Copper Flat Copper Mine

Final

Environmental Impact Statement

Estimated Lead Agency Total Costs Associated with Developing and Producing This EIS

$5.2 million

Sierra County, New Mexico

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Volume 1
April 2019

BLM

BLM MISSION. . .

To sustain the health, diversity, and productivity of the public land for the use and enjoyment of present and future generations.

BLM/NM/ES-16-02-1793

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Las Cruces District Office
1800 Marquess Street
Las Cruces, New Mexico 88005
www.blm.gov/nm/lascruces

In Reply Refer To:
1793 (1.0310)

Dear Reader:

Enclosed is the Final Environmental Impact Statement (FEIS) for the Copper Flat Copper Mine in Sierra County, New Mexico. This EIS was prepared to analyze the potential impacts of a Plan of Operations submitted by New Mexico Copper Corporation (NMCC), a wholly owned subsidiary of The Mac Resources Group, Ltd., to reestablish a poly-metallic mine and processing facility located near Hillsboro, New Mexico. The 2,190-acre project would utilize BLM-managed public land and private property. The Project would provide NMCC access to conduct mining activities in Sierra County on public land, leading to the extraction and processing of copper ore.

This letter provides a brief background of the project and the timeline for issuing a decision.

This FEIS has been prepared by the Bureau of Land Management (BLM) Las Cruces District Office in accordance with the National Environmental Policy Act of 1969, as amended, and in consultation with several Cooperating Agencies: the New Mexico Energy, Minerals, and Natural Resources Department, the New Mexico Environment Department, the New Mexico Department of Game and Fish, and the New Mexico Office of the State Engineer. The FEIS takes into account public comments received during the scoping effort as well as comments received on the Draft EIS, which was published in November 2015. A summary of the written comments received during the public review period for the Draft EIS and responses to the comments are provided in Appendix N of the FEIS.

Four alternatives are analyzed in this FEIS: a No Action alternative, the Proposed Action, and two action alternatives. The Proposed action along with both Alternatives would include an open pit, a mill, waste rock dumps, a lined tailings storage facility, water wells, haul roads, and other ancillary facilities. The Proposed action would process 17,500 tons per day (tpd) of ore for a mine life of 16 years, creating 170 jobs; Alternative 1 proposes to process 25,000 tpd for a mine life of 11 years, creating 170 jobs; and Alternative 2 proposes to process 30,000 tpd for a mine life of 12 years, creating 270 jobs. Alternative 2 is the BLM's preferred alternative.

Changes between the Draft and Final EISs

The FEIS differs from the DEIS in its determination of impacts to several federally protected species: Chiricahua leopard frog, yellow-billed cuckoo, southwestern willow flycatcher, Rio Grande chub, Rio Grande sucker, Rio Grande Cutthroat trout, Mexican gray wolf, and Bolson tortoise, as a result of Endangered Species Act Section 7 Consultation with the USFWS. This is explained in greater detail in the Biological Opinion. Mitigation that will offset impacts to the several species from the Copper Flat project have been incorporated into the FEIS . The Biological Assessment, and the additional mitigation measures are attached to the Final EIS as Appendix J. NMCC committed to additional measures to reduce impacts to surface water, threatened and endangered species, and to transportation routes. The FEIS and supporting information is available on the project web site at: https://www.blm.gov/programs/planning-and-nepa/plans-in-development/new-mexico/copper-flat-eis

Copies of the FEIS have been sent to affected Federal, State, and local government agencies, Native American Tribes, New Mexico Congressional members and staff, residents of Hillsboro, New Mexico, grazing permittees, and other interested citizens and groups. Copies of the FEIS are available for public inspection at the BLM Las Cruces District Office and public libraries in Hillsboro and Truth or Consequences, New Mexico.

The FEIS is not a decision document. The FEIS informs the public and interested parties of potential impacts associated with implementing the proponent's proposal as well as alternatives identified by the agencies. The publication of the Notice of Availability (NOA) in the Federal Register for this Final EIS initiates a required 30-day period where the document is available for review. Following the 30-day period, the BLM Authorized Officer will prepare and sign the Record of Decision (ROD) to disclose the BLM's final decision on NMCC's Plan of Operations and any project Conditions of Approval. Availability of the ROD will be announced through the Las Cruces-Sun News, the Truth or Consequences Herald, the Albuquerque Journal, the project mailing list, and posted on the project website.

For further information concerning the document, please contact Leighandra Keeven, Geologist, BLM Las Cruces District Office at (575) 525-4300 or by email at lkeeven@blm.gov.

Sincerely,

Bill Childress
District Manager

1 Enclosure

CONTENTS

TABLES:

FIGURES:

ACRONYMS

$\mu g/m^3$	micrograms per liters
AADT	average annual daily traffic
AASHTO	American Association of State Highway and Transportation Officials
ADT	average daily traffic
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
ACM	asbestos-containing material
ACS	American Community Survey
AF	acre-feet
AFY	acre-feet per year
AIRFA	American Indian Religious Freedom Act
amsl	above mean sea level
ANFO	ammonium nitrate/fuel oil
APE	area of potential effect
AQCR	Air Quality Control Region
ARD	acid rock drainage
ARPA	Archeological Resources Protection Act
AST	aboveground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
AUM	animal unit month
BA	Biological Assessment
BACT	best available control technology
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	best management practice
BOR	Bureau of Reclamation
CAA	Clean Air Act
CAS	Chemical Abstract Service
CDG	Chihuahuan Desert Grassland
CDS	Chihuahuan Desert Shrubland
CDP	Census Designated Place
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CERT	Community Emergency Response Team
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
cm	centimeters
CO	carbon monoxide

CO_2	carbon dioxide
CT	census tract
CYL	cattle yearlong
dB	decibels
dBA	A-weighted decibels
DHHS	U.S. Department of Health and Human Services
DNL	Day-night Sound Level
DOT	U.S. Department of Transportation
DP	discharge permit
DPS	distinct population segment
dstph	dry short tons per hour
EA	Environmental Assessment
EAR	Environmental Assessment Report
EE	Environmental Evaluation
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
ESAL	Equivalent Single Axle Loads
ET	evapotranspiration
°F	Fahrenheit (degrees)
FLPMA	Federal Land Policy and Management Act
FMP	Facilities Master Plan
FR	Federal Register
ft^3	cubic feet
FY	fiscal year
GHB	General Head Boundary
GHG	greenhouse gas
gpm	gallons per minute
GRT	gross receipts tax
GWh	gigawatt hours
HDPE	high-density polyethylene
HHPS	human health and public safety
HP	horsepower
HPTP	Historic Properties Treatment Plan
Hz	hertz
IM	isolated manifestation
IMPLAN	Impact Analysis for Planning
IPCC	U.N. Intergovernmental Panel on Climate Change
IRB	Industrial Revenue Bonds
ISO	International Organization for Standardization
JSAI	John Shomaker and Associates Inc.

KOP	key observation point
kV	kilovolt
kW	kilowatt
kWh	kilowatt hours
LCDO	BLM Las Cruces District Office
Leq	Equivalent Sound Level
LOS	level of service
LRWMF	Ladder Ranch Wolf Management Facility
LWA	Lee Wilson and Associates
mg	milligrams
mg/l	milligram per liter
mg/m^3	milligrams per cubic meter
MIBC	methyl isobutyl carbinol
MIW	mining influenced water
MMD	Mining and Minerals Division
MMPA	mining and mineral processing area
MORP	Mine Operation and Reclamation Plan
MPO	Mine Plan of Operations
MOU	Memorandum of Understanding
MSDS	Materials Safety Data Sheet
MSHA	Mine Safety and Health Administration
MW	megawatt
MWh	megawatt hours
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NATA	National Air Toxics Assessment
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMAAQS	New Mexico Ambient Air Quality Standards
NMAC	New Mexico Administrative Code
NMCC	New Mexico Copper Corporation
NMDA	New Mexico Department of Agriculture
NMDGF	New Mexico Department of Game and Fish
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMEMNRD	New Mexico Energy, Minerals, and Natural Resources Department
NMSA	New Mexico Statutes Annotated
NMWRRS	New Mexico Water Rights Reporting System
NNL	National Natural Landmark
NNSR	Nonattainment New Source Review
NO2	nitrogen dioxide

NO_x	nitrous oxide
NOAA	National Oceanic and Atmospheric Administration
NORM	naturally occurring radioactive materials
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
O_3	ozone
OHV	off-highway vehicle
OPI	other property income
OSHA	Occupational Safety and Health Administration
OSE	Office of the State Engineer
OSM	Office of Surface Mining
PA	programmatic agreement
PAP	permit application package
PCI	pavement condition index
pCi/L	picocurie per liter
PCPI	per capita personal income
PFYC	Potential Fossil Yield Classification
PILT	payment in lieu of taxes
$PM_{2.5}$	fine particles
PM_{10}	particulate matter
PMP	probable maximum precipitation
ppb	parts per billion
ppm	parts per million
PSD	prevention of significant deterioration
RD	Ranger Districts
RFRA	Religious Freedom Restoration Act
ROC	Region of Comparison
ROD	Record of Decision
ROI	Region of Influence
ROW	right-of-way
RMP	Resource Management Plan
RV	recreational vehicle
SAG	semiautogenous
SCP	spill contingency plan
SGCN	species of greatest conservation need
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMI	State Mine Inspector
SO_2	sulfur dioxide
SPCC	Spill Prevention Control and Countermeasures Plan

SRCP	State Register of Cultural Properties
SSP	Species Survival Plan
su	standard unit
SWPPP	Stormwater Pollution Prevention Plan
SX-EW	solvent extraction and electrowinning
TDS	total dissolved solids
TENORM	technologically enhanced naturally occurring radioactive materials
THEMAC	THEMAC Resources Group, Ltd.
TIMS	Transportation Information Management System
TNT	trinitrotoluene
tpd	tons per day
tpy	tons per year
TSF	tailings storage facility
TSP	total suspended particulate
U.N.	United Nations
U.S.	United States
USC	United States Code
USCB	U.S. Census Bureau
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
VFD	volunteer fire departments
VOC	volatile organic compound
VRI	visual resource inventory
VRM	Visual Resource Management
WRDF	waste rock disposal facility
yd^3	cubic yard

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

INTRODUCTION

The Bureau of Land Management (BLM) has prepared the Copper Flat Copper Mine Environmental Impact Statement (EIS) to assess the proposed reestablishment of a polymetallic mine and processing facility located near Hillsboro, New Mexico, previously owned and operated by Quintana Minerals Corporation (Quintana Minerals). The BLM manages surface ownership of 56 percent of the Copper Flat site and 44 percent is privately-owned. The mineral interest of the mining proponent, New Mexico Copper Corporation (NMCC), in the Copper Flat mine includes 26 patented mining claims and 231 unpatented mining claims, (202 lode claims and 29 placer claims), 9 unpatented millsites, and 16 fee land parcels in contiguous and noncontiguous land parcels and claim blocks. The BLM also manages substantial mineral ownership in the vicinity of the Copper Flat project.

This analysis has been carried out to meet the requirements of the National Environmental Policy Act of 1969 (NEPA). This Final EIS evaluates four alternatives: a No Action Alternative, the Proposed Action, and two action alternatives that include variations of the ore production rate. The EIS has been prepared to: 1) analyze the environmental impacts of alternatives that would meet the proposed purpose and need; and 2) assist the BLM in deciding whether to approve a Preferred Alternative that may be the Proposed Action, an identified alternative, or a combination of analyzed elements of the Proposed Action or alternatives.

The EIS has been prepared in accordance with NEPA requirements for the BLM and a Record of Decision (ROD) will be signed. If the Preferred Alternative identified in the ROD differs from the Mine Plan of Operations (MPO), the MPO must be revised by NMCC and approved by the BLM prior to commencing mining operations. The EIS evaluates the potential physical, biological, economic, and social consequences that would likely result from implementing each alternative.

The BLM has signed Memoranda of Understanding (MOUs) with NMCC, and with State agencies including the New Mexico Energy, Minerals, and Natural Resources Department (NMEMNRD) Mining and Minerals Division (MMD), the New Mexico Environment Department (NMED), the New Mexico Department of Game and Fish (NMDGF), and the New Mexico Office of the State Engineer (OSE). The MOUs identify the roles and responsibilities of each of the cooperating parties in developing the EIS and executing related State permitting processes. Each MOU formally designates MMD, the NMED, OSE, and NMDGF as cooperating agencies in the EIS. As such, these agencies share information and analyses, raise appropriate concerns, and assist with review of internal draft documents.

The EIS supports guidance outlined in Executive Order 13790-Promoting Agriculture and Rural Prosperity in America, by using public lands to foster jobs in the rural community associated with recreation, livestock grazing, mineral development and other uses. The EIS is consistent with administration priorities to sustainably develop our energy and natural resources, and Executive Order 13783 of March 28, 2017 (Promoting Energy Independence and Economic Growth).

PUBLIC INVOLVEMENT

On January 9, 2012, the BLM Las Cruces District Office (LCDO) published a Notice of Intent in the Federal Register (vol. 77, no. 5, pp. 1080-1081, Doc 2012-128) to prepare an EIS for this project in compliance with NEPA and the Council on Environmental Quality's regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500–1508). Exploration and mining activities on BLM-administered land are controlled by the Secretary of the Interior's regulations contained in 43 CFR 3715 and 3809. These regulations require mining operations to apply for a permit to use public land for activities that are reasonably incidental to mining, to prevent unnecessary or undue degradation of the land, and to reclaim disturbed areas.

Pursuant to NEPA Section 102(2) (c), the EIS will provide agencies and the public with a general understanding of the proposed Copper Flat mine project by evaluating the environmental impacts of the proposed MPO. The EIS will also evaluate alternatives to the proposed MPO. The purpose of this evaluation is to determine whether to approve the plan as proposed, or to require additional mitigation measures to minimize impacts to the environment, in accordance with BLM regulations.

External Scoping

Two public meetings were held during the scoping period, which began January 9, 2012 and ended March 9, 2012. Media advertisements notified the public that scoping meetings would be held in Hillsboro and Truth or Consequences, New Mexico on February 22 and 23, 2012, respectively. Public participants at the meetings numbered 59 in Hillsboro and 72 in Truth or Consequences. The open house portion of the meeting was used to encourage discussion and information sharing and to ensure that the public had opportunities to speak with representatives of the BLM's LCDO, the State of New Mexico, and NMCC. Several display stations with exhibits, maps, and other informational materials were staffed by representatives of the BLM LCDO, MMD, the NMED, NMCC, and Solv (EIS contractor). The BLM and NMCC provided fact sheets and informational materials at the meetings. In addition to the scoping meetings, the BLM solicited comments through use of scoping letters, a website, a toll-free telephone number, and an email address.

Issues Identified in Scoping

The key issues identified during the public scoping process focused on water, biological resources, traffic, and social and economic concerns. The four topics that received the highest number of comments related to resource issues are briefly summarized below.

Socioeconomics: Fifty-nine commenters provided 266 comments concerning socioeconomics. The comments addressed the current state of Sierra County's economy and the pressing need for jobs and increased tax revenue. Some commenters suggested using the mine as a source of tourism. Other commenters expressed concerns that the presence of the mine and mining operations might negatively impact current tourism revenue that depends on the quality of the environment and surface water recreation. Several commenters requested information on how the community might be compensated for potential problems associated with mining, such as loss of land use and water (both quality and quantity). Information was also requested on how loss of land and water use might affect the economy. Some commenters stated that the mine would be an economic opportunity and there may not be other economic opportunities as large in the area in the future.

Groundwater: Forty commenters provided 168 comments about groundwater. Commenters expressed concern that mining activities might either reduce available groundwater or pollute groundwater, which in turn would affect the community and environment. Concern was also expressed about the development of a cone of depression if mining operations pull water from the aquifer, and how this would affect wells, surface water, and wildlife. Some commenters questioned water use during droughts and water conservation practices in general to maintain groundwater.

Water quantity: Thirty-six commenters provided 146 comments concerned with water quantity. Commenters expressed concern that the water use of the mine coupled with potential water pollution would affect the amount of safe drinking water available to the people, agriculture, plants, and wildlife of

Sierra County. Several commenters asked how they can be assured that the amount of water proposed to be used would not affect the amount of water available for other uses or permanently deplete the aquifer.

Surface water: Twenty-nine commenters provided 98 comments concerned with surface water, which mainly focused on water quantity and water quality. Commenters expressed concern that mining operations would reduce stream levels and pollute surface water areas, which can affect wildlife, plants, and livestock operations. Commenters expressed concern that the aquifer would be permanently affected by mining activities and that this drawdown would affect surface water over the long term.

These key issues were considered in an alternatives development session attended by the BLM, cooperating agencies, and the third-party EIS contractor and were then incorporated into the following impact questions used to develop the alternatives to the Proposed Action:

- How would groundwater withdrawal affect surface ecosystems and other users?
- How would mining activities impact surface water and groundwater quality for present or foreseeable future use?
- How would mining activities use water efficiently?
- How would mining activities directly or indirectly affect wildlife species, their habitat, and their behavior?
- How would the mine affect public services, health and safety, and local economies?

PURPOSE AND NEED STATEMENT

The purpose of the BLM in relation to the proposed project is to manage the mineral resource within the Copper Flat mine to best meet the present and future needs of the American people in a balanced manner and to take into account the long-term sustainability of other resources and resource uses.

The need for the BLM to authorize this project is established under the General Mining Law of 1872, as amended. Under this law, persons are entitled to reasonable access to explore for and develop mineral deposits on public domain land. As the Federal agency responsible for managing mineral rights and access on certain Federal land, the BLM must ensure that NMCC's proposal complies with the BLM Surface Management Regulation (43 CFR 3809), the Mining and Mineral Policy Act of 1979 (as amended), and Federal Land Policy and Management Act of 1976 (FLPMA).

PROPOSED ACTION AND ALTERNATIVES

Proposed Action

The Proposed Action would consist of an open pit mine, flotation mill, tailings storage facility (TSF), waste rock disposal areas, a low-grade ore stockpile, and ancillary facilities. The Proposed Action was intentionally developed to reuse the existing foundations, production wells, and water pipeline that were employed by the previous Quintana operation. Reuse of this infrastructure would allow mine planners to limit the impact of the proposed mine. Proposed land reclamation efforts during mine operations and following mine closure would result in significant improvement to an existing brownfield site.

The previous Quintana operation produced ore at a 15,000-ton per day (tpd) rate; the alternative defined as the Proposed Action proposes to increase that throughput to 17,500 tpd to increase efficiency. The Proposed Action also varies from some of the other original Quintana mine plant elements to increase efficiency and improve the performance of mine infrastructure. NMCC's Proposed Action includes a lined TSF to increase water recycling and meet new regulation standards in New Mexico. The proposed lined TSF would be a substantial upgrade from the unlined TSF previously employed at the site.

In 2011, NMCC submitted an MPO that was based on the resource information and engineering studies available at the time. The current Proposed Action was deemed feasible and appropriate for the initiation of the EIS evaluations by the BLM. Subsequent engineering studies and exploration drilling have been completed to inform the EIS process. THEMAC Resources Group Limited (THEMAC), parent organization of NMCC, carried out a series of exploration activities at Copper Flat between 2009 and 2012 in order to confirm, characterize, and expand the Copper Flat mineral deposit. THEMAC's exploration program was comprised of drilling, geologic mapping, geophysical surveys, and sampling for mineral content, metallurgical testing, geochemical characterization, and geotechnical analysis. During this period, THEMAC completed 47,500 feet of drilling in 48 drill holes. No exploration activities have taken place at Copper Flat since completion of the 2012 program.

The Proposed Action was analyzed to adequately reflect the largest possible impact of the proposed mining footprint at Copper Flat. At the conclusion of the EIS process, the MPO would be revised to accurately represent the Preferred Alternative selected by the BLM for the ROD.

Alternative 1

In 2011 and 2012, NMCC performed a preliminary feasibility study to further develop internal engineering plans for the Copper Flat mine. In addition, an expanded resource exploration program was launched at Copper Flat to better define the ore body. The result of these two efforts was a revised plan of development for Copper Flat based on new more detailed information about the ore body and the engineering studies. NMCC's preliminary feasibility study for Copper Flat maintained the same locations indicated in the Proposed Action for the proposed mine pit, processing area, and TSF, but refined the process to reflect better engineering data, increase the mine efficiency, and improve project economics. Overall, this alternative (Alternative 1 or the Accelerated Operations Alternative) to the Proposed Action would have the same general scale and scope of operation, with differences mostly attributed to higher process rates to improve project viability, and some increases in efficiency. Table ES-1 summarizes the differences between the Proposed Action and Alternative 1.

Alternative 2

In 2013, NMCC advanced their mine plans by conducting a definitive feasibility study, which refines the preliminary feasibility study, to further fine-tune the internal plan of development for the Copper Flat mine. This study applied a more detailed approach to evaluating the mine processing circuit and overall initiative. The definitive feasibility study found that the mine would be more efficient with an increase to the TSF capacity and an increase to the annual ore processing rate. Alternative 2, as defined in this EIS, is based on the definitive feasibility study for Copper Flat and has a TSF that fits in the same footprint as the Proposed Action but has a larger volume for storage. Alternative 2, as defined in the EIS, has a 30,000 tpd plan with a 12-year mine life, but remains within the mine area evaluated under the Proposed Action.

In accordance with the requirements stated in 40 CFR 1500-1508, the BLM has designated Alternative 2 as the Preferred Alternative. This alternative has the same general scale and scope of the Proposed Action but proposes to process 25 million tons of ore more than the Proposed Action and Alternative 1. The other main differences are derived from an increase in the process rate to improve project economics and increases in efficiency where possible. Table ES-2 briefly summarizes the differences between the Proposed Action and Alternative 2.

Table ES-1. Summary of Differences Between Proposed Action and Alternative 1

Table ES-1. Summary of Differences Between Proposed Action and Alternative 1	
No Change from Proposed Action	**Changes From Proposed Action**
• General scale and scope of the operation • Total ore tons processed • Mining process o Open pit o Drill, blast, loader, truck o Type of equipment used • Mineral beneficiation process o Crush, grind, sulfide flotation, concentrate filtering o Type of equipment used • Tailings storage o Conventional slurry o Raised TSF o Centerline construction with tailings sand o Fully lined o Monitoring systems • Type of mine & process equipment used • Two final products o Copper concentrate with gold & silver o Molybdenum concentrate • Concentrate handling, shipping methods, shipping route, destination • Operating schedule (24 x 7) • Size of the mine area • Location and siting of the proposed facilities • Reuse of existing infrastructure and site grading • Reuse of existing diversion structures • Ongoing exploration • Concurrent reclamation practices • Reclamation standards and methods (with updates to new regulations) • Planned water conservation activities standard aspect of operating plan • Water source, storage, and delivery/distribution systems • Surface and groundwater protection methods • Standards for groundwater monitoring around facilities • Power source, transmission, and distribution systems • Growth media borrow and storage plans • Fencing and exclusionary devices • General viewshed • Construction workforce required • Mine workforce required • Construction and mine workforce skill requirements • No heap leach • No on-site smelting/refining • No placer mining	• Process rate increased to nominal 25,000 tpd to improve project economics • Mine life shortened to 11 years due to higher process rate • Whole tailings thickener removed from tailings flowsheet in order to improve TSF stability • Non process water use decreases due to more efficient designs • Annual water use increases due to higher process rate • Duration of water use decreases due to higher process rate • Total water use over life of mine increases slightly due to higher process rate • Total disturbance footprint reduced due to more efficient design • Number and disturbance footprint of rock storage piles reduced due to more efficient design • Power requirements increase due to increased process rate • Concentrate loads trucked on NM-152 and US I-25 increase due to higher process rate

Source: Summarized from Internal FEIS data.

Table ES-2. Summary of Differences Between Proposed Action and Alternative 2

Table ES-2. Summary of Differences Between Proposed Action and Alternative 2

No Change from Proposed Action	Changes From Proposed Action
• General scale and scope of the operation • Mining process o Open pit o Drill, blast, loader, truck o Type of equipment used • Mineral beneficiation process o Crush, grind, sulfide flotation, concentrate filtering o Type of equipment used • Tailings storage o Conventional slurry o Raised TSF o Centerline construction with tails sand o Fully lined o Monitoring systems • Type of mine & process equipment used • Two final products o Copper concentrate with gold & silver o Molybdenum concentrate • Concentrate handling, shipping methods, shipping route, destination • Operating schedule (24 x 7) • Size of the mine area • Location and siting of the proposed facilities • Reuse of existing infrastructure and site grading • Reuse of existing diversion structures • Ongoing exploration • Concurrent reclamation practices • Reclamation standards and methods (with updates to new regulations) • Planned water conservation activities standard aspect of operating plan • Water source, storage, and delivery/distribution systems • Surface and groundwater protection methods • Standards for groundwater monitoring around facilities • Power, transmission, and distribution systems • Growth media borrow and storage plans • Fencing and exclusionary devices • General viewshed • Construction workforce required • Construction and mine workforce skill requirements • No heap leach • No on-site smelting/refining • No placer mining	• Process rate increased to nominal 30,000 tpd to further improve project economics to meet minimum finance requirements • Total life of mine tons processed increased 25 million tons due to exploration success • Mine life shortened to 11 years due to higher process rate • Whole tailings thickener removed from tailings flowsheet in order to improve TSF stability • Non process water use decreases due to more efficient designs • Annual water use increases due to higher process rate • Duration of water use decreases due to higher process rate • Total water use over life of mine increases slightly due to higher process rate • Total disturbance footprint reduced due to more efficient designs • Number and disturbance footprint of rock storage piles reduced due to more efficient design • Power requirements increase due to increased process rate • Alternate power source selected • Concentrate loads trucked on NM-152 and US I-25 increase due to higher process rate • Mine workforce increases due to increased process rate • A package wastewater treatment plan proposed instead of septic tanks and leach field • Reclamation & closure: Buried pipelines and electrical conduits would be removed

Source: Summarized from internal FEIS data.

No Action Alternative

NEPA requires consideration of a "no action" alternative. Under the No Action Alternative, the project would not be constructed and NMCC's proposed open pit mining operations would not occur. The environmental, social, and economic conditions described as the affected environment would not be affected by the construction, operation, reclamation, or closure of the mine. Local employment and economic revenue would not increase as a result of this alternative. Existing uses such as grazing and recreation would continue at current levels. The mine area would be reclaimed according to BLM standards, and to NMED requirements pertaining to disturbances associated with site exploration.

Alternatives Eliminated from Further Consideration

Some alternatives suggested during scoping have been considered and eliminated from detailed study. These alternatives were evaluated using the following criteria to determine if further review was necessary. According to the BLM NEPA Handbook, an action alternative can be eliminated from detailed analysis if:

- It is ineffective (it would not respond to the purpose and need).
- It is technically or economically infeasible (consider whether implementation of the alternative is likely given past and current practice and technology; this does not require cost-benefit analysis or speculation about an applicant's costs and profits).
- It is inconsistent with the basic policy objectives for the management of the area (such as, not in conformance with the land use plan).
- Its implementation is remote or speculative.
- It is substantially similar in design to an alternative that is analyzed.
- It would have substantially similar effects to an alternative that is analyzed.

Based upon these criteria, the following alternatives were considered but eliminated from further study.

Dry Stack Tailings Disposal

Dry stack tailings disposal was initially considered as an alternative to the conventional method proposed in order to achieve the following potential benefits:

- Reduction of water consumption;
- Avoidance of the permitting, construction, and operation of a tailings dam regulated by the OSE;
- Allowance for concurrent reclamation to reduce erosion of stored tailings and mitigate the visual impact of the TSF; and
- Potential reduction of the footprint area of the TSF.

Dry stack tailings was eliminated as an alternative because it would incur increased operating costs, it requires additional water consumption for dust suppression, and using this alternative means that a failure in the filter plant would require the entire plant to shut down because there is no alternative for tailings disposition. Additionally, the dry stack tailings disposal method is not considered reasonable because its implementation is economically infeasible (reducing the internal rate of return below 15 percent).

Tailings Thickener Alternatives

Another set of alternatives that was considered was the use of tailings thickeners at various stages in the tailings storage process to enhance water conservation.

The Copper Flat TSF water balance model, developed to analyze water inputs and losses to and from the TSF, has water inputs from the tailing overflow and underflow, direct precipitation within the TSF limits, and precipitation run-on from undiverted upgradient areas. The model has water losses of evaporation from the supernatant pond, the tailings beach, the sand embankment areas, and water locked up or entrained within the tailings mass. Of these losses, the most significant is the water locked up or entrained within the tailings mass.

Additional water conservation can be achieved by reducing the volume of water loss due to lock-up. Water loss due to lock-up is a function of the density and saturation of the tailings mass. By increasing the density of the tailings, the volume of water loss is reduced, assuming no change in tailings saturation. One method of achieving an increase in the tailings density is to thicken the slurry being deposited. All of these thickened tailings alternatives were eliminated from further consideration because they would be at a level of a return on investment that would be considered economically infeasible.

ENVIRONMENTAL CONSEQUENCES

Table ES-3 presents the assessed impacts associated with the Proposed Action and each alternative for each resource area. A more complete description of the impacts is provided in Chapter 3.

Table ES-3. Summary of Impacts

Table ES-3. Summary of Impacts				
Resource Area	**Proposed Action**	**Alternative 1**	**Alternative 2 (Preferred Alternative)**	**No Action Alternative**
Air Quality	Not Significant	Not Significant	Not Significant	Not Significant
Climate Change and Sustainability	Not Significant	Not Significant	Not Significant	Not Significant
Water Quality	Not Significant	Not Significant	Not Significant	Not Significant
Surface Water Use	Significant	Significant	Significant	Not Significant
Groundwater Resources	Significant	Significant	Significant	Significant
Mineral and Geologic Resources	Significant	Significant	Significant	No Effect
Soils	Significant	Significant	Significant	Not Significant
Hazardous Materials and Solid Waste/Solid Waste Disposal	Not Significant	Not Significant	Not Significant	Not Significant
Wildlife and Migratory Birds	Significant	Significant	Significant	Not Significant
Vegetation, Invasive Species, and Wetlands	Significant	Significant	Significant	Not Significant
Threatened and Endangered Species/Special Status Species	Significant	Significant	Significant	Indeterminate
Cultural Resources	Significant	Significant	Significant	Significant
Visual Resources	Significant	Significant	Significant	No Effect
Land Ownership and Land Use	Not Significant	Not Significant	Not Significant	No Effect
Recreation	Significant and Not Significant	Significant and Not Significant	Significant and Not Significant	Significant and Not Significant
Special Management Areas	Not Significant	Not Significant	Not Significant	No Effect
Lands and Realty	Not Significant	Not Significant	Not Significant	No Effect
Range and Livestock	Significant	Significant	Significant	No Effect
Transportation and Traffic	Significant	Significant	Significant	Not Significant
Noise and Vibrations	Not Significant	Not Significant	Not Significant	Not Significant
Socioeconomics	Significant	Significant	Significant	Not Significant
Environmental Justice	Significant	Significant	Significant	Not Significant

Table ES-3. Summary of Impacts (Concluded)				
Resource Area	**Proposed Action**	**Alternative 1**	**Alternative 2 (Preferred Alternative)**	**Resource Area**
Human Health and Public Safety	Not Significant	Not Significant	Not Significant	Not Significant
Utilities and Infrastructure	Not Significant	Not Significant	Not Significant	Not Significant
Paleontology	No Effect	No Effect	No Effect	No Effect

Source: Summarized from internal FEIS data.

