SECTION 2

McLAUGHLIN MINE

LOWER LAKE, CALIFORNIA

2.0 THE MCLAUGHLIN MINE - LOWER LAKE, CALIFORNIA

2.1 Introduction

The McLaughlin mine is an example of an operating mine using modern environmental control technologies to meet the criteria listed in Wis. Stats. § 293.50:

- § 293.50(2)(a) - Sulfide ore body with net acid generating potential: Yes. The McLaughlin deposit contains sulfides of iron, arsenic, silver, antimony and mercury. Acidic leachate from the low-grade ore stockpile and waste rock is collected and controlled.

- § 293.50(2)(a) - Has operated at least 10 years without pollution of groundwater or surface water from acid drainage or the release of heavy metals: Yes. The McLaughlin mine has been in continuous operation since 1983; there is still gold production at the facility. No corrective action orders, notices of violation or other enforcement or compliance actions have been issued or undertaken with respect to acid drainage or the release of heavy metals.

- § 293.50(2)(b) - Has been closed at least 10 years without pollution of groundwater or surface water from acid drainage or the release of heavy metals: Not Applicable. The McLaughlin mine continues to operate in compliance with all pertinent environmental permits.

- § 293.50(2m)(a) - Not listed on the NPL: Yes. This site is not (and has not been) so listed.

- § 293.50(2m)(a) - Operator or successor still in business: Yes. The McLaughlin mine is owned and operated by Homestake Mining Company, which is still in business.

- § 293.50(2m)(b) - Significant environmental pollution: None. Based on extensive hydrological, biological and chemical testing, there is no record of significant environmental pollution.

2.1.1 Project Overview

First discovered in 1978, the McLaughlin mine began construction in September 1983, and continues in production from stockpiled ore today The mine is scheduled to complete production of nearly four million ounces of gold in late 2002 or early 2003 (McL-1). Located in the Coast Range of California, 70 air miles north of San Francisco (Figure 2-1; McL-1), the mine is acknowledged internationally for its innovative treatment of

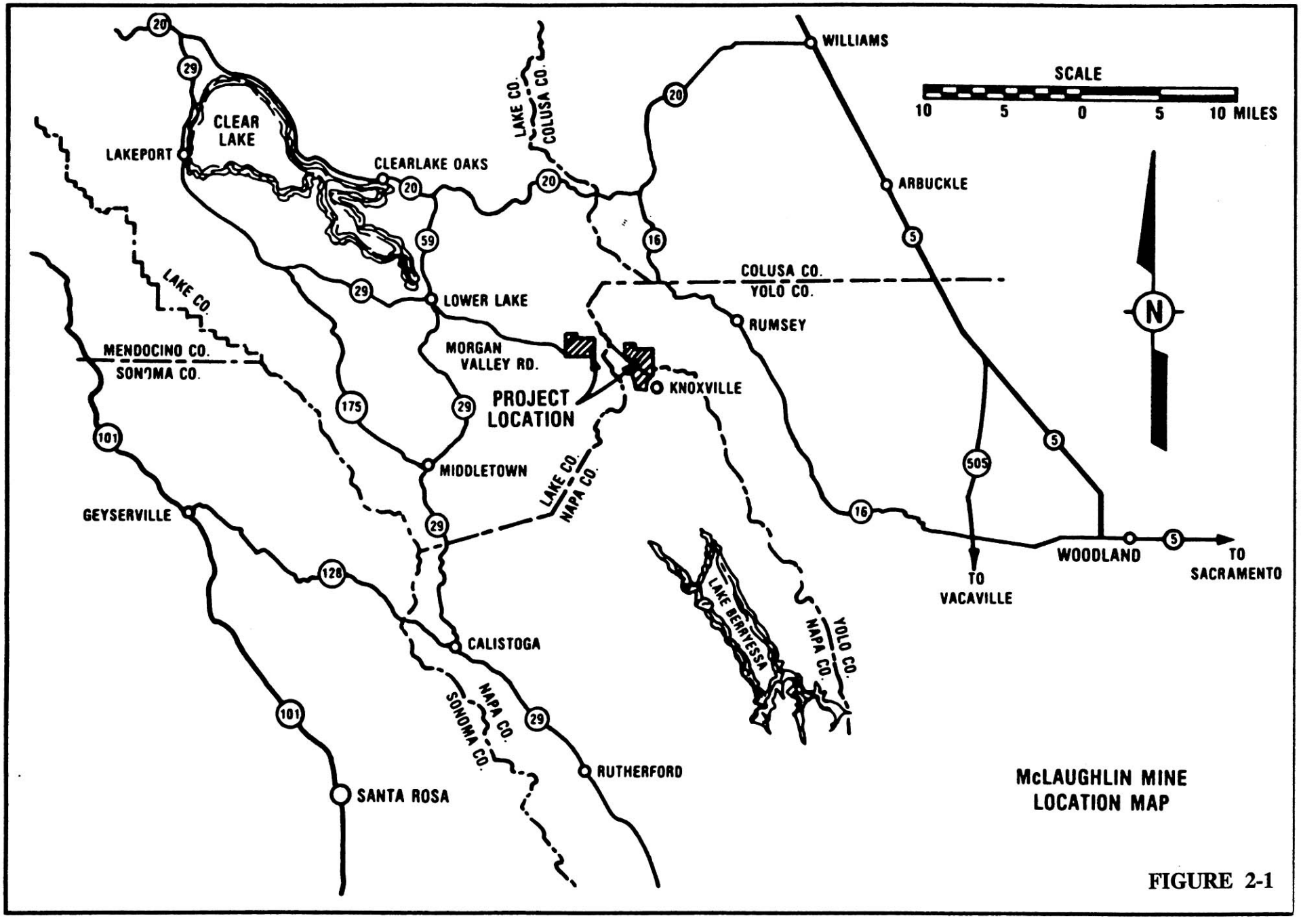
SCALE
10 5 0 5 10 MILES
N
WILLIAMS
ARBUCKLE
CLEAR LAKE
LAKEPORT
CLEARLAKE OAKS
LAKE CO.
COLUSA CO.
LOWER LAKE
COLUSA CO.
YOLO CO.
RUMSEY
LAKE CO.
MENDOCINO CO.
SONOMA CO.
MORGAN VALLEY RD.
PROJECT LOCATION
KNOXVILLE
MIDDLETOWN
LAKE CO.
NAPA CO.
GEYSERVILLE
CALISTOGA
LAKE BERRYESSA
YOLO CO.
NAPA CO.
NAPA CO.
SONOMA CO.
RUTHERFORD
SANTA ROSA
TO VACAVILLE
WOODLAND
TO SACRAMENTO
McLAUGHLIN MINE
LOCATION MAP

FIGURE 2-1

sulfide gold ores (McL-1, McL-2 [Appendix 2]).[9] In addition, the McLaughlin mine has won numerous awards recognizing its sound environmental management (McL-1, McL-2 [Appendix 2]).

The McLaughlin mine has in particular been an innovator in the management and disposal of waste rock with acid generating potential, preventing acid drainage through the identification, separate mining, and the selective placement and encapsulation of high sulfide wastes within the disposal units (see discussion at pp. 2-5 to 2-7; McL-2 [Appendix 2], McL-3 [Appendix 2], McL-7 [Appendix 2]).

