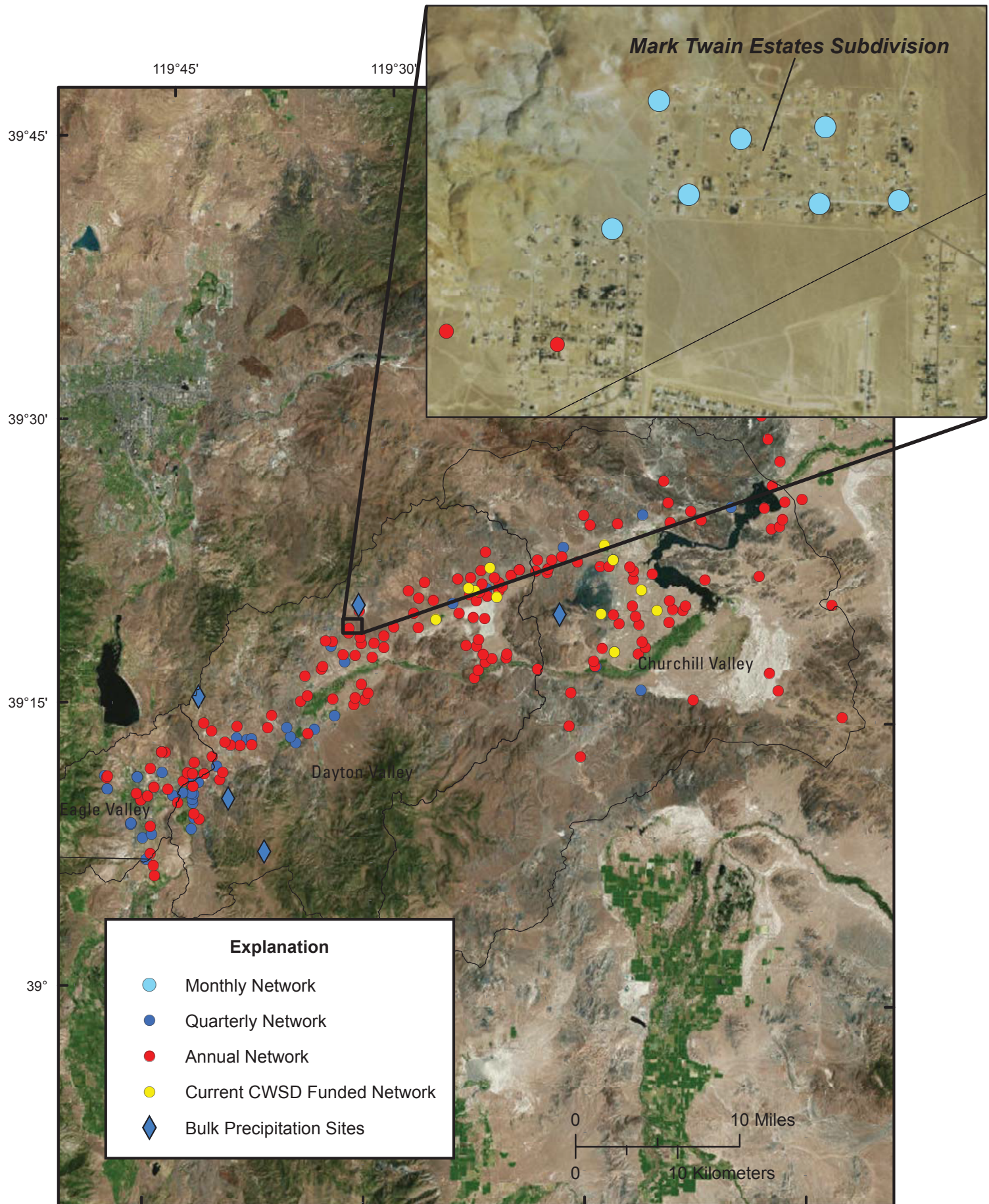
We propose new objectives for groundwater monitoring in the middle Carson River area to include (1) groundwater monitoring primarily at annual frequency, with the addition of quarterly measurements to capture inter-annual trends in groundwater-levels and groundwater pumping, (2) the increased spatial distribution of annual wells throughout the groundwater basins, especially in areas of subdivisions reliant on domestic wells, and (3) the development of a monthly well network in the Mark Twain Estates with the collection of continuous groundwater-levels from one domestic well in the area to quantify water-level declines and the collection of an annual water-quality sample from the Mark Twain Community Center. Annual water-quality samples at the Mark Twain Community Center exhibit elevated nitrate concentrations, ranging from 7 to 18 ppm (part per million).

Approach

The redesigned network will be monitored at a monthly (6-8 wells in Mark Twain Estates Subdivision), quarterly (44 wells), and annual (154 wells) frequency throughout Eagle, Dayton, and Churchill Valleys (fig. 2). Additionally, one water-level recorder will be deployed in the Mark Twain Estates Subdivision for continuous water-level collection. Annual water-quality samples will be collected from the Mark Twain Community center and the addition of a onetime sample analyzed for waste-water indicators. Bulk precipitation gauges will be measured at a quarterly frequency. Data collection is planned to begin in the Nevada State fiscal year 2017 (October 1, 2016), and continue for a period of at least three years (table 1). No formal USGS reports are currently planned with this monitoring effort. All data collected will be quality assured using standard USGS methods and made available online to the public through NWISWeb. Groundwater-level data will be available online within 2 weeks after the completion of well runs.

