Site Inspection Reassessment
San Vicente Creek Mill
CERCLIS #: NMD980879415
Grant, County New Mexico

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Superfund Oversight Section
Ground Water Quality Bureau
New Mexico Environment Department

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1.0 Introduction

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 United States Code (U.S.C.) §§ 9601 to 9675 (CERCLA), the New Mexico Environment Department (NMED) Superfund Oversight Section conducted a Site Inspection Reassessment (SIR) at the San Vicente Creek Mill site, Silver City, Grant County, New Mexico (CERCLIS ID: NMD980879415). The investigation compiled available information and collected sampling data to evaluate the site using the Hazard Ranking System (HRS) (Ref.1) and the Superfund Chemical Data Matrix (SCDM) (Ref. 2) to determine if a threat to human health and the environment exist such that further action under CERCLA is warranted.

2.0 Site Information

The San Vicente Creek Mill site is located just south of the Town of Silver City along the western bank of San Vicente Creek in Grant County, New Mexico (Figure 1). Sporadic milling and smelting took place from the 1880's through the 1940's (Ref. 5 and Ref. 6). The mill site is best known as the Silver City Reduction Works but also operated under the name of Carrolton Stamp Mill and the Flagler Reduction Works. Currently, a small concentrator smelter is operating on the mill site. The tailings and slag piles have remained uncovered and subject to erosion for many years.

2.1 Location and Description

The San Vicente Creek Mill site (mill site) is located on 20 acres situated adjacent to the western bank of the San Vicente Creek (Figure 1). At present the mill site contains several buildings, a tailings pile, a slag pile, an abandoned railroad right of way and areas of miscellaneous metal debris (Figure 2). The railroad has been abandoned and the right of way serves as an access road to the mill site. Several buildings exist on the northern end of the mill site which includes a small scale concentrator/smelter, owned by the Horton Family Limited Partnership (HFLP) (Ref. 3, p. 2). Mr. Ed Horton has refitted the old mill to extract platinum from existing slag on the mill site (Ref. 3). Two house trailers sit on the mill site and are occupied by two watchmen employed by Mr. Horton. The tailings pile, estimated to cover an area of 70,000 square feet (sq. ft.) with a volume of 22,500 cubic yards (cu. yds.) is located south of the mill buildings and west of the railroad right of way. The yellow/brown sandy tailings pile is bare of vegetation and all appearances confirm the pile is actively eroding. The slag pile is located on the eastside of the railroad right of way. The surface of the slag pile is level with the surrounding ground surface but has been estimated to be up to 30 feet in depth in places and covers an area of approximately 217,800 sq. ft. and has been estimated at one million tons (Ref. 3, p. 2). The eastern edge of the slag pile appears to be piled approximately 15 feet high along San Vicente

Creek filling in what maybe the floodplain.

The mill site is predominantly surrounded by residential and industrial properties to the north and west (Figure 2). Residential areas exist to the east and south of the mill site but are sparsely populated. The mill buildings and tailings pile sit approximately 20 feet above the channel of San Vicente Creek at an elevation of approximately 5,800 feet surrounded by steeply sloping terrain along its western boundary (Figure 1). This SIR report along with the previous EPA reports has identified the mill site and the drainage along it as San Vicente Creek while most other references including the USGS Topographic map identifies the drainage as San Vicente Arroyo. For clarity they are the same drainage.

The mill site and surrounding area has a mild, semi-arid, continental climate characterized by light precipitation totals, abundant sunshine and low relative humidity. Annual precipitation averages 16 inches per year; of that total the area receives 14.5 inches of snowfall annually. Almost 40 percent of the annual precipitation falls in the months of July, August and September (Ref. 4, p. 2). This precipitation occurs as high–intensity, convective thunderstorms.

The vegetation type in the area of the mill site is a mixture of savanna and desert shrub characterized by the presence of one-seed juniper and soaptree yucca (Ref. 5, 14, 15). Riparian vegetation exists along the floodplain of San Vicente Creek.

2.2 Operational History and Ownership

The mill site today is best known as the "Silver City Reduction Works." Originally, the mill site opened in the 1880's and operated as a pan amalgamation mill for the reduction of lead and silver ores under the name of "Carrolton Stamp Mill." In 1893, the mill site became the "Flagler Reduction Works" (Ref. 6).

By 1898 the mill site became the "Silver City Reduction Works" and operations expanded to include the processing of copper ores. It was at this time that smelting operations began at the mill site. The smelting operation was described to use iron oxide, limestone and coke along with other non-hazardous reagents. The Hearst family of newspaper fame was believed to be the owner of the mill at this time. The Hearst family was also known to own several mines and mills in the Silver City area (Ref 6, p 1).

The smelter at the Silver City Reduction Works site was destroyed by fire on June 30, 1903 (Ref. 7, p. 9). At the time of the fire the smelter was under option of purchase to the Comanche Mining & Smelting Company of Milwaukee. After the fire, the Comanche Mining & Smelting Company rebuilt the operation. By 1908 the smelter had been absorbed by the Savannah Copper Company of Utah and possibly closed. The mill site was abandoned no later than 1913 (Ref. 7, p.

15). A small mill reopened on the site in the mid-20s or mid-30s. This mill was known as the "Comanche Mining and Milling". This milling operation may have used a cyanide dissolution technique to accomplish the extraction of silver and gold from existing tailings and fresh ores (Ref. 6, p. 2).

Finally, during World War II, the Continental Chemical and Ore Company concentrated fluorspar at the site. Virtually none of the earlier structures remain at the site (Ref. 7, p. 15). Today the mill site is owned by several different owners. The northern half of the site is owned by HFLP where Mr. Horton currently operates as a small scale concentrator/smelter. The northern half of the site contains an old mill building refitted to extract platinum from the existing slag on-site (Ref. 3, p. 2). A portion of the southern half of the mill site is owned by 93 North LLC and Mr. Cork Andrews of Montana is the primary contact. The 93 North LLC ownership of the mill site includes the southern portion of the slag pile and some area of mill tailings although mill tailings appear to be from runoff of the tailings pile. Mrs. Lela Lupton of Bend Oregon is the present owner of the land containing the tailings pile (Ref. 8, p. 1,2 and Ref. 9, p. 1,3).

2.3 Previous Investigations

Several investigations were performed by the NMED Superfund Oversight Section between the mid 1980's to present. The New Mexico Environmental Improvement Division, currently NMED conducted a Site Inspection of the mill site in October 1985. Activities included a site reconnaissance, measurement of waste volumes and the collection of samples for laboratory analysis as follows: Water samples from San Vicente Creek, ponded water on the tailings material, tailing samples and slag samples. No existing wells were identified near the site thus no ground water samples were collected. Laboratory analysis of the tailings identified elevated concentrations of lead, zinc, copper, arsenic and cyanide. Ponded water on tailings sampled contained concentrations of cadmium, copper, zinc and arsenic. Samples collected from the slag pile contained concentrations of copper, lead, manganese, zinc and arsenic. Tailings extended into San Vicente Creek however significant levels of contamination were not detected in creek water (Ref. 10, p. 5).

EPA authorized NMED to conduct a Site Inspection Follow-Up report for the purpose of collecting additional data to evaluate the site using a HRS score for the mill site (Ref. 11, p. 1 & 3). NMED submitted a Site Inspection Follow-Up Report in September, 1988. This report summarized findings of investigations of the mill site conducted from June, 1987 through August, 1988. For this investigation, two monitoring wells were drilled at the mill site with an air rotary rig. Ground water samples were collected from each well to evaluate the possibility of ground water contamination. A domestic hand dug well 1000 ft. south of the mill site was also sampled. A natural spring off-site was sampled as a background. Ground water samples analyzed did not identify a release to ground water. Stream sediment samples were collected from the channel of San

Vicente Creek quantitatively documenting a release to the surface water pathway of lead a hazardous substance from the mill site (Ref. 12, p. 1-8).

The HRS was updated by EPA in 1991. NMED reevaluated the mill site using the newly revised version of the HRS. Based on this reevaluation the mill site was given a CERCLIS designation of "No Further Remedial Action Planned" (NFRAP) and the mill site was archived in March 1992 (Ref. 13, p. 1). Additional tailings and soil data was collected by an EPA contractor in 1999, this data also showed tailings material to be high in lead, zinc and copper and therefore spurred renewed interest in the mill site (Ref. 14, p. 1-2). Based on this data collected, NMED submitted a letter dated February 18, 2000 to EPA Region 6 requesting that the Response and Prevention Branch investigate the mill site to determine if removal actions were warranted (Ref. 15, p. 1). The EPA Region 6 conducted a removal assessment initiating site activities in August, 2000 and submitted a Removal Assessment Report dated January 19, 2001 (Ref. 3, p. 1-7). However a removal action has not occurred at the mill site to date.

In September 2008, the Town of Silver City notified NMED that retention berms around the tailings had been breached and tailings were eroding into San Vicente Creek (Ref. 16, p. 1). Photos submitted to NMED demonstrate that the berm had been breached as far back as October, 2007 (Ref. 9, p. 1-7) The berms and run-on channel were originally developed and maintained by Mr. Ed Horton as far back as 1991(Ref. 17, p. 1). After an on-site visit to confirm the breached berm and assess the site, the EPA Region 6 Emergency Removal Team rebuilt the perimeter berm and rebuilt the run-on channel on-site in November 2008. NMED initiated a SIR which is documented below.

