ALMADEN MINE
PRELIMINARY ASSESSMENT REPORT
WASHINGTON COUNTY, IDAHO

STATE OF IDAHO

DEPARTMENT OF ENVIRONMENTAL QUALITY

December 2002

Submitted To:
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

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LIST OF ACRONYMS

Acronym	Definition
amsl	above mean sea level
DEQ	Department of Environmental Quality
EPA	U. S. Environmental Protection Agency
PA	Preliminary Assessment
PPE	Probable Point of Entry
TDL	Target Distance Limit

1. INTRODUCTION

The Department of Environmental Quality (DEQ) was tasked by the United States Environmental Protection Agency (EPA) to provide technical support for completion of a preliminary assessment (PA) at the Almaden Mine site in Washington County, Idaho. DEQ completed PA activities in accordance with the goals listed below.

The specific goals for the Almaden Mine PA, identified by the DEQ, are to:

- Determine the potential threat to public health or the environment posed by the site.
- Determine the potential for a release of hazardous constituents into the environment.
- Determine the potential for placement of the site on the National Priorities List.

Completion of the PA included reviewing existing site information, collecting receptor information within the site's range of influence, determining regional characteristics, and conducting a site visit. This document includes a discussion of site background information (Section 2), a discussion of migration/exposure pathways and potential targets (Section 3), and a list of pertinent references. Photographic documentation is provided in Appendix A.

2. SITE BACKGROUND

2.1 SITE LOCATION

Site Name:	Almaden Mine
CERCLIS ID No.:	
Location:	Washington County, Idaho
Latitude:	44^0 14' 25" N
Longitude:	116^0 42' 53" W
Legal Description:	Common corner of S 4 and 5, T 10N, R 3 W and S 32 and 33, T 11 N, R 3 W, Boise Meridian
Site Owners:	Harold H. and Dean J. Davies 1545 Ross Rd. Weiser, ID 83672
Site Contact:	Owners

2.2 SITE DESCRIPTION/OWNERSHIP HISTORY

Almaden Mine is a former mercury mine located in Washington County, Idaho, approximately 11 miles east of the town of Weiser (Figure 2-1). The area is a semi-arid dissected plateau drained by the Weiser River and its tributaries. The site is located on Nutmeg Mountain, a prominent nearly flat-topped spur that projects from the upper eastern rim of the valley of the Weiser River. The mine lies on the crest of a long anticline in Tertiary beds where there is a local structural depression, in part the result of faulting, at an approximate elevation of 3,500 feet (Anderson, 1941). The site is most easily approached by all-weather dirt roads from the northwest and southeast where the slopes do not exhibit cliff bands. A locked gate precludes driving all the way to the mine; the final approach to the mine must be made on foot Site features include a quarry, tailings, a pozzolan ore pile, remnants of a rotary kiln, and miscellaneous debris and building foundations (Figures 2-2 and 2-3).

Based upon tax records, the site currently appears to be owned by Harold and Dean Davies of Weiser, Idaho (Washington County, 2002). Repeated attempts to contact the Davies to discuss the most recent site history and future plans for the site were unsuccessful.

2.3 SITE OPERATIONS AND WASTE CHARACTERISTICS

Ore deposits were first discovered in 1936. The year 1938 saw the first exploratory drilling and development by the Idaho Almaden Mines Company, including trenching, sinking shafts to determine the thickness of the deposit, and drilling. The initial results of the drilling revealed an ore body 250 feet long by 175 feet wide with an average depth of 16 feet. The company installed a 3-foot by 48-foot 50 ton-per-day rotary furnace and condensing system in the spring of 1939, and production began on May 18, 1939 (Ross, 1956). This furnace operated continuously until December 1942. At that time, it was the seventh largest producer of mercury in the country. In addition to strip mining, the mine was worked by underground methods. The underground mining was commenced because the overburden east of the quarry was too thick to remove economically and the underground mine protected the miners from the weather. "By the end of 1939, there were 17 shafts on the property in addition to the quarry and a small number of cuts. The deepest shaft was 155 feet with levels at 30 and 50 feet. There were about 550 feet of underground shafts plus about 80 feet of crosscuts" (Mitchell, 2000, p. 17). The mine was closed in December 1942. "At that time, workings at the mine consisted of four tunnels, twenty-four shafts, six raises, fourteen crosscuts, and twelve drifts for an approximate total development of 3,350 feet. This included 700 feet of shafts, 150 feet of raises, and 2,500 feet of tunnels, crosscuts and drifts" (ibid. p.18). At its maximum extent, the quarry was reputed to be about 270 feet in length with a maximum width of about 135 feet and a maximum depth of 30 feet (Ross, 1956).

Due to low prices for mercury, the mine sat "dormant" through approximately 1954-55 when Rare Metals Corporation acquired a lease with options and conducted an extensive exploration of the property. Four ore bodies (one new) were delineated, and a new plant

was built over the foundations of the old Idaho Almaden Mines Company's plant. This included an "oil-fired 5.5-foot by 90-foot Gould rotary furnace which was said to be the largest in the world at the time" (Mitchell, 2000, p. 23). A new condenser accompanied the new furnace.