Ores are crushed and ground in Napa County adjacent to the mine pit and then pumped through a five-mile-long slurry line to the gold recovery facility in Lake County. Tailings are deposited in an impoundment located adjacent to the recovery plant (Figures 2-2, 2-3; McL-1). Gold is recovered using traditional carbon-in-pulp technology (McL-1).

Situated on both federal and private lands in three counties, three different regional air basins, two Fish and Game Regions, and with facilities located in portions of two watersheds, the mine is subject to the regulatory oversight of more than a dozen federal, state and local agencies. Before pouring its first bar of McLaughlin gold, Homestake had to obtain 327 permits (McL-2 [Appendix 2]). The company's approach to the permitting process and its associated public participation was commended by the local chapter of the Sierra Club. The Club elected to not oppose the approval of the mine permits (McL-6 [Appendix 2], McL-7).[10]

The permits require that the mine conduct and document an extensive and comprehensive environmental monitoring program covering pre-construction, construction and

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[9] Reference notations followed by "[Appendix 2]" are included in the Appendix for this Section, which is bound with this report. All other numbered references are separately filed.

[10] That endorsement was described by the Honorable Vic Fazio (D. Ca.) in the Congressman's testimony delivered in the U.S. House of Representatives on June 29, 1984 (McL-6 [Appendix 2]):

> "As demonstrated by a recent letter to the Yolo County Planning Commission written by the chairman of the Yolano Group of the Mother Lode Chapter of the Sierra Club, environmentalists have also recognized Homestake's dedication and commitment to ensuring that the McLaughlin mine is built and operated in the most environmentally safe manner possible. Wrote Ada Merhoff, the conservation chair of the Yolano Group:
>
> > 'We would be remiss if we did not publically state our feeling that Homestake Mining Co. is to be commended for its willingness to accommodate the particular concerns of the interested public, and for its efforts to establish an environmentally sound mining operation here. Such cooperation from a large mining company is noteworthy and deserves due recognition.'"

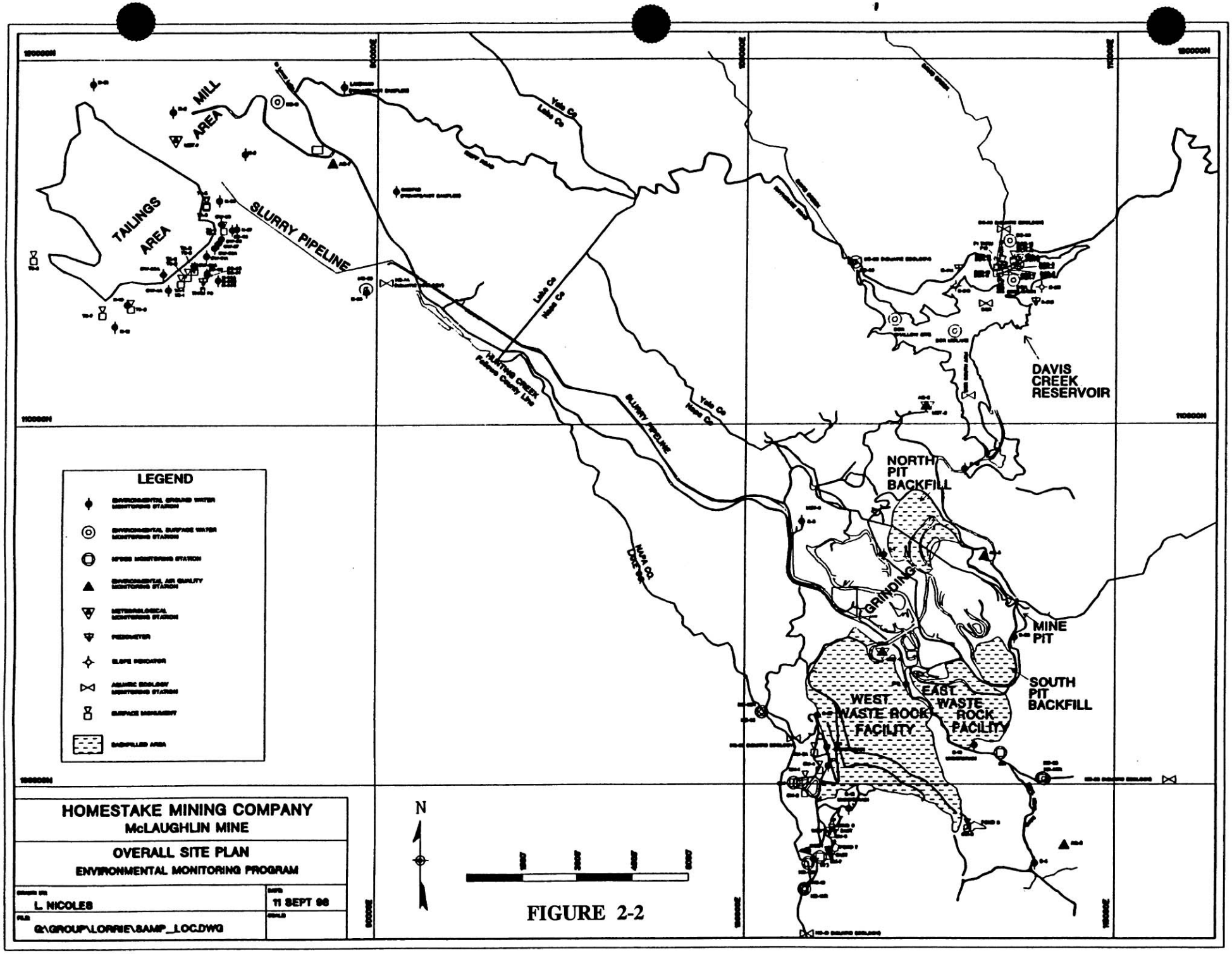
MILL AREA
TAILINGS AREA
SLURRY PIPELINE
DAVIS CREEK RESERVOIR
NORTH PIT BACKFILL
GRINDING
MINE PIT
SOUTH PIT BACKFILL
WEST WASTE ROCK FACILITY
EAST WASTE ROCK FACILITY
LEGEND
HOMESTAKE MINING COMPANY
McLAUGHLIN MINE
OVERALL SITE PLAN
ENVIRONMENTAL MONITORING PROGRAM
L. NICOLES
11 SEPT 98
G:\GROUP\LORRIE\SAMP_LOC.DWG
N

