

**Final Report**  
**San Vicente Creek River Stewardship Project Phase 1**  
**June 15, 2024**  
**Submitted by Gila Resources Information Project**

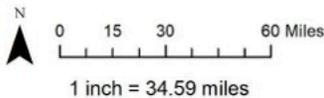
**Project Summary**

The Gila Resources Information Project (GRIP) San Vicente Creek River Stewardship Phase 1 project worked cooperatively with the Town of Silver City and private landowners to accomplish multiple objectives. Enjoyed by tourists and local residents alike, San Vicente Creek, its riparian corridor, and the trails and open space system are important natural assets that contribute to the vibrancy of downtown Silver City. The creek also provides important riparian habitat that serves as a corridor for migrating birds, including the state threatened Mexican Blackhawk, and other wildlife. The perennial reach of San Vicente Creek is the only watercourse in the Silver City watershed known to support a fishery.

Historically, extensive woodcutting and cattle grazing denuded vegetation from the Silver City watershed. Subsequent flooding incised drainages throughout the watershed and most acutely on San Vicente Creek where stormwater runoff incised the stream down to bedrock, and as deep as 55 feet in places, forming “The Big Ditch”. The Silver City Watershed is still in the process of recovering from this severe damage, but high volumes of storm water from streets and drains on top of these legacy incisions creates a continued threat to riparian habitat from high velocity/high volume flow that is exacerbated by extreme storm events as a consequence of climate change. Flood waters can cause erosion that not only destroys riparian habitat, but can also expose and damage the sewer pipeline and access to the sewer line in Pinos Altos and San Vicente creeks. The Town needs access to the sewer main in order to conduct routine maintenance to prevent sewage leaks that impair water quality. Sewer line access and maintenance needs to be carried out in a manner that allows for protection and restoration of riparian habitat, as well as management of Silver City’s trail system. Stabilization of stream banks, bed, and sewer line access is needed to balance these sometimes competing goals.

Building upon past work conducted by NMED, the San Vicente Creek River Stewardship Phase 1 project addressed water quality impairments and threats to riparian habitat in San Vicente Creek through non-native, invasive tree removal, native plant restoration, stream channel work to reconnect the floodplain, streambank protection and induced meandering, and construction of water harvesting infrastructure to capture urban stormwater runoff.

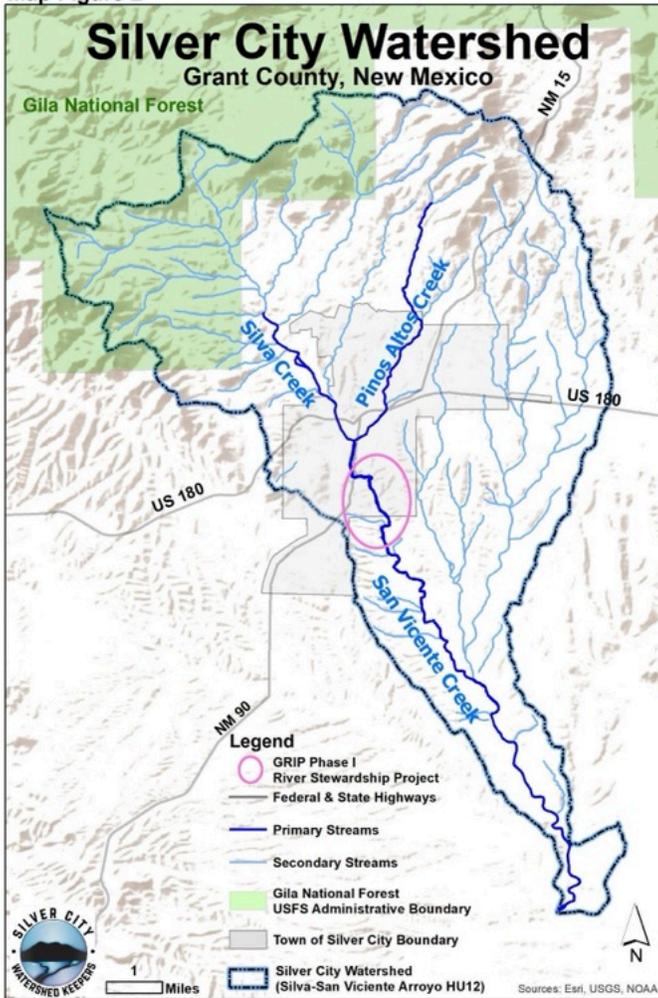
**Map Figure 1: Location of Silver City and the Silver City Watershed (HU12 Silva - San Vicente)**  
 In relation to the Upper Gila River Watershed and Arizona / New Mexico County Boundaries



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- Legend**
- City and Town Locations
  - ▭ Arizona Counties
  - ▭ New Mexico Counties
  - ▬ Upper Gila River
  - ▬ Mimbres-San\_Vicente\_Streams
  - ▬ Upper Gila River Watershed Area
  - ▬ Rio\_Grande\_Basin\_Major\_Rivers
  - ▭ Silver City Watershed
  - ▭ Mimbres\_HU6\_Watershed

Map Figure 2



## Project Results by Work Plan Tasks

### 1. Assessment of San Vicente Creek Riparian Areas

GRIP and its subcontractors established ten management units for the project area (SVC-001 through SVC-011, excluding SVC-008). For each management unit, we assessed the need for non-native tree eradication, slash pile removal, locations for stream restoration structures, willow plantings for stream bank protection and induced meandering, and check dams. This assessment was used as the basis for development of management prescriptions (design plans) discussed below.

We determined in better detail the private property boundaries within each management unit. However, because the Grant County parcel map is not accurate, we had to conduct extra mapping work to ground truth property boundaries, bench marking boundaries to

recent survey data from Esperanza Hills LLC. GRIP hired a GIS mapper to ensure that we knew where property boundaries are located and could conduct work with the appropriate permissions. We feel confident that our property ownership map is more accurate (to within 20 feet vs. as much as 100 feet for the Grant County parcel data).

Additionally, the property owner Vicente Alcorta passed away just prior to receipt of the Notice to Proceed. We were therefore not able to request permission to conduct work on his property. Similarly, we were unable to make contact with landowner Rosie Benavidez. Because we were not able to obtain landowner permissions for these two properties, we scaled back the acreage of the project by approximately 1 acre of riparian area.

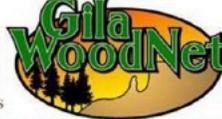
We held a kickoff meeting with the Town of Silver City, private property owners, and stakeholders to review the project goals and objectives and obtain input on issues and concerns. We had periodic discussions with the Town of Silver City Community Development Department, Utilities Department and Trails and Open Space Advisory Committee to discuss access to sewer line manholes and recreational trails issues related to the project.

GRIP mapped all of the manholes and utility line access roads from the Highway 90 bridge to Mobile Drive. This assessment served as a basis for discussions with the Town and private landowners regarding sewer line access for maintenance. Additionally, we mapped slash piles and potential areas for earthwork and grade control.

**GILA RESOURCES  
INFORMATION  
PROJECT (GRIP)**



**GRIP San Vicente Creek Restoration Project  
GRIP Phase I Management Units  
(svc001-011 & AgA001)**



**Wildlands  
Ecological  
Services**



## 2. Water quality monitoring

GRIP's Silver City Watershed Keepers (SCWK) coordinator carried out quarterly water quality monitoring of four sites: 2 directly upstream of the project area and 2 sites within the project area. Bacteria sampling has been conducted historically at 2 sites upstream of the project area. Budget constraints limited the number of sites the SCWK were able to monitor every quarter. However, given the frequency of Sanitary Sewer Overflows in San Vicente Creek, the SCWK started collecting grab samples from all 4 sites. A fifth site was added in Pinos Altos Creek in 2023. Volunteers helped out during a few of the water quality monitoring events.

See the attached Excel workbook for the results of quarterly water quality monitoring. San Vicente Creek and Pinos Altos Creek have met applicable surface water quality criteria for temperature and pH. Phosphate and nitrate levels were below acceptable levels for surface water. Although New Mexico does not have a numeric standard for turbidity, the water quality measurements have been less than 10 NTU which is generally considered low turbidity.

Dissolved oxygen has fallen below the applicable surface water quality criterion of >5 mg/L. This has occurred at a few sites during low flow periods (e.g., 2nd quarter prior to monsoons). However, all sites in March 2024 had low dissolved oxygen.

*E. coli* levels have generally been lower than the surface water quality criterion of 235 CFU for a single sample, except in the case of a known Sanitary Sewer Overflow (see data for June 2023). Total coliforms are consistently high during warmer weather.

## 3. Assess fuel loads pre-project

GRIP obtained the FIREMON software (Fire Effects and Monitoring System, Gen. Tech. Rep. RMRS-GTR-164-CD. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station) to assess fuel loads for the project, both pre-treatment and post-treatment as a measurement of project success. We consulted with the State Forestry Division on the use of the FIREMON methodology and they concurred with this approach to measuring fuel loads. GRIP and Stream Dynamics completed the Pre-Project Fuel Load assessment for each management unit in the project area in June 2022.

Measurements throughout the project area quantified fuel components: 1) dead and down woody debris (DWD), 2) understory vegetation. The Fuel Load method is used to sample DWD and estimate total vegetative cover and dead vegetative cover (Lutes et. al. 2006) .

GRIP surveys estimated DWD in terms of weights and volumes of downed woody material. Using a planar intersect technique (tape 60-ft [20-meter]), downed material was inventoried by 0- to 0.25-inch, 0.25- to 1-inch, and 1- to 3-inch diameter classes; and by diameter for downed logs over 3 inches. This involved counting downed woody pieces that intersect

vertical sampling planes (tape lines) and measuring the diameters of wood larger than 3 inches in diameter. A "go/no-go gauge" tallied DWD size classes quickly and accurately. A diameter tape was used to measure larger DWD greater than 3 inches.

Duff and litter depth will not be measured. No duff was observed in the floodplain. Accumulations of leaf litter were sporadically observed, usually tree leaves around flood debris. Furthermore, GRIP's goal is to reduce DWD and our proposed restoration would have limited impact on leaf litter.

Cover of live and dead vegetation was estimated at two points along each 60-ft (20-meter) sampling plane. Cover abundances of living and dead plants was recorded at the canopy, subcanopy and herbaceous layer.

Data results were used to calculate the amount of readily-combustible biomass as tons per acre. Biomass of DWD and vegetation was calculated using the Analysis Tools software provided by FIREMON.

Plot locations were determined prior to field survey using aerial photos, FEMA Floodplain Maps, USDA Soil Surveys and ArcGIS. Pre-determined plots were located on the project site using ArcGIS Field Map App on an Android Tablet.

The average density of Siberian elm trees was 94.1 trees/ac. Tree of Heaven was estimated to have 29.3 trees/ac. In contrast, native tree densities were negligible by comparison. This suggests a serious imbalance and suggests a serious risk to the future ecological quality of the Floodplain Gallery Forest. Other native species were observed in the area but the small sample number of macroplots did not capture their distribution and abundance.

Nonetheless, air photo interpretation and field observations support the fact that the actual numbers of cottonwoods, hackberries, box elder, etc. are indeed low. Furthermore, basal area (BA) and tree density measure the magnitude of the problematic invasive species and their effect on degrading natural ecosystems. In fact, in all four sampled management units, Siberian elm represents nearly 77% of all the tree BA estimates per acre. Tree of Heaven represents nearly 13% all tree BA.

### **Slash Piles**

There were 30 separate piles of woody debris attributed to slash or flood-deposited debris. The locations of these slash piles were photographed and mapped. See Figure 8 for slash pile locations.