3.0 Site Investigation

The SIR field investigation for the San Vicente Creek Mill Site was conducted by NMED staff during June of 2009. The principal investigator for the SIR was Allan Pasteris of the NMED Superfund Oversight Section. The SIR investigation workplan proposed to collect source and environmental samples to identify if hazardous substances are present, determine whether hazardous substances have been released to the environment and determine specific targets that may be impacted. Specific hazardous substances analyzed for include 19 metals and cyanide identified in Table 3. The principal tasks for the SIR included collecting source, soil, sediment, ground water and surface water samples and evaluating the site using the the HRS to determine if further action under CERCLA is warrented.

3.1 Source/Waste Characteristics

Two waste sources have been identified on the mill site. One waste source, a large area of black vitreous slag material sits between the San Vicente Creek and the railroad right of way. The other identified source is the yellow to brown colored sandy tailings that is located west of the slag material and the railroad right of way. Both waste sources are located south of the existing mill buildings on the mill site (Figure 2).

3.1.1 Source/Waste Description

The slag pile covers an area of approximately 217,800 sq. ft. The surface of the slag material appears to have been leveled with the surrounding topography. According to Mr. Ed Horton, a survey estimated the slag to be one million tons with an average depth of 20 to 30 feet below ground level (Ref. 3, p. 2). A small area of slag has been excavated to a depth of 15 ft. and native ground is not exposed (Ref. 12, p. 6) The slag material on the mill site is predominately very course to fine gravel in size with a fine sand size fraction within.

The tailings pile is estimated to cover 70,000 sq. ft. in area and contain a volume of 22,500 cu. yds. of material (Ref. 3, p. 2). The tailings pile is above ground, uncovered with no vegetation growing and shows evidence of being eroded over time. A small drainage from the west of the mill site has in the past run onto the tailings pile and eroded through the pile. Run-off from the pile has distributed tailings below the pile and to the south. Over time storm water has carried tailings off the mill site along the railroad right of way approximately one thousand feet. In this area storm water and tailings cross under the railroad right of way through a culvert down onto the floodplain and into San Vicente Creek (Ref. 12, p. 1,4,6). Tailings have also run-off in the area east of the pile (Ref. 9, p. 1,3 and Ref. 16, p. 1). The railroad bed has acted like a berm in the past and has kept the tailings from running throughout the mill site (Ref. 12, p. 3). It is not visually evident but wind over time may have dispersed tailings onto surrounding properties.

3.1.3 Existing Data

In 1999, the EPA Region 6 Superfund Technical Assessment and Response Team (START) contractor, Ecology and Environment, Inc. completed a x-ray fluorescence (XRF) screening of tailings material both on the tailings pile and transported off the tailings pile. The XRF results showed metal concentrations in tailings material for arsenic at 178 parts per million (ppm), copper at 2,210 ppm, iron at 222,753 ppm, lead at 6,926 ppm, and manganese at 1,634 ppm (Ref. 14, p. 1-2). The contractor also completed paste pH on the tailings material that range in value from 2.21 to 1.55. Additional XRF data collected in 2000 when EPA Region 6 START initiated removal assessment activities at the mill site that showed metal concentrations in tailings for arsenic at 158 ppm, lead at 13,054 ppm, zinc at 19,611 ppm and copper at 7,793 ppm. EPA Region 6 START removal assessment activities also included XRF screening of the slag material. Results of the slag screening showed metal concentrations for arsenic at 648 ppm, lead at 9,810 ppm, zinc at 19,667 ppm, and copper at 40,363 ppm (Ref. 3, p. 5). All results of XRF screening are provided in Table 1 and Table 2.

3.1.4 Source/Waste Characterization Methods

During the SIR, on June 2 and June 3, 2009, samples were taken of the tailings and slag piles to identify CERCLA hazardous substances (Figure 3). Samples were collected using a stainless steel hand held shovel and placed in 8 oz glass sample containers. Samples were analyzed for Target Analyte List (TAL) metals including cyanide and mercury under the Environmental Protection Agency's Contract Laboratory Program (CLP).

Two locations were selected to sample on the slag pile (Figure 3). Slag material was excavated to a maximum depth of six inches and screened through a 2 mm mesh until the sample container was appropriately full. A total of two slag samples were collected.

Two locations were selected to sample on the tailings pile (Figure 3). At each location a total of two tailings samples were collected. At each location the first sample was collected at a depth of 6 inches followed by further excavation of the tailings with the second sample collected at a depth of 24 inches. A total of four tailings samples were collected. The tailings are predominately a sandy material (<2 mm) so the tailings sample were not passed through a 2 mm mesh.

3.1.5 Source/Waste Characterization Results

Table 3 provides the total metal concentration from the tailing and slag samples collected. Analysis of tailings samples detected the presences of most of TAL metals analyzed for with the exception of antimony, beryllium, mercury, nickel and selenium. Analysis of slag samples detected the presences of all the TAL metals analyzed for.

Table 3 also compares metal concentrations detected in the tailings and slag samples to the metal concentrations detected in the background soil sample (SVSoil-1) collected during the SIR field investigation. The tailing samples shows metal concentrations elevated above the soil background concentrations for arsenic, cadmium, copper, iron, lead, manganese, thallium and zinc. The slag samples shows metal concentrations elevated above the background soil concentrations for arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium and zinc.

3.2 Ground Water Pathway

3.2.1 Geology

Silver City and the mill site are located in an area of physiographic transition between the Mexican Highland Section of the Basin and Range Province and the Datil-Mogollon Section of the Transition Zone Province (Ref. 18, p. 13). This area is a transition from the Colorado Plateau structures to the north and the Basin and Range to the south. This transition zone is characterized by widespread, intensive, recurrent, normal faulting and local, gentle folding. The faulting and the folding commonly were accompanied by local intrusions of igneous rock. The faulting resulted in extensive fracturing of all rock units and the folding and intrusions opened joints in otherwise dense rocks (Ref. 19, p. 20). The mill site is located in an area of tertiary intrusive rock trending north to south that is approximately 2 miles long b 1.5 miles wide(Ref. 20, p. 3, 7). Trauger (1972) identified this tertiary intrusive bedrock as fractured quartz monzonite (Ref. 12, p. 29).

Flowing north to south through the middle of this intrusive bedrock area is the San Vicente Creek. Quartenary alluvium is found beneath and immediately adjacent to San Vicente Creek. In the area of the mill site this alluvium is considered to be no more than 10 feet thick (Ref. 20, p. 2, 7). The USDA Soil Survey for Grant County describes the area on and surrounding the mill site as covered by a shallow soil, approximately 12 inches deep, formed in residuum predominantly from bedrock (Ref. 21, p. 1, 5). The drilling logs for the two monitoring wells completed on the mill site in 1987 show shallow soil overlaying weathered and unaltered quartz monzonite bedrock (Ref. 22, p. 10-13). The drilling logs show the quartz monzonite to be weathered to a depth of 40 feet in one well (Ref. 22, p. 33).

West of the mill site one-half mile is the area called the Boston Hill Mining District known for its manganiferous iron ores (Ref. 23, p. 7,10). The western boundary of the intrusive quartz monzonite on the mill site is a fault contact with the sedimentary rock (dolomite and shale) of the eastern boundary of the Boston Hill Mining District. At this contact the fault is trending approximately north to south (Ref. 23, p 32).

To the south and east of the mill site, the intrusive quartz monzonite rock is in unconformable, depositional contact by the late tertiary basin fill, Gila Conglomerate (Ref. 12, p. 29). One mile south of the mill site, closure documents for the old Silver City landfill site identify the old landfill to be underlain by the unconsolidated Gila Conglomerate. The Gila Conglomerate is estimated to be greater than 1,500 feet thick approximately 4 miles southwest of the mill site (Ref. 24, p. 12).

3.2.2 Hydrogeology

The Gila Conglomerate south of the mill site serves as the major ground water source for the Silver City area. A major portion of the aquifer serving Silver City is in the San Vicente sub-basin of the Mimbres basin. San Vicente Creek is the principal drainage and recharge area in the sub-basin (Ref. 25, p. 6, 7).

The San Vicente Creek is an important recharge area for the Gila Conglomerate aquifer serving the Silver City area (Ref. 19, p. 54). The recharge potential is demonstrated by the Town of Silver City Waste Water Treatment Plant (WWTP) which discharges to San Vicente Creek south of the mill site. Ground water levels have been observed rising in the McCauley well downstream of the Town of Silver City WWTP along San Vicente Creek. From 1954 to 1970, the water level continuously rose 15 feet in this well attributed to the WWTP discharge (Ref. 19, p. 62 and 25, p. 12). Another example of recharge is demonstrated by sharp rises in the same well in direct response to flood events in the San Vicente Creek (Ref. 19, p. 62).

Previous investigations have assumed that there is a hydrologic connection between the intrusive igneous rock at the mill site to the alluvium along San Vicente Creek and the Gila Conglomerate further down gradient (Ref. 12, p. 5). Similar to the topography of the mill site, it has been found that intrusive rock is more weathered under flatter slopes and is more open-jointed and fractured in the vicinity of larger faults. The courses of many creek channels follow lines of faulting and jointing in the rock. Commonly faulting and associated fracturing has increased the ability of the areas to transmit ground water. It has also been found that younger intrusive rock generally is dense and commonly acts as a dam to block the movement of ground water (Ref. 19. p. 34). Further investigation would have to be done to understand the hydrologic connection between the intrusive rock on the mill site and the other two geologic materials.

Given only two water levels from the monitoring wells no determination as to ground water gradient were made. Literature reviewed suggests a regional southeasterly groundwater flow along the axis of San Vicente Creek (Ref. 24 and Ref. 25).

