Project Name: Middle Carson River Restoration Projects, Dayton, Nevada

Project Location: Multiple Locations, Dayton, Nevada, Lyon County (See attached map)

Project Description: The DVCD has listed approximately two (2) areas that are in need of immediate restoration within the Middle Carson River. The total lengths of these projects are approximately 1,625 linear feet of riverbank; which would tie into existing projects completed in the past. These areas have vertical cut banks which are failing, even during low flow scenarios. The continued erosion is impacting the cottonwood gallery, wildlife habitat, water quality and vital agricultural lands. The district will utilize designs that have been proven successful in stabilizing the riverbanks by minimizing erosion, improving water quality, and re-establishing native vegetation along the Carson River. The design will include rock rip-rap, bio-engineering, shaping the banks to a 3:1 slope ratio and re-planting native vegetation to improve overall stability within the river channel.

Project Benefits: The benefits would include; improving wildlife habitat, improve water quality by minimizing erosion, stabilize the riverbank and protect vital agricultural lands, the vital cottonwood gallery along Middle Carson River, re-establish native vegetation, and trap in-stream sediment. The indirect benefit would help protect critical infrastructure including an irrigation ditch, Fort Churchill road and agricultural lands.

Estimated Date for Project to Begin: Pending funding approved and received possibly March, 2015.

Estimated Date for Project to End: March 31, 2016 (Approximate)

Required Approvals (all licenses, permits, and approvals required):	Status:
U.S. Army Corp of Engineers Nationwide 27 Permit	Approved
U.S. Army Corp of Engineers Nationwide 13 Permit	Pending
U.S. Army Corp of Engineers Nationwide 3 Permit	Pending
Nevada Division of Environmental Protection 401 W.Q. Cert.	Pending
Nevada Division of Environmental Protection Temp Roll Stock	Pending
Nevada Division of Environmental Protection General Permit	Approved
Nevada Division of State Lands Authorization Right of Entry	Pending

Estimated Total Cost of Project: $376,000.00

Amount Requested from CWSD: $75,000.00

Carson Water Subconservancy District
Request for funding FY 2015

January 30, 2015

APPLICANT: Dayton Valley Conservation District
P.O. Box 1807
Dayton, Lyon, Nevada 89403

APPLICANTS AGENT: Richard Wilkinson
#34 Lakes Blvd.
Dayton, Lyon, Nevada 89403

PROJECT NAME: Middle Carson River Streambank Stabilization Projects MCR 048, 049

PROJECT LOCATIONS: Fort Churchill State Historic Park/Minor Ranch. (Map Attached)

PROJECT DESCRIPTION: See Attached letter describing the need for the completion of these projects.

PROJECT BENEFITS: See Attached letter describing the benefits of completing these projects.

TOTAL AMOUNT OF PROJECTS: $376,000.00

AMOUNT REQUESTED FROM CWSD: $75,000.00

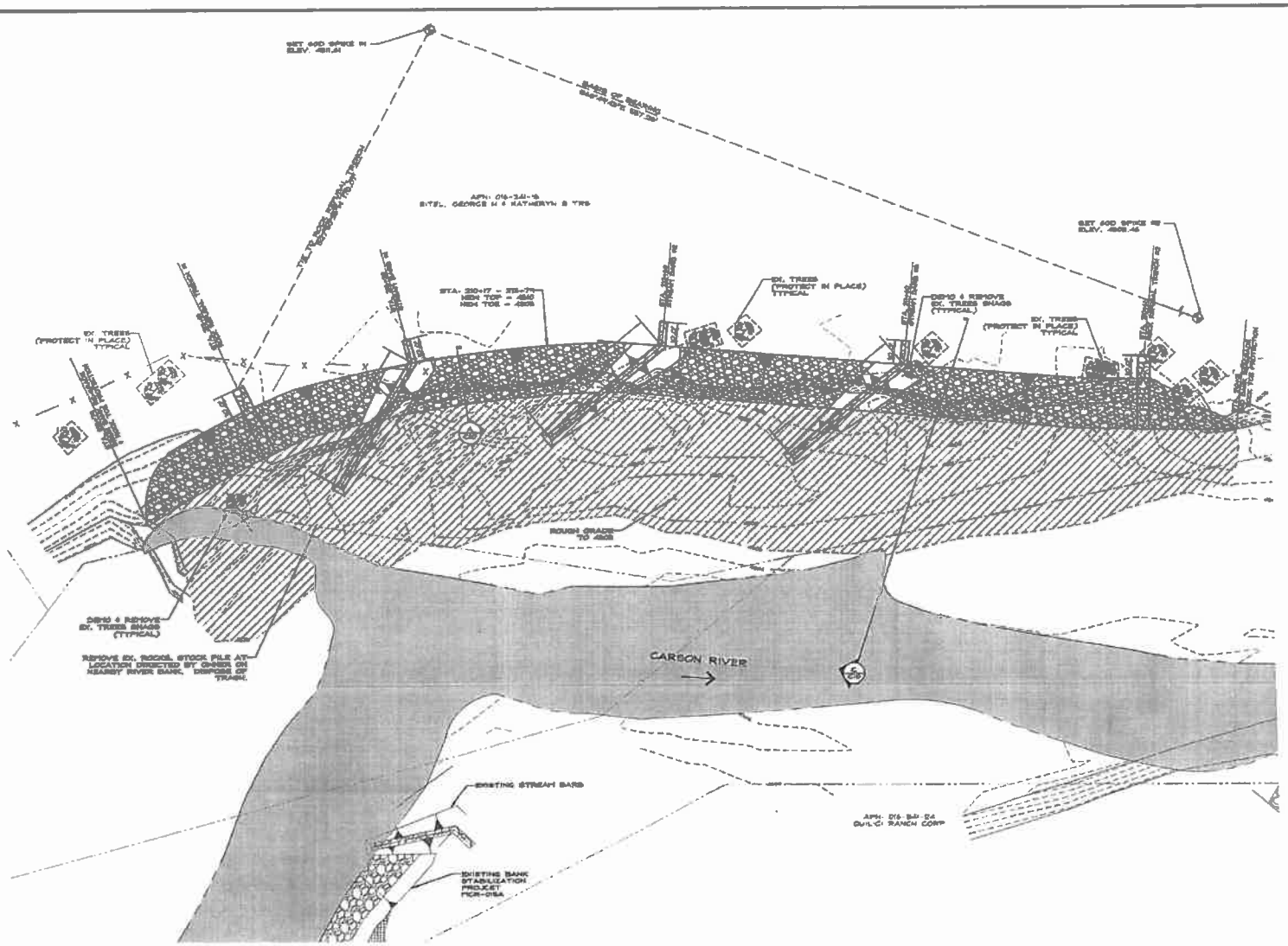
MATCH RATIO: 5 TO 1

ESTIMATED DATE OF PROJECT TO BEGIN: Permitting will start in March, 2015. Construction anticipated August, 2015.

ESTIMATED DATE OF PROJECT COMPLETION: Construction should be complete by December, 2015 and final reporting March, 2016.

ADDITIONAL INFORMATION: See attached letter with additional project information.

PROJECT PARTNERS:	Carson Truckee Water Conservancy District	$50,000.00 Pending
	Carson Water Subconservancy District	$75,000.00 Pending
	Nevada Department of Environmental Protection	$150,000.00 Approved
	Lyon County	$7,500.00 Approved
	Nevada Conservation District Program	$3,500.00 Approved
	Nevada Division of State Parks	$25,000.00 Pending
	DVCD Landowners (In-kind) Supplies	$50,000.00 Approved
	Natural Resource Conservation Service(In-kind)	$15,000.00 Approved
	Totals:	**$376,000.00**



ESTIMATED QUANTITIES

STREAM BARBS:

STREAM BARB #1 = 342 CY = 548 TON
STREAM BARB #2 = 342 CY = 548 TON
STREAM BARB #3 = 342 CY = 548 TON
TOTAL = 1,026 CY = 1,644 TON

ROCK TOE PROTECTION TOTAL = 1,925 CY = 1,480 TON

ROCK NATURAL TRENCHES = 125 CY = 188 TON

EARTH WORK:
CUT = 1,685 CY
FILL = 1,686 CY
NET CUT = 1 CY

* NOTE:
NO GUARANTEE IS MADE CONCERNING THE ACCURACY OF THE ESTIMATED QUANTITIES. THE CONTRACTOR SHALL RELY ON HIS OWN DETERMINATION OF ACTUAL QUANTITIES OF WORK ASSOCIATED WITH THE PROJECT.

NOTE: SEE STREAM BARB DETAIL ON SHEET C10 FOR LOCATION OF CONTROL POINTS.