**GILA RESOURCES  
INFORMATION  
PROJECT (GRIP)**

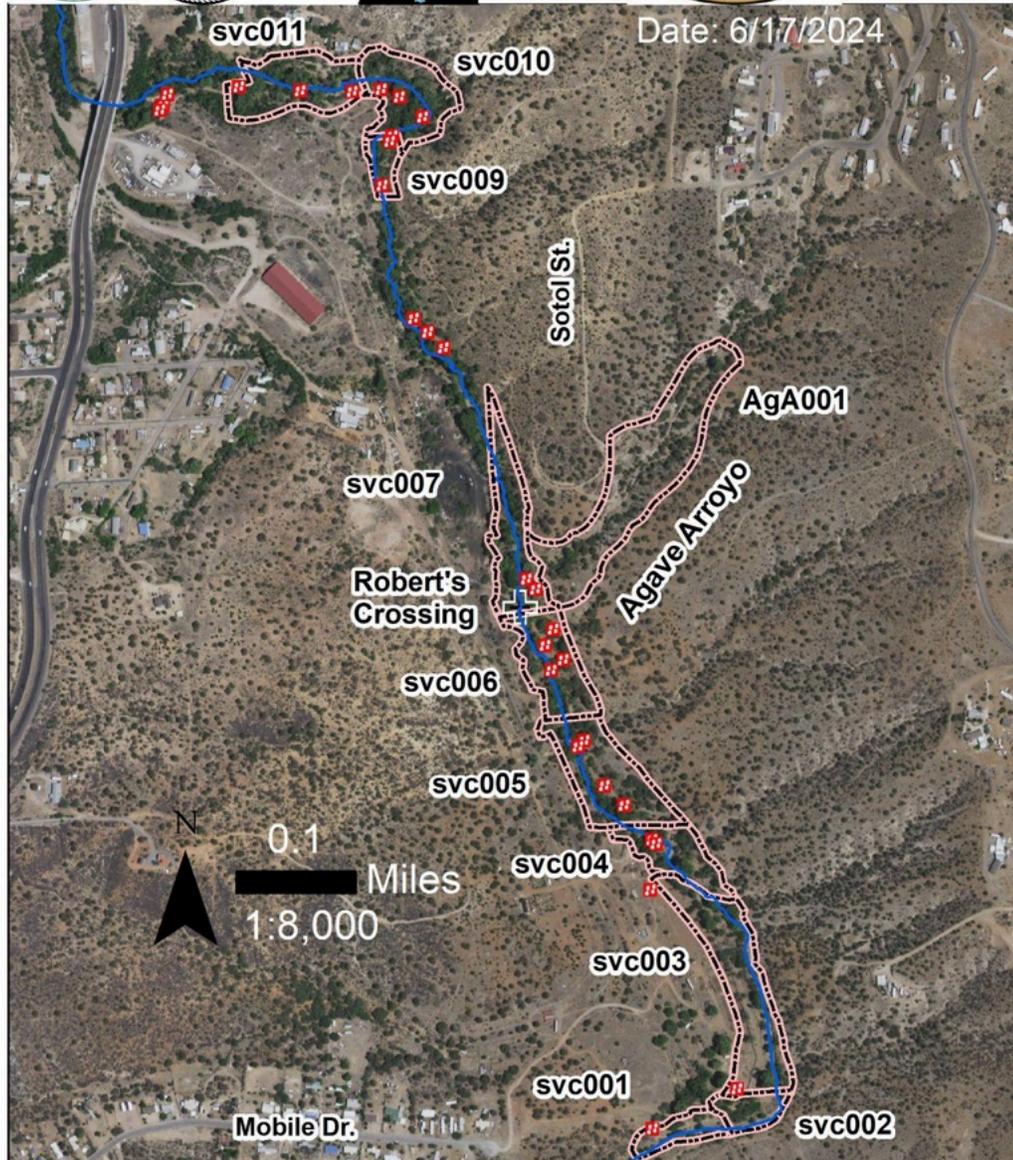


**GRIP San Vicente Creek Restoration Project**

**Figure 8 Slash Pile Locations**



**Wildlands  
Ecological  
Services**



Some of the flood deposited wood piles are not considered to be a threat because of their location within the streambed. GRIP's hydrologic team decided these slash piles valuable for preserving natural stream processes. Hazardous slash piles with dangerous amounts of potential fire fuels were removed.

See the attached Pre-treatment Fuel Load and Vegetation Survey Report.

#### 4. Draft design plans for invasive species removal and native planting/seeding

The overall goals of the invasive species removal and native planting and seeding management prescriptions were riparian habitat improvement and fire risk reduction. Removal of non-native Siberian elm and Tree of Heaven opens up the canopy to native tree species such as cottonwood, willow, box elder and walnut and reduce competition for sunlight, water and nutrients, allowing native trees and shrubs to thrive and gain dominance in the tree canopy over the non-natives. Additionally, by removing non-native tree species, slash, and ladder fuels we can reduce the fire risk within the riparian corridor. Planting native trees and shrubs and seeding of native grasses and wildflowers also improves riparian habitat.

GRIP and its subcontractors, Stream Dynamics, Lone Mountain Natives, and Gila WoodNet developed draft management prescriptions for invasive species eradication, slash removal and planting of native trees and shrubs and seeding of native grasses and wildflowers. These draft plans were presented to the Town of Silver City and stakeholders for input. The final draft plan was submitted to the NMED Project Officer for review and approval, and GRIP incorporated the Project Officer's comments in the final design plans.

#### 5. Obtain cultural clearances

GRIP submitted a request to the State Historic Preservation Division for cultural clearance for the project. Initially, we obtained clearance for the upper portion of the project area (Management Units 9 - 11), as well as clearance to plant willows along stream banks throughout the project area.

SHPO required an archaeological survey for site LA 131521, the Silver City Reduction Works. GRIP hired Neal Ackerly of Dos Rios Consultants to do the survey. Mr. Ackerly submitted the required paperwork to the State, and GRIP also submitted additional private property boundaries to demonstrate that the Silver City Reduction Works is on private land and outside of our project area.

SHPO cleared the lower portion of the project area based on the additional information.

The archaeological survey was not originally included in our budget so we used funding that was not used for the Corps of Engineers clearance since it was not needed (see Task 15 below) along with contractor personnel budget to cover the cost of the cultural survey.

6. Consult with, place order, and contract grow native plants through Lone Mountain Natives –

Based on the riparian assessment in Task 1 and management prescriptions outlined in Task 4, GRIP and subcontractor Stream Dynamics consulted with Mark Cantrell of Lone Mountain Natives to place an order for 412 native plants. Subcontractor Stream Dynamics also purchased 148 pounds of native grass seed and 53 pounds of native wildflower seed for the project area.

**PLANT LIST: River Stewardship-San Vicente Creek Phase 1  
Lone Mountain Natives**

**TP= tree pot; 1g = 1 gallon pot**

<b>Common Name</b>	<b>Species</b>	<b>#</b>	<b>Size</b>
Golden Currant	<i>Ribes aureum</i>	36	TP
NM Olive	<i>Forestiera neomexicana</i>	6	TP
Chokecherry	<i>Prunus virginiana</i>	22	TP
NM Locust	<i>Robinia neomexicana</i>	47	TP
Net Leaf Hackberry	<i>Celtis reticulata</i>	40	TP
AZ Cypress	<i>Cupressus arizonica</i>	12	TP
Rocky Mt Juniper	<i>Juniperus scopulorum</i>	12	TP
Mt Mahogany	<i>Cercocarpus breviflorus</i>	26	TP
W Soapberry	<i>Sapindus saponaria</i>	29	TP
Wolfberry	<i>Lycium pallidum</i>	5	TP
Three Leaf Sumac	<i>Rhus trilobata</i>	18	TP
Horsetail Milkweed	<i>Asclepias subverticillata</i>	26	TP
Broadleaf Milkweed	<i>Asclepias latifolia</i>	3	TP
Apache Red grass	<i>Zuloagaea bulbosa</i>	6	TP

Deer Grass	<i>Muhlenbergia rigens</i>	8	1g
Apache Plume	<i>Fallugia paradoxa</i>	24	1g
4 Wing Saltbush	<i>Atriplex canescens</i>	12	1g
False indigo	<i>Amorpha fruticosa</i>	7	1g
Fremont Cottonwood	<i>Populus fremontii</i>	4	1g
Rabbitbrush	<i>Chamisa nauseosa</i>	5	1g
Goodings Willow	<i>Salix</i>	18	1g
Winterfat	<i>Krascheninnikova l.</i>	10	1g
Elderberry	<i>Sambucus nigra</i>	18	1g
Woods Rose	<i>Rosa Woodsii</i>	4	TP
Monarda	<i>Monarda menthifolia</i>	6	TP
Wright's Goldenrod	<i>Solidago wrightii</i>	8	TP
<b>Total Plants</b>		<b>412</b>	

Because Lone Mountain Natives was not able to provide us with all 500 plants, we purchased 86 walnuts, velvet ash and sycamore from Upper Gila Watershed Alliance's Seedlings to Saplings program. Additionally, we received a donation of 7 cottonwoods in 1 gallon pots from the Silva Creek Botanical Garden for a total of 505 plants.

#### 7. Obtain Landowner Agreements

We worked with the NMED project officer to obtain private landowner agreements for private property within the project area. Landowner agreements were signed by the following property owners: Esperanza Hills LLC, Old Chinese Gardens LLC, and 93 North LLC.

#### 8. Rosgen Level II survey of stream channel

Stream Dynamics conducted Rosgen Level II longitudinal profiles and cross sections of San Vicente Creek within the project area. Stream Dynamics surveyed 6950 linear feet of stream bed as well as eight cross sections at points along the reach that were either ecologically significant/sensitive or critical points for utility access and/or recreational use. The information gleaned from the Rosgen Survey was compiled with other relevant project data to inform the final management prescriptions for earthwork and grade control.

Additional survey work was also carried out in January 2023 prior to earthwork construction due to high flows in September and October 2022 that changed the stream geometry in the vicinity of a very large cottonwood tree at station 4450 in the longitudinal profile.

## 9. Botanical survey Pre-Project

In July 2022, GRIP and Stream Dynamics collected vegetation data for four macro-plots within representative habitats within project management units. These macro-plots were selected to represent the various habitat types along the floodplain and terraces. Two macro-plots were located within open woodlands with an herbaceous layer dominated by grasses. Two other macro-plots were located within closed to partially-open forests. Macro-plot centers were located with a sub-meter GPS and marked with a 10-inch spike and labeled with a metal tag. Macro-plot corners were located by triangulation with meter tapes with edges oriented along cardinal points of the compass. Macro-plot data was collected using standard FIREMON (FFI) data sheets. FFI software was used to statistically analyze fuel-load biomass in terms of species abundance and frequency.

Different measures were used to estimate species abundance of Forb/Herbs, Graminoids, Vines, and woody seedlings (trees, shrubs, and subshrubs). A grid of 20 quadrats were laid on 5 transects transecting the 20m<sup>2</sup> macro-plot. These quadrats were 50 cm by 50 cm squares. Quadrats provide a repeated measures approach to sampling plant species in the herb layer. Woody seedlings were documented using this method. One measure is Frequency of Occurrence (percent frequency) of a species occurring within a macro-plot. A second measure of species abundance is percent cover. Within each quadrat the so-called leaf canopy of a species foliage and branches are measured as a percentage of the quadrat it dominates. If an herb covers one-fifth of the quadrat, then its percent cover is 20%. The percent cover represents an average of all the coverage of an herbaceous species or woody seedling within the 20 quadrat samples. For example, the grass species sideoats grama dominates nearly 30% of the herbaceous layer in Plot# 202. Sideoats grama was estimated to occur in 75% of all the quadrats.

There were 68 species observed within all four macro-plots sampled.

See the Pre-treatment Fuel Load and Vegetation Assessment Report for the detailed results of the pre-treatment vegetation assessment, including species occurrence and percent cover observed in each of the macro-plots.

## 10. Herbicide treatment of Tree of Heaven

GRIP and its subcontractor Stream Dynamics consulted with State Forestry and the Gila National Forest on methods for Siberian elm and Tree of Heaven removal. We proposed to use the cut-stump application of herbicide in which the tree is cut with a chainsaw, and a certified herbicide applicator paints or sprays on a small amount of herbicide on the cambium all around the circumference of the stump. State Forestry and the Gila National

Forest concurred with this method of herbicide application. We discussed alternative methods for Tree of Heaven since it is extremely difficult to remove. The Forest Service estimates that it can take between 3 and 5 years to completely eradicate Tree of Heaven. State Forestry recommended that we remove the leaves only of the small diameter thickets of Tree of Heaven to weaken the tree and then follow up with herbicide during the next season. We experimented with this method. Results are described below in Task 21.