Rare Metals produced the first mercury on September 30, 1955. The new workings were mostly open pits. The newly installed condenser consisted of 76 pipes 18 inches in diameter and 18 feet long (steel and cast iron) and included two redwood tanks (12 feet by 20 feet high). The burnt rock was discharged into a second kiln that measured 6 feet by 40 feet. This kiln served as a conveyor to discharge the rock out of the mill building over the top of a nearly sheer cliff several hundred feet high (Reynolds, 1956). The second kiln also served to draw off the heat from the baked ore for use elsewhere in the plant. The Rare Metals Corporation closed the mine and mill on December 5, 1961, "due to low mercury prices and depleted reserves" (Mitchell, 2000, p. 32).

With a renewed interest in mercury and an increase in mercury prices during the Vietnam War, El Paso Natural Gas Company reopened the mine in March 1965. In addition, the company constructed a plant to produce "pozzolan" as a byproduct of its mercury operation. "The plant would process calcined opalite, a waste product from furnacing mercury ore, to make pozzolan for use as a concrete additive for dam construction projects" (ibid. p.33) in the Pacific Northwest. The material came from two of the five pits the company was operating.

The mine continued to supply both mercury and pozzolan through 1972 when the mine closed after producing only 161 flasks of mercury. The site has not since been mined for mercury.

Activity picked up again in 1983 when Freeport Minerals and Homestake Mining began re-evaluating the site for both gold and mercury deposits. In 1985, Canu Resources Ltd. and Ican Resources Ltd. signed an agreement with Homestake Mining to further evaluate the site. Canu and Ican drilled 103 holes and identified two near-surface zones in the hot springs-type gold deposit. "The work outlined 12.5 million tons of ore with an estimated average grade of 0.035 ounces of gold per ton" (ibid. p.34).

By June 1986, the Canu-Ican venture had completed over 230 holes. This additional drilling boosted the reserves to 18 million tons averaging 0.035 to 0.045 ounces of gold per ton. In October of that year, Ican and Canu merged to form Ican Minerals (ibid.).

Ican eventually completed 36 more holes in 1987 increasing reserves to 25 million tons. From 1988 through 1990, Ican continued to evaluate reserves and drilled two 700-foot deep holes to test for feeder veins at depth. These holes demonstrated the main zone of the deposit was 250 feet deep and contained 40 million tons of 0.025 ounces gold per ton (ibid.).

In 1991, Amax Exploration leased the Almaden Mine from Ican. Amax conducted additional exploration in 1991 and 1992 and metallurgical modeling and new reserve

calculations in 1993. In 1993, interest in the site appeared to wane as Amax merged with Cyprus Minerals and redirected its efforts overseas.

Between 1939 and 1962, records show the Almaden Mine produced approximately 22,596 flasks of mercury from a minimum of 506,615 tons of ore. However, data was not recorded for all years. Extrapolating data to the years when they were not reported, a more realistic estimate of 861,000 tons of ore was obtained. "In addition, the mine produced approximately 73,100 tons of pozzolan between 1966 and 1969" (ibid. p. 40). All of these figures are inexact due to inconsistencies over the years in how available data was reported.

