

**Site Inspection Report  
Argonaut Mine  
Jackson, Amador County, California**

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## List of Acronyms

ACEHD	Amador County Environmental Health Department
AOC	area(s) of concern
APN	Assessor's parcel number
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
Biomet	Biomet II, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DTSC	Department of Toxic Substances Control
EPA	U. S. Environmental Protection Agency
ESA	Environmental Site Assessment
HRS	Hazard Ranking System
MCL	Maximum Contaminant Level
Mill Area	Argonaut Mine Mill Area
mg/kg	milligrams per kilogram
NA	not available
NPL	National Priority List
PA	Preliminary Assessment
ppm	parts per million
RSL	Regional Screening Level
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SI	Site Inspection
Site	Argonaut Mine Site
STLC	soluble threshold limit concentrations
Tailings Area	Argonaut Mine Tailings Area
TEL	threshold-effect-level
µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
Van Horn	Morse Van Horn
WESTON	Weston Solutions, Inc.
XRF	X-ray fluorescence

## 1.0 INTRODUCTION

### 1.1 Regulatory Background

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), Weston Solutions, Inc. (WESTON®) has been tasked to conduct a Site Inspection (SI) of the Argonaut Mine (the Site) in the City of Jackson, Amador County, California.

The Site was identified as a potential hazardous waste site and entered into the Superfund Enterprise Management System on October 19, 1992 (CAD983650011) (EPA, 2015a). A Preliminary Assessment (PA) was completed for the EPA by the Department of Toxic Substances Control (DTSC) on October 15, 1998 (DTSC, 1998). The purpose of a PA is to review existing information on a site with potential releases of a hazardous substance and its environs to assess the threats, if any, posed to public health, welfare, or the environment and to determine if further investigation under CERCLA is warranted.

After reviewing the PA, the EPA determined that further investigation of the Argonaut Mine site would be necessary to more completely evaluate the Site using the EPA Hazard Ranking System (HRS) criteria. The HRS assesses the relative threat associated with actual or potential releases of hazardous substances at the Site. The HRS has been adopted by the EPA to help set priorities for further evaluation and eventual remedial action at hazardous waste sites. The HRS is the primary method of determining a site's eligibility for placement on the National Priorities List (NPL). The NPL identifies sites at which the EPA may conduct remedial response actions. This report summarizes the results of the SI for the Argonaut Mine site.

More information about the Superfund program is available on the EPA website at <http://www.epa.gov/superfund>.

### 1.2 Apparent Problem

EPA determined that a SI was needed at the Site because of the following apparent problems:

- The Argonaut Mine operated as a gold mine from the 1850s until 1942. The raw ore was processed using stamp mills located at the Argonaut Mine Mill Area. After 1917, the mill tailings were transported by gravity through a flume to the Argonaut Mine Tailings Area located approximately 0.5 mile south of the mill. The tailings were further treated using cyanide to extract gold, and the processed material was placed in impoundments (ASC, 2014).
- Previous investigations at the Argonaut Mine Tailings Area have indicated that arsenic, lead, and mercury are present in on-site soil and tailings at concentrations exceeding EPA Regional Screening Levels (RSLs) for residential and industrial soil.
- More than 100 residential properties have been developed on tailings or within 200 feet of tailings.
- Surface water from the Site drains to Jackson Creek, and wetlands are located in the tailings impoundments.

## 2.0 SITE DESCRIPTION

### 2.1 Location

The Argonaut Mine Site is located in the City of Jackson, Amador County, California, and is one of many gold mines belonging to the Mother Lode Gold Mining District along the foothills of the Sierra Nevada Mountains. The geographic coordinates for the centroid of the Argonaut Mine Mill Area (Mill Area) are 38° 21' 45.5" north latitude and 120° 47' 04.0" east longitude and the Argonaut Mine Tailings Area (Tailings Area) are 38° 21' 14.5" north latitude and 120° 47' 11.8" east longitude (Appendix A). The location of the Site is shown in Figure 1.

### 2.2 Site Description

The Site comprises two principal areas: the Mill Area and the Tailings Area. The Argonaut Mine, together with the Kennedy Mine, constitutes California Historical Landmark #786. The Argonaut Mining Company historically owned approximately 330 acres of land northwest of downtown Jackson. The property was sold after the mine closed and approximately 90 acres of the former property have been developed as residential neighborhoods (Appendix B; Argonaut, 1907; ASC, 2013).

The **Mill Area** occupies approximately 80 acres in residential area and has shafts and buildings on the east and west sides of Highway 49. The Site is bordered to the north by a residential home, two businesses and the Kennedy Mine property, to the west by residential homes, to the south by residential homes and a hotel, and to the east by residential homes and an apartment building. The Mill Area layout is shown in Figure 2. The elevation of the Mill Area ranges from approximately 1,260 to 1,650 feet above mean sea level (Appendix B).

The western portion of the Mill Area (above and west of Highway 49) is located on Amador County Assessor's parcel number (APN) 44-360-018 on an eastward steeply sloped hillside with a terraced area constructed of waste rock from the mine. The terraced area is developed with large galvanized metal buildings and a steel hoist tower over the main mine shaft. A 1930 Sanborn Map shows the buildings were used as a hoist house, ore bin, compressor house, machine shop, steel shop and storage. A concrete foundation on the southern portion of the parcel appears to be the remains of an assay building that has a small furnace and a crucible dump on the slope between the building and Highway 49. The mine buildings are secured with a chain link fence and gated entrance from Spunn Road. A former 60-stamp mill was located uphill of the mine shaft and has been subdivided by the Argonaut Heights II residential development into more than 50 parcels (Appendix B; ASC, 2014).

The eastern portion of the Mill Area (below and east of Highway 49) is located on APNs 044-010-029 and 44-010-031 on a gently sloped valley drained by an un-named intermittent stream draining to the North Fork Jackson Creek. Highway 49 is located above a steep embankment from the mine buildings. The property is developed with two galvanized metal buildings and the foundation of a former 40-stamp mill (removed in 1916). A 1930 Sanborn Map shows the buildings were used as a hoist engine house and transformer house. A large waste rock pile is located on the east side of the highway and north of the buildings. The Moore Ditch (a former water conveyance canal) runs north-south and is located east of the waste rock pile and

former 40-stamp mill. The land east of the buildings is undeveloped and vegetated with grass and trees with dense blackberry bushes along the intermittent stream. An un-vegetated gray sands (processed tailings) area is located east of the intermittent stream. The parcels are fenced with a barbed wire along Highway 49 with a gated entrance on an access road from the highway (Appendix B; ASC, 2014).

The **Tailings Area** occupies approximately 65 acres between a residential and rural area and is located approximately 2,000 feet south of the Mill Area. The Site is bordered to the north by residential homes and a pasture, to the west by the Argonaut High School, Amador Superior Court and pasture land, to the south by pasture land, and to the east by residential homes and Jackson Junior High School. The Tailings Area layout is shown in Figure 3. The elevation of the Tailings Area ranges from approximately 1,320 to 1,540 feet above mean sea level (Appendix B).

The Tailings Area is composed of an unprocessed and semi-processed ore storage area, a cyanide plant area, tailings impoundments behind two earthen dams built from tailings, and a concrete dam. The 5-acre ore storage area, located in the western most portion of the property, is barren and devoid of vegetation. The cyanide plant, located southeast of the ore storage area, is approximately 6.5 acres and consists of various sized concrete cyanide processing tanks and vats and a thickening basin. There are eight partially buried round concrete tanks measuring 25 feet in diameter and 10 feet deep. Two of the tanks are filled with cyanide processing wastes. Several other vertical concrete tanks contain unidentified waste material. A large steel and redwood tumbling box, which may have been used to coat the tailings with coal tar, also contain waste material. The foundation of a probable amalgamation building is located between the cyanide plant and thickening basin (ASC, 2014; E&E 2013).

Three tailings impoundments are located southeast of the cyanide plant and were constructed in a drainage valley covering approximately 48 acres. The cyanide processed tailings (gray sands) were placed in impoundments behind two earthen dams and the concrete dam. The upper tailings impoundment (also referred to as the “gray sands pile”) is held behind the upper earthen tailings dam and is sparsely vegetated. The middle tailings impoundment is held behind the lower earthen tailings dam and has a wetland. Several deep erosional pits are located near the dam. The lower tailings impoundment is held behind a multiple arch concrete dam and has a wetland. An estimated 1,075,000 cubic yards of gray sands tailings are contained in the impoundments (Appendix B; URS, 2009).

## 2.3 Operational History

### Argonaut Mine Mill Area

The Argonaut Mine was originally known as the Pioneer Mine and was operated by the Pioneer Mining Company from 1850 through 1893. In 1893, the Argonaut Mining Company was formed and operated the mine steadily until 1919. The mine was closed in 1920 due to a fire, but resumed operations in 1921 continuing through 1942. The raw ore was processed at a 40-stamp mill on the east side of Highway 49 until 1916 when it was replaced by a 60-stamp mill located west of Highway 49. Processed tailings from the 40-stamp mill were deposited east (downslope) of the mill. Processed tailings from the 60-stamp mill were transported to the Tailings Area



located south of the mill. Both stamp mills used mercury amalgamation to extract gold (USBM, 1931).

In 1917, a 150-ton cyanide plant was installed east of the former 40-stamp mill and operated under contract by M. Latham and J. Simonds. The cyanide plant processed 200,000 tons of tailings that were stored in the tailings dam at the Mill Area (Mining Press, 1917).

In 1952, the Argonaut and Plymouth mines were sold to B. Monte Verda and the Mines Engineering & Equipment Company which ended up salvaging the surface operations (ASC, 2014).

Current tax records for the Mill Area parcels on the west side of Highway 49 show the property is owned by Jon & Carolyn Crowley / Paul & Marie Crowley Trust, and parcels on the east side of Highway 49 are owned by Romeo & Marie Surian. There were no operating activities conducted at the Mill Area parcels at the time of the SI.

### **Argonaut Mine Tailings Area**

After 1917, the tailings from the 60-stamp mill were conveyed by gravity through a flume over 3,000 feet to the Tailings Area. In 1918, the California Slimes Concentrating Company installed a cyanide plant to work the milled tailings after initial gold extraction at the 60-stamp mill. In 1922, the Amador Metals Reduction Company began operating the cyanide plant and expanded the operations. In 1941, the Argonaut Mining Company installed a new cyanide treatment plant to process tailings from the Argonaut Mine and the nearby Plymouth Mine. At the time the mine and milling operations ceased in 1942, the capacity of the cyanide plant was 500 tons (ASC, 2014).



A concrete dam was built in 1916 to minimize sediment entering Jackson Creek (ASC, 2014). Between 1917 and 1942, the cyanide processed tailings were placed in the impoundments at the Tailings Area behind a series of earthen dams and the concrete dam.

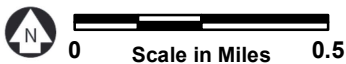
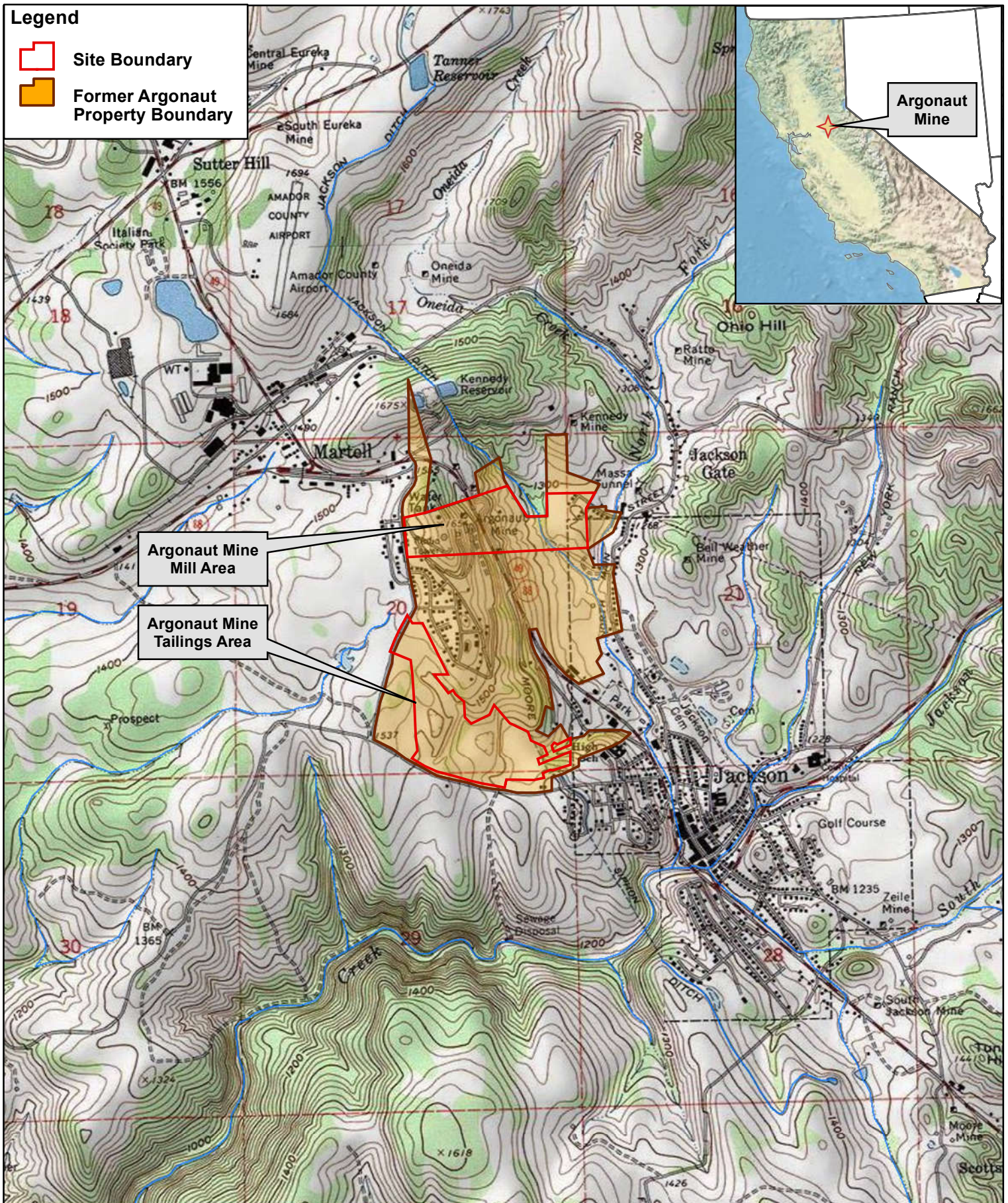
In 1952, the Argonaut and Plymouth Mines were sold to B. Monte Verda and the Mines Engineering & Equipment Company which ended up salvaging the surface operations (ASC, 2014).

In 1979, Morse Van Horn (Van Horn) purchased the Tailings Area property. In 1987, the northern portion of the Tailings Area was leased to Biomet II, Inc. (Biomet) to remove several tons of ore and/or tailings from the ore storage area and transport off site for further processing and gold extraction. Biomet conducted trenching and testing of the unprocessed ore and determined the unprocessed ore to be a hazardous material. In 1988, Van Horn filed a lawsuit for “quiet title” and Biomet filed for bankruptcy in 1989. In the early 1990s, Van Horn contracted North American Reclamation to remove approximately 48,000 to 60,000 tons of unprocessed ore to a processing plant in Nevada. Since the early 1990s, no further mining or business activity has occurred at the Tailings Area. Current tax records for the Tailings Area show the property is owned by Marilyn Van Horn. (DTSC, 1996b; DTSC, 1998).



