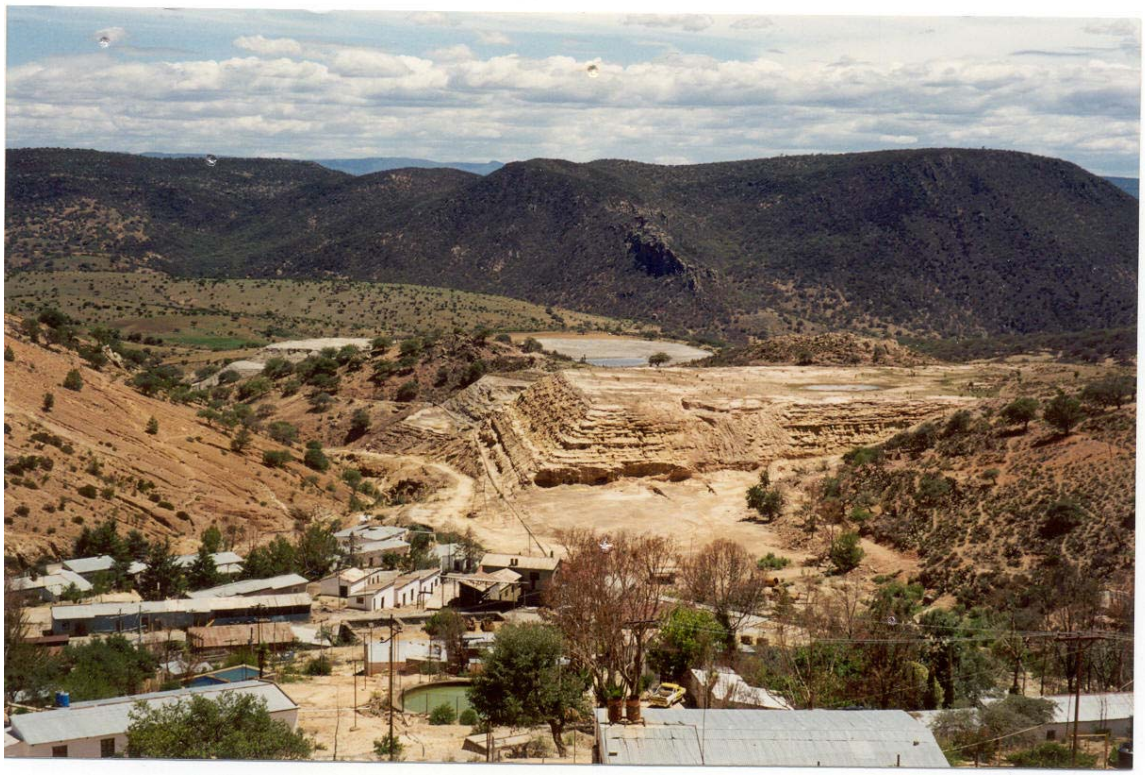
Mina La Colorada
Environmental Action Plan



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August 2002

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1.0 Introduction

The need for implementation of an Environmental Action Plan (EAP) during development of the La Colorada Project is stipulated by the International Finance Corporation[1] (IFC) and Mexican regulations. This document is prepared to address IFC requirements. This document is an "open" document and will be updated and modified as needed. This document will serve as the basis for the environmental and social monitoring and management programs to be implemented over the course of the project. Plata Panamericana will review the frequency and types of monitoring regularly to ensure:

- Compliance with all Mexican and World Bank guidelines;
- Compliance with all permit conditions; and,
- Effective monitoring and mitigation of project impacts.

The EAP was first disclosed in May 2000 in the World Bank Info Shop (Washington, D.C.), Mexico City, Zacatecas, and Durango, Mexico. Since that time, the following project developments have occurred:

- Existing operations have commenced to produce concentrate;
- Additional project design has been completed for construction of the new mine and mill;
- Compliance with Mexican environmental, health, and safety guidelines is on-going;
- Additional baseline sampling has been completed; and,
- Public consultation and disclosure have been ongoing.

Plata Panamericana is commencing upgrades on the mine and mill based on February 2002 Feasibility Study. This updated document reflects certain changes in the operating philosophy at the La Colorada operation. Commencing in 2001, Pan American Silver Corp. (PASC) decided to refurbish and operate an existing flotation mill at the La Colorada site. The initial throughput of sulphide ore was 100 tonnes per day and this processing rate was increased to 200 tonnes per day. The original concept of processing 1,000 tonnes per day of oxide ore through a new cyanidation facility has been modified by PASC in the feasibility study update. Present plans include continuing operation of the flotation concentrator coupled with the construction of an oxide ore cyanidation facility capable of processing 600 tonnes of ore per day. In addition, the original plans calls for processing of existing tailings from tailings dam #1.

[1] *Procedure for Environmental and Social Review of Projects – Guidance Note C: Outline of an Environmental Action Plan*, IFC, September 1998, pp. 45-46.

This updated version of the EAP (1st revision) identifies these changes in more detail and how they impact environmental, health, safety, and social issues for this project. This EAP will be updated at the end of construction to identify "as-built" operations.

1.1. Purpose

The EAP:

- Identifies potential impacts;
- Provides a schedule for implementation in a timely and effective manner; and,
- Describes the mitigation measures.

The EAP includes mitigation measures, monitoring, management, and an implementation schedule. This information is provided for construction and operation of the mine, mill, tailings facility, man camp, and ancillary facilities. It includes mitigation and monitoring for:

- Air quality;
- Terrain;
- Soils;
- Hydrogeology;
- Groundwater quality
- Surface water hydrology;
- Surface water quality;
- Vegetation;
- Fauna;
- Socio-economics;
- Health and safety;
- Spill prevention;
- Tailings management;
- Waste management;
- Reclamation and closure; and,
- Emergency response.

1.2. Project Background

The La Colorada Mine is located in the small town of "La Colorada" within the Municipality of Chalchihuites, Zacatecas State, west-central Mexico. The Chalchihuites area has been developed primarily as a mining district since the 1500's. The various mines have operated intermittently since then with periods of relative prosperity when metal prices were high interspersed with times of depression when metal prices were low. Small scale farming and ranching has developed that provides subsistence agriculture. The town of La Colorada has developed around the mine to provide housing and basic

services to mine workers. Prior to Pan American Silver Corporation's (PASC) purchase, the La Colorada Mine operated intermittently at a rate of about 200 tonnes per day with an accessible reserve base of less than 100,000 tonnes. This operation was under-financed and unprofitable, and could not have been sustained over an extended period.

The expanded La Colorada operation will provide a source of industry to an area that, in recent times, has become largely agrarian with service industries focused within the local communities. The number of migrant workers leaving the community for long periods of time will decrease, as the mine will provide jobs near their homes. The mine will also promote development of more broadly focused economic, social, and technological advances to the immediate Chalchihuites region. The larger surrounding area can also be expected to benefit from provision of goods, services, and housing to the mine employees and contractors. Throughout its life, the La Colorada Mine will have a net beneficial impact on the budgets and infrastructure of the small town of La Colorada, in addition to the surrounding local towns of Chalchuites, Ranchera, Canoas, San Juan de la Tapias and Sombrerete. This will come in the form of increased taxes and fees, as well as taxes paid by companies, employees and contractors for support services.

Since PASC acquired the property in 1998, the following activities have occurred:

- Completed 12,000 meters of additional drilling, rehabilitated the shaft and hoist, and initiated a 3,700 meter underground development and reserve definition program to move additional inferred resources into the measured and indicated categories;
- Independent reserve calculation by MRDI;
- Basic process and mine development engineering was completed by H.A. Simons International, and Agra Earth & Environmental Ltd.;
- An environmental impact assessment study (MIA) was developed by Clifton Associates Ltd. and submitted to Mexican regulators;
- Permit to construct was issued by the Mexican federal government in November 1999;
- Operations have commenced for the sulphide circuit processing up to 200 tonnes per day placing tails in existing, unlined, tailings dam #5;
- Produced an initial feasibility study in June 2000, which was subsequently updated in June 2002 based on modification to the original feasibility throughput level and the concurrent beneficiation of oxide and sulphide ores.

1.3. Existing Sulphide Processing Operations

In 2001 PASC refurbished an existing sulphide flotation plant in January 2001. From January through May 2001 only lead concentrate was produced due to equipment limitations. From June through December 2001, both lead and zinc concentrates were produced. The mill is currently operating at 200 tonnes/day, producing both lead and zinc

concentrates. The plant has been operating on a minimal budget with very little capital available for improvements.

The feed comes from the 320 level of the mine in NC2 East and 100 level of NC2 West. It is fed to the mill from a small stockpile (2 days worth or 400 tonnes). The grade is approximately 490 g/tonne silver. The mining method used is cut and fill mining. The ore is transported underground to the 295 level of the Aguila Shaft where it is brought to surface and delivered to the mill in 1 cubic meter rail cars. Mining of NC2 East and West has generated very little waste and this has been used for fill, with no waste rock being sent to the surface. Some minimal waste was produced during completion of access ramps to NC2 West but was used to backfill the underground operations.

Sulphide ore from the NC2E and NC2W veins are treated by conventional flotation methods. The existing sulphide flowsheet involves two-stage crushing, followed by fine grinding, flotation of two concentrates (lead concentrate and zinc concentrate), dewatering of concentrates and tailings disposal. The concentrates that are produced are treated at Penole's Torreon Smelter, 300 km north of the mine. The crusher stockpile is covered, but open on three sides to the environment. The crusher is enclosed within the crusher building. The crusher is fed from the live stockpile by a front-end loader. It is currently proposed to outfit the crusher and transfer points with a wet spray to reduce dust emissions. The entire circuit is located under one roof. The floor is concrete and has partitioned spill control designed to hold greater than 110 percent of the entire volume of the milling circuit. All spills are contained within the spill area and returned to the milling process. Water for the milling circuit is from the mine. Additionally, water is reclaimed from the tailings in an open-air tank located immediately outside of the mill walls. This water is reclaimed to the circuit.