#### 11. Draft design plans for grade control structures and bank protection

GRIP and subcontractor Stream Dynamics developed draft design plans for one grade control structure, bank protection, and induced meandering. The management prescription included construction of a grade control structure to reconnect the creek to the floodplain and secure a stream crossing for the Town of Silver City Utilities Department. It also included construction of a log vane for streambank protection and to induce meandering away from the sewer line.

Unfortunately Old Chinese Gardens landowners did not want to pursue breaching of the berm on their property to reconnect the creek to the floodplain, therefore this management prescription was removed from the work plan.

GRIP and Stream Dynamics met with the Town of Silver City in August 2022 and obtained their approval of the proposed management prescriptions. Since breaching of the berm on Old Chinese Gardens Property was removed from the management prescriptions, the Town of Silver City floodplain manager did not need to sign off on the design plans.

GRIP met with each landowner individually to go over management prescriptions on their respective private land and secure their approval.

#### 12. Draft design plans for cottonwood and willow planting sites for stream meanders

GRIP and subcontractors Stream Dynamics reviewed the results of the Rosgen Level II Stream Survey and developed draft design plans for cottonwood and willow planting and stream meanders. The goal was to armor stream banks where the creek was threatening to undermine the sewer line, as well as induce the stream to meander away from the sewer line where this made sense.

The plans were submitted to the NMED Project Officer for review and comment. We met with the Town of Silver City in August 2022 to review the proposed plans and received their approval to implement the proposed management prescriptions.

#### 13. Draft design plans for Corbin Street water harvesting and tributary check dams

The project proposal had envisioned constructing one-rock dams in two tributaries in the upper portion of the project area, in the vicinity of “The Jungle” and the Corbin St.

Trailhead. However, the Town of Silver City has had a difficult time with homeless camps being constructed in these two drainages. Although the camps were removed, they continue to be rebuilt. With the approval of the Town and the NMED Project Officer, we identified Agave Arroyo as a better location for the tributary check dams as there is no history of homeless camps in the drainage and a sewer line comes down the drainage from Mountain View Road and was being undermined by erosion. Additionally, this drainage discharges a significant amount of stormwater and sediment into San Vicente Creek. We identified and flagged potential check dam locations from the confluence of the drainage with San Vicente Creek all the way up to Agave Road, a distance of ½ mile.

The project proposal had also envisioned an infiltration basin at the Corbin Street Trailhead. During our kick-off meeting with property owners and discussions with the Town of Silver City, we realized that more drainage work than what was included in this project is likely required in this area, and any work would be overly complicated by property owners' perceptions, boundaries and access. Because of these issues, we removed this task from the work plan. The funds for this task were used to purchase rock for the one-rock dams, given that there is a lack of native rock in Agave Arroyo.

#### 14. Draft design plans for improved sewer line access for the town

Issues of access to the sewer line were discussed with the Town of Silver City, private landowners, and stakeholders (e.g, Trails and Open Space Advisory Committee) at the project kick-off meeting. During the pandemic, there was a sanitary sewer overflow at Manhole 17. The Town Utilities Department caused a significant amount of damage to the creek and private property, and trespassed with heavy equipment in their rush to access this manhole to unblock the sewer line. Private property owners were understandably upset, and the situation was the impetus behind this River Stewardship Project. GRIP facilitated a conversation with the Town, private property owners and stakeholders to reach consensus on the sewer line access road that respects private property, the San Vicente Creek Trail, and protects the creek and stream banks, while providing secure access to the Utilities Department. We agreed that we would secure a creek crossing at "Robert's Crossing," where a rutted dirt road came steeply down from the old railroad grade across the creek from the Agave Arroyo confluence. Along with access from Mobile Dr., all manholes from Agave Arroyo to Mobile Dr. would be easily accessible. At the time, manholes at the upper end of the project area below the Jungle were not accessible. However, because of another sewer overflow in June of 2023, the Town constructed a creek crossing and new sewer line access road, unfortunately removing some valuable walnut trees we had been planning to save, to access the remaining manholes except for one below "The Jungle" and above Robert's Crossing. See Task 26 discussion below.

#### 15. Floodplain Manager Review

GRIP consulted with the Town of Silver City Floodplain Manager for his review. He said he did not need to sign off on our plans, given that breaching of the berm at Old Chinese

Gardens was removed from the list of management prescriptions. This was the only potential flooding issue

#### 16. Schedule Construction

GRIP worked with its subcontractors, the Town of Silver City and stakeholders to schedule on-the-ground work for October 2022 through the end of February 2023. The work was scheduled in fall and winter to avoid the migratory bird breeding season. Our work extended by one week into early March 2023 given delays due to weather. After consulting with the New Mexico Department of Game and Fish, we were given approval to extend our work past the March 1 start of the migratory bird breeding season contingent upon daily bird surveys before starting work. Mike Fugagli of Stream Dynamics carried out these surveys each day to clear us for work.

Additionally because of the weather delays, the tree work in SVC009,010, and 011 (Corbin St. Trailhead and The Jungle) were postponed until fall 2023 after the close of the migratory bird breeding season.

#### 17. Section 404 Permit

Per a conversation with the Army Corps of Engineers office in Las Cruces, projects along San Vicente Creek do not need a 404 permit because closed basins are not jurisdictional under the federal Clean Water Act's Waters of the U.S. (WOTUS) rule. San Vicente Creek is part of the Mimbres Basin, a closed basin not covered by WOTUS. Because of this guidance, we removed this task from the workplan. Additionally, we did not need the associated state Section 401 permit.

#### 18. Scheduling and Organizing Volunteer work events

GRIP worked with its Silver City Watershed Keepers program and the Aldo Leopold Charter School Youth Conservation Corps program to schedule 46 volunteer planting, watering days, and other work days from April 2023 through June 2024. See task 29 below.

#### 19. Cottonwood and willow harvesting

Stream Dynamics harvested coyote willow whips from The Nature Conservancy Iron Bridge Preserve on the Gila River for planting along San Vicente Creek for stream bank stabilization and induced meandering. Additionally, three Goodding's willow poles and two cottonwood poles were harvested from TNC property for pole planting at Robert's Crossing to protect the bank and arm of the cross vane grade control structure on river left. Armoring the left bank was important given the close proximity of the sewer line. Willow whips were also planted in the log vane to protect the sewer line, which was on the right bank at that location.

## 20. Planting cottonwoods and willows

Stream Dynamics harvested willow whips from The Nature Conservancy Iron Bridge Preserve on the Gila River and planted 654 whips in San Vicente Creek to induce meandering and for stream bank stabilization.

Additional willow whips were planted at the log vane and grade control structures. Cottonwood and Goodding's willow posts (5 total) were planted in holes dug by an auger at the grade control structure at Robert's Crossing to stabilize the stream bank and protect the sewer line.

During the monsoons in fall 2023, an additional 6 willows and cottonwoods were planted with the Aldo Leopold Charter School EcoMonitors just above the 319 project at the Mobile Dr. end of the project area. The willows and cottonwoods were planted along the bank on river right to armor the stream bank as well as block off an unnecessary creek crossing for vehicles. This stream crossing was used by illegal ATV activity.

See Figures 4 and 5 for willow/cottonwood plantings (yellow lines) in the project area.



Planting willow whips along San Vicente Creek. Planted willow whips poke up on the gravel bar at the downed cottonwood. October 13, 2022

## Willow Whips - Growth Progress



Willow whips on cobble bar - February 2023



Willow sprout - April 2023



Willow whips on cobble bar - June 24, 2023 and May 2024.

**GILA RESOURCES INFORMATION PROJECT (GRIP)**  **GRIP San Vicente Creek Restoration Project**  
**Figure 4** Willow, Native Tree & Shrub Planting Areas  
**North**