CHAPTER 1

INTRODUCTION

CHAPTER 1. INTRODUCTION

1.1 PURPOSE AND NEED

The purpose and need for the action to be taken regarding the proposed reactivation and expansion of the Copper Flat mine are summarized in the sections presented below: 1.1.1, Background and 1.1.2, Agency Purpose and Need.

1.1.1 Background

The primary source for the Proposed Action is the Copper Flat Mine Plan of Operations (MPO), dated December 2010 and revised June 2011. As the project has evolved, additional or revised information has been developed to more accurately describe the Proposed Action and to correct errors in the original MPO document. The technically feasible elements within the Proposed Action, as well as the scale and intent of the Proposed Action, have remained unchanged. Alternatives to the Proposed Action include engineering solutions that were developed after the MPO was accepted for evaluation. Throughout this Environmental Impact Statement (EIS), information referenced using the term "Proposed Action" is equivalent to information contained in the MPO, as modified to correct errors.

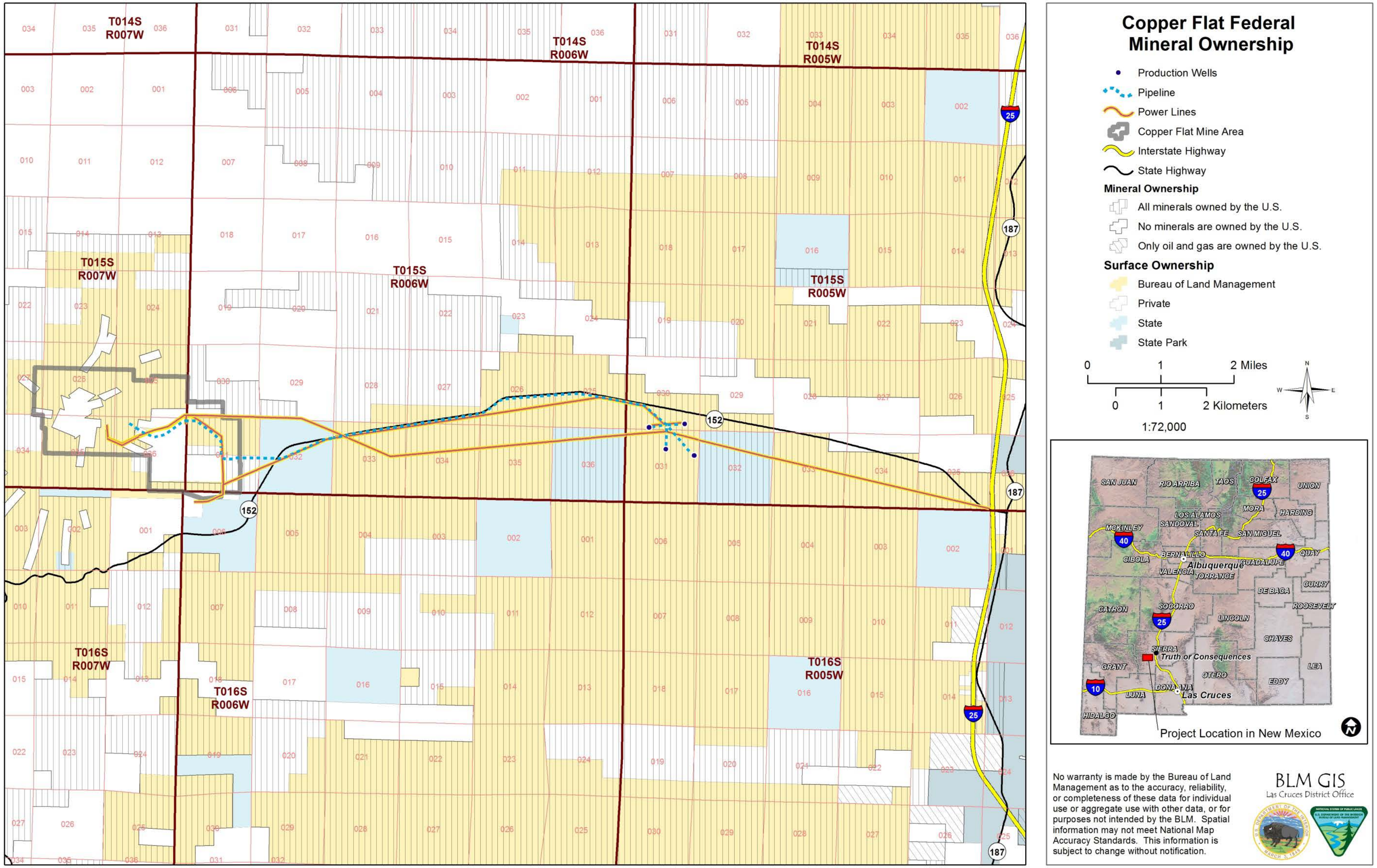
The Copper Flat project is the proposed reestablishment of a polymetallic mine and processing facility located near Hillsboro, New Mexico, previously owned and operated by Quintana Minerals Corporation (Quintana Minerals). The Bureau of Land Management (BLM) manages surface ownership of 56 percent of the Copper Flat site; 44 percent is privately owned. The mineral interest of the mining proponent, New Mexico Copper Corporation (NMCC), in the Copper Flat mine includes 26 patented mining claims and 231 unpatented mining claims (202 lode claims and 29 placer claims), 9 unpatented millsites, and 16 fee land parcels in contiguous and noncontiguous land parcels and claim blocks. The BLM also manages substantial mineral ownership in the vicinity of the Copper Flat project. (See Figure 1-1.)

The Proposed Action would consist of an open pit mine, flotation mill, tailings storage facility (TSF), waste rock disposal areas, a low-grade ore stockpile, and ancillary facilities such as millsites and an electrical substation. The Proposed Action was intentionally developed to reuse the existing foundations, production wells, and water pipeline that were employed by the previous Quintana operation. Reuse of this infrastructure would allow mine planners to limit the overall impact of the proposed mine. Proposed land reclamation efforts during mine operations and following mine closure would result in significant improvement of an existing brownfield site.

The previous Quintana operation operated at a 15,000 ton per day (tpd) rate; the alternative defined as the Proposed Action proposes to increase that throughput to 17,500 tpd. The NMCC Proposed Action includes a lined TSF to increase water recycling and meet new regulation standards in New Mexico. The proposed lined TSF would be a substantial upgrade from the unlined TSF previously employed at the site.

The 2011 MPO was based on the resource information and engineering studies available at that time. The current Proposed Action was deemed feasible and appropriate for the initiation of the EIS evaluations by the BLM. Subsequent engineering studies and exploration drilling have been completed to inform the EIS process. THEMAC Resources Group Limited (THEMAC) carried out a series of exploration activities at Copper Flat from 2009 to 2012 in order to confirm, characterize, and expand the known limits of the Copper Flat mineral deposit. THEMAC's exploration program comprised drilling, geologic mapping, geophysical surveys and sampling for mineral content, metallurgical testing, geochemical characterization, and geotechnical analysis. During this period, THEMAC completed 47,500 feet of

Figure 1-1. Copper Flat Federal Mineral Ownership and Mine-Associated Facilities



Source: BLM 2015.

drilling in 48 drill holes (THEMAC 2013c). No exploration activities at Copper Flat have taken place since completion of the 2012 program.

On January 9, 2012, the BLM Las Cruces District Office (LCDO) published a Notice of Intent in the Federal Register (vol. 77, no. 5, pp. 1080-1081, Doc 2012-128) to prepare this EIS in compliance with NEPA and the Council on Environmental Quality's regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500–1508). Exploration and mining activities on BLM-administered land are controlled by the Secretary of the Interior's regulations contained in 43 CFR 3715 and 3809. These regulations require mining operations to apply for a permit to use public land for activities that are reasonably incidental to mining, to prevent unnecessary or undue degradation of the land, and to reclaim disturbed areas.

The Proposed Action was analyzed to reflect the largest possible impact of the proposed mining footprint at Copper Flat. At the conclusion of the EIS process, the MPO would be revised to accurately represent the Preferred Alternative selected by the BLM for the Record of Decision (ROD).

1.1.2 Agency Purpose and Need

The purpose of the BLM in relation to the proposed project is to manage the mineral resource in the Copper Flat mine to best meet the present and future needs of the American people in a balanced manner and to take into account the long-term sustainability of other resources and resource uses.

The need for the BLM to authorize this project is established under the General Mining Law of 1872, as amended. Under the law, persons are entitled to reasonable access to explore for and develop mineral deposits on public domain land. As the Federal agency responsible for managing mineral rights and access on certain Federal land, the BLM must ensure that NMCC's proposal complies with the BLM Surface Management Regulation (43 CFR 3809), the Mining and Mineral Policy Act of 1970 (as amended), and FLPMA.

1.2 DECISION TO BE MADE

In conformance with the agency need described in Section 1.1.2, Agency Purpose and Need, the BLM must review the proposed MPO and determine if it can be implemented in a manner that would prevent unnecessary or undue degradation of public land by operations authorized by the mining laws. The BLM may disapprove an MPO when it: 1) does not meet content requirements as described in 43 CFR 3809.401; 2) proposes operations in an area withdrawn from the mining laws; or 3) proposes operations that would result in unnecessary or undue degradation of public land.

This EIS has been prepared to identify potential environmental effects that would result from implementing the Proposed Action. Reasonable alternatives to the Proposed Action have been developed and are identified in Chapter 2.

With its final decision, the BLM will identify and approve a Preferred Alternative that may be the Proposed Action, an identified alternative, or a combination of analyzed elements of the Proposed Action and alternatives. A ROD will be signed. If the Preferred Alternative identified in the ROD differs from the MPO, the MPO must be revised by NMCC and approved by the BLM prior to commencing mining operations.

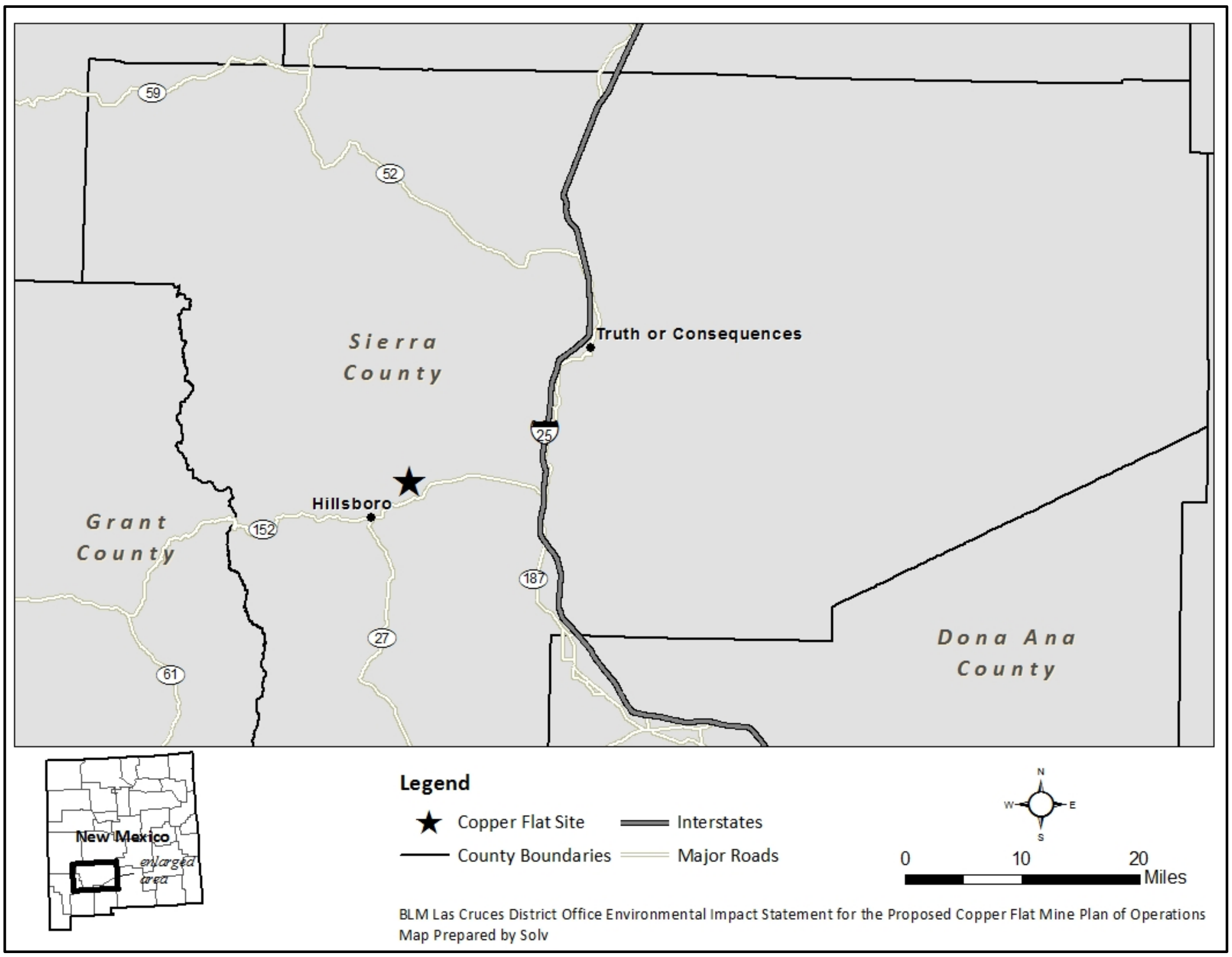
1.3 GENERAL LOCATION

The project is located in Sierra County, New Mexico, approximately 20 miles southwest of Truth or Consequences and 4 miles northeast of Hillsboro. (See Figure 1-2.) The general area can be reached by traveling south 15 miles from Truth or Consequences on Interstate Highway 25 (I-25), then 12 miles west on New Mexico Highway 152 (NM-152). The mine area lies 2 miles west-northwest from NM-152 (THEMAC 2011). (See Figure 1-3.)

The legal description of the proposed mine area, including ancillary facilities is:

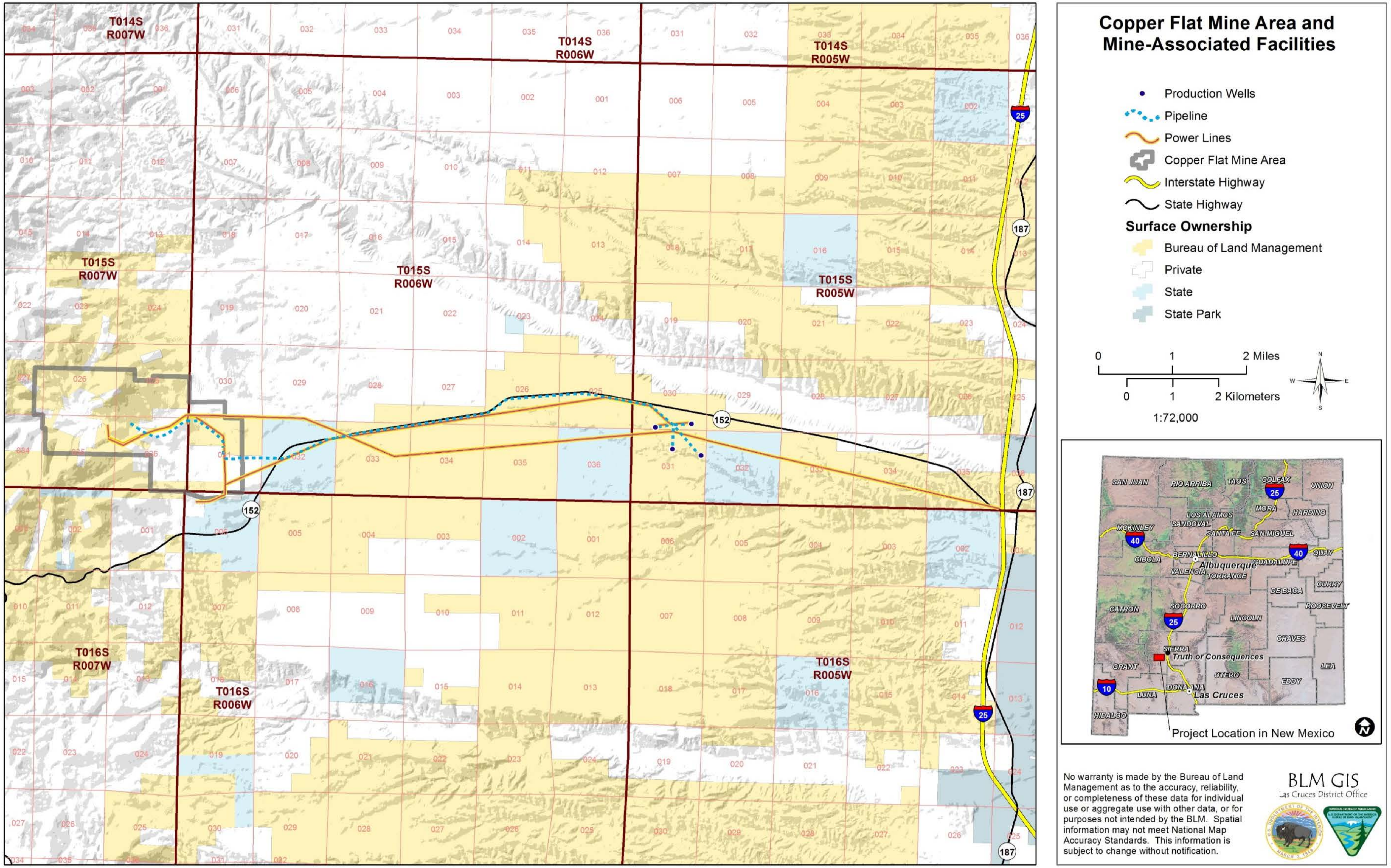
New Mexico Principal Meridian, New Mexico
T. 15 S., R. 5 W.,
secs. 30 and 31.
T. 15 S., R. 6 W.,
secs. 25, 26, 27, and secs. 30 thru 34.
T. 16 S., R. 6 W.,
sec. 6.
T. 15 S., R. 7 W.,
secs. 25, 26, 27, 35, and 36.

Figure 1-2. Copper Flat Vicinity Map



Source: ESRI 2010; NMCC 2012d.

Figure 1-3. Copper Flat Mine Area and Mine Associated Facilities



Source: BLM 2015.

1.4 MAJOR AUTHORIZING LAWS AND REGULATIONS

As previously stated in Section 1.1.2, Agency Purpose and Need, the BLM would authorize this project under the General Mining Law of 1872, as amended. This authorization is a major Federal action and compliance with NEPA requires an environmental analysis with public disclosure. The BLM may decide to approve the MPO for the Copper Flat mine as submitted, approve (an) alternative(s) to the MPO to mitigate environmental impacts, approve the MPO with stipulations to mitigate environmental impacts, or deny approval for the MPO (no action). If the BLM denies approval for the MPO, the applicant has the right to modify and resubmit the MPO to address issues or concerns identified by the BLM on the original MPO.

The BLM must also ensure that the proponent's proposal complies with the BLM Surface Management Regulation (43 CFR 3809), the Mining and Mineral Policy Act of 1970 (as amended), Use and Occupancy under the Mining Laws (43 CFR 3715), and FLPMA.

1.5 RELATIONSHIP TO POLICIES, PLANS, AND PROGRAMS

1.5.1 BLM Policies, Plans, and Programs

The Copper Flat MPO has been reviewed for compliance with BLM policies, plans, and programs. The proposal described in the MPO conforms to the general management guidance for locatable minerals cited below and is consistent with specific locatable minerals decisions contained in the ROD for the White Sands Resource Management Plan, approved in September 1986 (BLM 1986).

> *"Under the Mining Law of 1872, a person has the right to explore, develop, and produce minerals on public land. Unlike the management of leasable and saleable minerals where BLM has the authority to approve mining operations, locatable mineral activities are regulated by BLM only to prevent unnecessary or undue degradation of the lands."*

1.5.2 Non-BLM Policies, Plans, and Programs

Four New Mexico State agencies were requested to participate as cooperating agencies in the development of this EIS: the New Mexico Energy, Minerals, and Natural Resources Department (NMEMNRD), the New Mexico Environment Department (NMED), the New Mexico Department of Game and Fish (NMDGF), and the New Mexico Office of the State Engineer (OSE). Through the participation of these agencies, as well as through the parallel review process for the State permitting processes described in the next section, the MPO was reviewed for compliance against applicable New Mexico State policies, plans, and programs. From the perspective of compliance with New Mexico State policies, plans, and programs, the Environmental Evaluation (EE) described in Section 1.6.2.1.2, the NMEMNRD Mining and Minerals Division (MMD), and the EIS are regarded as functionally equivalent documents by the State of New Mexico.

1.6 PERMITS, LICENSES, AND OTHER ENTITLEMENTS

The proposed project must obtain approvals outside the NEPA process before it can be implemented. This section identifies these below in sections 1.6.1, Federal Permits, Approvals, and Consultations; 1.6.2 State Permits and Approvals; and 1.6.3, Water Rights Approval.

1.6.1 Federal Permits, Approvals, and Consultations

This section describes a brief history of NEPA actions and pending Federal agency consultations that are relevant to the proposed mine expansion project.

A NEPA review of a previous mining project at Copper Flat was initiated in 1994 after a mining company, Alta Gold Company (Alta), notified the BLM LCDO that the company had purchased rights to proceed with a mining project at Copper Flat from the owner at that time, Gold Express, and was assuming legal responsibility for the MPO initially submitted in 1991. The BLM then began the process of preparing an EIS. The draft EIS was completed in 1996 and the preliminary final EIS was completed in 1999. However, neither a final EIS nor a ROD was issued for the project as a result of Alta's bankruptcy in 1999 (THEMAC 2011).

The Endangered Species Act (ESA) directs all Federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the Act. Section 7 of the Act, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure that the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. Under Section 7, Federal agencies must consult with the U.S. Fish and Wildlife Service (USFWS) when any action the agency carries out, funds, or authorizes (such as through a permit) may affect a listed endangered or threatened species.

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effect of their undertakings on historic properties. The Advisory Council on Historic Preservation (ACHP) regulations that implement Section 106 (36 CFR Part 800) describe the process for identifying and evaluating resources; assessing effects of Federal actions on historic properties; and consulting to avoid, minimize, or mitigate those adverse effects. The NHPA does not mandate preservation of historic properties, but it does ensure that Federal agency decisions concerning the treatment of these resources result from meaningful consideration of cultural and historic values, and identification of options available to protect the resources. The BLM has executed a Programmatic Agreement (PA) with the ACHP and the National Conference of State Historic Preservation Officers that outlines how the BLM administers their activities subject to Section 106 of the NHPA. Each State that operates under the PA has a "protocol" agreement that defines how the BLM and that State's Historic Preservation Officer (SHPO) will operate and interact under the PA. The BLM LCDO follows the PA and the New Mexico protocol to meet their Section 106 responsibilities. For the Copper Flat project, the BLM identified historic properties in the project area and determined the potential effect of the project on those properties. The BLM has consulted with the New Mexico SHPO on their determination of effect and worked with the SHPO and the ACHP to identify measures to avoid, minimize, or mitigate those effects. These measures are described in a PA that is signed by the BLM, ACHP, SHPO, and NMCC and included with this EIS.

1.6.2 State Permits and Approvals

A number of State permits would also be required for the project. The NMED would issue most of these permits, including air quality permits and groundwater discharge permits (DPs). Alta submitted an application for a modification to the existing groundwater DP-001 for the project in early 1995. However, DP-001 was suspended until a Stage 1 Abatement Plan for a small groundwater impact associated with the existing TSF is submitted and approved. In addition, an application for a revised air quality permit (No. 365-M-1) was also submitted by Alta in early 1995. This permit was closed in 2002 due to inactivity (THEMAC 2011). In addition to approval by the State under the New Mexico Mining Act, NMCC would be required to secure a number of additional State and Federal permits and approvals that are summarized in Table 1-1.

1.6.2.1 Cooperating Agencies

The BLM signed Memorandums of Understanding (MOUs) with NMCC, NMEMNRD MMD, the NMED, and NMDGF in 2011 and with the OSE in 2012. The MOUs identify the roles and responsibilities of each of the cooperating parties in developing the EIS and executing related State permitting processes. Each MOU formally designates MMD, the NMED, OSE, and NMDGF as cooperating agencies in the EIS. As such, these agencies share information and analyses, raise appropriate concerns, and assist with review of internal draft documents (BLM and NMCC 2012d; BLM and NMDGF 2011; BLM and NMED 2011; BLM and NMEMNRD 2011; BLM and OSE 2012). The mission of each of these agencies and their role in the proposed project are described below.

Table 1-1. Major Permits and Approvals Required for Mine Operations

Table 1-1. Major Permits and Approvals	
Permit/Approval	**Granting or Regulating Agency**
	Federal
MPO approval	BLM
Completion of NEPA process	BLM
National Dredge and Fill Permit (Section 404)	U.S. Army Corps of Engineers
Federal Communications Commission License	Federal Communications Commission
Mine Safety and Health Administration registration	Mine Safety and Health Administration
Explosives permit	Bureau of Alcohol, Tobacco, and Firearms
ESA approval	USFWS
	State
Mining permit	NMEMNRD – MMD, Mining Act Reclamation Bureau
Mine registration	NMEMNRD – Mine Registration Reporting, and Safeguarding Program – Mine Registration
Permit to construct (air quality)	NMED – Air Quality Bureau
Permit to operate (air quality)	NMED – Air Quality Bureau
Permit to appropriate water	New Mexico OSE – Water Rights Division – District IV
Permits for dam construction and operations	New Mexico OSE – Dam Safety Bureau
Approval to operate a sanitary landfill	NMED – Solid Waste Bureau
Liquid waste system DP	NMED – Ground Water Quality Bureau
Groundwater DP	NMED – Ground Water Quality Bureau (DP-001)
NHPA approval	New Mexico Department of Cultural Affairs – Historic Preservation Division
Spill Prevention Control and Countermeasures Plan approval	U.S. Environmental Protection Agency
Aboveground petroleum storage tank registration	NMED – Petroleum Storage Tank Bureau

Source: THEMAC 2011.

1.6.2.1.1 New Mexico Environment Department

The NMED was established in 1991 under the provisions set forth in the Department of the Environment Act by the 40th New Mexico Legislature (NMED 2012a). The NMED's mission is to provide the highest quality of life throughout the State by promoting a safe, clean, and productive environment. The agency is committed to promoting environmental awareness through open and direct communication and sound decision making by carrying out departmental mandates and initiatives in a fair and consistent manner (NMED 2011).

The NMED conducts all of the permitting, spill response, abatement, and public participation activities for mining facilities in New Mexico in accordance with the Water Quality Act, New Mexico Statutes Annotated (NMSA) 1978, 74-6-1 to 17, the Water Quality Control Commission Regulations outlined in Title 20, Chapter 6, Part 2 of the New Mexico Administrative Code (NMAC), and the Copper Mine Rule (Section 20.6.7 NMAC) in Title 20, Chapter 6, Part 2 and Part 7. In addition, the NMED participates in the implementation of the New Mexico Mining Act and Non-Coal Mining Regulations by reviewing and commenting on mine permits and closeout plans, coordinating environmental protection requirements at mine sites with MMD, and providing determinations that environmental standards will be met during operation and after closure of mining operations (NMED 2012b).

Within the NMED, the Water Quality Program organization is composed of the Ground Water Quality, Surface Water, Department of Energy Oversight, and Hazardous Waste Bureaus. One of the Ground Water Quality Bureau's goals is to protect the quality of New Mexico's groundwater through water quality monitoring and the issuance of permits. One of the objectives under this goal is to "increase the number of permitted facilities in compliance with groundwater DP requirements." Strategies under this objective are:

- Ensure requirements of groundwater DPs are met by conducting inspections of permitted facilities.
- Document groundwater inspection and compliance reviews in a database.
- Review and evaluate monitoring results submitted by permitted groundwater facilities to determine if facilities are in compliance with their permits (NMED 2011).

In order to begin operations and discharge of effluent or leachate, the proposed copper mine must be issued a DP by the NMED. NMCC submitted a permit application to the NMED for a DP in 2011 and is planning to resubmit its application pursuant to the Copper Mine Rule (Section 20.6.7 NMAC) and to account for changes to the original mine plan.

1.6.2.1.2 New Mexico Mining and Minerals Division

The MMD is part of the NMEMNRD organization, which was created in 1987 through a merger between the Natural Resources Department and the Energy and Minerals Department. However, the various administrative components (divisions) of the Department have been in existence longer. The mission of the Department is "to position New Mexico as a national leader in the energy and natural resources areas for which the department is responsible." Its vision is "a New Mexico where individuals, agencies, and organizations work collaboratively on energy and natural resource management to ensure a sustainable environmental and economic future" (NMEMNRD no date(a)).

NMEMNRD includes the following divisions: Energy Conservation Management, Forestry, State Parks, MMD, Oil Conservation, and the Youth Conservation Corps (NMEMNRD no date(a)). The NMDGF is also administratively attached to NMEMNRD, but receives no direct budget support from it (NMEMNRD no date(b)).

One element of MMD's mission is to promote the public trust by ensuring the responsible utilization, conservation, reclamation, and safeguarding of land and resources affected by mining. The MMD pursues this mission via four major programs. The Abandoned Mine Land Program works with grants from the Federal government to identify, safeguard, and reclaim (pre-1977) abandoned mines that present a public safety hazard or environmental detriment. The Coal Mine Reclamation Program regulates, inspects, and enforces regulations on all coal mines not on Indian Reservations. The Mining Act Reclamation Program regulates, inspects, and enforces regulations on all hard rock or mineral mines. The Mine Registration Program registers all mines, collects production and employment data on active mining operations, distributes statistical information on New Mexico's mining industry, and acts as the division's public information office (MMD no date).