Table 1. Reagent Consumption

Reagent	Permitted Consumption (g/tonne ore)
$ZnSO_4$	375
Xanthate	30
AP 242	20
AP 348	20
Frother	80
NaCN	25

Reagent storage is located directly adjacent to the mill in a covered building that is well ventilated. The area has a concrete floor with a concrete containment berm located across the entryway to prevent any spills from escaping the building. Reagent storage typically contains enough reagents to last approximately 1 month of operations. Reagents are stored under the following conditions:

Table 2. Reagent Storage

Reagent	Container	Volume
$ZnSO_4$	Plastic and paper bag	25 kilogram
Xanthate	Drum	100 kilogram

Reagent	Container	Volume
AP 242	Drum	220 kilograms
AP 348	Drum	None on site
Frother	Drum	340 kilograms
NaCN	Drum	100 kilograms

All clean up materials for the reagents listed above are located in the mill and in the reagent storage area.

Concentrate is produced at a rate of approximately 5 tonnes per day. It is stored in an uncovered area of the mill. This area is cemented and has cement berms to protect the concentrate from wind and water erosion. The concentrate is covered with plastic to further protect from the wind. Concentrate is transported by contractors to Torreon a minimum of 2 times per month in covered trucks. Concentrate dewatering for both zinc and lead materials is accomplished by settling individual concentrates in static bays or pits, and then air-drying the settled solids on a drying patio.

The tailings are sent to a 10 m^3 open-air holding tank near the mill. From there they are pumped, via a 4-inch PVC line for 750 meters, with no secondary containment, into an unlined area of the old tailings dam #5. Total volumes sent to the tailings area to date are 65,355 tonnes.

Gasoline and oil storage is located in the existing fuel storage area near the offices. The area has the capacity to store approximately 2400 litres of gasoline. All gasoline and oil is stored in 200-litre drums. The gasoline and oil storage area is covered, locked, and well ventilated. It has a 20 cm containment berm across the door to prevent major spill events. The total fuel spill containment volume is 7000 litres. Gasoline is delivered one time per month, in one truck, from Sombrerete operated by a contractor.

The diesel is currently stored in the existing 10,000-litre diesel storage area located on the opposite side of the Arroyo La Colorada. This area is encased in a concrete berm that provides secondary containment for 34,000 litres. Diesel fuel is delivered one time per month from Durango in a 10,000-litre truck operated by a contractor.

The present operation requires approximately 120 workers. The current supply for potable water is trucked from San Juan de La Tapia and stored in various containers around the site and village of La Colorada. Pumping of water includes an agreement with the village of San Juan de La Tapia that requires Plata Panamericana to pay for approximately 50% of the total operational costs for the well, even though current water consumption is approximately five cubic meters every 3 or 4 days. During operations, Plata Panamericana will initiate a study to determine the socioeconomical feasibility of moving the water supply source to the village of La Colorada.

Sewage from each building currently drains into one of several “septic” tanks, and is carried by tubing to a 9000-litre per day biodigestion tank (TB) that uses enzymes to process sewage and service waters.

The original feasibility study included the construction of a new power line connecting to the Durango State Grid. During the year 2000, the power company upgraded the power line from Zacatecas resulting in very few power interruptions. Currently the plan is to use the existing power line and supplement the power supply with an emergency generator principally for mine pumping and ventilation.

1.4. Proposed Oxide Processing Project

Under the revised processing scheme defined in the feasibility study update, the mine will expand existing operations to incorporate the following additional changes. The La Colorada ore body contains both oxide and sulphide ores. The plan is to upgrade the existing 200 tonnes per day (tpd) sulphide mill (currently operating, and will continue to operate during construction) and construct a new 600 tpd oxide mill. The two mills will have a common crushing plant capable of more than 1000 tpd operating rate. The property will produce 280,000 tonnes annually, 210,000 tonnes of oxide and 70,000 tonnes of sulphide. Additionally, the mill will reprocess tailings located in tailings area #1. The total mine life is estimated to be 11 years. Most of the equipment for the proposed oxide processing project has been acquired from another mine located in the western United States.

1.4.1. Oxide Circuit

The oxide circuit involves two-stage crushing followed by fine grinding. Ground material is pumped to a primary thickener and then passes through a leaching and CCD circuit. Pregnant solution (rich in silver) is sent to the Merrill Crowe plant were the mixing of solution and zinc dust forms silver rich precipitates which are then melted in a furnace to produce dore bars for sale.

The three main reagents are lime, cyanide, and zinc dust. Lime and cyanide are metered to the grinding and leaching circuit as required, while the zinc dust is used to precipitate silver from pregnant solution.

All reagent mixing and distribution tanks will be located adjacent to the mill area on a bermed cement slab. Special procedures including ventilation and security will apply to the cyanide mixing and distribution tanks.

1.4.2. Waste Rock Production

It is estimated that 300,000 tonnes of waste rock will be produced during the mine life. All of this material will be used underground as fill material. A small open cut located at the existing San Fermin open pit will also be developed to provide additional backfill material as required. It is envisioned that up to 750,000 tonnes of material will be needed from this open cut. Additionally existing waste dumps on the property near the San Fermin portal will be utilized for underground fill. These dumps will be used ahead of the

open cut discussed above. Backfill will be dropped down a raise from surface to the 295 level (constructed during expansion) and then trammed to working areas as required by the mining cycle.

1.4.3. Mine Dewatering

During the life of the mine, underground dewatering holes will be drilled to allow for dewatering ahead of mining. In addition the existing shaft will be deepened in several stages as mine development progresses deeper. The water from the mine is used to supply mill make up water and domestic water for the site.

Presently the mine has a pumping capacity of about 700 usgpm, with two pumps located at the 252 level. Both pumps are equipped with 350 hp motors, one operating and one standby. Currently water is pumped from the lowest level of the mine (345 level) to the 295 level and then to the 252 level where it is finally pumped to surface via 8 and 6 inch water lines in the shaft. As the mine workings extend deeper, additional water flows are expected and hence provisions in the plan include new dewatering wells ahead of mining, a new water sump on the 295 level, and the installation of a 1000 usgpm pumping system on the 295 level (one operating, one standby).

A portion of the mine water will be pumped to the process water head tank. It is expected that 14 cubic meters per hour of water will be required for the sulphide plant, and 44 cubic meters per hour of water will be required for the oxide plant. Recycle water from individual tailings area will be recycled to separate head tanks to ensure separation of flows to the two circuits. The main head tank will also be the storage facility for domestic water, and a portion of the head tank will be reserved for firewater storage. Water not required for mill make-up or domestic use will continue to flow to Arroyo de La Colorada.

1.4.4. Tailings Facility

The new tailings impoundment has been designed to comply with both Mexican norms and international lending guidelines and policies. It optimizes use of existing disturbed areas while reducing long-standing problems associated with the existing abandoned tailings impoundments.

Tailings from the oxide and sulphide circuit will be stored in separate tailings facilities. Tailings from the oxide circuit will be disposed of in a proposed new facility. Tailings from the sulphide circuit will be disposed of in the existing tailings dam #5. The facilities will be separated from the natural up-gradient watershed by a stormwater diversion system. This system will include two diversion dams and two diversion ditches that will be sized to route runoff that would result from the once in 24-hour, 100-year storm event. Inflow in excess of this event will be routed into the tailings dam by means of an emergency spillway. The tailing impoundment will also be equipped with an emergency spillway as a safety precaution against overtopping of the dam.

Due to the scarcity of overburden material in the project area, and the need to clean up historic tailings deposits, both the subgrade and starter dam material will be existing, historic tailings material from dams 3 and 4. The total amount of existing tailings that will be placed in the starter dam is estimated at 100,000 m^3.

The sulphide ore will be deposited in the unlined, existing tailings dam #5. Prior to construction of the new dam, a stability study will be conducted on the #5 dam to ensure the facility meets international guidelines. Utilizing the dam for tailings disposal will have a beneficial reduction on potential dust sources from the property. If the stability study results in unacceptable requirements, two other options for sulphide tailings disposal will be examined including underground backfill to historic mined out areas, or disposal inside the new tailings area in a cell separated from the remainder of the dam. The results of the stability analyses will be provided to IFC prior to commencement of construction of the new tailings facility.

Tailings from the oxide circuit will be disposed of in the proposed new facility. It is evident from previous static acid-base accounting (ABA) testing, and mineralogy that the oxide tailings will be neutralizing. The proposed new tailings facility consists of a geomembrane-lined facility (a minimum 60-mil liner) with integrated underdrains to control and minimize seepage losses from the impoundment. A lined seepage collection pond is downstream of the main dam, and any solution collected will be pumped back to the main dam. The tailings impoundment will be constructed in phases, that will require scheduled expansion and embankment raises to accommodate production. The dam has a minimum capacity available of 3.5 million tonnes. Cyanide will be washed from the tailings prior to placement in the tailings impoundment. It is estimated that concentrations of cyanide will not exceed 25 ppm at the discharge of the tailings line. Due to the elevation and large number of sunny days, it is anticipated that the cyanide will degrade very quickly within the pond.

Construction of the tailings facility will involve replacement of existing tails from tailings areas 3 and 4 for the new tailings berm.