3.2.3 Ground Water Targets

The Silver City area primarily receives its drinking water from the Gila Conglomerate a deep unconsolidated basin fill material of quartenary to tertiary age. Most of the Town of Silver City drinking water wells are completed in the Gila Conglomerate in the Mimbres basin aquifer. Three wells (Franks well field) are west of the continental divide in the Gila basin aquifer. Only one TOSV well (Gabby Hayes) is within the target distance limit (TDL) of four miles from the mill site. The Woodward well field (5 wells) is five miles southwest and the Anderson well (1 well) is six miles from the mill site (Ref. 25 and Ref. 26). Most private domestic wells in the area are also completed in the Gila Conglomerate. In addition to the Gila Conglomerate several other rock units in the Silver City area yield enough water to be useful aquifers for domestic wells (Ref. 19). Several small capacity domestic wells exist in the same intrusive bedrock formation found at the mill site.

A search of the database for the New Mexico Office of the State Engineer's Water Rights Division was conducted to identify the registered domestic wells present within the TDL of the mill site. The search identified 475 registered domestic well within the four miles of the mill site (Ref. 27, p. 23). The number of people using domestic wells within the TDL was determined by multiplying the number of domestic wells in the TDL by 2.5, the average number of people per household in Grant County, New Mexico as measured by the 2000 United States Census (Ref. 28, p. 1). A population of 1,188 people is estimated to use ground water for drinking purposes from private wells within the TDL of the mill site.

One Town of Silver City drinking water system well is located within the TDL (Ref 25 and 26). The Town of Silver City drinking water system has a total of 12 wells and is a blended system with no well providing more than 40 percent of the total drinking water supplied. The TOSV drinking water system serves 18,615 people (Ref. 29, p. 1). In addition there are 4 mutual domestic water associations (MDWA) and the town site of Tyrone that purchase their drinking water from the Town of Silver City drinking water system for a total of 3,239 additional users (Ref. 29, p. 3-7). That is a total population of 21,854 (18,615 + 3,239) that is provided drinking water by the Town of Silver City water system. Given the above total population of 21,854 and 12 wells, one Town of Silver City well may serve approximately 1,821 (21,854 ÷ 12) people. Figure 4 shows the location of all domestic supply wells within the TDL a four-mile radius of the mill site. Table 4 summarizes the number of people utilizing ground water for domestic purposes within each TDL.

3.2.4 Ground Water Investigation Methods

Figure 5, identifies the location of four shallow ground water wells where samples were collected on June 2 - 3, 2009. Two monitoring wells completed in 1987 on the mill site for the Site Inspection Follow-Up report were also sampled. Both monitoring wells were completed in the intrusive quartz monzonite bedrock (Ref. 22, p. 33, 34). Monitoring well (SVGW-1) is located on the northern portion of the mill site, in the area of the old mill facilities and just east of the current mill buildings on the mill site. Monitoring well (SVGW-2) is located on the southern edge of the mill site, south of the slag pile and southeast of the tailings pile. A shallow dug well (SVGW-3) was sampled approximately 1,500 feet south of the mill site at an abandoned farmstead. These three wells sampled are considered down-gradient wells. A background well (SVGW-5) located approximately 1,500 ft. to the north of the mill site was sampled. This well is also a shallow hand dug domestic well.

The two monitoring wells on the mill site were purged and sampled using dedicated hand bailers. At least three well volumes were removed from each well. The two hand dug wells were purged and sampled using a Whaler Mini Purger pump. All samples were collected following the San Vicente Creek Mill Workplan Plan (Ref. 30). Quality Assurance/Quality Control (QA/QC) samples collected included a duplicate and a rinsate sample. Samples were collected and analyzed for TAL metals including cyanide and mercury under the EPA's CLP.

3.2.5 Ground Water Investigation Results and Discussion

All ground water samples collected were analyzed for TAL metals both total (unfiltered) and dissolved (filtered). Table 5 provides the data from ground water samples collected. The CERCLA hazardous substances (metals) identified in the samples at concentrations considered a release to the ground water pathway include aluminum, copper, iron and manganese (Ref. 1, p. 117). Metals released to the ground water pathway occur only in the samples from monitoring wells on the mill site.

Manganese exceeds the New Mexico Water Quality Control Commissions (WQCC) ground water standard of 200 ug/l from SVGW-1 and SVGW-2 samples, both mill site monitoring wells with concentrations of 3,660 µg/l and 365 µg/l respectively. Both samples were also three times higher than the background concentration for manganese from the SVGW-5 sample of 24.7 µg/l. The aluminum concentration from SVGW-2 (9.870 µg/l) exceeded the WQCC ground water standard of 5,000 µg/l. The iron concentrations from SVGW-1 and SVGW-2 samples do not exceed the WQCC ground water standards but does appear to be significantly higher (3x) than the background concentration for the SVGW-5 sample (25.9 µg/l). The copper concentration from SVGW-1 (27.2 µg/l) is also considered a release to ground water.

3.3 Surface Water Pathway

It is visually apparent that mill tailings have entered and will continue to enter the San Vicente Creek over time. Inspection of the mill site and the surrounding area indicates that waste material has migrated off-site. Tailings have been transported in storm water down the drainage ditch along the railroad right of way approximately 1,000 feet, crossing under the railroad right of way thru a culvert onto the floodplain of the San Vicente Creek. This floodplain area has accumulated tailings from the mill site over time. A drainage channel has formed over time that releases storm water and tailings material to the San Vicente Creek (Ref. 16, p. 1). A series of photos from a recent site inspection by NMED personnel on September 18, 2009 also show this pathway (Ref. 31, p 1-6).

3.3.1 Hydrology

The San Vicente Creek, which originates in the mountains north of the Town of Silver City, is the principle drainage of the northwest part of the Mimbres basin. Three perennial creeks north of the Town of Silver City include the Silva, the Pinos Altos, and the Little Walnut Creeks, merge to form the San Vicente Creek approximately two miles north of the mill site (Ref. 32, p. 6) (Figure 1). Stream flow in the San Vicente Creek within the Town of Silver City is perennial, fed by numerous springs near the northern town limit (Ref. 32, p. 6). A stream gauge in the Town of Silver City, up-gradient of the mill site has an estimated perennial discharge of 20 to 30 gallons per minute. This flow is primarily due to upstream groundwater contributions, return seepage from urban irrigation, and possible line losses from the city water system (Ref. 18, p. 38). In three site visits to the mill site in 2008 and 2009, visual observation of stream flow along the mill site, estimated flow at less than one cubic foot per second (cu. ft. /sec.). Visual observation of the San Vicente Creek one mile downstream of the mill site had no stream flow during several of these same visits. It is undetermined if flow in the San Vicente Creek is perennial or intermittent along the mill site. It could be that perennial flow along the mill site is due to inputs above the mill site and that this reach of the San Vicente Creek has an intermittent flow in that it loses water to ground water in the drier parts of the year and gains water from ground water in the wetter times of the year.

Throughout most of its length, 35 miles to its confluence with the Mimbres River, the San Vicente Creek is an ephemeral to intermittent stream (Ref. 18, p. 6 and Ref. 32, p. 38). A hydrologic study at the Old Silver City landfill approximately one mile south (downstream) of the mill site identified the San Vicente Creek along the landfill site as intermittent, ground water discharging to the creek in wetter parts of the year and recharging ground water the remaining drier parts. It was determined that surface water and ground water are integrally related: both behave similarly over time and the water elevations in the wells that are near the creek are very near surface water levels (Ref. 24, p. 14, 15).

The San Vicente Creek is tributary to the Mimbres River a classified closed basin. The San Vicente Creek is currently unclassified but is a significant drainage in the Mimbres watershed, with a drainage area of more than 300 square miles (198,000 acres) at its confluence with the Mimbres River about 35 miles downstream of the Town of Silver City. Where the San Vicente Creek leaves Silver City, its drainage area encompasses about 30 square miles (18,500 acres), extending north and west to the Continental Divide. The San Vicente Creek is a prominent hydrologic and historical feature of the town; within Silver City it is famously known as the "Big Ditch" (Ref. 32, p. 6).

3.3.2 Surface Water Targets

The San Vicente Creek in the area of the mill site is an unclassified perennial/intermittent water with designated uses that include aquatic life, livestock watering, wildlife habitat and secondary contact (Ref. 33, p. 15). Minnow type fish have been seen in pools in the San Vicente Creek along and downstream of the mill site. There is no record of San Vicente Creek along the mill site or downstream being utilized for irrigation and/or fishing purposes. San Vicente Creek is not a drinking water source within the TDL of 15 miles down stream.

Earlier site investigations have documented no endangered or threatened species are likely to inhabit San Vicente Creek or its floodplain along or downstream of the mill site (Ref. 34, p. 1). A search of the Threatened and

Endangered Species of New Mexico, 2008 Biennial Review did not identify any species specific to the San Vicente Creek but did identify some in the Mimbres River and Basin. These species include the Chihuahua Chub, Southwestern Willow Flycatcher and Common Black-Hawk (Ref. 35, p. 39, 92, 93 and 97). The Chihuahua Chub is limited to a 9 mile reach of the Mimbres River and associated spring habitats (Ref. 35, p. 39). The Southwestern Willow Flycatcher and Common Black Hawk rely on riparian vegetation for habitat (Ref. 35, p. 92, 97).