# Legend

-  Site Boundary
-  Former Argonaut Property Boundary



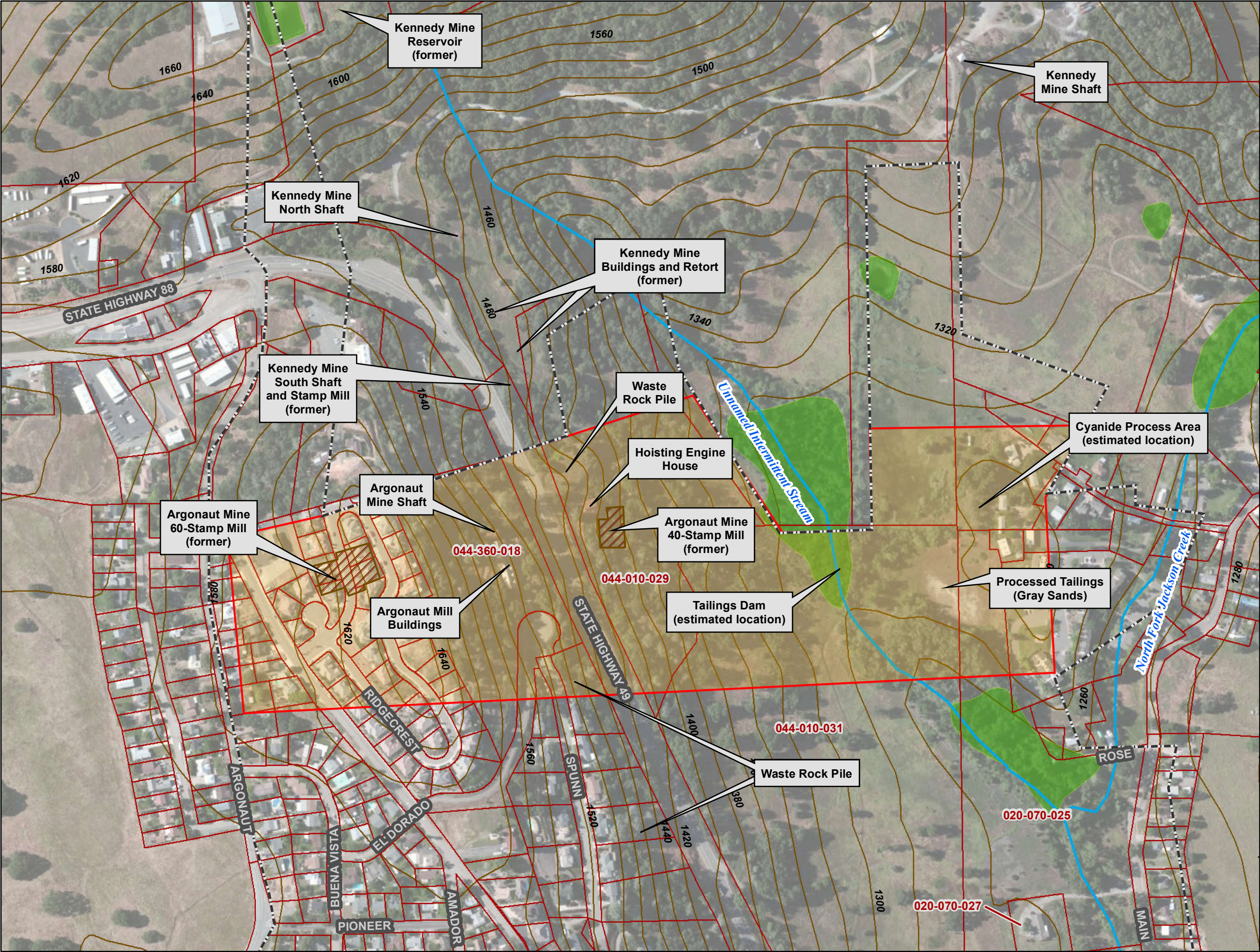
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Pacific Southwest



**FIGURE 1**  
**SITE LOCATION MAP**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California





**Legend**


- Argonaut Mine Mill Area
- Argonaut Property Boundary
- Parcels
- Former Mills
- Wetland
- Surface Water
- Elevation Contour

North arrow pointing up. Scale bar: 0 to 500 feet. Text: "Scale in Feet 500".

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**FIGURE 2**  
**MILL AREA LAYOUT**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California





**Legend**


- Argonaut Mine Tailings Area
- Argonaut Property Boundary
- Parcels
- Wetland
- Surface Water
- Elevation Contour

0 Scale in Feet 500

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**FIGURE 3**  
**TAILINGS AREA LAYOUT**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California



## **2.4 Regulatory Involvement**

### **2.4.1 U. S. Environmental Protection Agency**

The Site is not listed in the Resource Conservation and Recovery Information System database, as of January 16, 2015 (EPA, 2015b)

In October 1998, a PA was conducted at the Tailings Area and identified six distinct areas: an unprocessed ore area, drainage from the unprocessed ore, a cyanide plant area, a gray sand area, a historical impoundment basin, and the concrete dam basin. The Mill Area property was not assessed as part of the Site for the PA. Based on the PA, the EPA decided that further assessment was needed under CERCLA and that referral to the EPA Emergency Response Program was warranted (DTSC, 1998).

In 2008, EPA completed a Site Reassessment and referred the Site to the DTSC for enforcement action. The DTSC had issued an Imminent and Substantial Endangerment Determination to the property owner in 2007 and was utilizing state funds to conduct a Remedial Investigation/Feasibility Study with plans to prepare a Removal Action Workplan and implement remedial measures (EPA, 2008; EPA, 2015a).

In August 2013, the DTSC requested assistance from the EPA to conduct a removal action at the Tailings Area (DTSC, 2013).

From 2013 through 2014, EPA conducted a Removal Site Evaluation at the Tailings Area on six areas of concern (AOC) documenting arsenic, lead, and mercury concentrations above Site screening levels in surface soil and shallow subsurface soil samples. AOC-1 is located in the western portion of the Site and covers approximately 5.0 acres of unprocessed and semi-processed ore. AOC-2 is a 6.5-acre area located east of AOC-1 and contains a cyanide plant and a probable mercury amalgamation building. AOC-3 is a 48-acre area used as a tailings disposal area and impoundments comprised of two earthen tailing dams and a concrete dam. AOC-4 is the drainage area located below and downgradient of the concrete dam. AOC-5 is a 0.39-acre vacant lot located 300 feet north of AOC-1 that appears to have been used for storage or disposal of ore or mine tailings. AOC-6 is a mental health care facility located north of, and adjacent to AOC-1. The EPA soil sampling locations and corresponding arsenic concentrations are shown in Figure 3 (ASC, 2014; E&E, 2013; E&E, 2014a; E&E, 2014b; Weston, 2015a).

In 2014, a Cultural Resources Inventory and Evaluation of the Argonaut Mine Cyanide Plant and Tailings Site was conducted by the Sonoma State University Anthropological Studies Center. The purpose of the study was to inventory and evaluate cultural resources within the potential EPA removal and remedial work area for potential effects as required by the National Historic Preservation Act (ASC, 2014).

From 2014 through 2015, the EPA, in coordination with the U.S. Army Corps of Engineers (USACE), conducted a stability evaluation of the concrete dam because the dam, over the past century, has been neglected in terms of inspections, maintenance, and repair. Geotechnical

borings were drilled at the lower tailings impounded behind the concrete dam, middle tailings impoundment behind the lower earthen dam and from the lower earthen tailings dam to collect samples for geotechnical analysis. Three groundwater piezometers were installed in the geotechnical borings drilled in the lower and middle tailing impoundments. The results of the stability evaluation showed that the concrete dam failed to meet the minimum Engineering Manual requirements and the USACE recommended the dam should undergo a 35% repair/retrofit evaluation to avoid possible failure and loss of life downstream (Weston, 2015b, USACE, 2015).

In March 2015, the EPA conducted a removal of tailings from the vacant lot (AOC-5) located north of the Tailings Area and placed the excavated tailings in a repository located in the northern portion (AOC-1) of the Tailings Area. Additionally, the EPA conducted a removal assessment of residential homes in the Argonaut Heights and Sierra View Estates neighborhoods (EPA, 2015c).

#### ***2.4.2 California Environmental Protection Agency, Regional Water Quality Control Board***

In 1987, the Regional Water Quality Control Board (RWQCB) - Central Valley Region, DTSC, and Amador County Environmental Health Department (ACEHD) conducted an inspection of the Tailings Area. The RWQCB collected two samples from the tailings and found elevated concentrations of heavy metals, including arsenic (DTSC, 1995a).

In 1988, the RWQCB conducted an initial Toxic Pits Cleanup Act inspection and collected storm water runoff samples from the Tailings Area. The arsenic analytical results of the water samples documented an actual or threatened illegal discharge of hazardous waste which may be a threat to public health and safety (RWQCB 1988).

In 1990, the RWQCB issued Cleanup and Abatement Order No. 90-722 to Van Horn for the Tailings Area and subsequent Administrative Civil Liability Order 91-504 in 1991. The orders were issued to address an unlawful discharge of hazardous concentrations listed in Title 22, California Code of Regulations of arsenic, copper, nickel, zinc with acidic storm water runoff (pH 2-3) from approximately 60,000 to 100,000 tons of finely ground gold ore stockpiled at the Site (RWQCB, 1991).

#### ***2.4.3 California Environmental Protection Agency, Department of Toxic Substances Control***

The Site is listed in the Envirostor Database as an active site (Envirostor ID: 03100002). The southeastern portion of the Mill Area is listed as an inactive site in the Envirostor Database identified as the Home Depot Site (Envirostor ID: 60000300) (DTSC, 2015).

In 1987, the DTSC conducted a PA of the Tailings Area and recommended further characterization, fencing the unprocessed ores, and containment of surface water runoff (DTSC, 1988).

In 1993, soil samples collected from the ore storage area at the western most portion of the Tailings Area indicated that soil and tailings were impacted by arsenic, lead, and mercury (URS, 2009).

In December 2005, a draft Voluntary Cleanup Agreement for a proposed Home Depot Development was prepared by the DTSC to address arsenic contamination found on a 60-acre property comprised of APNs 020-120-024, 020-070-025, 020-070-027, and 044-010-031. The property is located in the Mill Area on the east side of Highway 49. A Phase I Environmental Site Assessment (ESA) and a limited Phase II Investigation were completed in November 2004. Additional Phase II Investigations were completed in 2005 and 2006 for Home Depot. The DTSC determined that a Remedial Action Workplan was necessary for the development of the property; however, Home Depot did not purchase the property and the project was terminated (DTSC, 2015; GeoSyntec, 2006).

In 2007, the DTSC issued an Imminent or Substantial Endangerment Determination regarding the Tailings Area. Based on the soil samples collected in July 1993 and October 2006, it was determined that hazardous concentrations of contamination exist on the property. Since the Site is adjacent to residential areas and in close proximity to two schools, and an October 2006 site visit observed footprints and bicycle tracks throughout the property, there was risk that the public could be exposed to hazardous substances as a result of trespassing (DTSC, 2007).

In 2008, the DTSC investigation was completed for the Tailings Area. As part of the investigation, soil and depth-discrete groundwater samples were collected from 46 soil borings to a maximum depth of 80 feet below ground surface (bgs) (URS, 2009).

In 2010, a treatability study was conducted for the ore storage area in the western portion of the Tailings Area to evaluate pH levels and the impact of neutralization on contaminated soils. (URS, 2010).

In 2011, the DTSC prepared a draft Community Wide Assessment Report for Abandoned Mine Land Properties in the Cities of Jackson and Sutter Creek under an EPA Brownfields Assessment Cooperative Agreement. The assessment included screening level sampling and metals analyses of 26 properties that may have been impacted by historic mining activities. The purpose of the assessment was to provide information for use by the communities, to be used in conjunction with site-specific investigations, to plan for future growth and support efficient development that is protective of human health and the environment. The assessment included properties adjacent to the Site including Argonaut High School, Jackson Junior High School, and the planned Sutter Street extension (DTSC, 2011).

In August 2013, the DTSC requested assistance from the EPA to conduct a removal action at the Tailings Area (DTSC, 2013).

#### ***2.4.4 Amador County Environmental Health Department***

In 1984, the ACEHD conducted an inspection of the Tailings Area in response to a complaint

(DTSC, 1995a).

In 1987, the ACEHD issued a fence and post order to Van Horn for the Site (DTSC, 1995a).

From 1989 through 2004, the ACEHD was involved with the residential redevelopment of land that was previously owned by the Argonaut Mine. The Argonaut Estates, Jackson View Estates, Sierra View Estates, and Argonaut Heights II residential developments were reportedly built on areas of known waste rock and mine tailings that were covered with imported fill prior to construction of the homes (ACEHD, 1994a; ACEHD, 1994b; ACEHD, 2006).

In April 2002, ACEHD collected two soil samples from a vacant property (AOC-5) located on the northeast corner of Argonaut Lane and Pioneer Street. In addition, as part of a review of a grading plan for the property that was submitted to the City of Jackson, the ACEHD used pH paper to assess drainage from the Site. At the time of the on-site drainage inspection, several bodies of standing water were present on the property. All five pH measurements performed were between pH 1 and 2 (ACEHD, 2003).

In 2006, the ACEHD conducted an inspection of a Mill Area building located outside the fenced mine buildings north of Spunn Road in response to reported drug lab activity at the property. The inspection did not find evidence of recent drug lab activity and noted that the building posed an attractive nuisance and should be secured or demolished. The inspection also noted that the property is likely impacted with hazardous substances associated with the former mining operations (ACEHD, 2006).

#### **2.4.5 City of Jackson**

In 1987, the City of Jackson issued a Fence and Post Order to Van Horn for the Tailings Area (DTSC, 1995a).

From 1991 through 1995, the City of Jackson issued a Reclamation Permit to North American Reclamations, a subcontractor to Van Horn, for the removal of 60,000 tons of semi-processed ore from the Tailings Area Site to the northerly city limits (Jackson, 1993; DTSC 1996).

From 1989 through 2004, the City of Jackson was involved with the residential redevelopment of land that was previously owned by the Argonaut Mine. The Argonaut Estates, Jackson View Estates, Sierra View Estates and Argonaut Heights II residential developments were reportedly built on areas of known waste rock and mine tailings that were covered with imported fill prior to construction of the homes (ACEHD, 1994a; ACEHD, 1994b; ACEHD, 2006).



### 3.0 INVESTIGATIVE EFFORTS

#### 3.1 Previous Sampling

Environmental sampling has been conducted at the Site by regulatory agencies since 1987. The majority of the previous investigations at the Argonaut Mine were focused on the Tailings Area. Conversely, the Mill Area has had minimal environmental sampling conducted by property developers at the location of the former 60-stamp mill and the property south of the former 40-stamp mill. The following provides a description of the sampling events conducted at the Site and brief summaries of the results. Arsenic analytical results of surface soil samples where sampling locations were identified are illustrated in Figures 4 and 5 for the Mill Area and Tailings Area, respectively.

In 1986, Biomet collected samples from the Tailings Area unprocessed ore area and slime pond. Soluble threshold limit concentrations analysis documented 4,880 parts per million (ppm) arsenic, 85 ppm copper, 212 ppm lead, 46 ppm nickel, and 50 ppm selenium (DTSC, 1995a).

In 1987, the RWQCB collected two samples from the Tailings Area. The samples contained 5,714 ppm arsenic, 1,267 ppm lead, and 6.9 ppm mercury. Soluble levels of arsenic were 394 ppm and the acid generating potential was 3.05 tons ( $H^+$ )/1000 tons of material. A water sample was collected and contained 21 ppm arsenic. Specific sampling locations were not available (DTSC, 1995a).

In 1988, the RWQCB collected two samples from the Tailings Area impoundments and one sample from the processed mine tailings. Soluble arsenic levels were 197 ppm in the impoundments area. Specific sampling locations were not available (DTSC, 1995a).

In 1993, the DTSC collected soil samples from the ore storage area at the western most portion of the Tailings Area. Maximum metal concentrations in the samples were 24,500 milligrams per kilogram (mg/kg) arsenic, 2,090 mg/kg lead, and 38 mg/kg mercury. Water samples collected from runoff from the ore storage area contained arsenic concentrations of 2,070 mg/kg. A site sketch shows approximate sampling locations (DTSC 1995b).

In 2002, ACEHD collected two soil samples from AOC-5. Arsenic was detected in both samples at concentrations of 120 mg/kg and 1,300 mg/kg. Several bodies of standing water were present on the property and exhibited pH between 1 and 2 (ACEHD, 2003).

In 2004, a Phase I/II ESA was conducted for a planned Home Depot development at the eastern portion of the Mill Area. In 2005 and 2006, additional Phase II investigations were conducted for the development project. Arsenic concentrations were documented at concentrations up to 79.9 mg/kg in surface soil samples, and up to 150 mg/kg in subsurface samples. Sediment and surface water samples were collected from the Site, however the data were not available. The reports indicate that a sediment sample collected from Jackson Creek contained 14 mg/kg arsenic, and surface water samples did not contain detectable concentrations of dissolved arsenic (Geosyntec, 2006). The sampling locations are shown in Figure 4.

In 2006, the DTSC collected soil samples for analysis using X-ray fluorescence (XRF) techniques. The XRF data indicated that arsenic contamination remained at the Site in concentrations up to 7,227 mg/kg (URS, 2009). The DTSC soil sampling locations and corresponding arsenic concentrations are shown in Figure 5.

In 2008, DTSC collected samples from 12 soil borings (SB-1 through SB-12) located in the northern portion of the Tailings Area (AOC-1). A maximum arsenic concentration of 39,000 mg/kg was detected at a depth of 0.5 foot bgs located along the northwest border of the Site. An additional 34 soil borings (SB-13 through SB-46) were collected mostly in the tailing impoundments. Groundwater samples were collected from four of the borings. Arsenic was detected in a majority of the samples, with a maximum concentration of 670 mg/kg detected in a boring located in the southeastern portion of the Site at a depth of 20 feet bgs. In addition, arsenic was detected in groundwater collected from beneath the Site at concentrations ranging from 120 micrograms per liter ( $\mu\text{g/L}$ ) to 220  $\mu\text{g/L}$  (URS, 2011). Sampling locations and corresponding arsenic concentrations are shown in Figure 5.

In 2010, the DTSC collected soil samples at six locations at depths from 0 to 2.5 feet bgs. Arsenic was detected in all of the samples with concentrations ranging from 50.0 mg/kg to 32,000 mg/kg (URS, 2011).

In 2011, the DTSC collected samples at the Argonaut High School, Jackson Junior High School, and the planned Sutter Street extension for XRF and laboratory analysis. A total of 12 surface soil samples were collected from the High School, and arsenic results ranged from 0.64 to 60 mg/kg. A total of 14 surface soil samples and two shallow subsurface soil samples were collected from the Junior High School, and arsenic results ranged from 11 to 110 mg/kg. A total of 22 surface soil samples and 21 shallow subsurface soil samples were collected from Sutter Street Extension, and arsenic results ranged from 15 to 410 mg/kg (DTSC, 2011).