The overall process site location is provided in Figure 1. An overall process flow diagram is provided in Figure 2A and 2B.

Figure 1. General Site Map and WQ Monitoring Scheme

Figure 2A. Process Flow Sheet Sulphide Plant

Figure 2B. Process Flow Sheet Oxide Circuit

1.5. Project Implementation

Originally, the project was scheduled to commence construction in the fall of 2000. Due to financial constraints, only the existing sulphide circuit has been operating at 200 tonnes/day. The upgrade construction project is scheduled to commence in September 2002 with operations scheduled to commence in September 2003. The construction schedule begins with a new mill arriving at site in June 2002. Construction will last approximately 12 months with the tailings pond construction completed in May 2003.

Since 1999, the mine has engaged in reclamation of historically impacted areas. Plata Panamericana is committed to continuing reclamation of these areas throughout the life of the mine.

1.6. Impact Summary

The La Colorada Project was classified a Category "A" project under World Bank Group Policies and Guidelines. A full EIA was completed and disclosed in September 2000. It is considered by IFC to be a project that may have diverse and significant environmental impacts. The La Colorada project includes the following significant impacts:

- Air quality impacts (dust, SO_2, NO_x);
- Land disturbance;
- Flora and fauna losses;
- Potential Water Quality Impacts; and,
- Socio-economics (overall positive impacts).

The La Colorada project will be built using internationally recognized mining techniques and practices designed to minimize environmental impacts. The environmental risk from the project can be predicted, and limited with the implementation of:

- Modern mining and milling practices;
- Proper tailing management techniques;
- Proper environmental engineering, mitigation, and reclamation measures; and,
- Careful monitoring of the project and prompt implementation of control measures in the event that environmental problems are detected.

The potential impacts of each aspect of the operations at the proposed La Colorada Project have been assessed and described for each component of the socio-ecological system.

2.0 Mitigation of Environmental and Social Impacts

Based on the updated design of May 2002, the main impacts associated with this project include:

- Water use and discharge – dewatering of the mine, contamination of surface waters due to historical tailings area, surface water run-off, effluent discharge from process and sanitary processes;
- Land disturbance – construction of a new tailings facility, new infrastructure, and historical areas required to be reclaimed;
- Positive socioeconomical impacts – employment opportunities up to 250 persons, improved infrastructure, technical training, and local development.
- Air quality – discharges from mill, fugitive dust from land disturbance, and mobiles sources;
- Flora and fauna losses – developing of tailings impoundment and infrastructure.

This section includes the main design solutions that will be implemented to ensure that the project works in an environmentally sound manner. These measures will be implemented throughout the life of the project, from construction through closure, to ensure that the site will be returned to the Mexican government in a satisfactory condition following closure and decommissioning. Mitigation measures and Best Management Practices can be changed during the life of the project based on management requirements, monitoring results, site characterization and waste characterization results, regulatory guidance, or identification of inefficient practices.

2.1. Air Quality Control Measures

The three main sources of air emissions are the stationary point sources, stationary fugitive dust sources, and mobile sources. The major pollutants that will be emitted during construction and mining operations include particulate matter, sulfur dioxide, oxides of nitrogen, and oxides of carbon.

2.1.1. Stationary Point Sources

The major stationary point sources for air emissions are:

- Melting furnace; and,
- Crushing plant and ore transfer points.

None of these sources will be operated during construction of the facility. Each stationary point source air emission control measure is described in the following sections.

Melting Furnace:

Emissions from the melting furnace have been calculated considering 300,000 gallons of fuel consumption annually. Additionally, the melting furnace will be equipped with a wet scrubber that was not included in the modeling exercise (in order to represent worst case scenario).

Dispersion modeling of point source emissions was conducted using U.S. Environmental Protection Agency-approved ISCST3, a steady-state Gaussian plume model that can be used to assess pollutant concentrations and/or deposition fluxes from a wide range of sources associated with an industrial complex. Results showed that all emissions would comply with World Bank Guidelines. Therefore, no other pollution control equipment besides the wet scrubber, is proposed.

Crushing Plant and Ore Transfer:

The crushing plant and ore transfer points are equipped with a baghouse, spray controls and dust covers to maximize prevention of dust emissions. Proper maintenance and operation of this equipment will ensure that dust emissions will be insignificant from the ore-processing circuit. In order to ensure that the baghouse is operating properly, the pressure drop across the baghouse will be monitored.

2.1.2. Fugitive Sources

Emissions during construction will consist primarily of fugitive dust sources. Fugitive dust includes wind erosion from cleared areas as well as dust mobilized from vehicle traffic. Because approximately 50% of the construction area has already been cleared during previous operations, additional impacts due to clearing of vegetated area will be minimal. The major source of impacts during construction will be fugitive dust from vehicle traffic. A program will be implemented in areas where dust may be a problem with the local population. Emissions from haul road will not disperse far from the roads due to the horizontal velocity of the dust. However, if it is determined during the course of construction or operation an additional dust suppression program can be implemented to reduce emissions.

Tailings area

Tails will be deposited in two separate tailings areas (oxide and sulphide) and may include underground backfilling (more positive environmental option). If excessive dusting is a problem during construction watering of heavy traffic areas will be carried out to mitigate the problem. During operations the majority of the tailings will be wet and dusting is not anticipated to be a problem. Prior to commencement operations, the site will develop operational guidelines designed to reduce fugitive emissions from the tailings pond. The tailings will be reclaimed by revegetating and will minimize dusting after decommissioning.

Use of tailings during construction of the new facility and reprocessing of some historical tails will have a positive impact on fugitive dust emitted from the tailings impoundment.

Worker air quality

The maintenance of good air quality in the working environment is required for preserving worker health, productivity, and safety. For this reason, the following measures will be implemented to ensure good worker air quality:

- Workers, as needed, will be provided individual respirators to provide personal protection for the maintenance of adequate air quality;
- The reagent preparation area will have exhaust fans that vent to the atmosphere to insure compliance with worker air quality;
- The mine will be ventilated in accordance with Mexican standards;
- Cyanide mixing will be conducted in a separate vented room; and,
- Concentrate storage and leaching tanks will be located outside.

2.2. Terrain/Land Disturbance

Mitigation measures for existing terrain disturbance include:

Reprocessing of existing tailings – Plata Panamericana plans to reprocess the tails from tailings impoundment #1, thus reclaiming these areas and eliminating erosion and deposition of the old tailings in Arroyo de La Colorada basin. This will reduce the historical tailings at the site by approximately 350,000 m^3.

Using tailings for construction material – The current plan calls for a portion of tailings from impoundments #3 and #4 to be used to construct the new tailings dam. Portions of each of these impoundments are on the Arroyo de La Colorada side of the divide between the La Colorada basin and the El Encino basin. The new tailings impoundment is in the El Encino basin. Those portions of the impoundments on the Arroyo de La Colorada side of the divide would be used in construction of the new tailing dam so that impacts from erosion of the old tailings into the La Colorada basin are minimized and the majority of the remaining old tailings would be contained within the same basin as the new tailings impoundment. This will reduce the impacts to the Arroyo de La Colorada from existing tailings. Prior to use of these tailings, ABA testing will be conducted to ensure suitability for use in construction.

Waste rock dumps – Plata Panamericana plans to use the San Fermin and Candelaria waste rock piles as backfill underground. This will reduce the terrain disturbance by approximately 90,000 m^3.

Mitigation measures for new terrain disturbance center around the new tailings dam. Mitigation measures include constructing the dam in a stable manner, prevent erosion of

the dam through a solid erosion control plan, and reclaiming the impoundment when it is no longer used.

2.2.1. Erosion control plan

During construction, surface disturbance could potentially influence water quality via runoff from disturbed areas. To mitigate the potentially adverse impacts, erosion and runoff control measures will be implemented on-site. The bulk of the project construction phase has been designed to be completed prior to the rainy season.

Optimal use of existing facilities and previously disturbed areas will minimize further disturbances. Other mitigation measures include engineered runoff diversion and leachate collection structures, concurrent revegetation of disturbed areas, and minimization of new surface disturbance. All are economically efficient and practical measures that will be implemented during construction (and operations) to prevent uncontrolled soil erosion. The following section presents a basic outline of the various approaches that may be used to implement an effective erosion control program.

A diversion ditch system has been designed to control run-off in the Arroyo La Colorada. It is capable of routing a 1 in 100 year, 24-hour storm event without any discharge to the impoundment. Any storm flows in excess of this will be directed in the impoundment by means of an open channel spillway located between the two diversion ditches. Additional information about the diversion ditch system can be found in Attachment 4 of this report.

Additional measures that will be employed at the site on an "as needed" basis include:

Culverts

Planned crossings should be clearly delineated and provided with culverts of adequate size or adequate, hard, submerged crossing points. During operations, these structures will require regular maintenance, including sediment and debris removal, especially for periods of high runoff. Erosion control, such as rock matting should be constructed at the culvert outfalls.

Stockpiling

Overburden material stripped during construction of the tailings area will be stockpiled in such a manner as to isolate the stockpile from run-off and erosion. This material will be seeded if it is not used during the 1st year of operation.

2.3. Soils

The mine is located in an area that has steep slopes that have been denuded during historical mining operations. These areas require implementation of an erosion control

program, management of any potentially acid generating materials and an aggressive revegetation plan. Preservation/collection of topsoil is a high priority to ensure adequate materials are available during revegetation activities.

During mining, almost all of the material removed from the mine will be processed in the mill; any waste rock generated during development will be used as backfill in the mine workings. The small waste rock stockpiles, totaling approximately 128,210 m^3, will also be used for mine backfill, thus removing potential acid generation and long-term impacts from these preexisting piles. These areas will be revegetated after the waste rock is removed.