FIGURE 2-1

Fig. 2-1. Site Vicinity Map; Almaden Mine

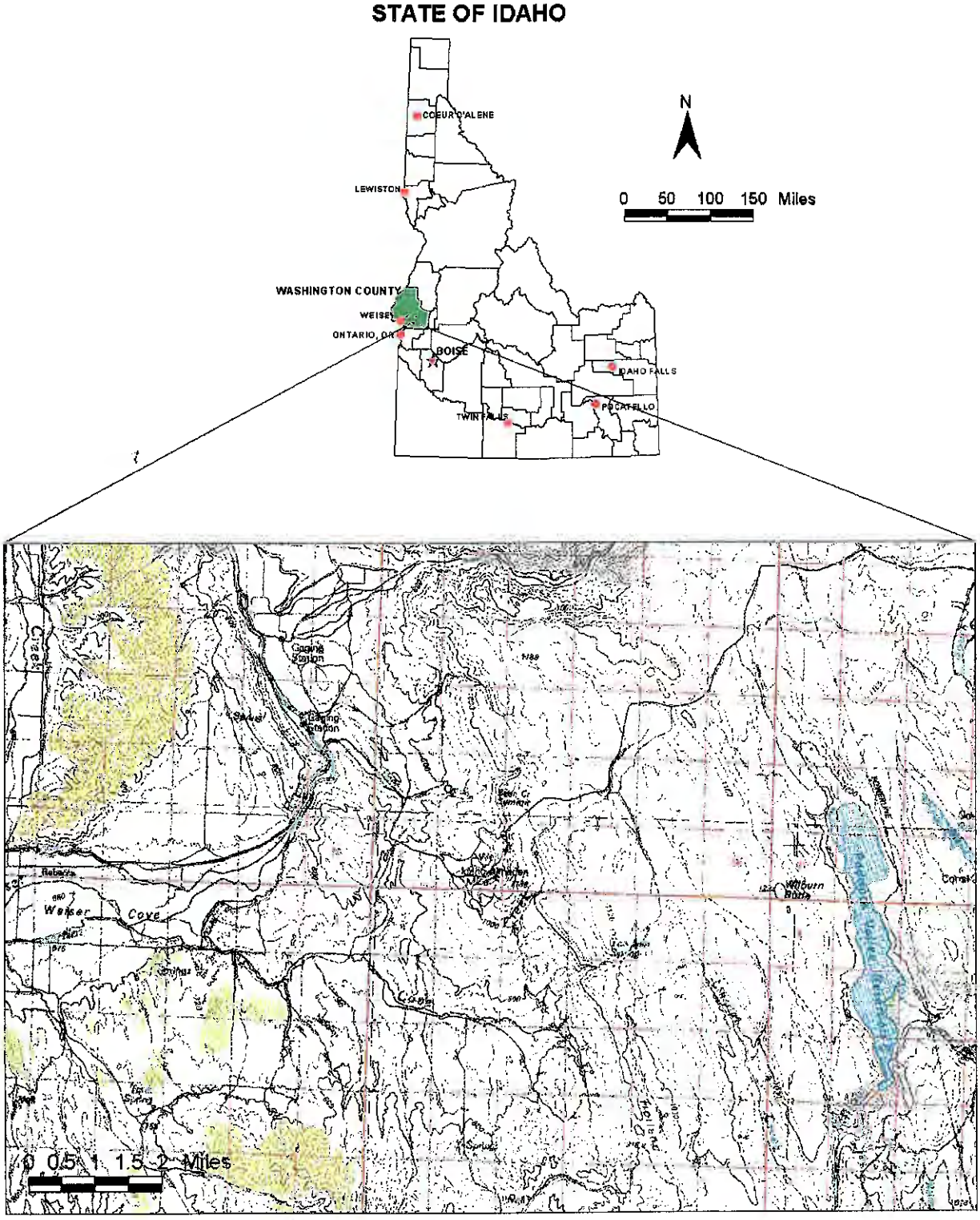


FIGURE 2-2

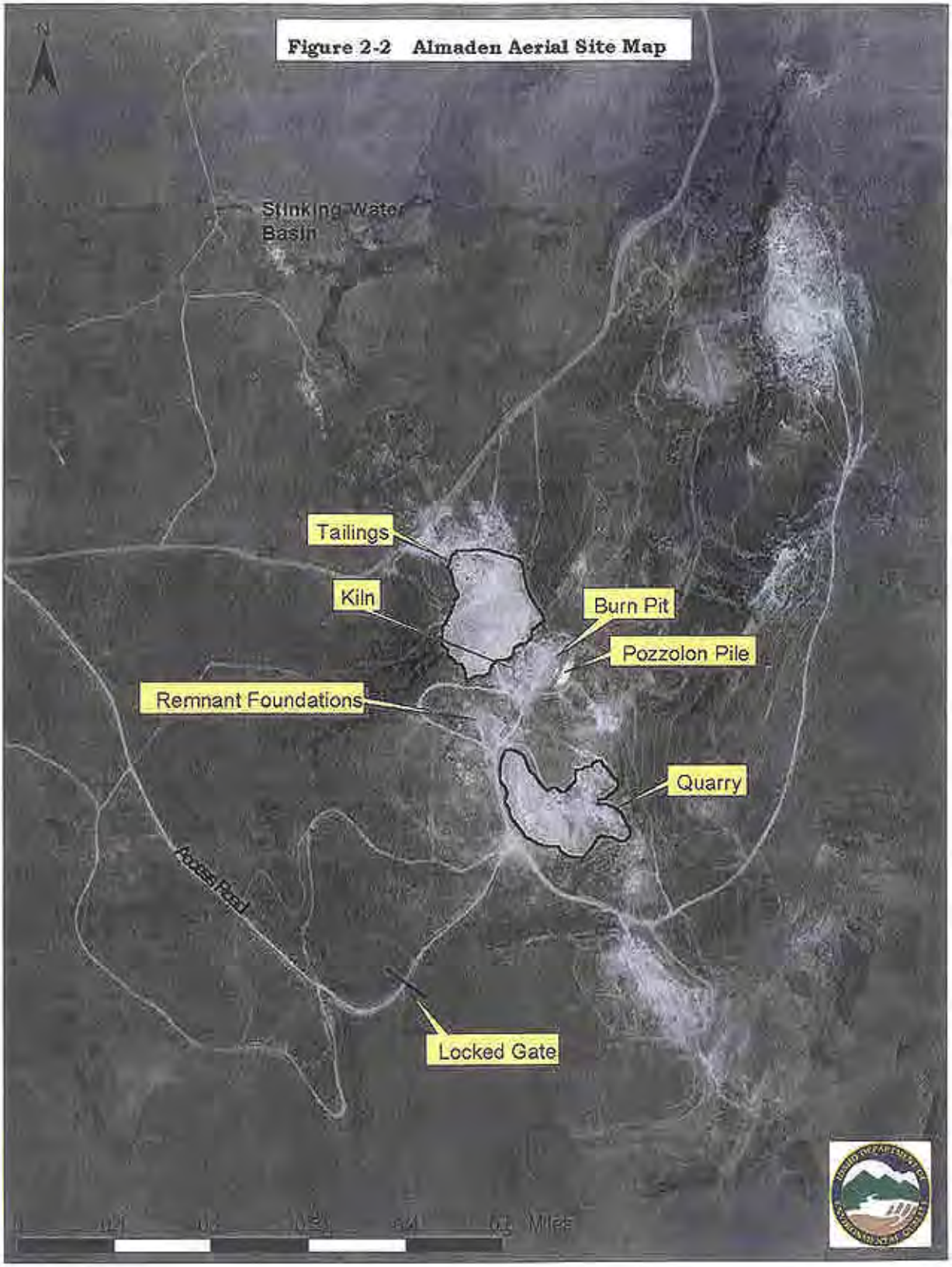


Figure 2-2 Almaden Aerial Site Map
Stinking Water Basin
Tailings
Kiln
Burn Pit
Pozzolon Pile
Remnant Foundations
Quarry
Locked Gate
Miles