STREAM BARB SURVEY CONTROL POINTS & DATA

	TOE	ANGLE	KEY
STREAM BARB NO. 1	N 1476776.13 E 2344718.49 ELEV. 4804	N 1475739.27 E 2344749.15 ELEV. 4804	N 1476747.41 E 2344742.90 ELEV. 4810
STREAM BARB NO. 2	N 1476710.44 E 2344808.38 ELEV. 4804	N 1475748.88 E 2344844.41 ELEV. 4804	N 1476769.84 E 2344855.31 ELEV. 4810
STREAM BARB NO. 3	N 1476720.89 E 2344887.16 ELEV. 4804	N 1475740.34 E 2344933.48 ELEV. 4804	N 1476780.30 E 2344934.67 ELEV. 4810

AFFECTED PROPERTIES

MCR-045 APN: 016-341-19 SITE: GEORGE H. & KATHERYN S. TRS
APN: 016-341-04 GUILCI RANCH CORP.

NOTES

1. REMOVE & RE-LOCATE EX. PASTURE FENCES ALONG NEW TOP OF BANK AS NECESSARY TO FACILITATE CONSTRUCTION.

NO.	DATE	REVISION BLOCK	BY

SCALE: 1" = 20'

R|O|Anderson

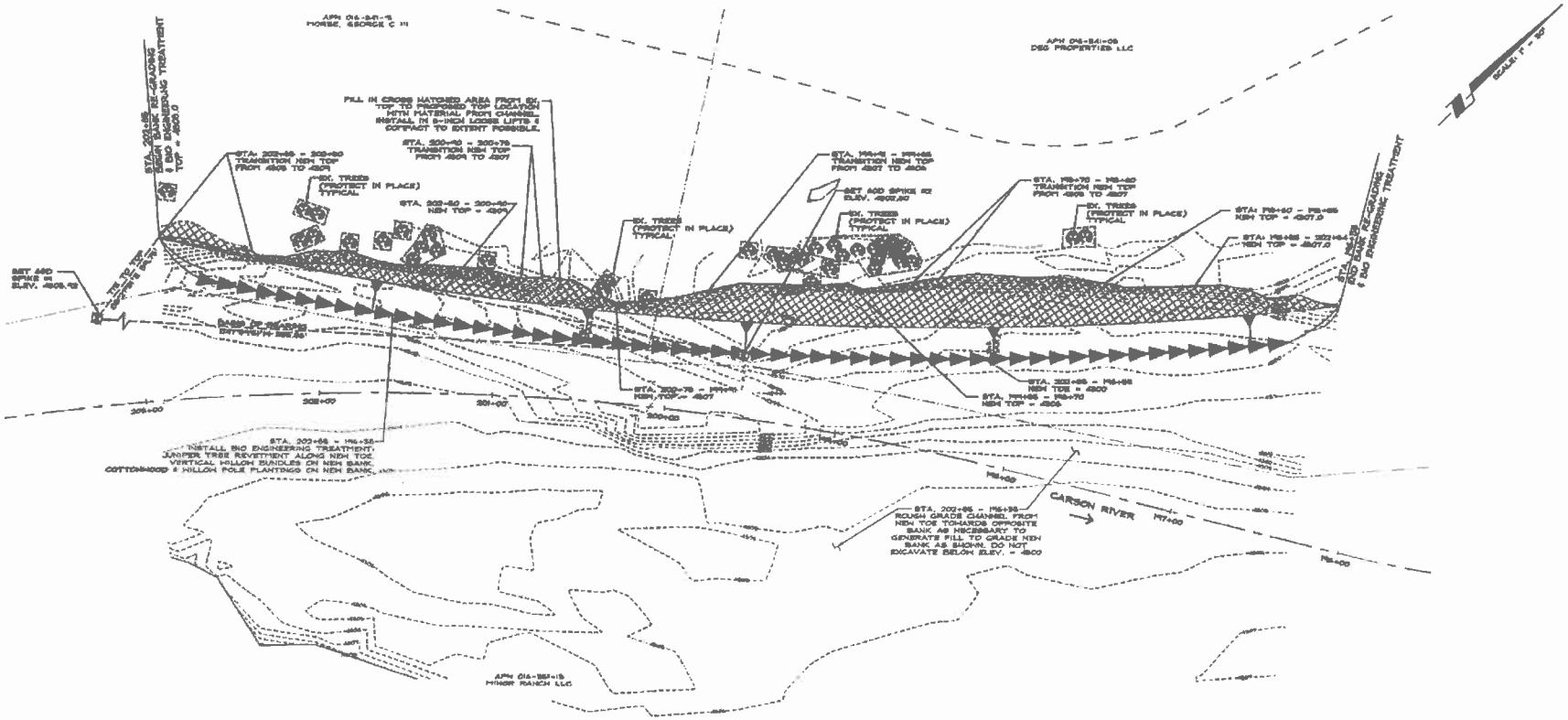
2012 CARSON RIVER BANK STABILIZATION PROJECT
DAYTON VALLEY CONSERVATION DISTRICT

MCR - 045
SITE & GRADING PLAN
STA. 209+25 TO 214+00

DRAWN: RBR/JAG
ENGINEER: JJH
SCALE: 1" = 20'
DATE: 06/07/12
JOB: 0892-016-12
DRAWING: 0101-016.01
SHEET: C7
OF: C10 SHEETS

BID SET

03-06-12



ESTIMATED QUANTITIES

EARTH WORK:

CUT = 70 CY
FILL = 295 CY
NET CUT = 5 CY

* NOTE: NO GUARANTEE IS MADE CONCERNING THE ACCURACY OF THE ESTIMATED QUANTITIES. THE CONTRACTOR SHALL RELY ON HIS OWN DETERMINATION OF ACTUAL QUANTITIES OF WORK ASSOCIATED WITH THE PROJECT.

AFFECTED PROPERTIES

MCR-046
APN: 016-241-05 DEG PROPERTIES LLC
APN: 016-241-15 MORSE, GEORGE
APN: 016-351-15 MINOR RANCH LLC

NO.	DATE	REVISION BLOCK	BY

SCALE: 1" = 30'

R|O|Anderson

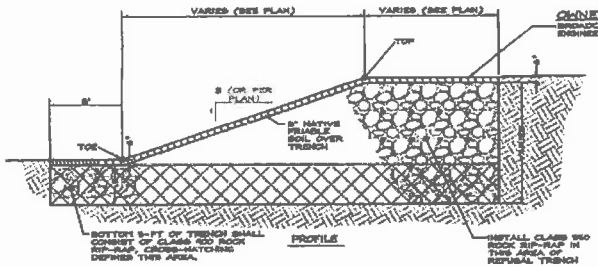
2012 CARSON RIVER BANK STABILIZATION PROJECT
DAYTON VALLEY CONSERVATION DISTRICT

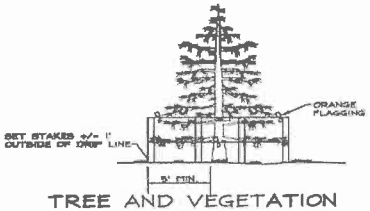
MCR - 046
SITE & GRADING PLAN
STA.197+00 TO 203+00

08-06-12

DRAWN: RSM/JAG
ENGINEER: JSI
SCALE: 1" = 30'
DATE: 05/07/12
JOB: 0502-016-12
DRAWING: 0502-06028
SHEET: C8
OF: C0 SHEETS

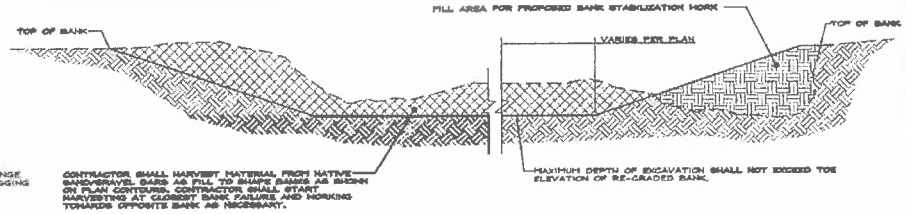
BID SET





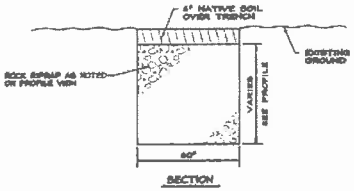
TREE AND VEGETATION PROTECTIVE FENCING

NO SCALE



TYPICAL CHANNEL CLEARING SECTION (C)

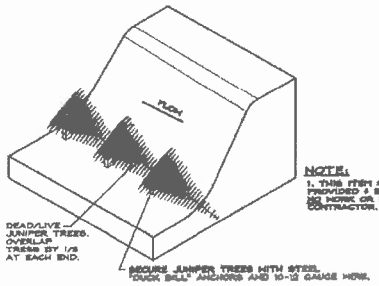
NO SCALE



NOTES:
1. FOR RIP-RAP SIZE SEE ROCK RIP-RAP SPECIFICATION MEMOIR.

ROCK REFUSAL TRENCH

NO SCALE



NOTE:
1. THIS ITEM SHALL BE WHOLLY PROVIDED & INSTALLED BY OWNER. NO WORK OR MATERIALS BY CONTRACTOR.