A 1984 U.S. Fish and Wildlife Service (USFWS) Wetland Inventory of the Silver City area including the San Vicente Creek identified several wetland areas within the 15 mile TDL. The inventory identified several palustrine wetlands associated with the perennial reach of the San Vicente Creek along and down gradient of the mill site. The USFWS also identified areas of the creek bed as riverine intermittent/ephemeral wetlands within the ephemeral reach of the San Vicente Creek downstream of the mill site (Ref. 36, p. 2, 3 and 4). These findings are preliminary and were not field examined (Ref. 36, p 2 and Ref 37, p. 1). Until further field data can be collected to identify actual wetland areas, for purposes of this report the assumption that some palustrine wetlands do exist along the perennial reach of San Vicente Creek but that the riverine intermittent/ephemeral wetland further down gradient do not.

Recreational use of San Vicente Creek is assumed. Houses downstream of the mill site exist along the Creek. The Town of Silver City has developed recreational athletic fields and a golf course along the San Vicente Creek down-gradient of the mill site approximately 1.25 miles that can provide easy access to the channel of the San Vicente Creek. The Town of Silver City is interested in purchasing a portion of the Slout Farm property approximately 1,500 feet south of the mill site for the purpose of developing a recreational trail and open space along San Vicente Creek. The NMED, Surface Water Quality Bureau is in the planning process to create a wetland along San Vicente Creek approximately a mile south of the mill site. This wetland project is being funded by a grant from EPA, Region 6.

3.3.3 Existing Data

As part of a purchase agreement the owner of the Slout Farm property, hired an environmental consultant to sample sediment in the adjacent San Vicente Creek. Ten sediment samples were collected from the channel of San Vicente Creek on April 22, 2009. Samples were collected starting at the northern property line, downstream to the southern property line. Samples were analyzed for total metals; arsenic, copper, lead and zinc. Table 9 contains sediment sample results (Ref. 38).

On September 11, 2009, a rain event (1.28 inches in one hour) produced storm water that topped the perimeter berm down gradient of the tailings pile (Ref. 39, p. 2). Storm water was released from the perimeter berm at the release point as constructed by EPA. NMED staff in Silver City inspected the mill site on September 18, 2009, after the rain event. Storm water ponded behind the perimeter berm had a measured pH of 2.5. Released storm water from the mill site that ponded on the flood plain of the San Vicente Creek had a measured pH of 3.5. San Vicente Creek below the floodplain had a measured pH of 5.5 (Ref. 31, p. 1 and 2). While the site investigation did not directly identify storm water entering the San Vicente Creek, it is assumed some volume did. A storm water sample was collected from the ponded water on the floodplain. A sediment sample was collected from the same flood plain and a sediment sample from San Vicente Creek down stream of the outfall to the creek from the impacted floodplain (Ref. 31, p 1 and 2). Table 6 shows metal concentrations in the samples collected. This data shows that storm water metal concentrations are comparable to the tailings metal concentrations and in excess of surface water background concentrations.

3.3.4 Surface Water Methods

During the SIR, samples were taken on June 2, 2009 for both surface water and stream sediments to determine if a release of CERCLA hazardous substances to the surface water pathway. Three sediment samples were collected from San Vicente Creek. A background sample (SVSed-3) was collected upstream from the mill site. Two sediment samples downstream of the mill site were collected. One sediment sample (SVSed-2) was collected upstream of the floodplain outfall described in Section 3.3 and the other collected downstream (SVSed-1) of the outfall. Two surface water samples were also collected. One sample (SVSW-2) was collected upstream of the mill site to serve as a background. The other sample was collected downstream of the floodplain outfall (SVSW-1), downstream of the mill site (Figure 2). Sediment and surface water samples (filtered and unfiltered) were shipped to an EPA CLP laboratory for analysis of TAL metals including cyanide and mercury according to EPA SOW5.2.

3.3.5 Surface Water Results and Discussion

Analytical results of sediment sampling from San Vicente Creek are presented in Table 7. The analytical results show that no metal concentrations downstream of the mill site were above the background sample to be considered a release of a hazardous substance to the surface water pathway.

Surface water samples showed no elevated levels of both total and dissolved metals above the background concentrations (Table 8). These analytical results do not document a release of a hazardous substance to the surface water pathway. The concentration of aluminum did exceed the WQCC surface water standard for chronic aquatic life in both the background and downstream samples (Ref.33).

When compared to the background sediment sample collected on June 2, 2009 the additional sediment samples collected on April 22, 2009 from San Vicente Creek adjacent to Slout Farm, two sediment samples (05 and 07) collected show lead and two sediment samples (05 and 08) identify arsenic at three times higher than the background (Table 9). These sediment samples thus establish a release to surface water of CERCLA hazardous substances to the surface water pathway.

3.4 Soil Exposure Pathway

There are two methods of deposition which could result in contaminated soil. One method is the deposition of wind blown material (from either air emissions from the former smelter or from fine grained waste sources); the other is by deposition of sediments from storm water runoff. Sources of CERCLA hazardous substances available to the soil exposure pathway include contaminated soil, the tailings pile and slag pile.

3.4.1 Soil Exposure Targets

Species with terrestrial habitats are most likely to be affected by contamination in the soil pathway. There are no identified terrestrial species representing sensitive environments (either Federal, state, endangered or threatened) that occur in the area surrounding San Vicente Creek and the mill site.

There are no residences or schools within 200 feet of the mill site waste sources (Figure 2). The closest residence to the site is approximately 400 feet to the northeast (Figure 2). Mr. Horton has several workers at the site presently and two residents that live on-site and function as watchmen (Ref. 17, p. 1). Mr. Horton maintains a fence and locked gate on the north-side of the mill site. A steep hill on the west-side of the mill site makes access difficult. The south-side of the mill site can be accessed from the railroad right of way. Mr. Horton has blocked the railroad right of way with old heavy turbines that make vehicular access to the site impossible (Ref. 9, p. 1, 7). Foot traffic is possible but less likely with watchmen on-site. "No Trespassing" signs are posted across the road entering the property and the railroad right of way. No trespassers were observed during all site visits in 2008 and 2009. Several warehouse and industrial sites are north of the mill site. A small residential area is located along the western boundary separated by a steep hill and undeveloped land. Another small residential area is located southwest of the site and is also separated by undeveloped land. East of the mill site is a steep hill with several houses on the ridge. Several hiking trails are evident on the hill side.

The Town of Silver City is interested in developing a recreational trail along San Vicente Creek which includes the area along the mill site. The Town of Silver City is or has already purchased the Slout Farm property approximately 1,500 feet south of the mill site for the purpose of recreational open space.

3.4.2 Soil Exposure Methods

During the SIR, nine soil samples were taken to determine areas of contaminated soil (Figure 3). Samples were collected within the top six inches of soil. Two samples (SVSoil2 and SVSoil4) were taken off the mill site down gradient of the perimeter berm from areas that were visibly contaminated with mine tailings, as described in Sections 3.1.1 and 3.3.3. SVSoil2 was taking in the drainage ditch along railroad right of way and SVSoil4 was taken on the floodplain along San Vicente Creek. Two samples (SVSoil8 and Soil9) were taken east of the mill site and San Vicente Creek on the hill side. The remaining soil samples (SVSoil5, SVSoil6 and SVSoil7 were collected between the railroad right of way and San Vicente Creek down to the Slout Farm property. One background sample (SVSoil1) was collected just north of Mr. Horton's operation, in an idle field. All soil samples were shipped to an EPA CLP laboratory for analysis of TAL metals including cyanide and mercury according to EPA SOW5.2.

3.4.3 Soil Exposure Results and Discussion

Arsenic exceeded EPA Soil Screening Levels for residential soil in all down-gradient soil samples except SVSoil6 (Table 10). In addition, samples exceed EPA Region 6 Soil Screening Levels for iron and lead in soil samples collected in areas with visible tailings (SVSoil2, SVSoil4, SVSoil5) on the soil surface. Continuing, soil samples collected in areas of visible tailings (SVSoil2, SVSoil4 and SVSoil5) barium, cadmium, copper, iron, selenium, and zinc were all three times above the background concentration. Mercury was not detected in the background sample but had concentrations above the CRQL.

Soil samples collected in areas that had no tailings visible on the soil surface include SVSoil6, SVSoil7, SVSoil8 and SVSoil9. Arsenic was the only concentration above the EPA Region 6 Soil Screening Levels. Additionally beryllium, cadmium, chromium, copper, iron, lead, selenium, silver, vanadium and zinc are three times above the background concentration. Mercury was not detected in the background sample but had concentrations above the CRQL.

Table 10 shows that with the exception of antimony, cobalt, cyanide, nickel and thallium all TAL metals analyzed for have been released to the soil pathway.

3.5 Air Pathway

At the mill site, the potential for contaminants being transported from a waste source via the air pathway is dependent upon particulate mobility. Material in the slag is primarily coarse-grained to cobble size and is not likely to be transported by wind. The tailings material however is fine to coarse-grained sand and could be entrained by wind. Past air emissions from the former smelter are also likely. The air pathway was not directly investigated during this SIR.

4.0 Summary and Conclusion

The mill site is located just south of the Town of Silver City along the western bank of San Vicente Creek in Grant County, New Mexico (Figure 1). Sporadic milling and smelting took place from the 1880's through the 1940's (Ref. 5 and Ref. 6). Currently, a small concentrator smelter is operating on the mill site. The tailings and slag piles have remained uncovered and subject to erosion for many years. The slag being black vitreous material erosion is not visually evident. The tailings being a finer sand grain material is visually evident that erosion and runoff from storm water have redistributed tailings onto areas of the mill site and onto surrounding properties (Ref. 9, p. 1-6). Visual estimates of additional surface areas covered by tailings from storm water runoff include 24,000 sq. ft. on the mill site. By visual estimates there are also approximately 13,000 sq. ft. of soil including the flood plain visually covered by tailings down gradient of the mill site (Ref. 9, p. 1, 3 and 4, and Ref. 41, p. 1).