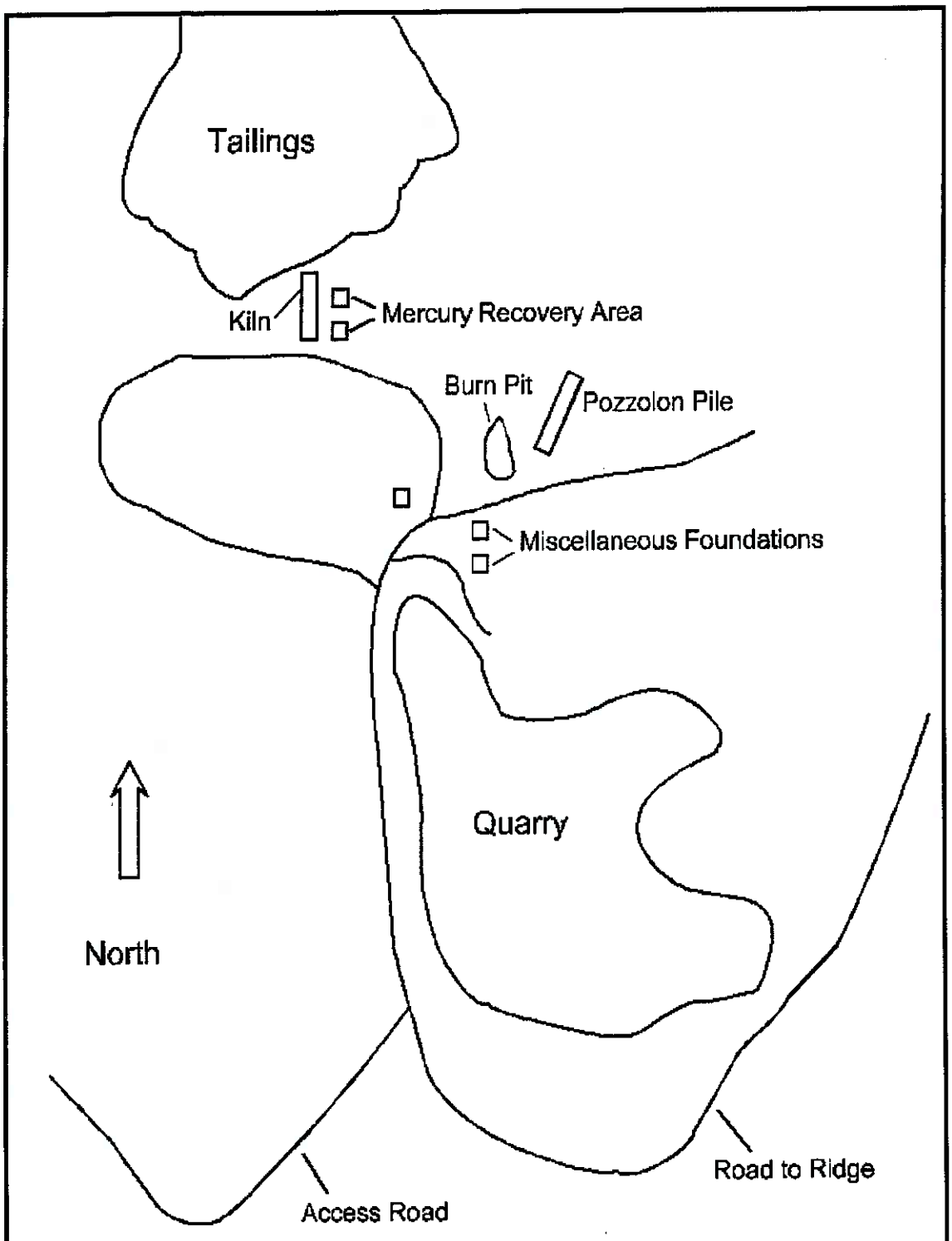


Figure 2-3 Almaden Mine Site

2.4 DEQ SITE ACTIONS

DEQ conducted a site visit on June 27, 2002. The primary site features included a quarry, waste rock piles, burn pits, numerous foundations, remnants of the rotary kiln and associated equipment, tailings, and a pile of unknown origin and content, possibly pozzolan ore (Figure 2-3, Appendix A). Based on historical information there are also collapsed adits that were not apparent or recognized as such during the site visit. Photographic documentation is provided in Appendix A. The photographs are labeled Mvc-821f through Mvc-837f. The site was accessible by road from the west, although a locked gate barred access to the remaining approximate 200 yards of road leading to the site.

The upper part of the site, the prominent ridge above and east-northeast of the quarry, was absent of any obvious structures or structural remnants, although a pit (approximately 50 feet by 75 feet by 7 feet) was observed on the ridge. There was also a road leading up to the ridge crest from the south (Figure 2-3).