TREE REVETMENT (BY OWNER)

NO SCALE

TABLE 200.07.04-1

Percentage by Mass Passing Sieve	Sieve Size (inches)					
	Class 150	Class 300	Class 400	Class 550	Class 700	Class 900
100	10	20	30	40	48	60
70 - 85	9	18	27	36	45	54
30 - 60	6	12	18	24	30	36
5 - 15	2	5	7	12	18	24
0	1	2	3	6	8	12
D50(1)	6	12	16	22	28	36

1 MEAN STONE SIZE.

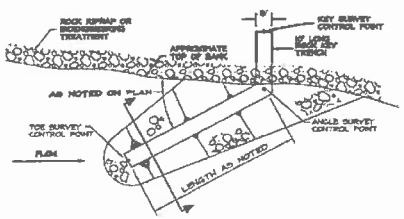
TABLE 200.07.04-2

Test	Test Method	Requirements
Resistance to Wear (percent)	ASTM C 535 (1)	45 Maximum
Absorption (percent)	ASTM C 127	4.2 Maximum
Apparent Specific Gravity	ASTM C 97	2.5 Minimum (2)
Durability	ASTM D 3744	52 Minimum

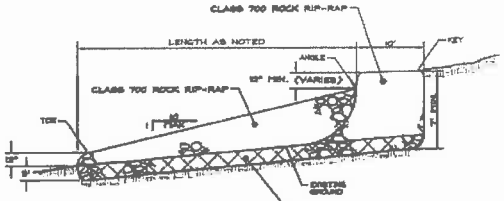
1. 1500 REVOLUTIONS
2. RIP-RAP WITH A SPECIFIC GRAVITY OF LESS THAN 2.5 WILL NOT BE ALLOWED.
3. RIP-RAP SHALL BE QUARRIED WITH FRACTURED FACES.
4. RIP-RAP SHALL HAVE AN EARTH TONE HUE THAT BLENDS WITH SURROUNDING ENVIRONMENT.

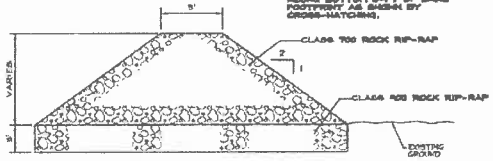
ROCK RIP-RAP SPECIFICATIONS

NO SCALE



NOTES:
1. FOR RIP-RAP SIZE SEE ROCK RIP-RAP SPECIFICATION MEMOIR.

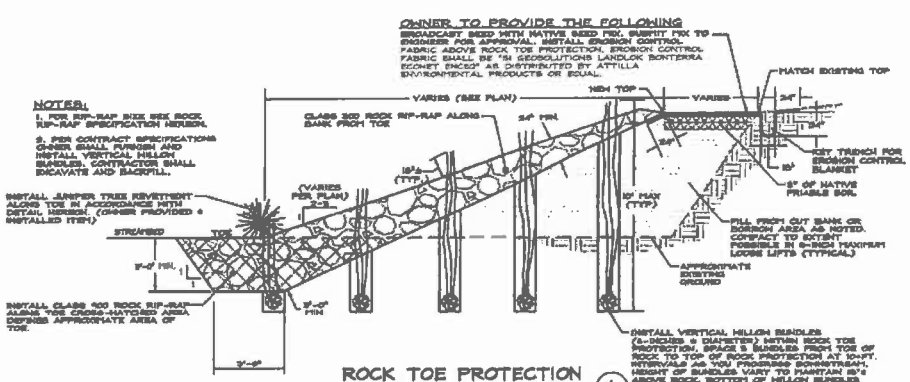




STREAM BARB DETAIL

NO SCALE

NOTES:
1. FOR RIP-RAP SIZE SEE ROCK RIP-RAP SPECIFICATION MEMOIR.
2. PER CONTRACT SPECIFICATIONS OWNER SHALL PURCHASE AND INSTALL VERTICAL WILLOW BUNDLES. CONTRACTOR SHALL EXCAVATE AND BACKFILL.



ROCK TOE PROTECTION (A)

NO SCALE

NO.	DATE	REVISION BLOCK	BY

R|O|Anderson

2012 CARSON RIVER BANK STABILIZATION PROJECT
DAYTON VALLEY CONSERVATION DISTRICT

DETAILS

DRAWN: RBR/JAG
ENGINEER: LJH
SCALE: AS NOTED
DATE: 06/07/12
JOB: 0842-016-12
DRAWING: 0842-08-C10
SHEET: C10
OF: C10 SHEETS

BID SET

Potential Sources of additional funding FY 2015:

State, Local and Federal Funding	Budget Amount	
River Wranglers Vegetation Management Workdays	$4,500	Approved
Lyon County, Nevada	$7,500	Approved
Lyon County, Nevada	$22,500	Approved
Division of Conservation Districts- Grants to Districts	$3,500	Approved
NDEP (NV Department of Environmental Protection)	$150,000	Approved
Carson Water Sub-Conservancy District (River)	$75,000	Pending
DVCD/Landowners/Materials (In-Kind)	$50,000	Approved
USDA/NRCS (In-kind)	$15,000	Approved
National Fish and Wildlife Foundation	$180,000	Approved
Nevada Department of Agriculture (Weeds)	$15,000	Pending
Nevada Division of State Parks (River)	$25,000	Pending
Nevada Division of Forestry (Fuels)	$69,500	Pending
Carson Truckee Water Conservancy District (Weeds)	$15,000	Pending
Carson Truckee Water Conservancy District (River)	$50,000	Pending
	Totals: $682,500.00	

Other Information:

This project proposal is part of a larger county wide effort to improve conditions along the Middle Carson River. These projects attempt to build on and connect to existing successful restoration projects from the past. These projects will be conducted using Best Management Practices that have been employed by the district on the Carson River over the past sixteen years. The District will be using bio-engineering treatment strategies whenever possible in order to achieve the best possible outcome. The DVCD incorporates the Carson River Stewardship plan and the Carson River Floodplain Management plan into our management strategy for the Middle Carson River.

Since 1996, DVCD has received over 4.5 million dollars in funding to support locally led resource management projects in Lyon County. The District will continue to work closely with local, state and federal agencies to ensure that resource management concerns are being addressed. With the assistance of the Carson Water Sub-Conservancy District, our District has established one of the most successful locally-led conservation efforts in the State of Nevada.

Respectfully,

Richard Wilkinson
District Manager
Dayton Valley Conservation District

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	$6,400.00
Landowners Equipment and Labor	$8,600.00
TOTAL:	$20,000.00

ESTIMATED DATE PROJECI' TO BEGIN: July l, 2015

ESTIMATED TIME TO COMPLETE PROJECI': June 30,2016

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, 2014 to June 30,2015

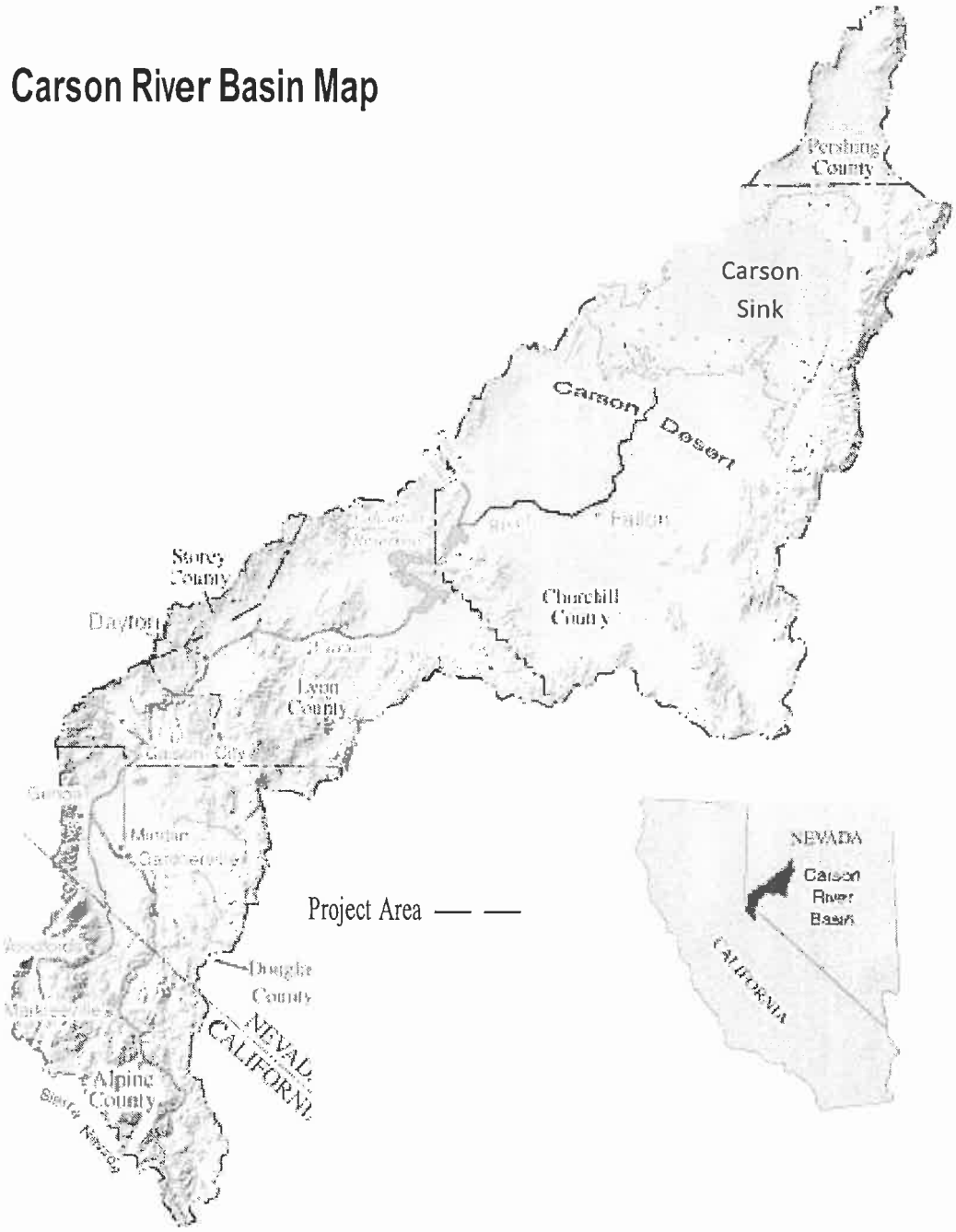
OTHER INFORMATION: Provide any other information that may be important to the approval of this application.