The MMD administers NMAC Title 19, Chapter 10, which recognizes the requirements of the New Mexico Mining Act. The purposes of this Act (NMSA 1978 69-36-1 to 20) include promoting responsible utilization and reclamation of land affected by minerals exploration, mining, or the extraction of minerals that are vital to the welfare of the State.

NMCC has submitted a Permit Application Package (PAP) to the MMD. The PAP consists of a sampling and analysis plan, a baseline data report, and a mining operations and reclamation plan. When these plans and reports are deemed administratively and technically complete, MMD, with the assistance of the third-party EIS contractor, conducts an EE. MMD then notifies the public that a draft EE has been prepared, and a public hearing is held if requested. The public may submit comments, which must be addressed by MMD. If necessary, the EE and PAP are modified, and a new mine permit is approved or denied (NMEMNRD 2010).

1.6.2.1.3 New Mexico Office of the State Engineer

The OSE (or State Engineer) is responsible for administering the State's water resources. The State Engineer has power over the supervision, measurement, appropriation, and distribution of all surface and groundwater in New Mexico, including streams and rivers that cross State boundaries. The State Engineer is also Secretary of the Interstate Stream Commission, which is charged with separate duties, including protecting New Mexico's right to water under eight interstate stream basins, ensuring that the State complies with each of the basin compacts, and water planning in New Mexico (OSE 2005).

All water users in New Mexico must have a permit from the OSE. When evaluating an application for a new appropriation or to change the place or purpose of use of an existing water right, the State Engineer must determine: 1) that water is available; 2) that the appropriation will not impair existing rights; 3) that the intended use meets State water conservation efforts; and 4) that the intended use is not detrimental to the public welfare (OSE 2006).

State water law also requires that the applicant for a water right publish the application in a newspaper and provide anyone with a legitimate objection the chance to protest the application (OSE 2006).

1.6.2.1.4 New Mexico Department of Game and Fish

The mission of the NMDGF is "to conserve, regulate, propagate, and protect the wildlife and fish within the State using a flexible management system that ensures sustainable use for public food supply, recreation, and safety and to provide for off-highway motor vehicle recreation that recognizes cultural, historic, and resource values while ensuring public safety" (NMDGF 2012).

In its Strategic Plan for fiscal years 2013 to 2018, the NMDGF developed the following objectives that are relevant to its role as a cooperating agency in the decision making process for the Copper Flat mining development (NMDGF 2012):

Conservation Services Program P717:

- **Objective 10:** Attain measurable progress toward the restoration of wildlife identified as being at risk of depletion or extinction.
- **Objective 11:** Ensure that legal and illegal take of threatened or endangered species or subspecies does not impede the prospects for their recovery.

Program Support P719:

- **Objective 1:** Ensure that sustainable management decisions are made considering biological, social, and economic factors.

1.6.3 Water Rights Approval

A critical element of the approval process for mining operations is assurance of sufficient water rights for all phases of the mine project. That assurance is obtained from the OSE, whose overall responsibilities are described above. This NEPA analysis is premised on the assumption that NMCC will be able to acquire water rights sufficient for implementation of all phases of the mine project. Although it is not certain whether NMCC will acquire these water rights, this EIS analyzes the foreseeable impacts should NMCC acquire these water rights.

The use of water in New Mexico is subject to strict regulation and control under a comprehensive system of water rights laws overseen by the OSE. The State's declared ground waters are public waters subject to appropriation for beneficial use in accordance with NMSA 1978, § 72-12-1 & 2. The OSE has the responsibility for measuring, appropriating, and distributing the public waters of the State in accordance with NMSA 1978, § 72-2-1. In a declared underground basin such as the Lower Rio Grande, potential appropriators must apply to the State Engineer for a permit. The State Engineer may grant the permit only if they find that there are unappropriated waters available and "that the proposed appropriation would not impair existing water rights from the source, is not contrary to conservation of water within the state and is not detrimental to the public welfare of the state," as stated in NMSA 1978, § 72-12-3(E). The State Engineer is authorized to suspend or revoke water permits if a permittee does not comply with either the OSE's conditions of its permits or New Mexico's water laws.

The Legislature has passed a law (NMSA 1978, §§ 72-12A-1, et seq.) allowing a mine to dewater an aquifer (i.e., open pit) that affects existing wells without causing "impairment". In this situation, the mining company may proceed with dewatering. If the well is determined to be impaired by the OSE, the mining company must comply with the law and provide the affected owner with a replacement well or replacement water supply. In this case, the mining company would pay for deepening the well or for drilling a new well if the well's function is diminished by mining operations.

The BLM recognizes and accepts the validity of this approach based upon this law recognizing that the performance of any wells within the permanent drawdown cone is not known to an extent that would allow an accurate determination of impact. If hydrological impacts to these wells from pit dewatering are demonstrated and documented against an accepted baseline as mine operations proceed, then NMCC would be obligated to replace the well or water supply in accordance with this law.

1.6.3.1 Current Status

NMCC had claimed the right to divert and use a total of 7,376 acre-feet per year (AFY) of groundwater from wells under State Engineer File No. LRG-4652 et al. The groundwater would be used to support proposed mining operations.

In a response to a NMCC application to repair and deepen wells, the New Mexico OSE concluded that the allowed diversion amount is limited to 888.783 AFY (OSE 2014a). NMCC appealed this determination pursuant to NMSA 1978, Section 72-2-16 (1973).

The New Mexico Environmental Law Center, on behalf of the Elephant Butte Irrigation District et al., filed a motion with the State of New Mexico, County of Doña Ana, Third Judicial District Court requesting designation of a stream system issue and expedited inter se of the water rights claimed by

NMCC (CV-96-888, January 14, 2014). On December 27, 2017, a decision was rendered by the Court validating less than 900 AFY of the amount claimed by NMCC.

NMCC filed an appeal of the December Court Decision on March 27, 2018. At the same time, parties opposing NMCC's water rights filed cross appeals protesting the Court-recognized water rights. The appeals have been assigned to the New Mexico Court of Appeals general calendar with specific dates to be determined. NMCC made final payment under a water rights purchase and option agreement in August 2018 and now owns the water rights recognized by the Court in the December 2017 decision.

NMCC is reviewing options for additional water rights. NMCC plans to secure lawful and sufficient water rights, either through owned water rights, or a combination of water rights currently owned, purchased, or leased, to be pumped from the Copper Flat production wells, as described further in the two options summarized below (LRPA 2014):

- **Lease Option:** NMCC would lease surface water rights to account for all water use above the diversion amount related to groundwater pumping. NMCC has been pursuing the lease option since before the December 2017 decision.
- **Purchase and Transfer Option:** NMCC would purchase and transfer groundwater rights from a well located elsewhere in the basin to the NMCC production wells. The amount purchased would be the amount necessary to ensure all water uses are accounted for, including any impacts to the Rio Grande.

NMCC expects that the point of diversion for water use evaluated in this EIS will remain the same regardless of the source of recognized water rights.

The OSE will ultimately approve the availability of adequate water rights in accordance with the ongoing process described above; all operations must be conducted in a manner consistent with the requirements of the OSE.

1.6.3.2 Mitigative Actions

In a March 23, 2017 letter from NMCC to the BLM, NMCC voluntarily committed to fully offsetting calculated and actual depletions to the Rio Grande resulting from mining operations. In a subsequent letter to the BLM on June 29, 2017, NMCC confirmed that the offset was to be provided with water obtained from a lease executed with the Jicarilla Apache Nation for a period of 15 years from when ore crushing would begin. After that, either the lease would be extended or another water source would be secured that would provide offsets up to year 29 after mine operations begin. The BLM may authorize this mine project and any operations are premised on the acquisition of necessary water rights under the authority of the OSE for the life of the mine plan. Thereafter, NMCC would retire an existing water right that holds a legal entitlement to deplete water from the river in an amount equal to NMCC's effects on the river at the time of retirement.

Finally, in an August 24, 2017 letter to the BLM, NMCC reaffirmed its intent to fully offset all NMCC pumping impacts on the Rio Grande, including years beyond year 29 with actual water. These "wet offsets" would ensure that no net effect on the river would occur due to the proposed operation of Copper Flat. NMCC would accomplish this by taking one or more of the following actions: extending the previously described Jicarilla Apache Nation water lease; securing another lease of equally effectual water; or securing and permanently retiring water rights that physically affect the river today, subject to the approval of the OSE. Regarding the permanent retirement of a water right, the offset would continue to have a positive effect on the Rio Grande as the NMCC effects on the river decline and entirely cease.

1.7 SCOPING

The scoping process, as defined in 43 CFR 46.235, is used during the early planning stages of an EIS to involve State, local, and tribal governments and the public in the early identification of concerns, potential impacts, relevant effects of past actions, and possible alternative actions. For the Copper Flat mine expansion project, the scoping process is summarized below in Sections 1.7.1, External Scoping; 1.7.2, Issues Identified in Scoping; and 1.7.3, Issues Excluded from the Analysis.

1.7.1 External Scoping

Two public meetings were held during the scoping period, which began January 9, 2012 and ended March 9, 2012. Media advertisements notified the public that scoping meetings would be held in Hillsboro and Truth or Consequences, New Mexico on February 22 and 23, 2012, respectively. Public participants at the meetings numbered 59 in Hillsboro and 72 in Truth or Consequences. The open house portion of the meeting was used to encourage discussion and information sharing and to ensure that the public had opportunities to speak with representatives of the BLM LCDO, the State of New Mexico, and NMCC. Several display stations with exhibits, maps, and other informational materials were staffed by representatives of the BLM LCDO, MMD, the NMED, NMCC, and Solv (the EIS contractor). The BLM and NMCC provided fact sheets and informational materials at the meetings. In addition to the scoping meetings, the BLM solicited comments through use of scoping letters, a website, a toll-free telephone number, and an email address.

1.7.2 Issues Identified in Scoping

The key issues identified from public scoping focused on water, biological resources, traffic, and social and economic concerns. The issues raised for the four resource areas receiving the most comments are briefly summarized below.

Socioeconomics: Fifty-nine commenters provided 266 comments concerning socioeconomics. The comments addressed the current state of Sierra County's economy and the pressing need for jobs and increased tax revenue. Some commenters suggested using the mine as a source of tourism. Other commenters expressed concerns that the presence of the mine and mining operations might negatively impact current tourism revenue that depends on the quality of the environment and surface water recreation. Several commenters requested information on how the community might be compensated for potential problems associated with mining, such as loss of land use and water (both quality and quantity). Information was also requested on how loss of land and water use might affect the economy. Some commenters stated that the mine would be an economic opportunity and there may not be other economic opportunities as large in the future for the area.

Groundwater: Forty commenters provided 168 comments about groundwater. Commenters expressed concern that mining activities might either reduce available groundwater or pollute groundwater, which in turn would affect the community and environment. Concern was also expressed about the development of a cone of depression if mining operations pull water from the aquifer, and how this would affect wells, surface water, and wildlife. Some commenters raised questions regarding both water use during droughts and water conservation practices in general to maintain groundwater.

Water quantity: Thirty-six commenters provided 146 comments concerned with water quantity. Commenters expressed concern that the water use of the mine coupled with potential water pollution would affect the amount of safe drinking water available to the people, agriculture, plants, and wildlife of Sierra County. Several commenters asked how they can be assured that the amount of water proposed to be used would not affect the amount of water available for other uses or permanently deplete the aquifer.

Surface water: Twenty-nine commenters provided 98 comments concerned with surface water, which mainly focused on water quantity and water quality. Commenters expressed concern that mining operations would reduce stream levels and pollute surface water areas, which could affect wildlife, plants, and livestock operations. Commenters expressed concern that the aquifer would be permanently affected by mining activities and that this drawdown would affect surface water over the long term.

These key issues were considered in an alternatives development session attended by the BLM, cooperating agencies, and Solv and were incorporated into the following impact questions used to develop the alternatives to the Proposed Action:

- How would groundwater withdrawal affect surface ecosystems and other users?
- How would mining activities impact surface water and groundwater quality for present or foreseeable future use?
- How would mining activities use water efficiently?
- How would mining activities directly or indirectly affect wildlife species, their habitat, and their behavior?
- How would the mine affect public services, health and safety, and local economies?

1.7.3 Issues Excluded from the Analysis

No issues identified in scoping were specifically excluded from further analysis. Many of the scoping issues were incorporated into the impact questions identified above that were used to develop alternatives.

CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

In accordance with NEPA, this Environmental Impact Statement (EIS) describes the Proposed Action and alternatives (40 Code of Federal Regulations [CFR] 1502.14). The EIS must consider a range of reasonable alternatives, including the Proposed Action and No Action Alternative, and provide a description of alternatives eliminated from further analysis (if any exist) with the rationale for elimination (40 CFR 1502.14(a)). This section provides that discussion.

The Copper Flat project (project) is the proposed reestablishment of a poly-metallic mine and processing facility located near Hillsboro, New Mexico. The Proposed Action would consist of an open pit mine, flotation mill, tailings storage facility (TSF), waste rock disposal areas, a low-grade ore stockpile, and ancillary facilities. In most respects, the facilities, disturbance, and operations would be similar to the former mining operation. The project is proposed and the mine would be operated by the New Mexico Copper Corporation (NMCC), a wholly-owned subsidiary of THEMAC Resources Group Limited (THEMAC) (THEMAC 2011).

Background: Records show that copper and gold mining has occurred in and around the Copper Flat location for more than 125 years. Modern exploration efforts at Copper Flat date back to the 1950s. Quintana Mineral Corporation (Quintana Minerals) began development of the Copper Flat mine in the 1970s (NMCC 2014a). An Environmental Assessment Report (EAR) was prepared for the Quintana operation in 1977 by the Bureau of Land Management (BLM) Las Cruces District Office (LCDO) to analyze potential impacts resulting from granting rights-of-way (ROWs) for utilities and access roads, as well as impacts resulting from the mine development. The ROWs were approved by the BLM in the EAR, and air quality, tailings discharge, and water discharge permits (DPs) were issued by the State of New Mexico. In 1982, Quintana Minerals brought the property into production as an open pit mine with a mill and concentrator. The Quintana facility required approximately 2 years to construct. The initial mine excavation needed to expose the ore body occurred during the 4- to 6-month period immediately preceding startup of the mineral processing plant. Following startup of mineral processing, the mine was in commercial production for 3.5 months until all operations were halted due to a significant decline in copper prices (NMCC 2014a).

In 1986, all on-site surface facilities were removed, and a BLM-approved program of non-destructive reclamation was carried out. Much of the property's infrastructure, including building foundations, power lines, and water pipelines, was preserved for reuse in the event copper prices recovered sufficiently to make reactivating the mine economically viable (THEMAC 2011).

In 1991, a proposed plan of operations was filed with the BLM by Gold Express Corporation to reactivate the Copper Flat mine. The BLM initiated an Environmental Assessment (EA) because Federal land would be "newly" disturbed. New archaeological, biological, threatened and endangered species, air quality, hydrologic, and socioeconomic studies were conducted. However, it was determined in 1993 that an EIS would be required for the mine development due to concerns related to water quality issues, and the EA was never completed (THEMAC 2011).

Alta Gold Company (Alta) acquired the property in early 1994 and proposed to rebuild the Copper Flat mining facility essentially as it existed in 1982. Alta submitted an updated mine plan of operations (MPO) and associated environmental baseline data to the BLM for initiation of the EIS process. The draft EIS for the Copper Flat Project was completed by the BLM in 1996. A preliminary final EIS for the Copper Flat Project was prepared by the BLM in 1999 following public comment on the draft EIS.

However, the EIS and Record of Decision were never finalized because Alta declared bankruptcy in early 1999 (THEMAC 2011).

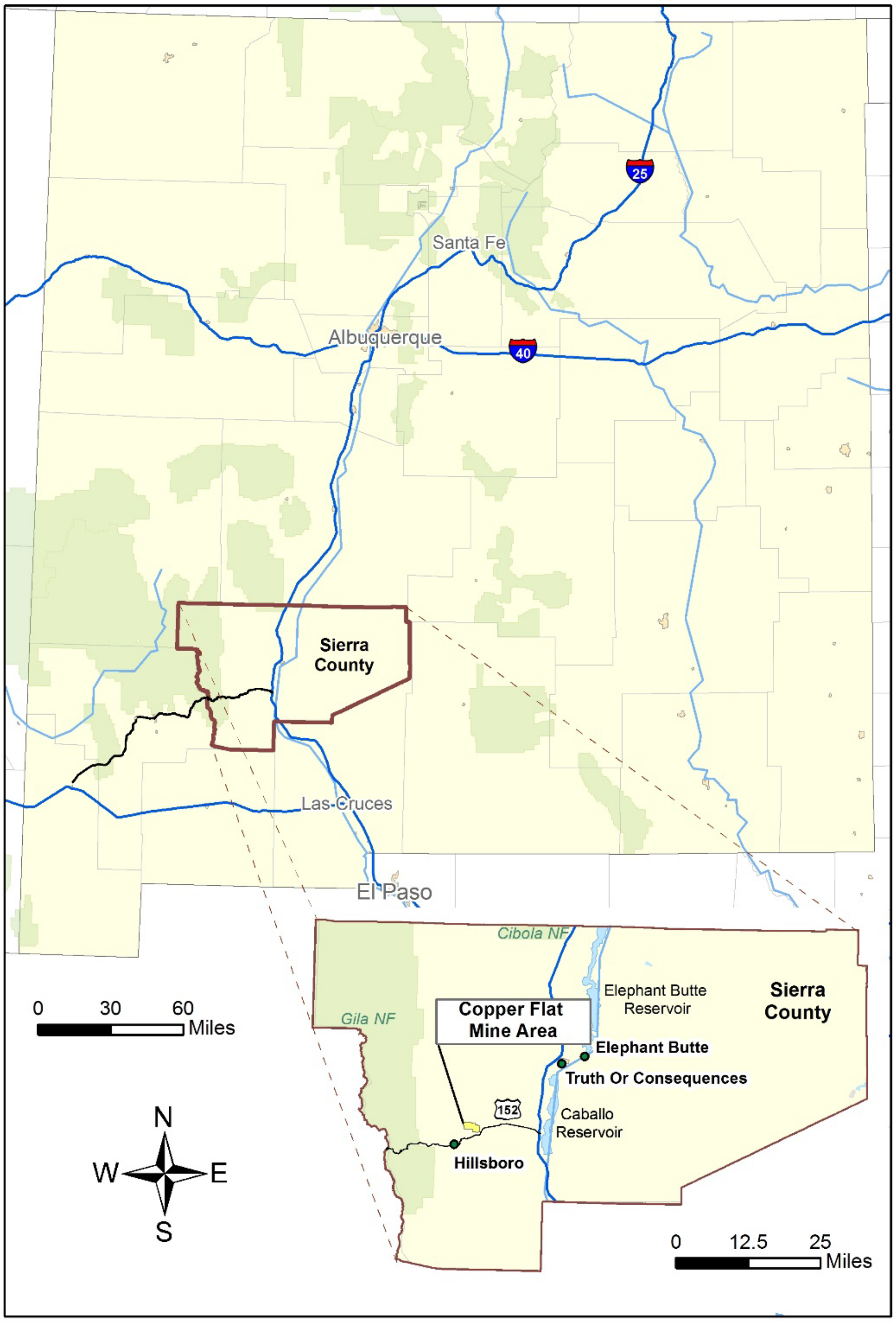
NMCC acquired the Copper Flat property in 2009 with the intent to re-establish an open pit mine and processing facility similar to the Quintana Minerals operation. Current work to evaluate and potentially re-permit the Copper Flat mine includes the development of this EIS and numerous studies that have been conducted to support the analysis presented herein. Permitting efforts with the State of New Mexico have included initiating the process toward a new mine permit with the New Mexico Mining and Minerals Division (MMD) through submission of a Sampling and Analysis Plan and subsequent baseline data reports. NMCC submitted an application for a new air permit; this was issued by the New Mexico Environment Department (NMED) Air Quality Bureau in July 2013. Efforts to renew the DP associated with the mine area are underway with the NMED Ground Water Quality Bureau. In addition, work to address previous impacts at the site associated with the Quintana facility has included the submission of a Stage I Abatement Plan that was approved by the NMED in February 2012 and four quarterly periods of groundwater and surface water monitoring in 2013 (NMCC 2014a). The general location of the mine is shown below in Figure 2-1.

Land status: The Copper Flat project is composed of a mixture of public and private land that includes patented and unpatented mining claims (lode, placer, and millsite). The proposed mine area is 2,190 acres.

The reestablishment of the Copper Flat mine would affect nearly 1,586 acres within the mine area, approximately 910 acres of which have been previously disturbed and 676 acres that would be newly disturbed land, and 97.2 acres outside the mine area for ancillary facilities for the Proposed Action. Overall, the proposed Copper Flat project would disturb approximately 745 acres of unpatented mining claims on public land and 841 acres of private land controlled by NMCC. Activity at the Copper Flat mine in 1982 disturbed approximately 361 acres of BLM-administered public land and 549 acres of private land (THEMAC 2011). Approximately 57 percent of the area needed for the proposed MPO has been disturbed by prior operations, and approximately 90 percent of the ore would be mined from private land (THEMAC 2011).

Portions of the waste rock disposal areas, as well as the crushing facility and the mill facility, would be located on public land subject to unpatented mining claims controlled by NMCC. Approximately 28 percent of the TSF and 10 percent of the open pit would be located on public land subject to mining claims controlled by NMCC (THEMAC 2011).

Figure 2-1. Project Location Map



Source: THEMAC 2011.

2.1 PROPOSED ACTION

The Proposed Action was submitted to the BLM in June 2011 in the form of an MPO that was based upon the plan of operations that Quintana Minerals used in the previous operation of Copper Flat mining activities in 1982, with some upgrades and modifications based on current engineering designs and regulations. The Proposed Action was designed to reuse the existing foundations, production wells, water pipeline, and electrical substation that were employed by the previous Quintana operation. Additionally, the Proposed Action would reuse existing infrastructure on an existing brownfield site.

The Quintana operation processed 15,000 tons per day (tpd) of ore; the alternative defined as the Proposed Action proposes to increase that throughput to 17,500 tpd to increase efficiency. The Proposed Action varies from some of the original Quintana mine plant elements in ways that would increase efficiency and improve the performance of mine infrastructure. NMCC's Proposed Action includes a lined TSF, which would increase water recycling and meet new regulatory standards in New Mexico. The Proposed Action's TSF liner would be a substantial upgrade from the unlined TSF previously employed at the site.

The primary source of information about the Proposed Action is the Copper Flat MPO, dated December 2010 and revised June 2011. As the project has evolved, additional or revised information has been developed to more accurately describe the Proposed Action and address current regulatory requirements. These changes from the most recent version of the MPO are referenced separately throughout the EIS. The NMCC proposed operation includes the following activities:

- Expand the mine area to include additional land controlled by NMCC;
- Provide for exploration over the entire proposed plan area;
- Expand the existing open pit;
- Re-activate existing haul and secondary mine roads;
- Expand, operate, and reclaim existing waste rock disposal facilities (WRDFs);
- Construct, operate, and reclaim low-grade ore stockpiles;
- Construct, operate, and reclaim the mill and associated processing facilities;
- Construct, operate, and reclaim the TSF;
- Construct ancillary buildings (administration offices, laboratory, truck shop, reagent building, substation, gatehouse, etc.);
- Re-activate and maintain an existing water supply network;
- Construct growth media stockpiles for use in future reclamation of the site; and
- Re-activate and maintain surface water diversions.

The 2,190 acres within the mine area consist of 1,227 acres of BLM land (361 acres previously disturbed and 384 acres newly disturbed) and 963 acres of private land (549 acres previously disturbed and 292 acres newly disturbed). Thus, the project would directly impact 1,586 acres within the mine area, as shown below. (See Table 2-1.)

Table 2-1. Summary of Proposed Disturbance Within the Mine Area

Table 2-1. Summary of Proposed Disturbance Within the Mine Area	
Disturbance	**Total (Acres)**
TSF	627
Open pit	169
WRDFs	260
Low-grade ore stockpile	99
Haul roads	58
Plant site area	184
Growth media stockpiles	101
Diversion structures	48
Exploration	40
Total Disturbance	**1,586**
Public land	745
Private land	841

Source: NMCC 2014a.

The project would also impact 97.2 acres for ancillary facilities outside the mine area as shown in Table 2-2.

Table 2-2. Summary of Proposed Disturbance to Ancillary Facilities

Table 2-2. Summary of Proposed Disturbance to Ancillary Facilities				
Disturbance	**Total (Acres)**	**BLM Land**	**NM State Trust Land**	**Private Land**
Pipeline corridor	44.4	34.6	7.8	2.0
Millsites	45.0	45.0	0	0
Production well roads	7.8	7.8	0	0
Total Disturbance	**97.2**	**87.4**	**7.8**	**2.0**

Source: NMCC 2015a.

Annually, the mining operation would process an estimated 6.4 million tons of copper ore mill feed. Waste rock production is estimated to average 2.4 million tons per year (tpy) (ranging from 1.0 to 4.0 million tpy) with tailings production estimated at 6.3 million tpy, with the difference being mill feed leaving the site as mineral concentrate. An operational life of approximately 16 years plus additional time for permitting, construction, and closure is currently projected for the operation (NMCC 2014a). The duration of each of the phases of the Copper Flat project are estimated as follows:

- Pre-construction (permitting) - 2 years;
- Construction (site preparation) - 2 years;
- Operations (mineral extraction) - 16 years;
- Closure/reclamation - 3 years; and
- Post-closure monitoring - 12 years.

For the most part, the plant facilities would be constructed at the original Quintana plant site and, to the extent practicable, would use most of the original concrete foundations. The plant site, which would include the crusher, concentrator, assay lab, mine shop, warehouse, security, and administration buildings, would occupy approximately 184 acres and would be located between the open pit and the TSF.

Scheduled operating time for the mill would be 24 hours per day, 7 days per week, and 365 days per year. Products produced by the mine would be two mineral concentrates: a copper concentrate, which would contain the recovered copper, gold, and silver, and a separate molybdenum concentrate. The concentrate would be sold to an off-site buyer and transported from the mine by truck to another location for smelting and refining. A general depiction of the proposed mine layout is shown in Figure 2-2.

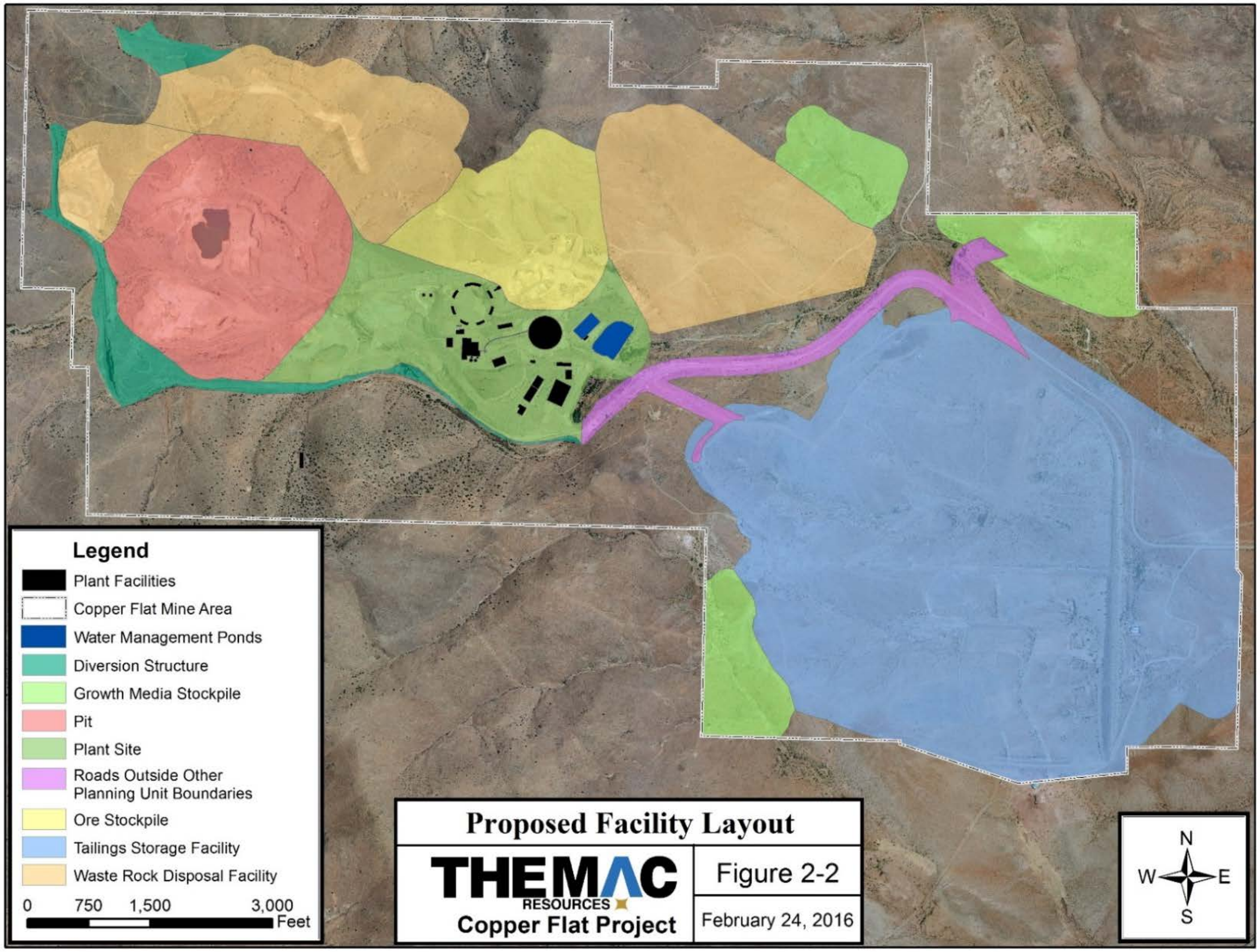
2.1.1 Mine Operation - Open Pit

The mining of new ore would entail the expansion of an existing open pit. Currently, a portion of the ore body at Copper Flat is exposed at and near the surface and would be mined by conventional truck and shovel open pit methods in a manner similar to the previous operation. Over the life of the project, the mine would produce approximately 100 million tons of copper ore. Low-grade copper ore would likely be processed at the end of the mine life. As such, it would require stockpiling until eventually processed. The operation would process at a nominal throughput of 17,500 tpd of ore through the copper sulfide flotation mill, using standard technology similar to that of the previous operation. While the operation would focus primarily on copper and molybdenum, other polymetallic resources such as gold and silver would be extracted from the Copper Flat ore.