The lower and relatively flat part of the site contains all of the obvious mine features. The largest of these is the quarry (Mvc-821f and –822f), with approximate dimensions similar to those cited for the year 1942: 270 feet in length, 135 feet in width, and 30 feet in depth (Mitchell, 2000). The quarry occupies the entire central part of the site located in the flat portion of the Nutmeg Mountain crest. The western and northwestern parts of this area contain the last remnants of the mine including the rotary kiln (Mvc-825f, -828f, and -830f). Based on the dimensions observed, this kiln was probably the furnace used to bake the ore and drive off mercury. Judging from historical photographs, the foundations adjacent to the kiln (Mvc-830f) probably supported the ore bins, crushing plant, condenser system and redwood scavenger tanks (Mitchell, 2000). The remaining foundations (Appendix A) observed around the site are of unknown origin, but obviously supported features important to the mine. None of the former adits cited in reports were obvious and presumably are collapsed with no present surface expression.

Other features associated with the lower mine site were at least two burn pits/trash piles (Mvc-823f and –837f), the pozzolan pile (Mvc-832f, -835f and -836f) and the tailings on the slope overlooking Stinking Water Basin (Mvc-833f and –834f).

3. MIGRATION/EXPOSURE PATHWAYS AND TARGETS

3.1 GROUND WATER MIGRATORY PATHWAY

The mine is found in moderately consolidated sandstones and siltstones of the Payette Formation deposited in Lake Payette - one of the largest of the lakes impounded behind basalt lava flows during late Miocene time (Alt, 1989). " The sedimentary rocks are largely arkosic, but also contain some tuffaceous or diatomaceous beds (Mitchell, 2000, p. 1).

The sandstones are well sorted, moderately coarse, rounded to subangular grains with finer material in the interstices of some beds, but generally highly porous (Anderson, 1941). The structure of the area is characterized by a series of broad-crested northwest trending asymmetrical anticlines and their accompanying synclines (Ross, 1956). The Nutmeg Mountain anticline is faulted and the crest is flattened and depressed (Mitchell, 2000). Two sets of faults are found at the mine site, trending north and northwest, respectively. The faulting provided the conduits for the mineralization of the sandstones (ibid.).

"The mercury deposits occur within sedimentary rocks that have been replaced more or less by silica, usually in the form of opalite (an aggregate of silica replacement minerals so fine that it looks like opal)" (ibid. p. 4). The mine represents an epithermal hot springs deposit that formed at temperatures between 100 and 150 °C and at near surface pressures (Anderson, 1941). During the last two million years, hot water circulated through the fault system, providing conduits for the mineralization and altering much of the sandstone on Nutmeg Mountain to opalite, heavily laced with cinnabar. Cinnabar in both a crystalline and amorphous form is the only ore mineral occurring at the site (Mitchell, 2000).

Ground water exists locally within fractures in the bedrock and surficial unconsolidated deposits. No surface seeps or springs were noted in the immediate vicinity of the mine. The nearest apparent springs or seeps were observed just to the northwest in Stinking Water Basin as evidenced by changes in vegetation.

Six ground water drinking water wells (all private domestic wells) are located within the 4-mile Target Distance Limit (TDL) (Figure 3-1). The nearest well is located approximately 1.0 miles due east from the site. The depth to ground water at this well is approximately 12 feet below ground surface (DEQ, 2002). The remaining wells are located in the 2 to 3 miles ring (three wells) and the 3 to 4 miles ring (two wells). Based upon the Washington County average number of persons per household of 2.61 people (DOC, 2000), these wells serve 15.66 individuals. Table 1 provides the number of drinking water wells and the individuals using ground water as a drinking water source per target distance ring. No public supply wells are located within the 15-mile TDL (DEQ, 2002).

Table 1

GROUND WATER DRINKING WATER POPUATION WITHIN A 4-MILE RADIUS
IDAHO ALMADEN MINE PRELIMINARY ASSESSMENT
WASHINGTON COUNTY, IDAHO

Distance (Miles)	Wells	Population[1]
0-0.25	0	0
0.25-0.5	0	0
0.5-1	0	0
1-2	1	2.61
2-3	3	7.83
3-4	2	5.22
Total	**6**	**15.66**

[1] Based on the average number of persons per household for Washington County of 2.61

Precipitation data is not available for the immediate site area. The mean annual precipitation at Weiser, Idaho, located 11 miles west from the site and at an elevation approximately 1,290 feet lower than the line (USGS, 1970) is 11.73 inches (WRCC, 2002). The site is not located within a wellhead protection area (DEQ, 2002).

There are no obvious on-site conditions inherent to abandoned mines such as stained soils, abandoned storage tanks, holding ponds, or open adits that would indicate an on-going source of contamination. However, one Probable Point of Entry (PPE) is rainwater and snowmelt infiltration of waste rock dumps, old workings and exposed outcrops to ground water.

3.2 SURFACE WATER MIGRATION PATHWAY

The site is located in a nearly flat depression on the top of Nutmeg Mountain. The site generally slopes to the northwest towards Stinking Water Basin. At the time of the site visit, no obvious drainage off-site or evidence of drainage in the form of rilled tailings, staining, or obvious intermittent stream channels was identified. As noted in the Groundwater Migration Pathway Section (3.1), during periods of heavy precipitation there may be surface water runoff from Stinking Water Basin towards the northwest. However, no apparent PPE was identified during the site visit.