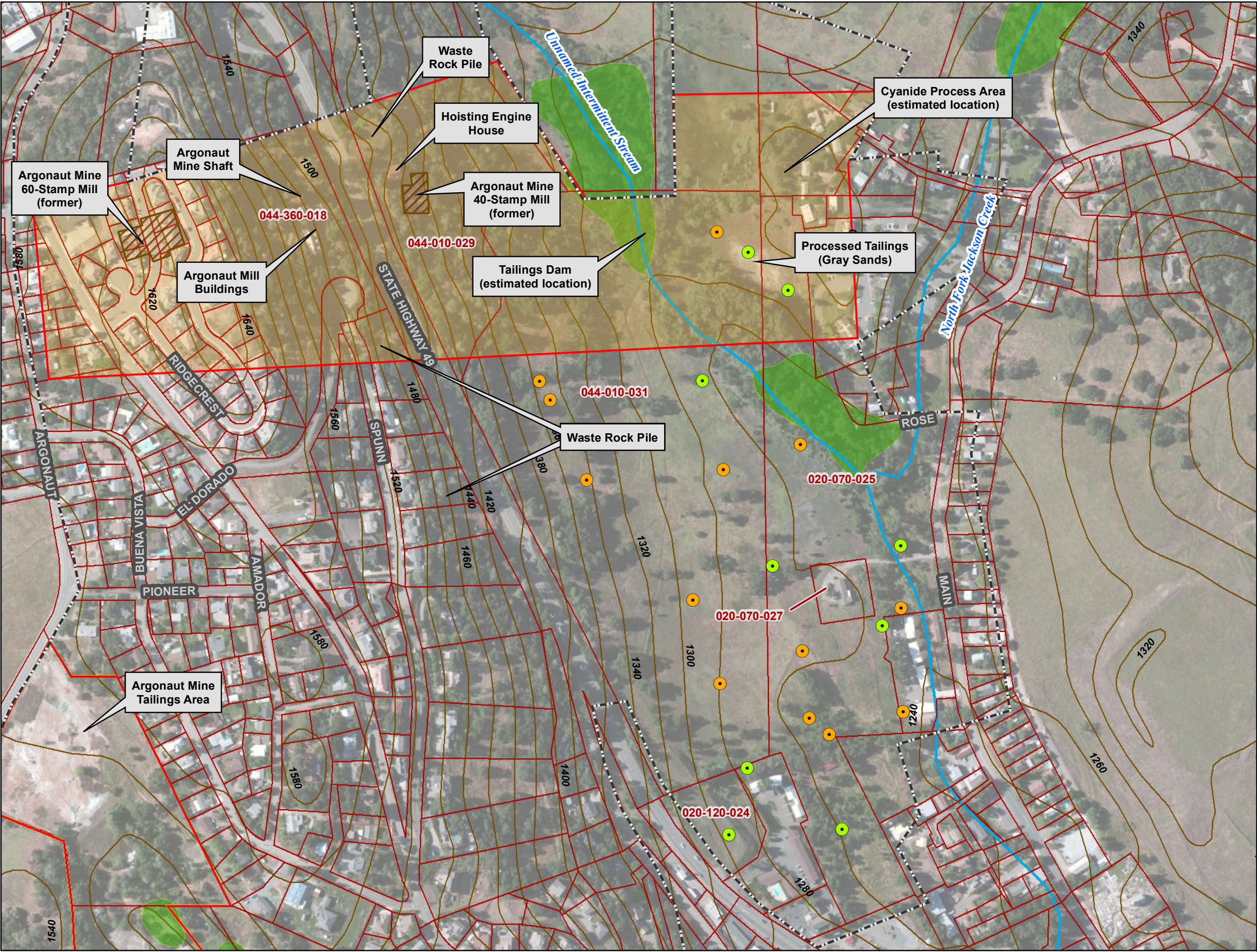
In a July 2013 removal assessment, the EPA collected a total of 95 soil and sediment samples (including field duplicate and preparation duplicate samples) from the Tailings Area. The samples were analyzed for metals using both XRF and laboratory techniques. A total of 75 soil samples were collected from the former unprocessed ore storage area (AOC-1) and arsenic concentrations ranged from 4.3 to 48,000 mg/kg. A total of 13 soil samples were collected from the cyanide plant area (AOC-2) and ranged from 63 to 6,300 mg/kg arsenic. Additionally, four sediment samples were collected from surface water drainages at the Site and arsenic concentrations ranged from 44 to 7,300 mg/kg (E&E, 2013). Sampling locations and corresponding arsenic concentrations are shown in Figure 5.

In September 2013, the EPA collected a total of 19 soil samples (including a field duplicate) from the vacant property (AOC-5) located north of the Tailings Area. A total of eight composite surface and subsurface samples were collected from four decision units, and 10 discrete surface and subsurface samples were collected from five locations. Arsenic concentrations ranged from 27 to 25,000 mg/kg. Nine surface and subsurface soil samples were collected from properties to the northwest and south of AOC-1, one shallow subsurface sediment sample was collected from

the AOC-2 vat, and two surface sediment samples were collected from below the concrete dam. Additionally, two composite surface and subsurface samples, and four discrete surface and subsurface soil samples were collected from a mental health care facility (AOC-6) located adjacent to the north side of AOC-1. Arsenic concentrations in soil ranged from 12 to 910 mg/kg at the properties northwest and south of AOC-1. The AOC-2 sample collected from the vat at the cyanide plant contained 12,000 mg/kg arsenic. Sediment samples collected below the concrete dam contained arsenic up to 2,900 mg/kg. Soil samples at AOC-6 ranged from 11 to 150 mg/kg arsenic (E&E, 2014b; E&E, 2014b).

In 2014, the EPA collected 14 surface soil samples and eight subsurface soil samples at the location of a probable mercury amalgamation building located at AOC-2, and 17 surface soil/sediment samples and 11 subsurface soil/sediment samples from below the concrete dam. The samples were analyzed for metals using XRF techniques. Arsenic concentrations ranged from 134 to 8,557 ppm and mercury was detected at concentrations up to 179 ppm in the soil samples collected from the probable amalgamation building. Arsenic concentrations ranged from 15 to 2,313 ppm in the soil/sediment samples collected below the concrete dam (Weston, 2015a).





**Legend**

- Argonaut Mine Mill Area
- Argonaut Property Boundary
- Parcels
- Former Mills
- Wetland
- Surface Water
- Elevation Contour

**Arsenic Results in Surface Soil**

- <26.7 mg/kg (3X background)
- 26.7 to 100 mg/kg
- >100 mg/kg

The highest background arsenic concentration in Site Inspection surface soil samples is 8.9 mg/kg. The site-specific arsenic screening level is 100 mg/kg.

0 Scale in Feet 500

**PREPARED BY:**  
Weston Solutions, Inc.  
1340 Treat Blvd, Ste 210  
Walnut Creek, CA 94597

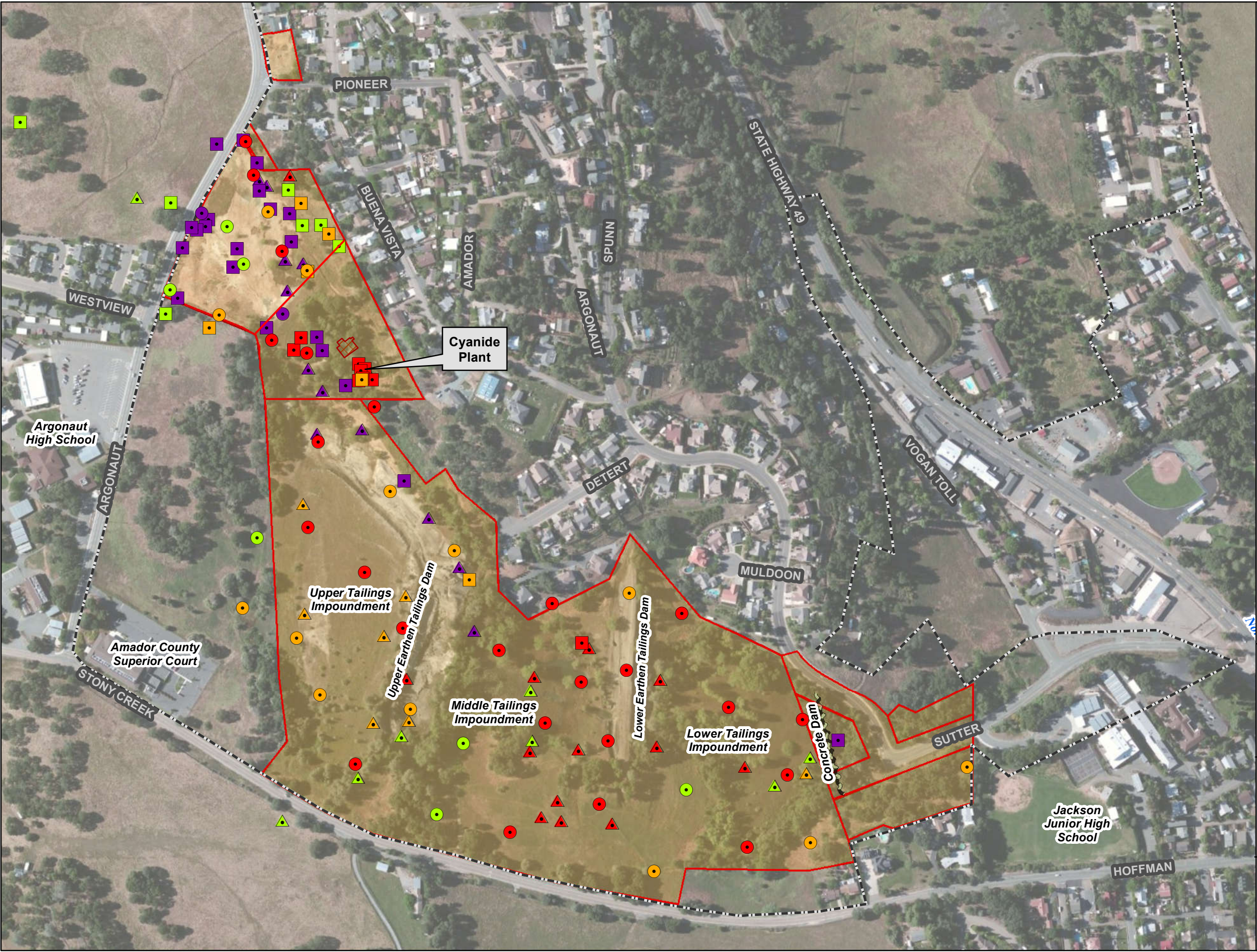


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Pacific Southwest



**FIGURE 4**  
**MILL AREA**  
**PREVIOUS SAMPLING LOCATIONS**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California











**Legend**




 Argonaut Mine Tailings Area




 Argonaut Property Boundary

**Arsenic Results in Soil Samples**

   <26.7 mg/kg (3X background)

   26.7 to 100 mg/kg

   100 to 500 mg/kg

   >500 mg/kg

The highest background arsenic concentration in Site Inspection surface soil samples is 8.9 mg/kg. The site-specific arsenic screening level is 100 mg/kg.




  
0 Scale in Feet 500

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**FIGURE 5**  
**TAILINGS AREA**  
**PREVIOUS SAMPLING LOCATIONS**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California



### 3.2 Site Inspection Sampling

From July 28, 2014 through August 1, 2014, the WESTON sampling team collected soil, sediment and surface water samples at the Site. Samples were collected in accordance with the SAP approved by the EPA on March 10, 2014. Deviations that occurred during the field work are described in Section 3.3. The SAP is provided in Appendix F.

A total of 90 soil samples (including nine duplicate soil samples) were collected from the surface (0 to 6 inches bgs) and shallow subsurface (up to 2 feet bgs) at 47 sampling locations at the Site. The subsurface samples were collected using either a track-mounted direct push sampling rig and Macro-core soil sampler lined with an acetate sleeve, or by hand auger. Soil samples were collected from nine locations at the Mill Area on the west side of Highway 49; nine locations at the Mill Area on the east side of Highway 49; five soil locations at the Tailings Area; 19 locations at residential properties; and three locations at Jackson Junior High School. Background soil samples were collected from two locations west and north of the Tailings Area; Soil sampling locations are shown in Figures 6, 7, and 8 for the Mill Area, Tailings Area, and residential area, respectively.

A total of 27 sediment samples (including two duplicate sediment samples) were collected from 25 sampling locations at the Site. Three sediment samples were collected from an unnamed intermittent stream and one sediment sample was collected from a drainage swale running through the eastern portion of the Mill Area. One sediment sample was collected from an unnamed intermittent stream below the Tailings Area concrete dam. Five sediment samples were collected from North Fork Jackson Creek; seven sediment samples from Jackson Creek; one sediment sample was collected from South Fork Jackson Creek; and three sediment samples were collected from two unnamed intermittent stream drainages leading to Jackson Creek. Additionally, sediment samples were collected from two wetlands at the Tailings Area and from a wetland located approximately 1.2 miles south of the Tailings Area. Sediment sampling locations are shown in Figure 9.

A total of 13 sets of filtered and unfiltered surface water samples and three duplicate water samples were collected from 13 collocated sediment sampling locations where water was present. Three equipment blank samples were collected from a decontaminated hand auger or Macro-core cutting shoe to assess whether the decontamination of the non-dedicated sampling equipment was sufficient to prevent the cross-contamination from one sampling location to another. Surface water sampling locations are shown in Figure 10.

Samples were submitted to Bonner Analytical, located in Hattiesburg, Missouri, under the EPA Contract Laboratory Program for metal analysis by Inorganic Superfund Methods (ISM01.3) and cyanide by EPA Method 9010/9012. The metal analytical data were validated by EPA. The EPA validated laboratory data packages are included in Appendix G.

Table 1 presents benchmarks developed by several different sources. These benchmarks, while not directly applicable to the HRS evaluation of the Site, are being presented for comparison purposes. The EPA RSLs for residential soil are included for comparison with the data generated

from the soil and tailing analyses. The EPA RSLs combine current EPA toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media (soil, air, and water) that are considered protective of humans, including sensitive groups, over a lifetime. Chemical concentrations above these levels would not automatically designate a site as “contaminated” or trigger a response action. However, exceeding a RSL suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. Further evaluation may include additional sampling, consideration of ambient levels in the environment, or a reassessment of the assumptions contained in these screening-level estimates. Note that RSLs are only applicable for surface soils. For deeper soils, RSLs should be used for first-order comparison purposes only. The 2013 Removal Assessment used 61 mg/kg for arsenic based on a modified EPA RSL using an assumed 60% bioavailability factor and an estimated excess cancer risk of  $10^{-4}$  for a residential scenario. The EPA conducted an in vitro bioaccessibility assay of 40 soil/tailings samples collected from the Site and surrounding areas, and determined that a site-specific screening level of 100 mg/kg for arsenic was appropriate using a 20% bioavailability factor and an estimated non-cancer hazard index of 1 for a residential scenario (EPA, 2015d).

Surface water analyses are being compared to EPA’s Ambient Water Quality Criteria (AWQC) for the protection of freshwater aquatic organisms. Because any potential release from the Site is expected to be continuous and long-term, concentrations are compared with chronic AWQC. Hardness was calculated from analytical data and was used to determine AWQC for metals that are hardness dependent. Hardness was calculated as calcium carbonate for each surface water sampling location using dissolved calcium and magnesium analytical results. Hardness in surface water samples collected from the Site was calculated to range from 91.5 to 391 ppm.

Sediment analyses were compared to threshold-effects-levels (TELs) published by the National Oceanic and Atmospheric Administration Screening Quick-Reference Tables. Screening with conservative, lower-threshold TELs ensures, with a high degree of confidence, that any contaminant sources eliminated from future consideration pose no potential threat. Conversely, exceeding the TELs does not necessarily predict toxicity. Freshwater TELs are based on benthic community metrics and toxicity results.

In addition to the secondary benchmarks, drinking water maximum contaminant levels (MCLs) are presented for reference because Jackson Creek flows to Lake Amador, which is a domestic water source.

**Table 1: Benchmark Levels**

Analyte	RSL Residential Soil (mg/kg)	TEL Fresh Water Sediments (mg/kg)	AWQC Chronic Fresh Water (µg/L)	MCL (Fed/State) Drinking Water (µg/L)
Aluminum	77,000	NA	87	NA /1,000
Antimony	31	NA	NA	6/6
Arsenic	100*	5.9	150 D	10/10
Barium	15,000	NA	NA	2,000/1,000
Beryllium	160	NA	NA	4/4
Cadmium	70	0.596	0.25 D, H	5/5
Chromium	0.29	37.3	74 Cr <sup>3+</sup> , D, H	100/50
Cobalt	23	NA	NA	NA
Copper	3,100	35.7	9 D, H	1,300/1,300
Iron	55,000	NA	1,000	300/300**
Lead	400	35	2.5D, H	15
Manganese	1,800	NA	NA	50/50**
Mercury	9.4	0.174	0.77 D	2
Nickel	1,500	18	52 D, H	NA /100
Selenium	390	NA	5	50/50
Silver	390	NA	NA	NA /100
Thallium	NA	NA	NA	2/2
Vanadium	5.5	NA	NA	NA
Zinc	23,000	123	120 D, H	5,000/5,000**

Notes:

\* = EPA site-specific screening level for arsenic.