The results of the SIR investigation shows that several CERCLA hazardous substances associated with waste sources on the mill site have been released into the ground water, surface water and soil pathways. A release of aluminum, cooper, iron and manganese to ground water has been documented. These metals measured in ground water samples from mill site monitoring wells. Lead and arsenic concentrations in sediment samples down gradient of the mill site document a release to surface water. Lead and arsenic concentrations, three times higher than background concentrations, are attributable to mill site wastes. This investigation documented a release to soil surrounding the mill site of CERCLA hazardous substances. Arsenic, iron and lead were found in surface soil at concentrations that exceed EPA Region 6 Soil Screening Levels. Concentrations of beryllium, cadmium, chromium, copper, iron, silver, vanadium and zinc were found in soil at levels three times higher than background concentrations. Mercury was also identified as released to the soil pathway.

A release of hazardous substances has been documented to the ground water, surface water and soil pathways at the mill site. Storm water samples collected from ponded water on mill tailings show storm water quality that is acidic and dissolved metal concentrations in excess of ground water and surface water background concentrations. Given this potential source of contamination, further investigation of ground water and/or surface water may be warranted. Thus further investigation of the ground water pathway is recommended to characterize ground water flow direction, characterize ground water/surface water interaction, and characterize alluvial ground water quality under San Vicente Creek.

Finally it is recommended that further investigation is needed to evaluate levels of actual contamination at targets through exposure from the ground water and soil pathways. Therefore, the additional sampling of domestic wells and residential soil down-gradient of the mill site is recommended.

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TABLES

Table 1. Tailings XRF Screening Results, Ref 14.

San Vicente Creek Mill Site						
Tailings XRF Screening Results (1999)						
Analyte	EPA-SSL**	TPB*	TPW*	TPO*	RO*	ROL*
	PPM					
	Total Metals					
Antimony	31.0	310.8	6.1	5.4	3.7	5.6
Arsenic	2.2	166.3	58.6	50.4	32.8	6.8
Barium	16,000	126.8	180.2	508.1	405.3	394.2
Cadmium	39.0	65.1	21.8	2.4	3.9	21.9
Chromium	210	64.4	14.2	16.7	22.6	18.6
Cooper	2,900	2,167.0	564.4	167.9	205.9	495.3
Iron	55,000	206,117.9	67,432.10	57,397.40	50,110.90	67,603.20
Lead	400	1,211.30	6,519.70	2,147.90	1,883.50	6,648.30
Manganese	3,200	1,456.30	1,071.90	206.6	265.9	573
Mercury	23.0	ND	ND	ND	ND	ND
Nickel	1,600	ND	ND	ND	ND	ND
Selenium	390	ND	4.8	3.1	2.5	0.3
Silver	390	38.5	18.1	5.8	7.6	18.2
Thallium	5.5	310.8	872.3	1,370.80	1,101.20	561.2
Zinc	2,300	13,322.9	12,052.50	752.5	1,353.70	5,714.70

* - TPB (Brown Tailings, Saturated Paste pH=2.21),
TPW (White Tailings, Saturated Paste pH=1.55),
TPO (Organg Tailings, Saturated Paste pH=2.15),
RO (Transported Tailings, Saturated Paste pH=2.19),
ROL (Transported Tailings Low Area).

** - EPA, Region 6 Soil Screening Levels, Residential Soils.

ND - Not Detected

Table 2. XRF Screening Results, Removal Assessment Report, Ref. 3.

San Vicente Creek Mill				
XRF Screening Results (2000)				
Mill Material Sampled	Lead	Arsenic*	Zinc	Copper
	ppm			
	Total Metals			
Tailings	ND-13,054	5-158	89-19,611	ND-7,793
Slag	0-9,810	5-648	193-19,677	19-40,363
Culvert	11-2,991	11-107	222-5,940	37-4,413
Drainage	ND-10,043	4-40	225-22,664	44-2,2007
Railway	25-2,179	11-25	165-11,873	107-11,557

* - Results are from laboratory analysis

ND - Not detected

Table 3. Waste (Tailings and Slag) Material Samples Results, Ref. 42, 43 and 44.

San Vicente Mill Site								
Waste Material Samples (June 2 & 3, 2009)								
Analyte[1]	Contract Required Quantitation Limit (CRQL)	Background Soil[2] SVSoil1	Slag		Tailings			
			SVSL1*	SVSL2*	SVTL1*	SVTL2**	SVTL4*	STVL5**
	mg/kg							
	Total Metals							
Aluminum	20.0	10,400	1,170	**11,800**	3,560	5,880	5,570	6,360
Antimony	6.0	U	U	U	U	U	U	U
Arsenic	1.0	U	U	**193**	**146**	**123**	**124**	**153**
Barium	1.0	120	7.2	**342**	13.6	26.4	29.0	42.8
Beryllium	0.5	0.5	U	1.1	U	U	U	U
Cadmium	0.5	U	**11.0**	**12.7**	U	**2.4**	**2.5**	U
Chromium	1.0	6.1	U	**31.4**	U	1.9	1.7	U
Cobalt	5.0	5.3	**44.0**	**24.7**	3.3	**5.7**	**5.6**	U
Copper	2.5	102	**432**	**3,740**	**220**	**348**	**360**	**232**
Cyanide	2.5	<5.21[3]	<2.63	<5.35	<7.00	<6.75	<6.71	<6.56
Iron	10.0	11,300	**237,000**	**101,000**	**85,300**	**68,600**	**68,400**	**62,100**
Lead	1.0	34.2	8.3	**2,230**	**4,120**	**5,800**	**5,960**	**6,260**
Manganese	1.5	578	**1,950**	**9,240**	**1,610**	**1,700**	**1,700**	**893**
Mercury	0.1	U	U	**0.213**	U	U	U	U
Nickel	4.0	5.1	**13.9**	**9.8**	U	U	U	U
Selenium	3.5	12.8	**207**	**106**	U	U	U	U
Silver	1.0	1.1	**13.6**	**30.6**	**2.7**	**9.5**	**10.1**	**8.3**
Thallium	2.5	U	U	U	**13.5**	**14.8**	**12.6**	U
Vanadium	5.0	21.7	**41.6**	**34.9**	13.3	**24.0**	21.3	**36.4**
Zinc	6.0	111	**249**	**9,240**	**2,550**	**4,380**	**4,400**	**1,800**

* - Samples collected within the upper six inches of material.

** - Samples collected at a depth of 24 inches of material.

U - Not detected.

[1] - Samples were analyzed for total metals.

[2] - Background Soil Values, SVSoil1

[3] - Reporting limits are adjusted for sample size and matrix interference.

Bold - concentration higher than the background soil concentration

Table 4. Ground Water Targets within TDL, Ref 1, 27, 28 and 29.

San Vicente Creek Mill Site					
Ground Water Targets within TDL					
Radius Distance	Number of Domestic Wells °	Population Using Domestic Wells[1]	Number of Municipal Wells[2]	Population Using Municipal Well[3]	Weigthed Population Values*
0-¼	0	0	0	0	0
¼ - ½	0	0	0	0	0
½ - 1	22	55	0	0	17
1 - 2	128	320	0	0	94
2 - 3	211	528	0	0	68
3 - 4	114	285	1	1821[3]	131
Totals	475	1188	1	1821	310

° - Domestic and Municipal wells identified from OSE database.

1 - Population determined by multipling the number of wells by 2.5 (# per household, Grant County 2000 U.S. Census).

2 - 1 of 12 wells for the TOSC drinking water system found within the TDL.

3 - Total TOSC drinking water system users divided by the total number of Silver City municipal wells (21,852 ÷ 12).

* - Table 3-12, EPA Hazard Ranking System, 40 CFR Part 300, Appendix A.

Table 5. Ground Water Analytical Results, Ref. 42, 43, 44 and 45.

San Vicente Mill Site										
Ground Water Samples (June 2 & 3, 2009)										
Analyte	EPA MCL/WQCC Ground Water Standards[2]	ICP-AES, CRQL[1]	SVGW1		SVGW2		SVGW3		SVGW5*	
			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	µg/L									
Aluminum	50[3]/5000	200	U	**265**	***9,780***	**298**	U	**256**	U	**238**
Antimony	6.0/NA	60	U	U	U	U	U	U	U	U
Arsenic	10/100	10	U	U	U	U	U	U	U	U
Barium	2000/1000	200	46.6	36.6	381	62.2	54.3	56.2	385	415
Beryllium	4.0/NA	5.0	U	U	U	U	U	U	U	U
Cadmium	5.0/10	5.0	U	U	U	U	U	U	U	U
Chromium	100/50	10	U	U	U	U	U	U	U	U
Cobalt	NA/50	50	U	U	U	U	U	U	U	U
Copper	1000/1000	25	27.2	U	U	U	U	U	U	U
Cyanide	200/200	<40**	<40.0	NA	<40.0	NA	<40.0	NA	<40.0	NA
Iron	300[3]/1000	100	**484**	**126**	**7,510**	60.4	26.8	U	25.9	U
Lead	15/50	10	U	U	U	U	U	U	U	U
Manganese	50[3]/200	15	**3,660**	**2,710**	**365**	6.2	61.8	64.3	35.2	24.7
Mercury	2.0/2.0	0.2	U	U	U	U	U	U	U	U
Nickel	NA/200	40	U	U	U	U	U	U	U	U
Selenium	50/50	35	U	U	U	U	U	U	U	U
Silver	100/50	10	U	U	U	U	U	U	U	U
Thallium	2.0/NA	25	U	U	U	U	U	U	U	U
Vanadium	NA/NA	50	U	U	U	U	U	U	U	U
Zinc	5000[3]/10000	60	30.6	U	30.6	U	U	U	U	U

* - Background Sample

** - Reporting limits are adjusted for sample size and matrix interference

1 - Inductively Coupled Plasma-Atomic Emission Spectroscopy, Contract Required Quantitation Limit

2 - EPA Maximum Contaminant Level/Water Quality Control Commission Ground Water Standards

3 - EPA Secondary Maximum Contaminant Levels

Bold - Exceeds EPA MCL or WQCC Ground Water Standard

Pink - Exceeds three times the Background concentration

U - Not Detected

NA - Not analyzed, total only

Table 6. Storm (Water and Sediment) Sampling Results, Ref. 31 and 48.