The construction material for the new tailings dam (from existing dam #3 and #4) has shown the potential to be acid generating. In addition, the new tailings generated from sulphide processing ore are also potentially acid generating. Only two samples of new tailings have been tested. During construction and operation any seepage originating from the new dam or the new tailings impounded upstream of the new dam will be collected in the leachate pond located immediately downstream of the starter dam. In addition, any seepage from the existing tailings impoundment will be collected in a separate area. Mitigation measures will include properly designed diversion ditches and a seepage collection system that will return seepage to the tailings impoundment. After operations, the tailings impoundment will be reclaimed in such a manner to prevent the generation of acid drainage.

Preliminary static ABA testing indicates the oxide ore exhibits neutralizing potential. To date only two samples have been taken.

The relatively small amounts of existing waste rock, regional climatic conditions (low rainfall), and the opportunity to take preventative measures during construction and operations may reduce any impacts from soils to the natural environment from acid rock drainage. Mitigation of surface run-off and erosion control measures will be the major mitigation measure employed to prevent acid rock drainage. Monitoring wells and surface water sampling will allow monitoring of seepage and potential contamination.

A finalized Erosion Control and Rain Diversion Program will be prepared prior to September 2002.

2.4. Surface and Groundwater Impacts

The largest sources of potential impacts to surface water quality surrounding the La Colorada mine site are:

- Waste rock and tailings from previous mining operations;
- Waste water discharge;
- New tailings pond;

- Mine water discharge; and,
- Landfill.

Each of the impacts identified above are expanded in detail below based on existing conditions, construction, and operation of the mine. Data is included as an appendix at the end of this report.

2.4.1. Water Quality Impacts Due to Previous Mining Operations

Previous operations at the mine have left waste rock and tailings piles on the surface with no controlled drainage from these areas. Oxidation, generation of acidic conditions and leaching of metals or other contaminants into the surrounding soils have significantly impacted the water quality in the area. Seepage, runoff and sediment eroded during substantial rainfall events has flushed contaminants out of the wastes and carried them to the surface water courses. The proposed use of existing waste rock piles for mine backfill and subsequent regrading and revegetation of these areas will significantly reduce potential for further impacts by these piles. Likewise the reprocessing and/or use of old tailings for construction material in the new tailings basin will greatly reduce the potential impacts of these impoundments on the Arroyo La Colorada. Plata Panamericana is maximizing remediation of this problem by utilizing as much of the wastes as possible in their operations. These efforts include:

- Reprocessing tailings impoundment #1;
- Placement of San Fermin and Candelaria waste rock piles underground;
- Using portions of impoundments #3 and #4 for construction; and,
- Stabilizing slopes of remaining tailings impoundment to prevent tails from entering the Arroyo La Colorada.

Two samples of tailings from impoundments that will be the source for construction of the new dam have been tested for trace metals and static ABA testing. One of the samples was very strongly neutralizing and the other was weakly acid generating. Further testing will be conducted so that a representative number of samples have been analyzed. The number of samples recommended for testing is based on the number of tonnes of the material that will be used in the starter dam. Approximately 100,000 m^3 (160,000 tonnes) are estimated for the dam, 6 samples will be analyzed. Samples will be collected from an evenly spaced grid established over the portions of impoundments 3 and 4 that lie on the Arroyo La Colorada side of the divide.

2.4.2. Potential Water Quality Impacts from New Tailings

The long-term impacts to groundwater are also estimated to be minimal, regardless of leachate quality. Once operations cease, the tailings water will drain within a short period of time (probably less than 20 years since the process water drained from impoundment #5 within 2 years after the operations ceased in 1997). The thickness of the unsaturated zone between the tailings and the regional water table combined with the

arid climate and low permeability crystalline bedrock will ensure that no groundwater mounding will occur.

The long-term impacts on surface water could be significant if rainfall or runoff were allowed to infiltrate into the pile and subsequent seepage discharge from the toe of the impoundment entered the surface water system. Grading the final contours of the pile to maintain positive drainage will minimize infiltration. Placement of available soil cover material and revegetation will further reduce the infiltration into the tailings over the long term. Maintenance of freshwater diversion channel around the site is practical during operations, however in the long term some diversion water may infiltrate the tailings. Therefore the characteristics of the tailings will be further quantified using the following approach.

Tailings derived from the oxide facies ore will comprise approximately 64% of the tailings (2.1 million tonnes). The chemical characteristics will be confirmed by completing an additional ABA, trace metal analysis and leachate analysis on a representative number of oxide ore samples. Chemical characterization of the ore will provide a conservative estimate of the tailings characteristics since some of the trace constituents may be removed with the gold and silver during the leaching process.

Tailings derived from the sulphide ore will comprise approximately 21% of the tailings (0.7 million tonnes). The chemical characteristics of the sulphide tailings will be confirmed by completing an additional ABA, trace metal analysis and leachate analysis on a representative number of sulphide facies ore. If these tailings are identified as acid generating, provisions will be made in the tailings management plan to minimize the potential long-term impact of the tailings.

Tailings derived from the reprocessing old tailings will comprise approximately 15% of the tailings (0.5 million tonnes). The chemical characteristics of the old tailings will be confirmed by completing an additional acid-base accounting, trace metal analysis and leachate analysis on a representative number of samples from the old tailings impoundments. Depending upon the results of the chemical characterization provisions will be made in the tailings management plan to minimize the potential long-term impacts.

2.4.3. Mine Water Discharge

Mine water discharge is currently about 700 USGPM and it comprises the majority of the flow in the Arroyo La Colorada. Downstream users do not currently use this water for agricultural purposes. During the proposed operations the discharge will probably fluctuate, going down slightly when the mill starts up (the mill will use about 80 USGPM) and then increasing slightly as mining proceeds to deeper levels.

Historically, during times of mine shutdown, the water level in the mine rose to approximately 160 meters below surface and then became static. At present it is not known what level the mine will flood back to or whether the flood back level could result

in discharge and provide a water supply without the need for long term pumping. In order to assess which scenario is likely a site investigation is proposed. The investigation may include measurement of water levels in existing monitoring wells or open diamond drill holes if available and/or other hydrological predictive means designed to determine final water levels. These studies will provide useful information about probable minimum floodback water levels. The predictions will allow assessment of which options are feasible and cost effective for long-term maintenance of water supply. Plata Panamericana does not accept long-term financial responsibility for maintaining the pumps for the mine. The study would simply provide additional data for the municipality to make a decision about the long-term viability of pumping water after mine closure.

2.4.4. Landfill

Currently, domestic solid waste is placed in the upgraded sanitary landfill located in the area of the Aguila shaft. Although this facility is unlined, it is considered appropriate for deposition of non-hazardous industrial and domestic wastes due to the fact that it does not collect a lot of surface water run-off and does not impact any groundwater sources.

Water quality results do not show heavy metal leaching from this facility.

As part of construction, Plata Panamericana will improve the design and construct of the sanitary landfill in a relatively flat area near the Aguila shaft. Following consultation with the municipality of Chalchuites, which has jurisdiction of this facility, it is expected that the newly constructed landfill will be able to receive the following items:

- Construction wastes (wood, concrete, etc.);
- Shredded tires and other rubber items;
- Paper and wooden packing materials;
- Domestic solid wastes; and,
- Scrap metal that cannot be recycled.

There will be two “boneyards” for disposal of scrap material- one within the planned shops and warehouse area, and a second within the area of the landfill. The landfill “boneyard” disposal area will be designated for the disposal of scrap machinery, rails from the mine, other metals, and non-toxic metal containers and materials, which are not considered to be of immediate use. Adequate drainage structures will be constructed to control the movement of surface water runoff through and off of both sites. In addition, the “boneyards” will be organized for easy access from waste generating sources and to allow for items placed in the “boneyards” to be easily recycled, backhauled, broken-down, or re-used. Waste items will be grouped into separate areas, so that metal scrap can be accessed for salvage or re-use at any time.

The following materials will not be stored in the scrap metal waste dump:

- Spent oil filters and petroleum containers;

- Used equipment and truck batteries;
- Products containing pressurized gas;
- Empty reagent containers or drums;
- Other metal containers that contain resins, solvents, cleaners, paint; or petroleum products; or,
- Soils and other materials contaminated with petroleum products.

These materials will be temporarily stored in a specially designated bermed area with a concrete floor, synthetic liner or appropriate cover. This area will be secure, well labeled and clearly delineated. These materials will be shipped off site on a regular basis by an approved company to a designated disposal facility.

2.5. Vegetation

Project goals for development of the deposit are based upon maximum use of previously developed land in the vicinity of the proposed sites for construction of the mine, processing mill, tailings facility, man camp, auxiliary facilities, and access road. This will ensure that any substantial growth of the disturbed land areas will not occur and therefore limit the physical impact on natural resources to the vicinity of previous activities. A total of an additional 35 ha will be disturbed during construction and operation.

Impacts to vegetation during operations are expected to be reduced via an aggressive reclamation plan that calls for revegetation of any area that is not used during construction and operations.

During operations, the only impacts to vegetation will be localized. Impacts to vegetation may result from dust generated along the haul and access roads for the facility. These impacts will be limited to during heavy traffic periods. These effects are considered insignificant and short-term.

Mitigation measures include:

- Minimizing new land disturbances;
- Construction of a nursery to establish plants to be used during reclamation;
- Aggressive approach to revegetating exposed surfaces whenever land is not in use;
- Minimizing air pollution and fugitive dust by watering roads when necessary; and,
- Implementation of a sound surface water run-off diversion program.