**GILA RESOURCES  
INFORMATION  
PROJECT (GRIP)**

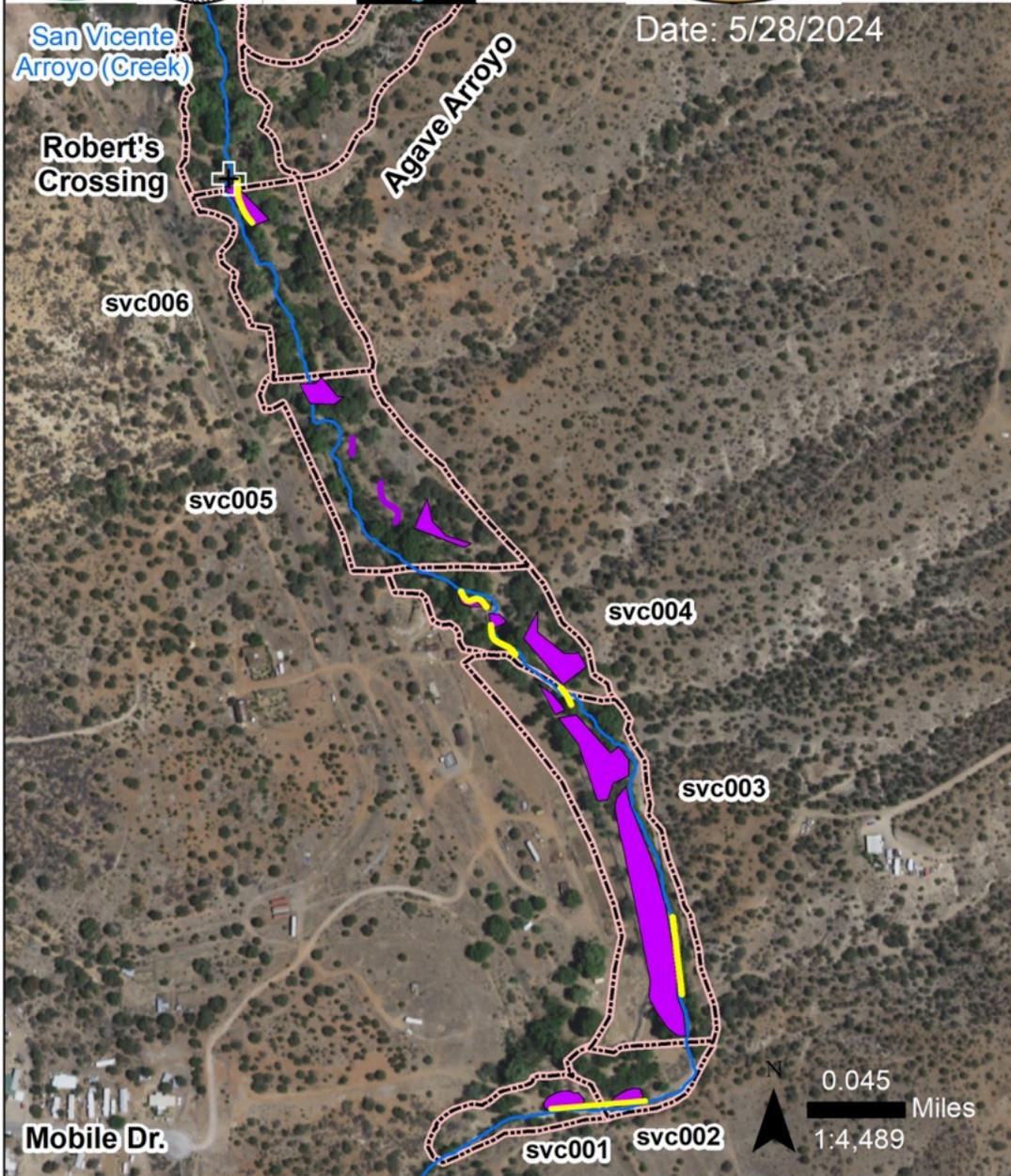


**GRIP San Vicente Creek Restoration Project  
Figure 5  
South  
Willow, Native Tree  
& Shrub Planting Areas**



**Wildlands  
Ecological  
Services**

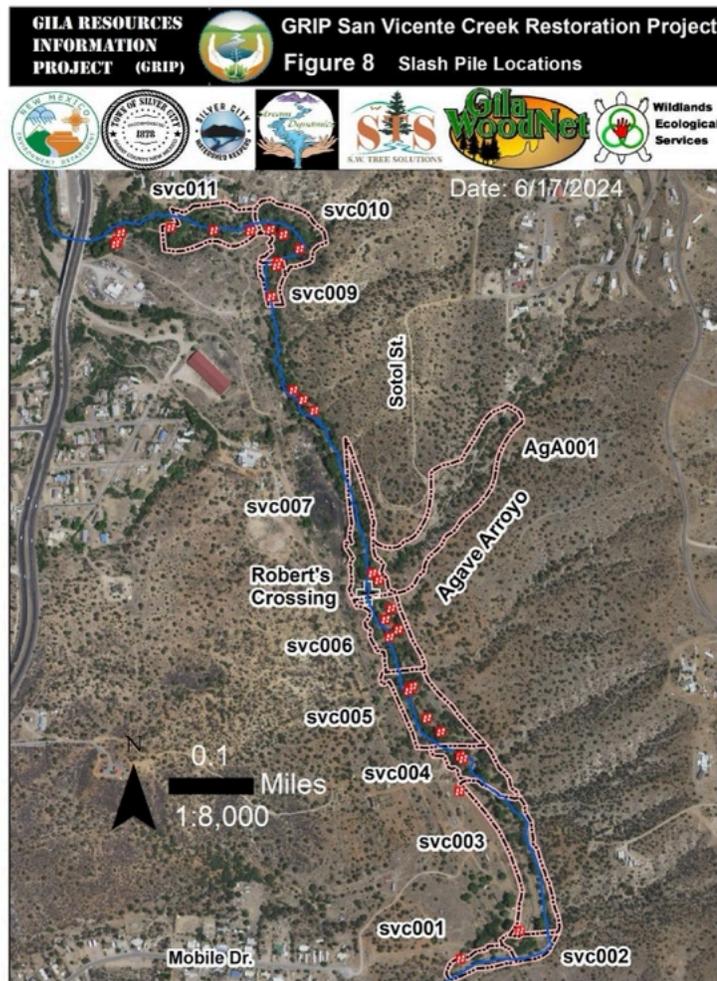
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21. Non-Native Plant Species Cutting, Tree Thinning and Pruning. Hauling large wood off site. Chipping and mulching slash.

GRIP, Gila WoodNet and Stream Dynamics carried out non-native tree cutting, thinning, pruning, hauling, chipping and mulching for the project area from Robert's Crossing downstream to the lowest end of the project area on Mobile Drive (Management Units 001 through 007) in January through early March 2023. Non-native trees were selectively removed from approximately 13.4 acres in the lower portion of the project area (SVC-001 through SVC-007).

Slash piles were also removed from the area where they posed a fire risk.



Due to wet weather, muddy conditions and equipment failures, the tree work was delayed, and we were not able to complete the upper portion of the project area (Corbin St. trailhead and “Jungle”) before the beginning of migratory bird breeding season. We did receive permission from the Department of Game and Fish to extend our work past March 1 for a few days to finish hauling biomass out of the project area. However, we needed to defer the tree cutting, thinning and pruning work in the upper portion of the project area to fall 2023.

Because of Gila WoodNet’s chronic equipment issues, Southwest Tree Solutions became our new contractor to carry out the tree work in Management Units 009, 010, and 011 in October of 2023. Stream Dynamics applied herbicide to tree stumps in this area after cutting by Southwest Tree Solutions.

Large diameter Tree of Heaven was removed in its entirety to the best of our ability. Tamarisk and Siberian elm trees were cut and herbicide applied. Elm trees were selectively cut in order to preserve some shade canopy as appropriate. Herbicide was applied to the stumps of cut elm trees, tamarisk and large diameter Tree of Heaven. Smaller stems of Tree of Heaven were cut, followed by foliar spraying and mechanical removal of resprouts in the late summer/early fall 2023. Herbicide application of resprouts of Tree of Heaven and elm was carried out in summer/early fall 2023 and at the end of the project period in June 2024. We also experimented with weakening Tree of Heaven thickets by removing the foliage only with successive cutting followed by herbicide application.

Gila WoodNet hauled biomass to the Old Chinese Gardens and segregated it. Large diameter logs that can’t be chipped will be used for firewood or biochar. Biochar was made from the Tree of Heaven biomass given its allelopathic characteristics. Elm trees were ground with the grinder to make mulch. The mulch was applied to access routes and disturbed areas after reseeding as part of restoration activities. Mulch was also used in project plantings.

Management treatments removed an estimated 63 tons of woody biomass throughout the project area. This is a 41% reduction of total standing biomass. Standing biomass in the canopy/subcanopy alone was reduced by 36%. The removed biomass came from non-native Tree of Heaven and Siberian elm. Subcontractors Gila WoodNet and Southwest Tree Solutions reported removing a total of about 63 tons of biomass (50 tons from the lower area (SVC-001 through SVC-007 and 13 tons from the upper area (SVC-009 through SVC-011), which was hauled from the project area and either chipped or used for firewood or biochar. Chips were used in mulching of project disturbance, access roads and plantings.



Gila WoodNet and Stream Dynamic elm and Tree of Heaven removal in lower area of San Vicente Creek - February 2023



Cut biomass was stacked along access roads to facilitate pickup by either the grapple logging equipment or loader. Biomass was hauled to Old Chinese Gardens for processing into chips, biochar or firewood. January - March 2023



Gila WoodNet processed biomass at Old Chinese Gardens farm. The grinder processed biomass into mulch that was used in access road rehab and plantings and compost. Larger logs were used for biochar and firewood. February 2023.



Southwest Tree Solutions cut Siberian elm and Tree of Heaven from SVC-009 through SVC-011 in October 2023. Large logs were hauled from the project area. Some of the chips were distributed on the project site.

22. Identify locations of utility lines where digging will occur

Stream Dynamics called 811 as per state law to identify utility lines to ensure that we didn't damage any utility lines during the project implementation.

23. Construct grade control structures in creek to induce meandering

GRIP and Stream Dynamics constructed a boulder grade control structure to stabilize the utility access at "Robert's Crossing" during the next large flood. The grade control was built in anticipation of a headcut that will occur when the log jam gives out. (We ended up removing the log jam when we stabilized the bank in this vicinity to protect the sewer line in Phase 2.) We anticipate that the next large flood will remove the sediment that had accumulated behind the log jam, and our grade control structure will create a plunge pool and riparian habitat, while also protecting the grade of the stream at the crossing. The banks along the structure were stabilized with plantings of coyote willow, Goodding's willow and cottonwood. The Goodding's willow and cottonwood posts were planted directly into groundwater with holes dug with an auger.



Robert's Crossing Grade Control Before - looking downstream and looking upstream.  
January 2023



Robert's Crossing grade control construction - January 31



Placing the rock for the grade control structure.



March 2023

April 2023

Goodding's willows and cottonwood posts can be seen on the left bank along the cross-vane grade control structure. Coyote willow planted on the inside of the structure.



Coyote willows, Goodding's willows, and cottonwoods at cross vane grade control structure (L). Pole planted Goodding's willow at Robert's Crossing. October 2023

A log vane structure was constructed to induce meandering of the creek away from the sewer line in the vicinity of Old Chinese Gardens. The Town of Silver City had previously constructed an access route along the stream bank in this area, without the private property owner's knowledge, to address a sewer line overflow in 2020. Since that time this bank has been eroding badly. Stream Dynamics used an excavator to carry the bole of a large cottonwood tree, that had been illegally cut down in the vicinity of Robert's Crossing, and brought it to this site. We excavated a shallow trench in the stream bed and bank, and set the log in as an upstream pointing barb with the but end embedded into the right bank at bankfull elevation. It was held down by a large boulder, backfilled with gravel and sediment, and then planted with willow whips. The sediment used to hold the log vane down was obtained by recontouring the opposite bank to be vertical, and more prone to erosion. Unfortunately, the private property owner Old Chinese Gardens LLC decided that they did not want us to breach the berm on their property to reconnect the creek to the floodplain. We therefore removed this task from the workplan.

### Log Vane - BEFORE/CONSTRUCTION



### Log Vane - AFTER



February 2023



June 2023

### 25. Build Corbin Street water harvesting berms and basins

As discussed above, we removed the Corbin Street water harvesting berms and basins from the work plan given the complexities of drainage issues and property boundaries in this area.

### 26. Implement plan for re-routing sections of sewer line access routes to minimize floodplain impact

GRIP and Stream Dynamics improved the sewer line access route on 93 North LLC, Esperanza Hills, Old Chinese Gardens and Town of Silver City property according to the approved design plan.

GRIP and subcontractors met with the Utilities Department and other Town officials to reach agreement on the best route to access all of the manholes in the lower portion of the project area. The following work was carried out:

The steep-sloped access road to Robert's Crossing that had been eroded into a deep V profile was filled in, repaired and contoured with three rolling dips to direct stormwater off the road to prevent gullying and to direct stormwater runoff from going directly into the creek. Stream Dynamics applied gravel to the road bed. At the conclusion of work, volunteers picked up three truck loads of trash from the area, seeded and mulched the access road and water drainage areas. Trees were removed to provide adequate access to the Utilities Dept. equipment to manholes. All access routes were restored, including reseeding and mulching.

The sewer line access route was tested by the Town of Silver City utilities department near completion to ensure that the project met project goals. Based on feedback from Town staff, we carried out the following tasks before returning heavy equipment.

- Leveled out access road around manhole #MH-18-015 by bringing in dirt and gravel and placing it around the manhole cover to bring up the grade. This facilitated the maintenance equipment trailer getting over the manhole. During our practice run, the back wheel of the trailer was getting hung up on the manhole since it sat 6 inches or more above the road grade.
- We removed more tree of heaven stumps from the turnaround at Manhole #MH-18-017. Utilities staff were worried the stumps might puncture a tire.
- We also removed soil with the loader and one cottonwood branch to facilitate access of the sewer line maintenance trailer to manhole MH-A-001(at confluence of San Vicente Creek and Agave Arroyo) and to the access road up Agave Arroyo.

Figure 2 below shows the access routes to the sewer line manholes. Table 1 provides information on which routes will be used to access the manholes in the project area.

We provided the GIS data layer of the manhole locations and sewer line alignment to the Town of Silver City Community Development Department and a hard copy, large format map to the Utilities Department to assist the Town with its maintenance.