The maximum 24-hour rainfall event recorded for Weiser between 1948 and 2000 is 2.55 inches (WRCC, 2002). The Almaden Mine is located in an upland area not threatened by flood events (USGS, 1970). There are approximately 4.6 acres of wetlands within the 15-mile TDL (NWI, 2002). These wetlands are restricted to the Weiser River.

Because no runoff or evidence of runoff was observed on or near the site during the site visit, and there is no obvious drainage route(s), the likelihood of a release from the site with potential to affect the surface water TDL is unlikely.

3.3 SOIL EXPOSURE PATHWAY

Access by foot to the Almaden Mine is unrestricted. There are no residences or workers within 200 feet of the site. No schools or day-care facilities are located within 200 feet of the site and no individuals live within a 1-mile travel distance of the site. The nearest residence is approximately 1.5 miles from the site. No commercial agriculture or silviculture is present within the area of potential contamination. No terrestrial sensitive environments are believed to occur at the site.

During the site visit, direct observation revealed burn pits, waste rock and tailings piles and a pozzolan pile (Figures 2-2 and 2-3, Appendix A). Pozzolan is normally a finely ground siliceous material, but the presumed pozzolan pile at Almaden Mine is probably opaline chert. Potentially, both the pozzolan and waste rock and tailings piles could contain mercury. Volumes were not estimated due to uncertainties regarding thickness, especially the tailings located northwest from the kiln.

3.4 AIR MIGRATION PATHWAY

The nearest permanent residence is approximately 1.5 miles from the site. Approximately 16 individuals reside within the 4-mile TDL (Table 1). It is expected there will continue to be some livestock production and grazing within 0.5 miles of the site (cattle were observed grazing in Stinking Water Basin). There appear to be no sensitive environments or endangered species within the 4-mile TDL (FWS, 2002).

The site has numerous small waste rock piles, a slope covered with tailings, and a fine-grained (talc-like consistency) pile of pozzolan. The likelihood of aerial dispersion of material from these piles appears remote.