FIGURE 2-2

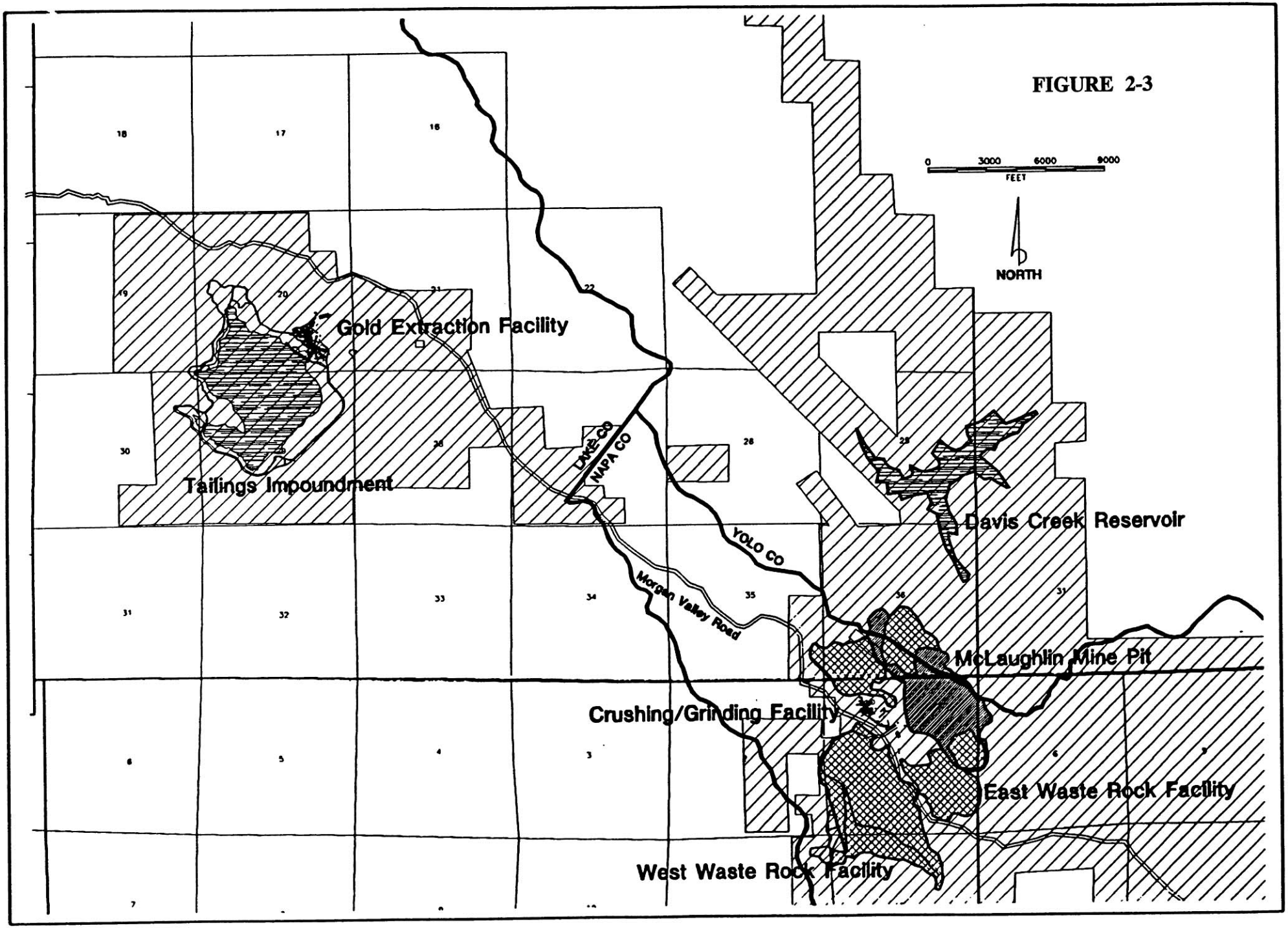
FIGURE 2-3
0 3000 6000 9000
FEET
NORTH
Gold Extraction Facility
Tailings Impoundment
LAKE CO
NAPA CO
YOLO CO
Davis Creek Reservoir
Morgan Valley Road
McLaughlin Mine Pit
Crushing/Grinding Facility
East Waste Rock Facility
West Waste Rock Facility

operating periods (McL-81). Environmental monitoring results are reported annually to all regulatory agencies and the public, and are reviewed in a yearly public hearing by the Napa County Planning Commission acting as the lead environmental agency on behalf of all of the regulatory authorities (personal communication, Sylvia Tooth, Napa County).

Throughout its existence, the mine has also been subject to the special scrutiny of the Solano Irrigation District. The District provides domestic, industrial and agricultural water supplies to the north-east San Francisco Bay Metropolitan Area from Lake Berryessa, a major 1.6 million acre-foot freshwater reservoir situated 18 miles downstream from the mine's tailings and waste rock disposal facilities (McL-8 [Appendix 2]).

In addition to the periodic analysis of ground and surface water samples, the mine contracts with scientists from the University of California to conduct extensive, semiannual aquatic ecology studies of the downstream watersheds (Figure 2-2, McL-9 to McL-20 [Appendix 2]). Both the chemical and biological monitoring demonstrate that downstream areas remain ecologically unchanged from pre-mine conditions (McL-9 to McL-20, McL-21 [all in Appendix 2]).

2.1.2 Information Reviewed

The Central Valley Regional Water Quality Control Board administrative record for the McLaughlin mine was determined to contain the information most pertinent to this inquiry, and was fully reviewed. This agency issues permits called "Board Orders." The McLaughlin mine has two Board Orders: an NPDES permit and a Waste Discharge Requirement (WDR). The record includes all project permit applications and support documents, public hearing records, issued NPDES Permits and WDRs, the approved Monitoring Manual, the Quarterly and Annual Environmental Monitoring Reports, inspection reports, and correspondence. (Executive summaries of Homestake's Annual Environmental Monitoring Reports are included in McL-9 through McL-20 [Appendix 2]. The full reports are not filed with this submission because of their bulk, but are available for inspection upon request.)

The Napa County Conservation, Development and Planning Department (the lead environmental agency for the project) reviews of the McLaughlin Annual Environmental Monitoring Reports are filed as McL-9 through McL-20 [Appendix 2]. In addition, public documents issued by Homestake Mining Company, the professional literature, the press and other publications were obtained and reviewed. Were there any enforcement action, administrative proceeding, or mandated corrective action relating to a release of acid drainage or heavy metals, that would be reflected in this record. None is present.

2.1.3 Agency Contacts

The following key individuals were contacted to obtain information for this submission:

NAME	AGENCY	PHONE	ADDRESS
Steve Rosenbaum Area Representative	Regional Water Quality Control Board, Central Valley Region	916-255-3131	3443 Routier Road Sacramento, CA 95827
Sylvia Tooth, Supervising Planner	Napa County, Conservation, Development and Planning Department	707-253-4416	1195 Third Street Napa, CA 94559

2.2 Geologic Criteria

2.2.1 Sulfide Ore Body

The McLaughlin deposit is a large hot spring-type gold deposit located in the northern Coast Ranges of California at the faulted lithologic contact between the Coast Range ophiolite and the Great Valley sequence. The ophiolite, forming the footwall of the Stony Creek fault, is composed of tabular blocks of basalt and metasedimentary rocks in a matrix of serpentinite. The tectonic interleaving of the various rock units in the footwall preceded formation of the deposit. The Coast Range ophiolite is structurally overlain by the Upper Jurassic Knoxville Formation, the basal formation of the Great Valley sequence, which forms the hanging wall of the Stony Creek fault. The Knoxville Formation is composed dominantly of mudstone, siltstone, fine-grained graywacke, and minor conglomerate. Clear Lake volcanic rocks in the McLaughlin mine area are basaltic andesite in composition forming flows, agglomerate blankets, and hypabyssal intrusions that filled a west-trending valley approximately parallel to the structural grain in the ophiolite (McL-22).