\*\* = Secondary MCL value.

AWQC = EPA Ambient Water Quality Criteria. CCC (criterion continuous concentration) chronic values presented.

Cr<sup>3+</sup> = trivalent chromium.

D = Criterion applicable to dissolved metals.

H = Criterion for metal is a function of hardness.

MCLs - Primary Maximum Contaminant Levels for drinking water pursuant to the Safe Drinking Water Act.

mg/kg = milligrams per kilogram (equivalent to parts per million).

NA = none available.

RSL = Regional Screening Levels (EPA Region 9, January 2015).

TEL = Threshold Effects Level from National Oceanic and Atmospheric Administration, Screening Quick Reference Tables - guidance thresholds for the protection of freshwater aquatic life.

µg/L = milligrams per liter (equivalent to parts per billion).

### 3.2.1 Soil Sampling

#### 3.2.1.1 Background Locations

Background soil samples were collected from location AB-01 at pasture land located northwest of the Tailings Area and location AB-02 at pasture land located southwest of the Tailings Area. Background concentrations of arsenic ranged from 1.2 to 8.9 mg/kg; background concentrations of lead ranged from 7.1 to 14.8 mg/kg; and background concentrations of mercury ranged from <0.10 mg/kg (non-detect) to 0.15 mg/kg. The background concentration of cyanide was 0.64



mg/kg, and all other sample results were below the laboratory reporting limits. Sampling locations are shown on Figures 7 and 8; analytical results are summarized in Table 2.

**Table 2: Background Soil Sampling Results**

Sample No.	Sampling Location	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
AB-01-0	Pasture Northwest of Argonaut Mine Tailings Area	0 - 0.5	8.9	14.8 J	0.15
AB-01-1.5		1.0 - 1.5	2 J	9 J	<0.11
AB-02-0	Pasture Southwest of Argonaut Mine Tailings Area	0 - 0.5	3.1 J	11.2 J	<0.10
AB-02-1.5		1.0 - 1.5	1.2 J	7.1 J	<0.11
Regional Screening Levels			100*	400	9.4

Notes:

\* = EPA site-specific screening level for arsenic.

< = less than

**Bold** and underlined values are significantly above background.

J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

mg/kg = milligrams per kilogram

Regional Screening Levels (EPA Region 9, June 2015).

### 3.2.1.2 Argonaut Mine Mill Area

Soil samples were collected from nine locations around mine buildings at the shaft area on the west side of Highway 49, and from nine locations around mine buildings at the former 40-stamp mill, a large waste rock pile, and the drainage valley below the 40-stamp mill on the east side of Highway 49. The samples were collected to determine the presence of a hazardous substance source. Sampling locations are shown on Figure 6; analytical results are summarized in Tables 3 and 4.

#### Mill Area - Western Property

Surface soil and shallow subsurface soil samples were collected from nine locations at the western portion of the Mill Area. Five sampling locations (AMA-01 through AMA-05) were along the hillside between the mine shaft buildings and Argonaut Heights residential development; sampling location AMA-05 was between the two main buildings; sampling AMA-06 was at an assay crucible dump area on the slope between the mine shaft buildings and Highway 49; sampling location AMA-07 was outside the cracked foundation of a furnace (possible retort) building; and two sampling locations (AMA-08 and AMA-09) were at a level area in front of the buildings.

Arsenic concentrations in the samples ranged from 26.8 to 743 mg/kg, with nine of the 14 samples exceeding the modified RSL of 100 mg/kg. Lead concentrations in the samples ranged from 3.6 to 47,200 mg/kg, with four of the 14 samples exceeding the RSL of 400 mg/kg. Mercury concentrations in the samples ranged from <0.1 mg/kg (non-detect) to 348 mg/kg, with two of the 14 samples exceeding the RSL of 9.4 mg/kg. The highest concentrations of arsenic and mercury were found in sample AMA-07-0, adjacent to the furnace building. The highest concentration of lead was found in sample AMA-06-0 at the assay crucible dump area.

**Table 3: Argonaut Mine Mill Area – Western Property Soil Sampling Results**

Sample No.	Sampling Location	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
AMA-01-0	Mill Area near Argonaut Estates II	0 - 0.5	<b><u>115 J</u></b>	21.9	0.13
AMA-01-0 (duplicate)	Mill Area near Argonaut Estates II	0	<b><u>127</u></b>	22 J	<0.10
AMA-01-2	Mill Area near Argonaut Estates II	1.5 - 2	84.2	5 J	<0.11
AMA-01-2 (duplicate)	Mill Area near Argonaut Estates II	1.5 - 2	81.5	3.6 J	<0.11
AMA-02-0	Mill Area near Argonaut Estates II	0 - 0.5	26.8	16.3	<0.1
AMA-02-2	Mill Area near Argonaut Estates II	1.5 - 2	48	5.3 J	<0.12
AMA-03-0	Mill Area near Argonaut Estates II	0 - 0.5	66.1	27.8	0.21
AMA-04-0	Mill Area near Argonaut Estates II	0 - 0.5	<b><u>108</u></b>	13.6	0.11
AMA-04-2	Mill Area near Argonaut Estates II	1.5 - 2	97	8.9 J	<0.12
AMA-05-0	Mill Area Mine Buildings	0 - 0.5	<b><u>154</u></b>	<b><u>4,060</u></b>	4.1
AMA-06-0	Assay Crucible Dump	0 - 0.5	<b><u>339</u></b>	<b><u>47,200</u></b>	<b><u>17.2</u></b>
AMA-07-0	Probable Retort Building	0 - 0.5	<b><u>743</u></b>	<b><u>20,800</u></b>	<b><u>348</u></b>
AMA-08-0	Mill Area Mine Buildings	0 - 0.5	<b><u>235</u></b>	<b><u>763</u></b>	1.6
AMA-08-2	Mill Area Mine Buildings	1.5 - 2	<b><u>187</u></b>	8.2 J	0.24
AMA-09-0	Mill Area Mine Buildings	0 - 0.5	<b><u>168</u></b>	84.2	0.62
AMA-09-2	Mill Area Mine Buildings	1.5 - 2	<b><u>161</u></b>	53.5	2.4
<b>Regional Screening Levels</b>			100*	400	9.4

Notes:

\* = EPA site-specific screening level for arsenic.

&lt; = Not detected less than the stated laboratories reporting limit.

**Bold** and underlined values are significantly above background.

J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

mg/kg = milligrams per kilogram

Regional Screening Levels (EPA Region 9, June 2015).

### Mill Area - Eastern Property

Surface soil and shallow subsurface soil samples were collected from nine locations at the eastern portion of the Mill Area. Two sampling locations (AMA-10 and AMA-11) were at the top of the waste rock pile adjacent to Highway 49 and sampling location AMA-12 was at the base of the waste rock pile; sample location AMA-13 was adjacent to the hoist building; sampling location AMA-14 was adjacent to the mercury retort building south of the 40-stamp mill foundation; sampling location AMA-15 was in a depression east of the former 40-stamp mill; two sampling locations (AMA-16 and AMA-18) were near the unnamed intermittent stream; and sampling location AMA-17 was at a gray sands (processed tailings) area at the location of a probable cyanide processing area.

Arsenic concentrations in the samples ranged from 13.4 to 221 mg/kg, with four of the 14 samples exceeding the modified RSL of 100 mg/kg. Lead concentrations in the samples ranged from 14.5 to 2,920 mg/kg, with one of the 14 samples exceeding the RSL of 400 mg/kg. Mercury concentrations in the samples ranged from 0.13 to 111 mg/kg, with three of the 14 samples exceeding the RSL of 9.4 mg/kg. The highest concentration of arsenic was found in sample AMA-11-0 at the waste rock pile. The highest concentration of lead was found in sample AMA-

15-0 at a depression east of the 40-stamp mill. The highest concentration of mercury was found in sample AMA-14-1 adjacent to the former retort building.

**Table 4: Argonaut Mine Mill Area – Eastern Property Soil Sampling Results**

Sample No.	Sampling Location	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
AMA-10-0	40-Stamp Mill Area Waste Rock Pile	0 - 0.5	<u>185</u>	80.2	0.38
AMA-11-0	40-Stamp Mill Area Waste Rock Pile	0 - 0.5	<u>221</u>	41.7	0.26
AMA-12-0	40-Stamp Mill Area Waste Rock Pile	0 - 0.5	60.2	46.1	0.33
AMA-12-2	40-Stamp Mill Area Waste Rock Pile	1.5 - 2	24.7	18.4	0.27
AMA-13-0	40-Stamp Mill	0 - 0.5	<u>234</u>	35.9	0.61
AMA-13-2	40-Stamp Mill	1.5 - 2	<u>120</u>	89.4	0.3
AMA-14-0	40-Stamp Mill Possible Tailings	0.5 - 1	54.6	41 J	<u>80.5</u>
AMA-14-1	40-Stamp Mill Possible Tailings	1.5 - 2	78.8	44.2 J	<u>111</u>
AMA-15-0	40-Stamp Mill Possible Tailings	0 - 0.5	86.2	<u>2,920</u>	22.3
AMA-15-2	40-Stamp Mill Possible Tailings	1.5 - 2	13.4	130	4.3
AMA-16-0	Mill Area Tailings Dam	0 - 0.5	69.5	17	0.87
AMA-17-0	Mill Area Former Cyanide Plant	0 - 0.5	22.2	15.2	0.21
AMA-17-0 (duplicate)	Mill Area Former Cyanide Plant	0 - 0.5	22.9	14.5	0.13
AMA-17-1	Mill Area Former Cyanide Plant	1.5 - 2	27.7	19.1	0.42
AMA-17-1 (duplicate)	Mill Area Former Cyanide Plant	1.5 - 2	27.9	19.1	0.56
AMA-18-0	Mill Area Former Cyanide Plant	1.5 - 2	75.4	29	2.4
<b>Regional Screening Levels</b>			100*	400	9.4

Notes:

\* = EPA site-specific screening level for arsenic.

**Bold** and underlined values are significantly above background.

J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

mg/kg = milligrams per kilogram

Regional Screening Levels (EPA Region 9, June 2015).

### 3.2.1.3 Argonaut Mine Tailings Area

The EPA and DTSC have conducted several environmental investigations and assessments at the Tailings Area and hazardous substances in the tailings are well documented. Soil samples were collected from five locations at the Tailings Area to determine the presence of a hazardous substance source. Sampling locations are shown on Figure 7; analytical results are summarized in Table 5.

Two sample locations (ATA-01 and ATA-02) were at the upper tailings impoundment earthen dam; sampling location ATA-03 was near residential properties off of Detert Lane adjacent to the middle tailings impoundment; sampling location ATA-04 as at the northern end of the lower earthen dam; and sampling location ATA-05 was near residential properties off of Muldoon Place adjacent to the lower tailings impoundment.

Arsenic concentrations in the samples ranged from 10.4 to 3,490 mg/kg, with five of the eight samples exceeding the modified RSL of 100 mg/kg. Lead concentrations in the samples ranged

from 8.3 to 193 mg/kg; all eight samples were below the RSL of 400 mg/kg. Mercury concentrations in the samples ranged from <0.1 mg/kg (non-detect) to 2.5 mg/kg; all eight samples were below the RSL of 9.4 mg/kg. The highest concentrations of arsenic, lead and mercury were found in sample ATA-03-0 adjacent to the middle tailings impoundment.

**Table 5: Argonaut Mine Tailings Area Soil Sampling Results**

Sample No.	Sampling Location	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
ATA-01-0	Tailings Area Gray Sands	0 - 0.5	54.8	13	<0.1
ATA-02-0	Tailings Area Gray Sands	0 - 0.5	49.4	8.4	0.38
ATA-03-0	Tailings Area near Sierra View Estates	0 - 0.5	<b><u>3,490</u></b>	193	2.5
ATA-03-2	Tailings Area near Sierra View Estates	1.5 - 2	<b><u>502</u></b>	8.7	0.05 J
ATA-04-0	Tailings Area near Sierra View Estates	0 - 0.5	<b><u>362</u></b>	11.8	0.062 J
ATA-04-0 (duplicate)	Tailings Area near Sierra View Estates	0 - 0.5	<b><u>347</u></b>	8.8	<0.1
ATA-04-2	Tailings Area near Sierra View Estates	1.5 - 2	<b><u>266</u></b>	10.9	0.087 J
ATA-05-0	Tailings Area near Sierra View Estates	0 - 0.5	10.4	8.3	0.052 J
ATA-05-1.5	Tailings Area near Sierra View Estates	1 - 1.5	<b><u>237</u></b>	27.9	0.52
<b>Regional Screening Levels</b>			100*	400	9.4

Notes:

\* = EPA site-specific screening level for arsenic.

< = Not detected less than the stated laboratories reporting limit.

**Bold** and **underlined** values are significantly above background.

J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

mg/kg = milligrams per kilogram

Regional Screening Levels (EPA Region 9, June 2015).

### 3.2.1.4 Residential Area

Surface soil and shallow subsurface soil samples were collected from 19 residential lots and from Jackson Junior High School to assess whether the properties were impacted by historic operations at the Site. Six sampling locations (ARA-01 through ARA-06) were at the Argonaut Heights II neighborhood developed at the location of the former 60-stamp mill; two sampling locations (ARA-07 and ARA-08) were at the Argonaut Estates neighborhood developed along the waste rock pile south of the Mill Area; five sampling locations (ARA-09 through ARA-13) were at the Argonaut Heights neighborhood around the Tailings Area AOC-5; sampling location ARA-14 was at the Argonaut Heights neighborhood north of AOC-1; three sampling locations (ARA-15 through ARA-17) were at the Argonaut Heights neighborhood east of the cyanide plant at AOC-2; and two sampling locations (ARA-18 and ARA-19) were located at Sierra View Estates neighborhood near the middle tailings impoundment behind the lower earthen tailings dam. Three sampling locations (ARA-20 through ARA-21) were collected at the Jackson Junior High School from exposed fill material resembling processed tailings used to create athletic fields. Sampling locations are shown on Figure 8; analytical results are summarized in Table 6 through Table 9.

Arsenic concentrations in samples collected at the Argonaut Heights II neighborhood (former 60-stamp mill) ranged from 5.6 to 61.8 mg/kg, with none of the samples exceeding the modified RSL of 100 mg/kg. Lead and mercury concentrations in the samples were also below RSLs. Arsenic concentrations in samples collected at the Argonaut Estates neighborhood (waste rock pile) ranged from 5.1 to 148 mg/kg, with only one of the four samples exceeding the modified RSL of 100 mg/kg. The highest concentration of arsenic was found in sample ARA-07-01. Lead and mercury concentrations in all four samples were below RSLs.

**Table 6: Argonaut Mine Mill Area - Residential Soil Sampling Results**

Sample No.	Sampling Location	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
ARA-01-0	Argonaut Heights II Neighborhood	0 - 0.5	5.9	8 J	<0.11
ARA-02-0	Argonaut Heights II Neighborhood	0 - 0.5	5.6	5.9	<0.21
ARA-02-1		0.5 - 1	25.6	12.3 J	<0.15
ARA-03-0	Argonaut Heights II Neighborhood	0 - 0.5	61.8	12.5 J	2.4
ARA-03-1		0.5 - 1	72	12.2 J	0.22
ARA-04-0	Argonaut Heights II Neighborhood	0 - 0.5	6.9	7.9 J	<0.12
ARA-05-0	Argonaut Heights II Neighborhood	0 - 0.5	50.5 J	21.1 J	0.15
ARA-05-0 (duplicate)		0 - 0.5	47.8	14.7	0.11
ARA-06-0	Argonaut Heights II Neighborhood	0 - 0.5	11.2 J	8.3	0.13 J
ARA-06-1.5		1 - 1.5	30.5 J	6.7 J	0.055 J
ARA-07-0	Argonaut Estates Neighborhood	0 - 0.5	68.5 J	25.6 J	0.14
ARA-07-1		1.5 - 2	<b><u>148</u></b>	21.5	0.16
ARA-08-0	Argonaut Estates Neighborhood	0 - 0.5	68.3 J	13	0.081 J
ARA-08-1		0.5 - 1	5.1 J	3.5	0.029 J
Regional Screening Levels			100*	400	9.4

Notes:

\* = EPA site-specific screening level for arsenic.

< = Not detected less than the stated laboratories reporting limit.

**Bold** and underlined values are significantly above background.

J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

mg/kg = milligrams per kilogram.

Regional Screening Levels (EPA Region 9, June 2015).

Arsenic concentrations in samples collected at the Argonaut Heights neighborhood north of the Tailings Area and near AOC-5 ranged from 20.4 to 39,900 mg/kg, with six of the 10 samples exceeding the modified RSL of 100 mg/kg. The highest concentration of arsenic was found in sample ARA-09-02 (adjacent to AOC-5); the same sample also contained 3,220 mg/kg lead and 193 mg/kg mercury exceeding RSLs. Lead and mercury concentrations in the remaining four samples were below RSLs.