2.6. Hunting and Poaching

A firm policy against hunting and poaching will be implemented by the project sponsors. The policy will serve to mitigate impacts to any large game species from poaching or hunting in the area. Additionally, Plata Panamericana will allow free access to regulators to police the site.

2.7. Socio-economic

Impacts from the project on socioeconomics of the region are expected to be positive. Measures that Plata Panamericana are proposing to ensure positive impacts include:

- Showing bias towards hiring persons that live in villages surrounding the mine site;
- Developing a training program designed to provide valuable working skills for future employment in the mining and milling industry;
- Providing a potable water source for the town of La Colorada during operations; and,
- Developing the road along the access route.

Each of these positive social impacts is described in greater detail in the following sections.

2.7.1. Hiring bias

During consultation with the surrounding communities, concerns were expressed about the ability of local community members to compete with other mining specialists for jobs at La Colorada. Plata Panamericana has committed to hiring locals for most of the jobs at La Colorada. If a local is not qualified for the position, Plata Panamericana has committed to implementing an aggressive training program for these workers exclusive of trade laborers.

Currently, the sulphide operations is employing 111 persons. Table 3 identifies where the current workers originate.

Table 3. Origins of Workers at La Colorada

# Persons	Town	Distance
32	La Colorada Mpio. Chalchihuites, Zac.	0 Km.
21	Atotonilco, Mpio. Jimenez del Teul, Zac.	10 Km.
18	Sombrerete, Zac.	36 Km.
5	Real de Catorce, San Luis Potosi.	440 Km.
5	San Jose de Ranchos, Mpio. Sombrerete,Zac.	18 Km.
6	Durango, Dgo.	150 Km.
3	La Libertad, Mpio. Chalchihuites, Zac.	5 Km.
3	Colonio Orion, Mpio. Sombrerete, Zac.	20 Km.

# Persons	Town	Distance
2	Tayoltita, Dgo.	
2	La Magdalena, Mpio. Chalchihuites, Zac.	5 Km.
2	Saltillo, Coah.	550 Km.
2	Zacatecas, Zac.	220 Km.
1	Aguascalientes, Ags.	330 Km.
1	Real de Asientos, Ags.	290 Km.
1	Gomez Palacio, Dgo.	340 Km.
1	Canatlan, Dgo.	210 Km.
1	Torreon, Coah.	340 Km.
1	Chalchihuites. Zac.	42 Km.
1	San Martin, Sombrerete, Zac.	50 Km.
1	Concepcion del Oro, Zac.	440 Km.
1	San Jose de Avino, Mpio. Fco. I. Madero, Dgo.	230 Km.
1	Fresnillo, Zac.	140 Km.
111	T O T A L	

During construction it is anticipated that approximately 260 persons will be employed. During operations this number will be reduced to approximately 210 persons.

2.7.2. Training program

Plata Panamericana is committed to hiring and training workers for the project from the local communities around the project. In addition to showing a bias for hiring local community members, Plata Panamericana has developed a program for training. This program will include training in both theoretical and practical aspects of mining and milling to ensure that the workers over time are capable of completing the tasks required in the mining industry.

Training will provide the workers with marketable skills that can be used in the mining industry. Considering the fact that the Chalchuihites district is one the richest mining districts in the world, the training may have a long-term, far-reaching impact on employment opportunities in the area.

2.7.3. Potable water

Currently, potable water is trucked from other communities to La Colorada. Plata Panamericana pays 50% of the costs for the power consumed during pumping and the vehicle to transport the water. Plata Panamericana will investigate the possibility of providing a potable water source either through drilling a new potable water well or treating a portion of the underground mine water discharge so that it meets drinking water standards. This would provide the community with a source of drinking water that does not depend on availability from other communities. The results of this investigation must be compared to the benefits to the other communities through the use of one well.

2.7.4. Community development

Plata Panamericana is developing a fund designed to assist the neighboring communities around the mine that may be impacted by the project. It is estimated that this fund will contain approximately $US 60,000. This money will be used on infrastructure development of villages along transport routes. The primary areas targeted include:

- Colonia Orion; and,
- San Juan de La Tapias

Specific projects currently include upgrading of road conditions, repairing bridges as needed and improving road conditions to allow the passage of large vehicles to the mine. The results of previous public consultation with Colonia Orion and San Juan de La Tapias indicated that a by-pass of the two villages was not the preferred alternative.

Historically, Plata Panamericana has helped the nearby villages not only with projects that support the La Colorada mine, but also the communities. Projects that have been completed in the past include:

- Providing 10 tons of cement to the village of Chalchihuites for infrastructure repairs (cost - $US 1,500);
- Help to neighboring communities with construction materials such as pipes, cement, fencing, etc. (cost – $US 10,000);
- Repairs on roads around the mine ($US 40,000);
- Help to the police department in Chalchuihites with gasoline and other supplies ($US 1,500);
- Provides clean-up and other environmental awareness programs to local communities; and,
- On-going environmental education within the local schools.

Plata Panamericana is committed to continuing support to La Colorada during operations through the infrastructure development fund. The main focus will be to improve waste management and sanitary conditions around the village of La Colorada.

2.8. Health and Safety

A full Environmental, Health and Safety Plan (HSP) has been created for this project. The framework of the HSP was developed based on the World Bank's Occupational Health and Safety Guidelines (World Bank, 1988), Mexican health and safety requirements, and the U.S. Mine Safety and Health Administration (MSHA, 1980-1998) guidelines. The HSP includes information on:

- Worker responsibilities;
- Emergency procedures;

- Accident investigation procedures;
- General health and safety guidelines;
- Personal protective equipment;
- Cyanide handling and transportation
- Laboratory and chemical safety;
- Employee information and training; and,
- Transportation safety.

The full HSP is found in Attachment 2 of the EAP. The HSP will continue to be updated as part of the EAP to incorporate the contractors HSP as more information becomes available.

During construction, if a general contractor is used, the contractor will provide a full-time health and safety specialist to ensure health and safety at the job site. This person will be responsible for ensuring all aspects of the Health and Safety Program are implemented. The health and safety department will report directly to the Plata Panamericana's Health and Safety Department and indirectly to Plata Panamericana General Director.

Additionally, the contractor agrees to all Plata Panamericana's Health and Safety Policies. These policies are based on WBG guidelines and international best practices.

During operations, La Colorada has a full-time health and safety person for the mine site. This person is responsible for implementing the Health and Safety Plan and compliance with Mexican Health and Safety Requirements. The health and safety department reports directly to the Mine Manger and indirectly to the General Director and corporate health and safety department.

2.9. Spill Prevention, Control, and Countermeasure Plan

The Spill Prevention, Control, and Countermeasures Plan (SPCC) identifies the procedures required to ensure that the potential for, and risk resulting from, accidental releases of potentially hazardous materials is minimized to the greatest degree possible.

The materials used at the mine and mill are common to other mining facilities of this type located elsewhere and include diesel fuel, lubricants, petroleum solvents, miscellaneous laboratory chemicals, and a variety of process reagents. A list of the major chemical reagents to be used at the La Colorada mine and processing plant, including the estimated rates of consumption, is provided in the SPCC Plan.

The SPCC includes information on:

- Materials, properties, quantities, and containers;
- Transport of materials;
- Spill responsibility;

- Readiness;
- Accidental release notifications, and protocols;
- Spill prevention;
- Spill control and countermeasures; and,
- Employee training.

The full SPCC Plan is found in Attachment 3. This document will be updated as part of the EAP as more information becomes available during project implementation. These updates will include a comprehensive Emergency Response Plan (ERP) for transportation, storage, use, and management of hazardous substances.

2.10. Waste Management Plan

This management plan details the various aspects of waste disposal including management supervision, waste classification, and arrangements for regular waste removal. The Waste Management Plan applies to construction, operation, and closure of the project.

It includes management of wastes generated during construction, operations, and closure. The following types of wastes are covered in the plan:

- Domestic liquid effluent;
- Domestic solid wastes; and,
- Industrial solid wastes.

Disposal methods proposed include collection and sorting of materials and then placement of the materials within a secured and appropriate landfill designed to meet World Bank Group guidelines. Additionally, general management guidelines are provided in this plan. Prior to commencement of operations, the Waste Management Plan will be updated and submitted to IFC for review. The full Waste Management Plan is provided in Attachment 4 of the EAP.

2.11. Reclamation and Closure Plan

The purpose of reclamation is to return the disturbed areas to stabilized conditions following mining and ore processing activities as well as ensure long-term protection of land and water resources in the area. Any interim reclamation completed will have the goal of stabilizing a given area as soon as possible after mining activities are completed in that area. The overall reclamation plan (see Attachment 5) will have the following goals:

- Establish stable topographic and drainage conditions that are compatible with the surrounding landscape and controlling erosion;

- Establish surface conditions that are conducive to regeneration of a stable plant community where practical through removal, stockpiling, and re-application of a suitable soil cover; and,
- Establish a long-term productive, self-sustaining, biotic community compatible with the proposed future land uses and comparable to what currently exists at the site by seeding/coring/sprigging of disturbed areas using species adapted to site conditions.

The long-term revegetation goals for the areas reclaimed at the project site will be to achieve perennial plant cover similar to those measured in an adjacent vegetative community or reference area. Acceptable levels for reclamation success are defined as:

- Re-establishment of a vegetative cover having a density of at least 75% of the surrounding undisturbed areas; and,
- An average species diversity of approximately 30 to 40% of the surrounding undisturbed area at the end of 7 years following revegetation.