Hydrothermal activity at the McLaughlin paleo-hot spring is loosely dated as late Pliocene or Pleistocene in age. Precious metal-bearing veins were deposited from ascending, boiling fluids along with significant concentrations of the sulfides of iron, arsenic, mercury, silver and antimony (McL-23). Base metal sulfides are restricted to the deeper portions of the deposit and the overall base metal content of the McLaughlin hydrothermal system is relatively low (McL-24).

Early metallurgical testing revealed the highly refractory nature of the McLaughlin ore. Without some means to oxidize the sulfidic matrix encapsulating the gold particles, gold recoveries were restricted to less than 40 percent. Ultimately, pressure oxidation (or autoclaving) was selected for the treatment of high grade ores because it proved to be both environmentally and economically superior (McL-2 [Appendix 2]). In the presence of pure oxygen, the sulfides are converted, under elevated pressure and temperature within specially engineered pressure vessels, to sulfates. In the presence of water, the sulfates form sulfuric acid. This pressure oxidation process enhances gold recovery and accelerates acid production. The acid is then recycled into the process. Excess acid is neutralized using lime (McL-1).

Stockpiled low-grade ores undergo natural oxidation and are processed by direct cyanidation. Air and water penetration of the stockpiles is enhanced to promote sulfide conversion to sulfuric acid. Acid leachate is contained, used as process water and neutralized, or evaporated in the mine's approved waste disposal facilities.

2.2.2 Net Acid Generating Potential

Technical studies performed for the McLaughlin mine predicted that development of the mine would result in an acceptable increase in sulfate and total dissolved solids ("TDS") due to stormwater runoff, and those consequences were discussed in the Environmental Impact Statement for the then proposed project (see, e.g., McL-12 [Appendix 2]). Initial testing of McLaughlin mine waste rock conducted in 1981 and 1982, using then state-of-the-art waste characterization protocols, predicted that the material would, on balance, be non-acid generating. Early warning monitoring of waste dump underdrains, however, detected higher than expected levels of acid formation (McL-9 to McL-20). Reevaluation of the waste characteristics resulted in significant revisions to the mine operating plan in order to prevent acid drainage (McL-3, McL-4).

The initial evaluation was found to significantly underestimate the acid formation potential of the waste rock, because the composite samples tested masked or minimized acid potential, while the static testing of uniformly ground samples over-estimated the neutralizing potential of the waste. Consequently, these early results were not predictive of how the waste rock would behave in the field. Subsequent column leach testing established that the waste rock had a net acid generation potential and that special management measures were required to minimize or prevent formation of acid rock drainage (McL-6 [Appendix 2], McL-7 [Appendix 2]).

Selective mining and encapsulated placement of sulfidic waste rock has successfully minimized acid leachate formation. Residual seepage is intercepted and pumped to the process circuit for reuse, or evaporated in an approved waste unit (McL-9 to McL-20). Some of the acid generating waste rock is encapsulated with non-acid generating waste rock in the pit. This encapsulation management technique for acid generating waste rock is described in the Waste Discharge Requirement (Board Order No. 94-315) for the project as follows (McL-25 [Appendix 2]):

> "Waste rock placed in the mine pit will consist of both acid forming waste rock and non-acid forming waste rocks. These rock types will be randomly discharged from the pit bottom to about 1700 feet MSL. Groundwater levels in the pit are expected to stabilize at this elevation following cessation of mining activities, thereby minimizing waste rock oxidation in the lower portion of the waste piles. Above 1700 feet MSL, acid forming waste rock will be placed in thick lifts separated by layers of non-acid forming rock. At final grade, the waste rock areas above 1700 feet MSL will be covered with a layered cap consisting of compacted clay, non-acid forming rock and topsoil. This encapsulation and reclamation strategy is used in the East and Main Waste Rock

Disposal Areas to minimize oxidation and acid generation within the waste rock. Final elevation for the waste rock units will be near 1900 feet MSL in the north pit and 1940 feet MSL in the south pit."

It should also be noted that without pressure oxidation (autoclaving), the McLaughlin tailings would be acid generating. (See Section 2.7.1, below.) The sulfide oxidation achieved by this metallurgical treatment eliminates any residual acid generation potential, and immobilizes trace heavy metals in relatively insoluble complexes such as jarosite and oxide minerals (McL-4 [Appendix 2]).

2.3 Ten-Year Operating Criteria

Construction of the project began in September 1983, with pre-mine stripping and segregation of low-grade ores. Gold was produced at the site beginning in March 1985 (McL-1).

Groundwater protection at the McLaughlin mine is mandated by California's Porter Cologne Act. The Act requires the filing and approval of a Waste Discharge Report that demonstrates that the beneficial uses of the waters of the State will not be impaired should the project proceed (McL-25 [Appendix 2]). California Administrative Code Chapter 27 sets forth the implementing regulations and includes specific requirements for the disposal of mine wastes. In the case of the McLaughlin mine, these wastes include tailings and waste rock.

Surface water at the McLaughlin mine is regulated pursuant to an NPDES Permit issued by the Central Valley Region of the California Water Quality Control Board (the Clean Water Act is a state delegated program in California) (McL-26 [Appendix 2]). Annual rainfall averages 24 inches, with wet years exceeding 45. Because this site is in a net evaporation zone, the tailings impoundment is designed and operated as a zero-discharge facility. Stormwater runoff from active mining and processing areas is also contained without discharge under design flow conditions (McL-2 [Appendix 2], McL-4 [Appendix 2]).

2.3.1 Tailings

The release of acid and heavy metals from the McLaughlin tailings is prevented by the use of optimal site selection (geologic containment), the choice of a favorable metallurgical process (oxidation of the sulfides followed by neutralization of any excess acid with lime), and aggressive water conservation (maximum recycling). In addition, the five-hundred-and-fifty-acre, zero-discharge tailings disposal facility provides backup (tertiary) containment for the mine's process (gold recovery) plant (McL-4 [Appendix 2]).

The success of these measures is demonstrated by the groundwater monitoring of the N-series wells surrounding the tailings impoundment, as well as downstream surface water and aquatic ecology monitoring (McL-81, McL-9 to McL-20 [Appendix 2]). Over thirteen years of monitoring confirms that there has been no release of acid or heavy metals to either ground or surface water. In addition, downstream aquatic ecology remains unchanged from pre-mine conditions.

2.3.2 Mine, Ore Storage, and Waste Rock Facilities

Pollution prevention engineering has similarly been applied to the design, construction and operation of the McLaughlin mine's other components (Figure 2-4; McL-4 [Appendix 2]). The now-idle mine pit (approximately one mile long, one-half mile wide, and 1000 feet deep) has been demonstrated to be hydrologically isolated from usable groundwater and surface water. Low-grade ore is stockpiled on clay-lined pads until processed. Storm water run-off and resulting leachate from the low-grade ore are collected and used for process water or evaporated in an approved mine waste disposal unit (McL-25 [Appendix 2]).

Acid generating waste rock was placed in fifty-foot lifts and encapsulated with low permeability clays to limit infiltration of air and water and, thus, minimize the formation of acid leachate (McL-3 [Appendix 2]). The individual cells were progressively closed and revegetated to minimize the onset of bacterially accelerated acid formation (McL-4 [Appendix 2]). The limited amounts of leachate formed there are collected, monitored (McL-9 to McL-20 [Appendix 2]), and recycled in the process circuit or pumped to an authorized, zero-discharge waste disposal unit and evaporated (McL-25 [Appendix 2]).