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 to remove dead and fallen trees, remove beaver dams, and burn slash piles to improve river flow, along the lower Carson River.

SIGNED: Bill Washburn
NAME: Bill Washburn
TITLE: Chairman, Lahontan Conservation District
DATE: February 10. 2015

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

Carson River Basin Map



Crews Clearing Debris along River Near Venturacci Lane Bridge 2014

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 Task Force

PROJECT LOCATION: Carson River channel, below Diversion Dam to the Carson River Sink

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

Create a river channel that is clear of abstraction and provides for free flow at natural choke points. An example is the Reno Highway Bridge has historically been clogged by debris during high water flooding events. Obstructions in these locations causes back up and over flow that moves into residential housing areas in both the county and City of Fallon. Four key locations have been identified and are described herein where sediment caused islands changed the flow, eroded banks or blocked flows under bridge works. Removal of sediment will provide for structures to operate within their design parameters. (See attached work locations)

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

This project will prevent and minimize property loss and other damage during flood conditions. Further maintaining a clear channel will enable the citizens to utilize the river for recreation. Creating a distinct path within the river channel will assist all recreational users. Maintaining an adequate velocity of the river flow prevents stagnant pools from developing where mosquitoes can propagate and create health issues for residents along the course of the Carson River

TOTAL ESTIMATED PROJECT COST: $200,000.00 (4 sites identified in attachment)
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.

- **Truckee-Carson Irrigation District – Maintenance including personnel and equipment**
- **Churchill County – Engineering, administration and removal work (Road Department Crews and Equipment)**
- **City of Fallon – Heavy Equipment**
- **Churchill County Mosquito, Vector and Weed Control District – Personnel and Equipment**
- **Volunteers – Adjoining landowners along the River that have offered their time and equipment**

Dollar equivalent amounts will vary from each contributor. However, the amalgamated total will necessarily equal the remaining $200,000.00 to complete the work.

ESTIMATED DATE PROJECT TO BEGIN: Fall and Winter of 2015 **Contingent on weather and water levels in the river.**

ESTIMATED TIME TO COMPLETE PROJECT: **180 days after work begins (affected by weather and water) This will ultimately be a project undertaken over a number of years to positively affect the entire reach of the river below Lahontan Dam.**

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.

1. Nevada Division of Environmental Protection, Bureau of Water Pollution Control - Temporary Permit TNEV2014402.

2. Right of Entry Authorization –Nevada Division of State lands – issued 12-20-2012

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

The work requested here compliments and furthers the work normally accomplished by the Lahontan Conservation District. It takes a combination of debris, foliage, beaver dam and sediment removal to maintain a clear channel. This unified work effort provides the following benefits on an annual basis and must also be maintained and continued to overcome the normal foliage growth, discarding of manmade debris and natural obstructions that enter the channel repeatedly.

Improvement Criteria Achieved:

a. **Ancillary or downstream benefits to improve the Carson River Watershed.**
b. **Minimize stream bank erosion, improve water quality, and re-establish native vegetation.**
c. **Reduce flooding risk along the Carson River, particularly to residential and commercial development.**
d. **Reduce flood damage risk to water and sewage infrastructure installed in Churchill**

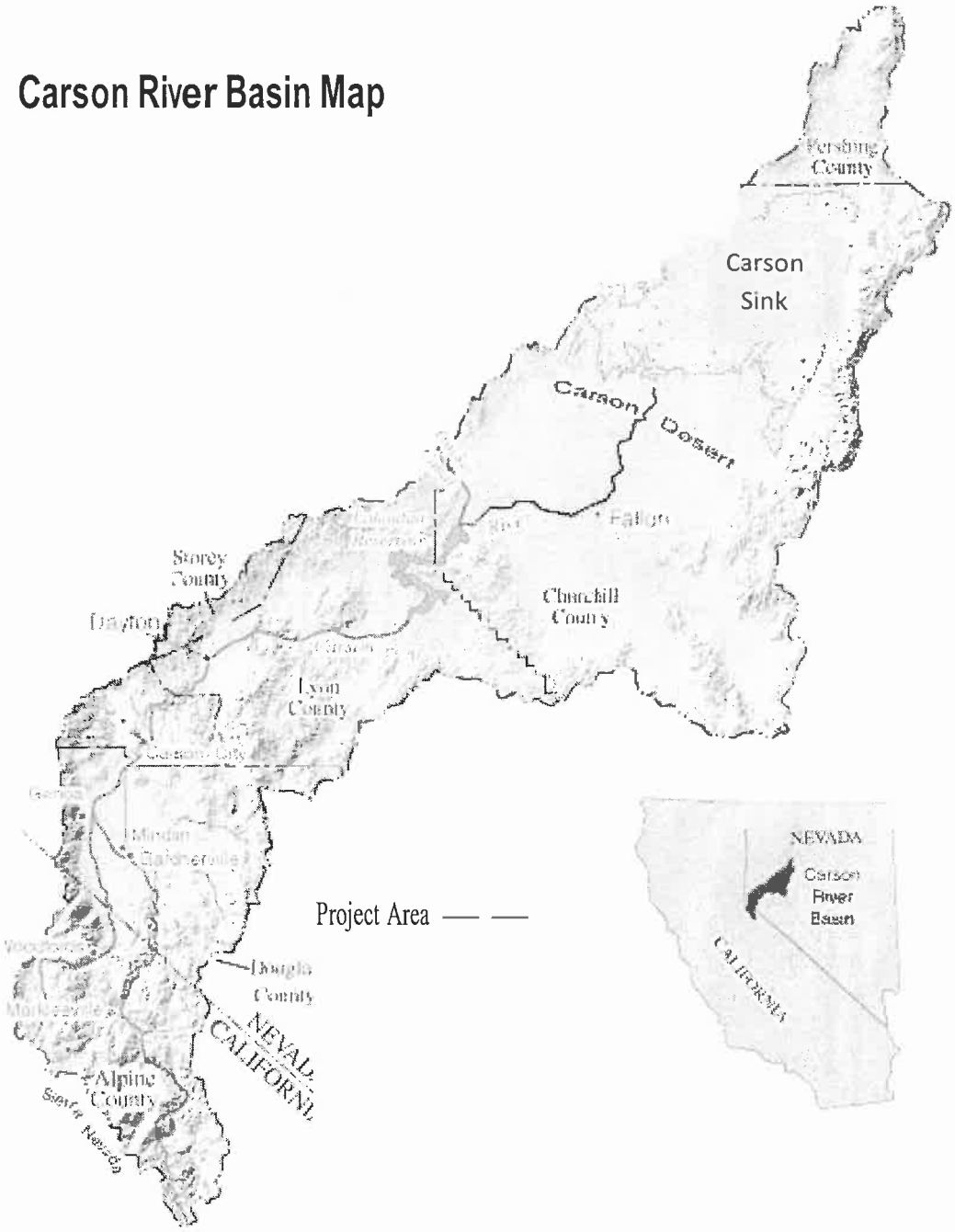
County.