Pre-production stripping of overburden (top layers of soil) was completed in 1982 during the previous operation. Approximately 3 million tons of overburden material was stripped, and over 1.2 million tons of ore was mined from the existing pit during the early 1980s.

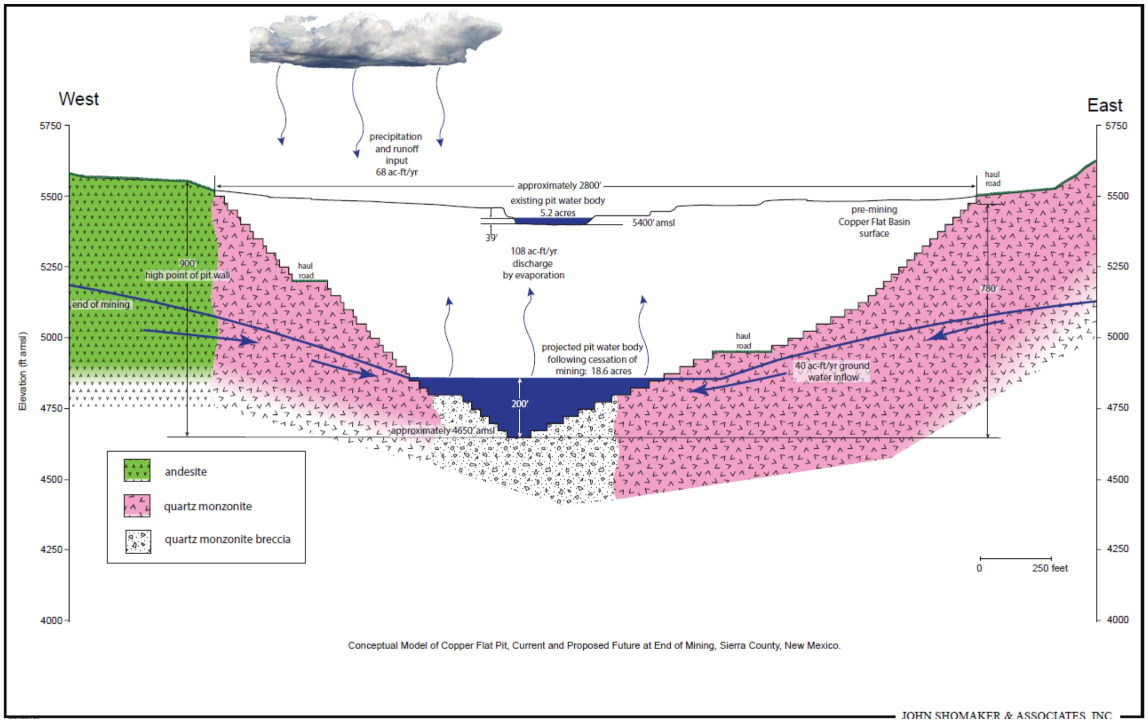
The existing pit would eventually be enlarged to a diameter of approximately 2,800 feet with an ultimate depth of approximately 780 vertical feet below the pre-mining ground surface at the middle of the Copper Flat Basin and approximately 900 vertical feet below the high point of the pit wall, as shown in the conceptual model. (See Figure 2-3.) The area of the pit would be expanded from the current 102 acres to 169 acres. A diversion of Greyback Arroyo, previously constructed south of the pit, would not be altered by the proposed pit expansion.

Figure 2-2. Mine Layout – Proposed Action



Source: NMCC 2015a.

Figure 2-3. Pit Conceptual Model



Source: NMCC 2016.

Bench height would be 25 feet, and the working inter-bench slope of the pit walls would range from 38 to 45 degrees (NMCC 2012b). Safety benches would remain as required by regulation. NMCC does not propose to backfill the pit. Backfilling operations would not allow sequential mining of the deposit, may cover future mineral resources, and would be economically unfeasible following closure of the operation, although some benign waste rock would be used for pad preparation, plant site development, and in connection with the reclamation of disturbed areas.

Ore material from the pit would be drilled and blasted, loaded, and hauled to the primary crusher and then conveyed to the process mill where the mineral values would be removed by conventional flotation processes. Waste rock would be placed in designated disposal areas.

Blasting would be limited to daylight hours and performed by trained and certified blasters. Rotary diesel-driven drills or electric-powered drills or down-the-hole hammer drills would be used for blast hole drilling. Wet drills would be used in conformance with Mine Safety and Health Administration (MSHA) requirements for secondary breakage when necessary. Safe seismic disturbance and air blast limits would be established to prevent damage to buildings.

Blasting agents and explosives would be stored in secured areas in compliance with applicable State and Federal regulations. Ammonium nitrate and diesel fuel would be stored on-site in bins and tanks. Detonators, detonating cord, boosters, caps, and fuses would be stored apart from the batch plant area in secured separate magazines. All locations chosen for storage of blasting agents and explosives would be selected to provide for the safety of personnel and the public and to comply with regulations.

Cuttings samples would be taken from blast holes. Based upon the assay values of these samples, the broken rock in the pit would be classified as "ore" or "waste." The broken rock would be loaded onto end-dump haul trucks for transport to the primary crusher, low-grade stockpile, or waste rock disposal area(s) depending on the assay classification.

Loading of both ore and waste rock would be accomplished by front end loaders (NMCC 2012b). Ore and waste rock haulage would be handled by a fleet of end-dump, diesel-powered haulage trucks with a nominal 100-ton capacity (NMCC 2012b). Additional units may be added to the fleet over time as the pit is deepened.

Noise from the mine equipment would comply with and be regulated under MSHA. Mining equipment would consist of standard units that are typical of the mining industry and would be fitted with mufflers, spark arresters, and other fire prevention and safety equipment. The major equipment proposed for the mine operation is shown below in Table 2-3.

Table 2-3. Major Mine Equipment Fleet on Hand

Table 2-3. Major Mine Equipment Fleet on Hand																	
Equipment	Year of Operation																
	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Blast hole drill, 45,000 lb.	1	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1
Hydraulic shovel, 14 cubic yards (y^3)	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Haul truck, 100 tons	4	6	7	7	8	8	9	9	9	9	9	7	7	7	7	7	6
Track dozer, 410 HP	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2
Wheel dozer, 354 HP	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Motor grader, 16’	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water truck, 10,000 gal.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pioneer drill	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Backhoe, 2 yd^3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total	**16**	**20**	**21**	**21**	**22**	**22**	**23**	**23**	**23**	**23**	**23**	**21**	**19**	**18**	**19**	**19**	**18**

Source: NMCC 2012b.

Notes: Units owned based on fleet buildup and replacement.
HP = horsepower.

The proposed plan also includes ongoing exploration drilling to define the copper ore body (infill and step-out drilling in addition to tests for possible deep extensions of the ore body) as well as testing for near-surface coarse gold vein and alluvial gold potential in the area of the mine.

A 5.2-acre lake currently occurs in the existing pit. The pit lake contains near-neutral water that is periodically acidic with elevated concentrations of dissolved metals and other contaminants. The floor of the existing pit is currently at 5,400 feet above sea level, which is approximately 100 feet beneath the original pre-mining ground surface. The water level in the pit lake was 5,439 feet above sea level in September 2013, indicating that the depth of the pit lake was 39 feet at that time. As a result of seasonal variations in precipitation, the pit lake water level has fluctuated by 1 to 5 feet per year.

Dewatering of the pit lake would be necessary prior to mining and would be necessary throughout the life of the mine to facilitate mining operations. Groundwater inflow to the pit during previous operations ranged from 50 to 75 gallons per minute (gpm).

Initial dewatering of the pit would be accomplished with two or three portable construction trash pumps (pumps designed to move water as well as hard and soft solids such as mud, rocks, twigs, and sludge) operating on a continuous basis. Pumping characteristics would require 6- to 10-inch trash pumps. Water evacuated from the pit would be pumped to a construction pond through fused high-density polyethylene (HDPE) pipe. Dewatering the existing pit would be accomplished in approximately 30 days (NMCC 2015a). The water pumped from the pit would be used for dust suppression on the roads and waste rock dumps. If necessary, pit water would be temporarily stored in a reservoir in the mineral processing area prior to use.

During mining, water inflows to the pit from all sources would be approximately 12 million gallons per year, and dewatering would occur on an intermittent basis. As the mine progresses, mine equipment would be used to prepare small, temporary water collection sumps on each mining level as a normal part of the operation. Pumping and piping equipment used for dewatering during mine operation would be similar to the initial pit dewatering effort. The discharge pipe would follow the mine haul road to the edge of the pit and terminate at a small pond or tank at the edge of the pit; water would be drawn from this pond or tank and used for dust control on roads and other surface areas. As the mine progresses and deepens, mine crews would extend the discharge pipe by fusing additional HDPE pipe segments at the bottom of the pipe run. Pumping stations would be added at intermediate points along the mine haul road as needed to lift the water to the pit edge. During mining, the dewatering pumps would operate several times per day for a total of 3 to 5 hours per day in order to keep up with expected inflows (NMCC 2015a).

Water removal from the pit would continue over the operational life of the mine through a sump or series of sumps located within the pit. Water removal would end once mining is completed. At the end of mining, the pit bottom would be 4,720 feet above mean sea level. The final pit bottom would be approximately 780 vertical feet below the pre-mining ground surface at the middle of the Copper Flat Basin and approximately 900 vertical feet below the high point of the pit wall. After mining and associated dewatering activities end, a pit lake would reform as a result of inflowing groundwater, direct precipitation, and runoff from adjacent slopes. The pit lake would eventually be approximately 200 feet deep and cover 18.6 surface acres. The size of the lake would fluctuate annually depending on precipitation and evaporation rates. At an average evaporation rate of 65 inches per year, a simulated (annual) pit water balance shows inflows of about 63 acre-feet per year (AFY) from direct precipitation and runoff from adjacent slopes and 38 AFY from groundwater inflow, with discharge of about 100 acre-feet (AF) as evaporation from the pit water surface (NMCC 2014a).

2.1.2 Ore Processing

The proposed plant would be a sulfide-flotation plant similar to that originally constructed and operated at the site by Quintana Minerals in 1982 and would be typical of plants operating at other locations in New Mexico, Arizona, and elsewhere. It would include a molybdenum processing circuit similar to that designed by Quintana Minerals. Additionally, the plant would include a gravity gold recovery circuit, which would recover coarse gold into a smeltable concentrate. No leaching processes (such as cyanide leaching) would be used. A general depiction of the mining process is shown on the next page. (See Figure 2-4.) The sulfide flotation plant would be designed to process approximately 6.4 million tons of ore per year at a nominal throughput of 17,500 tpd (assuming 93 percent availability).

Ore from the pit would be hauled via end-dump haulage trucks to the primary crusher area located east of the pit. The ore processing operation would commence with the dumping of the ore into the primary crusher for the first stage of crushing. After the first stage of crushing, the ore would be conveyed to downstream mills for further crushing and grinding for the purpose of liberating the copper and other recoverable minerals from the host rock. During the crushing and grinding operations, a portion of this ore stream would be fed through a gravity gold separation process.

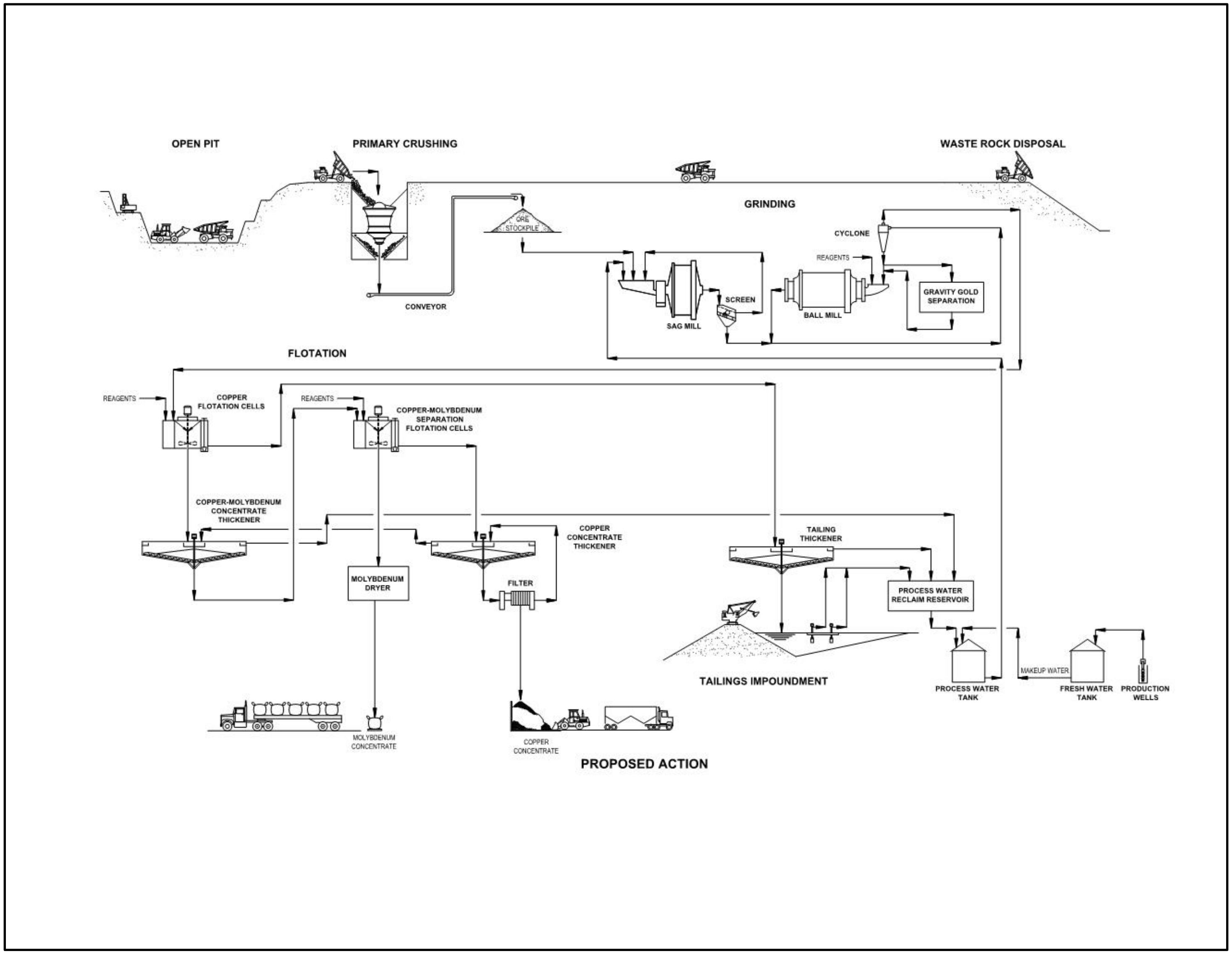
Once the ore is sized for optimum liberation of the minerals through the crushing and grinding operations, the ore would be introduced into the flotation process. In the flotation process, the ore, which at this time would include the finely ground host rock and liberated minerals, would be mixed with additional process water. Organic reagents would be added to this mixture creating a froth and causing the liberated minerals to adhere to the froth bubbles. The sulfide-mineral-laden froth would be collected and filtered to form a concentrate containing copper, molybdenum, silver, and gold minerals. This concentrate would receive further flotation processing to create a copper concentrate that contains copper, silver, and gold minerals and a separate concentrate containing molybdenum minerals.

2.1.3 Mine Facilities

For the most part, the plant facilities would be constructed at the site of the original Quintana plant site and, where feasible and practical, the plant would use concrete foundations that were constructed for the Quintana operation in 1982. The plant site would be part of the larger 184-acre process/shop/administration site prepared for the Quintana operation located between the open pit and the TSF area. Table 2-4 lists major facilities that would be constructed at the plant site as part of the Proposed Action. A general depiction of the facility layout is shown in Figure 2-5.

All mechanical, civil, structural, and architectural designs would be in accordance with applicable standards and codes. Equipment and fabricated items would be furnished with manufacturers standard finish and retouched after erection. Safety painting would be in accordance with MSHA standards and New Mexico mining codes.

Figure 2-4. Mining Process – Proposed Action



Source: THEMAC 2011.

Table 2-4. Primary Plant Site Structures and Facilities

Facility	Length (ft)	Width (ft)	Height (ft)	Diameter (ft)	Slab (ft)	Construction Type
Primary crusher	90	30	103	-	0.83	Metal roof, metal siding
Primary crusher control/ mechanical building	20	15	35	-	0.67	Metal roof, metal siding
Coarse ore stockpile tunnel	400	16	26	-	Varies	Existing, below ground, reinforced concrete
Concentrator building, grinding area	192	145	125	-	1.00	Metal roof, metal siding
Concentrator building, flotation area	22	26	80	-	0.66	Metal roof, metal siding
Concentrator building, maintenance area	70	50	30	-	0.50	Metal roof, metal siding
Concentrate handling & storage area	154	103	50	-	0.66	Concrete with metal roof and siding, separate from concentrator
Filter deck	24	20	80	-	0.66	Metal roof, metal siding
Concentrate thickeners (2)	-	-	-	50	-	Steel tank
Ball bins	109	51		-	1.00	Concrete
Reagent building	60	50	26	-	0.50	Metal roof, metal siding
Reagent storage and lime handling	100	52	50	-	0.83	Metal roof, block walls
Lime mill	27	22.5	8.5	-	0.50	Metal roof, metal siding
Flammable material storage building	25	17	9	-	0.67	Metal roof, metal siding
Tailings thickener	-	-	-	350	-	Steel tank
Tailings cyclone station	Central cyclone station not used in plan; plan is individual cyclones arranged around periphery of TSF.					
Mine shop/warehouse	340	90	-	-	1.00	Metal roof, metal siding
Tire/lube	90	60	41	-	1.00	Metal roof, metal siding
Small vehicle repair building	90	30	40	-	0.83	Metal roof, metal siding
Wash pad	58	33	0	-	0.83	Concrete
Administration building	120	60	14	-	0.50	Metal roof, metal siding
Change house	180	40	20.5	-	0.50	Metal roof, metal siding
Gatehouse	8	12	10	-	0.50	Metal roof, metal siding
Assay & metallurgical laboratory	180	40	16	-	0.50	Metal roof, metal siding
Records & receiving office	41	20	12	-	0.50	Metal roof, metal siding
Copper Flat electric substation	94	68	NA	-	1.00	Outside area enclosed by 8-foot chain link fence

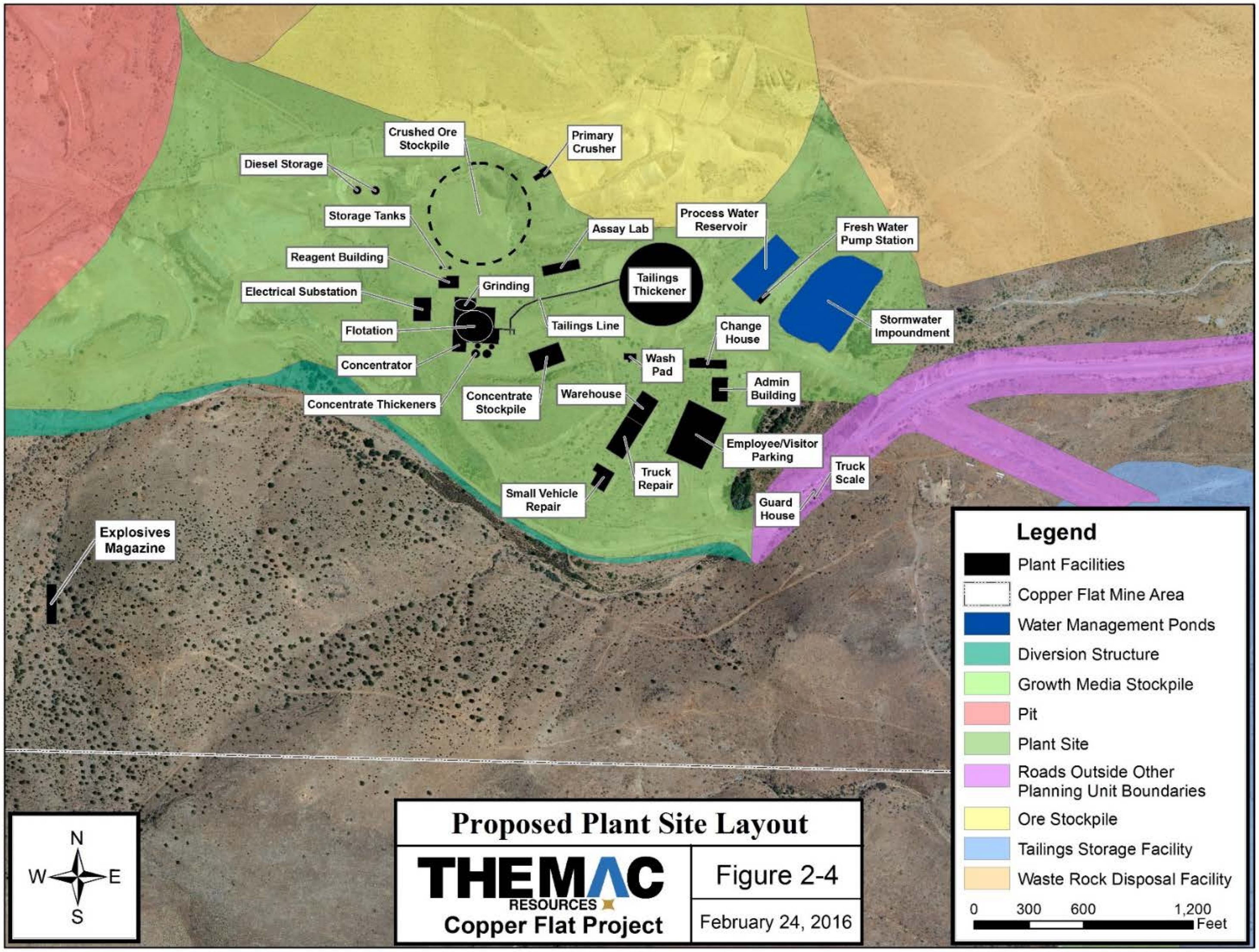
Table 2-4. Primary Plant Site Structures and Facilities (Continued)

Facility	Length (ft)	Width (ft)	Height (ft)	Diameter (ft)	Slab (ft)	Construction Type
Fresh water/fire tank (1)	-	-	24	34	-	Metal
Process water tank (1)	-	-	26	20	-	Metal
Fresh water pump station tanks (6)	-	-	18	17	-	Metal
Potable water tank	-	-	7.25	12	-	Carbon steel, 6,000 gal
Seal water tank	-	-	8	8	-	Carbon steel, 3,000 gal
Reclaim reservoir fresh water surge tank	16	-		8	-	Carbon steel, 5,500 gal
Reclaim reservoir fresh water storage tank	-	-	36	40	-	Carbon steel, 300,000 gal
Off road diesel fuel storage tank (2)	-	-	24	42	-	Nominal 250,000-gal tank, field erected steel tanks
On road diesel storage tank	-	-	12	12	-	Carbon steel, 10,000 gal
Gasoline storage tank	-	-	12	12	-	Carbon steel, 10,000 gal
Engine oil storage tank	-	-	-	-	-	Carbon steel, 1,000 gal
Hydraulic fluid storage tank	-	-	-	-	-	Carbon steel, 1,000 gal
ATF fluid storage tank	-	-	-	-	-	Carbon steel, 1,000 gal
Gear oil storage tank	-	-	-	-	-	Carbon steel, 1,000 gal
Anti-freeze storage tank	-	-	-	-	-	Carbon steel, 1,000 gal
Used oil storage tank	-	-	-	-	-	Carbon steel, 2,000 gal
Recycle water tank - truck wash	-	-	12	12	-	Carbon steel, 10,000 gal
Used antifreeze storage tank	-	-	-	-	-	Carbon steel, 2,000 gal
Lime silo	18	24	25	20	0.83	200-ton capacity
Lime slurry tank	-	-	25	12	-	Carbon steel, 20,000 gal
Pax mix tank	-	-	10.67	8	-	Carbon steel, 4,000 gal
Pax distribution tank	-	-	10.67	8	-	Carbon steel, 4,000 gal
Methyl isobutyl carbinol (MIBC) storage tank	-	-	6	8	-	Carbon steel, 2,000 gal
No. 2 diesel storage tank	-	-	10	11	-	Carbon steel, 7,000 gal
Sodium hydrosulfide (NaHS) mix tank	-	-	10.67	8	-	Carbon steel, 4,000 gal
NaHS distribution tank	-	-	10.67	8	-	Carbon steel, 4,000 gal
Molybdenum collector mix tank	-	-	6	8	-	Carbon steel, 2,000 gal
Molybdenum collector distribution tank	-	-	6	8	-	Carbon steel, 2,000 gal
AERO 238 mix tank	-	-	10.67	8	-	Carbon steel, 4,000 gal
AERO 238 distribution tank	-	-	10.67	8	-	Carbon steel, 4,000 gal

Table 2-4. Primary Plant Site Structures and Facilities (Concluded)						
Facility	**Length (ft)**	**Width (ft)**	**Height (ft)**	**Diameter (ft)**	**Slab (ft)**	**Construction Type**
NaHS stock tank	-	-	10.67	8	-	Carbon steel, 4,000 gal
Flocculant tanks (2)	-	-	7.25	12	-	Carbon steel, 6,000 gal each tank
Gravity concentrator tank	-	-	9.5	12	-	Carbon steel, 8,000 gal
Copper concentrate stock tank	-	-	24.6	17	-	Carbon steel, 42,000 gal
Explosive magazines (2)	8	8	8	-	-	Manufactured/constructed, located and secured per Federal and State regulations
Ammonium nitrate silo	-	-	60	15	-	Manufactured/constructed, located and secured per Federal and State regulations

Source: M3 2012.

Figure 2-5. Mine Facilities – Proposed Action



Source: THEMAC 2011.

Equipment in the concentrator building is expected to consist of the following (NMCC 2014a):

Primary crushing

- One 42- x 65-inch gyratory crusher; and
- One 48-inch x 454-foot-long stockpile feed conveyor.

Grinding

- One 32-foot-diameter x 14-foot-long semiautogenous (SAG) mill, 10,000 horsepower (hp);
- One 18-foot-diameter x 28-foot-long ball mill, 6,000 hp;
- One 4.5-foot cone crusher, 300 hp (grinding circuit pebble crusher);
- One UTM-600 tower mill (copper regrind);
- One KW-100 tower mill (moly regrind);
- Two 8- x 20-foot double deck vibrating screens;
- One primary cyclone cluster with ten 26-inch diameter cyclones;
- One cyclone feed pump, 800 hp;
- One 48-inch x 470-foot-long reclaim conveyor;
- One 36-inch x 89-foot-long SAG mill oversize conveyor;
- One 36-inch x 257-foot-long pebble crusher feed conveyor; and
- One 36-inch x 101-foot-long pebble crusher product conveyor.

Flotation

- Ten 1,500-cubic-foot (ft^3) bulk rougher cells (copper/moly);
- Thirteen 300-ft^3 cleaner cells (copper);
- Seven 24-ft^3 cleaner (copper);
- Eight 100-ft^3 rougher cells (moly);
- Five 18-ft^3 cleaners (moly); and
- Five 15-ft^3 cleaners (moly).

Concentrate

- One 50-foot-diameter bulk concentrate thickener (copper/moly);
- One 50-foot-diameter concentrate thickener (copper);
- One 12- x 14-foot press belt drum filter (copper); and
- One 4.5- x 5-foot press belt drum filter (moly).

Tailings

- 350-foot-diameter tailings thickener.

2.1.3.1 Primary Crushing Facilities

The primary crusher would be located within the existing foundation about 2,500 feet east of the pit. Normally, ore hauled from the pit would be dumped directly into the primary crusher; however, some ore may go to a small stockpile near the crusher and be fed to the crusher at a later time. The primary crusher would reduce the mine run rock to a nominal size less than 8 inches in diameter. Crusher discharge would be fed by apron feeder onto a belt conveyor for transport to the coarse ore stockpile located near the mill. Storage capacity of the coarse ore stockpile would be about 75,000 tons. The crusher would be located below ground level to limit noise and contain dust. The crusher would normally operate 12 to 16 hours per day; however, it would occasionally operate longer as needed to maintain production (NMCC 2014a).

2.1.3.2 Grinding

Crushed ore would be removed from the coarse ore stockpile by three draw chutes and apron feeders located in an existing ore reclaim tunnel located under the stockpile. The ore would be fed onto a belt conveyor for transport into a large diameter SAG mill for grinding. Reduction in the SAG mill would be the result of impact between the rock entering the mill and 5-inch steel grinding balls fed to the mill along with the rock. Water and various reagents would be added to the SAG mill feed to start the conditioning of the ore pulp for subsequent stages of treatment.

The SAG mill would discharge onto a double-deck vibrating screen for sizing. Rock passing through both screen decks (undersize) would travel to the cyclone feed sump. Rock remaining on top of the upper screen deck (oversize) would be taken by belt conveyor to a cone crusher where it would be crushed to less than 0.75-inch in diameter and returned by belt conveyor to the SAG mill. Rock passing through the upper screen deck but not passing through the bottom screen deck (middling) would be returned directly to the SAG mill by conveyors. Ore from the cyclone feed sump would be pumped to a cluster of hydro-cyclones for material sizing. The fine product from the hydro-cyclones would be sent to the feed sump for the first stage of flotation, and the coarse product from the hydro-cyclones would go to the ball mill for further grinding (NMCC 2014a).

Milling will also include a gravity gold recovery circuit. A portion of the hydrocyclone underflow slurry would be taken through a Knelson-type gravity concentrator circuit to collect gravity recoverable gold. The gravity separation circuit will consist of two Knelson-type concentrators, each of which will have an upstream scalping screen to remove oversize material. The gravity concentrates will pass through magnetic separators for removal of tramp iron and broken grinding media. The tailings from the gravity concentrators will be pumped back to the cyclone feed sump. The processing facility will be located on approximately 128 acres, including the crushed ore stockpile, concentrator, laydown yard and fuel station, process water reservoir and the administration, warehouse, and other facilities.