During operation, storm water from active dump surfaces was collected in sediment control ponds, settled, its quality monitored, and then either released to the downstream watershed pursuant to the mine's NPDES permit or pumped back to the process circuit for use. Storm water run-off from reclaimed surfaces is released to the downstream watershed pursuant to the mine's NPDES permit (McL-26 [Appendix 2]). NPDES monitoring confirms that there has been no release of acid or heavy metals to the downstream watershed as a result of acid drainage (McL-9 to McL-20 [Appendix 2]). While several releases of sediment and accompanying metals have occurred during severe storm events, more than ten years of environmental monitoring has shown that downstream aquatic ecology remains unchanged from pre-mine conditions (McL-9 to McL-20, McL-21 [all in Appendix 2]).

Review of the Central Valley Regional Water Quality Control Board files indicates that the mine has reported all upsets and potential releases, regardless of their consequence. These have included minor ore slurry releases and occasional, but infrequent, transient exceedances of permit limits resulting from temporary upset conditions that overwhelmed capacity at waste dump leachate containment or pumpback facilities during extreme rainfall events (McL-47 to McL-70 [Appendix 2]).

Slurry (ground ore and water) releases were largely contained within the slurry line secondary containment system. Slurry which sprayed beyond secondary containment was collected and removed to the tailings pond and did not enter any waterway.

Escaped waste dump leachate was of such low volume that receiving waters were not impacted by acid or metals. Transient concentrations of TSS exceeding permit effluent limits had no impact on receiving waters. Because accompanying rainfall amounts exceeded the ten year-24 hour storm volume, the incidences qualified for exemption from the NPDES standards. Nevertheless, Homestake monitored and reported all such occurrences.

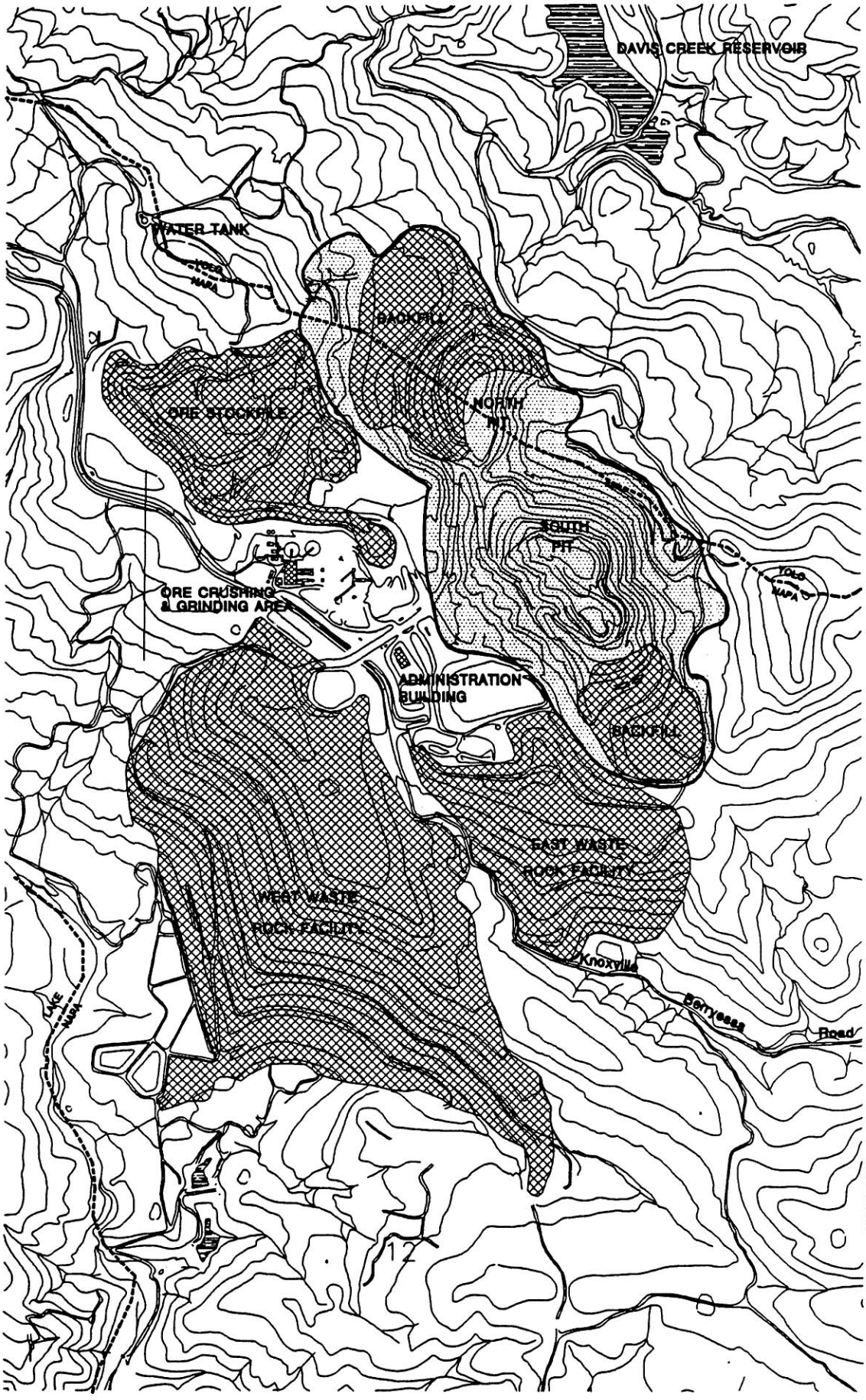
DAVIS CREEK RESERVOIR
WATER TANK
TOLO
NAPA
BACKFILL
ORE STOCKPILE
NORTH PIT
SOUTH PIT
TOLO
NAPA
ORE CRUSHING & GRINDING AREA
ADMINISTRATION BUILDING
BACKFILL
EAST WASTE ROCK FACILITY
WEST WASTE ROCK FACILITY
Knoxville
Berryessa
Road
LAKE
NAPA
12
North
0
800
1600
Scale in Feet
HOMESTAKE
HOMESTAKE MINING COMPANY
Figure 3
McLAUGHLIN MINE
MINE & WASTE ROCK OPERATION

FIGURE 2-4

The mine's M-1 sediment pond overtopped as the result of an accumulation of 16.3 inches of rainfall during a nine-day period in February of 1986. This storm exceeded the 100-year/24 hour storm volume. Although the discharge qualified for the NPDES storm exemption (exceeding the 10-year/24-hour rainfall event), downstream water quality was monitored for the duration of the discharge. Both the Regional Water Quality Control Board and Napa County, as the lead environmental review agency, concluded that the incident did not constitute a permit violation and caused no environmental harm (McL-46).[11]

In each and every case of upset or potential release, the company has -- on its own initiative -- immediately implemented appropriate repairs or other improvements to minimize the potential for a recurrence. Neither the Regional Board nor any other local, state or federal agency with jurisdiction over the mine has ever found it necessary to issue any corrective action orders, or to initiate other enforcement or compliance actions with regard to he McLaughlin mine or any of its facilities. Inspection reports in the record further confirm compliance (McL-28 to McL-45, McL-71 to McL-78 [all in Appendix 2]).