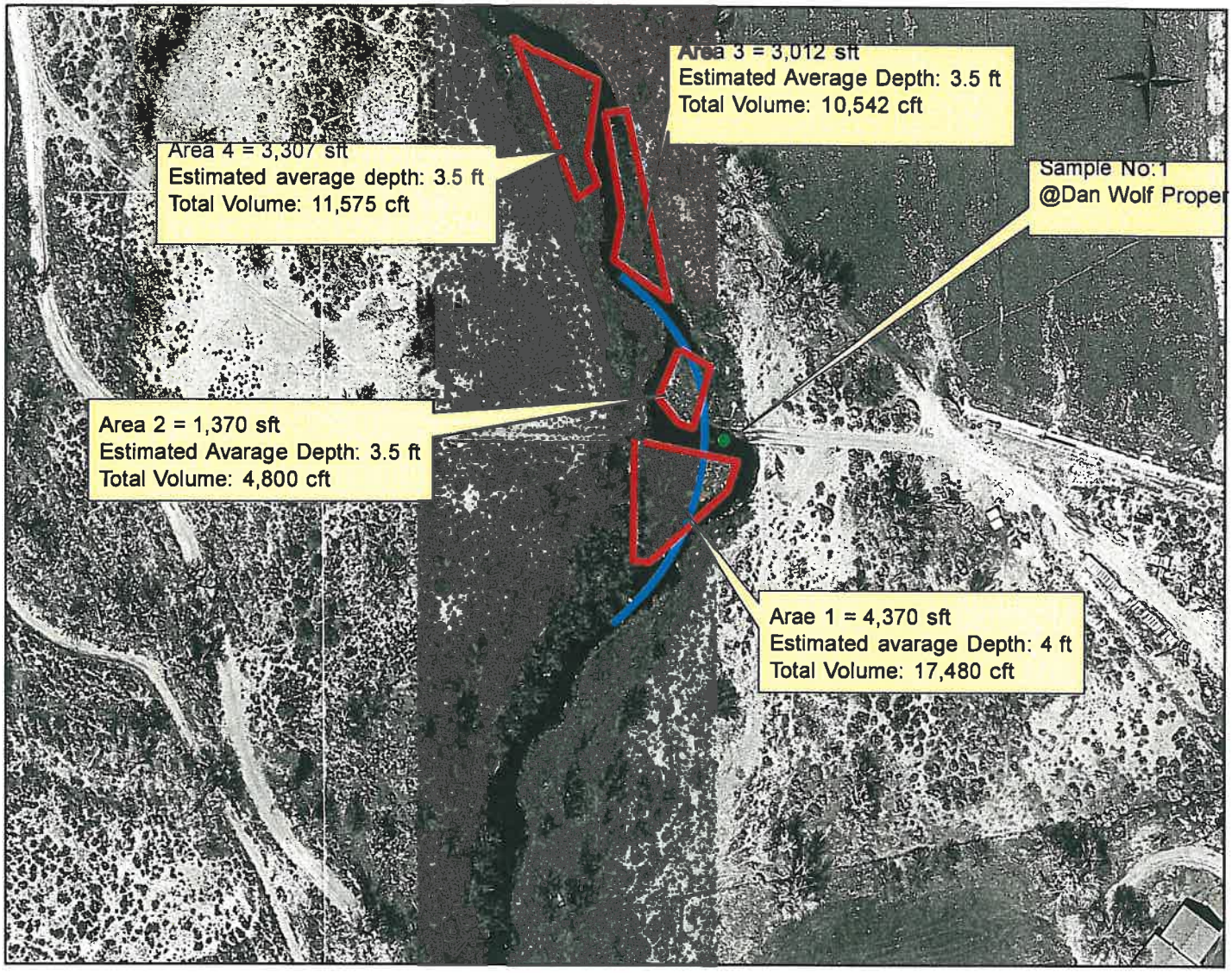
e. **Improve the administration and management of the river and stream system.**
f. **Improve the opportunities for citizens to use the river for recreational purposes.**
g. **Maintaining a clean/clear river channel will improve water quality and aid the overall stewardship plan for the Carson River.**

SIGNED: Bill Washburn
NAME: Bill Washburn
TITLE: Chairman. Lahontan Conservation District
DATE: February 10.2015

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

Carson River Basin Map





0 20 40 80 120 Yards

1 inch = 42 yards

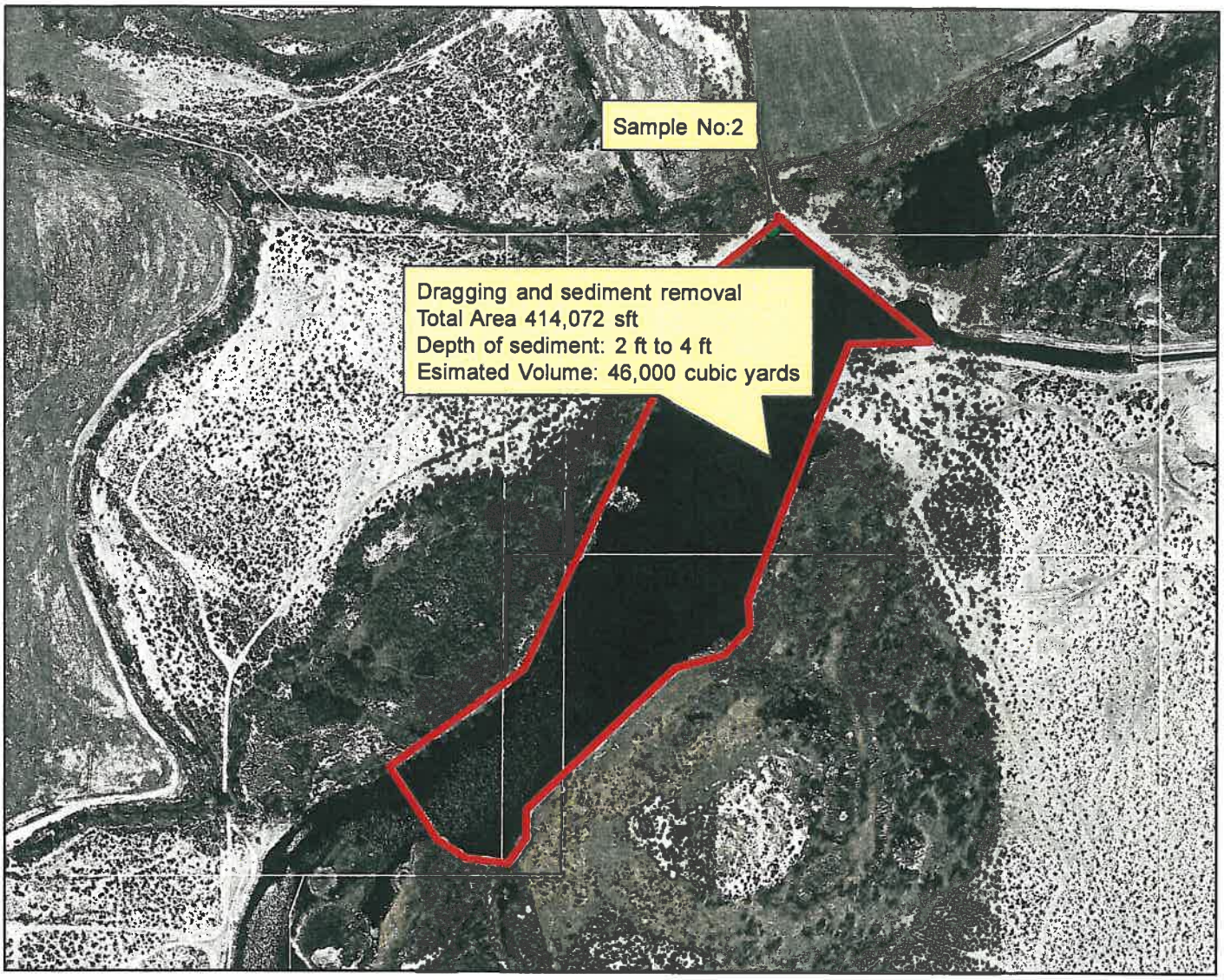
Carson River Improvment Project, Location No:1

Owner: Mr. Dan Wolf
Site Coordinates:N39.56194; W118.72899

Brief Description:
At the shown location sand deposit in the Carson River did change flow capacity, reducing area of flow and with meandring lenght reducing slope.
Existing river crossing should be consider in the future as permanent.

Proposed Action and Work:
Adjustment of river flow in direction as shown (blue line)
at the map would make shorter curve and increase the slope for about 10 %.
All exccessive material should be deposit out to increase area of the flow. Only 20% of the estimated volume for removal can be placed at the river channal not affecting maximum possable area of the flow.