2.1.3.3 Flotation and Concentration

Cyclone overflow from the feed sump would be sent to a series of first stage (rougher) flotation cells. Each cell would be equipped with a mechanism to agitate or stir and induce air into the ore pulp as it passes through the tank. Reagents would be added to the pulp to cause the mineral bearing sulfide mineral particles to adhere to bubbles created by the induced air and frothing agents. Reagents such as xanthate, sodium hydroxide, MIBC, sodium hydrosulfide, and diesel fuel would be used in the concentrator for the mineral flotation process. Small amounts of other reagents may be used in the process from time to time as part of an ongoing effort to improve metal recoveries and to cope with changing ore characteristics. The mineral bearing sulfide laden bubbles would rise to the top of the cell to be skimmed off. The copper/molybdenum concentrate floated off of the primary rougher would be routed to the molybdenum plant where the copper would be depressed and the molybdenum would be floated up, graded, filtered, and dried. After separating the molybdenum, the copper concentrate, which would average about 28 percent copper, would be dewatered in a settling facility (thickener) to decant water, then disk filtered to 12 percent moisture and stored for shipment.

The copper concentrate would be loaded by a front-end loader into covered trucks for transportation off-site to a smelter. The molybdenum concentrate would be dried and packaged in sacks for shipment. Filtrate from both the copper flotation circuit and the molybdenum flotation circuit would be returned to concentrate thickeners. Thickener overflow would be returned to the plant reclaim water system (as described in more detail below in Section 2.1.16, Environmental Protection Measures). No smelting or refining would be conducted at the mine area.

2.1.3.4 Tailings Storage Facility

An existing TSF at Copper Flat was constructed by Quintana Minerals to serve their 1982 mining operation. Tailings are the materials left over after the process of separating the valuable ore. The TSF received 1.2 million tons of material and was reclaimed in 1986. The TSF remains in place and is located southeast of the former plant site. NMCC proposes to construct a new, lined TSF over the area used by previous operations for tailings disposal. Tailings would be transported from the mill via slurry pipeline and deposited in the TSF. Ancillary facilities associated with the TSF would include a tailings slurry delivery system, a tailings solution reclaim and recycling system (barge pump system), and an underdrain collection and return system. The TSF would be lined to limit infiltration of process water into the subsurface and to increase efficiency of water recycling.

Approximately 95 million tons of tailings processed through the mill are expected to be impounded over the life of the project. During operation, water would be pumped from the TSF and returned to the process circuit.

TSF design: The new TSF would be expanded approximately 1,000 feet to the east of the existing unlined TSF. NMCC proposes to utilize the existing 1982 Quintana dam as a borrow source for the new starter embankment construction and to supplement the borrow with mine waste and alluvial material. The proposed method of construction for the new TSF is by centerline raises, using cycloned tailings sand that is compacted to form a stable embankment. The centerline construction method was selected because the tailings deposition rate of rise is expected to be greater than 10 feet per year in the first 5 years and up to 80 feet per year in the initial 2 years of TSF operation (NMCC 2014a). Initial construction would include a toe berm to buttress the tailings embankment and a starter dam for placement of the tailings header line and cyclones. Sand (cyclone underflow) would be placed on the embankment while the tailings slimes (cyclone overflow) would be discharged to the TSF interior. A geomembrane liner would be placed beneath the starter dam and anchored on the crest of the toe berm. An underdrain system consisting of filter compatible soil and drainage collection pipes would be placed on top of the geomembrane liner and beneath the sand dam footprint to facilitate drainage and consolidation of the cycloned sand. The liner and underdrain system would extend into the total area of the TSF interior.

Underdrainage would be routed to a lined underdrain collection pond located downstream of the toe berm. The TSF would be constructed in a phased manner. During initial construction phases, diversion ditches would be constructed to divert stormwater from upstream catchment areas within the area contributory to the TSF. The contributory area is approximately equivalent to the ultimate TSF footprint, as only minor peripheral areas drain into the TSF. At final build out, minimal potential exists for surface water run-on from external areas. Throughout most of the life of the facility, stormwater management requirements would be limited to direct precipitation.

Based on the rules and regulations of the New Mexico Office of the State Engineer (OSE), the Copper Flat TSF would be classified as a large dam having significant hazard potential. All considerations regarding dam design addressed in this section of the document would require approval under a permit granted by the OSE Dam Safety Bureau. As such, the TSF would be designed to contain the equivalent of 100 percent of the probable maximum precipitation (PMP) during operations. A spillway capable of passing 75 percent of the PMP would be required upon closure.

TSF process: Following the flotation process, the remaining slurry consisting primarily of non-valuable minerals, pyrite, miscellaneous un-floated minerals, and water would flow into a tailings thickener for partial dewatering. The slurry would enter the tailings thickener at approximately 30 percent solids by weight. Water would be removed by decanting, and the tailings would exit the thickener at 50 percent solids. Water removed by the thickener would be returned to the process water pond for reuse (NMCC 2014a).

The thickened tailings would then flow by gravity through a 24-inch pipeline into the TSF. To contain possible spills or leaks, the TSF pipeline would be constructed between earthen berms. The pipeline foundation materials and berms would be sloped to direct any spillage or leakage to the TSF. Thickened tailings slurry would be distributed around the periphery of the TSF by numerous spigots or hydro-cyclones, which would separate coarse material from the fines in the slurry. The coarse material deposited at the periphery of the TSF would be used to construct embankment rises from the new starter embankment. The fine silt and slimes would flow away from the upstream face of the raised embankment toward the pool.

As the finer material would flow into the TSF, gravitational settlement of solids would form beaches. Supernatant solution (the residual water in the tailings that seeps to and collects on the surface of the TSF as the tailings settle and compress) and precipitation runoff would flow towards the TSF low point formed by the beaches to form the free pool. Tailings deposition would be managed to force the pool away from the embankment towards an ultimate pool location. The tailings used to form the initial beaches would have a permeability coefficient of approximately 1×10^{-6} cm/sec after consolidation occurs, due to progressive loading.

Water returning to the TSF would be recovered from the pool of water that would form in the TSF and be returned to the mill process water system for reuse. Stormwater runoff could also contribute to the volume of water in this pool. The height of the embankment would be designed to contain the normal operating volume of water completely within the TSF, combined with the amount of stormwater runoff from 100 percent of the PMP, which is estimated to be about 26 inches for a single event.

The size and location of the TSF pool would vary during the life of the project. The size of the pool would be affected by pre-deposition grading in the TSF, the amount of tailings deposited, precipitation, evaporation rates, water collection rates by the underdrain collection and return system, and water recycling rates. The location of the pool would migrate as tailings beaches form but would remain within the TSF area. Tailings deposition would be managed to force the pool away from the embankment toward the upstream reaches of the TSF. The TSF area would be fenced to restrict access.

TSF monitoring: The TSF would be regulated by the OSE Dam Safety Bureau for safety of operations. The design, operation, and closure inspection of the TSF dam would be subject to approval of the OSE. The OSE requires the submittal of monthly reports of the tonnages deposited into the TSF along with readings of the piezometers, settlement devices, and settlement monuments that monitor movement.

The NMED Ground Water Quality Bureau requires a monthly report of tonnages of tailings discharged along with analyses of the tailings to identify possible contaminants. Samples of water from new monitoring wells proposed downstream of the tailings dam would be analyzed quarterly and the results sent to the Ground Water Quality Bureau. These samples would be used to identify any leakage from the new, lined TSF. Abatement plans would be implemented should leakage and contamination be detected.

2.1.3.5 Ancillary Facilities

The process plant complex would include buildings such as a mine administration building, an assay lab, a mobile equipment shop, a truck scale, and the security gatehouse (NMCC 2014a).

The administration building would be approximately 60 feet by 120 feet with a 14-foot eave height. The building would have central heating and air conditioning and would accommodate the plant administration, engineering, accounting, secretarial, and clerical personnel. Appropriate sanitary facilities would be provided for men and women.

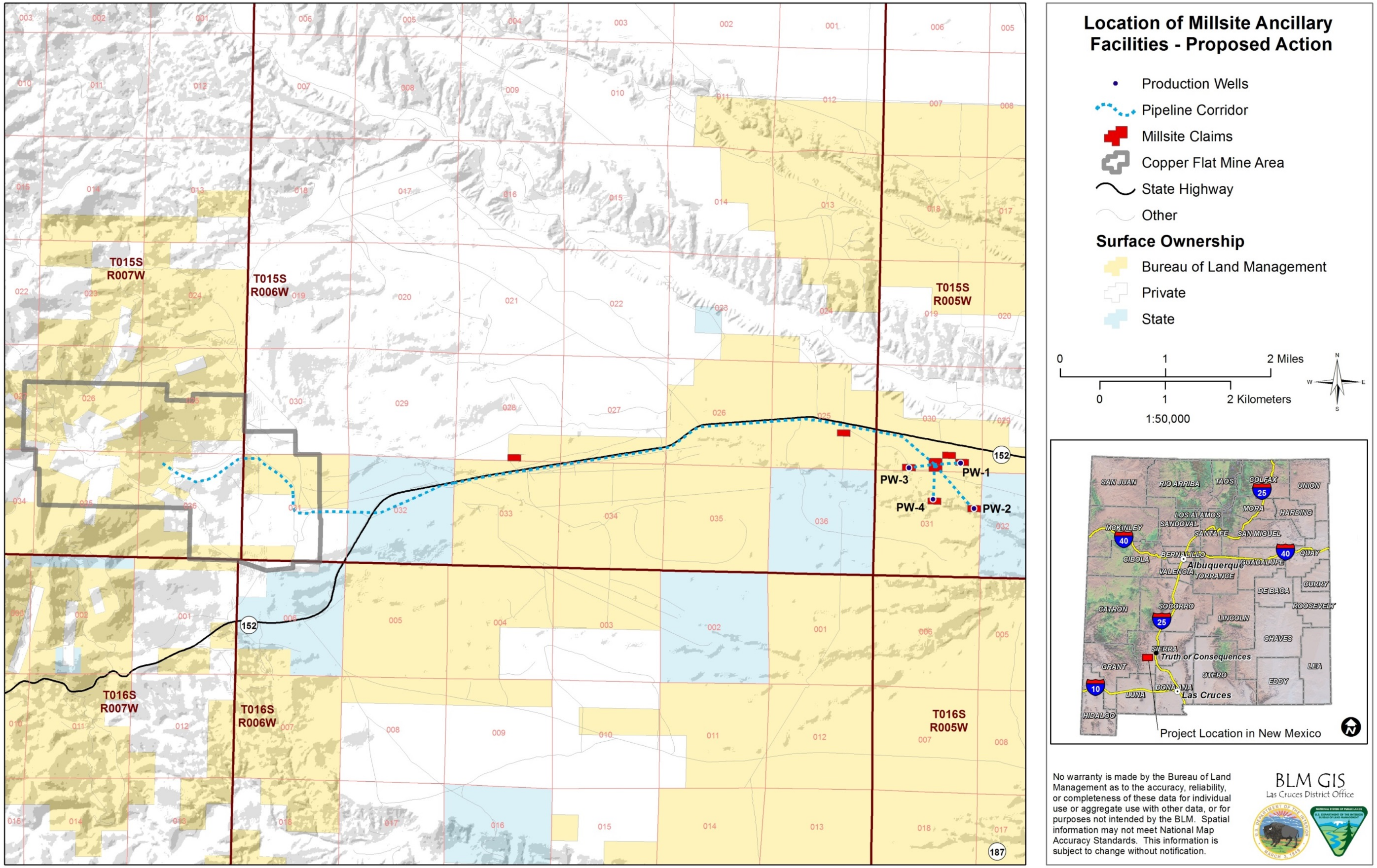
The assay and laboratory offices would be 40 feet by 180 feet. Appropriate sanitary facilities would be provided. A small air compressor would be mounted on an exterior concrete pad for furnishing service air to the building. The security gatehouse building would be approximately 8 feet by 12 feet. A parking area for employee vehicles would be located adjacent to the main plant entry gate. The shop and warehouse building would be an equipment servicing facility. The reagent building would be 60-feet by 50-feet. The buildings would all be prefabricated, standard, rigid-framed structures. All mechanical, civil, structural, and architectural designs would be in accordance with applicable standards and codes. Equipment and fabricated items would be furnished with manufacturers standard finish and retouched after erection. Safety painting would be in accordance with MSHA standards and New Mexico mining codes. Buildings and facilities would be painted in colors consistent with guidance provided in the BLM Handbook 8400, Visual Resource Management.

Outside the mine area there are nine millsite claims that were previously established by Quintana, as shown below. (See Figure 2-6.) The individual 5-acre parcels (45 acres total) would be used for staging, equipment, well pads, water tanks, pumping systems, truck access, and structures to maintain the water supply pumping stations.

An existing 20-inch water supply line, as described in Section 2.1.7, Water Supply, would provide fresh water needed for the mining operations. Four production wells would provide the water to the pump station. The BLM granted a ROW (ROW NMNM 125293) to allow NMCC to test the pipeline strictly for the purpose of the feasibility studies. The same ROW originally allowed access to a water facility and access roads. With amendments, the ROW added access to the pipeline, and for testing only, access to the four production wells and another six monitoring wells. If the project is approved, the pipeline and wells would then be authorized under the MPO and the ROW grant would be terminated. The pipeline would be located within a 60-foot-wide corridor, occupying the following BLM-owned, privately-owned, and State-owned areas outside the mine area:

- Total BLM land area: 34.6 acres;
- Total private land area: 2.0 acres; and
- Total State Trust land area: 7.8 acres.

Figure 2-6. Location of Millsite Ancillary Facilities – Proposed Action



Source: BLM 2015.

2.1.3.6 Sanitary Wastewater Treatment

Sanitary liquid wastes would be handled and disposed of through two existing septic tanks/leach fields permitted by the NMED. The septic systems would be slightly modified, including enlargement of the leach fields and placement of larger septic tanks. At closure the septic tanks and leach fields would be decommissioned.

2.1.4 Waste Rock Disposal Facility

WRDFs would be located adjacent to the open pit in areas used for waste rock disposal by the previous operator in both disturbed and undisturbed areas. These disposal areas would be expanded to cover approximately 260 acres. Prior to the expansion of existing disposal areas into previously undisturbed areas, reclamation materials (including suitable growth media and "topsoil") would be removed and stockpiled for future use in reclamation. It is anticipated that 1-2 feet of growth media would be removed, but at no time would the removal depth exceed bedrock contact.

The primary WRDF for the Proposed Action would be located east-northeast of the process area on the east side of Animas Peak. Two smaller WRDFs would be located adjacent to the pit. The waste rock disposal areas would be regraded and reclaimed to blend into the surrounding topography to the extent practicable. Horizontal surfaces would be regraded and contoured to reduce infiltration of water and provide positive drainage to sediment collection points.

Water erosion controls, such as berms and diversion ditches, would be installed to divert runoff away from the WRDFs. These diversion ditches and berms would also be used to control water inflow onto waste rock disposal piles containing partially oxidized and unoxidized material. Runoff from the WRDFs and the low-grade ore stockpile would be controlled by diverting the runoff water into collection ditches and then recycling it into the process water system. No discharge is expected to occur from the WRDFs' stormwater collection system. The final grading plan for the WRDFs would be designed to eliminate surface water run-on, improve runoff, reduce infiltration, reduce visual impacts, and facilitate revegetation through back-grading or crowned grading. Catch benches would be left in place to interrupt surface sheet flow, and regrading would approximate the adjacent and nearby geomorphic land shapes. At the end of the mine life, the height of the largest disposal area would be 340 feet higher than at present, 5,900 feet above sea level. The WRDFs are designed to facilitate regrading during reclamation.

During operations, the WRDFs would be constructed in up to 200-foot lifts to facilitate regrading during reclamation so the overall slope faces would not exceed 3.0H: 1.0V. Benches would be established at the existing lift elevations and at intermediate intervals to reduce erosion. Surface runoff from Animas Peak would be diverted around the disposal area to prevent surface run-on and infiltration into the waste rock. As the WRDFs progress, concurrent reclamation would be performed on areas that are no longer needed for future mine operations or for access (NMCC 2014a). Concurrent reclamation is reclamation activity that is performed while mine operations are ongoing.

For reclamation, the WRDFs and any remaining stockpiles would be regraded and surface runoff velocity dissipaters would be constructed to reduce velocities and limit erosion and soil loss. Exact design parameters specific to the site climatology and soil conditions would be reviewed and approved as part of the mine operations and reclamation plan.

To limit oxidation potential post closure, the reclaimed waste rock and any remaining stockpiles would be covered with growth media and vegetated.

2.1.4.1 Reclamation Material

The proposed soil cover system is a monolithic store-and-release or evapotranspiration (ET) cover. A store-and-release cover system stores precipitation during wet periods and releases the moisture back to the atmosphere via ET during dry periods, reducing net infiltration. Where mine wastes are present, growth media or topsoil soil covers would be 36 inches thick unless NMCC can demonstrate that a thinner cover can be protective of groundwater (per New Mexico Administrative Code [NMAC] 20.6.7.33.F), resist erosion, and support vegetation (NMCC 2017a). The quantity of reclamation material would be determined by the specifics of the mine and reclamation plans. Suitable reclamation materials would be identified in the field by qualified personnel. (See Table 2-5.)

Table 2-5. Available Reclamation Cover Material

Table 2-5. Available Reclamation Cover Material	
Location	**Quantity (yd^3)**
Open pit	316,070
Plant site	204,580
TSF	14,800,000
Waste rock & low-grade stockpile facilities	1,016,400
Total	**16,337,050**

Source: NMCC 2017a.

Note: A sufficient quantity of reclamation cover materials has been identified as available for salvage. After field identification and marking, reclamation materials would be recovered and the stockpiles constructed using standard earth-moving equipment such as scrapers, excavators, loaders, trucks, and track dozers.

Three separate reclamation stockpiles are planned, and a general location for each has been identified on the site plans. Specifics regarding the location and footprint of each stockpile would be finalized to address conflicts with requirements identified by other studies (cultural resources, facility access and location plans, etc.). Studies of existing soils and growth media at Copper Flat show that material characteristics are fairly consistent to depths and across areas considered for salvage. Segregating materials by soil type or horizon is not planned. The combined storage volume of the three reclamation stockpiles is sufficient to meet future needs for cover and growth media, as shown in the following table. (See Table 2-6.)

Table 2-6. Reclamation Stockpile Storage Capacity

Table 2-6. Reclamation Stockpile Storage Capacity	
Stockpile ID	**Stockpile Capacity (yd^3)**
GM-01	510,000
GM-02	2,100, 000
GM-03	1,900,000
Total	**4,510,000**

Source: NMCC 2017a.

If additional storage capacity becomes necessary, other areas suitable for storing reclamation materials are available within proposed facility footprints and inside the mine area. During construction, the stockpiles would be built, shaped, and maintained in a manner that limits material loss due to wind erosion and equipment impacts. After shaping, the surface of the stockpiles would be seeded with an agency-approved seed mix to provide a plant cover to protect material loss from wind erosion and provide a source of organic material.

During construction, vehicle access onto the stockpiles would be limited to those vehicles and equipment needed for placement, shaping, and seeding. After the stockpiles are established, vehicle and equipment access onto the stockpiles would be prohibited except for stockpile maintenance or emergency purposes. Signs to identify the nature of the stockpile and provide notice of no access would be located around the perimeter of each stockpile. The stockpiles would be inspected for indications of vehicle access, water or wind damage, or damaged/fallen signs, and prompt action would be taken to address any issues identified.

2.1.5 Project Workforce and Schedule

The construction phase of the project is expected to take approximately 2 years. During this time, the workforce for development of the Copper Flat mine would average about 120 to 130 persons per day. The estimated operational life required to recover the proven minerals (copper, molybdenum, gold, and silver) is 16 years. Approximately 80 to 100 people would be employed in the office and mine; 40 to 70 people would be employed in the mill. The reclamation workforce would consist of up to 20 employees.

Southwestern New Mexico and Sierra County have a history of mining and agriculture, and NMCC would provide employment opportunities to individuals living in the immediate area of the mine. It is likely that personnel from outside the local area would be required to meet the full staffing needs of the mine; however, the southwestern U.S. provides a large base of experienced personnel to complete the employee roster (NMCC 2014a). The mine would operate 24 hours per day, 7 days per week, and 365 days per year. The mill would operate on that same schedule. Administrative personnel would work a standard day shift, 5 days per week, 50 weeks per year. Labor requirements for the mine are displayed in Table 2-7.

Table 2-7. Mine Personnel Requirements - Year One

Table 2-7. Mine Personnel Requirements - Year One	
Work Type	**Number of Employees**
Mine salary	10
Mine operators	52
Mobile maintenance	26
Mine tech services	4
Process salary	8
Process operators	30
Process maintenance, electricians, etc.	17
Process tech services	6
Administration	17
Total mine workforce	**170**

Source: NMCC 2014a.

All work types would be constant over the life of mine with the exception of mobile equipment operators and mobile maintenance. These two groups would grow over the first third of the mine life as the pit gets larger (primarily adding haul truck operators and associated mechanics). The total workforce would peak at about 180 employees in or around year 5 of operation. From years 5 through the end of mine life, the workforce needs would fall to levels lower than year 1 due to the decrease in the required stripping ratio, which would decrease mobile equipment operators and mobile maintenance needs. Around 150 to 160 personnel would be employed by the end of mine life (NMCC 2014a).

2.1.6 Electrical Power

Power for the project would be furnished by Sierra Electric Cooperative by means of an existing 115-kilovolt (kV) transmission line that runs from the Caballo switching station near the junction of Interstate 25 (I-25) and NM-152. The transmission line terminates within 300 feet of the mill facility at the site of the proposed mine substation.

The 115-kV line was a dedicated line to Copper Flat installed for the 1982 mine to avoid interfering with power supply to the community of Hillsboro and the surrounding rural areas. The existing 115-kV line is a wooden pole, H-frame structure and would be in full accordance with State and Federal electric codes. Tri-State Generation and Transmission owns the line and is responsible for maintenance (ROW Grant #NMNM 32038). The mine substation would be reconstructed in the same location as in 1982 and would be fenced and constructed in accordance with BLM stipulations. NMCC would own the substation equipment and would be responsible for construction and maintenance. From the substation, the voltage would be stepped down by primary transformers and distributed throughout the mine.

An existing 25-kV distribution line provides power to the production wells located east of the mine, pump stations on the fresh water pipeline, and the reclaim water pump stations at the tailings dam. Sierra Electric Cooperative owns this line and is responsible for maintenance. The plant electrical load requirement is tabulated in Table 2-8.

Table 2-8. Summary of Average Project Electrical Demand

Table 2-8. Summary of Average Project Electrical Demand	
Activity	**Demand (kWh/ton)**
Primary crushing	0.25
Total grinding	17.48
Total copper flotation	1.74
Molybdenum flotation	0.27
Thickening	0.05
Reagent handling	0.05
Water system	2.05
Ancillary facilities	0.65
Total	**22.54**

Source: THEMAC 2011

An emergency generator would be provided as backup power in the event of power loss to maintain critical systems and to aid in a controlled shut down. On-site power distribution would include one 25-kV distribution line. Because of the configuration and size of these distribution lines, standard raptor-proof protective designs would be incorporated into the line design and line upgrade, as presented in the Rural Electrification Administration guidelines. This design would be used for the entire length of the distribution line within the mine area. NMCC is analyzing the viability of solar power generation to partially offset the mine's energy demand along with other energy and water conservation measures.

2.1.7 Water Supply

Water is essential to mining. It is used for ore processing, dust control, and other important activities. Water is a limited resource in New Mexico, and the Copper Flat mine would implement best management practices (BMPs) to conserve this valuable resource. BMPs would include monitoring water use, providing for water conservation, and water recycling.

The water supply for the Copper Flat mine would be composed of two distinct types of water classifications:

1. Process water: Process water would be collected on-site as part of ongoing operations and that would be reused within the operation. This includes water recycled from the TSF, stormwater catchment ponds, pit dewatering operations, and water contained within the copper ore rock as moisture. Seventy-two percent of the water supply for the Copper Flat mine would be process water.
2. Fresh water: Fresh water would be pumped to the site from off-site groundwater wells. Fresh water would be necessary to supplement process water in order to meet total water use requirements. NMCC would employ water conservation measures during the design and through the entire life of the mine. These measures would come from a combination of water recycling or reuse activities as well as activities that would decrease the need or use of water in order to minimize the amount of fresh water pumped to the site. Twenty-eight percent of the water supply for the Copper Flat mine would be fresh water.

2.1.7.1 Water Use

Total water use for the Copper Flat mine, including all recycled water, would be approximately 13,370 AF on a yearly average basis. Total water use is presented in Table 2-9.

Table 2-9. Total Water Use

Table 2-9. Total Water Use	
Average annual water use during ore processing (AF)	13,370*
Average water used to process 1 ton of material (gallons)	682*
Total water use during operations – life of mine (AF)	212,000*

Source: NMCC 2018c.

Note: * Includes recycled water.

Ninety-three percent of total water use would be used for processing copper ore, the direct beneficiation of minerals recovered by the operation through the improvement of physical or chemical properties of the minerals to prepare for smelting and refining. The other 7 percent of water use would be for dust control, maintenance, laboratory, and sanitary use. Average annual water use by process is presented in Table 2-10, and the discussion of each water use follows.

Table 2-10. Water Use by Process

Table 2-10. Water Use by Process				
Water Use	**Acre-Feet per Year**			**Percent of Total**
	Recycled	**Non-recycled**	**Total**	
Ore processing:				
Reclaimable TSF water	9,096	0	9,096	68%
Water retained in tailings	0	2,650	2,650	20%
Evaporation	0	643	643	5%
Concentrates	0	13	13	<1%
Subtotal	**9,096**	**3,306**	**12,402**	**93%**
Dust control	0	726	726	5%
Other	0	242	242	2%
Total use	**9,096**	**4,274**	**13,370**	**100%**

Source: NMCC 2018c.

Reclaimable TSF water: A portion of the water contained in the tailings that are deposited in the TSF could be reclaimed. This portion of water, referred to as reclaimable TSF water, would be reclaimed at the TSF through a designed water collection system for reuse. Other portions of the water contained in the tailings would not be reclaimable due to being entrained within the tailings or lost due to evaporation. As shown in Table 2-10, reclaimable TSF water would be the single largest use of water at the operation.

Water retained in tailings: A percentage of the water deposited in the TSF would be retained within the tailings. Entrainment of this water within the tailings would prevent it from being reclaimed by the TSF collection systems in a timely manner.

- **Evaporation:** Some water used within the ore processing circuit would be lost due to evaporation. The majority of evaporation would occur at the supernatant pond located within the TSF, but additional evaporation losses would occur throughout the process.
- **Concentrates:** Copper concentrate produced at the site would be dewatered through a filtering process prior to shipment. However, some moisture would be retained and shipped off-site with the concentrates.
- **Dust control:** Water would be used within the mine for dust control on roads and other traffic areas.
- **Other:** The “other” category is the summation of small amounts of water that would be used throughout the site (mine operations and maintenance activities, laboratory use, sanitary use, and contingency).

The washing facility for the mobile equipment would be equipped with a water/oil separator system. Gray water from the equipment wash facility would be reused for washing equipment or recycled for use in the ore processing stream. Sediment from the equipment wash facility would be taken to the TSF for disposal.

2.1.7.2 Water Sources

Table 2-11 and Figure 2-7 below summarize the sources and amounts of water that would be used at the Copper Flat mine.

Table 2-11. Water Sources

Table 2-11. Water Sources				
Water Source	Acre-Feet per Year			Percent of Total
	Recycled	Non-recycled	Total	
Process water:				
Water reclaimed from TSF	9,096	0	9,096	68
Stormwater	304	0	304	2
Moisture in the ore	129	0	129	1
Pit dewatering	39	0	39	>1
Subtotal	**9,568**	**0**	**9,568**	**72**
Fresh water for mine operation (groundwater wells)	0	3,802	3,802	28
Total use	**9,568**	**3,802**	**13,370**	**100**

Source: NMCC 2018c.

Note: Columns may not sum exactly due to rounding.

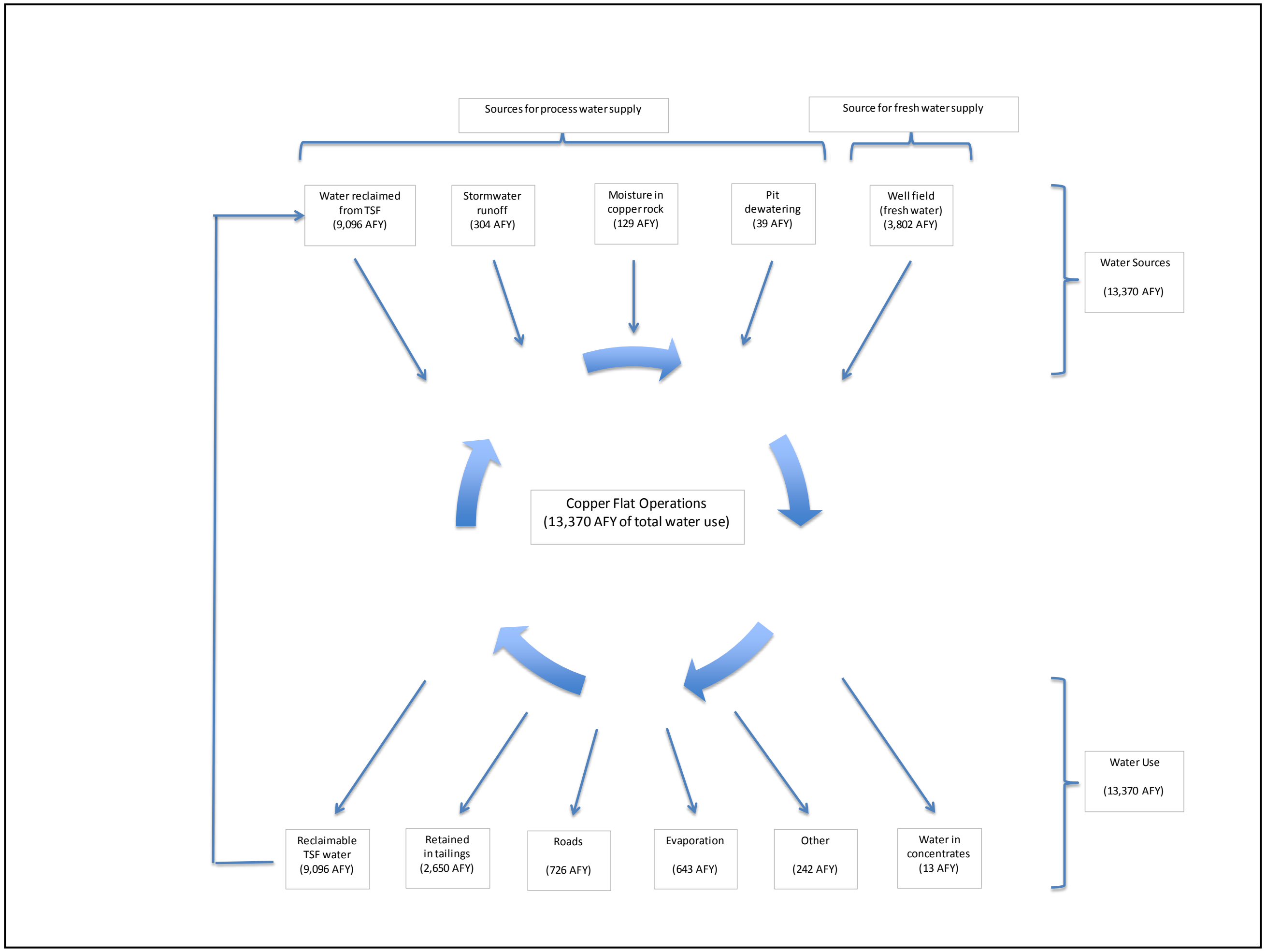
Process water sources: The majority of the 13,370 AFY of water that would be used at Copper Flat would be process water sourced on-site. These process water sources would provide for 9,568 AFY (72 percent) of the total water use by the Copper Flat operation. Process water sources would include:

- Water reclaimed from the TSF and recycled;
- Water collected from stormwater catchment ponds and reused within the operation;
- Water collected by the pit dewatering operation and reused; and
- Water contained within the ore rock as moisture and mined in conjunction with the mining of copper ore.