2.4 Ten-Year Closure Criteria

NOT APPLICABLE

This is an active operation with an exemplary record of no violations of pertinent environmental laws for the past 15 years.

2.5 Responsible Party Criteria

Founded in 1876, Homestake Mining Company has been in continuous existence for 122 years. In addition to the McLaughlin mine, Homestake maintains active gold operations and exploration elsewhere in the United States, Australia and Canada, as well as in Latin America and Europe. The Company currently produces approximately 2.5 million ounces of gold annually from 16 operating mines.

Homestake shares are publicly traded on the New York Stock Exchange, the Australian Stock Exchange and the Basel, Geneva and Zurich Stock Exchanges in Switzerland. The company has received numerous awards for its responsible environmental, health and safety stewardships.

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[11] It should be noted that the agency correspondence about this event incorrectly states that M-1 was not included in the NPDES permit, that inadequate freeboard was maintained in M-1, and that the discharge was unauthorized. Review of the NPDES permit in effect in 1986 (Board Order No. 85-031, NPDES No. CA0081477) includes a discharge point (004) at M-1. This permit also exempts ponds regulated by the NPDES permit from the three-foot minimum freeboard requirement. The Standard Provisions and Reporting Requirements attachment to the NPDES permit discusses upset events. Apparently the company chose not to challenge the Staff interpretation, insofar as agreement was reached on the outcome of the event and no corrective action order was issued.

The McLaughlin mine is 100 percent owned and operated by Homestake Mining Company, which is headquartered at:

Homestake Mining Company
650 California Street
San Francisco, CA 94108
Phone: 415-981-8150

The McLaughlin mine has never been considered for inclusion on the National Priorities List, and is not so listed (see http//www.epa.gov/superfund).

2.6 No Significant Environmental Pollution

2.6.1 Water Quality

All of the environmental monitoring requirements contained in each of the McLaughlin mine permits are compiled and presented in the mine's Environmental Monitoring Manual (McL-81). Surface and ground water monitoring requirements are those imposed by the Central Valley Regional Water Quality Control Board and contained in the mine's Waste Discharge Report and NPDES Permit. The permits are reviewed and renewed at least once every five years (McL-25, McL-26, McL-27 [all in Appendix 2]).

Samples are analyzed by an independent laboratory and the results compiled and presented in the annual Environmental Monitoring Reports (1984-85 to 1996-97) and the various quarterly data reports. Annual reports include period-of-record data. New results are statistically compared to both pre-operational baseline data and other operational period data.

This statistical comparison is used to identify any new results which lie outside of the range of expected values known as Maximum Likely Concentrations (MLCs). Values exceeding the MLC's trigger further review which includes trend analysis and water type evaluations using Piper and Stiff diagrams. These evaluations serve as an early basis for identifying any potential gradual releases and provide an opportunity to implement remedial containment measures before the potential release might result in water quality impairment requiring an agency response (McL-9 to McL-20 [Appendix 2]).

"Points of compliance" and "constituents of concern" are designated by the Central Valley Regional Water Quality Control Board in the approved Waste Discharge Report and the NPDES Permit (McL-25 [Appendix 2], McL-26 [Appendix 2]). The Board has determined that "[t]he comprehensive hydrogeologic investigations conducted prior to construction of the waste rock units demonstrated that only minor amounts of groundwater underlie the waste rock disposal areas, and that there are no detectable vertical or lateral hydraulic interconnection(s) with groundwater or surface water systems with beneficial uses" (McL-25 [Appendix 2], McL-26 [Appendix 2]). The same finding was made with regard to the mine's tailings disposal facility. Compliance with water quality standards is determined at the nearest point at which waters subject to protection of beneficial uses are found (McL-25 [Appendix 2], McL-26 [Appendix 2]).

Groundwater compliance is determined around the perimeter of the tailings facility at stations N-5, N-8 (A,B,& C), N-9, N-11, and N-12 (Figure 2-2, McL-25 [Appendix 2], McL-27 [Appendix 2]). Mine area station S-10 is the point of compliance between the mine pit and the mine's fresh water reservoir. Additional waste rock underdrain and groundwater stations are located between the waste units and protected waters, and are monitored for early warning purposes, rather than as points of compliance. All surface water stations, excepting background (i.e., upgradient) stations, are designated as points of compliance.

Water quality monitoring results are reviewed annually by all of the responsible agencies. The results are also presented to the public in an annual public hearing convened by the Napa County Planning Commission (McL-9 to McL-20 [Appendix 2]). No corrective action orders, notices of violation, or other enforcement or compliance actions have been issued with regard to the surface or groundwater compliance points at the McLaughlin mine.

2.6.2 Aquatic Ecology

In addition to the extensive and comprehensive water quality monitoring required by the Central Valley Regional Water Quality Control Board, the McLaughlin mine is required to perform systematic aquatic ecology monitoring. The Company contracts with independent scientists from the University of California to conduct this work. Quarterly, and later, biannual monitoring of benthic organisms and fish has been conducted during the pre-operational and operational periods.

Results are reported in the Annual Environmental Monitoring Reports (McL-9 to McL-20 [Appendix 2]). The work demonstrates that there has been no change in the aquatic ecology of the downstream watersheds as a result of operations at the McLaughlin mine (McL-21, McL-9 to McL-20 [all in Appendix 2]).

2.6.3 Analysis

The McLaughlin Mine Environmental Monitoring Program has been used as a model for application at other mines throughout California and the rest of the world (McL-5). Monitoring locations, frequencies and parameters are designed to detect most likely releases and are keyed to site specific climatic, geologic and ecologic conditions.

Quality control/quality assurance procedures are an integral part of the program (McL-81, McL-9 to McL-20 [Appendix 2)]. Sample splits are regularly collected by the staff of the Central Valley Regional Water Quality Control Board and the Solano Irrigation District. Monitoring results are statistically compared to pre-mine conditions and evaluated for trends and shifts that might otherwise be overlooked.

Monitoring reports are widely circulated to all responsible agencies and interested members of the public. Public hearings are held annually to provide an opportunity for public review and to consider improvements or modifications to the monitoring program, as well as to satisfy all concerned that the mine remains in compliance with all regulatory requirements. In addition, the mine manages its extensive non-mined lands to meet

conservation objectives, including enhancing wildlife habitat quality, protecting colonies of threatened species of bats, and preserving sensitive plant populations (McL-79, McL-80, McL-86).

The public record of the environmental performance of the McLaughlin mine is exceptionally comprehensive and detailed. This record consistently supports the conclusion that the mine has not caused any significant pollution of surface water or groundwater. Long term monitoring also demonstrates that the McLaughlin mine and its associated facilities have not adversely impacted the downstream aquatic ecology (McL-21 [Appendix 2]).