Total Estimated Volume for removal is: 44,397 cft or 1,644 cubic yards



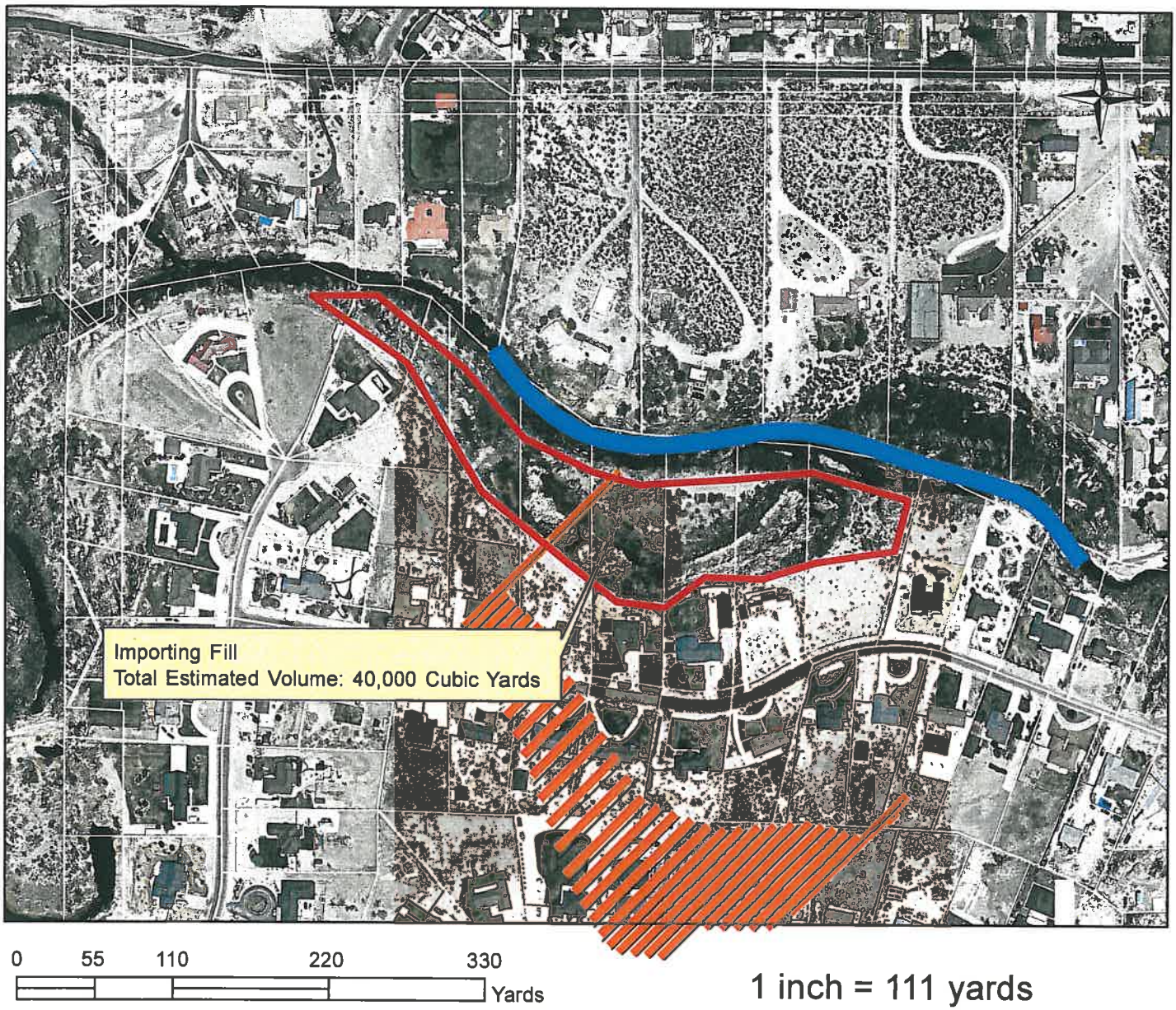
0 55 110 220 330 Yards

1 inch = 111 yards

Carson River Improvment Project, Location No: 2

Project Area No: 2
Carson River Improvemnt Project - Sagouspi Dam West
Location: N39.54025; 118.72899
Brief Description:
Sagouspi Dam need to be dragged and periodicallyall water discharged. Expected mud on the bottom is 2 to 4 ft tick.
Estimated volume of46,000 cubic yards should be remove from the bottom and properly disposed.
Soil sample was obtain if this project takes place in the future.

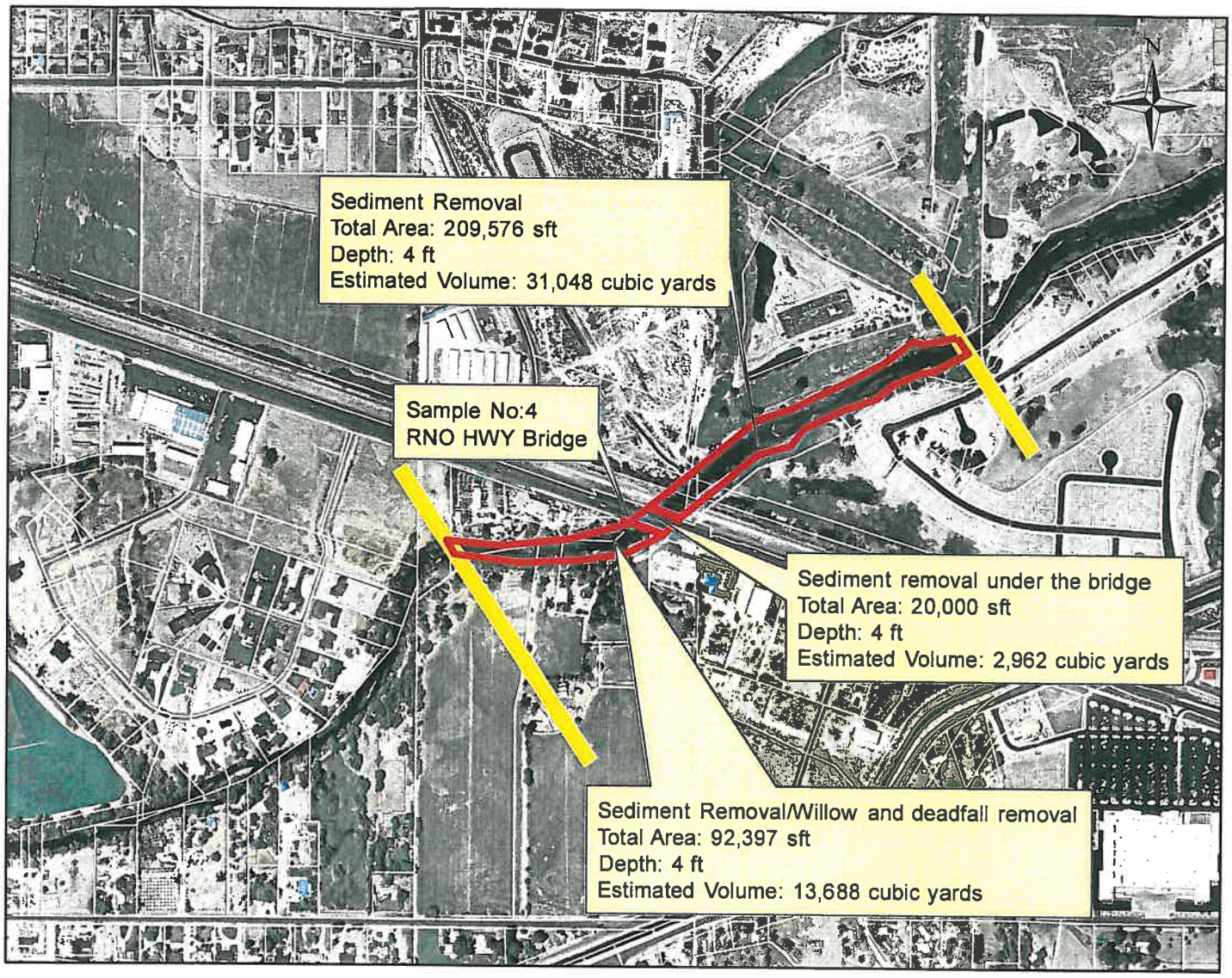
volume is: 24,330 cubic yards



Carson River Improvment Project, Location No:3

Brief Description:
At the shown location Carson River should be chanalized and on the south side fill material imported.
This will reduce future meandring and increase velocity.
Existing depression shown on the map should be eliminated as a source of mosquitos and potential health hazard.
This area has lower priority and needs to be done with property owner's assistance.

Total Estimated Volume for fill is: 40,000 cubic yards



0 137.5 275 550 825 Yards

1 inch = 262 yards

RNO HWY Bridge - Carson River Improvment Project, Location No:4

Site Coordinates:N39,48017; W118.81484

Brief Description:
At the shown location sand deposit in the Carson River did change flow capacity, reducing area of flow and with meandring lenght reducing slope.

Wiiows and deadfall did change velocity of the flow and increase sedimentation.
Sediments are 4 to 6 ft.

Proposed Action and Work:
Sediment removal with avarage depth of 5 ft would be suggested as a necessary considering importance of this bridge.
Willow and deadfall removal would be required.
Bridge should be maintain for the design flow in the future and maximum possable area of the flow.