Stormwater that would come in contact with disturbed mine and plant site areas would be collected in catchment ponds and recycled into the process water system. The use and ongoing maintenance of diversion ditches, dams, and berms would limit the amount of stormwater that would come in contact with disturbed areas and collected in catchment ponds.

The use of pit water would be for dust control only, would require a groundwater DP from the NMED, and would be subject to the applicable New Mexico groundwater standards in 20.6.2.3103 NMAC. Pit dewatering activities would be managed according to a mine operation and water management plan approved by the NMED. The mine operation and water management plan is a component of the NMED Groundwater Discharge Permit Application (NMCC 2014a).

Figure 2-7. Copper Flat Water Sources and Water Use



Source: THEMAC 2015.

Fresh water source: The BLM may authorize this mine project; any operations are premised on the acquisition of necessary water rights under the authority of the OSE for the life of the mine plan. Four groundwater production wells would be sourced for fresh water. (See Figure 2-6). They are located approximately 8 miles east of the proposed mine site and south of NM-152 on BLM land. These wells (PW-1, PW-2, PW-3, and PW-4) were drilled by Quintana. Production wells 1, 2, and 3 were drilled in 1975-1976 and PW-4 was drilled in 1980. All four wells have 16-inch-diameter steel casing and vary in depth from 957 to 1,005 feet below ground surface. The wells were tested after completion to establish individual well capacities and were the main source of water for the Quintana operation in 1982. All four production wells have remained intact and locked shut since the end of the Quintana operation, and there have been no subsequent events that would compromise the quality of the water in these wells. In 2012, NMCC conducted well maintenance on PW-1 and PW-3, installed pumps in those wells to test their capacity, and conducted a localized aquifer test. The water quality in the production wells meets groundwater standards in the State of New Mexico.

Water pumped from the production wells would be conveyed through a 10-inch steel pipe to a pump station located on millsite claims between PW-1 and PW-3. From this pump station, water would be conveyed in the existing 20-inch underground pipeline to a second pump station located within the mine and plant site area. The existing 20-inch welded steel pipeline is associated with ROW Grant #NMNM 125293, and the pipeline is buried a minimum of 2 feet deep from the well field to the point of entry to the permit area. From the second pump station, water would be conveyed via pipeline for use.
Fresh water would provide for 3,802 AFY (28 percent) of the total water use for the Copper Flat operation.

2.1.7.3 Water Conservation

NMCC would employ water conservation measures at the Copper Flat mine during the design phase and through the entire life of the mine. Efforts to conserve water would come from a combination of water recycling or reuse activities as well as activities that would decrease the need for or use of water. Conservation measures involving water recycling or water reuse are discussed further in Section 2.1.7.4, Water Recycling. Water conservation measures that would be taken to decrease the need or use of water are discussed in Section 2.1.7.5, Decreasing Water Demand.

2.1.7.4 Water Recycling

Water available for recycling would consist of water collected on-site as part of ongoing operations and reused within the operation. Approximately 72 percent of the water supply for the Copper Flat mine operation would be recycled water. The largest source of water for recycling is process water reclaimed from the TSF. Recycling water from the TSF is the largest single water conservation activity that would be employed at Copper Flat. The majority of the water use at the mine would be for ore processing, and the majority of the ore processing water would be recycled. Process water would be recovered from the TSF and returned to the ore processing circuits to offset fresh water needs. Processing ore at the mine would require approximately 682 gallons of water per ton of ore processed, an amount that is typical of copper flotation circuits. Of this amount, approximately 488 gallons is supplied through recycling water from the TSF.

Other sources of recycled water at Copper Flat would include:

- Stormwater harvesting;
- Pit dewatering;
- Returning gray water to the process stream; and
- Concentrate dewatering.

2.1.7.5 Decreasing Water Demand

Methods that would be employed on an adaptive management basis to reduce water loss or decrease water demand at Copper Flat include:

- Managing the TSF to limit the size of the supernatant pond;
- Limiting driving surfaces;
- Limiting surface disturbance;
- Interim reclamation;
- Minimizing open launders and ditches;
- Improved control of water truck sprays;
- Covering solutions storage tanks;
- Water efficient fixtures; and
- Spill and leak prevention.

Additional discussion and information regarding the primary water conservation actions that would be implemented at the mine is provided below.

- **Manage TSF supernatant pond:** The size of the supernatant pond at the TSF would be managed and controlled to reduce evaporative water losses.
- **Stormwater recycling:** The mine area and TSF would be graded to limit stormwater run-on from reaching impacted areas. Impacted areas would be graded to capture the stormwater that came in contact with impacted areas, and this water would be contained in catchment ponds and recycled for use. Site plans have been prepared and evaluated using regional precipitation and runoff calculations; stormwater recycling would provide approximately 304 AFY of process water.
- **Pit dewatering:** The existing pit lake contains approximately 20 to 28 million gallons (61 to 86 AF) of water (NMCC 2014a). During operation, NMCC estimates that groundwater would continue to seep into the pit at an annual average rate of 24 gpm (39 AFY). Pumping of the pit lake would be necessary prior to mining and continuously throughout the life of the mine. Minor drilling work in 1976 indicated that groundwater in the pit area is localized in the larger fractures. As a result of seasonal precipitation, the pit water level has fluctuated by 1 to 5 feet per year. The water inflow into the pit would be used for dust suppression on the roads. If necessary, pit water could be temporarily stored in a tank or reservoir in the area of the pit. Water removal from the pit would continue over the operational life of the mine through a sump or series of sumps located within the pit. Water removal would end once mining is completed.
- **Concentrate dewatering:** After production, the final concentrate product would be dewatered by filtering prior to shipment, and the reclaim water would be returned to the process circuit for reuse. In the proposed mine design, the concentrate filters would recover approximately 83 percent of the water content of concentrates entering the concentrate filter plant.
- **Gray water reuse:** Gray water from the equipment wash facility would be reused for washing equipment or recycled for use in the ore processing stream.
- **Surface treatment of roads:** Permanent haul roads and secondary access roads would be conditioned with an approved soil stabilizer product to bind fines and reduce water requirements for dust control. Field experience shows that water requirements for dust control can be significantly reduced through proper application and management.
- **Minimizing disturbed areas:** Construction of new haul roads, secondary access roads, and other graded areas would be limited, and where feasible, existing roads and graded areas would be closed off to traffic to reduce water required for dust control.

- **Interim reclamation:** Growth media stockpiles and disturbed areas no longer required for the operation would be graded and revegetated to reduce water requirements for dust control.
- **Minimizing open launders and ditches:** Open launders and ditches would be limited to reduce water loss to evaporation.
- **Covering solution tanks:** Fresh water tanks and, where possible, process solution tanks would be covered to reduce water loss to evaporation.
- **Water efficient fixtures:** The operation would specify water efficient fixtures in facilities to reduce water demand.
- **Water management system:** Water meters, flow control devices, and tracking logs would be employed on fresh and process water circuits. Logs would be monitored and analyzed on a regular basis to identify potential water losses and prompt action would be taken to address issues when identified. In the event of water losses (i.e., a leak in the system), the response would be to find and repair the leak and clean up spills as necessary.
- **Water truck auto spray control:** Mine water trucks would incorporate digital spray control to limit overspray and overwatering conditions. Though digital spray control systems are a new application for the industry, empirical data indicates a potential 25 percent improvement over non-controlled systems.

2.1.8 Growth Media

Available growth media would be salvaged and stored in stockpiles for reclamation. Growth media would consist of soils stripped prior to surface disturbance activities and containing some organic matter. Growth media remaining in a stockpile for one or more planting seasons would be shaped for erosion control and seeded with an interim seed mix to stabilize the material, reduce establishment of undesirable weeds and noxious weeds, and assist with control of blowing dust.

2.1.9 Borrow Areas

Borrow sources would be required for prepared sub-grade materials, drainage materials, pipe bedding materials, road surfacing materials, retarding layer materials, reclamation materials, growth materials, and riprap. Construction-related borrow areas would be located within facility footprints.

Borrow area locations would depend on construction requirements and material conditions as well as locations of cultural resources sites that must be avoided. NMCC would source borrow materials from the TSF area. Other areas within the areas disturbed by construction and mining activities would be used as needed, including the pit area and the waste rock and low-grade ore stockpile areas. Borrow areas would be kept free of steep walls and would be sloped and stabilized to allow for safe wildlife entry and exit and to prevent erosion (NMCC 2015a).

With regard to reclamation cover, no areas unaffected by construction and mining activities are currently proposed to be disturbed in order to obtain these cover materials. Several borrow areas within the limits of the TSF would be the main source of the reclamation cover. Mine haul trucks and front-end loaders would be used to excavate the required materials during the construction period and stockpile it in designated locations. These locations were chosen to reduce haul distances and to limit erosion. The stockpiles would be constructed with 3H.0:1V slopes.

2.1.10 Inter-Facility Disturbance

As with most mining facilities, general ground disturbance occurs around and between structures and facilities as a result of construction, operation, and maintenance. This inter-facility disturbance would be in addition to the formal footprint created by design. NMCC has included disturbance buffer zones surrounding specific facilities (i.e., TSF, waste rock disposal areas, open pit area, etc.) for the purpose of calculating the surface area for disturbance in order to ensure that the full extent of disturbance associated with these facilities is accounted for and that appropriate reclamation and bonding of these areas can be facilitated.

2.1.11 Fencing and Exclusionary Devices

NMCC would construct BLM-approved barbed wire fencing to prevent livestock from entering the WRDFs and TSF. Wildlife exclusion fences would be constructed around the pit and other water and solution ponds to keep out wildlife such as deer, antelope, and smaller animals. This fencing would meet New Mexico Department of Game and Fish (NMDGF) standards for wildlife exclusion fencing that require an 8-ft high fence, chain link or welded wire material. The bottom portion of the eight-foot chain link fence should be finer meshed and wrapped in a durable and corrosion-resistant material that would exclude small mammals and other terrestrial species. This portion of fencing should extend from ground level to a height of at least three feet. Additionally, the bottom of the fence should be buried to prevent animals from digging underneath. In areas where a higher level of security or safety is needed, such as the mine substation, chain-link fences would be erected. Gates or cattle guards would be installed along roadways within the proposed mine area as appropriate.

NMCC would monitor the fences on a regular basis and repairs would be made by NMCC as needed. In the event that livestock manage to enter the proposed mine area via a gate or opening in a fence, the grazing permittee would be contacted immediately. NMCC would assist as requested in moving these animals out of the proposed mine area. The fencing and exclusionary devices would be sufficiently maintained to achieve their intended purpose throughout the project, including the reclamation stage.

The use of avian exclusion devices would be employed as needed to prevent deleterious exposure of birds to toxic chemicals or conditions used or created by mining and mineral processing operations.

2.1.12 Haul Roads and On-Site Service Roads

Haul roads would be constructed and utilized to haul material to the crusher, stockpiles, and waste rock disposal areas and to access the truck shop area and equipment parking areas. Some minor realignment of these roads may be necessary, and road widths would vary. The on-site roads would be constructed and utilized for easy access and traffic movement within the mine area.

During operation of the Copper Flat project, water trucks would be used as needed to control emissions of fugitive dust from the haul roads as well as other roads within the mine area. Wetting agents and binding agents, such as magnesium chloride, would also be used to control dust as a water conservation measure.

2.1.13 Transportation

Access to and from the site is by three miles of all-weather gravel road and ten miles of paved highway (NM-152) east to I-25, near Caballo Reservoir. The ten miles on NM-152 to I-25 is mainly a straight and relatively flat road that does not include any sharp turns or significantly adverse grades. I-25 is a primary north-south highway. Traffic associated with reestablishment of the Copper Flat project would be broadly grouped as follows:

- **Concentrate shipments:** After production, shipment of concentrate and other products would be trucked off-site. Copper concentrate would be hauled by 25-ton capacity highway trucks towing 10-ton trailers to I-25 and then to a nearby railhead in southern New Mexico. It would then be transported by rail to a smelter in North America or to port facilities for shipping to Asia or Europe. Molybdenum concentrate and any other mineral would be filtered, dried, and packaged on-site and then transported to an off-site refinery by truck. The proposed schedule for concentrate shipments is:
- Copper concentrate shipment schedule (hauling weekdays only) would be:
  - Years 1–5: ship 10 to 14 truckloads per day, 4 days per week; and
  - Years 6 +: ship 6 to 10 truckloads per day, 4 days per week.
- Molybdenum concentrate shipment schedule (hauling weekdays only) would be:
  - Life of mine: ship two truckloads per month (NMCC 2014a).
- **Incoming supplies:** Vendors, equipment, and service suppliers are anticipated to take an average of 10 to 15 trips per day by truck, in total, to the mine. Except for emergencies, deliveries to the mine would be scheduled to occur during the day shift on Monday to Friday. Title 49 CFR regulates the transportation of hazardous materials in commerce. Anyone who transports, packages, loads, unloads, or in any way assumes responsibility for marking, labeling, or handling of any regulated hazardous materials must comply with 49 CFR. In addition, carriers must comply with the Federal Motor Carrier Safety Regulations of the Department of Transportation (DOT) (parts 383, 390, 397, and 399). Hazardous materials required for operation of the Copper Flat project include gasoline, diesel fuel, propane, other petroleum products, explosives, solvents for degreasing of machinery and equipment, and laboratory chemicals. These materials would be purchased from various vendors and brought to the site by truck. NMCC would ensure that the Hillsboro volunteer fire department and the Sierra County fire district are aware of the nature of the materials routinely being transported to the site, and that they have appropriate response training in the event of a spill or other accident involving hazardous materials.
- **Employees and visitors:** The majority of employees are expected to commute from the local area. It is anticipated that the majority of employees would carpool in groups ranging from two to five individuals per vehicle trip. Applying an average of three employees per carpool, and accounting for the planned rotation schedules, the operation would expect 40 to 45 vehicle trips for employees on day shifts Monday to Friday, 25 to 30 vehicle trips on weekend days/nights, and night shift seven days per week for a total of 65 to 75 employee vehicle trips per day. An additional 15 to 20 trips per day would be expected by visitors and sales representatives. NMCC would encourage employee car and van pools. At present, there are no plans for a company-operated employee transportation system, or for rail or air access to mine facilities or operations.

2.1.14 Exploration Activities

NMCC conducted exploration activities in 2010, 2011, and 2012 to identify new reserves and expand existing reserves within the plan area. All NMCC exploration activities were completed under appropriate approvals from Federal and State agencies. Exploration and mineral evaluations were focused within and on previously disturbed Federally-administered land and privately-owned patented lands. Exploration disturbance generally included the construction of access roads, drill pads, sumps, trenches, surface sampling, bulk sampling, and staging areas. Exploration methods included both reverse circulation and core drilling, with minor trenching also conducted.

Additional future exploration activities are planned; however, exact locations of the exploration disturbance have not been determined. Future exploration activities would be composed of approximately

15,000 linear feet of drill road (average width of 20 feet), approximately 100 drill pads (average dimensions of 100 feet by 100 feet), and approximately 150 drill holes (average diameter of 5 inches; average depth of 1,200 feet below ground surface). The BLM would require future exploration activities to be handled on a case-by-case basis.

In addition to exploration activities, and once mining activities commence at Copper Flat, ongoing development drilling would be required to support the operation. Development drilling would be necessary to supply data and access in the support of mine planning, reserve estimation, ore control, and pit-slope monitoring functions. Development drilling could also become necessary for pit-slope dewatering if it becomes necessary to dewater the pit slopes for stability purposes as the pit deepens. Development drilling would be conducted within the pit as well as areas adjacent to the pit perimeter. Disturbance created by development drilling activities would be within the life-of-mine pit disturbance area.

2.1.15 Reclamation and Closure

The Copper Flat mine area would be reclaimed to achieve a self-sustaining ecosystem appropriate for the climate, environment, and land uses of the area. The objective of the reclamation plan is, at a minimum, to return the mine area to conditions similar to those present before reestablishment of the mine. The project is designed to meet, without perpetual care, all applicable Federal and State environmental requirements following closure.

2.1.15.1 Statutory and Regulatory Requirements

Reclamation of disturbed areas caused by the project would comply with Federal and State regulations. Under FLPMA, the BLM is responsible for preventing undue or unnecessary degradation of Federally-administered public land, which may result from operations authorized by the mining laws (43 CFR 3809). The New Mexico Mining Act requires the preparation of a reclamation plan for submittal and approval by the New Mexico Energy, Mineral, and Natural Resources Division (NMEMNRD), MMD, and the NMED. In addition, closure of the tailings embankment must also comply with requirements of the OSE. Reclamation activities would be carried out concurrent with mine operations wherever possible, and final closure and reclamation measures would be implemented at the time of mine closure.

2.1.15.2 Post-Mining Land Use

Major land uses occurring in the vicinity of the mine area are mining, grazing, wildlife habitat, and recreation. Following closure, the mine area would continue to support mineral development, grazing, wildlife habitat, and recreation. Following closure, the pit would partially fill with water from subsurface groundwater flow and surface water runoff resulting in a permanent pit water body.

2.1.15.3 Summary of Disturbance

Reconstruction would involve utilization of existing foundations and previously disturbed land where feasible. For the Proposed Action, approximately 57 percent of the proposed disturbance would take place on areas disturbed during the previous operations. New disturbance of previously undisturbed land would be kept to a minimum. Approximately 43 percent of the new disturbance would be related to the tailings and waste rock facilities.

Areas to be disturbed are divided into the following major mine components: TSF, open pit area, WRDFs, stockpiles, process facilities, stormwater diversions, structures, roads, and exploration. The utility corridor, access road, and surface water diversions were developed during the previous operations, and no further disturbance associated with these facilities is anticipated. The majority of the haul roads were also developed during previous operations, and only minor additional disturbance would be related to haul road construction.

2.1.15.4 Reclamation Objectives

The objective of mine reclamation is to restore disturbed areas to a self-sustaining ecosystem consistent with applicable regulations, post-mining land use, and mine reclamation standards. Specific objectives of the Copper Flat reclamation plan are to:

- Meet or exceed applicable State and Federal reclamation requirements through application of most appropriate technologies and BMPs.
- Prevent erosion and limit contribution of suspended solids to streams and other bodies of water through employment of BMPs and contemporaneous reclamation. Contemporaneous reclamation would be conducted on disturbed areas not to be re-disturbed by future mining operations.
- Protect human health and safety, the environment, wildlife and domestic animals, cultural resources, hydrologic balance, and extant riparian and wetland areas, including through reclamation of any streams that may be impacted by the mining operations.
- Protect the quality of surface and groundwater resources by minimizing pollutant formation and on-site containment of any unavoidable toxicity.
- Preserve suitable topsoil and other approved topdressing material for use in reclamation by employing appropriate technologies and BMPs for sampling, testing, replacement, and stabilization.
- Establish surface soil conditions most conducive to regeneration of a stable plant community through stockpiling, and reapplication of alluvial or soil material where feasible.
- Revegetate and stabilize disturbed areas with a diverse mixture of appropriate plant species in order to achieve a self-sustaining ecosystem.
- Maintain public safety and site stability through appropriate recontouring and revegetation of disturbed areas within the mine area.

After completion of mining and processing, surface facilities, equipment, and buildings related to the mining project would be removed, foundations broken and removed from public land, and the plant site returned to conditions similar to those present before reestablishment of the mine. The topography, slopes, and aspects of the disturbed and reclaimed areas would conform to the present, existing physiographic forms of the Copper Flat area.

2.1.15.5 Implementation

Contemporaneous reclamation would be conducted on disturbed areas not to be re-disturbed by future mining operations. Both public and private land would be reclaimed. Upon completion of mining activities, the site would be restored in accordance with the restoration and reclamation plan. The reclamation and restoration must be demonstrated to be sustainable without perpetual care. Closure of the site would be accomplished by the following activities:

- **Pre-construction and permitting:** In this stage, baseline data are collected to characterize the existing environment.
- **Construction:** Where feasible, the existing soils and suitable alluvial material would be removed first from major disturbance areas (TSF, waste rock disposal areas, etc.), then stockpiled, protected, and used in the reclamation and restoration process. The revegetation test program would be initiated during this phase of the operation.

- **Operations:** Reclamation and restoration efforts would be implemented at the earliest feasible time in areas where activities are discontinued. This includes recontouring; scarifying; placement of soil, alluvial material, and other approved topdressing material; and revegetation. The revegetation test program and concurrent reclamation would be monitored during this phase to provide data that would be utilized to determine final closure methods to be implemented to achieve reclamation and restoration goals and pre-determined plans, subject to regulatory approval.
- **Closure:** Upon closure of the mining operations, facilities would be reclaimed according to the reclamation plan.
- **Post-closure monitoring:** Following the completion of reclamation and closure activities, revegetation would be monitored for at least two growing seasons and would meet Part 6 requirements under the New Mexico Mining Act. Groundwater would be monitored according to conditions set forth in the groundwater DP, which was prepared by NMCC for submission to the NMED and is currently undergoing technical review.

2.1.15.6 Environmental Considerations for Reclamation

Signs, markers, and safeguarding: Measures such as signs, markers, fences, and barricades would be used to protect the public, wildlife, and domestic animals from potentially dangerous areas associated with the project.

Wildlife and domestic animal protection: Reclamation of the Copper Flat project would be conducted to achieve a stable configuration, and access to the site would be restricted for protection of the public and animals. The project would result in the reclamation of over 910 acres of land disturbed by previous mining activities.

Cultural resources: Cultural resources requiring protection and any cemeteries or burial grounds would be protected or avoided during reclamation activities. This includes any resources identified before or during project activities.

Hydrologic balance: Several provisions are in place including recycling, runoff diversion, and control of infiltration that would optimize the use and quality of water resources in the mine area. Additional details on these provisions are described below:

- **Acid rock drainage (ARD):** Partially oxidized transitional waste rock would be managed and reclaimed to alleviate potential ARD. The transitional waste rock may be segregated and placed in the west and north waste rock disposal areas. The exact method of disposal and possible segregation would be determined though the current geochemical testing program and the development of a material handling plan. This plan would be developed and in place prior to the reclamation of the mine. To minimize oxidation post-closure, waste rock would be placed in an engineered WRDF (NMCC 2014a). The WRDFs would be contoured to enhance runoff; covered to reduce infiltration; and reclaimed by regrading. This would be done with a dozer to compact the surface and cover this surface with up to 36 inches of growth media or topsoil (or as may be allowable under State statutes). The WRDFs containing transitional material would be located adjacent to the pit.
- **Plant site discharges:** The plant site surface drainage was originally designed to contain or control a 24-hour precipitation event of 2.6 inches with a maximum 1-hour intensity of 2.0 inches. These calculations would be verified during the engineering design phase of the project in accordance with current regulatory requirements and design criteria. Surface runoff from the area around the administration/mine office, concentrator, assay building, reagent storage, and tailings thickener would be controlled by surface grading and directed to a containment pond. Water from the containment pond would be used for mineral processing make-up water or dust control at the site (NMCC 2014a).

- **Suspended solids:** Sediment control would be achieved using BMPs including regrading, seeding and mulching, silt fences, straw bale dams, diversion ditches with energy dissipaters, and rock check dams at appropriate locations during construction and operation. Diversion structures, including existing structures, would divert run-on away from disturbed areas. All sediment control structures would be monitored and maintained on a regular basis. During operations, all runoff from the plant site would be directed into a sediment pond located on the east side of the site adjacent to the make-up water pond. Following reclamation, all ponds would be regraded to prevent holding water, surfaces covered with growth media, and vegetated.
- **Diversions and overland flow:** The surface drainage of the mine area was designed to contain or control the 100-year/24-hour storm event. During reclamation, most areas would be regraded and, where possible, the original drainages restored. The diversion of surface water runoff around the waste rock disposal areas would remain in place. Ditches would be lined with riprap as needed to protect the channels from erosion.
- **Stream diversions:** The watershed area to the west of the pit is drained by Greyback Arroyo, an ephemeral stream that is dry over most of its length except during the rainy season. Greyback Arroyo used to pass through the pit area. This drainage has been intercepted, diverted around the southern periphery of the pit, and returned to the original channel east of the pit area. This was accomplished by cutting a channel through the ridges and placing diversion dams in the tributary arroyos. Following closure of the previous operation, the diversion was left in place. The diversion would be left in place following closure of the proposed operation.
- **TSFs:** The TSF would be designed, constructed, and maintained to prevent adverse impacts to the hydrologic balance and adjoining property, and to assure the safety of the public and wildlife.
- **Prevention of mass movement:** All slopes, TSF embankments, and WRDFs would be designed, constructed, and maintained to prevent mass movement during operations and following closure.
- **Riparian areas:** The riparian areas south and east of the proposed plant area are in the existing Greyback Arroyo channel. The Proposed Action does not change the flow of water through the diversion channel and Greyback Arroyo.
- **Roads:** Access to the site is via an existing county road (Gold Dust Road/County Road 27), which would remain following closure. Prior to final closure, the State of New Mexico and the BLM would determine which other roads would be left intact around the site in order to conduct post-closure monitoring or provide adjacent landowner access. All other NMCC mine-related roads would be reclaimed.
- **Surface facilities or roads not subject to reclamation:** A number of pre-1981 primitive roads exist within the proposed mine area. Some of these roads would not be utilized during the currently proposed operation and, therefore, are not subject to reclamation by NMCC.
- **Drill hole plugging and water well abandonment:** Mineral exploration and development drill holes, monitoring, and production wells subject to State regulations would be abandoned in accordance with applicable rules and regulations (NMAC 19.27.4 et seq.). Borings or wells that penetrate a water-bearing stratum would be plugged under the terms of an NMAC 19.27.4 OSE-approved Well Plugging Plan of Operations, which typically calls for the placement of a column of sealant from maximum depth to ground surface to prevent cross contamination between aquifers and to prevent contamination by surface access. Monitoring wells around the TSF would be maintained until NMCC is released from this requirement by the NMED, MMD, and the BLM. These wells would then be plugged and abandoned according to applicable requirements.

2.1.15.7 Post-Closure Monitoring

Monitoring would be ongoing throughout the life of the operation, during closure, and for a post-closure period. The post-closure monitoring period includes final abandonment of monitoring wells (ROW Grant #NMNM 125870) and reclamation of access roads needed for monitoring (NMCC 2014a). The BLM and State agencies would set post-closure monitoring requirements at mine closure. Sampling of the water in the pit after mine closure would continue for a period that is established by consultation with the NMED to determine any changes in pit water quality. The tailings dam/pond would be regulated by the OSE for safety of operations. A DP that requires monitoring for seepage into the groundwater would be needed from the NMED Ground Water Quality Bureau. Following closure, water samples from monitoring wells located downstream of the tailings dam and in the plant and pit area would be taken and analyzed on a regular basis and the results sent to the Ground Water Quality Bureau in accordance with monitoring requirements set forth in the DP. These samples would identify any seepage from the tailings pond or other mine units at the facility that have the potential to impact groundwater quality. The DP would contain contingency requirements that would address groundwater exceedances resulting from leakage from the tailings dam and, if necessary, require an abatement plan to address groundwater exceedances.

2.1.15.8 Site Stabilization and Configuration

The mine area would be stabilized, to the extent practicable, to prevent future impact to the environment and protect air and water resources. All facilities, slopes, embankments, and roads would be designed, constructed, maintained, and reclaimed to achieve stable configurations. The topography, slopes, and aspects of the disturbed areas would be developed to blend in with the surrounding topography as much as practicable. All drainage channels, ditches, and earthen water control structures would be revegetated to the extent practicable. Additionally, riprap, sediment traps, or other types of BMPs would be utilized as needed to prevent erosion. Alluvial materials suitable for surface treatment would be salvaged from disturbed areas where safe and feasible operation of earthmoving equipment is possible and would be stockpiled and protected for use in reclamation.

2.1.15.9 Plant Growth Media and Cover Materials

Removal and storage: Suitable soil material available for reclamation from the previously mined and disturbed areas at the mine site is very limited. Where salvageable soil exists either on undisturbed or reclaimed areas, NMCC would salvage as much material as can be safely and practically recovered. The lack of reclamation cover material available from previously disturbed areas and the poor development of topsoil (top dressing) at the site would require the evaluation of alternative sources and types of materials for use as reclamation cover. The estimated volumes of salvageable cover material available in areas to be newly disturbed or re-disturbed by the project are shown in Table 2-5, above. NMCC plans to salvage the near-surface alluvial materials from within the limits of the TSF to cover the identified soil deficit to meet reclamation cover requirements.

Diversion ditches would be constructed and maintained around the reclamation material stockpiles to prevent run-on erosion. They would be seeded with an interim, weed-free seed mix. Seeding is typically done once, right before the monsoon season. Efforts would be made to salvage the existing vegetation on the areas that would be newly disturbed by the project. Prior to and during soil salvage, woody plants and vegetation would be removed. The vegetation would be stored with the growth media to increase the organic matter content of the growth media.