**Table 7: Argonaut Mine Tailings Area - Northern Residential Soil Sampling Results**

Sample No.	Sampling Location	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
ARA-09-0	Argonaut Heights Neighborhood	0 - 0.5	<u>1,380 J</u>	226	1.4
ARA-09-2		1.5 - 2	<u>39,900 J</u>	<u>3,220 J</u>	<u>193</u>
ARA-10-0	Argonaut Heights Neighborhood	0 - 0.5	<u>143 J</u>	92.6	0.3
ARA-10-2		1.5 - 2	<u>655 J</u>	50.5	0.43
ARA-10-2 (duplicate)		1.5 - 2	<u>634</u>	44.4	0.37
ARA-11-0	Argonaut Heights Neighborhood	0 - 0.5	47.3 J	43.8 J	0.14
ARA-11-2		1.5 - 2	20.4 J	8.3 J	0.05 J
ARA-12-0	Argonaut Heights Neighborhood	0 - 0.5	21.2 J	31 J	0.44
ARA-12-2		1.5 - 2	58.6 J	19.2 J	0.12
ARA-13-0	Argonaut Heights Neighborhood	0 - 0.5	<u>376 J</u>	141	1.1
ARA-13-1		1.5 - 2	<u>1,200 J</u>	225	1.8
Regional Screening Levels			100*	400	9.4

Notes:

\* = EPA site-specific screening level for arsenic.

**Bold** and underlined values are significantly above background.J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.  
mg/kg = milligrams per kilogram.

Regional Screening Levels (EPA Region 9, June 2015).

Arsenic concentrations in samples collected at the Argonaut Heights neighborhood east of the Tailings Area ranged from 47.8 to 269 mg/kg, with seven of the eight samples exceeding the modified RSL of 100 mg/kg. The highest concentration of arsenic was found in sample ARA-15-1 (adjacent to the cyanide plant); the same sample also contained 564 mg/kg lead (above the RSL of 400 mg/kg), and 3.3 mg/kg mercury (below the RSL of 9.4 mg/kg). Lead and mercury concentrations in the remaining five samples were below RSLs.

Arsenic concentrations in samples collected at the Sierra View Estates neighborhood east of the Tailings Area ranged from 55.3 to 423 mg/kg, with three of the four samples exceeding the modified RSL of 100 mg/kg. The highest concentration of arsenic was found in sample ARA-18-1.5. Lead and mercury concentrations in the four samples were below RSLs.

**Table 8: Argonaut Mine Tailings Area - Eastern Residential Soil Sampling Results**

Sample No.	Sampling Location	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
ARA-14-0	Argonaut Heights Neighborhood	0 - 0.5	<u>225 J</u>	36.5 J	1
ARA-14-1		1.5 - 2	49.8 J	13 J	0.35
ARA-14-1D		1.5 - 2	47.8	12.1 J	0.33
ARA-15-0	Argonaut Heights Neighborhood	0 - 0.5	<u>206 J</u>	<u>564</u>	1.1
ARA-15-1		1.5 - 2	<u>269 J</u>	286	3.3
ARA-16-0	Argonaut Heights Neighborhood	0 - 0.5	<u>139</u>	89.6	0.28
ARA-16-1		0.5 - 1	<u>147</u>	121	0.85
ARA-17-0	Argonaut Heights Neighborhood	0 - 0.5	<u>116</u>	24.3	0.35
ARA-17-2		1.5 - 2	<u>123</u>	30	0.2
ARA-18-0	Sierra View Estates Neighborhood	0 - 0.5	<u>310</u>	46	0.63
ARA-18-1.5		1 - 1.5	<u>423</u>	115	1.4
ARA-19-0	Sierra View Estates Neighborhood	0 - 0.5	55.3	10.1 J	0.033 J
ARA-19-1		1.5 - 2	<u>122</u>	8.5 J	0.043 J
Regional Screening Levels			100*	400	9.4

Notes:

\* = EPA site-specific screening level for arsenic.

**Bold** and **underlined** values are significantly above background..J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.  
mg/kg = milligrams per kilogram

Regional Screening Levels (EPA Region 9, June 2015).

Arsenic concentrations in samples collected at the Jackson Junior High School ranged from 17 to 659 mg/kg, with two of the six samples exceeding the modified RSL of 100 mg/kg. The highest concentration of arsenic was found in sample ARA-22-0, collected from the upper slope of exposed fill. Lead and mercury concentrations all four samples were below RSLs.

**Table 9: Jackson Junior High School Soil Sampling Locations**

Sample No.	Sampling Location	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
ARA-20-0	Jackson Junior High School	0 - 0.5	<u>239</u>	20.2	0.2
ARA-20-2		1.5 - 2	18.7	13.2 J	0.15
ARA-20-2D		1.5 - 2	17	12.2 J	0.086 J
ARA-21-0	Jackson Junior High School	0 - 0.5	57.6	14.7 J	0.19
ARA-21-2		1.5 - 2	21.5	9 J	0.07 J
ARA-22-0	Jackson Junior High School	0 - 0.5	<u>659</u>	45.3	0.33
ARA-22-2		1.5 - 2	26.6	8.1 J	0.21
Regional Screening Levels			100*	400	9.4

Notes:

\* = EPA site-specific screening level for arsenic.

**Bold** and **underlined** values are significantly above background.J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.  
mg/kg = milligrams per kilogram

Regional Screening Levels (EPA Region 9, June 2015).



### 3.2.2 Sediment Sampling

A total of 28 sediment samples, including two duplicate samples, were collected from drainages and streams at background locations upstream from Site mining activities, and locations downstream of the Mill Area and Tailings Area. Sampling locations are shown on Figure 9; analytical results are summarized in Tables 10 through 13.

#### 3.2.2.1 Background Locations

Background sediment samples were collected from drainages, creeks and wetlands from locations upgradient of the Site and potential source samples. Background sample ABS-01 was collected from Kennedy Mine upstream of the unnamed intermittent stream running through the eastern portion of the Mill Area; sample ABS-02 was collected from a drainage located southwest of the Tailings Area; and sample ABS-03 was collected from a spring fed wetland located approximately 1.2 miles south of the Tailings Area.

Sample ABS-01 contained arsenic and lead concentrations of 48.4 mg/kg and 12.8 mg/kg, respectively; mercury was not detected at concentrations >0.1 mg/kg. Sample ABS-01 may have been impacted by historic activities conducted at the Kennedy Mine. Sample ABS-02 contained arsenic and lead concentrations of 3.5 mg/kg and 12.7 mg/kg, respectively; mercury was not detected at concentrations >0.1 mg/kg. Sample ABS-03 contained arsenic, lead, and mercury concentrations of 3.8 mg/kg, 30.5 mg/kg, and 0.18 mg/kg, respectively.

**Table 10: Background Sediment Sampling Results**

Sample No.	Sampling Location	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
ABS-01	Unnamed Intermittent Stream Upstream of Argonaut Mine Workings	<b><u>48.4</u></b>	12.8	<0.1
ABS-02	Intermittent Stream Southwest of Tailings Area	3.5	12.7 J	<0.1
ABS-03	Wetland South of Tailings Area	3.8	30.5 J	<b><u>0.18</u></b>
Threshold Effects Level		5.9	35	0.174

Notes:

< = Not detected less than the stated laboratories reporting limit.

**Bold** and underlined values are significantly above background.

mg/kg = milligrams per kilogram.

Threshold Effects Level from National Oceanic and Atmospheric Administration, Screening Quick Reference Tables – guidance thresholds for the protection of freshwater aquatic life.

#### 3.2.2.2 Argonaut Mine Mill Area

Two sediment samples (AMS-02 and AMS-05) were collected from the unnamed intermittent stream located in the eastern portion of the Mill Area and one sediment sample (AMS-03) was collected from a drainage leading from the 40-stamp mill area to the stream. Both the drainage and stream were dry at the time of sampling. Sample AMS-02 contained the highest concentrations of arsenic, lead, and mercury found in the intermittent stream at 121 mg/kg, 36.7 mg/kg, and 3.3 mg/kg, respectively and exceeding the TELs for metals.



**Table 11: Argonaut Mine Mill Area Sediment Sampling Results**

Sample No.	Sampling Location	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
AMS-02	Mill Area Intermittent Stream	<u>121</u>	<u>36.7</u>	<u>3.3</u>
AMS-03	Drainage from Mill Area	<u>240</u>	51	<u>4.8</u>
AMS-05	Mill Area Intermittent Stream	<u>88.8</u>	18.1	<u>1.1</u>
<b>Threshold Effects Level</b>		5.9	35	0.174

Notes:

**Bold** and underlined values are significantly above background.

mg/kg = milligrams per kilogram.

Threshold Effects Level from National Oceanic and Atmospheric Administration, Screening Quick Reference Tables – guidance thresholds for the protection of freshwater aquatic life.

### 3.2.2.3 Argonaut Mine Tailings Area

Two sediment samples (ATS-01 and ATS-02) were collected from wetlands at the middle tailings impoundment above the lower earthen dam and the lower tailings impoundment above the concrete dam, respectively. One sediment sample (ATS-03) was collected from the drainage leading to the North Fork Jackson Creek below the concrete dam.

Arsenic was detected in samples ATS-01, ATS-02, and ATS-03 at concentrations of 2,000 mg/kg, 204 mg/kg, and 293 mg/kg, respectively. Sediment samples collected from the Site wetlands contained arsenic, lead, and mercury at concentrations exceeding the TELs for the metals. The sample collected from the drainage below the concrete dam exceeded TELs for arsenic and mercury.

**Table 12: Argonaut Mine Tailings Area Sediment Sampling Results**

Sample No.	Sampling Location	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
ATS-01	Wetland Behind Lower Earthen Tailings Dam	<u>1,690</u>	<u>95.8</u>	<u>0.56</u>
ATS-01D		<u>2,000</u>	<u>98.7</u>	<u>0.56</u>
ATS-02	Wetland Behind Concrete Dam	<u>204</u>	<u>38.8</u>	<u>1.5</u>
ATS-03	Unnamed Intermittent Stream below Concrete Dam	<u>293</u>	23.3	<u>1.1</u>
<b>Threshold Effects Level</b>		5.9	35	0.174

Notes:

**Bold** and underlined values are significantly above background.

mg/kg = milligrams per kilogram.

Threshold Effects Level from National Oceanic and Atmospheric Administration, Screening Quick Reference Tables – guidance thresholds for the protection of freshwater aquatic life.

### 3.2.2.4 Jackson Creek

Sediment samples (AJS-01, AJS-02, AJS-04, AJS-05, and AJS-06) were collected from five sampling locations along North Fork Jackson Creek between the Mill Area and the confluence of Jackson Creek; two samples (AJS-07 and AJS-08) were collected from Jackson Creek upstream of the confluence with North Fork Jackson Creek; one sample (AJS-09) was collected from South Fork Jackson Creek upstream of the confluence with Jackson Creek; six samples (AJS-10, AJS-11, AJS-13, AJS-14, AJS-15, and AJS-17) were collected from Jackson Creek downstream of the confluence with North Fork Jackson Creek; and two samples (AJS-12 and AJS-16) were collected from unnamed intermittent streams draining to Jackson Creek.

Arsenic was found in samples collected from North Fork Jackson Creek at concentrations ranging from 37.1 mg/kg (AJS-06) to 87.7 mg/kg (AJS-01). Arsenic was found in samples collected from Jackson Creek and South Fork Jackson Creek, upstream of the confluence with North Fork Jackson Creek, at concentrations ranging from 7.9 mg/kg (AJS-07) to 9.5 mg/kg (AJS-08). Arsenic was found in samples collected from Jackson Creek, downstream of the confluence with North Fork Jackson Creek, at concentrations ranging from 10.8 mg/kg (AJS-13) to 40.8 mg/kg (AJS-10). All of the sediment samples, with the exception AJS-16, exceeded the TEL for arsenic.

**Table 13: Jackson Creek and its Tributaries Sediment Sampling Results**

Sample No.	Sampling Location	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
AJS-01	North Fork Jackson Creek Upstream of Confluence with Mill Area Intermittent Stream	<u>87.7 J</u>	<u>39.6</u>	<u>0.67</u>
AJS-02	North Fork Jackson Creek Downstream of Confluence with Mill Area Intermittent Stream	<u>50.4 J</u>	14.9	<u>0.3</u>
AJS-04	North Fork Jackson Creek Upstream of Confluence with Tailings Area Intermittent Stream	<u>61.6 J</u>	29.1	<u>0.2</u>
AJS-04D		<u>35.8</u>	20.3	<0.12
AJS-05	North Fork Jackson Creek Downstream of Confluence with Tailings Area Intermittent Stream	<u>79 J</u>	25	<u>0.3</u>
AJS-06	North Fork Jackson Creek Upstream of Confluence with Jackson Creek	<u>37.1 J</u>	<u>47.3</u>	<u>0.18</u>
AJS-07	Jackson Creek Upstream of Confluence with North Fork Jackson Creek	<u>7.9 J</u>	25.9	<0.17
AJS-08	Jackson Creek Upstream of Confluence with South Fork Jackson Creek	<u>9.5 J</u>	<u>67.6</u>	<u>0.31</u>
AJS-09	South Fork Jackson Creek Upstream of Confluence with Jackson Creek	<u>8.9 J</u>	18.3	<0.20
AJS-10	Jackson Creek Downstream of Confluence with North Fork Jackson Creek	<u>40.8 J</u>	<u>46.9</u>	<u>0.22</u>
AJS-11	Jackson Creek Upstream of Confluence with Intermittent Stream	<u>17.9 J</u>	22.3	<0.16
AJS-12	Intermittent Stream Upstream of Confluence with Jackson Creek	<u>8.7 J</u>	16	<0.27
AJS-13	Jackson Creek Downstream of Confluence with Intermittent Stream	<u>10.8 J</u>	26.8	<0.13

Sample No.	Sampling Location	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
AJS-14	Jackson Creek Downstream of Sewage Treatment Plant	<b><u>10.8 J</u></b>	30.3	<b><u>0.43</u></b>
AJS-15	Jackson Creek Upstream of Confluence with Intermittent Stream	<b><u>33.3 J</u></b>	<b><u>56.8</u></b>	<0.14
AJS-16	Intermittent Stream Upstream of Confluence with Jackson Creek	3.6 J	11.7	0.14
AJS-17	Jackson Creek Downstream of Confluence with Intermittent Stream	<b><u>11 J</u></b>	8.7	<0.12
<b>Threshold Effects Level</b>		5.9	35	0.174

Notes:

< = Not detected less than the stated laboratories reporting limit.

**Bold** and underlined values are significantly above background.

J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.  
mg/kg = milligrams per kilogram.

Threshold Effects Level from National Oceanic and Atmospheric Administration, Screening Quick Reference Tables – guidance thresholds for the protection of freshwater aquatic life.

### 3.2.3 Surface Water Sampling

A total of 29 surface water samples, including three duplicate samples, were collected from 13 sampling locations downstream of the Mill Area and Tailings Area. Filtered and un-filtered water samples were collected from each sampling location. The creeks were not flowing at the time of the SI sampling, and surface water samples were collected from collocated sediment sampling locations where stagnant water was present. Sampling locations are shown on Figure 9; analytical results are summarized in Table 14.

#### 3.2.3.1 Background Locations

Surface water samples were planned to be collected from the same background locations as the sediment samples. Water was not present at the background locations and therefore no surface water samples were collected.

#### 3.2.3.2 Jackson Creek

The creeks were not flowing at the time of the SI sampling, consequently surface water samples were collected from collocated sediment sampling locations where stagnant water was present. Filtered and un-filtered water samples were collected from each sampling location. Samples (AJS-04, AJS-05, and AJS-06) were collected from three sampling locations along North Fork Jackson Creek; two samples (AJS-07 and AJS-08) were collected from Jackson Creek upstream of the confluence with North Fork Jackson Creek; one sample (AJS-09) was collected from South Fork Jackson Creek upstream of the confluence with Jackson Creek; six samples (AJS-10, AJS-11, AJS-13, AJS-14, AJS-15, and AJS-17) were collected from Jackson Creek downstream of the confluence with North Fork Jackson Creek; and one sample (AJS-12) was collected from unnamed intermittent streams draining to Jackson Creek.

Arsenic concentrations detected in un-filtered water samples ranged from 1.4 to 68.3 µg/L, and from 1.3 to 16 µg/L in filtered water samples; all sampling results were below the action level of 150 µg/L for arsenic. Lead concentrations detected in un-filtered water samples ranged from 2.9

to 17.7 µg/L, exceeding the action level of 2.4 µg/L for lead; only one filtered sample contained detectable concentrations of lead at 2.0 µg/L. Mercury concentrations were detected in only one un-filtered water sample at 0.21 µg/L, exceeding the action level of 0.05 µg/L for mercury; only one filtered sample contained detectable concentrations of lead at 2.0 µg/L. Mercury concentrations detected in filtered water samples ranged from 0.038 to 0.064 µg/L, with two samples exceeding the action level of 0.05 µg/L for mercury.