Fig 3-1 Almaden Mine 4-Mile Radius Map

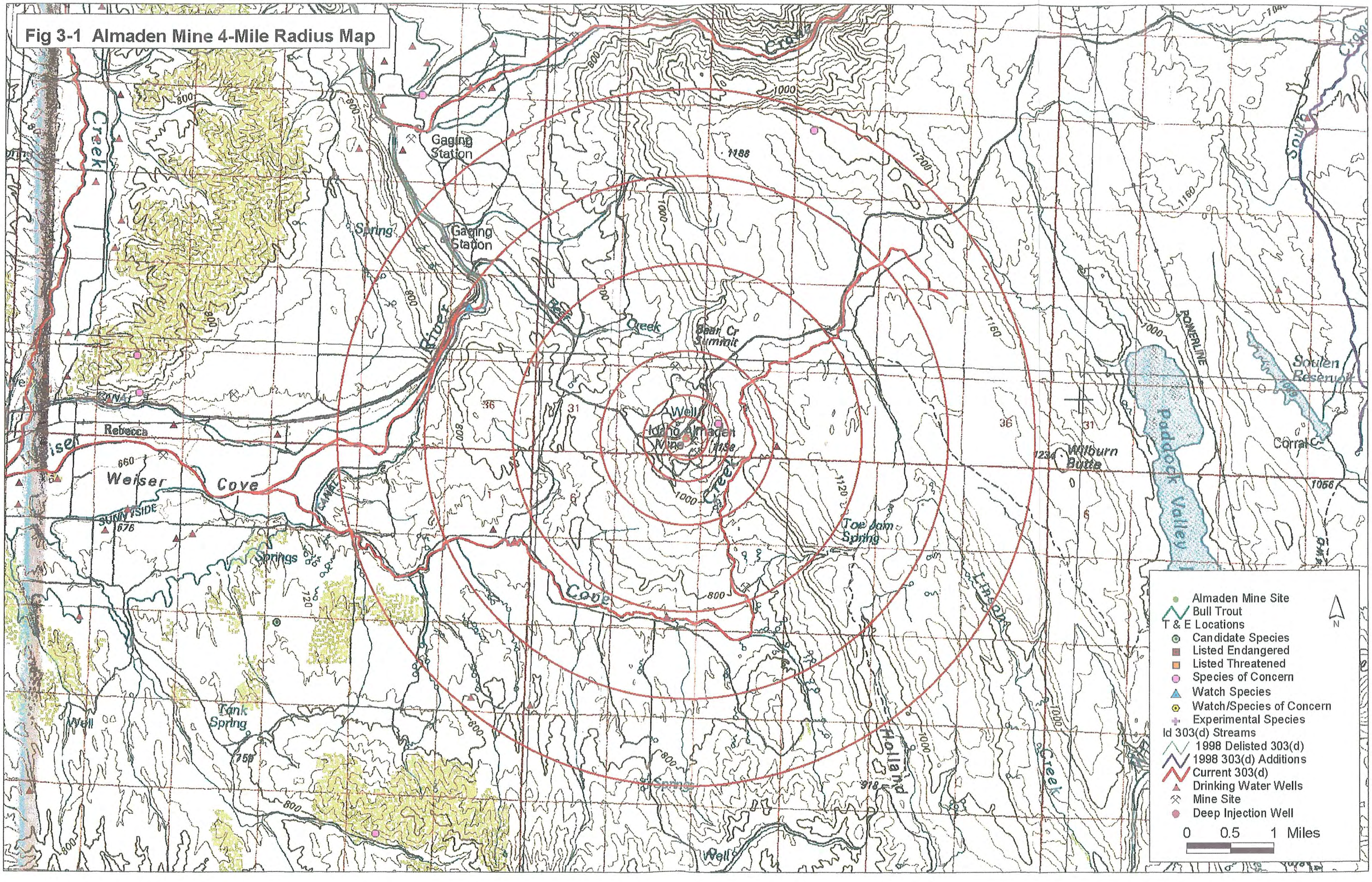


FIGURE 3-2

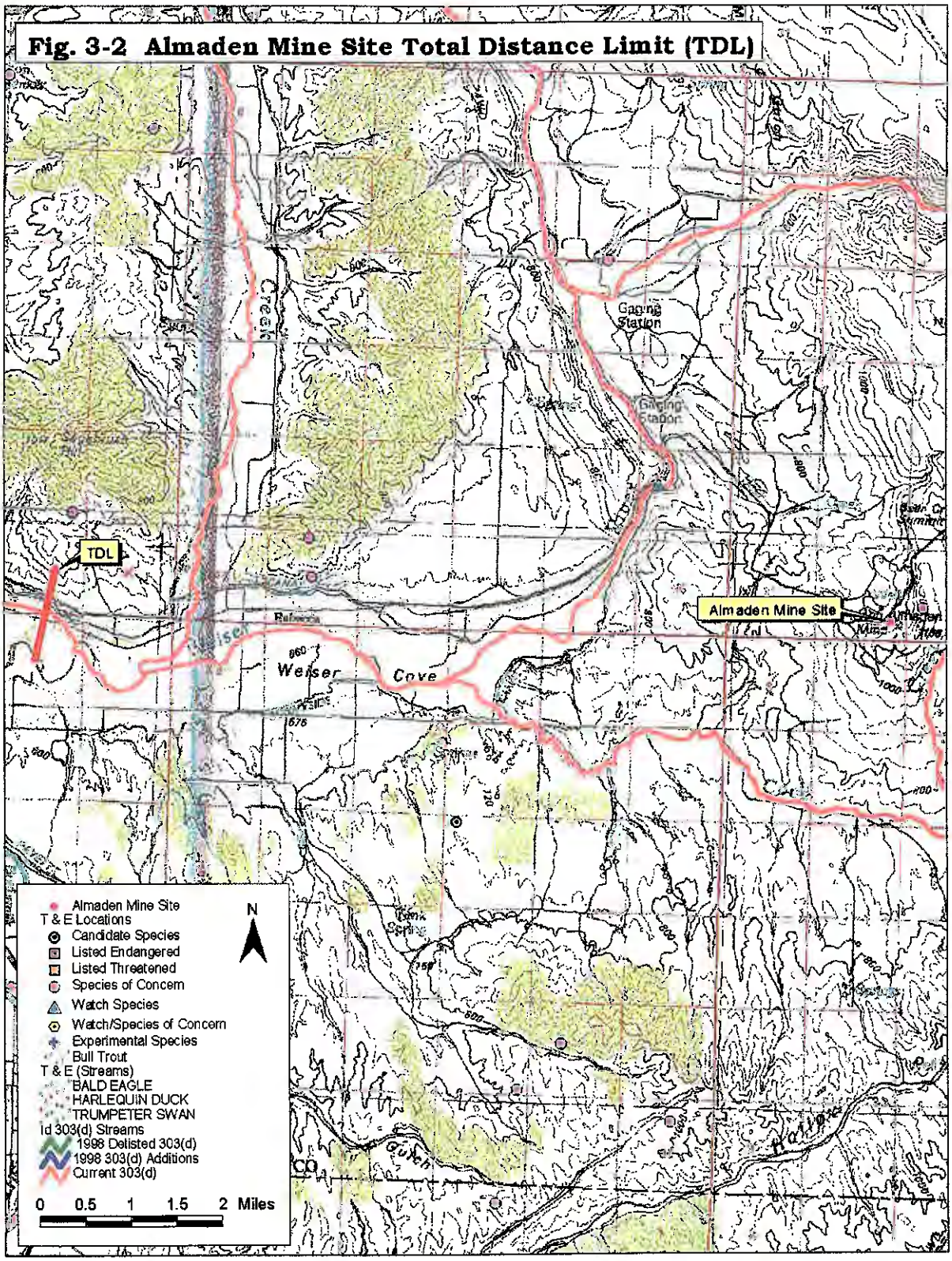


Fig. 3-2 Almaden Mine Site Total Distance Limit (TDL)
TDL
Almaden Mine Site
Weiser Cove
Gaging Station
Almaden Mine Site
T & E Locations
Candidate Species
Listed Endangered
Listed Threatened
Species of Concern
Watch Species
Watch/Species of Concern
Experimental Species
Bull Trout
T & E (Streams)
BALD EAGLE
HARLEQUIN DUCK
TRUMPETER SWAN
Id 303(d) Streams
1998 Delisted 303(d)
1998 303(d) Additions
Current 303(d)
N
0 0.5 1 1.5 2 Miles

REFERENCES

Alt, D.D. and D.W. Hyndman, 1989, Roadside Geology of Idaho, Mountain Press Publishing Company, 383 p.