San Vicente Creek Mill				
Storm Samples (September 18, 2009)				
Analyte	Storm Water[1]		Tailings[1]	Sediment[2]
	µg/l		mg/kg	
	Total	Dissolved	Total	Total
Aluminum	100,000	97,000	9,500	8,500
Antimony	4.7	7.0	3.0	1.5
Arsenic	95.0	10.0	120	4.6
Barium	160	24.0	330	110
Beryllium	7.5	7.2	0.56	0.72
Cadmium	1,000	1,000	3.4	1.5
Chromium	26.0	23.0	7.0	23.0
Cobalt	310	300	6.1	9.7
Copper	11,000	10,000	630	63.0
Iron	140,000	77,000	80,000	11,000
Lead	6,500	310	6,100	13.0
Manganese	71,000	71,000	640	710
Mercury	0.19	0.052	0.21	0.034
Nickel	88.0	87.0	4.5	11.0
Selenium	24.0	21.0	U	3.9
Silver	23.0	10.0	13.0	0.26
Thallium	U	U	U	U
Vanadium	U	U	32.0	32.0
Zinc	320,000	330,000	2,000	370

[1] - Samples collected on flood plain along San Vicente Creek.

[2] - Sample collected in San Vicente Creek downstream from flood plain samples.

U - Analyte not detected in sample/below instrument detection level.

Table 7. San Vicente Creek Sediment Sample Results, Ref. 42 and 43.

San Vicente Creek Mill Site Sediment Samples (June 2, 2009)				
Analyte	CRQL[1]	SVSED1	SVSED2	SVSED3*
	Total Metals mg/kg			
Aluminum	20	7,180	15,500	11,000
Antimony	6.0	U	U	U
Arsenic	1.0	U	U	U
Barium	20	117	**491**	127
Beryllium	0.5	U	1.0	1.1
Cadmium	0.5	0.8	1.1	1.1
Chromium	1.0	7.6	20.9	19.4
Cobalt	5.0	6.8	11.4	12.1
Copper	2.5	57.1	65.7	49.7
Cyanide	<2.5[2]	<4.29	<3.24	<3.70
Iron	10	16,600	31,000	29,300
Lead	1.0	43.2	36.8	61.3
Manganese	1.5	792	666	1,220
Mercury	0.1	U	U	U
Nickel	4.0	8.0	13.5	12.1
Selenium	3.5	27.6	38.1	36.9
Silver	1.0	U	3.1	2.6
Thallium	2.5	U	U	U
Vanadium	5.0	31.2	75.4	59.1
Zinc	6.0	157	161	249

* - Sample serves as background

1 - Contract Required Quantitation Limit

2 - Reporting limits are adjusted for sample size and matrix interference.

Bold - Exceeds three times the background concentration.

U - Not Detected

Table 8. San Vicente Creek Surface Water Sample Results, Ref 33, 42, 43and 47.

San Vicente Creek Mill Site						
Surface Water Samples (June 2, 2009)						
Analyte	EPA National Water Quality Criteria*	NMWQCC Surface Water Standards*	SVSW1		SVSW2**	
			Total	Dissolved	Total	Dissolved
	µg/l					
Aluminum	□	87	U	243	U	253
Antimony	□	□	U	U	U	U
Arsenic	150	150	U	U	U	U
Barium	□	□	62.8	66.1	67.8	68.9
Beryllium	□	□	U	U	U	U
Cadmium	0.25	0.3	U	U	U	U
Chromium	74	74	U	U	U	U
Cobalt	□	1,000[2]	U	U	U	U
Copper	9.0	9.0	U	U	U	U
Cyanide[1]	□	□	<40.0	NA	<40.0	NA
Iron	□	□	26.3	U	62.1	U
Lead	2.5	2.5	U	U	U	U
Manganese	□	□	19.5	11.9	30.6	12.1
Mercury	0.77[3]	0.77[3]	U	U	U	U
Nickel	52	52	U	U	U	U
Selenium	5.0	5.0	U	U	U	U
Silver	3.2	3.2	U	U	U	U
Thallium	□	□	U	U	U	U
Vanadium	□	100	U	U	U	U
Zinc	120	120	U	U	U	U

* - Standard for chronic aquatic life unless noted, assumes 100 mg/l hardness.
** - Sample serves as background.
1 - Cyanide is for total only.
2 - Standard is for livestock watering
3 - Standard is for wildlife habitat
U - Not detected.
NA - Not analyzed.
□ - No Standard

Table 9. San Vicente Creek Sediment Samples, Slout Farm, Ref. 38 and 42.

San Vicente Creek Mill											
San Vicente Creek Sediment Samples, Slout Farm*											
Analyte	Sed 1	Sed 2	Sed 3	Sed 4	Sed 5	Sed 6	Sed 7	Sed 8	Sed 9	Sed 10	SVSed3**
	mg/kg										
	Total Metals										
Arsenic	U	U	U	U	**1.6**	U	U	**3.3**	U	U	U
Copper	38	26	38	26	53	34	33	46	39	39	49.7
Lead	140	100	32	29	**210**	67	**240**	40	22	28	61.3
Zinc	200	160	180	160	210	170	150	250	200	180	249

* - Samples collected by Azurite Consulting on 4/22/2009

** - Background sample collected by NMED on 7/2/2009

Bold - An observed release is established.

U - not detected, detection limit is 1.0 mg/kg

Table 10. Soil Sample Results, Ref 42, 43 and 47.

Analyte	EPA Region 6 Soil Screening Levels*	CRQL[1]	SVSoil1[2]	SVSoil2	SVSoil4	SVSoil5	SVSoil6	SVSoil7	SVSoil8	SVSoil9
San Vicente Creek Mill Site										
Soil Samples (June 3, 2009)										
	mg/kg									
	Total Metals									
Aluminum	76,000	20	10,400	6,220	1,700	12,000	22,000	14,200U	11,400	11,400
Antimony	31.0	6.0	U	U	U	U	U	U	U	U
Arsenic	2.2	1.0	U	**68.5**	**83.2**	**61.9**	U	**37.8**	**61.9**	**72.3**
Barium	16,000	20	120	118	190	**414**	304	166	258	245
Beryllium	150	0.5	0.5	U	0.9	1.4	**1.6**	**2.0**	0.9	**1.7**
Cadmium	39.0	0.5	U	**2.7**	U	**11.5**	U	**2.2**	**6.9**	**5.4**
Chromium	210	1.0	6.1	4.5	9.9	11.5	**22.4**	**23.5**	7.5	**20.3**
Cobalt	900	5.0	5.3	5.4	6.7	11.7	8.6	11.2	8.2	12.9
Copper	2,900	2.5	102	**325**	**468**	**392**	77.2	148	282	**340**
Cyanide	1,200	2.5	<5.21	<5.99	<6.84	<6.76	<6.38	<6.10	<6.07	<5.90
Iron	55,000	10	11,300	**46,900**	**58,000**	29,300	26,700	28,200	16,200	30,200
Lead	400	1.0	34.2	**1,750**	**4,101**	**1,100**	84.7	**124**	**282**	**321**
Manganese	3,200	1.5	578	475	431	1,310	480	841	657	1,310
Mercury	23.0	0.1	U	U	**0.167**	**0.122**	U	U	**0.132**	**0.225**
Nickel	1,600	4.0	5.1	U	6.0	9.2	10.5	12.0	5.1	13.1
Selenium	390	3.5	12.8	*51*	U	U	U	U	U	U
Silver	390	1.0	1.1	*8.5*	*7.3*	*3.3*	U	U	1.3	1.3
Thallium	5.5	2.5	U	U	U	U	U	U	U	U
Vanadium	390	5.0	21.7	26.4	36.7	40.8	57.7	**71.7**	56.2	**69.1**
Zinc	23,000	6.0	111	**1,140**	**1,600**	**1,460**	139	265	32.3	**519**