References

- Artega, F.E., and Durbin, T.J., 1979, Development of a relation for steady-state pumping rate for Eagle Valley ground-water basin, Nevada: U.S. Geological Survey Open-File Report 79-261, 44 p.
- Berger, D.L., 1987, Ground-water levels in water years 1984–86 and estimated ground-water pumpage in water years 1984–85, Carson Valley, Douglas County, Nevada: U.S. Geological Survey Open-File Report 86-539, 16 p.
- Glancy, P.A., and Katzer, T.L., 1976, Water-Resources Appraisal of the Carson River basin, Western Nevada: Nevada Division of Water Resources, Reconnaissance Report 59, 126 p.
- Harrill, J.R., and Preissler, A.M., 1994, Ground-water flow and simulated effects of development in Stagecoach Valley, a small, partly drained basin in Lyon and Storey Counties, western Nevada: U.S. Geological Survey Professional Paper 1409-H, 74 p.
- Jeton, A.E., and Maurer, D.K., 2007, Precipitation and streamflow simulations of the Carson Range and Pine Nut Mountains, and updated estimates of ground-water inflow and the ground-water budget for basin-fill aquifers of Carson Valley, Douglas County, and Alpine County, California: U.S. Geological Survey Scientific Investigations Report 2007-5205, 56 p.
- Maurer, D.K., Paul, A.P., Berger, D.L., and Mayers, C.J., 2009, Analysis of streamflow trends, ground-water and surface-water interactions, and water quality in the upper Carson River basin, Nevada and California: U.S. Geological Survey Scientific Investigations Report 2008-5238, 192 p.
- Woodmansee, K, 2015, "Study Sought to Find Causes of Water Woes In Mark Twain Estates." Virginia City News [Virginia City] 20 Nov. 2015, Vol. 7 No. 47 ed.



Hydrography modified from 1:24,000-scale U.S. Geological Survey (USGS) National Hydrography Dataset, 2014. Universal Transverse Mercator, Zone 11N, North American Datum of 1983.

Figure 2. Proposed groundwater monitoring wells in the Middle Carson River area, 2016-2019.

PROJECT GOALS AND BENEFITS: The proposed study is aligned with the USGS science strategy goal of informing the public and decision makers about the status of freshwater resources across America, and is consistent with the goal of the USGS Strategic Plan of providing water-resource managers with accurate, reliable, and impartial scientific information. The data will provide an increased understanding of groundwater levels in Eagle, Dayton, and Churchill Valleys and provide water managers with information on how water resources may be affected by increased development.

Project benefits include:

1. Groundwater level observations in approximately 208 wells. Additional monitoring wells will be included near areas of proposed expansion with the USA Parkway Highway, near Silver Springs, and near the Iron Mountain Subdivision near Stagecoach, NV.
2. Monthly groundwater-level monitoring of the Mark Twain Estates and a continuous water-level data recorder at one well to assist managers in determining water-table declines.
3. The continued collection of bulk precipitation on McClellan Peak, Brunswick Canyon, Churchill Butte, and in the Virginia Range, for future use in potential groundwater model scenario development (figure 2).
4. Entry of Dayton and Silver Springs Utilities groundwater levels into the USGS online database.
5. The annual monitoring of water-quality from the Mark Twain Community Center well and analysis for waste-water compounds.
6. Publish and maintain data online for public use in the USGS National Water Inventory System database.
- 7.

Table 1. Project Timeline

[Quarters represent NV State Fiscal Quarters, State fiscal year is July 1 to June 30.
The monthly run will be collected each month of the fiscal year.]

NV State Fiscal Year	FY2017				FY2018				FY2019				FY2020
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Monthly Well Run	X	X	X	X	X	X	X	X	X	X	X	X	X
Quarterly Precip	X	X	X	X	X	X	X	X	X	X	X	X	X
Quarterly Well Run	X	X	X	X	X	X	X	X	X	X	X	X	X
Annual Well Run	X				X				X				X
Data processing/Review	X			X				X				X	X

TOTAL ESTIMATED PROJECT COST: \$145,461

AMOUNT REQUESTED FROM CWSD: \$90,678

SOURCE OF OTHER FUNDS: List all other sources of funds to be used to match funds requested from CWSD. List the provider of the matching funds and the amount requested from each provider.

Pending the availability of federal matching funds, it is anticipated that funds provided by the Carson Water Subconservancy District will be matched by the USGS. This proposal will be presented at a Carson Water Purveyors meeting, with the intention of gaining support from Storey County for monitoring in the Mark Twain Estate Subdivision.

ESTIMATED DATE PROJECT TO BEGIN: October 1st, 2016

ESTIMATED TIME TO COMPLETE PROJECT: 3 years, ending September 29th, 2019


Table 2. Funding Distributed per Fiscal Year

[Fiscal Year (FY) represents the Nevada State fiscal years from July 1 to June 30.]

	FY17	FY18	FY19	FY20	Total
USGS Funds	\$15,814	\$14,459	\$14,792	\$9,717	\$54,782
CWSD Funds	\$26,177	\$23,933	\$24,485	\$16,084	\$90,678
Total	\$41,991	\$38,392	\$39,277	\$25,800	\$145,461

PERMIT REQUIREMENTS: No permits are anticipated to complete the project. However, owner information and verbal permission to measure groundwater wells will be collected.

OTHER INFORMATION: Provide any other information that may be important to the approval of this application.

SIGNED: 
NAME: DAVID SMITH
TITLE: U.S. GEOLOGICAL SURVEY HYDROLOGIST
DATE: 2-9-2016

THE CARSON WATER SUBCONSERVANCY DISTRICT RESERVES THE RIGHT TO DENY ANY AND/OR ALL APPLICATIONS FOR FUNDING.