The reclamation plan covers a total of 65 ha that will be subject to the following reclamation measures:

- Removal of equipment and structures;
- Portal closures;
- Regrading and recontouring of all areas;
- Revegetation in accordance with the natural vegetation structure; and,
- Long-term water management measures to prevent soil erosion.

Newly reclaimed areas will be managed consistent with the project reclamation goals. The sites will be evaluated periodically during the first several years after revegetation to determine the effectiveness of the reclamation plan. The success of the reclamation plan will be monitored during this time to assure erosion has been prevented and that the species reestablishment has been occurring. Maintenance will be conducted on the site as necessary to assure reestablishment of vegetative species.

Total costs for reclamation, including recontouring, rehabilitation of existing areas of impacts, biological stabilization (planting for erosion protection, seeding of perennial grasses) and physical stabilization (anti-erosion measures) are approximately $US 1,250,000. This amount will be corrected depending on the results of the reclamation plan that will be submitted prior to commencement of operations.

This money will be accrued ($US 125,000 dollars/year beginning in Year 2) by Plata Panamericana to be used solely for the purposes of Reclamation and Closure. Each year, as part of the Annual Monitoring Report submitted to IFC, an annual reclamation plan will be submitted to IFC for review.

3.0 Implementation and Monitoring

This section presents the proposed Environmental Monitoring Program (EMP) for the La Colorada Project. All of this section should be considered "guidelines" for monitoring, a final detailed monitoring plan will be implemented during construction. When the EMP is finalized and the Mexican licenses are granted for air, water, and waste discharges, the EMP should be made available in both Spanish and English. The English version will be provided to IFC for disclosure as part of the updated EAP.

The primary purpose of the EMP is to ensure that the project is in compliance with Mexican operating permits and environmental regulations as well as World Bank Group policies and guidelines, and to evaluate the effectiveness of the environmental mitigation measures as described herein. The results of the monitoring program will be reviewed by project management on a periodic basis. If adverse environmental changes occur as a result of the project, appropriate remedial measures will be implemented to reduce or eliminate project-related effects. Specific details of any mitigation measures associated with unforeseen project-related effects will be developed based on the results of the monitoring.

Environmental monitoring is proposed for the following environmental components and mine facilities:

- Site meteorology/air quality;
- Groundwater quality;
- Surface water quality;
- Tailings impoundment; and,
- Acid rock drainage.

The following sections provide more detail.

3.1. Meteorological Station

Meteorological data is important to determine ambient air concentrations, risks of contamination during upset conditions, weather conditions that might be adverse to operation, water balances, and other air pollution dispersion measurements. Since there are no long-term meteorological records for the site, the quantitative meteorological data was provided from analogous locations. While this data can be used for feasibility level design, Plata Panamericana will construct a meteorological station at the site to ensure accurate meteorological data.

3.1.1. Parameters to measure

- Wind speed;

- Wind direction;
- Temperature;
- Solar radiation;
- Solar flux;
- Evaporation;
- Precipitation; and,
- Relative humidity

3.1.2. Method to use

Campbell Scientific Meteorological Station with CR10 Datalogger ($US 12,000). This weather station comes with a 10-meter mount and is considered a worldwide standard for meteorological monitoring. The system includes a data logger, wind speed, wind direction, temperature, relative humidity, rain gauge, and power supply.

3.1.3. Sampling location

Sampling location will be determined during project development to ensure that representative meteorological data is recorded. The site should be relatively free of interference and close enough to the offices to allow regular downloading of meteorological data.

3.1.4. Frequency of measurements

Measurements will be measured automatically every 15 minutes.

3.1.5. Reporting and Record keeping

Logs will be summarized in annual reports to IFC and submitted to Mexican regulatory agencies in accordance with Mexican guidelines.

3.2. Ambient Air Quality

An air quality monitoring program will be developed to run during construction and full-scale operations. Particulate matter is the only significant source of ambient air pollution due to fugitive dust sources.

3.2.1. Parameter to be measured

Particulate matter

3.2.2. Method to be used

Mini-volume particulate samplers ($US 1,500 each)

3.2.3. Sample Location

Sampling locations will be determined during project development to ensure that the ambient air is monitored appropriately. This site should sufficiently distinguish between ambient air concentrations from the various air pollution sources and a representative background concentration.

The sampling of the mini-vols or high/low volume samplers should incorporate the following requirements:

- The siting should be as close to the fence line as possible to determine, as accurately as possible, what off-site concentrations will be.
- The siting should take into account local topography. The terrain should allow for no obstructions for the PM sampler and anemometer.
- Additional considerations should be given to future development. The site should be located in such a manner to avoid obstructions to the sampler as the mine life progresses.
- The siting should be a sufficient distance from sources that may bias the measurements. Sources such as haul roads, stockpiles, waste dumps, etc., should be included in the siting analysis.
- The site should be easily accessible to staff.
- A power source should be provided at the site.
- The location of the site should be easily securable.

3.2.4. Frequency of Samples

Weekly. These records will be recorded in a log that will be reported to IFC and Mexican regulatory agencies in accordance with Mexican guidelines.

3.3. Combustion Stack Gas

Combustion gases will be generated from the La Colorada melting furnace. These gases will be dependent on the hours of operation, sulfur content of the diesel fuel, fuel consumption, and other parametric variables.

3.3.1. Parameters to measure

- Fuel consumption;
- Hours of operation; and,
- Sulfur content of the fuel

3.3.2. Method to use

Parametric monitoring will be used to ensure compliance, annual testing as required under Mexican guidelines.

3.3.3. Frequency of measurements

Daily logs will be kept and actual measurements will be taken annually.

3.3.4. Reporting and record keeping

Records will be recorded in a log that will be reported to IFC and Mexican regulatory agencies in accordance with Mexican guidelines.

3.4. Groundwater Monitoring

Currently, Plata Panamericana monitors groundwater from two monitoring wells (MW 98-4 and MW99-1). There were originally 5 monitoring wells but three do not typically have water in them. Those that have had water in them have been sampled primarily for depth of water due to the fact that the wells have not been purged prior to analyses.

MW 98-4 is located within the proposed impoundment area and will have to be abandoned once the liner construction proceeds. The well must be backfilled with cement bentonite grout to avoid it representing a pervious bentonite conduit from the tailings impoundment to the underlying perched groundwater system. Additional deep monitoring wells will need to be installed up and down-gradient of the impoundment as ongoing hydrogeologic studies of the site proceed.

The recommended monitoring approach includes three sets of measurements:

- Depth to water;
- Measurement of field parameters; and,
- Determination of groundwater constituents.

Table 4 lists the ground water constituents.

Table 4. Laboratory Analyses to be Performed on Groundwater Samples

No.	Parameter	No.	Parameter
1	pH	2	Total Dissolved Solids
3	Alkalinity	4	Bicarbonate
4	Calcium	6	Magnesium
5	Potassium	8	Sodium
7	Chloride	10	Fluoride
9	Nitrate and N	11	Ammonia + Ammonium
11	Sulfate	12	Arsenic
13	Bromine	14	Cadmium

No.	Parameter	No.	Parameter
15	Chromium	16	Copper
17	Iron	18	Lead
19	Manganese	20	Mercury
21	Selenium	22	Silver
23	Zinc	24	Total Petroleum Hydrocarbons

Samples will be taken from monitoring wells utilizing a portable pump. The water in the well must be purged three times the volume of the casing to assure that the water sampled is indeed groundwater, and not ponded rainwater. Field parameters will be measured on-the-spot and samples for laboratory analysis will be bottled, chemically preserved where necessary, and stored on ice until delivery to the analytical laboratory.

Equipment needed for groundwater monitoring and approximate prices are provided in Table 5:

Table 5. Specifications of Equipment Required for Groundwater Monitoring

Instrument	Manufacturer	Price (US)	Detection Limits
pH meter with thermocompensator	Beckman	$820	0.00 - 15.99 pH
Conductivity meter-handheld digital	Cole Parmer	$315	0.00 - 199.99 S
Alkalinity test kit	Hach	$150	no limits
Portable pump	Solinst	$5000	NA

3.4.1. Frequency of Measurements

On a monthly basis, the groundwater monitoring wells will be measured for water table level elevation. In addition, field water quality parameters will be determined, including temperature, pH, alkalinity and electrical conductivity. On a quarterly basis, groundwater monitoring wells will be measured for water level elevation, field parameters, and the parameters listed in Table 4.

3.5. Surface Water Monitoring

Surface water monitoring to date has focused on the following sampling points:

A-3: Mine water discharge

Data have been collected for the mine water discharge thru October 2001. During this period, the samples showed compliance with most Mexican and World Bank Group (WBG) guidelines and standards. The exception was oils and greases where the results occasionally exceeded Mexican standards and consistently exceeded WBG guidelines.

A-10: Arroyo El Encino

Data have been collected for the valley that collects the seepage from tailings dam #5 thru October 2001. During this time, results showed compliance for Mexican and WBG guidelines and standards for all parameters except suspended solids, lead, zinc, iron, cadmium, oils and greases. The seepage from this area does not report to the creek formed by the mine water discharge and eventually disappears in the arroyo.

A-11: Midpoint Arroyo La Colorada

Data have been collected for this point thru October 2001. This point is used to identify impacts from the historical tailings that have spilled in Arroyo La Colorada. Results from monitoring indicate exceedances for most metals measured in comparison with WBG guidelines. The exceedances are easily diluted by the mine discharge and are not found further down the arroyo.

A-TB: Septic Tank

The discharge from the septic tank is measured before it mixes with the Arroyo La Colorada. Data have been collected thru September 2001. Results indicate that there are exceedances in most base metals in relationship to WBG guidelines. These metals include: lead, zinc, iron, copper, and selenium.