**Table 14: Jackson Creek and its Tributaries Surface Water Sampling Results**

Sample No.	Sampling Location	Arsenic (µg/L)	Lead (µg/L)	Mercury (µg/L)
AJS-04-W	North Fork Jackson Creek Upstream of Confluence with Tailings Area Intermittent Stream	4.3 J	<10	<0.2
AJS-04-WF (dissolved)		1.5 J	<10	0.044 J
AJS-05-W	North Fork Jackson Creek Downstream of Confluence with Tailings Area Intermittent Stream	68.3	17.7	0.21
AJS-05-WF (dissolved)		6.3 J	<10	<0.2
AJS-06-W	North Fork Jackson Creek Upstream of Confluence with Jackson Creek	17.5	12.4	<0.2
AJS-06-WD (duplicate)		12.2	5.9 J	<0.2
AJS-06-WF (dissolved)		6.9 J	<10	<0.2
AJS-07-W	Jackson Creek Upstream of Confluence with North Fork Jackson Creek	<10	<10	<0.2
AJS-07-WF (dissolved)		<10	<10	<0.2
AJS-08-W	Jackson Creek Upstream of Confluence with South Fork Jackson Creek	1.4 J	<10	<0.2
AJS-08-WF (dissolved)		<10	<10	<0.2
AJS-08-WFD (dissolved, duplicate)		<10	<10	0.038 J
AJS-09-W	South Fork Jackson Creek Upstream of Confluence with Jackson Creek	1.6 J	<10	<0.2
AJS-09-WF (dissolved)		<10	<10	<0.2
AJS-10-W	Jackson Creek Downstream of Confluence with North Fork Jackson Creek	5.1 J	3.7 J	<0.2
AJS-10-WD (duplicate)		7.5 J	11.9	<0.2
AJS-10-WF (dissolved)		2.3 J	<10	<0.2
AJS-11-W	Jackson Creek Upstream of Confluence with Intermittent Stream	53.2	2.9 J	<0.2
AJS-11-WF (dissolved)		16	2 J	0.064 J
AJS-12-W	Intermittent Stream Upstream of Confluence with Jackson Creek	5.8 J	<10	<0.2
AJS-12-WF (dissolved)		4.8 J	<10	0.05 J
AJS-13-W	Jackson Creek Downstream of Confluence with Intermittent Stream	10.2	<10	<0.2
AJS-13-WF (dissolved)		7.1 J	<10	<0.2
AJS-14-W	Jackson Creek Downstream of Sewage Treatment Plant	<10	<10	<0.2
AJS-14-WF (dissolved)		1.8 J	<10	<0.2

Sample No.	Sampling Location	Arsenic (µg/L)	Lead (µg/L)	Mercury (µg/L)
AJS-15-W	Jackson Creek Upstream of Confluence with Intermittent Stream	1.4 J	<10	<0.2
AJS-15-WF (dissolved)		1.3 J	<10	<0.2
AJS-17-W	Jackson Creek Downstream of Confluence with Intermittent Stream	2.1 J	<10	<0.2
AJS-17-WF (dissolved)		1.4 J	<10	<0.2
Ambient Water Quality Criteria		150	2.3 to 11	0.77

## Notes:

< = Not detected less than the stated laboratories reporting limit.

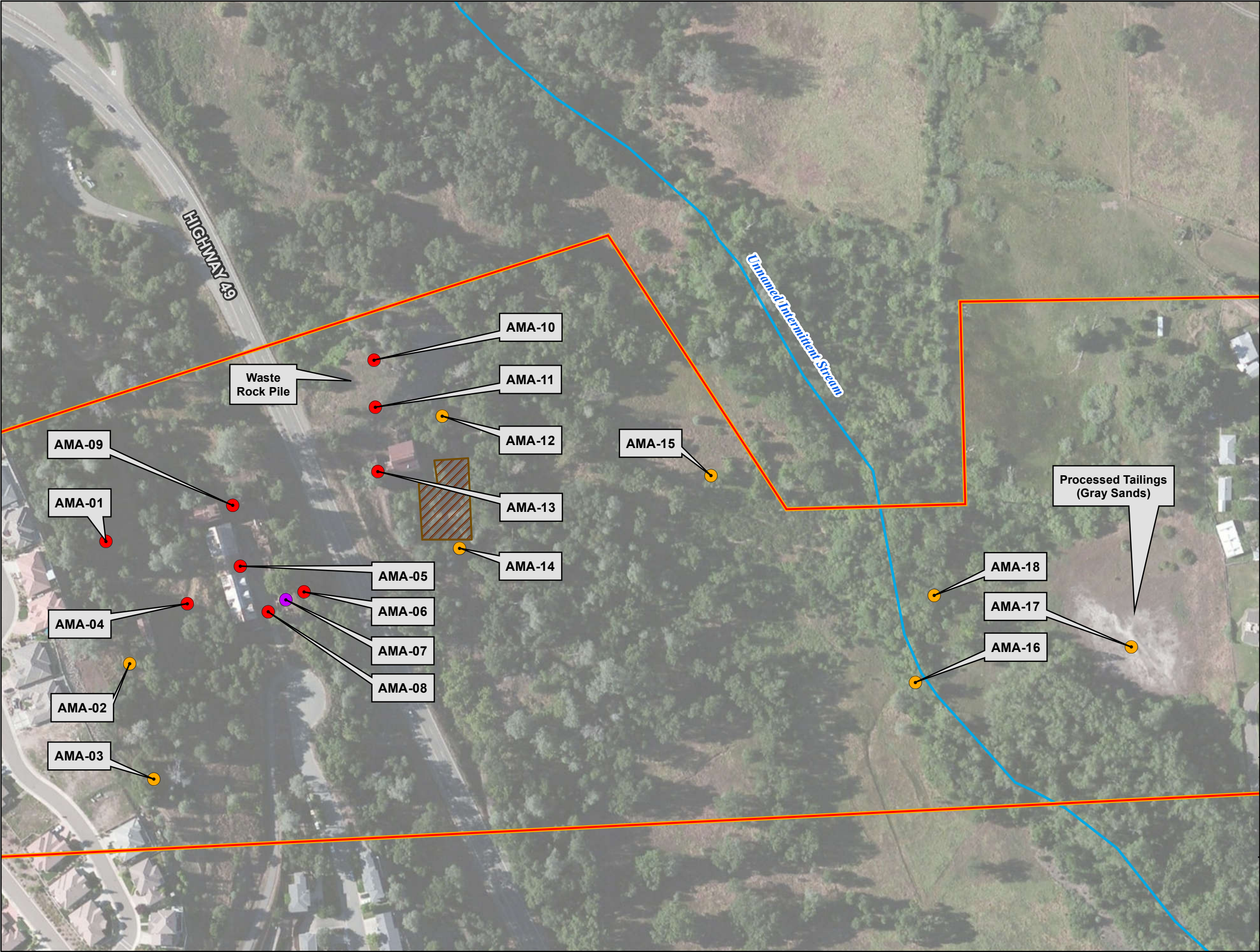
J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

µg/L = micrograms per liter

WF = filtered water samples for dissolved metals

EPA Ambient Water Quality Criteria. Criterion (AWQC) continuous concentration values presented. AWQCs for arsenic, lead, and mercury are applied to dissolved (filtered) metals. The criterion for lead is a function of hardness.





**Legend**

- Argonaut Mine Mill Area
- Former Mill
- Wetland
- Surface Water
- Elevation Contour

**Arsenic Results in Surface Soil**

- <26.7 mg/kg (3X background)
- 26.7 to 100 mg/kg
- 100 to 500 mg/kg
- >500 mg/kg

The highest background arsenic concentration in Site Inspection surface soil samples is 8.9 mg/kg. The site-specific arsenic screening level is 100 mg/kg.



0 Scale in Feet 250

**PREPARED BY:**  
Weston Solutions, Inc.  
1340 Treat Blvd, Ste 210  
Walnut Creek, CA 94597

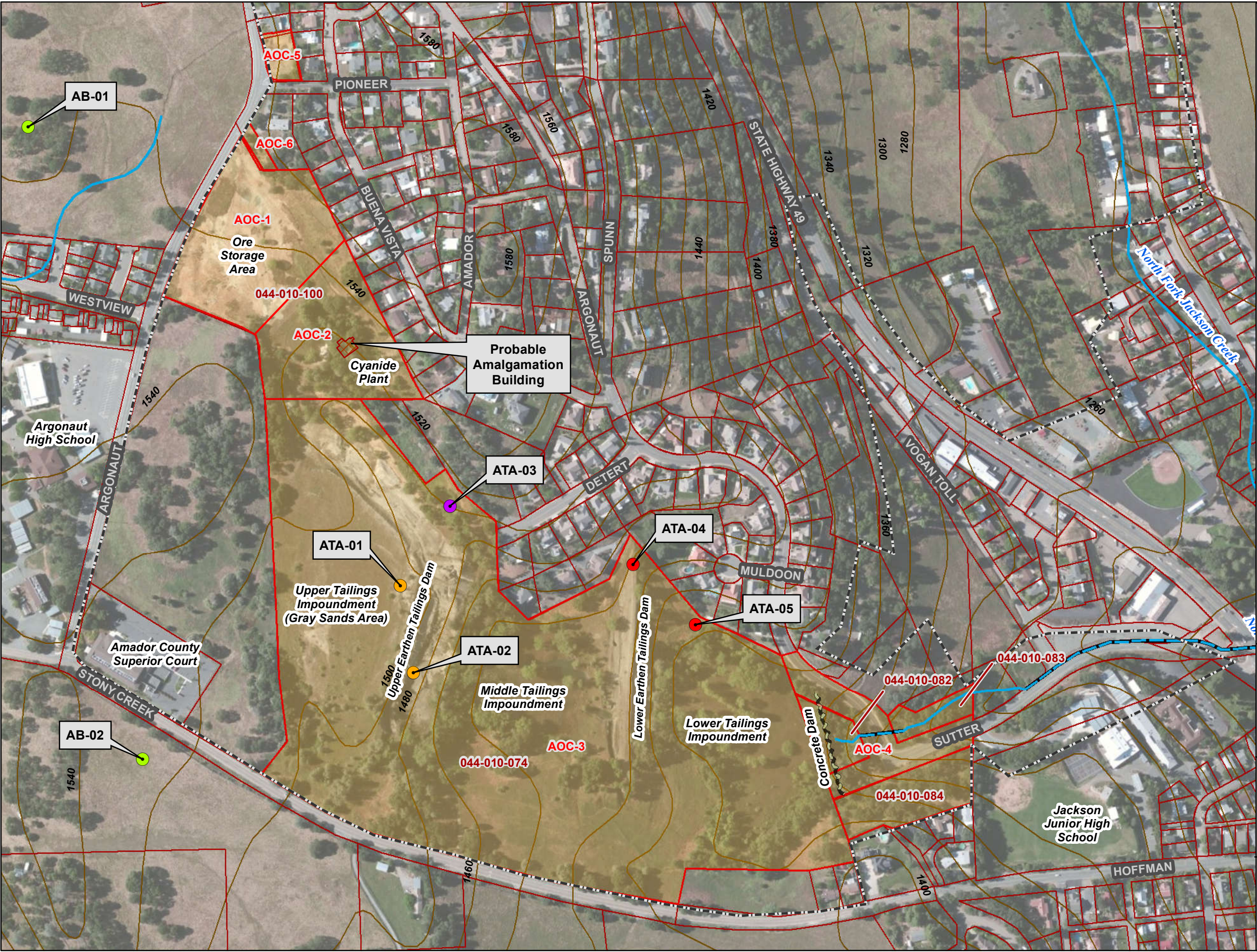


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EPA Region 9  
Pacific Southwest



**FIGURE 6**  
**MILL AREA**  
**SOIL SAMPLING LOCATIONS**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California





**Legend**

- Argonaut Mine Tailings Area
- Argonaut Property Boundary
- Parcels
- Surface Water
- Elevation Contour

**Arsenic Results in Surface Soil**

- <26.7 mg/kg (3X background)
- 26.7 to 100 mg/kg
- 100 to 500 mg/kg
- >500 mg/kg

The highest background arsenic concentration in Site Inspection surface soil samples is 8.9 mg/kg. The site-specific arsenic screening level is 100 mg/kg.

Scale in Feet 500

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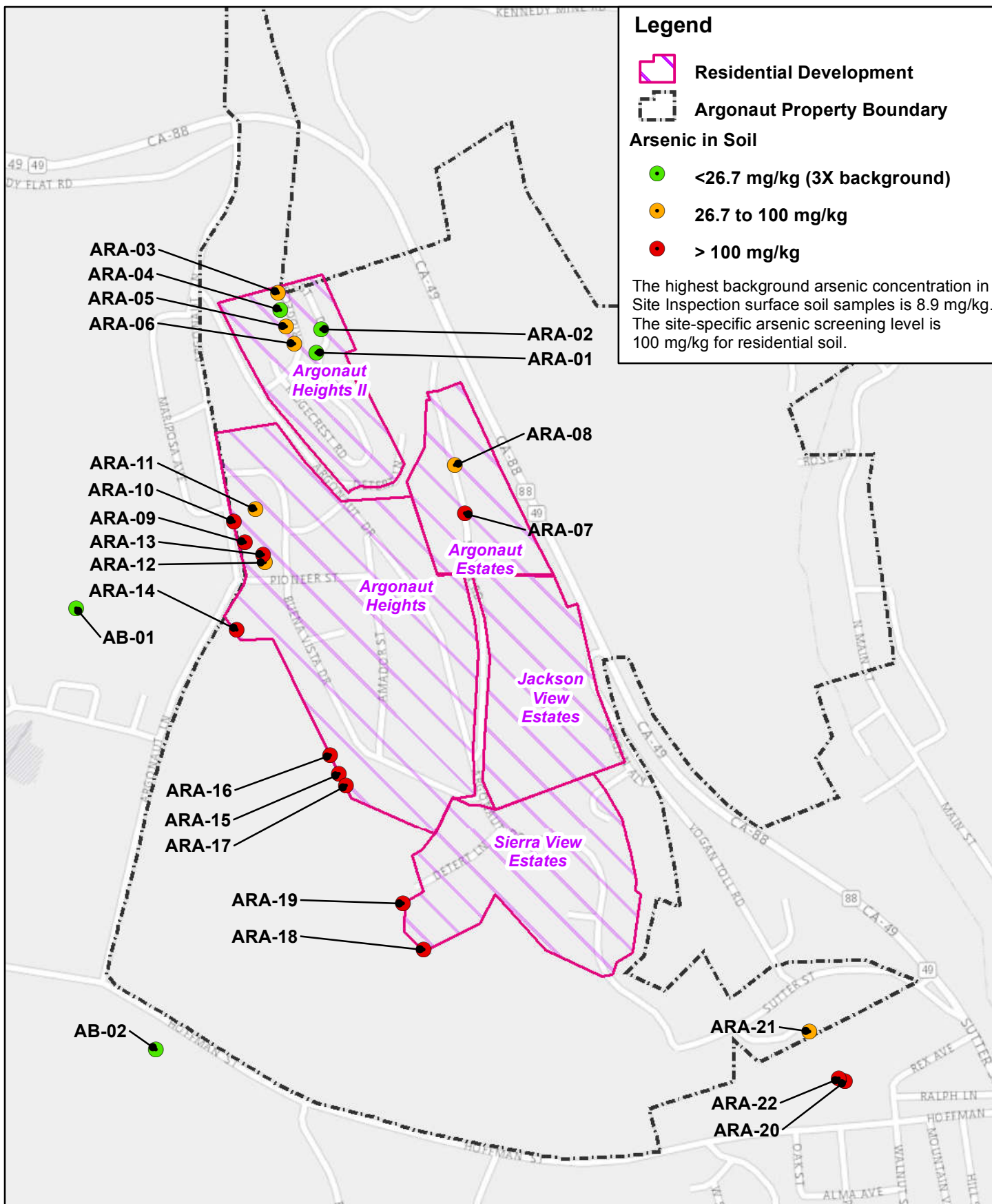


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**FIGURE 7**  
**TAILINGS AREA**  
**SOIL SAMPLING LOCATIONS**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California