* - EPA Region 6 Human Health Medium Specific Screening Levels 2007

[1] - Contract Required Quanitation Limit, ILM05.4

[2] - Soil sample serves as a background

Bold - concentration exceeds EPA Region 6 Soil Screening Levels

Pink - exceeds three times the background concentration

Brown - background not detected, value exceeds CRQL

U - Not Detected

FIGURES

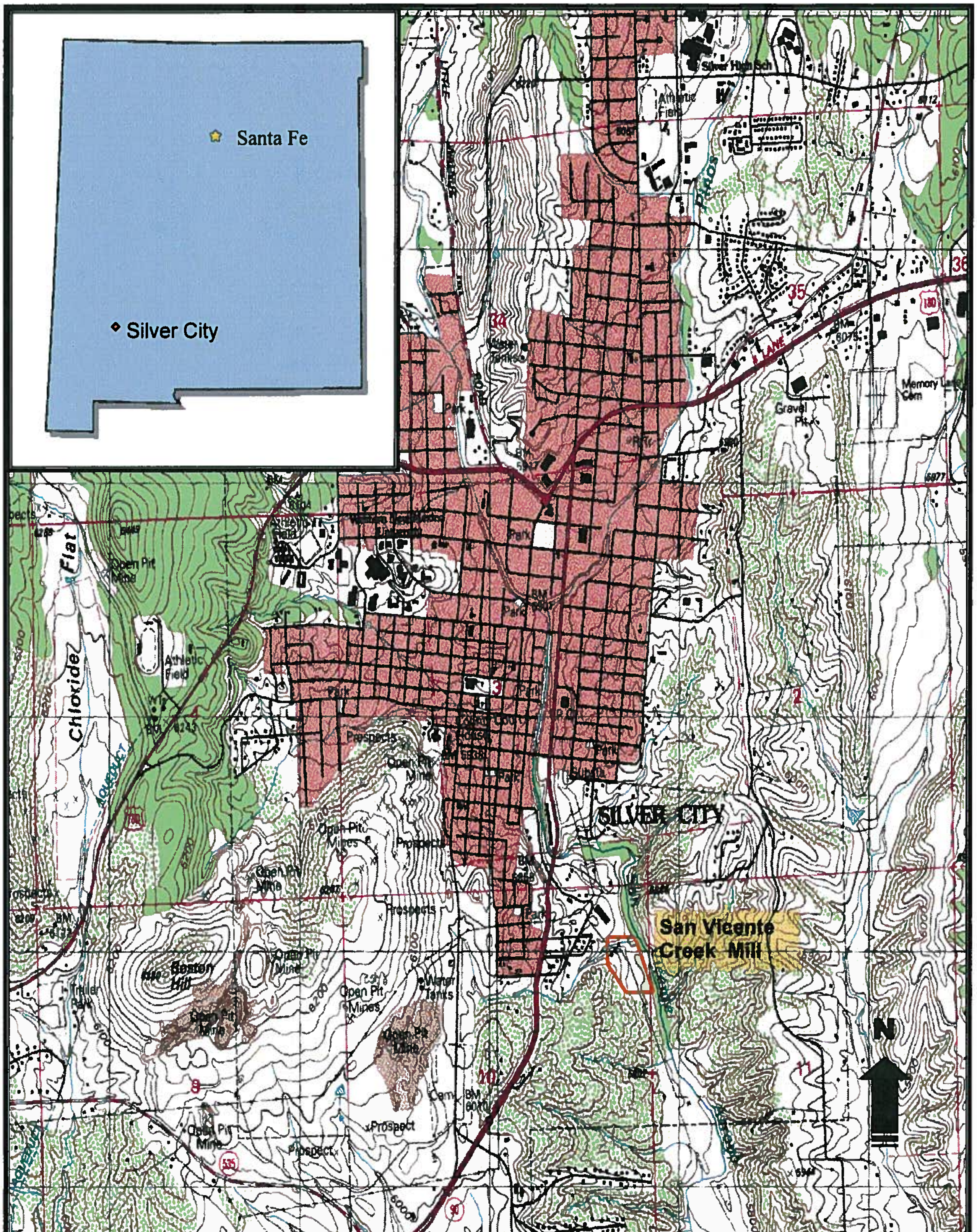

Figure 1. Location of San Vicente Creek Mill Site, Silver City, New Mexico, Ref. 40