Total Estimated Volume for removal is:47,698 cubic yard

CARSON WATER SUBCONSERVANCY DISTRICT
REQUEST FOR FUNDING

APPLICANT: **USGS (Angela Paul and Ramon Naranjo)**
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2730 N. Deer Run Rd.
Address
Carson City City | **Carson City** County | **NV** State | **89701** Zip Code
appaul@usgs.gov or rnaranjo@usgs.gov Email | **775-887-7697** Telephone #

APPLICANT'S AGENT (if different from Applicant):

Name

Address

City | County | State | Zip Code

Email | Telephone #

PROJECT NAME: Phase I: Evaluation of Existing Data for Assessing the Vulnerability of Public Supply Wells to Arsenic Enrichment in Southeastern Carson Valley, Douglas County, Nevada

PROJECT LOCATION/ADDRESS: **Carson Valley, Douglas County, Nevada**

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

To maintain an adequate supply of water to the public, the town of Minden has been providing water to Douglas County and Carson City. Due to the projected increases in municipal demand, water resource managers are concerned that increasing pumping rates from wells in Minden may change groundwater chemistry and degrade the resource by potentially drawing in arsenic enriched water. In order to assess the vulnerability of the municipal water-supply wells in the Town of Minden to arsenic enrichment, the transport of arsenic in groundwater in the vicinity of the pumping wells is warranted. In preparation for such an evaluation, the first step is to compile existing data from entities involved in the collection of groundwater samples for the determination arsenic concentration and other constituents and physical parameters known to be important in mobilizing arsenic. Factors such as municipal and agricultural well locations, depth, and pumping schedules will be compared to existing water chemistry data for a cursory evaluation of trends. Critical gaps in available data will be identified and recommendations

made, if necessary, for additional monitoring.

See attached proposal for additional information regarding the proposed 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.

(1) Compile and evaluate the suitability of existing groundwater chemistry (e.g. arsenic, phosphate, and redox-related parameters such as dissolved oxygen, nitrate, iron, and manganese), well lithology, and depth-to-water data currently available from local water purveyors, county, state, and federal sources for evaluating arsenic transport in the southeastern area of Carson Valley,

(2) Identify areas where additional information is needed for the evaluation of arsenic transport in groundwater in the vicinity of public-supply wells in southeast Carson Valley.

Compiled data will be quality assured using standard USGS protocols and data that meet the data quality standards of the USGS will be stored in the USGS NWIS database. Data compiled into the database will be considered for evaluating the transport of arsenic in groundwater underlying southeast Carson Valley as influenced by groundwater pumping using a groundwater flow and transport model.

This initial evaluation will provide all interested parties a current assessment of the spatial distribution of arsenic concentrations in southeastern Carson Valley.

TOTAL ESTIMATED PROJECT COST: $40,000_____
AMOUNT REQUESTED FROM CWSD: $20,000_____

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.

Matching funds are currently available from the USGS through the Cooperative Water Program.

USGS will contribute about $20,000
CWSD will contribute about $20,000

ESTIMATED DATE PROJECT TO BEGIN: July 2015

ESTIMATED TIME TO COMPLETE PROJECT: January 2016

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.

Not applicable

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

SIGNED: Angela Paul

NAME: Angela Paul

TITLE: Hydrologist

DATE: February 13, 2015

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

ATTACHMENT

Phase I: Evaluation of Existing Data for Assessing the Vulnerability of Public Supply Wells to Arsenic Enrichment in Southeastern Carson Valley, Douglas County, Nevada

Angela Paul and Ramon Naranjo

BACKGROUND

Over the past 15 years Douglas County has removed production wells in northern Carson Valley from use due to relatively high arsenic concentrations (Carl Ruschmeyer, January 2013, Douglas County Public Works Director, verbal communication). To maintain the supply of water to the public, the town of Minden has been providing water to Douglas County and Carson City. Due to the projected increases in municipal demand, water resource managers are concerned that increasing pumping rates from wells in Minden may change groundwater chemistry and degrade the resource by potentially drawing in arsenic enriched water. Long-term exposure to arsenic can cause illnesses ranging from skin discoloration to various cancers including those of the bladder, skin, and kidney (U.S. Environmental Protection Agency, 2012a).

Naturally occurring arsenic is one of the most common contaminants in groundwater in the western United States. Arsenic found in basin-fill aquifers is oftentimes associated with alluvial/lacustrine sedimentary deposits derived from the weathering of volcanic rocks (Welch and others, 1988). The primary aquifers beneath Carson Valley are comprised of quaternary aged basin-fill deposits of weathered granitic and volcanic material (Welch, 1994).

Arsenic mobility and transport through the subsurface is largely controlled by the interaction of groundwater with aquifer sediments. Arsenite (As(III)), the reduced form of inorganic arsenic, usually exhibits greater mobility in groundwater than the oxidized form, arsenate (As(V)). The difference in mobility is largely due to the greater attraction of As(V) to aquifer sediments relative to that of As(III) at pH values exceeding 8.5 (Smedley and Kinniburgh, 2002). Arsenic speciation (form) is influenced by the relative redox condition of the aquifer environment. In the vicinity of the Douglas County Airport, where arsenic speciation has been characterized, arsenic

in groundwater collected at depths greater than 250 feet from land surface was found to be primarily As(III); however, in the upper 150 feet of the aquifer As(V) predominated (Paul and others, 2010). Other factors contributing to the enrichment of arsenic concentrations in groundwater include, but are not limited to, relatively long groundwater flow paths, the application of phosphate containing fertilizers, and leaching from soils in irrigated areas (Busbee and others, 2009; Anning and others, 2012). The vulnerability of groundwater resources to contamination is influenced by the physical properties of the aquifer, well location and screened interval relative to the groundwater flow system, and geochemical environment (Focazio and others, 2002).

This proposal presents the first phase of a multi-phase study. This first phase of study will provide (1) an evaluation of existing data on the occurrence of arsenic in groundwater in Carson Valley as available from local water purveyors, county, state, and federal databases for spatial extent and any noticeable temporal patterns in concentration and (2) recommendations for additional monitoring of arsenic and redox related parameters as required to fill identifiable gaps in data for the future evaluation of arsenic transport in groundwater underlying the southeastern area of the valley.

PROBLEM

In January 2001, the U.S. Environmental Protection Agency (USEPA) lowered the maximum contaminant level (MCL) for arsenic in drinking water from 50 to 10 micrograms per liter (µg/L; U.S. Environmental Protection Agency, 2012a). Many areas throughout the United States that previously met the drinking-water standard of 50 µg/L are now exceeding the revised standard.

Groundwater samples collected by the U.S. Geological Survey from Carson Valley, had arsenic concentrations ranging from below detection to 85 µg/L (fig. 1). Samples collected from decommissioned water-supply wells in northern areas of Carson Valley had a median concentration of about 34 µg/L; exceeding the current drinking-water criterion (fig. 2). The 2013 assessment of drinking-water quality for the East Valley Water System, Douglas County, Nevada, indicated that arsenic concentrations in groundwater ranged from 5 to 13 µg/L (Douglas County Water Utility, 2013).

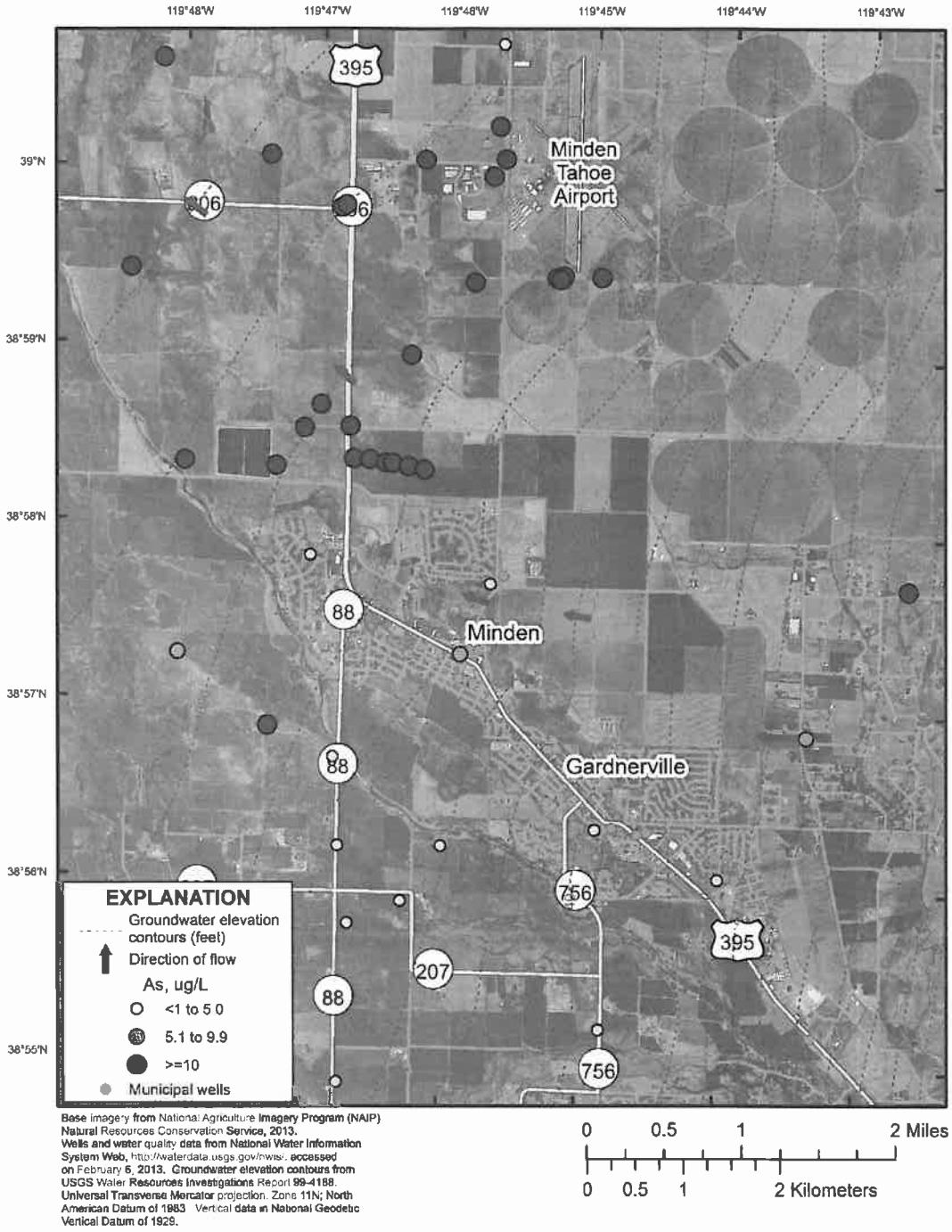

Figure 1. Distribution of known arsenic concentrations in groundwater samples collected from 1983 to 2008 by the U.S. Geological Survey from Carson Valley, Douglas County, Nevada. The general direction of groundwater flow is from the southeast valley, northwest toward the Carson River.