The following excerpts from an April 29, 1994 memorandum prepared by the Solano Irrigation District provides information on the McLaughlin mine's compliance history and environmental track record as viewed by a downstream stakeholder (McL-8 [Appendix 2]):

> "The McLaughlin Mine is engineered, constructed and operated in an environmentally state of the art, zero-discharge facility. The mine has achieved an international reputation for sound environmental design and practices. Detailed environmental monitoring proves that the mine has in no way impacted the excellent quality of the water supply.
>
> "Continuous Water Quality Monitoring Station: In addition to the normal periodic stream samples, the program includes an automated, continuous water quality sampling station, located on Hunting Creek, downstream of all of the mine's facilities. This assures that no undetected release can occur between the normal sampling periods.
>
> "Monitoring Results: Since initiated in 1983, the program has resulted in 127,727 water quality analyses from almost 3,953 separate samples. These data show that the quality of Solano's water remains excellent, and that the Mine has in no way degraded that water. Monitoring of aquatic ecology downstream of the project confirms that the streams remain unchanged from pre-mine conditions."

2.7 Assessment of Technology

The McLaughlin mine illustrates the benefits of applying comprehensive planning and sound engineering to the design, construction, operation, reclamation and closure of a mining project. These planning and engineering elements can be generally grouped into three categories: pollution prevention/containment, reclamation and stewardship.

2.7.1 Pollution Prevention/Containment

Planning and engineering for pollution prevention and the containment of mining impacts to the mine site included comprehensive studies of the geologic and climatic conditions specific to the site, and careful evaluation of the constituents and characteristics of

the materials to be mined, processed and disposed of on the mine site. Mechanisms for the transport and potential release of contaminants to the environment were identified and specific features designed and engineered to prevent such release.

Mineral Recovery Process Selection

The geochemistry of ore bodies varies tremendously from site to site. Metallurgical studies are required to determine the feasibility of mineral recovery and to select a preferred mineral recovery technology. These studies can also effectively evaluate the environmental consequences of those technologies.

Homestake selected pressure oxidation (or autoclaving) to process the McLaughlin ore on the basis of both economic and environmental advantages. That process, which is optimal for the McLaughlin mine's particular requirements, immobilizes trace heavy metals, eliminates the potential for acid formation, and reduces the concentration of the residual cyanide in the tailings. Thus, the McLaughlin tailings are nonhazardous according to both state and federal standards, and present no threat to waterfowl or wildlife.

The Crandon Project has undertaken similar studies to arrive at the optimal recovery process for its requirements.

Tailings Disposal

Screening studies identified all potential tailings disposal sites within a ten-mile radius of the ore body. Fatal flaw analysis and field reconnaissance reduced the original thirty four sites to three. The selected sites were subject to detailed field investigations.

The tailings disposal site identified by these investigations is ideal. It provides secure containment for the tailings, protecting downstream water quality and preventing the degradation of surrounding groundwater.

Ongoing monitoring of surrounding ground and surface waters demonstrates that no contaminants have been released from the site. Residual cyanide has remained below a concentration that would pose a threat to waterfowl and wildlife.

Process and Storm Water Management

While the McLaughlin operation takes full advantage of the fact that the regional climate provides substantially more evaporation than rainfall, it still must have an effective means for managing runoff and all other potentially contaminated waters. All process water is discharged to the zero-discharge tailings impoundment and either recycled or evaporated.

Water quality protection in the vicinity of the McLaughlin mine pit is maintained by a collection and containment system that intercepts all storm water flow, as well as all water removed from the mine pit. All water contacting ore, low-grade ore and

unreclaimed waste material is pumped to the grinding circuit and used as process water. This system also provides backup containment for fuel, waste oil, and other bulk materials.

Similarly, the McLaughlin extraction plant is engineered to drain to the tailings pond, thus eliminating the discharge of any storm water from that facility to the downstream watershed and providing backup containment for the entire plant and its contents.

Extensive water quality and aquatic ecology monitoring demonstrates the effectiveness of this zero-discharge design at preventing pollution, preserving surrounding ecosystems, and protecting the beneficial uses of downstream waters.

Waste Rock Management

The exposure of sulfide rich minerals to air and water, coupled with the occurrence of sulfide oxidizing bacteria, may produce an acidic leachate which can dissolve and mobilize heavy metals. At McLaughlin, an active program of selective placement of the waste rock was devised that prevents the formation of significant volumes of acid leachate. This program includes the identification of potentially acid forming waste rock in the pit and its encapsulation within non-acid generating clays in the disposal facility. This isolates the material from air and water and, thereby, minimizes the formation of acid leachate.

Dump under-drains deliver what little leachate is formed to a pumpback system which returns the water to the grinding circuit. Storm water runoff from the active dump surfaces is routed through a series of sediment control ponds, settled and discharged or pumped back for reuse, depending on its quality. Runoff from reclaimed surfaces is discharged. Closure and reclamation of each dump lift occurs at the earliest opportunity.

The McLaughlin acid rock drainage management program has effectively eliminated this source of potential pollution. Downstream water quality and aquatic ecology remain unchanged from pre-mine conditions.

2.7.2 Reclamation

Baseline environmental studies were used to characterize the pre-mining conditions of the mine-site and its surroundings. Both the environmental constraints and opportunities inherent in the site were documented in order that facilities could be optimally planned and located to avoid sensitive areas.

The proposed post-mining land use of the site was established, and the final condition of those areas to be disturbed by the project identified. Facility siting, construction, utilization, and closure plans were established to assure consistency with the closure and reclamation objectives. Reclamation activities were scheduled to occur at the earliest opportunity, assuring the progressive reclamation of the site, minimizing exposed disturbed areas, and accelerating the reestablishment of usable habitat.

Post-Mining Land Use

At the conclusion of mining, the McLaughlin mine will become an approximately 10,000-acre environmental studies field station. An evaluation of post-mining assets revealed that a valuable educational resource would result from the project in the form of the accumulated environmental baseline and monitoring data. In addition, the mine's laboratory, offices, shops and other physical improvements will become available for field station use. The station, to be managed by the University of California, will be available for use by regional public schools and colleges, as well.

Site Reclamation

Physical reclamation of the site is designed to minimize erosion and to stabilize disturbed areas with a permanent, diverse vegetative cover which will support local wildlife populations. Suitable soils from disturbed areas throughout the project have been identified and stockpiled for reclamation use. Priority is assigned to the closure and revegetation of the waste rock and tailings disposal areas. Substantial portions of the mine pit have been backfilled, with the remaining portion reclaimed as a lake or waterbody. The highwall benches will be planted with native trees and shrubs to provide habitat for raptors and other cliff dwellers.

Revegetation

Resoiled areas are hydroseeded using a mix of grasses and clovers naturally occurring in the area. Seeded slopes are mulched with blown straw to protect the seed and prevent erosion until the grasses can become established. Once reclaimed areas have been stabilized, native woody plants are introduced to provide habitat diversity. Reclamation is conducted concurrently with mining, and not deferred to the end of the life of the mine. The reclamation of the site is guaranteed by a twelve-million dollar letter of credit payable to the local, state and federal governments.

2.7.3 Stewardship

The McLaughlin mine utilizes but a small portion of the lands owned and managed by Homestake. Production of the gold resource makes it possible for the company to restore and enhance the wildlife habitat on over 8,500 acres of buffer lands. Contaminants from three abandoned historic mercury mines have been removed and their sites reclaimed. A Contiguous Lands Management Plan provides for the restoration of the property's ecosystems. A program to provide protected roosting habitat for the threatened Townsend's big-eared bat has been implemented. In short, the mining project provides the opportunity and the economic support for the restoration of an area substantially abused, not only by historic mercury mining, but also over-grazing and illegal hunting.