**GILA RESOURCES  
INFORMATION  
PROJECT (GRIP)**

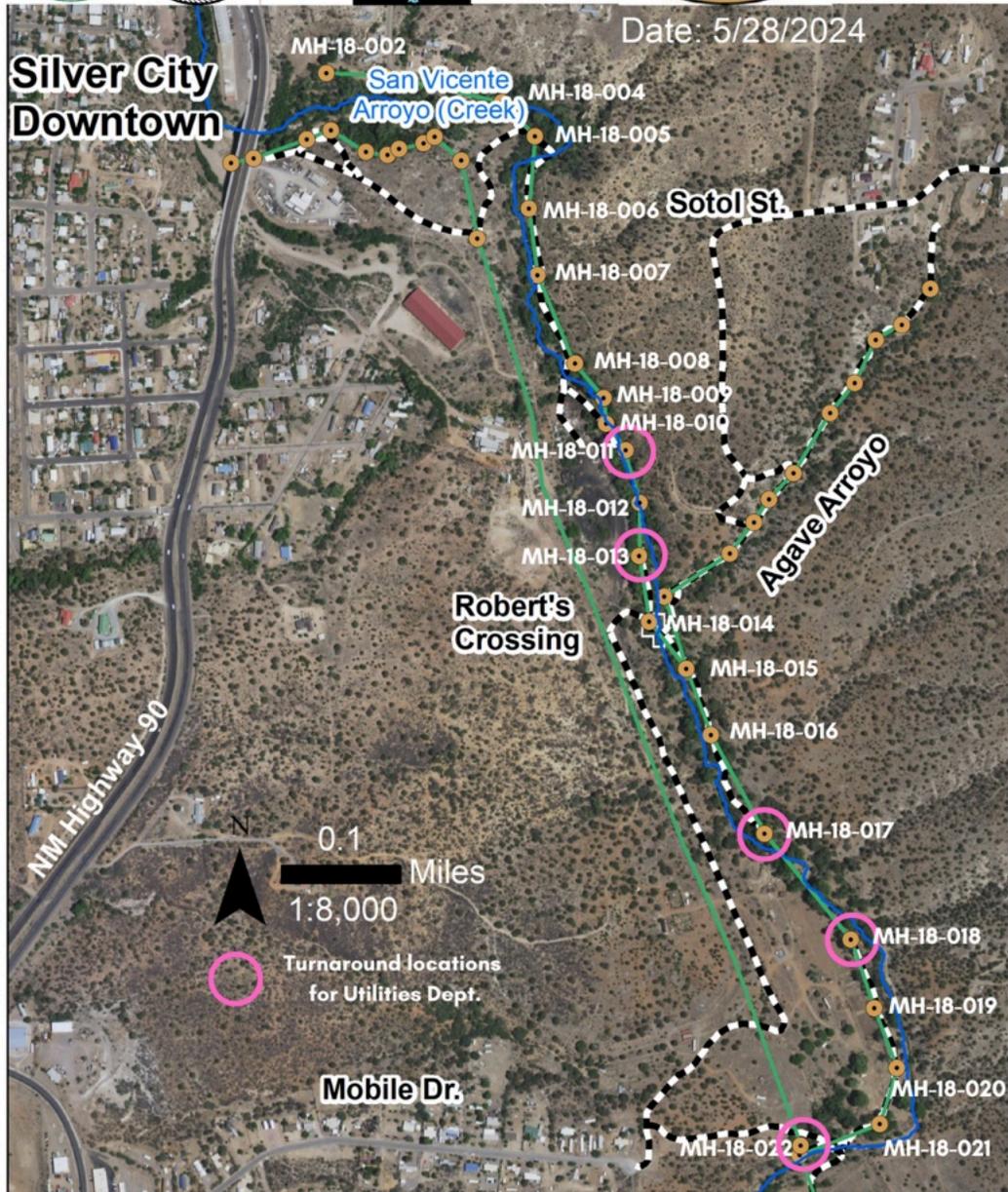


**GRIP San Vicente Creek Restoration Project  
Manhole Locations, Sewer Lines,  
and Access ROW**

**Figure 2**



**Wildlands  
Ecological  
Services**



**Table 1 - San Vicente Creek River Stewardship Project - Sewer Line/Manhole Access**

<b>Manhole #</b>	<b>Side (River L/R)</b>	<b>Access</b>	<b>Notes</b>
<b>MH-18-002</b>	L	Corbin St. to Barela St. west	Not in Project Area. Rosie Benavidez property owner
<b>MH-18-003</b>	L	Corbin St. to Barela St. east	Not in Project Area, Pena, Reyes, Larson
<b>MH-18-004</b>	L	Corbin St. to Barela St. east	Larson private property.
<b>MH-18-005</b>	R	Slag Road to Outdoor Classroom along new access road	Town of Silver City created new access road through the Jungle in June 2023
<b>MH-18-006</b>	L	Slag Road to Outdoor Classroom along new access road	Town of Silver City created new access road through the Jungle in June 2023
<b>MH-18-007</b>	L	Slag Road to Outdoor Classroom along new access road	Town of Silver City created new access road through the Jungle in June 2023
<b>MH-18-008</b>	L	Slag Road to Outdoor Classroom along new access road	Town of Silver City created new access road through the Jungle in June 2023
<b>MH-18-009</b>	L	Slag Road to Outdoor Classroom along new access road	Town of Silver City created new access road through the Jungle in June 2023
<b>MH-18-010</b>	L	Slag Road to Outdoor Classroom along new access road	Town of Silver City created new access road through the Jungle in June 2023
<b>MH-18-011</b>	L	Slag Road to Outdoor Classroom along new access road	Town of Silver City created new access road through the Jungle in June 2023
<b>MH-18-012</b>	L	Inaccessible	"Pedestal manhole" on river left.
<b>MH-18-013</b>	R	Slag Rd from the South; turn left off Robert's Crossing access road before the creek; Manhole in floodplain.	
<b>MH-18-014</b>	R	Slag Rd from the South; Manhole is on north side of Robert's Crossing access road before the creek	
<b>MH-18-015</b>	L	Slag Rd. from the South; cross creek at Robert's Crossing; drive south on access road river left	
<b>MH-18-016</b>	L	Slag Rd. from the South; cross at Robert's Crossing; drive south on access road river left	
<b>MH-18-017</b>	L	Slag Rd. from the South/cross at STA 3780, cross at Robert's Crossing; drive south on access road river left.	Truck/equipment turnaround at this location.
<b>MH-18- 18</b>	R	Mobile Drive	Truck/equipment turnaround at this location.

<b>MH-18-019</b>	R	Mobile Drive	
<b>MH-18-020</b>	R	Mobile Drive	
<b>MH-18-021</b>	R	Mobile Drive	
<b>MH-18-022</b>	R	Mobile Drive	
<b>MH-12-022</b>	R	Mobile Drive	
<b>MH-A-001</b>	L	Slag Rd. from South; Cross creek at Robert's Crossing; turn left on access road.	Bottom of Agave Arroyo at confluence with San Vicente Creek.
<b>MH-A-002 through MH-A-009</b>	L	Slag Rd. from South; Cross creek at Robert's Crossing; turn left on access road.	Follow road up Agave Arroyo to access sewer line.



Regrading and repair of access route at Robert's Crossing (L). Town of Silver City Utilities Department tests Robert's Crossing and access route at completion of our work. February 2023. (R)

27. Build check Dams in two tributaries

As discussed in Task 13 above, we shifted work in tributaries in the Corbin St. area to Agave Arroyo given problems with homeless camps. GRIP subcontractor Stream Dynamics constructed 15 check dams on the Town of Silver City Right of Way in Agave Arroyo. These one-rock dams were built in strategic locations to protect the sewer line that is being undermined by erosion. We purchased rock because there was not enough native rock to construct all of the check dams. We were able to build 15 check dams with the rock we had. Additionally, Stream Dynamics, along with the help of Aldo Leopold Charter School Rainwater Harvesting YCC Summer Crew students, mitigated some of the Sotol Rd drainage that was eroding the Agave Arroyo sewer line access route by constructing several check dams to slow down the velocity and decrease the volume of stormwater running down the hill and onto the Agave Arroyo access route.

**GILA RESOURCES  
INFORMATION  
PROJECT (GRIP)**



**GRIP San Vicente Creek Restoration Project  
Figure 3 Phase I Check Dam Locations  
in Agave Arroyo**



Date: 5/29/2024



## Agave Arroyo Check Dams

Before



After



## 28. Native Plant Planting, Seeding and Mulching

GRIP, Stream Dynamics, and Lone Mountain Natives worked with YCC students and volunteers in March, April and May 2023 to plant native trees and shrubs and seed and mulch disturbed areas and access roads with native grass and wildflower seed.

Planted 211 trees and shrubs April 15, 2023 in SVC004 through SVC007. Planted 181 trees and shrubs on May 26 and May 31 in SVC004 and SVC005. Additional plantings took place in fall 2023 and winter 2024: 6 cottonwoods and willows were planted at SVC 001 to armor the streambank on river right and block an unneeded crossing of the creek. The remaining 107 were planted in SVC002 and SVC003. The plant list is provided in Task 6 above.

We had originally thought that we would plant trees and shrubs in the upper portion of the project area (SVC-009, 010, 011 – Corbin St. Trailhead and The Jungle), but finding volunteers to water an additional area has been difficult. The lack of monsoon and significant winter precipitation necessitate weekly supplemental watering. We have had our hands full with watering plants in the lower part of the project area. We therefore decided to not plant in the upper area.

### **Silver City Watershed Keepers Volunteer Re-seeding and Mulching**



Re-seeding at SVC-001 -(TOH thicket) (Feb 2023) Access road at SVC-001 (TOH thicket) June 2024



Reseeding at the Log Vane site (February 2023)



Log vane site (October 2023)

Reseeding and mulching of the access roads and disturbed areas was successful at re-establishing vegetation and restoring the disturbance caused by heavy equipment.



Access road in SVC-006 is full of native grasses and wildflowers. October 2023.



Access road in SVC-001 at Tree of Heaven thicket looking to the east revegetated with grasses. October 2023.

## 29. Hold Native Planting Volunteer work days

GRIP coordinated and held 41 volunteer work days during the project period to plant native trees and shrubs; prep for, reseed and mulch disturbed areas and access roads; water plants; and “swamp” carry cut biomass to piles for removal. Volunteers contributed over 656 volunteer hours. Aldo Leopold Charter School contributed \$6067.85 in in-kind work hours from their rainwater harvesting and eco-monitors crews during the summer 2023 YCC program.

## River Stewardship Project - San Vicente Creek Phase 1

Volunteer Planting/Reseeding/Mulching/"swamping"/Watering  
Tasks and Volunteer Hours

Project	Date	Task Description	Hours
RSP - San Vicente Creek	1/27/23	Aldo Leopold Charter School YCC EcoMonitors - "swamped" for sawyers - 8 kids + 1 adult x 6 hours = 54 hours	54
RSP - San Vicente Creek	2/3/23	Aldo Leopold Charter School YCC EcoMonitors - "swamped" for sawyers - 8 kids + 1 adult x 6 hours = 54 hours	54
RSP - San Vicente Creek	2/17/23	Aldo Leopold Charter School YCC Garden Crew - mixed and bagged seeds for reseedling - 7 kids x 5 hours = 35 hours	35
RSP - San Vicente Creek	2/18/23	Pick It Up - Toss No Mas Trash Cleanup - cleaned up trash at 93 North LLC crossing. 6 volunteers X 3 hours= 18 hours	18
RSP - San Vicente Creek	2/24/23	Aldo Leopold Charter School YCC EcoMonitors -reseedling/mulching - 8 kids + 1 adult x 6 hours = 54 hours	54
RSP - San Vicente Creek	2/24/23	Silver City Watershed Keepers Volunteers - reseedling/mulching - 2 volunteers X 5	10
RSP - San Vicente Creek	2/25/23	5 Silver City Watershed Keepers Volunteers - reseedling and mulching - 5 volunteers X 3 hours	15
RSP - San Vicente Creek	3/11/23	1 Silver City Watershed Keepers volunteers - reseedling and mulching - 1 volunteer x 4.5 hours	4.5
RSP- San Vicente Creek - Phase 1	4/15/23	Volunteer Planting Day - 18 SCWK and YCC volunteers X 6 hours	108
RSP- San Vicente Creek - Phase 1	4/28/23	Watering - 3 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek - Phase 1	5/5/23	Watering - 2 SCWK volunteers x 2 hours	4
RSP- San Vicente Creek - Phase 1	5/12/23	Watering - 2 SCWK volunteers x 2 hours	4
RSP- San Vicente Creek - Phase 1	5/26/2023 and 5/31/2023	Watering, planting, Sotol Dr. drainage - Ecomonitoring and Rainwater Harvesting Summer YCC Crews - value provided by Aldo Leopold Charter School	Value= \$6067.85

RSP- San Vicente Creek - Phase 1	6/2/23	Watering - 2 SCWK volunteers x 2 hours	4
RSP- San Vicente Creek - Phase 1	6/9/2023 and 6/10/2023	Watering - 4 SCWK volunteers x 1.5 hours	6
RSP- San Vicente Creek - Phase 1	6/15/23	Watering - 4 SCWK volunteers x 1.5 hours	6
RSP- San Vicente Creek - Phase 1	6/24/23	Watering - 2 SCWK volunteers x 2 hour	4
RSP- San Vicente Creek - Phase 1	6/30/23	Watering - 2 SCWK volunteers x 2 hours	4
RSP- San Vicente Creek - Phase 1	7/14/23	Watering - 3 SCWK volunteers x 2 hour	6
RSP- San Vicente Creek - Phase 1	7/21/23	Watering - 2 SCWK volunteers x 2 hours	4
RSP- San Vicente Creek - Phase 1	7/28/23	Watering - 3 SCWK volunteers x 2 hour	6
RSP- San Vicente Creek - Phase 1	8/4/23	Watering - 3 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek - Phase 1	8/11/23	Watering - 3 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek - Phase 1	8/25/23	Watering - 5 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek - Phase 1	8/25/23	YCC volunteer day - Tree of Heaven eradication - 9 YCC students X 6 hours	36
RSP- San Vicente Creek - Phase 1	9/1/23	Watering - 3 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek - Phase 1	9/8/23	Watering - 4 SCWK volunteers x 2 hours	8
RSP- San Vicente Creek - Phase 1	9/15/23	Watering - 2 SCWK volunteers x 2 hours	4
RSP- San Vicente Creek - Phase 1	9/22/23	Watering - 3 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek - Phase 1	10/6/23	Watering - 3 SCWK volunteers x 2 hour	6
RSP- San Vicente Creek - Phase 1	10/13/23	Watering - 3 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek - Phase 1	10/13/23	Watering - 3 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek - Phase 1	10/27/23	Watering - 2 SCWK volunteers x 2 hours	4