Placement: The goal is to salvage sufficient growth media and alluvial material to provide required cover on areas to be revegetated. Table 2-12 below shows the required cover volumes by specific disturbed areas. The final details of the placement and use of these materials in reclamation would be approved by the State and the BLM following analysis of the results of a test-plot program that would be conducted during the mining operation. To ensure good contact with the subsoils, the surface would be roughened by ripping or disking prior to placement of the cover material. The cover material would be spread and graded with care taken to prevent a reduction in bulk density by limiting the number of passes. Following placement, the area would be graded with a dozer to lightly compact the soil.

Amendments: Soils and alluvial materials to be salvaged for reclamation cover are deficient in nitrogen, phosphorus, and potassium and would require 4,000 to 8,000 pounds per acre of amendments to create fertile growth media. Aerobically digested sanitized sewer sludge, cotton husks, and feedlot cattle waste are possible natural materials that might be used, if available, to amend the growth media prior to placement on reclaimed areas. Composting of materials, if required, would be performed on-site to better control the rate and amount of composting. Any natural soil amendments used would be certified free of invasive and noxious weeds. Repeated applications may be required based upon additional testing and vegetation monitoring.

Revegetation: The revegetation plan is designed to create a stable, self-sustaining plant community and would be in conformance with the planned post-mining land uses of wildlife and grazing. The dominant biotic community of the Copper Flat area is Chihuahuan desert scrub (often dominated by creosote bush). To achieve the post-mining land use of wildlife and grazing, revegetation of the site would consist mainly of the establishment of grass and shrub species characteristic of the desert grassland community. Appropriate native riparian and hydrophilic plant species (willows, cottonwood, cattails, sedges, etc.) would be planted in shallow areas near the shoreline of the pit lake after mining is complete.

Table 2-12. Estimated Reclamation Cover Requirements

Table 2-12. Estimated Reclamation Cover Requirements		
Facility	**Surface Area (Acres)**	**Growth Media Cover Requirements (yd^3) (Top Dressing & Reclamation Cover)**
West WRDF	16.3	78,906
North WRDF	69.9	338,405
East WRDF	122.0	594,432
Low-grade stockpile	64.3	*54,611
Plant area	78.0	62,920
TSF	547.0	**2,500,509
Roads & miscellaneous	50.0	40,333
Total	**947.5**	**3,670,116**

Source: THEMAC 2011.

Notes: * The low-grade stockpile does not require reclamation cover as it is anticipated to be processed and removed at the end of mining; however, the disturbance footprint of the stockpile would require some top dressing in order to facilitate revegetation.

** No areas unaffected by construction and mining activities are currently proposed to be disturbed in order to obtain reclamation cover materials. Several borrow areas currently existing within the limits of the TSF would be the primary source of the excavated materials. Mine haul trucks and front-end loaders would be used to remove the required materials during the construction period and stockpile it in designated locations. These locations were chosen to reduce haul distances and to limit erosion. The stockpiles would be constructed with 3H.0:1V slopes. The different aspects and slopes of the stockpiles would be used in the test revegetation program to evaluate slope revegetation methods.

Seed mixes: The seed mixes and any plants used for any purpose, including reclamation, would be determined by seed availability, compatibility with the vegetation of the surrounding areas, soil and climatic conditions of the area, and by recommendations from the BLM and NMEMNRD. Table 2-13 shown below provides the proposed interim seed mix for disturbed areas planned for contemporaneous reclamation (primarily associated with the seeding of the stockpiled growth media). It also shows the final seed mixes proposed for the grazing and wildlife post-mining land uses. The seed mixes include native warm and cool season grasses, perennial shrubs, and forbs (NMCC 2017a).

Planting techniques: Seeding would take place prior to the traditional monsoon season. Compacted soils would be ripped or scarified to a depth of 6 to 12 inches prior to seeding. The types of seeding employed, drill or broadcast, would be determined by consideration of seed type, soil type, moisture content, and other factors.

Revegetation success: Revegetation success would be determined by monitoring the vegetation parameters of ground cover, productivity, woody plant density, and plant species diversity. Monitoring would include objectives and quantitative benchmarks that would be developed at a later date.

Reclamation research: As part of the reclamation plan, NMCC would conduct a revegetation test program to determine the most effective methods to meet revegetation standards as defined in their reclamation plan.

Concurrent reclamation: As part of the Proposed Action, NMCC would periodically review areas disturbed by the operation and complete concurrent reclamation, including grading and revegetation, of areas no longer necessary for operation or areas expected to remain inactive for a significant period of time to limit blowing dust and potential erosion (NMCC 2014a).

Table 2-13. Proposed Reclamation Seed Mixes

Table 2-13. Proposed Reclamation Seed Mixes	
Species	**Application Rate (lbs/acre)**
Drill Seed Mix	
Blue grama (*Bouteloua gracilis*)	0.6
Sideoats grama (*Bouteloua curtipendula*)	1.3
Indian ricegrass (*Oryzopsis hymenoides*)	1.2
New Mexico feathergrass (*Stipa neomexicana*)	1.0
Tobosa grass (*Pleuraphis mutica*)	1.2
Black grama (*Bouteloua eriopoda*)	0.6
Cane bluestem (*Bothriochloa barbinodis*)	1.0
Narrowleaf globemallow (*Sphaeralcea angustifolia*)	0.5
Four-wing saltbush (A*triplex canescens*)	0.8
Broadcast Seed Mix	
Blue grama (*Bouteloua gracilis*)	0.6
Sideoats grams (*Bouteloua curtipendula*)	1.0
Sand dropseed (*Sporobolus cryptandrus*)	0.5
New Mexico feathergrass (*Stipa neomexicana*)	1.0
Silver bluestem (*Bothriochloa laguroides*)	1.0
Apache plume (*Fallugia paradoxa*)	1.0
Four-wing saltbush (*Atriplex canescens*)	1.0
Blanket flower (*Gaillardia pulchella*)	0.5
Narrowleaf globemallow (*Sphaeralcea angustifolia*)	0.1

Source: THEMAC 2011.

Interim reclamation: There is a possibility that continuous, full-scale production might be interrupted for short periods in response to economic considerations or unforeseen circumstances. In this event, interim reclamation would be initiated as outlined below:

- **ROWs:** Power lines and the water pipeline would be inspected regularly and maintained as necessary. None of the facilities would be altered or removed. The main access road would receive regular maintenance. The internal roads would receive minimal maintenance.
- **Pit:** The pit area would be protected by fencing with a locked access gate capable of excluding wildlife. Monitoring of pit water would be ongoing.
- **TSF:** The TSF would be retained for potential future development. Limited care and maintenance of the reclaimed embankment face would be performed as necessary to continue stabilization of the area.
- **Diversion ditches:** Diversion ditches would be inspected and maintained as necessary. Surface water runoff would be managed in accordance with the site's DP requirements.
- **Buildings:** The process buildings, equipment, and support facilities would be guarded by an on-site resident security guard and maintained as necessary. None of the buildings would be destroyed or modified.

2.1.15.10 Interim Management Plan

In accordance with 43 CFR 3809.401(b)(5), NMCC has prepared the following interim management plan to manage the mine area during periods of temporary closure (including periods of seasonal closure, if necessary) to prevent unnecessary or undue degradation. This section provides an overview of the plan which includes:

- Measures to stabilize excavations and workings;
- Measures to isolate and control toxic or deleterious materials;
- Provisions for the storage or removal of equipment, supplies, and structures;
- Measures to maintain the mine area in a safe and clean condition; and
- Plans for monitoring site conditions during periods of non-operation. A schedule of anticipated periods of temporary closure during which the interim management plan would be implemented, including provisions for notifying the BLM of unplanned or extended temporary closures.

NMCC's DP requirements include stormwater management controls, for periods of mining operations as well as temporary closure, to divert clean water away from mine facilities and to divert water that has contacted mine facilities (i.e. direct precipitation) to lined impoundments. In addition, Grayback Arroyo intermittent water would be sampled per the Monitoring Plan and the draft DP. The NMED will also require an Interim Emergency Water Management Plan. NMAC 20.6.7.30(K) states that this plan "shall be submitted… no less than 60 days prior to discharge at a new copper mine facility." NMCC would conform to this requirement and submit an Interim Emergency Water Management Plan no less than 60 days prior to discharge at Copper Flat.

2.1.15.11 Schedule of Operations

The standard operating schedule at the Copper Flat project would be 24 hours a day, 365 days a year for the mining activities and processing circuits. No temporary or interim closures of the facility are currently planned. It is possible that, due to various mechanical, technical, economic, legal, or other unforeseen events, mining and processing facilities would have to be temporarily closed. In the event of an unplanned temporary closure, the following plan would be implemented:

- The BLM, MMD, and the NMED would be notified within 30 days of the temporary closure of the flotation mill or the concentrate circuit.
- NMCC would supply the BLM, MMD, and the NMED with a list of supervisory personnel who would oversee the mine facility during the temporary closure period.
- If the interim closure period exceeds 180 days, NMCC would either apply for standby status or would begin to evaluate procedures required to carry out a permanent closure of the process components.

2.1.15.12 Measures to Stabilize Excavations and Workings

No additional measures would be necessary to stabilize excavations and workings during an unplanned temporary closure. Pit dewatering activities may cease during the temporary closure period, in which case all dewatering pumps, pipelines, and water storage tanks would be drained. Interim reclamation procedures would be implemented as necessary to stabilize disturbed sites during the temporary closure period. These procedures would be coordinated with the BLM, MMD, and the NMED. Adequate storage capacity would be maintained in the process components to accommodate runoff resulting from the design-level storm event.

2.1.15.13 Measures to Isolate Waste Rock

In addition to the waste rock management provisions of Section 2.1.15.6, Environmental Considerations for Reclamation, NMCC would follow the waste rock management procedures described in the MPO to isolate waste rock as necessary during an unplanned temporary closure.

2.1.15.14 Storage or Removal of Equipment, Supplies, and Structures

In the event of a temporary closure, it is anticipated that equipment, supplies, and structures would not be removed or placed into storage. In addition, the following steps would be taken:

- Additional reagents would not be introduced into any process component during the temporary unplanned closure period. Process piping and pumps would be drained if the process circuits are shut down. Stored equipment would be clearly identified as having contained process solutions.
- Any mine equipment remaining in operation during the temporary closure, including haul trucks, shovels, loaders, drills, and personnel vehicles would continue to be maintained according to standard company procedure.
- Following any temporary closure period, the integrity of the entire fluid management system would be evaluated before startup is initiated. Solution tanks, pumps, and piping would be visually inspected and repaired as necessary. The mineral processing circuit would be charged with process solution and visually inspected for evidence of leaks. Mine equipment would be inspected for compliance with appropriate Federal and State mining regulations before mining activities recommence. Upon reopening, it is unlikely that mining activities would be affected by a temporary closure. The mine dewatering system would be visually inspected and repaired as necessary. Pit dewatering would resume as soon as possible.

2.1.15.15 Monitoring During Periods of Non-Operation

All provisions of this plan and all other regulatory and permitting requirements would continue to be met during the temporary closure period.

2.1.15.16 Facility-Specific Reclamation

Mine pit: NMCC does not propose to backfill the pit. Backfilling operations would not allow sequential mining of the deposit, may cover future mineral resources, and would be economically unfeasible following closure of the operation. Groundwater inflow formed a lake in the former pit. The current water level is at about 5,439 feet; therefore, pit dewatering would be necessary during operations. Following cessation of dewatering activities, a lake would again form in the pit. The post-closure pit water elevation is estimated to be approximately 4,900 feet. The depth of the lake would fluctuate a few feet depending on precipitation and the evaporation rate. If natural refilling were to be selected, this would proceed over a number of years. Rapid filling, proposed as mitigation, would occur much more quickly. This would occur under conditions of water right approval to quickly submerge mineralized wallrock and limit mineral oxidation and formation of soluble mineral residue. Reclamation of the pit during operations would be limited to erosion control and maintaining slope stability.

At closure, stable pit walls would be left in place, and unstable pit walls would be stabilized by blasting or other safe methods. In those areas where pit benches could be safely accessed with the appropriate equipment, alluvial material would be placed on the benches above the projected water level, and the benches would be graded and seeded to limit erosion. Roads would be ripped and water barred to control surface water runoff. Disturbed areas around and adjacent to the pit would be covered with alluvial material and revegetated. The ramp would be graded or ramps placed at different locations to allow escape routes for wildlife. The pit area and high walls would be appropriately barricaded with physical barriers or fences and posted according to MSHA and New Mexico Office of the State Mine Inspector (SMI) regulations. Access would be limited by a locked gate and the access road blocked with a physical barricade.

NMCC must design a pit reclamation plan that would meet BLM requirements in CFR 3809.420, including a post-mining land use consistent with applicable BLM land use plans, operations that comply with all pertinent Federal and State laws, and reasonable measures to control on-site and off-site damage of Federal land. NMCC pit reclamation must adhere to MMD requirements in NMAC 19.10.6, including the achievement of a self-sustaining ecosystem appropriate for the life zone of the surrounding area. MMD pit reclamation requirements also include stabilization, to the extent practicable, to minimize future impact to the environment and to protect air and water resources. Because the mine pit is privately owned, and the resulting water body has been demonstrated to be a hydraulic sink, water in the pit after mine closure would be neither a water of the State (pending a determination by the State via permit issuance) nor a water of the U.S. and would not be required to meet State surface water standards found in NMAC 20.6.4. The pit lake water quality would instead meet a permit condition imposed by MMD, based upon NMAC 19.10.6.603, that the water quality be similar to what exists prior to the start of mining operations.

The proposed post-mining land use for the pit (excepting the lake) is wildlife habitat. After mine operation, the benches and walls of the pit would be stabilized, the overall pit slope would be maintained, and the pit would be about 900 feet deep. The bottom of the pit would naturally fill with water to a steady-state depth of about 200 feet, leaving about 700 feet of high walls and benches. The pit walls and benches would become Chihuahuan Desert wildlife habitat, providing abundant rock outcroppings, which are regularly utilized by bats for day or night-roosting, or for cliff-dwelling bird species such as raptors for nesting. Water quality in the lake that will reform will not support aquatic life although some emergent and/or riparian vegetation may establish on the margin. Pit reclamation would include the following strategies:

- “Rapid fill” of the pit would bring the pit water to a steady-state water level elevation in less than a year through the addition of groundwater from the mine production wells, rather than the many years it would take for the pit water elevation to rise to this level if it were to refill naturally. Additional details for the rapid fill scenario include the following:

- Rapid fill would occur by pumping the mine production wells at approximately 3,000 gpm for about 7 months. Water would be pumped into the bottom of the pit via a temporary HDPE pipe laid along the haul road. The total pumped volume would be about 1,600 AF.
- Rapid fill from groundwater would introduce good quality water, dilute solutes derived from water-rock interaction, submerge walls and benches to limit the exposure of sulfide minerals to oxygen to inhibit oxidation, stabilize pit water quality, and create a steady-state condition for a hydraulic sink in the near term rather than waiting for natural refilling of the pit. Initial pit water chemistry would be composed of 98 percent supply well water and 2 percent stormwater runoff from the pit shell.
- The rapid fill pumping rate from the production wells would be close to the pumping rate employed during mine operation; therefore, there would be no change to the predicted final drawdown. Recovery of water levels at the production wells would be delayed for 6 months to a year. The rapid fill pumping rate would not exceed its allowed water rights.

- Reclamation of disturbed areas in the watershed surrounding the open pit would be accomplished to minimize infiltration and promote vegetative growth. This proposed reclamation measure would create a store and release cover, minimize infiltration of stormwater around the pit perimeter, and limit water–rock interaction in the upper pit walls. The design details for the open pit reclamation described may be reviewed in Appendix E of the Mine Operations and Reclamation Plan (NMCC 2017a).

- An existing waste rock stockpile west of the pit would be reclaimed such that the western portion of the pit perimeter would be graded to drain away from the pit into a proposed toe channel that would drain to the Greyback Arroyo diversion. NMCC's Revised Mine Operations and Reclamation Plan (MORP) (NMCC 2017a) provides details about how the Existing Waste Rock Stockpile-1 (EWRSP-1) on the western portion of the pit will be reclaimed according to MMD and NMED requirements that will protect surface water and groundwater, including a 36-inch cover and revegetation. As noted in Section 2.1.2 of the MORP Appendix E, waste rock adjacent to the Grayback Diversion would be pulled back from EWRSP-1 or moved to provide clear separation between the final toe of the reclaimed stockpile and the bank of the Grayback Diversion channel. The plan includes covering of the top surfaces and slopes of the EWSPs with 36 inches of growth media, as well as ripping and seeding of covered and disturbed areas to reestablish vegetation using a seed mix approved by the BLM and MMD.

- A controlled pathway would be provided for the pit watershed area to direct excess runoff to the pit bottom to protect water quality and prevent erosion. Additional water collected in the pit through storm events would provide dilution of naturally occurring constituents. Additional details for the controlled pathway scenario include the following:
  - Reclamation of several pit benches at the pit crest and the 90-foot-wide haul road within the open pit would occur through the installation of a stormwater conveyance system around the northern and eastern perimeter and along the haul road into the pit. Other reclamation measures that would be employed would include erosion control features, such as reducing the width of the haul road to allow single vehicle access, ripping the haul road to 12 inches, and placing 6 inches of cover material and seeding for natural revegetation where appropriate. Haul road reclamation would be performed in stages prior to and after rapid filling. The first stage would likely include removal of loose material, installation of stormwater controls, and a stormwater conveyance system.
  - After rapid filling, the second stage of haul road reclamation would include localized placement of substrate (if needed) and revegetation. Access would be prohibited except for maintenance, monitoring, or emergency purposes.

- During the initial stage of the rapid fill scenario, vehicle access to the pit would be limited to only vehicles and equipment needed for reclamation work and monitoring. In the second stage, vehicular access would be further restricted through the placement of berms, to only that which is necessary for monitoring or emergencies. Signs to provide notice of no access would be located around the perimeter of the pit. Wildlife would have access to and from the pit via the haul road. Surface features would be designed such that wildlife could not become trapped in the pit.

The open pit would be reclaimed to include the following actions:

- Rapid filling of the pit with approximately 1,600 AF of water from the off-site well field over a period of approximately 6 months;
- Construction of an earthen berm around the perimeter of the open pit to limit public access and ensure that the pit area does not pose a current or future hazard to public health or safety. The berm would be constructed from local rock and soils and would be 15- to 20-foot wide at the base and 5- to 6-feet high with side slopes angled at 1.5H:1V;
- Construction of surface water conveyance channels around the perimeter of the pit (immediately upstream of the perimeter berm/security fence) to direct surface water around the pit to the newly constructed open pit conveyance channel;
- Construction of the open pit conveyance channel along the existing haul road to direct surface water flows from around the perimeter of the pit to the pit lake;
- Construction of energy-dissipation structures at channel outlets to reduce erosive velocities where necessary. Where possible the channels would be constructed to incorporate existing topography, grade controls, and exposed inert bedrock, which would promote long-term integrity of the structures;
- Grading of the disturbed areas associated with the pit perimeter, perimeter channels, and safety berm construction. It is assumed there would be an approximate 100-foot-wide disturbance area around the pit. The 100-foot width is a generalized approximate average width of disturbance around the pit perimeter that occurs during mining operations. The actual width of disturbance would vary by location. In some areas there may be little or no disturbance;
- Removal of aboveground electrical systems and infrastructure, including pumps, lighting and transmission lines not necessary for post-closure site operations and maintenance;
- Installation of a security gate at the haul road entrance into the pit to allow access for operation, maintenance, and monitoring activities to authorized personnel;
- Installation of a barbed wire fence around the outside perimeter of the pit safety berm to exclude livestock and other large mammals;
- Posting of signs at 500-foot intervals along the security fence/earthen berm and at all access points, warning of potential hazards present;
- Ripping and seeding of disturbed areas around the pit perimeter to reestablish vegetation using a seed mix approved by the BLM and MMD; and
- Installation, operation, and maintenance of groundwater monitoring wells that may be required for post-closure monitoring in accordance with 20.6.7.35.B NMAC.

Waste rock disposal areas and low-grade stockpile: The primary WRDF for the Proposed Action is located east-northeast of the millsite on the east side of Animas Peak. Two smaller WRDFs would be located adjacent to the pit. The waste rock disposal areas would be regraded and reclaimed to blend into the surrounding topography to the extent practicable. Horizontal surfaces would be regraded and contoured to reduce infiltration of water and provide positive drainage to sediment collection points.

Partially oxidized waste rock represents some of the material in the existing west and north WRDFs. All the WRDFs and any low-grade ore remaining in the low-grade ore stockpile would be reclaimed in a manner that has been determined to reduce infiltration and to alleviate the long-term risk of acid generation and metals leaching. Following regrading, the surface of the disposal areas would be consolidated with earthmoving equipment and covered with a layer of alluvial material and revegetated. Waste rock disposal areas would be covered with suitable reclamation materials and revegetated contemporaneously as practicable with the operations.

Diversion structures would be revegetated to the extent practicable. Additionally, riprap would be used as needed to reduce erosion and left in place following closure. The low-grade ore stockpile is located immediately north of the process plant area and would include about 19 million tons of rock assaying lower than 0.20 percent copper. If the low-grade ore stockpile is milled by the end of mine life, the pad area would be ripped, contoured for drainage control, covered with growth media, and revegetated. If the low-grade stockpile remains following closure, the stockpile would be reclaimed in the same manner as the WRDFs; it would be regraded to overall slopes of 3.0H:1.0V and shaped to enhance runoff, prevent infiltration, and ponding. The surface would be consolidated with earth-moving equipment, covered with a layer of alluvial material, and revegetated.

Plant site: At closure, all surface facilities, equipment, and buildings would be removed from the area. For buildings located on public land administered by the BLM, the concrete foundations would be broken, excavated, and disposed of in a suitable location on adjacent private land. The concrete building slabs, footings, and foundations for facilities located on private land controlled by NMCC would be broken, covered with waste rock material and available growth media, regraded, and revegetated. All fuel tanks and reagent storage facilities would be removed from the site according to applicable Federal and State laws. The general surface area would be shaped and contoured for surface drainage control and covered with a minimum of 6 inches of stockpiled alluvium/growth media to conform to the surrounding topography to the extent practicable. The tailings thickener and tailings reclaim pond would be backfilled and regraded to eliminate ponding prior to placement of alluvial material/growth media and revegetation. After closure, the stormwater pond located east of the plant site would be removed, regraded, revegetated, and opened to drain to Greyback Arroyo (NMCC 2014a).

TSF: A TSF located southeast of the plant site was designed to hold a total of 95 million tons of tailings, including tailings from 11 million tons of low-grade ore. Closure of the TSF would include:

- Final grading of embankment outslopes to establish erosion controls and control surface water drainage (BMPs);
- Placement of a soil or rock cover and revegetation of the embankment outslope;
- Placement of riprap and erosion controls on the embankments of surface water drainage structures;
- Regrading or depositional modification of the TSF surface to promote drainage to a permanent engineered spillway;
- Placement and vegetation of a soil cover over the tailings surface;
- Armoring of surface drainage channels and implementation of BMPs for erosion control; and
- Management of underdrainage.

During ore processing, solution reporting to and flowing from the TSF underdrain collection pond is projected at 1,200 gpm. When processing and tailings deposition ends, the free water pond remaining at the top of the TSF would be evaporated to eliminate the largest source of draindown solution, and solution flow through the TSF underdrain system would reduce to approximately 800 gpm approximately

9 months after processing shutdown. After that time, draindown from the TSF would continue to decline at a steady rate. Draindown solution would be collected in the TSF underdrain collection pond, from which it would be pumped to the top of the TSF to be evaporated or used as reclamation cover irrigation if the water is of suitable quality. If the draindown solution is not suitable for reclamation cover, a portion of the TSF would be left un-reclaimed and uncovered for evaporation operations. When the draindown flow rate reaches a very low level, estimated to require 3 to 5 years following process shutdown, and with the approval of the appropriate New Mexico regulatory agencies, a passive ET system would be installed below the TSF to eliminate final draindown flows. The seepage collection pond would be incorporated into a passive evapotranspiration system and reclamation of the TSF completed.

Final grading of the TSF surface would be accomplished with earth-moving equipment or through modification of tailings disposal patterns during the final years of operation. Tailings discharge from selected locations would be used to relocate the supernatant pool to a location adjacent to the post-closure spillway. This would reduce grading requirements and limit earth-moving operations in areas where working conditions are expected to be difficult due to the presence of soft and saturated tailings. At the location of the spillway, a bedrock foundation is anticipated. If the spillway channel is erodible, grouted riprap or other erosion controls would be applied.

Ancillary project facilities: All surface pipelines, poles, and commercial signage would be removed. At time of closure, the BLM would determine whether buried pipelines and electrical conduits would be left in place.

Fences: The tailings and mine area would be fenced to discourage access by people, wildlife, and livestock for safety purposes. Fences used to restrict access to potentially hazardous areas would remain in place. The BLM would determine which fences would remain intact on public land. All fencing on public land would be constructed to meet BLM requirements.

Water tanks: The fresh water and process water tanks would be removed, their foundations buried in place, and the side-hill cuts recontoured to approximate the original topography. Following recontouring, the areas would receive alluvial material if the replaced fill material would not support vegetation. The areas would then be revegetated.

Roads: A portion of the access road has been deeded to Sierra County and provides access through the mine area to private and public property adjacent to the west boundary of the project. From the point where the mine access road leaves the county road north of the TSF, it would be narrowed to a standard two-lane road. Prior to final closure, the State and the BLM would determine which auxiliary roads and haul roads would be left intact. Roads to be reclaimed would be recontoured to approximate the original topography if constructed on sidehills or contoured and ripped if constructed in flat areas. Water bars would be constructed to reduce erosion. Recontoured areas would be covered with alluvial material if replacement fill material would not support vegetation. These recontoured areas would also be revegetated.

Electrical power: Power for the project would be furnished by means of existing overhead power lines. The overhead lines would be removed from the millsite and disconnected from the 115-kV line owned by Sierra Electrical Cooperative by removing the wires of the last span of the line. Pumping stations and electrical substations on the site would be removed if no other post-closure land use is identified and approved. The disturbance associated with removal would be reclaimed by regrading and seeding. If renewable energy facilities are deployed at specific buildings, these would be removed and associated disturbances would be regraded and reseeded. The existing 25-kV line that provides power to the production wells, pumping stations on the fresh water pipeline, and reclaim water pump stations at the tailings dam would remain in place.

Water supply: Water would be supplied to the mine from four production wells located about 8 miles east of the plant site. A 20-inch welded steel pipeline transports the water to the mine and is buried at a minimum depth of 2 feet from the well field to the point of entry to the mine area. The buried pipeline is owned by the BLM. The BLM would determine upon closure whether the buried pipeline would remain in place. All roads and power lines for the production wells are in place. The BLM would determine whether the well area would remain as it currently exists after closure of the mine.

Sanitary solid waste disposal: At closure, the system used to treat domestic wastes would be dismantled and removed, and the area would be regraded and vegetated in accordance with site closure plans (NMCC 2014a). If a private landfill is permitted for on-site disposal of solid waste, the landfill would be closed according to NMED requirements.

Reclamation bond: A reclamation bond is required by the BLM and State of New Mexico to guarantee completion of project reclamation (43 CFR 3809.500-3809.599).

2.1.16 Environmental Protection Measures

In addition to mine operations and reclamation actions described elsewhere in this chapter, NMCC would commit to the following practices to prevent unnecessary environmental degradation during the life of the project. These practices, described briefly below, are to be considered part of the Proposed Action and the operating plan and procedures. More detailed information would be developed as the project is advanced to more detailed design stages.

Air quality: The Copper Flat project would be designed to control both gaseous and particulate emissions and to meet all regulatory standards. Appropriate air quality permits would be obtained from the NMED Air Quality Bureau for the proposed project facilities and land disturbance. As per NMED regulations, the project air quality operating permit must be authorized by the NMED prior to project commissioning. The NMED Air Quality Bureau issued a New Source Review Permit to NMCC dated June 25, 2013.

Committed air quality practices would include dust control for mine unit operations. In general, the fugitive dust control program would provide for water application on haul roads and other disturbed areas; chemical dust suppressant application (such as magnesium chloride) where appropriate; and other dust control measures as per industry practice. Also, disturbed areas would be seeded with an interim seed mix to limit fugitive dust emissions from unvegetated surfaces where appropriate. Drilling operations would be done wet or with other efficient dust control measures as set by MSHA, the SMI, and New Mexico mining and exploration permit requirements (NMCC 2014a).

Fugitive emissions in the process area would be controlled at the crusher and conveyor drop points through the use of water sprays and dry cartridge filter-type dust collectors where necessary. Other process areas requiring dust or emission controls include the concentrate drying and packaging circuit, various process plants, and laboratory. Appropriate emission control equipment would be installed and operated in accordance with the construction and operating air permits. The lime storage would be fitted with a baghouse for capture of fugitive dust during loading of the lime bin. The sample preparation lab would be equipped with fans and filters.

Deposition of tailings would be by dispersion spigots or cyclone discharge. Using this procedure, the surface would be wet, thereby eliminating or reducing fugitive dust. As necessary, control of fugitive dust in the vicinity of the tailings pond would be attained by watering, sprinkling, and vegetation. No gaseous contaminants above allowable standards are expected to be emitted to the atmosphere from the proposed operations.

Combustion emissions would result from the mobile mining machinery and support vehicles. All combustion equipment emits nitrogen dioxide and carbon monoxide. The mobile mining equipment is diesel-fueled and would also emit particulate matter. Combustion emissions would be controlled by original equipment manufacturer pollution control devices. Fugitive emissions from ore and the flotation equipment are expected to be small due to the low volatility of the sulfur compounds present in the concentrate.

Water resources: Process components would be designed, constructed, and operated in accordance with NMED regulations. The proposed process facilities would be zero discharge, and the TSF facilities would have engineered liner systems. Waste rock with the potential to generate acid or mobilize deleterious constituents would be determined through the current geochemical testing program and the development and execution of a NMED-approved waste management plan.

Erosion and sediment control: BMPs would be used to limit erosion and reduce sediment in precipitation runoff from proposed project facilities and disturbed areas during construction, operations, and initial stages of reclamation. BMPs that would be used during construction and operation to limit erosion and control sediment runoff would include:

- Surface stabilization measures — dust control, mulching, riprap, temporary and permanent revegetation/reclamation and restoration, and placing growth media;
- Runoff control and conveyance measures — hardened channels, runoff diversions; and
- Sediment traps and barriers check dams, grade stabilization structures, sediment detention, and sediment/silt fence and straw bale barriers.