Anderson, A.L., 1941, Geology of the Idaho Almaden Mine Near Weiser, Idaho, Idaho Bureau of Mines and Geology Pamphlet No. 55, 9 pages.

DEQ (Idaho Department of Environmental Quality), 2002, Personal Communication with R. Taylor, Technical Services Division

DOC (United States Department of Commerce, Census Bureau), 2000, General Housing Characteristics, Idaho, http://factfinder.census.gov.

FWS (United States Fish and Wildlife Service), 2002.
http://pacific.fws.gov/ecoservices/endangered/listing/default.htm

Mitchell, V.E., 2000, History of the Idaho Almaden Mine, Washington County, Idaho, Idaho Geological Survey, 43 p.

NWI (National Wetlands Inventory), United States Fish and Wildlife Service, 2002.
http://wetlands.fws.gov

Reynolds, J.R, 1956, Idaho-Almaden Mercury Mine: mining and geology, Mining Engineering, Volume 8, No. 11, pp. 1096-1099

Ross, C.P, 1956, Quicksilver deposits near Weiser, Washington County, Idaho, U.S. Geological Survey Bulletin 1042-D, pp. 79-104.

USGS, 1970, Holland Gulch Quadrangle, Idaho, United States Geological Survey, 7.5 minute series topographic map.

Washington County, 2002, Washington County Treasurer-Tax Collections, Weiser, Idaho.

WRCC (Western Regional Climate Center), 2002.
http://www.wrcc.dri.edu/summary/climsmid.html.

APPENDIX A

PHOTOGRAPHIC DOCUMENTATION

Mvc-821f

Almaden Mine quarry. (N-NE)

Mvc-822f

Almaden Mine quarry. (NE)

Mvc-823f

Burn pit and foundation. (E-SE)

Mvc-824f

Foundation, possibly base of weigh station. (W-NW)

Mvc-825f

Rotary kiln or furnace. (N-NE)

Mvc-826f

Tailings and dump face. (N)

Mvc-827f

Ore unloading area and mine chutes. (S)

Mvc-828f

One of numerous foundations, use unknown. (W)

Mvc-829f

Rotary kiln and associated equipment. (NW)

Mvc-830f

Foundations (probably condenser area) near kiln. (SE)

Mvc-831f

Concrete vault, with outlet at bottom and timber remnants. (N-NE)

Mvc-832f

White, very fine-grained, material pile (pozzolan). (NE)

Mvc-833f

Tailings face, looking towards Stinking Water Basin. (N-NW)

Mvc-834f

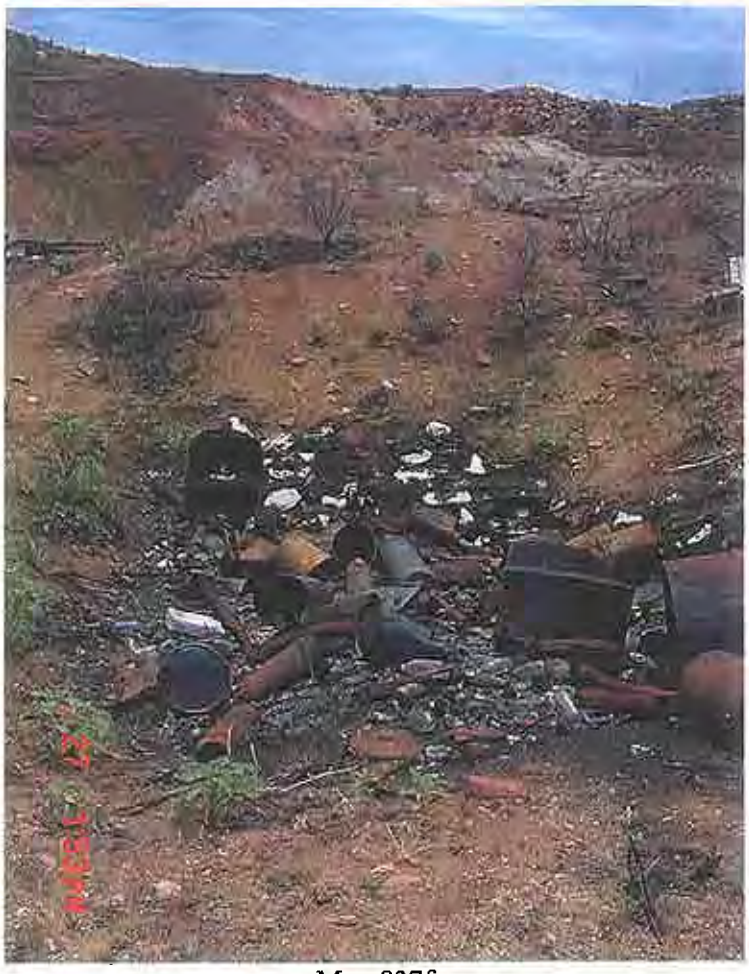
Toe of tailings, Stinking Water Basin. (N-NW)

Mvc-835f

On top of very fine-grained white material. (SE)

Mvc-836f

Close up of fine-grained material pile. (SW)



Mvc-837f

Burn site and trash pile. (E)