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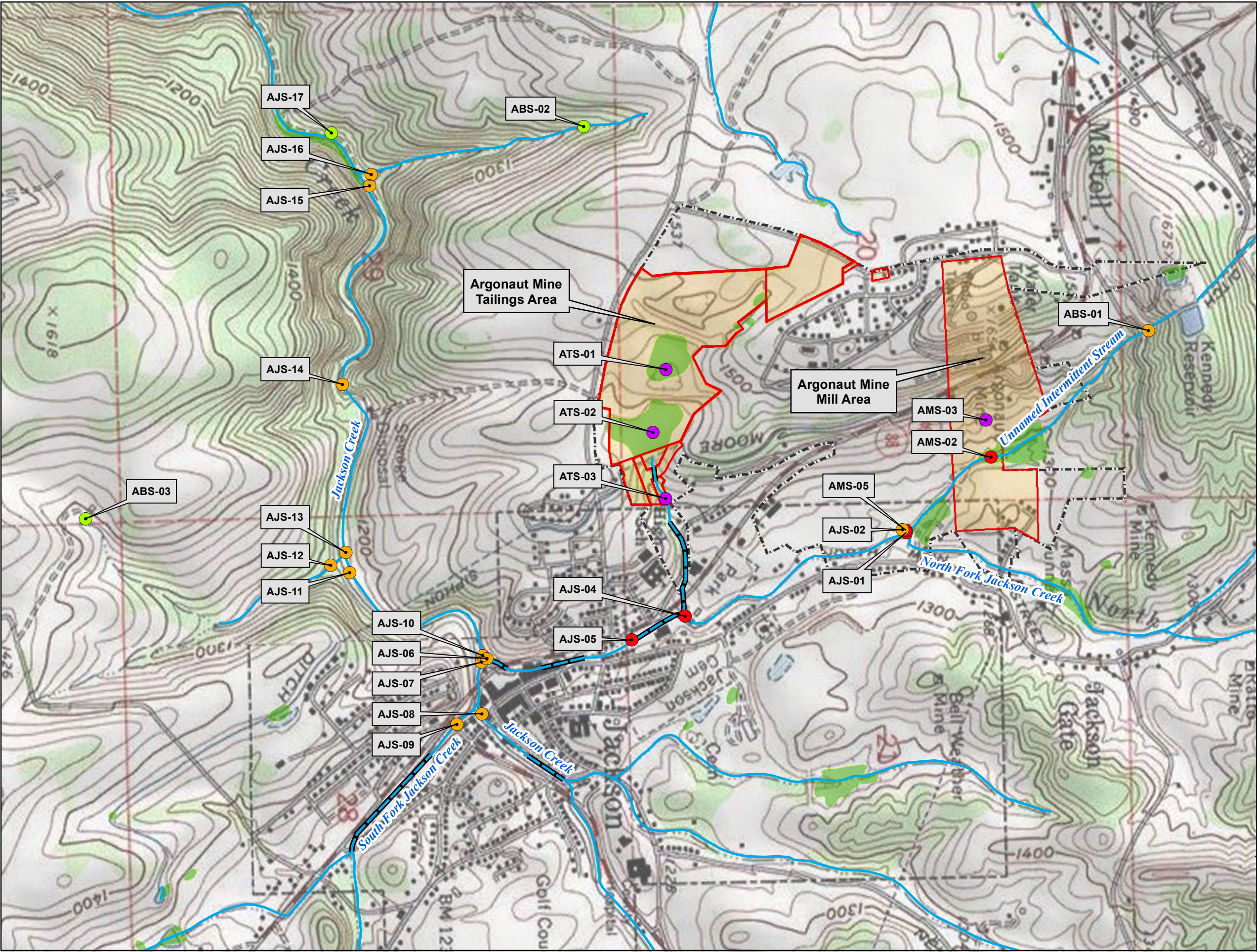
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Pacific  
Southwest



**FIGURE 8**  
**RESIDENTIAL AREA**  
**SOIL SAMPLING LOCATIONS**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California

Project Number:20074.063.085.1009





**Legend**

- Argonaut Mine Site
- Argonaut Property Boundary
- Wetland
- Surface Water
- Underground Culvert

**Arsenic Results in Sediment Samples**

- <5.9 mg/kg
- 5.9 - 59 mg/kg
- 60 to 200 mg/kg
- >200 mg/kg

The highest background arsenic concentration in Site Inspection sediment samples is 3.8 mg/kg.

Sediment screening level for arsenic is 5.9 mg/kg using National Oceanic and Atmospheric Administration threshold-effects-level for the protection of freshwater aquatic life.

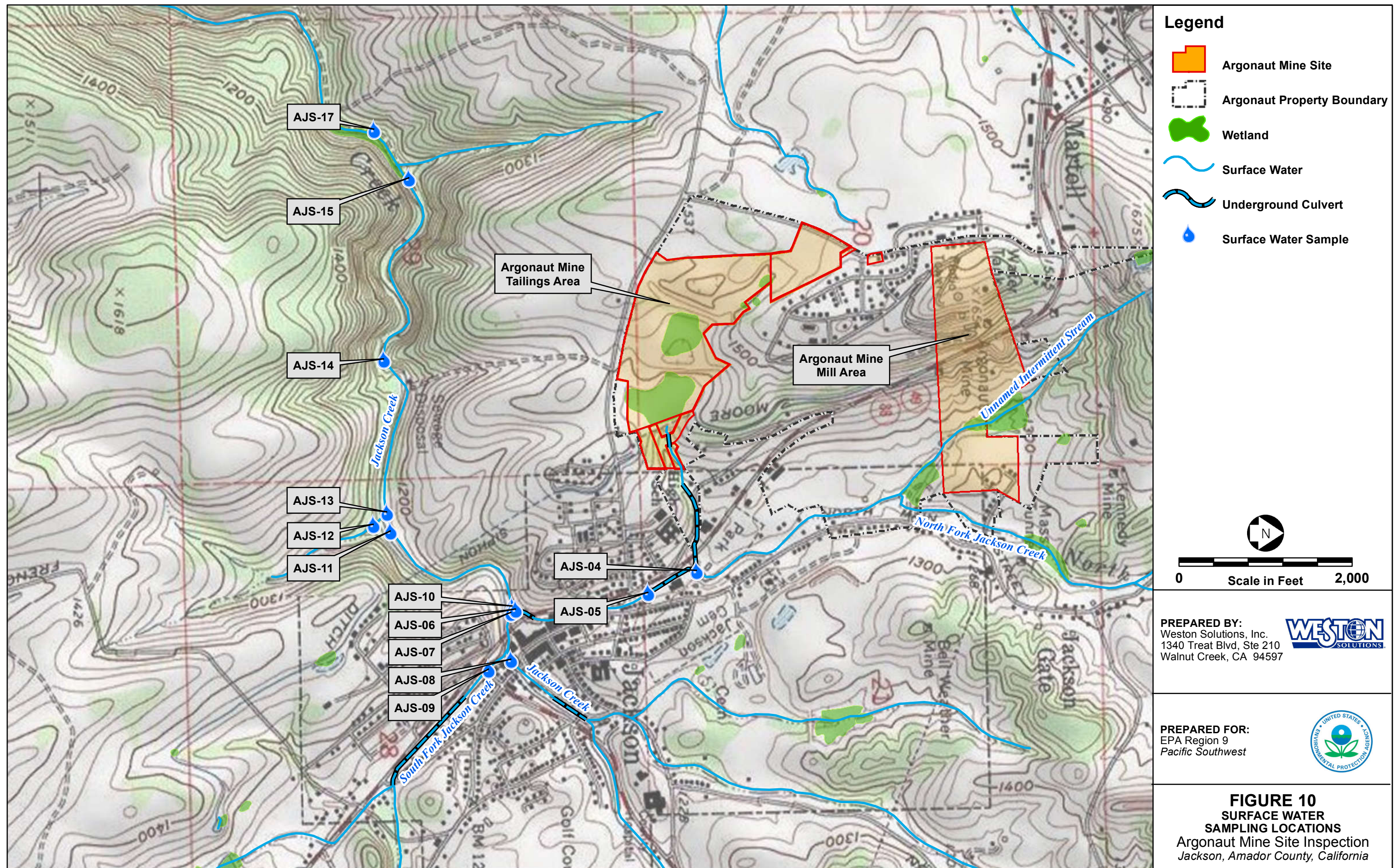


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EPA Region 9  
Pacific Southwest

**FIGURE 9**  
**SEDIMENT SAMPLING LOCATIONS**  
Argonaut Mine Site Inspection  
Jackson, Amador County, California







### 3.3 Deviations from the SAP

The following deviations from the SAP occurred during the field work:

- The SAP specified one sample collected from the tailings dam area at the Mill Area. An additional sample was collected in the vicinity of the tailings dam. The tailings dam was not found due to dense blackberry bushes along the unnamed intermittent stream.
- The SAP specified that residential soil samples would be collected from 11 locations beneath city streets. Instead, a total of 19 residential properties were sampled to provide data to support the soil exposure pathway after access agreements from property owners were obtained.
- Selected soil sampling locations were identified to have two sampling intervals (surface soil and from 1.5 to 2 feet bgs). A sampling hand auger encountered refusal due to rocky soil at 10 locations resulting in shallower sampling intervals, and two locations had no subsurface sampling.
- The planned sediment sampling location (AMS-04) from behind the Mill Area tailings dam was not collected due to dense blackberry bushes along the unnamed intermittent stream.
- Sediment and surface water sampling location AJS-03 was not collected as property access was not granted at the time of the SI sampling.
- Surface water samples could not be collected at sampling locations ABS-01, ABS-02, ABS-03, AMS-01, AMS-02, AMS-03, AMS-05, ATS-01, ATS-02, ATS-03, AJS-01, and AJS-02 due to the absence of water.
- None of the surface water samples (ABS-01, ABS-02, AMS-03, AMS-05, ATS-01, ATS-02, and ATS-03) planned for cyanide analysis as specified in the SAP were collected due to the absence of water at the sampling locations.
- Surface water samples were not analyzed for total hardness by EPA Method 130.2. Hardness was calculated as  $\text{CaCO}_3$  from analytical results of calcium and magnesium.

None of these deviations are expected to have any adverse impact on the data or conclusions of this report.

## **4.0 HAZARD RANKING SYSTEM FACTORS**

### **4.1 Sources of Contamination**

For HRS purposes, a source is defined as an area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance.

Potential hazardous substance sources associated with the Argonaut Mine Site include, but may not be limited to:

- In the Mill Area, a waste rock pile measuring 68,000 cubic yards is located on the east side of Highway 49. Historical documents indicate that 200,000 tons of tailings were present behind the old tailings dam at a location east of the former 40-stamp mill. An area of light gray sands is located east of the former 40-stamp mill and may be processed tailings from a cyanide plant. The gray sands were found to extend to 11 feet bgs. Elevated concentrations of arsenic, lead, and mercury are present in these tailings (Table 4) (GeoSyntec, 2006).
- An estimated 1,075,000 cubic yards of tailings are present in the Tailings Area. Elevated concentrations of arsenic, lead, and mercury are present in these tailings (Table 5) (URS, 2009).

### **4.2 Groundwater Pathway**

In determining a score for the groundwater migration pathway, the HRS evaluates: 1) the likelihood that sources at a site actually have released, or potentially could release, hazardous substances to groundwater; 2) the characteristics of the hazardous substances that are available for a release (i.e., toxicity, mobility, and quantity); and 3) the people (targets) who actually have been, or potentially could be, impacted by the release. For the targets component of the evaluation, the HRS focuses on the number of people who regularly obtain their drinking water from wells that are located within 4 miles of the Site. The HRS emphasizes drinking water usage over other uses of groundwater (e.g., food crop irrigation and livestock watering) because, as a screening tool, it is designed to give the greatest weight to the most direct and extensively studied exposure routes.

Groundwater in most of Amador County is not well defined. The majority of available groundwater is transient and found in fractured rock (Amador, 2007). There are no known drinking water wells within the target distance limit from the Site (Weston, 2014). Therefore, this pathway does not contribute significantly to the listing decision for the site.

### **4.3 Surface Water Pathway**

To determine the score for the surface water pathway, the HRS evaluates: 1) the likelihood that sources at a site actually have released, or potentially could release, hazardous substances to surface water (e.g., streams, rivers, lakes, and oceans); 2) the characteristics of the hazardous substances that are available for a release (i.e., toxicity, persistence, bioaccumulation potential, and quantity); and 3) the people or sensitive environments (targets) who actually have been, or

potentially could be, impacted by the release. For the targets component of the evaluation, the HRS focuses on drinking water intakes, fisheries, and sensitive environments associated with surface water bodies within 15 miles downstream of the site.

#### **4.3.1 Hydrological Setting**

The HRS surface water pathway evaluated in this SI is along the North Fork Jackson Creek to Jackson Creek, 7 miles westward to the Lake Amador Reservoir. Jackson Creek continues beyond the reservoir to flow 7 miles to Dry Creek, which is a tributary to the San Joaquin River that flows to the San Francisco Bay. The 15-mile Target Distance Limit ends in Jackson Creek, approximately 0.5 mile before the confluence to Dry Creek. The North Fork Jackson Creek is an intermittent stream and Jackson Creek is a perennial stream. The North Fork and South Fork of Jackson Creek drain through the Mother Lode Gold Mining District and Jackson Creek passes by several gold, silver, and chromium mines between the Site and Lake Amador. Average annual precipitation in the Site vicinity is approximately 21 inches (Weston, 2014; WRCC, 2015).

Surface water runoff from the waste rock and tailings piles in the Mill Area enter the unnamed intermittent stream east of the property, flow to the North Fork Jackson Creek (intermittent stream) and enter Jackson Creek after approximately 1.3 miles of overland flow. Two wetlands are present in the unnamed intermittent stream upstream of the confluence with North Fork Jackson Creek. The upper wetland has 750 feet of stream bisecting it with 1,500 feet of frontage; the lower wetland has 530 feet of stream or 1,060 feet of frontage.

The tailings impoundments at the Tailings Area are a documented source of arsenic, mercury, and other metals that have impacted the unnamed intermittent stream that flows the length of the property. The intermittent stream is fed by seasonal springs. Surface water runoff at the property is also directed to the intermittent stream. The intermittent stream runs over the gray sands tailings and flows over and through the concrete dam. The intermittent stream continues to flow on the north side of Sutter Street to a culvert where it is directed underground to the North Fork Jackson Creek and enters Jackson Creek after approximately 0.75 mile of overland flow. Two wetlands are present within the intermittent stream upstream of the lower earthen dam and concrete dam. These wetlands have perimeters of 1,580 and 2,313, respectively. Additional wetlands are present in Jackson Creek downstream of the Site (Weston, 2014).

#### **4.3.2 Surface Water Targets**

There are no drinking water diversions in Jackson Creek between the Site and Lake Amador. Lake Amador Reservoir was created in 1965 by damming Jackson Creek. The reservoir is currently used for recreation and fishing, as well as irrigation for portions of the San Joaquin Valley. The reservoir was historically a drinking water source and could potentially be used for drinking water in the future. The reservoir supplies domestic water to 81 homes, Oaks Mobile Home Park, and Lake Amador Resort for bathing and washing; a mandatory bottle water program is in effect for the community since 2001 by the California Department of Public Health. Jackson Creek flows through ranch lands and the surface water could be used for livestock watering. Drinking water for the residents of the City of Jackson is obtained from the Mokelumne River (Amador, 2007; JVID, 2013).

Jackson Creek is not a fishery; however, Lake Amador is a popular recreational fishing resort and is stocked with fish from its own hatchery (Lake Amador, 2015).

The U.S. Fish and Wildlife Service Wetlands Inventory identifies several wetlands on the Tailings Area impoundment basins and along the intermittent stream at the Mill Area. The wetlands inventory also identifies wetland areas further downstream in Jackson Creek (Weston, 2014).

### 4.3.3 Surface Water Pathway Conclusion

A release of hazardous substances from the Argonaut Mine Site to surface water has been established, based on the results of the SI sampling effort. For HRS purposes, a release to surface water is established when a hazardous substance is detected in a hydraulically downstream location at a concentration significantly above background levels, and some portion of the release is attributable to the Site. A hazardous substance is considered to be present at a concentration significantly above background levels when one of the following two criteria is met: (1) the hazardous substance is detected in the contaminated sample, when not detected in the background samples or (2) the hazardous substance is detected in the contaminated sample at a concentration equal to or greater than three times the maximum background level, when detected in the background samples.

As shown in Tables 15 and 16, the release is established to the Tailings Area wetlands and to the Mill Area wetlands. Arsenic and mercury are present in sediments from the Tailings Area wetlands at concentrations significantly above background. Mercury is present in sediments from the Mill Area wetlands at concentrations significantly above background.

The wetlands are located within the overland segment. The overland segment consists of intermittent waterways that flow to Jackson Creek. Based on the results of the SI, an observed release is not documented to Jackson Creek.

**Table 15: Sediment Sampling Establishing an Observed Release to Tailings Area Wetlands**

Sample No.	Sampling Location	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
<b>Background Sample</b>				
ABS-03	Wetland South of Tailings Area	3.8	30.5 J*	0.18
<b>Release Samples</b>				
ATS-01	Tailings Area Wetland	<u><b>1,690</b></u>	95.8	<u><b>0.56</b></u>
ATS-01D	Tailings Area Wetland (duplicate)	<u><b>2,000</b></u>	98.7	<u><b>0.56</b></u>
ATS-02	Tailings Area Wetland	<u><b>204</b></u>	38.8	<u><b>1.5</b></u>

Notes:

\* = Background value is qualified with unknown bias. In accordance with EPA, 1996, value is multiplied by factor.

**Bold and underlined** values are significantly above background. Qualified data are compared in accordance with EPA, 1996.

J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

mg/kg = milligrams per kilogram

**Table 16: Sediment Sampling Establishing an Observed Release to Mill Area Wetlands**

Sample No.	Sampling Location	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
<b>Background Sample</b>				
ABS-01	Intermittent Stream Upstream of Argonaut and Kennedy Mine Workings	48.4	12.8	<0.1
<b>Attribution Sample</b>				
AMS-03	Overland drainage from Mill Area	240	51	4.8
<b>Release Samples</b>				
AMS-02	Mill Area Intermittent Stream	121	36.7	<b><u>3.3</u></b>
AMS-05	Mill Area Intermittent Stream	88.8	18.1	<b><u>1.1</u></b>

Notes:

&lt; = Not detected less than the stated laboratories reporting limit.

**Bold** and underlined values are significantly above background. Qualified data are compared in accordance with EPA, 1996.

mg/kg = milligrams per kilogram.