RSP- San Vicente Creek - Phase 1	10/27/23	Planting with YCC EcoMonitors at Mobile Dr. 3 hours X 1 adult + 5 students	18
RSP- San Vicente Creek - Phase 1	11/3/23	Watering - 3 SCWK volunteers x 2 hours	6
RSP- San Vicente Creek -Phase 1	2/23/24	Planting day with SCWK volunteers and ALCS YCC crew at bottom of Mobile Dr. - 5 hours X 5 adults and 17 students	110
RSP- San Vicente Creek -Phase 1	4/26/24	Watering with Aldo Leopold Charter School interns 2.25 hours x 3 students	6.75
RSP- San Vicente Creek -Phase 1	5/3/24	Watering with Aldo Leopold Charter School interns and SCWK volunteers - 2 students, 1 SCWK volunteer x 2.25 hours	6.75
RSP- San Vicente Creek -Phase 1	5/26/24	Watering - 1 volunteer X 2 hours	2
<b>TOTAL 656 hours</b>			

**Volunteer Planting Day - April 15, 2023**





**Aldo Leopold Summer YCC Crew Planting Day - May 26, 2023**



## Volunteer Planting Day. February 23, 2024



Chokecherry with large mulched basin and hardware cloth to protect from deer/goat browse. May 2023

### 30. Project maintenance

Project maintenance tasks included application of herbicide to resprouts and watering of plants.

Stream Dynamics certified herbicide applicator applied herbicide to resprouts during July and August of 2023 and again at the end of the project period in June 2024. However, because of limited budget remaining, the second treatment of resprouts in June 2024 was carried out only in the worst tree of heaven resprout areas in SVC-001, SVC002, and SVC-003.

We had early success with resprouts of Siberian elm with only approximately 1% or less of cut trees resprouting by the end of June 2023. We reapplied herbicide in July and August 2023. In spring of 2024, Siberian elm had resprouted more significantly in some areas. At the lower end of the project area, elm resprouts are about 10 - 20%. In the rest of the project area elm resprouts are minimal. In the Corbin St area which was cut in October 2023, elm resprouts are about 40%.

Tamarisk eradication was mostly successful after the second application of herbicide with only a few minor resprouts.

Tree of Heaven has proven to be difficult to eradicate as we expected. We were able to eradicate large diameter Tree of Heaven trees. However, Tree of Heaven thickets of small diameter stems are tenacious. In SVC-001 (at the 319 project on Mobile Dr.), we applied herbicide after cutting, but resprouts in June/July 2023 were about 50 - 60%. We then hand pulled and cut leaves of stems in the thicket (per State Forestry) and also reapplied herbicide. In May 2024, the thicket was improved with about 40% resprouts. Other small pockets of Tree of Heaven have been manageable with 10 - 30% resprouts on average. We reapplied herbicide a second time before the end of the project period in the worst tree of heaven areas (SVC-001, SVC-002 and SVC-003) and hand pulled smaller stems when appropriate.

The Tree of Heaven thicket in SVC-001 was the worst thicket in the project area.



SVC-001 Fuel load and vegetation survey in Tree of Heaven thicket. June 2022



SVC-001 Cutting of Tree of Heaven thicket. January 2023



YCC EcoMonitors cut and hand pull resprouts in SVC-001 Tree of Heaven thicket. August 2023



SVC001 - Tree of Heaven thicket looking west - post-herbicide application #1 (Oct 21, 2023)

SVC-001 - Tree of Heaven thicket looking west - June 2024



SVC-001-Tree of Heaven thicket looking east  
May 25, 2024



SVC-001 - Tree of Heaven thicket looking east  
June 15, 2024 after herbicide treatment #2



SVC-001 Tree of Heaven looking west - post-herbicide  
application #2 (June 15, 2024)

Watering of plants is discussed below in task 34.

### 31. Effectiveness monitoring of treatments

#### **Log vane at Old Chinese Gardens – SVC003**

The tree we used to build the log vane had been growing upstream about 2000 feet when it was illegally cut by squatters on 93 North LLC and Nuevo Principio property. Our sawyers cleaned up the mess and Van Clothier of Stream Dynamics hauled this giant branch with the excavator to the site via the old railroad grade. Once at the vane site, it was custom cut to fit into the bank, leaving two big chunks. These were used in conjunction with the last two boulders we had to block illegal vehicle access. This is immediately downstream of the log vane site on river right. It is quite apparent that this has effectively blocked access ever since construction.



May 2024

The log vane has been through a few sub-bankfull events, which have caused a small amount of erosion of the opposite bank (river left) and a small amount of deposition on the near bank (river right). This is exactly what was intended. The willows that were pole planted in the back fill of the log vane are doing great, averaging about 3 feet high. This natural infrastructure is in good shape, but it remains to be tested by a very large runoff event. There have been no significant storms since the building of the log vane.



May 2024

At the time of construction, the left bank (on the right side of this photo which is looking up the creek) was intentionally undercut with the excavator to increase its erodibility. Everything looks good so far and native dace are present in the pool. Hopefully we will get a decent monsoon this summer and this structure will be put to a proper test.

### **Grade control structure at Robert's Crossing– SVC006 and SVC007**

The grade control structure was built below the existing grade of the stream to anticipate when the log jam downstream either blew out or was removed (we removed it as part of Phase 2), sending a headcut upstream. This grade control structure was set at the appropriate elevation to protect the sewer line access creek crossing immediately upstream from being undercut if this were to happen. Due to local temporary aggradation, the pour-over of this Rosgen Cross Vane that is tied into the bedrock on river right is about 19" under the water surface right now, and covered with a few inches of sand. We expect this sediment to be scoured out of the channel and carried far downstream during a big flood at some point. When that happens, we expect that the headcut started by reconfiguring the log jam completed in Phase 2 will finish re-grading the channel for 600 feet as the rest of the sediment plug that had collected behind the log jam is finally scoured out. The headcut will complete its migration to the cross vane, which will then be revealed. The grade control structure will be put to a proper test when this happens. It was designed and built to stop the headcut from taking out the sewer line access creek crossing immediately upstream at the same time that it scours its pool.

The Goodding's willows and coyote willows that were planted on the left bank among the boulders of the grade control structure are doing great. They average about 6 feet high.



May 2024

### **Access Road Improvements**

In the photo below, you can see that the improved access route at Robert's Crossing is doing great. Before the project, this steep section of road had cut a deep V because it was carrying stormwater from the old railroad grade all the way into the creek. (See the first photo below.) Being a rather steep road, the steep V profile made it treacherous to even walk. The erosion was filled in with the material that came from removing a berm next to the large cottonwood on the other side of the creek. Removing this berm improved floodplain access in the vicinity of Robert's Crossing and took pressure off the grade control structure. In order to stabilize the new roadbed, we built three rolling dips.



**BEFORE (2021)**



**AFTER (2023)**

In this image, you can see that the road drains to the floodplain of the creek in the right of the photo instead of taking stormwater and its sediment directly into the stream.



May 2024

In the photo below, which was taken higher up the road, you can see another rolling dip taking stormwater off the road to the viewer's left.



May 2024

### **Induced meandering and streambank protection through willow planting**

#### ***Downed Cottonwood SVC-004 and Old Chinese Garden SVC-003***

The photo below shows the willows that Stream Dynamics pole planted on river right above the downed cottonwood. The willows are doing well. Years ago at this site, a cottonwood had rotated out of the left bank and blocked the stream by starting a log jam about 5 feet high. This backed sediment nicely up the creek and created pleasant Cienega-like conditions in the valley bottom for a few years before cutting to the left (away from the sewer fortunately), and starting a much-needed meander. Part of the tree is visible in the right of the photo. On the left is the cutbank on the outside of the new meander bend, which has now been slowed by encountering a few embedded boulders and another tree that the creek is slowly removing. In the meantime, our willow stand on the gravel bar on the inside of this bend is going to aggrade to bankfull stage over time, maintaining lateral pressure on the left bank.



May 2024

The photo below shows the gravel bar below the downed cottonwood that we also pole planted with willows in October 2022. The willows are averaging about 6 – 7 feet high. The survival rate was over 95%. This feels like a tremendous success because the new thicket is already thick enough to influence sediment deposition, and this will continue to put pressure on the left bank over time. We are inducing meandering into that bank because the stream needs sinuosity, and the sewer is buried in the opposite bank here (river right). This willow thicket has radically increased Manning's  $n$ , which is the roughness factor. This will decrease the particle size that can be raked across this bar during a flood, thus causing the bar to aggrade. The willows will grow through this aggradation.



May 2024

In the photo below, last year's coyote willows averaged about 3 ft high all along the right river bank downstream of the gravel bar. This was difficult to plant due to the very stony bank and crowding by invasive tall fescue and sweet pea, but we believe we have finally gotten enough willow density here. Walnuts are also growing on the bank.



May 2024

Note: this reach was only planted on river right because the sewer line is too close to the bank on that side and we need to protect against meandering towards the sewer line.

### ***Willow planting at “The Jungle” - SVC-010***

Willow whips were planted on the right bank in “The Jungle” as well as on the left bank at a sharp bend in the creek to the right. Willow plantings in this area didn’t do quite as well given the shady location and the invasive tall fescue and sweet pea that buried some of the willow whips. Whips planted at the bend also didn’t do quite as well as some were buried by flood debris.



May 2024



May 2024

### **Check dams in Agave Arroyo**

All 15 of the check dams we built in Phase 1 are doing quite well. Since they were built, there have been several rather fierce runoff events in Agave Canyon. Significant amounts of sediment have been captured behind the check dams, creating the sponge effect that is sub-irrigating the bank vegetation. Although every single structure survived, a small number of structures lost a bank rock or needed some kind of improvement. This maintenance work was done in Phase 2 while we were there building more check dams, some with rock, and some with cut up pieces of Siberian elm and tamarisk.

In the photo below, looking upstream in Agave Arroyo, you can see that this structure has filled in nicely with coarse sand and gravel behind it. This creates the sponge of porous sediment on top of the shallow bedrock.



May 2024

### 32. and 33. Post-project Botanical Survey and Fuel Load Assessments

Pretreatment sampling of standing biomass and surface fuels was done on June 15-16, 2022. GRIP conducted 10 biomass macro-plots at locations selected within each of the 10 management units. Post-Treatment biomass macro-plots were sampled on July 17, 2023 (svc001-svc007) and April 18, 2024 (svc008-svc010). The reason for the delay for the latter three macro-plots was because the contractor could not conduct treatment until late Fall 2023. For pre-treatment vegetation sampling, three macro-plots were collected on July 25 & 26, 2022. The three Post-Treatment vegetation macro-plots were re-surveyed on May 4-5, 2024. The results document changes in fuel load biomass (Downed Woody Debris - DWD) and standing vegetation following management treatments.