A-13: Potable water supply

Potable water is sampled from the tap near the main office in La Colorada. Data have been collected thru September 2001. Results indicate that the water quality is in compliance with Mexican guidelines and mostly in compliance with WBG guidelines. Exceedances of some base metals are most likely due to contamination from the piping network.

A-22: Old Compliance Point

Data have been collected for this point thru October 2001. This point was originally used as an overall site monitoring point because it is located below the last point of potential contamination in Arroyo La Colorada. Results indicate occasional exceedances of WBG guidelines in suspended solids and some base metals (lead, zinc, and copper) as well as oils and greases.

A-99: New Compliance Point

The compliance point was moved to the property boundary to determine what the discharges are at the edge of the property. Samples have been collected thru October 2001. Results indicate that the discharge is mostly in compliance with Mexican and WBG guidelines and standards.

Surface water monitoring stations will be established to comply with all Mexican regulatory requirements and regulatory guidance.

3.5.1. Parameters to measure

Parameters that will be analyzed as a part of the surface water quality monitoring program are commensurate with the sources of potential contamination to streams and rivers throughout the project area. Those sources as outlined in Volume 1, Section 6.0, Impacts, are:

- Surface disturbance;
- Mining activities;
- Tailings storage; and,
- Sewage treatment and disposal.

The monitoring program will adequately determine any potential impacts from each of these sources. A combination of field observations, on-site analysis, continuous monitoring and laboratory analysis will be used to integrate the surface water monitoring program. On-site observations will detect any obvious changes in flow, turbidity and odor. Field water quality analyses will include stream flow, pH, temperature, dissolved oxygen, alkalinity, conductivity and turbidity. Parameters to be included in laboratory analysis are presented in Table 6.

Table 6. Surface Water Quality Monitoring Parameters for Laboratory Analysis [A]

No.	Parameter	No.	Parameter
1	PH	21	Ammonia + Ammonium
2	Total Suspended Solids	22	Nitrites
3	Total Dissolved Solids	23	Nitrates
4	Total Petroleum Hydrocarbons (TPH)	24	Phosphates
5	Detergents	25	Free Iron
6	Phenols	26	Silicon
7	CN_{Total}	27	Selenium
8	Alkalinity (total/$CaCO_3$)	28	Beryllium
9	Bicarbonate as HCO_3	29	Vanadium
10	Sulfate	30	Cadmium
11	Calcium	31	Cobalt
12	Magnesium	32	Copper
13	Sodium	33	Molybdenum
14	Potassium	34	Arsenic
15	Chloride	35	Nickel
16	BOD_5	36	Mercury
17	COD	37	Lead
18	Telerium	38	Antimony
19	Chromium	39	Zinc
20	Flotation Reagents		

[A] parameters may be added or deleted from this list based on discussions with Mexican regulators during permitting and baseline evaluations.

3.5.2. Methods to use

Monitoring and sampling of surface waters will be conducted according to both Mexican and EPA methodologies. Daily observations will be done through visual and olfactory estimations. Field water quality measurements will be made with the equipment presented in Table 7 by qualified technicians specially trained in the instrumentation.

Table 7. Specifications of Equipment Required for Surface Water Monitoring

Instrument	Manufacturer	Price (US)	Detection Limit
pH meter with thermocompensator	Beckman	$820	0.00 - 15.99 pH
Conductivity meter-handheld digital	Cole Parmer	$315	0.00 - 199.99 S
Alkalinity test kit	Hach	$150	no limits
Dissolved oxygen meter	YSI	$700	0.00 - 20.00 mg/L
Portable turbidimeter	Ben Meadows	$895	.01 - 100.00 NTU

Samples to be analyzed in the laboratory will be collected at mid-stream and mid-depth of the stream reach according to EPA protocols.

3.6. Tailings Dam Monitoring

A monitoring program for the tailings impoundment will be maintained to evaluate and document the performance of the tailings facility. This monitoring program is divided into the following parts:

- Geotechnical observations;
- Water quality monitoring;
- Review of proper implementation of construction and deposition plans; and,
- Water balance review.

3.6.1. Geotechnical observations

Geotechnical instrumentation and monitoring will be performed throughout the construction and operation of the tailings management facility in order to assess performance and to verify actual conditions are consistent with the design assumptions. Data obtained through a monitoring program will allow design modifications to be made (if necessary) to the facility throughout the operating life and into closure.

The instrumentation and monitoring system is composed of piezometers that will be placed to monitor saturation of the tailings dam. Piezometer readings will be taken

weekly until constant trends can be established. Thereafter, monthly readings will be considered adequate.

As the dam is raised, additional piezometers will be placed within the dam shell. The intent of these piezometers is to understand the seepage regime as the dam is raised. Monitoring of the piezometers will be integrated into an overall dam surveillance program to identify any design and/or operational modifications that may be needed. The dam surveillance program will include:

- Visual inspection of seepage collected;
- Measurement of the underdrainage flows;
- Measurement of flow from the collector drain along the toe of Dam 5;
- Inspection of the downstream slope of the dam;
- Inspections of the tailings and reclaim pipelines;
- Dialing recording of the tailings pond water levels; and,
- Inspection of the diversion dams and ditches.

3.6.2. Water quality monitoring

Monitoring of surface waters and groundwater wells below the tailings facilities will be conducted throughout the life of the project to assure early detection of any contaminant leakage.

The general groundwater monitoring program for various facilities at the mine site is addressed in Section 3.4, Groundwater Monitoring. The groundwater monitoring program around the tailings impoundment will be designed to measure any changes in existing groundwater conditions downgradient of the tailings impoundments. Monitoring wells may be used in combination with piezometric wells to measure pore pressures within the actual embankment of the tailings impoundment.

3.6.3. Water balance

A mill and tailings impoundment water balance will be developed on an annual basis as based on variations in operations and meteorological conditions. Monitoring of the water balance will serve to indicate if any significant and unexplained water losses or gains in this system are occurring. Such losses or gains could indicate seepage or other problems along the closed circuit water supply system.

The information needed to construct an annual water balance will include:

- Precipitation data;
- Runoff volumes;
- Tailings levels;
- Tailings density; and,
- Evaporation.

3.6.4. Construction QA/QC Monitoring

Prior to and during construction, the biggest issue will be the stability of existing tailings dam #5. Plata Panamericana is in the process of conducting a 3rd party, independent stability analysis of the existing tailings impoundment. This plan will be made available prior to use of the facility.

3.6.5. Tailings Management Plan

A Tailings Management Plan will be developed based on the average conditions proposed for the mill operations. The plan will be completed in January 2004. The Tailings Management Plan outlines guidelines for the operations staff as to how the tailings will be placed. This will help maximize the placement of tailings in the facility and minimize the volume of water that will need to be treated and released each year.

The Tailings Management Plan will set out the monitoring recommended to confirm the disposal facility is properly operated. The Tailings Management Plan will be reviewed on an annual basis and updated to reflect operational changes.

Additionally, under IFC policy, an independent, 3rd party review of the tailings impoundment must be completed for any operational or new tailings dams over 15 meters in height. This requirement will apply to the new tailings dam and impoundment #5. Detailed terms of reference will be prepared after a final decision has been made on placement of sulphide tailings.

3.7. Potential Acid Rock Drainage

To evaluate the chemical composition of the runoff and infiltration to groundwater from acid rock drainage (ARD), water quality monitoring of surface and groundwater down drainage of the waste rock disposal or ore stockpiling areas will be conducted. Existing waste rock piles and ore stockpiles will be sampled during the first years of operations. Waste rock will undergo static testing to determine acid generation potential. If the waste rock shows a potential to generate acid, weathering tests or shake flask kinetic tests will be conducted to determine long-term acid generation potential.

The tailings pond will also have potentially acid generating materials during the project. In the reclamation plan, which must be completed prior to commencement of operations, design considerations will be listed for covering and isolating the potentially acid generating tails.

4.0 Social, Health and Safety Monitoring

The Health and Safety Program presented in Attachment 2 requires that sources of health hazards be closely monitored, which include the monitoring of noise and toxic mine gases. Monitoring will be conducted that the project complies with all World Bank Group guidelines and ensure that the project has an overall positive social impact on the area. The plans that have been developed for the La Colorada project are attached to this EAP. These documents are preliminary in nature. As these documents are refined prior to start-up, they will be submitted to IFC for review.

4.1. Waste Classification

Waste classification and tracking of disposal routes is an essential part of an effective and realistic waste management program. For example, wastes should be classified as hazardous or non-hazardous according to pre-determined criteria. These wastes should then be separated and disposed of in different manners. A waste classification and tracking form is provided in the Waste Management Plan, Attachment 4. This table outlines the various waste types that will be generated throughout the project area, as well as providing a means of tracking the disposal routes and ensuring that waste disposal practices are matching environmental protection directives. Such tracking helps to ensure that regular waste collection does occur, and that all wastes are routed to the appropriate disposal location.

4.2. Underground Ventilation Monitoring

Ineffective ventilation may result in oxygen deficiency and accumulation of toxic gases at underground workings and therefore close monitoring is required to assure a healthy working environment for miners. On a regular basis, the mine health and safety person will sample air quality in the mine to ensure that the air is in compliance with Mexican and IFC guidelines.

Parameters to be measured are:

- Oxygen (O_2);
- Sulfur dioxide (SO_2) ;
- Nitrogen oxides (NO_x);
- Carbon monoxide (CO); and,
- Carbon dioxide (CO_2).

Sampling locations:

- All active current and new underground workings.