#### 4.4 Soil Exposure and Air Migration Pathways

In determining the score for the soil exposure pathway, the HRS evaluates: 1) the likelihood that there is surficial contamination associated with the site (e.g., contaminated soil that is not covered by pavement or at least 2 feet of clean soil); 2) the characteristics of the hazardous substances in the surficial contamination (i.e., toxicity and quantity); and 3) the people or sensitive environments (targets) who actually have been, or potentially could be, exposed to the contamination. For the targets component of the evaluation, the HRS focuses on populations that are regularly and currently present on or within 200 feet of surficial contamination. The four populations that receive the most weight are residents, students, daycare attendees, and terrestrial sensitive environments.

In determining the score for the air migration pathway, the HRS evaluates: 1) the likelihood that sources at a site actually have released, or potentially could release, hazardous substances to ambient outdoor air; 2) the characteristics of the hazardous substances that are available for a release (i.e., toxicity, mobility, and quantity); and 3) the people or sensitive environments (targets) who actually have been, or potentially could be, impacted by the release. For the targets component of the evaluation, the HRS focuses on regularly occupied residences, schools, and workplaces within 4 miles of the Site. Transient populations, such as customers and travelers passing through the area, are not counted.

##### 4.4.1 Physical Conditions

The Argonaut Mining Company historically owned approximately 330 acres of land northwest of downtown Jackson. Approximately 90 acres of the former mine property were developed as residential neighborhoods after the mine closed. The Mill Area is located within a residential and rural area and has shafts and workings on the east and west sides of Highway 49. A portion of the Mill Area has been redeveloped with more than 50 individual residential parcels. The Tailings Area is located in a residential and rural area, and is bordered by residential homes, Argonaut High School, and Jackson Junior High School. Exposed tailings and waste rock are present throughout the Site. The Site is fenced, but accessible to the public (Argonaut, undated).

#### 4.4.2 Soil Exposure and Air Targets

Areas on and around the Mill Area and Tailings Area have been developed into the Argonaut Heights, Argonaut Heights II, Argonaut Estates, Jackson View Estates, and Sierra View Estates residential neighborhoods. Jackson Junior High School is located immediately to the east of the Site. Some of these developments were built on waste rock piles, tailings, and contaminated soils associated with the Site (ACEHD, 1994a; ACEHD, 1994b; ACEHD, 2006).

Soil samples collected from thirteen residences in the site vicinity, as well as Jackson Junior High School, contained arsenic, lead, and/or mercury at concentrations significantly above background. According to the United States Census, there are an average of 2.32 persons per household in Amador County (USCB, 2015). Jackson Junior High School has 345 students and 10 staff (CADOE, 2015). Residential and school soil sampling results that are significantly above background are presented in Table 17 below.

**Table 17: Soil Exposure Pathway Targets**

Sampling Location	Sample No.	Sample Depth (feet)	Sample Rationale	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
AB-01	AB-01-0	0 - 0.5	Background	8.9	14.8 J	0.15
	AB-01-1.5	1.0 - 1.5	Background	2 J-	9 J	<0.11
AB-02	AB-02-0	0 - 0.5	Background	3.1 J-	11.2 J	<0.10
	AB-02-1.5	1.0 - 1.5	Background	1.2 J-	7.1 J	<0.11
<b>3x highest background</b>				<b>26.7</b>	<b>63.9*</b>	<b>0.45</b>
ARA-07	ARA-07-0	0 - 0.5	Residence	<u><b>68.5 J+</b></u>	25.6 J	0.14
	ARA-07-1	1.5 - 2	Residence	<u><b>148</b></u>	21.5	0.16
ARA-08	ARA-08-0	0 - 0.5	Residence	<u><b>68.3 J+</b></u>	13	0.081 J
ARA-09	ARA-09-0	0 - 0.5	Residence	<u><b>1,380 J+</b></u>	<u><b>226</b></u>	<u><b>1.4</b></u>
	ARA-09-2	1.5 - 2	Residence	<u><b>39,900 J+</b></u>	<u><b>3,220 J</b></u>	<u><b>193</b></u>
ARA-10	ARA-10-0	0 - 0.5	Residence	<u><b>143 J+</b></u>	<u><b>92.6</b></u>	0.3
	ARA-10-2	1.5 - 2	Residence	<u><b>655 J+</b></u>	50.5	0.43
	ARA-10-2D	1.5 - 2	Residence	<u><b>634</b></u>	44.4	0.37
ARA-11	ARA-11-0	0 - 0.5	Residence	<u><b>47.3 J+</b></u>	43.8 J	0.14
ARA-12	ARA-12-2	1.5 - 2	Residence	<u><b>58.6 J+</b></u>	19.2 J	0.12
ARA-13	ARA-13-0	0 - 0.5	Residence	<u><b>376 J+</b></u>	<u><b>141</b></u>	<u><b>1.1</b></u>
	ARA-13-1	1.5 - 2	Residence	<u><b>1,200 J+</b></u>	<u><b>225</b></u>	<u><b>1.8</b></u>
ARA-14	ARA-14-0	0 - 0.5	Residence	<u><b>225 J+</b></u>	36.5 J	<u><b>1.0</b></u>
	ARA-14-1	1.5 - 2	Residence	<u><b>49.8 J+</b></u>	13 J	0.35
	ARA-14-1D	1.5 - 2	Residence	<u><b>47.8</b></u>	12.1 J	0.33
ARA-15	ARA-15-0	0 - 0.5	Residence	<u><b>206 J+</b></u>	<u><b>564</b></u>	<u><b>1.1</b></u>
	ARA-15-1	1.5 - 2	Residence	<u><b>269 J+</b></u>	<u><b>286</b></u>	<u><b>3.3</b></u>
ARA-16	ARA-16-0	0 - 0.5	Residence	<u><b>139</b></u>	<u><b>89.6</b></u>	0.28
	ARA-16-1	0.5 - 1	Residence	<u><b>147</b></u>	<u><b>121</b></u>	<u><b>0.85</b></u>
ARA-17	ARA-17-0	0 - 0.5	Residence	<u><b>116</b></u>	24.3	0.35
	ARA-17-2	1.5 - 2	Residence	<u><b>123</b></u>	30	0.2



Sampling Location	Sample No.	Sample Depth (feet)	Sample Rationale	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
ARA-18	ARA-18-0	0 - 0.5	Residence	<u>310</u>	46	<u>0.63</u>
	ARA-18-1.5	1 - 1.5	Residence	<u>423</u>	<u>115</u>	<u>1.4</u>
ARA-19	ARA-19-0	0 - 0.5	Residence	<u>55.3</u>	10.1 J	0.033 J
	ARA-19-1	1.5 - 2	Residence	<u>122</u>	8.5 J	0.043 J
ARA-20	ARA-20-0	0 - 0.5	Jackson Jr. High	<u>239</u>	20.2	0.2
ARA-21	ARA-21-0	0 - 0.5	Jackson Jr. High	<u>57.6</u>	14.7 J	0.19
ARA-22	ARA-22-0	0 - 0.5	Jackson Jr. High	<u>659</u>	45.3	0.33

Notes:

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< = Not detected less than the stated laboratories reporting limit.

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J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

J+ = The result is an estimated quantity, but the result may be biased high.

J- = The result is an estimated quantity, but the result may be biased low.

mg/kg = milligrams per kilogram

#### 4.4.3 Soil Exposure and Air Pathway Conclusions

Surface soil contamination associated with the Argonaut Mine Site has been established, based on the results of the SI sampling effort. For HRS purposes, a release to soil is established when a hazardous substance is detected at a concentration significantly above background levels, and some portion of the release is attributable to the site. A hazardous substance is considered to be present at a concentration significantly above background levels when one of the following two criteria is met: (1) the hazardous substance is detected in the contaminated sample, when not detected in the background samples or (2) the hazardous substance is detected in the contaminated sample at a concentration equal to or greater than three times the maximum background level, when detected in the background samples.

Areas of Observed Contamination are documented in the Mill Area, the Tailings Area, the residential neighborhood, and Jackson Junior High School, as shown in Tables 17 and 18.

**Table 18: Soil Exposure Pathway Observed Contamination, Mine Property**

Sampling Location	Sample No.	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
<b>Background Samples</b>					
AB-01	AB-01-0	0 - 0.5	8.9	14.8 J	0.15
	AB-01-1.5	1.0 - 1.5	2 J-	9 J	<0.11
AB-02	AB-02-0	0 - 0.5	3.1 J-	11.2 J	<0.10
	AB-02-1.5	1.0 - 1.5	1.2 J-	7.1 J	<0.11
<b>3x highest background</b>			<b>26.7</b>	<b>63.9*</b>	<b>0.45</b>
<b>Argonaut Mine Mill Area</b>					
AMA-01	AMA-01-0	0 - 0.5	<u>115 J-</u>	21.9	0.13
	AMA-01-0D	0 - 0.50	<u>127</u>	22 J	<0.10
	AMA-01-2	1.5 - 2	<u>84.2</u>	5 J	<0.11
	AMA-01-2D	1.5 - 2	<u>81.5</u>	3.6 J	<0.11

Sampling Location	Sample No.	Sample Depth (feet)	Arsenic (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
AMA-02	AMA-02-0	0 - 0.5	<u>26.8</u>	16.3	<0.1
	AMA-02-2	1.5 - 2	<u>48</u>	5.3 J	<0.12
AMA-03	AMA-03-0	0 - 0.5	<u>66.1</u>	27.8	0.21
AMA-04	AMA-04-0	0 - 0.5	<u>108</u>	13.6	0.11
	AMA-04-2	1.5 - 2	<u>97</u>	8.9 J	<0.12
AMA-05	AMA-05-0	0 - 0.5	<u>154</u>	<u>4,060</u>	<u>4.1</u>
AMA-06	AMA-06-0	0 - 0.5	<u>339</u>	<u>47,200</u>	<u>17.2</u>
AMA-07	AMA-07-0	0 - 0.5	<u>743</u>	<u>20,800</u>	<u>348</u>
AMA-08	AMA-08-0	0 - 0.5	<u>235</u>	<u>763</u>	<u>1.6</u>
	AMA-08-2	1.5 - 2	<u>187</u>	8.2 J	0.24
AMA-09	AMA-09-0	0 - 0.5	<u>168</u>	<u>84.2</u>	<u>0.62</u>
	AMA-09-2	1.5 - 2	<u>161</u>	53.5	<u>2.4</u>
AMA-10	AMA-10-0	0 - 0.5	<u>185</u>	<u>80.2</u>	0.38
AMA-11	AMA-11-0	0 - 0.5	<u>221</u>	41.7	0.26
AMA-12	AMA-12-0	0 - 0.5	<u>60.2</u>	46.1	0.33
AMA-13	AMA-13-0	0 - 0.5	<u>234</u>	35.9	<u>0.61</u>
	AMA-13-2	1.5 - 2	<u>120</u>	<u>89.4</u>	0.3
AMA-14	AMA-14-0	0.5 - 1	<u>54.6</u>	41 J	<u>80.5</u>
	AMA-14-1	1.5 - 2	<u>78.8</u>	44.2 J	<u>111</u>
AMA-15	AMA-15-0	0 - 0.5	<u>86.2</u>	<u>2,920</u>	<u>22.3</u>
	AMA-15-2	1.5 - 2	13.4	<u>130</u>	<u>4.3</u>
AMA-16	AMA-16-0	0 - 0.5	<u>69.5</u>	17	<u>0.87</u>
AMA-17	AMA-17-1	1.5 - 2	<u>27.7</u>	19.1	0.42
	AMA-17-1D	1.5 - 2	<u>27.9</u>	19.1	<u>0.56</u>
AMA-18	AMA-18-0	1.5 - 2	<u>75.4</u>	29	<u>2.4</u>
<b>Argonaut Mine Tailings Area</b>					
ATA-01	ATA-01-0	0 - 0.5	<u>54.8</u>	13	<0.1
ATA-02	ATA-02-0	0 - 0.5	<u>49.4</u>	8.4	0.38
ATA-03	ATA-03-0	0 - 0.5	<u>3,490</u>	<u>193</u>	<u>2.5</u>
	ATA-03-2	1.5 - 2	<u>502</u>	8.7	0.05 J
ATA-04	ATA-04-0	0 - 0.5	<u>362</u>	11.8	0.062 J
	ATA-04-0D	0 - 0.5	<u>347</u>	8.8	<0.1
	ATA-04-2	1.5 - 2	<u>266</u>	10.9	0.087 J
ATA-05	ATA-05-1.5	1 - 1.5	<u>237</u>	27.9	<u>0.52</u>

## Notes:

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J = The result is an estimated quantity. The associated value is the approximate concentration of the analyte in the sample.

J+ = The result is an estimated quantity, but the result may be biased high.

J- = The result is an estimated quantity, but the result may be biased low.

mg/kg = milligrams per kilogram

## **5.0 REMOVAL EVALUATION CONSIDERATIONS**

The National Contingency Plan [40 CFR 300.415 (b) (2)] authorizes the EPA to consider emergency response actions at those sites that pose an imminent threat to human health or the environment. For the following reasons, a referral to Region 9's Emergency Response Office does appear to be necessary:

- Residential neighborhoods are located adjacent to the Tailings Area and homes have been constructed on land formerly utilized for the storage of tailings containing hazardous substances.
- Hazardous substances associated with the Site are found in surface soil at residential properties and the Jackson Junior High School within 200 feet of occupied structures.
- The DTSC does not currently have the resources to conduct removal activities at the Site or offsite properties.

## 6.0 SUMMARY

The Argonaut Mine Site is located in the City of Jackson, Amador County, California and is one of many gold mines belonging to the Mother Lode Gold Mining District along the foothills of the Sierra Nevada Mountains. The Argonaut Mine historically occupied approximately 330 acres of land northwest of downtown Jackson. The Argonaut Mine Site comprises two principal areas: the Mill Area (shafts, buildings, former milling areas, and waste rock piles) and the Tailings Area (unprocessed and semi-processed ore storage area, cyanide plant, and tailings impoundments). The property was sold after the mine closed, and approximately 90 acres of the former property have been developed as residential neighborhoods.

The mine operated from 1850 through 1942. The raw ore was processed at a 40-stamp mill on the east side of Highway 49 until 1916 when it was replaced by a 60-stamp mill located west of Highway 49. Processed tailings from the 40-stamp mill were deposited east (downslope) of the mill. Processed tailings from the 60-stamp mill were transported to the Tailings Area located south of the mill. Both stamp mills used mercury amalgamation to extract gold. In 1917, a 150-ton cyanide plant was installed east of the former 40-stamp mill. The cyanide plant processed 200,000 tons of tailings that were stored in the tailings dam at the Mill Area. Additional cyanide plants were installed in 1918 and 1941. Between 1917 and 1942, the cyanide-processed tailings were placed in the impoundments at the Tailings Area behind a series of earthen dams and a concrete dam.

Environmental sampling has been conducted at the Site by various federal, state, and local regulatory agencies since 1987. In October 1998, an EPA Preliminary Assessment was conducted at the Tailings Area. Based on the Preliminary Assessment, the EPA decided that further assessment was needed under CERCLA. In 2008, EPA completed a Site Reassessment and referred the Site to the DTSC for enforcement action. In August 2013, the DTSC requested assistance from the EPA to conduct a removal action at the Tailings Area. From 2013 through 2014, EPA conducted a Removal Site Evaluation at the Tailings Area documenting arsenic, lead, and mercury concentrations above Site screening levels in surface soil and shallow subsurface soil samples. From 2014 through 2015, the EPA, in coordination with the USACE, conducted a stability evaluation of the concrete dam. The results of the stability evaluation showed that the dam failed to meet the minimum Engineering Manual requirements and the USACE recommended the dam should undergo a 35% repair/retrofit evaluation to avoid possible failure and loss of life downstream. In March 2015, the EPA conducted a removal of tailings from the vacant lot located north of the Tailings Area and placed the excavated tailings in a repository located in the northern portion of the Tailings Area. Additionally, the EPA conducted a removal assessment of 19 residential homes in the Argonaut Heights and Sierra View Estates neighborhoods.

From July 28, 2014 through August 1, 2014, the WESTON sampling team collected soil, sediment and surface water samples from the Site as part of an EPA SI. As a result of the SI sampling, hazardous substance sources containing elevated concentrations of arsenic, lead, and mercury were documented at the Site. In addition, a release of hazardous substances attributable to the site was documented to surface water, and observed contamination was documented in residential soils and soils of Jackson Junior High School.



The following pertinent Hazard Ranking System factors are associated with the Site:

- Hazardous substance sources at the Argonaut Mine Site have been documented. An estimated 1,075,000 cubic yards of tailings are present in the Tailings Area. In the Mill Area, a waste rock pile measuring 68,000 cubic yards is located on the east side of Highway 49. Historical documents indicate that 200,000 tons of tailings were present behind the old tailings dam at a location east of the former 40-stamp mill. An area of light gray sands is located east of the former 40-stamp mill and may have been processed tailing from a cyanide plant. The gray sands were found to extend to 11 feet bgs. Elevated concentrations of arsenic, lead, and mercury are present in these tailings.
- A release of hazardous substances from the Argonaut Mine Site to surface water has been established. The release is established to the Tailings Area wetlands and to the Mill Area wetlands. Arsenic and mercury are present in sediments from the Tailings Area wetlands at concentrations significantly above background. Mercury is present in sediments from the Mill Area wetlands at concentrations significantly above background.
- Surface soil contamination associated with the Argonaut Mine Site has been established. Areas of observed contamination are documented in the Mill Area, the Tailings Area, the residential neighborhood, and Jackson Junior High School.

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