Management consisted of cutting trees, saplings, and shrubs, then treating stumps with herbicide. GRIP used pre-treatment data to target areas for reducing fuel load biomass, identify areas dominated by non-native species, and target areas for native species plantings. GRIP then conducted post-treatment analysis to document the amount of biomass removed. Treatment included removal of non-native Siberian elm, Tree of Heaven, tamarisk, and in some cases native Juniper if located in the riparian corridor or encroaching upon native trees. Some slash piles were also removed. Macro-plot data were collected using standard FFI / FIREMON data

sheets. FFI software was used to enter data and statistically analyze Fuel-Load biomass in terms of tons per acre. FFI methods to quantitatively evaluate data in macro-plots are very useful for documenting changes in ecosystems before and after management treatments, such as prescribed burns or removing invasive species.

Management treatments removed an estimated 63 tons of woody biomass throughout the project area according to sub-contractors. FFI / FIREMON estimates that this is a 41% reduction of total standing biomass. Standing biomass in the canopy/subcanopy alone was reduced by 36%. The removed biomass came from non-native Tree of Heaven and Siberian elm.

While most individual macro-plots show a reduction in total standing biomass (tons/acre), macroplot svc005 is an exception with biomass increases in woody vegetation between treatment years. These increases were attributed to a misalignment of macro-plot locations between treatment years. This sampling error occurred because we could not relocate the macroplot marker located at the pre-treatment macro-plot center. Nonetheless, despite the sampling error in macro-plot svc005, average total biomass for standing vegetation generally decreased following management treatment.

Surface fuel biomass increased in all categories of DWD. Average Pre-Treatment estimates for Total DWD was 6.5 tons/acre. Average Post-Treatment estimates for Total DWD was 7.8 tons/acre. The difference between treatment years of 2.3 tons/acre represents a 20% increase in surface fuels (DWD). Contrast this with the average total of 16.7 tons/acre of standing biomass removed by treatment.

Most of the increase in DWD can be attributed to one macro-plot where a very large cottonwood trunk fell after we had completed our tree work. This one macro-plot is an outlier in the normal distribution of DWD. When we removed the data from macro-plot svc007, the average total increase in DWD was only 0.8 tons/acre. Thus, macro-plot svc007 – with its one large, downed trunk – represents 65.2% of the between treatment years increase of DWD surface biomass. It is interesting to note that while DWD biomass increased in svc007, standing biomass decreased in the canopy layer of svc007 between treatment years.

The conclusion that biomass reductions are attributed to woody species in the Canopy, Subcanopy and Shrub Layers is further corroborated by reductions of tree density and basal area. Tree of Heaven trees were completely eliminated in the canopy, subcanopy and sapling layers in all three vegetation plots. Meanwhile, the average total basal area of Siberian Elm trees in the canopy/subcanopy were substantially decreased on average by 64% (sq. ft./acre). Some trees of Siberian elm were left in the canopy because they provided bird nesting habitat. However, all standing trees of Tree of Heaven were completely removed wherever it was found in all management units.

The elimination of non-native trees is also observed in tree sapling counts. Reduction of woody biomass was corroborated by the 79% reduction in the average density of canopy trees. Tree

density (DBH >4.0 cm) dramatically decreased 90% for Siberian elm. Some large DBH Siberian elm were left as bird habitat; however, these were larger diameter trees, so DBH average is higher in the post-treatment macro-plots but with fewer trees. Native tree density increased slightly for Arizona walnut and alligator juniper in the post-treatment evaluation. Tree density declined for New Mexico locust and one-seeded juniper. Furthermore, the average Basal Area of canopy trees (>4.0 cm DBH) was reduced by management treatment by 64% (13.5 sq. ft. /acre). Invasive Tree Basal Area (sq. ft./acre) was dramatically reduced by 64% for Siberian Elm following management treatment. Tree of Heaven in the canopy was completely eliminated within the vegetation macro-plots (no basal area).

Basal area for native trees of Arizona walnut and New Mexico locust declined. The primary reason why walnut and locust decreased in the project area, was because the Town of Silver City needed to remove trees in an emergency to create access to fix a sanitary sewer overflow. In doing so, the City removed both native walnut and locust as well as non-native Siberian elm. GRIP also removed some native juniper that were encroaching on cottonwood trees. Additionally, some native Juniper was removed that impeded access to the work area. GRIP created access roads to sewer manholes. This will help reduce further damage and loss of native trees and plants in the future. No tree saplings were recorded in post-treatment evaluations. This demonstrates the effectiveness of management treatments for eliminating invasive tree saplings. However, it also suggests that native saplings were removed as well. Native saplings and shrubs were seen outside sampling quadrats and nested subplots; their absence in post-treatment surveys may suggest sampling error.

The abundance of invasive woody seedlings was reduced, but non-native seedlings were not eliminated. The frequency of occurrence for Siberian elm seedlings was reduced 50% between treatment years. Likewise, seedlings of Tree of Heaven declined 60% in the frequency of occurrence between treatment years. Cover abundance of the foliage for non-native seedlings declined substantially as well. Species in the herbaceous layer showed increases in standing biomass between treatment years. The herbaceous strata pre-treatment estimates were 0.4 tons/acre, while post-treatment estimates were 1.1 tons/acre. This 175% increase in biomass of herbaceous plants is corroborated by macro-plot-species-year data. This substantial increase is attributed to the removal of the overstory cover, which allowed more sunlight to the ground layer species. For example, an important native grass in gallery forests, big sacaton (*Sporobolus wrightii*) increased in percent cover from 1.65% cover in pre-treatment year A to 6.65% cover in the post-treatment survey. Average plant height and the frequency of occurrence, both remained identical between treatment years.

See the Post-treatment Fuel Load and Vegetation Assessment Report for the detailed results of the post-treatment vegetation assessment, including species occurrence and percent cover observed in each of the macro-plots.

### 34. Monitoring and watering of plantings

GRIP’s Silver City Watershed Keepers coordinated 27 volunteer days to water plantings in the project area from April 2023 through May 2024 (see table in Task 29 for dates). This was many times more than we had expected. Unfortunately, Silver City did not get much of a monsoon and the rains arrived later than “normal”. Climate change has shifted the norm.

Once the plants went dormant in the fall and winter, we stopped watering. We started watering again in April 2024 every couple weeks.

In May 2024, GRIP carried out an inventory of trees and shrubs that were still alive at the end of the project period versus the number of plants that were planted from tree pots. We have achieved a 35% survival rate of trees and shrubs planted from tree pots. The species that were most successful included hackberry, New Mexico olive, winterfat, four wing saltbush, walnut, Rocky Mountain juniper, Arizona cypress, false indigo, chokecherry, and golden currant.

GRIP also carried out monitoring of resprouts of Tree of Heaven and Siberian elm during the summer of 2023 and then again at the end of the project period in May 2024.

<b>Location</b>	<b>% resprout June 2023</b>	<b>Follow-up Treatment #1 July/August 2023</b>	<b>% resprout May 2024</b>	<b>Follow-up Treatment #2 June 2024</b>
SVC-001	50 - 60% TOH < 1% elm	TOH - hand pulling, removed foliage; apply herbicide on foliage for some stems; applied herbicide directly onto cut stems; Elm - apply herbicide	40% - TOH 10 - 20% - elm	TOH- foliar spray with herbicide; hand pulling when appropriate Elm - herbicide application
SVC-002	1% TOH < 1% elm	herbicide application on resprouts for larger diameter TOH and elm	10 -20% resprouts of elm <1% TOH	herbicide application
SVC-003	1% elm no TOH a few resprouts of tamarisk	herbicide application on resprouts of elm and tamarisk; hand pulling and cutting of leaves for small diameter	very few resprouts of elm. A few TOH here and there. Minor resprouts of tamarisk.	herbicide application for Elm and TOH or hand pulling as appropriate

		stems of TOH;		
SVC-004	tamarisk-small sprouts on one tree trunk; 70-80% resprouts next to golden currant patch; 20 - 30% by sacaton grass	herbicide application on resprouts of tamarisk, elm. Foliar cutting and herbicide application	50% TOH resprouts next to golden currant patch; <10% resprout at sacaton grass	NA
SVC-005	very few resprouts of elm. TOH thickets resprouted (5%) on river left between access road and trail	herbicide application for elm; hand pulling and cutting of foliage.	very few resprouts of elm. TOH thickets resprouted on river left between access road and trail	NA
SVC-006	TOH resprouts at Walnut grove - 30% resprout <1% elm 5% Resprouts of TOH next to trail.	herbicide application and cutting of foliage of TOH	< 1% elm; some TOH	NA
SVC-007	< 1% at Robert's Crossing	herbicide application	< 1% elm; some TOH	NA
SVC-009	Initial cut in fall 2023		1% elm; 1% TOH	NA
SVC-010	Initial cut in fall 2023		TOH thicket in the Jungle needs treatment.	NA
SVC-011	Initial cut in fall 2023		40% resprouts of elm and TOH	NA

### 35. and 36. - Semi - annual progress reports and Final Report

We submitted four semi-annual reports and one final report on this project.

#### **Project Accomplishments**

The San Vicente Creek Phase 1 River Stewardship Project met all the objectives of the project as described below:

- Improve water quality - It's extremely difficult to show water quality improvement through periodic water quality monitoring. However, we believe that our project improves water quality of San Vicente Creek by 1) reducing sediment loads into the creek by building check dams in Agave Arroyo; 2) mitigating the potential for a sewer line break and discharge of raw sewage into the creek by protecting the Town of Silver City's sewer line from high velocity stormwater; and 3) securing access to manholes so that the Town Utilities Department can maintain the sewer line and reduce the frequency/eliminate sanitary sewer overflows that discharge into the creek, raising levels of *E. coli*.
- Enhance Riparian habitat – The project selectively removed non-native Tree of Heaven, Siberian elm, and tamarisk from approximately 20 acres of riparian corridor along and about 1 mile of San Vicente Creek. Management treatments removed an estimated 63 tons of woody biomass throughout the project area, achieving a 41% reduction of total standing biomass. Standing biomass in the canopy/subcanopy alone was reduced by 36%. The removed biomass came mostly from non-native Tree of Heaven and Siberian elm.

These management treatments will tip the balance in favor of individual native plants in hundreds of places where they are in direct competition with non-native vegetation. We carefully cut the elms, tree of heaven and tamarisk out to allow the native trees to establish their dominance in the canopy. We have created trigger spots where native plants will be able to outcompete the invasives and gradually gain more ground within the riparian forest, improving native habitat diversity within the riparian zone. At the same time, we will be thinning the nearly pure stands of Siberian elm for forest health so that the trees can create the tallest canopy, creating habitat in the lower canopy layers for other species to get established over time. For example, in the Jungle, samplings of walnut and cottonwood are now open to the sunlight as a result of thinning and will be able to thrive due to crowding out by elm and Tree of Heaven.

Successful pole planting of over 650 willows and cottonwoods along with planting of 500 native trees and shrubs will help establish healthy riparian habitat over time. Pole planting of willow whips and cottonwood and willow posts was extremely successful with over 95% success rate. Since cottonwood and willow recruitment is very low, our project contributed to establishing new cottonwoods and willows in the San Vicente

Creek riparian corridor. Although the survival rate of trees and shrubs planted from tree pots was only 35%, we intend to continue to water those surviving plants that have been able to make it through drought conditions.

- Reduce riparian fire risk – The project removed 63 tons of non-native tree biomass, including slash and ladder fuels. This is a 41% reduction of total standing biomass. Standing biomass in the canopy/subcanopy alone was reduced by 36%. The removed biomass came from non-native Tree of Heaven and Siberian elm. This effort has reduced riparian fire risk along approximately 1 mile of riparian corridor.
- Protect and stabilize the sewer line - The project stabilized and protected the sewer line along San Vicente Creek and Agave Arroyo through armoring of stream banks with willow plantings, check dams, and induced meandering using a constructed log vane. These treatments have addressed some of the highest priority areas along the 1 mile stretch of San Vicente Creek and along Agave Arroyo where the sewer line was being threatened by high velocity/high volume stormwater. Our restoration work will prevent the sewer line from being undermined and averting a potential sewer line break and release of sewage into San Vicente Creek.
- Secure access to sewer line - Working with the Town of Silver City, we successfully established secure access to sewer line manholes for maintenance by the Utilities Department. We built a grade control structure to stabilize the creek crossing at Robert's Crossing so that Utilities Department vehicles and equipment can successfully cross the creek. The lack of access led the Department to significantly damage riparian resources when attempting to fix sanitary sewer overflows during the pandemic. This situation was the major impetus for this project. Secure sewer line access will allow the Town to routinely maintain the sewer line to cut down on the frequency of sanitary sewer overflows that lead to water quality impairment of San Vicente Creek.
- Protect stream banks - We planted over 650 willow whips/posts and three cottonwood posts to armor streambanks to protect them from erosion by high velocity/high volume stormwater. We had a greater than 95% success rate with willow and cottonwood planting.
- Induce meandering - Willow planting and construction of a log vane will induce meandering of San Vicente Creek helping to restore stability to this incised stream, as well as push the creek to the opposite bank away from the sewer line. This was a critical task to complete in order to protect the sewer line from being undermined by high volume/high velocity stormwater.
- Reduce sediment from Agave Arroyo – The project completed 15 check dams and drainage mitigation in Agave Arroyo to reduce sediment loads to San Vicente Creek from the Agave Arroyo drainage.