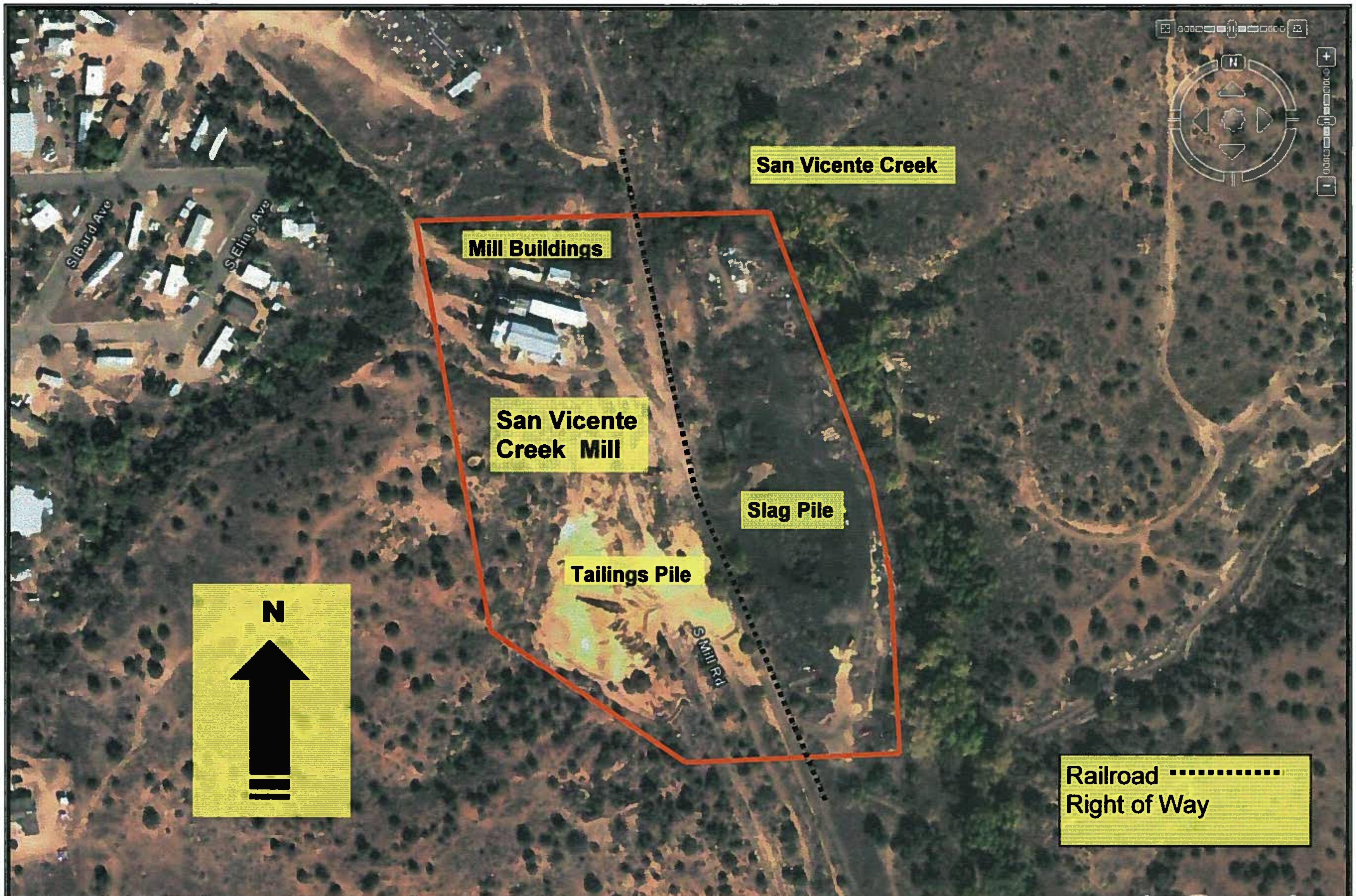

Figure 2. San Vicente Creek Mill Site, Silver City, New Mexico, Ref 41

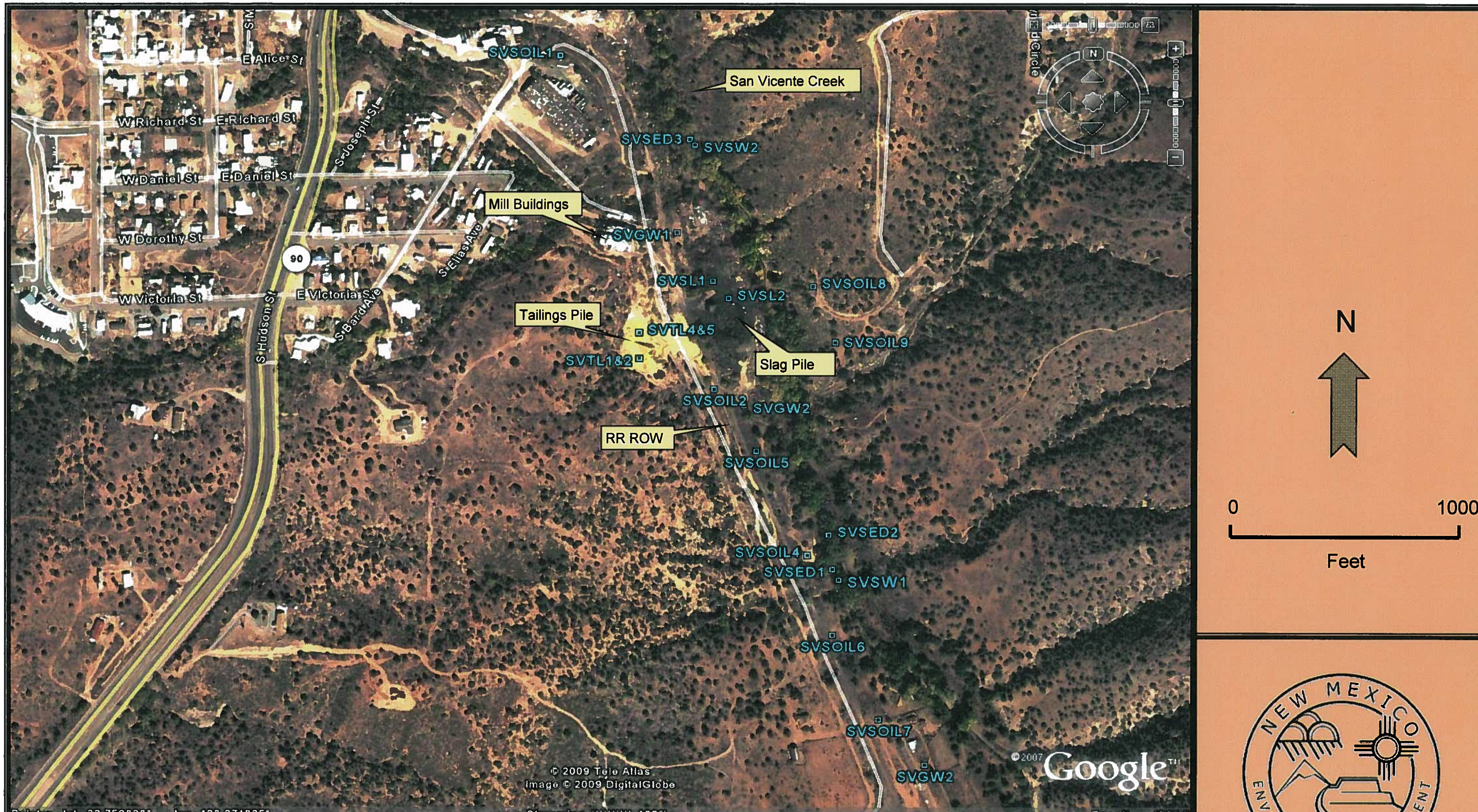

Figure 3. San Vicente Creek Mill Sample Locations, Ref 41

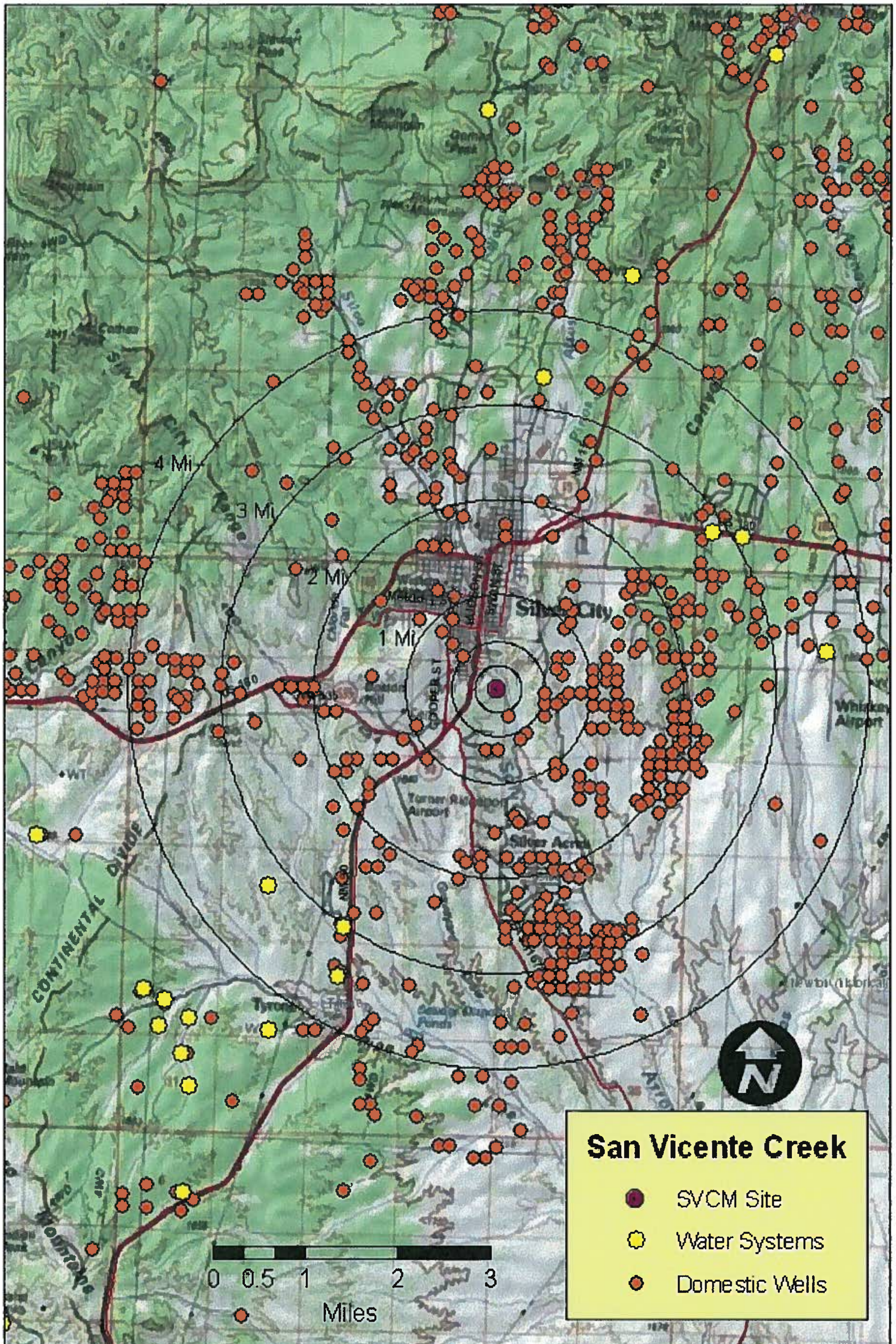

Figure 4. San Vicente Creek Mill, Drinking Water Wells within the TDL, Ref. 27 and Ref. 40

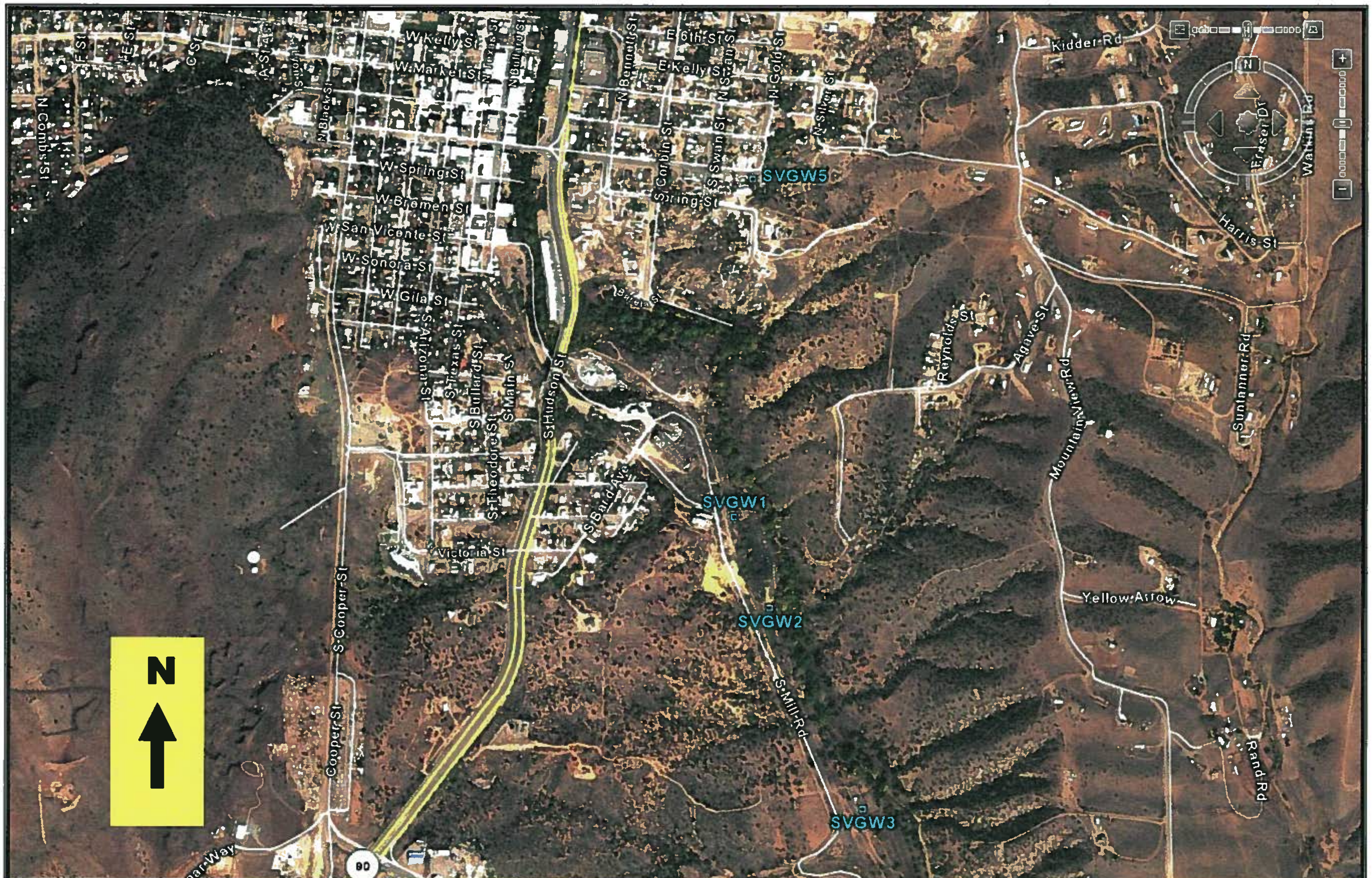

Figure 5. San Vicente Creek Mill Site, Ground Water Sample Locations, Silver City, New Mexico, Ref. 40