4.3. Public Consultation and Disclosure

Public consultation on the project has been on-going since the first EAP in 1999. During the initial EAP, the company was very active in the communities and ejidos around the minesite. A public consultation and disclosure plan was designed and implemented that is in compliance with IFC/WBG guidelines. During implementation of the initial consultations, very high expectations for the project were generated due to the extensive numbers of meetings that occurred. After the financing for the project was halted, Plata Panamericana returned to a more conservative public consultation approach, meeting with village and ejido leaders to discuss progress on the project. Over the course of the next two years, meetings to discuss potential project developments were informal and not recorded. In July and August, 2002, Plata Panamericana arranged formal meetings with the local ejidos and communities along the access route. This included meetings with the Chalchuihites (7/23/02) and Jimenez del Teul municipalities (8/5/02) and planned meetings with the villages of Colonia Orion (8/15/02) and San Juan de la Tapia (8/28/02). A brief summary of the meetings that have already occurred are provided in Attachment 6 (Public Consultation and Disclosure).

Additionally, the CEO of Pan American Silver Corp. and the General Director of Plata Panamericana met with the Governor of Zacatecas on July 2, 2002 (after financing of the mine was secure) in a locally broadcasted forum discussing development of the mine. People in attendance were able to ask questions and responses were given underlining Plata Panamericanas committed to following both WBG policies and guidelines and Mexican requirements for mining. Newspaper summaries of the meeting are provided in Attachment 6.

As Plata Panamericana moves forward in the project, Plata Panamericana will arrange regular public meeting with local stakeholders (beginning in July 2002) to update information on the project.

5.0 Environmental Management

The overall philosophy of Pan American Silver at its subsidiaries is to integrate local specialists to the maximum extent possible coupled with strong auditing from the corporate office and western consultants. Environment, social, health, and safety are integrated into one department. This department is responsible for overseeing compliance at the local facilities and conducting audits of existing facilities.

5.1. Existing Environmental Management at Pan American Silver Corp

Pan American Silver Corp has a Board of Directors that consists of 7 persons to whom the Officers report. The following officers report directly to the Board:

- Chairman Executive Officer;
- President; and,
- Chief Financial Officer.

Within the environmental department, there is currently one person overseeing corporate level environmental management and permitting issues for all operations that are in exploration, development, and operations. The Manager of Health, Safety, and Environment reports directly to the President of Pan American Silver and twice a year to the Board of Directors.

Pan American Silver Corp. is currently developing an Environmental Management System (EMS) that will include detailed management strategies that will be implemented at all Pan American subsidiaries and integrate environmental management into all aspects and stages of Pan American Silver Corp. business activities. The goal is to allocate clear responsibilities at corporate level (environmental, social, health and safety) and recommend adequate staffing and resources for environmental management at each project. The first part of the EMS to be developed is the Environmental Management Plan (EMP), which will outline principles and guidelines that will be followed by operations. The EMP will be completed in February 2003. After completion of the EMP, each facility will be internally audited on a schedule appropriate to their level of implementation of each individual EMS. This is anticipated for all facilities by the end of 2004. After an internal audit has been completed in 2004, an external audit will be completed the following year (end of 2005).

5.1.1. Training at Pan American Silver Corp.

The corporate-level environmental team is responsible for ensuring that appropriate programs of training and education are carried out by the operating subsidiaries so as to fulfill the corporate philosophy on environmental, health, safety, and social issues. The target is to institute basic guidance at the corporate level so each operation provides basic procedures and work instructions at all operational levels to ensure comprehensive and consistent environmental management.

5.1.2. Auditing of Pan American projects

The Health, Safety, and Environmental Manager is responsible for scheduling independent reviews, and conducting internal audits of all of the subsidiaries on a regular schedule. The results of these audits along with the regular reports provided by the

subsidiaries will be compiled into reports that are to be submitted to the Board of Directors no less than two times per year.

Over the next two years, Pan American Silver Corp. will complete the following activities:

- Develop and integrate a corporate environmental and social policy at all company facilities. This will include a review of all staffing and resources for environmental management at each operation;
- Inspect all company facilities to establish compliance with the corporate guidelines; and,
- Ensure that local environmental staff has appropriate training to provide compliance with the environmental and social corporate policies.

5.2. Environmental Management at La Colorada

Currently, Plata Panamericana has one H&S person and one Environmental staff. The environmental person splits time between construction and environmental duties. These persons are responsible for all on-site requirements for H&S. During construction, the only major change will be that there will be a full-time environmental person on site. These people will report to the site construction manager and indirectly to the corporate environmental, health and safety staff.

As part of the corporate EMS, Plata Panamericana has developed an Environmental, Health, and Safety policy that will guide operations at La Colorada. Additionally, Plata Panamericana is ensuring that adequate resources are provided to manage environmental, health, safety, and social issues at the mine. This includes a Manager of Environment and a Manager of Health and Safety. Both of these positions currently report to the General Director and will report directly to the Mine Manager during operations. The managers will be responsible for hiring and training all environmental, health and safety, specialists at the mine. This will include at least two persons working directly with the environmental manager and one person at the site that will work on health and safety issues within the mine and mill. The Manager of Environment will be responsible for internal audits and coordinating with the corporate office and independent auditors.

5.3. Environmental Management of Subcontractors

Plata Panamericana will make available, in a language which is understandable, all applicable environmental, social, health, and safety requirements to all independent contractors and suppliers for them to read and sign, acknowledging their acceptance of the policies.

Additionally, random checks of independent contractors and suppliers will be made for environmental, health, and safety requirements. Violations of Plata Panamericana EAP will result in a written warning for the 1st violation. Subsequent violations will be grounds for fines and ultimately for dismissal.

Plata Panamericana will work with the subcontractors to ensure that the subcontractor operates at a level that is consistent with World Bank Group Guidelines, Mexican guidelines, and the requirements of both the EIA and EAP.

6.0 Implementation and Schedule

Table 8 provides the cost and implementation schedule for the La Colorada ESAP.

Table 8. Cost and Implementation Schedule for the La Colorada ESAP

Item No.	Budget	Description	Detailed Studies	Date of Implementation	Estimated Costs (US 1000)	
					Provision	Recurrent
C-1	EMP	*Environmental Management Program for construction:* Define and submit environmental structure to include job descriptions and allocate clear responsibilities at site level for environmental, social, health, and safety	Prepare and submit a detailed site staffing for environmental, social, health, and safety	August 31, 2002	-	-
C-2	EMP	*Environmental Monitoring Program:* Prepare and implement a full QA/QC program for sampling program designed to determine existing environmental conditions.	On-going baseline studies to continue through until construction	September 2002	25	50
C-3	EMP	*Environmental Monitoring Program:* Procurement of all baseline sampling equipment	All equipment proposed in EAP to be purchased	October 31, 2002	25	5
C-4	ESAP	*Management of Sulphide Tailings. Provide final placement option for sulphide tailings (surface or underground)*	If #5 is used, stability analysis required. If underground hydrology and geotechnical information is required	October 31, 2002	40	-
C-5	EMP	*Environmental Monitoring Program:* Conduct study to determine mine water characteristics move to end	Initiate study to find depth of water and end of mine static level	December 31, 2005	25	-
C-6	ESAP	*Environmental and Social Action Plan:* Finalize EAP following public comment period at the end of construction	Revised and update EAP (August 2002) to include public comments, additional information, and "as built" design of facility. Submit plan to IFC and Mexican regulators to be disclosed in WB Info Shop	September 1, 2003	-	-

Item No.	Budget	Description	Detailed Studies	Date of Implementation	Estimated Costs (US 1000)	
					Provision	Recurrent
C-7	ERP	*Emergency Response Plan:* Develop and finalize ERP to include mine evacuation plan and cyanide management	Submit plan to IFC for review and disclosure in WB Info Shop	September 30, 2002	-	-
C-8	RCP	*Reclamation and Closure Plan:* Develop detailed Reclamation and Closure Plan including mitigation of existing impacts and impacts associated with mine water discharge Annual report on reclamation activities	Submit plan to IFC and Mexican regulatory agencies for review and approval prior to commencement of operations Annual reclamation work plan submitted as part of Annual Monitoring Report	December 31, 2003	50 -	- -
C-9	WMP	*Waste Management Plan:* Develop detailed Waste Management Plan as part of shift form construction to operations	Submit plan to IFC and Mexican regulatory agencies for review and approval prior to commencement of operations Update to WMP submitted as part of Annual Monitoring Report	September 30, 2003	- -	- -
C-10	SPCC	*Spill Prevention, Control, and Countermeasures Plan:* Develop final SPCC Plan as part of shift from construction to operations	Submit plan to IFC and Mexican regulatory agencies for review and approval prior to commencement of operations Update to SPCC submitted as part of Annual Monitoring Report	September 30, 2003	- -	- -

Item No.	Budget	Description	Detailed Studies	Date of Implementation	Estimated Costs (US 1000)	
					Provision	Recurrent
C-11	EMP	*Tailings dam independent review:* Independent review of tailings dam stability and operation in accordance with WB policy OP 4.37	Tailings dam will be reviewed independently after elevation exceeds 15 meters	Fall 2003	15	-
C-12	EMP	*Independent Audit: Conduct independent audit of La Colorada*	Conduct an independent audit of La Colorada to determine implementation level and compliance with Pan American Silver Corp. corporate EMP	2005	20	-

Attachment 1. Water Quality Monitoring Data

Attachment 2. Health and Safety Plan

Attachment 3. Spill Prevention, Control, and Countermeasures Plan

Attachment 4. Waste Management Plan

Attachment 5. Reclamation and Closure Plan

Attachment 6. Public Consultation and Disclosure Update

Attachment 7. Licenses and Permits