- Engage volunteers in watershed restoration and stewardship - We engaged 176 volunteers in 41 volunteer events with over 650 hours of volunteer time over the course of the project. Working with Aldo Leopold Charter School Youth Conservation Corps allowed us to educate and teach skills to the next generation of stream restorationists. Organizing community volunteers for stream restoration activities, such as tree planting, watering, and litter removal has connected community members to our local water resources and riparian ecosystem, providing people with a strong sense of place and feeling of giving back to our environment and community.

**Table 2. Project Accomplishments by Management Unit**

<b>Management Unit</b>	<b>Location/Landmark</b>	<b>Treatment Accomplished</b>
SVC001	Mobile Drive/319 project	Tree of Heaven, Siberian elm, slash removal; planted native trees/shrubs; closed off secondary crossing of creek to stop vehicle crossing and streambank erosion; Put up educational signage.
SVC002	Railroad Trestle	Tree of Heaven, Siberian elm, slash pile removal; planted native trees/shrubs
SVC003	Old Chinese Gardens/Log Vane	Removed Siberian Elm, Tree of Heaven, tamarisk, slash piles; Build log vane to induce meandering away from sewer line; plant willows to protect stream bank; planted native trees/shrubs
SVC004	Downed Cottonwood	Removed Siberian Elm, Tree of Heaven, tamarisk, slash piles; Pole plant willows upstream and downstream of downed cottonwood to dissipate energy, restore creek within its floodplain in relationship to the meander wavelength and protect the sewer line. Planted native trees/shrubs
SVC005	Manhole 17 sewer line access turnaround to Log Jam	Removed Siberian Elm, Tree of Heaven, slash piles; Planted native trees/shrubs; Created truck/equipment turnaround.
SVC006	Log Jam	Removed Siberian Elm, Tree of Heaven, slash piles; Planted native trees/shrubs; raised grade around manhole 15.
SVC007	Robert's Crossing	Removed Siberian Elm, Tree of Heaven, slash piles; Built grade control structure to secure stream crossing; willow and cottonwood pole planting; planted native trees/shrubs.

SVC009	New access road downstream from the Jungle	Removed Siberian Elm, Tree of Heaven, slash piles
SVC010	The Jungle	Removed Siberian Elm, Tree of Heaven, slash piles; Planted willows for stream bank protection
SVC011	Corbin St. Trailhead	Removed Siberian Elm, Tree of Heaven, slash piles; Put up educational signage.
Agave Arroyo- Phase 1	Agave Arroyo from confluence with San Vicente Creek to San Vicente Trail crossing	15 check dams constructed on Town of Silver City ROW to protect sewer line, slow down urban stormwater, reduce sediment entering San Vicente Creek; drainage work on Sotol St.

**Unexpected Benefits of the Project**

- The experience gained through the San Vicente Creek River Stewardship Project helped obtain additional funding from the USDA Forest Service for urban and community forestry projects for Silver City, the Mining District, Deming and Lordsburg.
- The US Forest Service Rocky Mountain Research Station is interested in our fuel load/vegetation survey results, since we used its FIREMON model and kept track of the amount of biomass removed by our tree contractors. Our results may help them improve their model. We have shared our final fuel load/vegetation assessment report with them.

**Additional Funds Leveraged for the Project**

There was \$33,300 in additional resources that were leveraged for our project. This was over \$20,000 more than what was estimated in the work plan. The leveraged resources breakout as follows:

- Aldo Leopold Charter School YCC crews labor - The YCC crews were involved in planting and watering native plants. Because of the lack of monsoons in 2023, we needed assistance with watering and appreciated that these students stepped up to help us. The YCC students contributed over \$6500 in volunteer time to the project.
- Silver City Watershed Keepers (SCWK) volunteer time - As mentioned above, the lack of monsoons necessitated weekly watering of native plantings. The SCWK coordinated volunteers for both planting days and watering days with over 654 volunteer hours dedicated to the project. In total, over \$24,000 in volunteer labor was donated to the project. This was more than three times what was estimated in the work plan.

- Silver City Watershed Keepers supplies – The SCWK contributed \$1219 in supplies to the project including hardware cloth to protect plants, flagging ,and project signage.
- Town of Silver City capital outlay funding for San Vicente Creek – At our urging, the Town used some of its capital outlay funding for San Vicente Creek to pay for locking gates around the perimeter of the San Vicente Creek trail/open space to prevent illegal ATV use within the riparian corridor. ATVs had driven over some of our plantings. Gates were installed at Mobile Dr., 93 North LLC access to Robert’s Crossing, Sotol Road, Chukar Road, and Scott Park.
- Old Chinese Gardens watering - Old Chinese Gardens members have dedicated time and resources to watering weekly restoration plantings adjacent to their property along 0.14 mile of creek. We do not have a monetary estimate of their contribution to the project, however, it has been a critical element of the project to maintain the survival of our plants.
- Stream Dynamics match - Subcontractor Stream Dynamics contributed \$770 in supplies and some personnel to the project.
- GRIP match - Contractor Gila Resources Information Project contributed \$6930 to the project in personnel time. This was over \$1200 more than estimated in the workplan.

### **Lessons Learned (obstacles)**

We learned a tremendous amount from this project that we will carry forward in other phases of the San Vicente Creek restoration work and restoration efforts elsewhere.

- Grant County parcel map is grossly inaccurate - The Grant County parcel map GIS layer of property boundaries is grossly inaccurate and can be off by more than 100 feet. This situation required us to hire a GIS mapper to try to fine tune the property boundaries in our project area based on more recent survey data. The mapping task was very important to get right since we needed to make sure we had landowner agreements in place for properties where we were working. The County Assessor's Office is currently engaged in an expensive upgrade to the parcel data to try to rectify this situation. Until this happens, it is necessary to ask for property owner survey information to ground truth the County map.
- GPS measurements vary by device - Compounding the inaccuracy of the County property boundary data is the fact that GPS data accuracy varies by device. We used ArcGIS Field Maps and ArcGIS Reporter apps on different smartphones and tablets. We also borrowed the Town of Silver City’s Trimble GPS unit and got better accuracy for collection of post-project location data for structures and planting areas. The lack of accuracy between devices caused lots of headaches in creating maps that reflected the reality on the ground.

- Long-term drought precludes the ability to successfully plant natives unless there is reliable and consistent water supply - The lack of monsoon in 2023 seriously impacted survival of native trees and shrubs planted as part of this project. The monsoon did not materialize until later in the summer and when it did, it was weak. We watered once a week with volunteers, but this was insufficient. Extreme heat and aridity caused high mortality in the plantings of trees and shrubs planted from tree pots. Overall we achieved a 35% survival rate. The species that were most successful at withstanding the heat included hackberry, New Mexico olive, winterfat, four wing saltbush, walnut, Rocky Mountain juniper, Arizona cypress, false indigo, chokecherry, and golden currant. We also learned that planting location was important to take into consideration. Trees that had afternoon shade and were not in full sun all day, seem to have fared better. Digging deep planting basins and properly applying mulch was helpful in maintaining soil moisture between waterings.
- Watering with volunteers is very difficult over the long term - It's hard work to water acres of restoration plantings, especially in the heat. Keeping volunteers engaged in this task over the long term is very difficult even though volunteers feel "attached" to the survival of the plants. It's disheartening to lose plantings due to the lack of precipitation. Given the outlook for long-term drought due to climate change, it is probably unrealistic to rely on volunteers to help water plants until they become established. It could take a couple years of supplemental watering until plants can be left on their own.
- Pole planting of willows and cottonwoods is an effective method for re-establishing riparian vegetation - Pole planting of willows and cottonwoods was very successful (greater than 95% survival rate). Willows and cottonwoods planted by this method were able to survive the lack of monsoon since they were planted directly into groundwater. Fortunately, the creek did not dry up during the project period, with base flows relatively remaining stable.
- Non-native tall fescue and sweet pea choke out restoration plants planted on stream banks - The non-native tall fescue and sweet pea grew more quickly and thickly than our restoration plantings that were planted from tree pots. Very few of the restoration plantings planted on stream banks with tall fescue and/or sweet pea survived since they were choked out by these two invasive species. There are some woods rose and golden currant that survived on a steep slope with fescue and sweet pea by the log vane; however, we need to continue to remove the invasives by hand to prevent the plantings from getting smothered. In some areas, the tall fescue also impacted willow growth, but to a much lesser extent than trees and shrubs planted from tree pots. As long as the tall fescue and sweet pea occupy the stream banks, it will be difficult to get natives established. Pole planting of willows and cottonwoods is much more successful at overcoming intense competition from the tall fescue and sweet pea.

- Tree of Heaven takes multiple treatments to fully eradicate – Tree of Heaven eradication requires patience, time and a large herbicide application budget. The Forest Service estimates it takes 3 - 5 years to fully eradicate Tree of Heaven. We had good success eradicating larger diameter TOH through the cut stump and spray method, but thickets of small diameter stems require a lot of herbicide for foliar spraying, as well as patience making one's way through dense thickets. Hand pulling small resprouts can be effective, but time consuming. We utilized YCC students for this task as well as the weakening method described below and they were not happy about it - it's hard work! The weakening method - using successive removal of foliage followed by spraying - didn't seem to be as effective. Constant monitoring of resprouts is required so that herbicide can be re-applied before the resprouts get out of hand and one has a large job to deal with. It's back to square one if the project can't continue to stay on top of the resprouts.
- More funding needed in the maintenance budget for herbicide application - We realized we needed more resources in the maintenance budget to be able to stay on top of the Tree of Heaven resprouts. More herbicide was needed as well as the time of a certified herbicide applicator to be able to stay on top of the resprouts. We focused our remaining budget on the worst Tree of Heaven resprout areas in SVC-001, SVC-002, and SVC-003. But we didn't have enough budget to complete all the resprout areas. We will address the resprouts in Phase 3.
- Illegal ATV use is difficult to control - Illegal ATVs have damaged riparian resources and some of our restoration plantings. Throughout the project period, we have been encouraging the Town through its Trails and Open Space Advisory Committee to control illegal ATV use in the San Vicente Creek corridor. The Town agreed to use some of its capital outlay funding to put up perimeter fences and locked gates to keep ATVs and other motorized vehicles out of the San Vicente Creek trail system. The gates were installed in fall 2023 and locks put in place in spring 2024. Although the gates and metal fences have cut down on ATV trespass, unfortunately some ATVers won't give up and find alternative entry points to the area. Enforcement continues to be a problem and ongoing monitoring of the illegal activity by community volunteers will be needed.
- More funding needed in the supply budget for hardware cloth to prevent deer and goat browse - We did not include in the approved work plan budget funding for hardware cloth and other supplies to protect restoration plantings from deer and goat browse. A member of Old Chinese Gardens LLC, a partner in the project, has a small herd of goats that sometimes gets out of hand. Unfortunately, some of the goats ate tender leaves of saplings and in some cases pulled the plants right out of the ground. GRIP contributed a few hundred dollars in hardware cloth to the project to protect all of the chokecherry that we knew would be vulnerable to deer and goats. We learned that we probably should have put hardware cloth around all of the plants to protect them. We talked to the property owner and the goat herd owner has promised to keep his goats out of the planting areas.