The fresh water reservoir constructed to provide water to process the McLaughlin ore impounds sufficient winter runoff not only to meet the mine's requirements, but also to provide significant new wildlife habitat. Monitoring reveals extensive use of the new reservoir by both resident and migratory waterfowl. A nearby herd of endangered tule

elk have expanded their range to use the reservoir margins. Winter roosting bald eagles are seen daily stalking the waterfowl and golden eagles have begun to establish a nest nearby. Bear and mountain lion, along with more common predators such as bobcats and coyotes, are frequent visitors. Deer populations, and those of many small mammals, have also grown.

2.8 References

(Items shown in bold face are included in Appendix 2. All other listed references have been separately filed with the WDNR.)

Reference No.	File/Publication Source	Type	Title	Author	To	Date	Remarks
McL-1	Homestake Mining Company	Report	McLaughlin Mine, General Information Summary	Homestake Mining Company	Public Document	1997	
McL-2	**Society of Mining Engineers**	**Paper**	**Environmental Management at Homestake's McLaughlin Mine**	**Raymond E. Krauss Homestake Mining Company**	**Society of Mining Engineers Preprint No. 90-23**	**2/1990**	
McL-3	**Colorado Mining Assoc.**	**Paper**	**Acid Mine Drainage at the McLaughlin Mine**	**Tim Janke Homestake Mining Company**	**Conference Presentation**	**9/1989**	
McL-4	**Proceedings: Pollution Prevention in Mining Conference, Snowmass CO**	**Paper**	**Pollution Prevention in Mining, Homestake Mining Company's McLaughlin Mine, A Case Study**	**Raymond E. Krauss Homestake Mining Company**	**Conference Proceedings**	**8/1993**	
McL-5	Society of Mining Engineers	Paper	Environmental Success at Homestake Mining Company's McLaughlin Mine	R.E. Krauss Homestake Mining Company	Society of Mining Engineers Preprint 97-305	2/1997	
McL-6	**Congressional Record**	**Remark**	**Tribute to Homestake Mining Co.**	**Hon. Vic Fazio Congressman**	**House of Representatives**	**6/1984**	
McL-7	Sonora Union Democrat	Article	One Mine Pleased the Sierra Club	Lois Nielsen Sonora Union Democrat	News Article	6/1985	
McL-8	**Solano Irrigation District**	**Memo**	**McLaughlin Mine Tour: Solano Irrigation District/Homestake Mining Company, Water Quality Protection Agreement**	**Brice Bledsoe Solano Irrigation District**	**Solano Irrigation District Directors Managers and Water Users**	**4/29/94**	
McL-9 to McL-20	**Napa County Conservation, Development and Planning Department**	**Staff Reports**	**Review of the Homestake Mining Company, McLaughlin Mine, Annual Environmental Monitoring Reports 1984-85 through 1995-96**	**Napa County Staff**	**Regulatory Agencies and Interested Public**	**5/85 to 2/97**	
McL-21	**Regional Water Quality Control Board**	**Letter Report**	**Hunting Creek Aquatic Ecology Monitoring Program Interim Report, April 1994**	**Dr. Peter G. Connors University of California, Davis**	**Regional Water Quality Control Board**	**4/24/94**	
McL-22	Economic Geology Vol 90, 1995, pp 2156-2181	Journal Article	Origin of the McLaughlin Mine Sheeted Vein Complex: Metal Zoning, Fluid Inclusion, and Isotopic Evidence	Dr. Ross L Sherlock, et al University of Ontario, Waterloo	Economic Geology Publication	1/1995	
McL-23	United States Geologic Survey, MRDS Database	Database	RECNO W700452	Matthew E. Paidakovich United States Geologic Survey	United States Geologic Survey Publication	11/93	
McL-24	United States Geologic Survey	Article	Precious Metal Mineralization in a Fold and Thrust Belt: The McLaughlin Hot Spring Deposit, Northern California	R.M. Tosdal, N.J. Lehrman, et al	Geological Society of Nevada Symposium Publication	9/22/94	
McL-25	**Regional Water Quality Control Board**	**Permit**	**Order No. 94-315, Waste Discharge Requirements for Homestake Mining Company of California, McLaughlin Mine, Lake, Napa and Yolo Counties**	**Regional Water Quality Control Board**	**Homestake Mining Company and Public**	**11/94**	
McL-26	**Regional Water Quality Control Board**	**Permit**	**Order No. 94-159, NPDES No. CA 0081477, Waste Discharge Requirements**	**Regional Water Quality Control Board**	**Homestake Mining Company and Public**	**5/1994**	

Reference No.	File/Publication Source	Type	Title	Author	To	Date	Remarks
			for Homestake Mining Company of California, McLaughlin Mine, Lake, Napa and Yolo Counties				
McL-27	Regional Water Quality Control Board	Permit	Revised Monitoring and Reporting Program No. 94-315, for Homestake Mining Company of California, McLaughlin Mine, Lake, Napa, and Yolo Counties	Regional Water Quality Control Board	Homestake Mining Company and Public	5/1996	
McL-28 to McL-45	Regional Water Quality Control Board	Inspection Reports	California Regional Water Quality Control Board, Central Valley Region, Inspection Reports	Regional Water Quality Control Board	Homestake Mining Company and Public	2/85 - 12/98	
McL-46	Regional Water Quality Control Board	Letter	Homestake Mining Company, McLaughlin Mine - Lake, Napa and Yolo Counties	Greg K. Vaughn Regional Water Quality Control Board	Ray Krauss Homestake Mining Company	6/4/86	
McL-47 to McL-70	Regional Water Quality Control Board	Letters	Homestake Mining Company Upset Notifications and Related Reports	Homestake Mining Company	Regional Water Quality Control Board	5/85 – 7/98	
McL-71 to McL-78	Department of Conservation	Inspection Reports	Surface Mining Inspection Reports 1991-1998	Napa, Lake and Yolo County and BLM Staff	Department of Conservation	10/91 - 4/98	
McL-79	Wildlife Habitat Council	Bulletin	Homestake Mining Company's McLaughlin Mine: A Successful Example of Adaptive, Ecology-Based Habitat Management Planning	Raymond E. Krauss Homestake Mining Company	Habitat Quarterly Volume 1 - Number 1	11/1996	
McL-80	Bat Conservation International	Article	Help for Townsend's Big-Eared Bats in California	Elizabeth D. Pierson	Bat Conservation International	1990	
McL-81	Regional Water Quality Control Board	Report	Homestake Mining Company, McLaughlin Mine, Environmental Monitoring Manual	Homestake Mining Company		3/1997	
McL-82	Lake County Record Bee	Article	The Greening of McLaughlin Mine	Kieth Bowers	News Article	2/1992	
McL-83	Clear Lake Observer	Article	Homestake Gets National Environmental Award		News Article	2/1992	
McL-84	Mining World news	Article	The McLaughlin Mine: Environmental Planning at its Best	G.S. Elliot	News Article	3/1991	
McL-85	Mining Engineering	Article	Reclamation Practices at Homestake's McLaughlin Mine	Raymond E. Krauss		11/1990	
McL-86	High Desert Museum	Paper	The McLaughlin Mine: A 21st Century Model	Raymond E. Krauss	Chiles Award Paper	12/1993	