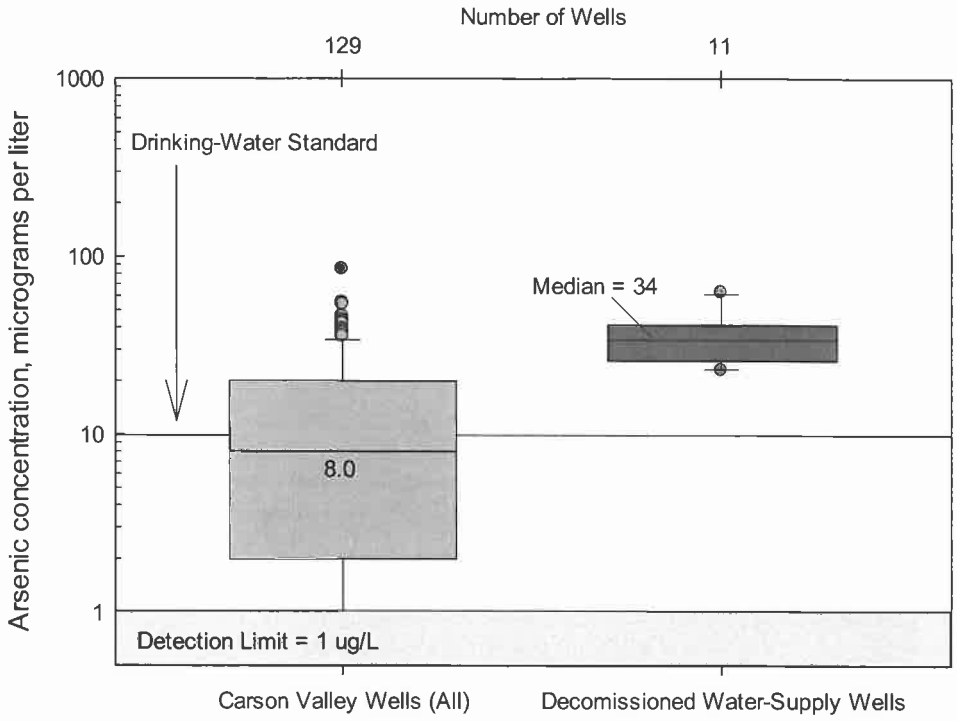

Figure 2. Arsenic concentrations in groundwater samples collected from 1983 to 2008 in Carson Valley. For perspective, data from decommissioned water-supply wells in northern Carson Valley were included (Ron Roman, February 1, 2013, Douglas County Public Works, written communication). The median arsenic concentration in samples collected from a water-supply well in Minden was 8 µg/L (Gregg Hill, February 4, 2013, Town of Minden, written communication).

Utilizing the location of municipal and agricultural wells and pumping rates similar to those during the 2005 water year, Yager and others (2012) estimated that projected declines in water levels would be between 5 to 40 feet within the groundwater flow path toward the Minden public-supply wells over the next 50 years. Changes in water level could result in changes in zones within the aquifer from which the municipal-supply wells might intercept source water. The results of an arsenic transport evaluation can be used to assess the vulnerability of water-supply wells to arsenic enrichment.

OBJECTIVES AND SCOPE

This project will provide an assessment of available chemical and physical data necessary to characterize arsenic distribution in Carson Valley. During this first phase of study, currently available data from local water purveyors and county, state, and federal databases will be assessed spatially and temporally for critical gaps and recommendations made for additional sample collection and monitoring under conditions of routine groundwater pumping from both municipal and agricultural supply wells.

The primary objectives of the Phase I work are:

1. Compile and evaluate the suitability of existing groundwater chemistry (e.g. arsenic, phosphate, and redox-related parameters such as dissolved oxygen, nitrate, iron, and manganese), well lithology, and depth-to-water data currently available from local water purveyors, county, state, and federal sources for evaluating arsenic transport in the southeastern area of Carson Valley,

2. Identify areas where additional information is needed for the evaluation of arsenic transport in groundwater in the vicinity of public-supply wells in southeast Carson Valley.

APPROACH

The purpose of compiling available data on the occurrence of arsenic in Carson Valley from multiple agencies is to determine the suitability of existing data for evaluating the distribution and mobility of arsenic in the groundwater resources underlying the valley. Groundwater samples have been collected from various wells for the determination of arsenic by Douglas County, Gardnerville Ranchos General Improvement District (GID), Gardnerville Water Company, Indian Hills GID, the Town of Minden and other entities; and the data provided to the State of Nevada. Data will be compiled along with existing data from the U.S. Geological Survey's National Water Information System (NWIS) database.

Information regarding the physical attributes will be inventoried for each well that chemical data are obtained. This information will mainly be compiled from well logs available from the State of Nevada Division of Water Resources. Data will include depth of well, lithology, screened interval(s), and proposed use.

Depending on data availability, recommendations may be made for additional monitoring necessary to characterize aquifer conditions important for the evaluation of arsenic transport in groundwater underlying southeast Carson Valley. For example, if arsenic speciation and information regarding the redox condition of the aquifer are found to be limited to areas outside the capture zones of public-supply wells, sampling of groundwater for arsenic speciation and constituents indicative of redox conditions (such as dissolved oxygen, organic carbon, nitrate/nitrite, ammonia, iron species, and sulfate) may be needed in key areas of the valley.

Factors such as municipal and agricultural well locations, depth, and pumping schedules will be compared to existing water chemistry data for a cursory evaluation of trends. For example, do arsenic concentrations increase or decrease in groundwater sampled from wells during periods when municipal supply or agricultural wells are actively pumping? The Douglas County Water Utility (2013) reported that arsenic concentrations in groundwater sampled from Well No. 8 tend to be higher when pumping lower than normal volumes. Recommendations for additional monitoring from existing wells will be made based on results of the initial evaluation of available data.

PRODUCTS

Data will be quality assured using standard USGS protocols and stored in the USGS NWIS database. Data compiled into the database will be considered for evaluating the transport of arsenic in groundwater underlying southeast Carson Valley as influenced by groundwater pumping using a groundwater flow and transport model. USGS scientists will provide a summary report and presentation to the cooperator summarizing the findings of this data assessment.

REFERENCES

Anning, D.W., Paul, A.P., McKinney, T.S., Huntington, J.M., Bexfield, L.M., Thiros, S.A., 2012, Predicted nitrate and arsenic concentrations in basin-fill aquifers of the southwestern United States: U.S. Geological Survey Scientific-Investigations Report 2012-5065, 78 p. and appendices.

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CARSON WATER SUBCONSERVANCY DISTRICT
REQUEST FOR FUNDING

APPLICANT: Steven N. Berris
U.S Geological Survey
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Carson City Carson City NV 89701

snberris@usgs.gov 775-887-7693

APPLICANT'S AGENT (if different from Applicant):

Name

Address

City County State Zip Code

Email Telephone #

PROJECT NAME: **Surface-Water Monitoring Program in West-Central Nevada**

PROJECT LOCATION/ADDRESS: **West-Central Nevada**

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

This funding request is for the continuation of the cooperative monitoring program between Carson Water Subconservancy District and the U.S. Geological Survey for surface-water monitoring program activities in the Carson River Basin for fiscal years (FY) 2016-2017 (July 1, 2015 – June 30, 2017). Surface-water O&M costs include maintaining the streamgaging equipment at 9 gaging stations, real-time monitoring and display of water information, making streamflow measurements, computing streamflow, quality assurance, and data publication and archive in NWIS (National Water Information System) database.

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

Streamflow information and flow measurements provided at real-time and non-real-time gages in the Carson River Basin define hydrologic conditions throughout the basin, such as sources, sinks, and fluxes of water. Accurate flow data from streamgages provide critical information for water accounting for legal agreements, river and project operations, hazard forecasts, water-quality assessments, and research (such as interaction of water systems; groundwater/surface-water interactions).