Revegetation of disturbed areas would reduce the potential for wind and water erosion. Following construction activities, areas such as cut and fill embankments and growth media/cover stockpiles would be seeded as soon as it is practicable. Contemporaneous reclamation would be conducted on disturbed areas not to be re-disturbed by future mining operations. All sediment and erosion control measures would be inspected periodically and repairs performed as needed.

Wildlife: Land clearing and surface disturbance would be timed to prevent destruction of active bird nests or birds''' young during the avian breeding season (March 1 to August 31) to comply with the Migratory Bird Treaty Act. If surface disturbing activities are unavoidable during the avian breeding and nesting season, NMCC would have a qualified biologist survey areas proposed for disturbance for the presence of active nests immediately prior to the disturbance. If active nests are located, or if other evidence of nesting is observed (mating pairs, territorial defense, carrying nesting material, transporting of food), NMCC would work with the biologist and the BLM to develop a work plan to allow construction activities to continue without impacting the identified nesting area during the nesting and breeding season.

Operators would be trained to monitor the mining and process areas for the presence of larger wildlife such as deer and antelope. Mortality information would be collected. NMCC would establish wildlife protection policies that would prohibit feeding or harassing wildlife.

Cultural resources: Avoidance is the BLM-preferred management response for preventing impacts to historic properties (a historic property is any prehistoric or historic site eligible for the National Register of Historic Places) or unevaluated cultural resources. If avoidance is not possible or is not adequate to prevent adverse effects, NMCC would undertake data recovery from such sites. Development of a treatment plan, data recovery, archeological documentation, and report preparation would be based on the Secretary of the Interior's "*Standards and Guidelines for Archeology and Historic Preservation*" 48 CFR 44716 (September 29, 1983), as amended or replaced. If an unevaluated site could not be avoided, additional information would be gathered and the site would be evaluated. If the site does not meet eligibility criteria as defined by 36 CFR Part 60.4, no further cultural work would be performed. A cultural resources report prepared for the proposed activities within the mine area and further submitted to the State Historic Preservation Officer by the BLM includes a recommendation that a data recovery plan and associated data recovery effort be completed for this project (NMCC 2014a).

Protection of survey monuments: To the extent practicable, NMCC would protect all survey monuments, witness corners, reference monuments, bearing trees, and line trees against unnecessary or undue destruction or damage. If, during operations, any monuments, corners, or accessories are destroyed, NMCC would immediately report the matter to the authorized officer. Prior to destruction or damage during surface disturbing activities, NMCC would contact the BLM to develop a plan for any necessary restoration or reestablishment activity of the affected monument. NMCC would bear the cost for the restoration or reestablishment activities.

Health and safety and emergency response: The development of the Copper Flat mine would comply with environmental and health and safety regulations of all governmental agencies and regulations including MSHA and the New Mexico Mining Act. The State agencies primarily involved are the NMED, the SMI, MMD, and OSE.

The NMED has jurisdiction over ambient air quality, discharges to groundwater, surface water impacts, solid waste disposal, and liquid waste disposal (sanitary facilities). The SMI and MSHA have jurisdiction over health and safety within the mine; the OSE has jurisdiction over the tailings dam construction and operation and the administration of water rights. The MMD is responsible for issuing a mining permit and is concerned with all issues related to mine operations and reclamation. All relative laws, State and Federal, would be adhered to in regard to water rights.

As specified under SMI and MSHA regulations, appropriate dust collection and noise abatement equipment would be installed at the mine. Noise levels in both the mine area and process area would also be subject to MSHA regulations. All drinking water storage vessels would be enclosed in order to preserve the water's potable quality. Within the mine and mill area and the TSF, vehicular traffic and human movement would be controlled through the use of fences, locked gates, signs, and supervisory personnel. Fencing would also discourage access by cattle. Livestock grazing is currently permitted in adjacent properties and would continue during mine operation in adjacent areas.

Fire protection: As specified by MSHA, NMCC would institute a fire protection training program and have a rehearsed fire suppression plan. A fire protection system would be installed that would incorporate Sierra County and State code requirements in the administration and warehouse complexes, truck shop, crushing plant, and process plant. Hydrants would be located near all buildings. A 100,000-gallon fire water reserve would be stored in a water storage tank located sufficiently above and near the mill and crushing area to provide adequate water pressure. A fuel break would be constructed around the facilities. Mine water trucks and equipment would be available in the event of a fire. An ambulance would be located on-site in the event emergency transportation is required. NMCC would promptly comply with any emergency directives and requirements of Sierra County and the BLM pertaining to industrial operations during the fire season.

Invasive, non-native species: NMCC recognizes the economic and environmental impact that can result from the establishment of noxious weed and invasive species and has committed to a proactive approach to their control. Objectives would include:

- Determination of noxious and invasive species currently present;
- Prevention of spread; and
- Prevention of further introduction.

A noxious weed survey would be completed prior to any earth-moving disturbance. Areas of concern for noxious weeds would be flagged by a weed scientist or qualified biologist/botanist to alert all personnel to avoid those areas pending any remediation of the area. Information and training regarding noxious weed management and identification would be provided to all personnel affiliated with the implementation and maintenance of the project.

A noxious weed monitoring and control plan would be implemented during construction and continued through operations. The plan would contain a risk assessment, management strategies, provisions for annual monitoring and treatment evaluation, and provisions for treatment. The results from annual monitoring would be the basis for updating the plan and developing annual treatment programs.

Policies and training would be developed so that personal vehicles and mine equipment that enter an identified noxious weed area would be properly inspected and cleaned. Vehicle cleaning would eliminate the transport of vehicle-borne weed seed, roots, or rhizomes. To eliminate the transport of soil-borne noxious weed seeds, roots, or rhizomes, infested soils or material would be handled in a manner that limits the transport of soil-borne noxious weed seeds, roots, and rhizomes. Appropriate measures would be taken to avoid wind or water erosion of the affected stockpile. All interim and final seed mixes including mulch such as hay, straw, or wood products would be certified weed-free for New Mexico and BLM-identified noxious weeds.

Weed monitoring would be conducted for the life of the operation or until the reclamation financial surety is released. If the spread of noxious weed(s) is noted, weed control procedures would be determined in consultation with BLM personnel and would be in compliance with State of New Mexico and BLM handbooks and applicable laws and regulations. Mixing of herbicides and rinsing of herbicide containers and spray equipment would be conducted only in areas that are a safe distance from environmentally sensitive areas and points of entry to bodies of water (storm drains, irrigation ditches, streams, lakes, or wells).

Paleontological resources: No paleontological resources of critical or educational value have been identified within the proposed mine area. The western half of the mine area lies predominantly in Cretaceous-age andesite formations, which are not conducive to fossil formation because of their origin in a molten, volcanic environment. The eastern half of the mine area is within the Palomas Formation of the Santa Fe Group. The Santa Fe Group is Miocene to Pliocene in age, the same age as the Ogallala Formation in eastern New Mexico, which has produced a variety of mammalian fauna. It is designated as a Potential Fossil Yield Classification (PFYC) 3 area. The Palomas Formation represents two depositional environments forming interpenetrating wedges: alluvial fan deposits from the surrounding uplifts and axial river deposits from the ancestral Rio Grande. Vertebrate fossil localities have been found in the Palomas Formation in the Palomas Basin area. Almost all of them occur in the axial river deposits (Ziegler 2015).

NMCC would immediately notify the BLM Authorized Officer of any paleontological resources discovered as a result of operations. NMCC would suspend all activities in the vicinity of such a discovery until notified to proceed by the Authorized Officer and shall protect the discovery from damage or looting. NMCC may not be required to suspend all operations if activities can be adjusted to avoid further impacts to a discovered locality or be continued elsewhere. The Authorized Officer would evaluate, or would have evaluated, such discoveries as soon as possible, but not later than 10 working days after being notified. Appropriate measures to mitigate adverse effects to significant paleontological resources would be determined by the Authorized Officer after consulting with the operator. Within 10 days, the operator would be allowed to continue construction through the site or would be given the choice of either: 1) following the Authorized Officer’s instructions for stabilizing the fossil resource in place and avoiding further disturbance to the fossil resource; or 2) following the Authorized Officer’s instructions for mitigating impacts to the fossil resource prior to continuing construction through the mine area.

Materials and waste management: Operations at the Copper Flat project would result in the generation of nonhazardous and hazardous waste materials. The majority of waste would be mill tailings and waste rock that are currently excluded from regulation under the Resource Conservation and Recovery Act (RCRA). NMCC anticipates that the mine would fall in the small generator category (NMCC 2014a). The management of regulated solid and hazardous waste is discussed below.

Sanitary and solid waste disposal: Nonhazardous solid wastes that would be generated at the site include waste paper, wood, scrap metal, and other domestic trash. A recycling program would be implemented in preference to landfilling nonhazardous solid wastes. NMCC anticipates the recycling program to include clean plastics, paper, cardboard, aluminum, wood, and scrap metal. The amount of recycling would be subject to the availability of off-site programs to receive recycled material. Nonhazardous solid wastes that cannot be recycled would be disposed of in a permitted on-site Class III sanitary landfill on private land, which would be approved by the State of New Mexico or by other methods approved by the State and Sierra County (NMCC 2014a).

Sanitary liquid wastes would be handled by the proposed septic system that would be installed at the mine to accommodate liquid sanitary wastes generated from the mine office, shower, and restroom facilities. The washing facility for the mobile equipment would be equipped with an oil/water separator system. Waste oil and lubricants would be collected and transported off-site by a buyer/contractor for recycling on an as needed basis. Reagent drums would be recycled by the reagent supplier. Scrap metal would be sold to a dealer and transported off-site (NMCC 2014a).

Chemical wastes from the laboratory that exhibit a hazardous waste characteristic, including off-specification commercial chemicals and assay wastes, would be managed as hazardous waste.

Employee training would include appropriate landfill disposal practices such as the allowable wastes that can be placed in the landfill, management of used filters, oily rags, fluorescent light bulbs, aerosol cans, and other regulated substances. Used solvent, liquids drained from aerosol cans, accumulations of mercury fluorescent lights, and used antifreeze may be regulated pursuant to RCRA. Signs would be installed at the landfill sites reminding employees of appropriate disposal practices.

Reagent management: Reagents used as part of the copper/molybdenum concentrating process would include frothers, flotation promoters, flotation collectors, flocculants, flotation reagents, pH regulators, and filter and dewatering aids, as shown below in Table 2-14. These reagents would be delivered by truck from commercial sources to the mine area where facilities would be provided for offloading, storing, mixing, handling, and feeding. Reagents that are received dry would be mixed in agitation tanks and pumped to either outdoor storage tanks or liquid storage tanks inside the mill building where they would be metered into the concentrating process. Residual reagent concentrations in the tailings and reclaim water streams are expected to be present at very low levels since they would be added to water in amounts resulting in concentrations of approximately 3 parts per million (ppm). Also, normally 95 percent of the reagents would be adsorbed onto the copper or molybdenum mineral surface and floated off in the mineral froth. The reagent would then be subsequently consumed in the off-site smelting process. Assuming 95 percent of the reagents are absorbed, the residual reagent reporting to the tailings stream drops to less than 0.15 ppm.

Table 2-14. Copper Flat Project Materials Management

Reagent	Chemical Abstract Service (CAS #)	Type	Use	Annual Quantity (lbs)
Lime	1305-62-0	Caustic powder; non-combustible solid; incompatible with acids	pH control	15,700,000
Xanthate Z-11/Z-200	140-93-2	Fugitive dust potential	Flotation reagent	58,000
AEROFLOAT 238 (Sodium Hydroxide)	001310-73-2	Caustic alkali liquid; corrosive; incompatible with strong oxidizing agents and mineral acids	Flotation promoter	116,000
MIBC	108-11-2	Class II combustible liquid	Moly. frother	116,000
Ammonium sulfide	12135-76-1	Poisonous, corrosive, flammable liquid; incompatible with numerous chemicals	Flotation reagent	1,400,000
Unnamed flocculent (similar to SUPERFLOC polyacrylamide or acrylamide-acrylic)		Organic polymer flocculent	Thickener	17,400
AERODRI 100 (ethanol, sodium dioctyl sulfosuccinate, 2-ethylhenanol)	000064-17-5 000577-11-7 000104-76-7	Flammable liquid; incompatible with strong acids, alkalines, and strong oxidizing agents	Filter aid/ dewatering aid	92,800
Sodium hydrosulfide	16721-80-5	Highly corrosive; incompatible with chemicals listed for ammonium sulfide	Flotation reagent depressant cation exchange	1,400,000
Fuel oil (diesel) Dryer fuel (diesel)	8008-20-6	Flammable liquid	Moly. collection/ truck operation	150,000
Sulfuric acid	7664-93-9	Strong acid	Lab use	<100

Source: NMCC 2014a.

Notes: Either ammonium sulfide or sodium hydrosulfide would be used as a flotation reagent.

Chemicals include acids, alcohols, carbonates, esters, halogenated organics, ketones, organic sulfides, aldehydes, amides, combustibles, flammables, hydrazine isocyanates, organic peroxides, phenols, nitrites, organic nitro compounds, organophosphates, explosives, polymerizable compounds, epoxides, and oxidizing agents.

Frother reagents to be used at the mine include MIBC. MIBC is biodegradable in low concentrations. The dosage rate would be 0.02 pounds per ton of mill feed. The bulk of this reagent would report to the concentrate fraction and end up at the smelter. The reagent would be received in 20-ton-capacity trucks and stored in a 16,000-gallon tank. Lime used in alkalinity control in the flotation circuit would be received in pebble form in bulk by 20-ton-capacity trucks and stored in a 200-ton-capacity storage silo. The lime would then be slaked with water in a small mill, and the resulting "milk of lime" would be pumped to the addition points in the grinding and flotation circuits for use as a pH regulator. It is anticipated that lime would be used at a rate of 2.7 pounds per ton of mill feed to control the pH of the flotation circuit. During the milling process, most of the lime would react with sulfide minerals to form gypsum.

Either sodium hydrosulfide or ammonium sulfide would be added to the circuit process as a flotation collector and depressant to affect the copper molybdenum separation. These reagents are rapidly oxidized through contact with copper minerals and air bubbles entrained in flotation pulp. These reagents would be transferred from a delivery truck to an appropriate on-site holding tank.
Diesel fuel would be used as a molybdenum collector in the mineral processing operation. The fuel would be stored in a 2,000-gallon holding tank approximately 8 feet in diameter by 6 feet tall. The fuel storage tank would be installed in conformance with applicable NMED Petroleum Storage Tank Bureau regulations for New Storage Tank Systems in 20.5.4 NMAC.

Diesel fuel for mobile equipment would be stored in tanks at another location on-site. The tanks would be installed in conformance with applicable NMED Petroleum Storage Tank Bureau regulations for New Storage Tank Systems in 20.5.4 NMAC. The expected volume of diesel for the site is less than 500,000 gallons, to be contained in two 248,690-gallon aboveground storage tanks (ASTs), 24 feet high, with a diameter of 42 feet. As required secondary containment would be constructed with a capacity of at least 110 percent of the size of the largest AST in the containment area plus the volume displaced by the other AST(s). If used for containment, a geo-synthetic membrane would have a minimum thickness of 60 mils and would be covered with fine material to limit damage due to abrasion or puncturing.

NMCC plans to store less than 2,000 gallons of antiscalants in appropriate ASTs that meet industry standards. The antiscalants proposed would likely be NALC09731 or NALC09735 (or equivalent). Other reagents would be maintained in the reagent building, a structure made with 8-inch concrete block walls and a metal roof, 3,000 square feet in size, slab on grade construction, with a 6-inch concrete floor. On-site reagent storage is expected to be similar to the storage and processing employed by Quintana in 1982, as follows:

- Lime storage: A 200-ton-capacity silo would funnel lime into a lime feed pump tank and from there into two holding tanks.
- Xanthate (K. Amyl) (or equivalent): Flotation reagent Xanthate would be kept in drums and transferred to a mixing tank, then to a holding tank, and finally to the head tank.
- AEROFLOAT 238 (or equivalent): Used in flotation promoting, would be received in 50-gallon drums and have a plant storage capacity of 2,800 gallons. Aerofloat would be kept in drums and transferred to a mixing tank, then to a holding tank, and finally to a head tank.
- MIBC (or equivalent): MIBC would be transferred from trucks to a holding tank and, as needed, to a head tank.
- AERODRI 100: Used as a filter and dewatering aid, would arrive on-site in 500-pound drums. The reagent would be fed directly from the drums into the milling process.
- Sulfuric acid: Use of small amounts (<100 pounds) of sulfuric acid would be limited to the laboratory.

All reagent storage tanks and mixing areas would be located inside secondary containment to protect soils and groundwater. A collection sump and pump system would be provided at each containment to return spilled material back to a storage tank or into the milling process as necessary. Material Safety Data Sheets for the reagents to be used would be readily available in accordance with MSHA's *Hazard Communication for the Mining Industry* (30 CFR Part 47).

Hazardous materials management: In 49 CFR 172.101, the Hazardous Materials Table designates the materials listed as "hazardous materials for the purpose of transportation of those materials". Hazardous substances are designated as such in 40 CFR 302.4 and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) Title III. Hazardous materials would be transported to the Copper Flat mine by DOT-regulated transporters and stored on-site in DOT-approved containers. Spill containment structures would be provided for storage containers. Hazardous materials would be managed in accordance with regulations identified in 40 CFR 262 Standards Applicable to Generators of Hazardous Waste.

Hazardous materials and substances that may be transported, stored, and used at the Copper Flat mine in quantities less than the threshold planning quantity designated by SARA Title III for emergency planning would include blasting components, petroleum products, and small quantities of solvents for laboratory use. Small quantities of hazardous materials not included in the above list may also be managed at the Copper Flat project; such materials are contained in commercially produced paints, office products, and automotive maintenance products.

Blasting components, including ammonium nitrate and diesel fuel, would be stored on-site in bins and tanks. NMCC currently anticipates utilizing two explosives magazines (one for boosters and one for blasting caps), each no larger than 8 feet by 8 feet, with 1,000-pound capacities. In addition, NMCC would utilize one 75-ton capacity silo for storage of ammonium nitrate. All explosive materials would be stored away from the plant site in compliance with MSHA, the New Mexico SMI's regulations, and U.S. Department of Homeland Security requirements. Management of hazardous materials at the Copper Flat project would comply with all applicable Federal, State, and local requirements, including the inventory and reporting requirements of Title III of CERCLA, also known as the Emergency Planning and Community Right to Know Act. All petroleum products, kerosene, and reagents used in the mill would be stored in aboveground tanks within a secondary containment area capable of holding 110 percent of the volume of the largest vessel in the area.

The spill contingency plan (SCP) would be reviewed and updated at a minimum of every 3 years and whenever major changes are made in the management of these materials. Inspection and maintenance schedules and procedures for the tanks, as well as all piping connecting the facility with the tailings pond, would be set forth in the sections of the SCP that address hazardous materials and petroleum products. Fuel and oil for diesel- and gas-powered equipment would be stored in aboveground, sealed tanks located near the processing facilities area. The tanks would have secondary containment capable of holding 110 percent of the volume of the largest vessel. Designated fuel dispensing areas would be lined pads consisting of gravel underlain by a plastic liner. Surface piping would lead from each tank to the fuel dispensing area. The refueling hoses would be equipped with overflow prevention devices and emergency shutoff valves. Storage of refueling hoses would be within secondary containment. Other refueling would occur in the field utilizing fuel/lube service trucks with either secondary containment built into the truck or the vehicle would be parked within an area having secondary containment when not in use.

Hazardous wastes, other than those from the laboratory, would also be managed in the short-term storage facility prior to their shipment to an off-site licensed disposal facility. These materials may include waste paints and thinners. Spent solvents and used oils would be returned to recycling facilities. Waste oil and lubricants would be collected and hauled off-site by a buyer/contractor for recycling. Solvents would be collected by a subcontractor and recycled off-site.

An ongoing inventory of all materials used at the mine area and mill would be provided on a monthly basis to the appropriate Federal, State, and local regulatory agencies. The local fire department would be kept informed about materials stored on-site and appropriate emergency response.

SCP: NMCC has developed a preliminary SCP to prevent and limit the impacts of a reagent or fuel spill. This plan describes the reporting and response that would take place in the event of a spill, release, or other upset condition, as well as procedures for cleanup and disposal. The plan would be posted and distributed to key site personnel and would be used as a guide in the training of employees. Also, the plan would address mitigation of potential spills associated with project facilities as well as activities of on-site contractors. The use, transportation, and storage of reagents and fuels would be covered in the plan. The emergency reporting procedures would be posted in key locations throughout the mine area. Containment structures designed to prevent the migration of a spill are included in the design of the facilities.

NMCC would be responsible for spill events at the mine area, while contract haulers (i.e., trucking companies) would be responsible for accidents and spills along the transportation routes. Fuel and oil for the diesel- and gasoline-powered equipment would be stored in aboveground, sealed tanks near the processing facilities area. The tanks would have secondary containment capable of holding 110 percent of the volume of the largest vessel. Reporting of spills or releases of certain materials to the environment may be divided into four categories:

- Those requiring internal notification only;
- Those also requiring notification to the State of New Mexico;
- Those also requiring notification to the National Response Center and the local emergency planning committee pursuant to CERCLA or Superfund; and
- Those subject to Clean Water Act requirements only.

Determining which of the above categories is appropriate for any particular spill or release depends on the material spilled or released, the amount spilled or released, and the circumstances of the spill or release.

Monitoring: Baseline monitoring of current environmental conditions was conducted in 2010, 2011, 2012, and 2013 in accordance with the Sampling and Analysis Plan for Copper Flat mine. This plan, known as the Copper Flat Monitoring Plan, was developed to collect local and regional baseline information and provides the basis for the monitoring of regional impacts that may result from the operation of the mine. This plan would be updated as detailed engineering for the proposed mine facilities is completed, and the monitoring requirements become more defined.

Technical updates: During the course of operations, NMCC would periodically review and update the geochemical and hydrogeological predictions, mine waste characterization studies, and pit lake studies to incorporate new information accumulated during operations. NMCC would review the data every 5 years and make updates as necessary. These updates would provide quantitative predictions of water quality during the operational and post-closure period. Mitigation would be developed as necessary.

Sustainability: NMCC recognizes the social and economic impacts from "boom and bust cycles" that sometimes occur in connection with the mining industry. In addition, removal of facilities that may have post-mining uses is not in accordance with the overall environmental practice of conservation. NMCC would work with the local and regional communities to identify post-mining uses of the land and facilities to enhance opportunities to sustain the economy and culture in the post-mining phase of this project.

Environmental baseline: For the purpose of establishing baseline conditions for environmental resources at the Copper Flat mine area prior to beginning mining operations, NMCC has gathered resource data and conducted surveys for potentially disturbed land within the mine area for the project. These baseline conditions are documented in baseline data reports used in this EIS as a tool to identify and evaluate changes from baseline environmental conditions.

Land has also been identified that would be disturbed outside the mine area. There are nine millsite claims that were previously established by Quintana. The 5-acre millsite claims would be used for staging, equipment, well pads, water tanks, pumping systems, truck access, and structures to maintain the water supply pumping stations.

The disturbed land outside the mine area was independently surveyed to establish an environmental baseline that is also used in this EIS as a tool to identify and evaluate changes from baseline environmental conditions.

2.2 ALTERNATIVE 1: ACCELERATED OPERATIONS – 25,000 TONS PER DAY

In 2011 and 2012, NMCC followed the standard industry practice of performing a preliminary feasibility study to further develop internal engineering plans for the Copper Flat mine. In addition, an expanded resource exploration program was launched at Copper Flat to better define the ore body. The result of these two efforts was a NMCC-revised plan of development for Copper Flat based on new, more detailed information about the ore body and the engineering studies. NMCC's preliminary feasibility study for Copper Flat maintained the same locations indicated in the Proposed Action for the proposed mine pit, processing area, and TSF, but refined the process to reflect better engineering data, increase the mine efficiency, and improve project economics.

Overall, this alternative (Alternative 1 or the Accelerated Operations Alternative) to the Proposed Action would have the same general scale and scope of operation, with differences largely attributable to higher process rates to improve project viability, and some increases in efficiency wherever possible. Table 2-15 below describes the differences between the Proposed Action and this alternative.

This section highlights only those activities and conditions that would change as a result of accelerating the operations. The source for this section is NMCC 2012d - Mine Operation and Reclamation Plan, NMCC, dated July 18, 2012. Additional information has been collected which updates the MORP. That information is included and is referenced separately.

The project would directly impact 1,401 acres as shown in Table 2-16. Of this, 644 acres would be public land and 757 acres would be private land. Disturbance at ancillary facilities would be the same as the Proposed Action.

Table 2-15. Summary of Differences Between Proposed Action and Alternative 1

Table 2-15. Summary of Differences Between Proposed Action and Alternative 1	
No Change from Proposed Action	**Changes from Proposed Action**
• General scale and scope of the operation • Total ore tons processed • Mining process o Open pit o Drill, blast, loader, truck o Type of equipment used • Mineral beneficiation process o Crush, grind, sulfide flotation, concentrate filtering o Type of equipment used • Tailings storage o Conventional slurry o Raised TSF o Centerline construction with tailings sand o Fully lined o Monitoring systems • Type of mine & process equipment used • Three final products o Copper concentrate with gold & silver o Molybdenum concentrate o A small amount of coarse gold concentrate • Concentrate handling, shipping methods, shipping route, destination • Operating schedule (24 x 7) • Size of the mine area • Location and siting of the proposed facilities • Reuse of existing infrastructure and site grading • Reuse of existing diversion structures • Ongoing exploration • Concurrent reclamation practices • Reclamation standards and methods (with updates to new regulations) • Planned water conservation activities standard aspect of operating plan • Water source, storage, and delivery/distribution systems • Surface and groundwater protection methods • Standards for groundwater monitoring around facilities • Power source, transmission, and distribution systems • Growth media borrow and storage plans • Fencing and exclusionary devices • General viewshed • Construction workforce required • Mine workforce required • Construction and mine workforce skill requirements • No heap leach • No on-site smelting/refining • No placer mining	• Process rate increased to nominal 25,000 tpd to improve project economics • Mine life shortened to 11 years due to higher process rate • Whole tailings thickener removed from tailings flowsheet in order to improve TSF stability • Non-process water use decreases due to more efficient designs • Annual water use increases due to higher process rate • Duration of water use decreases due to higher process rate • Total water use over the life of the mine increases slightly due to higher process rate • Total disturbance footprint reduced due to more efficient design • Number and disturbance footprint of rock storage piles reduced due to more efficient design • Power requirements increase due to increased process rate • Concentrate loads trucked on NM-152 and US I-25 increase due to higher process rate

Source: NMCC 2012d.

Table 2-16. Summary of Proposed Disturbance Within the Mine Area – Alternative 1

Disturbance	Total (Acres)
TSF	619
Open pit	156
WRDFs	237
Low-grade ore stockpile	41
Haul roads	25
Plant site area	129
Growth media stockpiles	112
Diversion structures	44
Exploration	40
Total disturbance	**1,401***
Public land	644
Private land	757

Source: NMCC 2014a.

* Totals are rounded for simplicity.

The Accelerated Operations Alternative proposes to increase material processing at the mine from 17,500 tpd to 25,000 tpd. Annually, the mining operation would process an estimated 9.1 million tons of copper ore mill feed. The operations include the phases and activities summarized below. In general, these phases are sequential, but there would be some overlap as the activities of an earlier phase continue during the implementation of subsequent phases.

- Pre-construction (permitting) - 2 years;
- Construction (site preparation) - 1.5 years;
- Operations (mineral beneficiation) - 11 years;
- Closure/reclamation - 3 years; and
- Post-closure monitoring, care, and maintenance - 12 years.

As with the Proposed Action, the plant facilities would be constructed at the site of the original Quintana plant site, and, to the extent practicable, would use most of the original concrete foundations. The plant site, which would include the crusher, concentrator, assay lab, mine shop, warehouse, security, and administration buildings, would occupy approximately 129 acres and would be located between the open pit and the TSF area. Scheduled operations and saleable products would be the same as with the Proposed Action.

2.2.1 Mine Operation - Open Pit

As with the Proposed Action, the mining of new ore would entail the expansion of the existing open pit, and the Copper Flat ore body would be mined by a multiple bench, open pit method. Over the life of the project, this alternative would produce approximately 100 million tons of copper ore, 60 million tons of waste rock, and 3 million tons of low-grade copper ore (less than 0.20 percent copper). The existing pit would eventually be enlarged to a diameter of approximately 2,800 feet with an ultimate depth of approximately 900 feet. The area of the pit would be expanded to 156 acres. The existing diversion of Greyback Arroyo, located south of the pit, would not be altered by the proposed pit expansion. The processing of the ore would be the same as with the Proposed Action.

As under the Proposed Action, mine equipment types would consist of standard off-the-shelf units. Table 2-17 summarizes the major mine equipment units that would be present on-site throughout the life of the mine.

The amount of equipment proposed for use under this alternative is larger than that for the Proposed Action because of the accelerated mining process. In addition, a 19.6-cubic-yard hydraulic shovel and a 17-cubic-yard front-end loader is proposed under this alternative to match production requirements based on the financial analysis of the mine schedule (NMCC 2012c). The number of blast hole drills would also be increased under this alternative due to the increased rate of ore processing.

Table 2-17. Major Mine Equipment Fleet on Hand

Equipment	Year of Operation											
	-1	1	2	3	4	5	6	7	8	9	10	11
Blast hold drill, 45,000 lb.	1	3	3	3	3	3	3	3	3	3	3	3
Hydraulic shovel, 19.6 cubic yard	-	1	1	1	1	1	1	1	1	1	1	1
Loader, 17 cubic yard	1	1	1	1	1	1	1	1	1	1	1	1
Haul truck, 100 tons	4	8	9	9	9	10	10	10	10	10	10	10
Track dozer, 410 HP (D9T)	3	3	3	3	3	3	3	3	3	3	3	3
Wheel dozer, 354 HP (824H)	1	1	1	1	1	1	1	1	1	1	1	1
Motor grader, 16’ (16M)	2	2	2	2	2	2	2	2	2	2	2	2
Water truck, 10,000 gal.	2	2	2	2	2	2	2	2	2	2	2	2
Pioneer drill	1	1	1	1	1	1	1	1	1	1	1	1
Backhoe, 2 cubic yard	1	1	1	1	1	1	1	1	1	1	1	1
Total	**16**	**23**	**24**	**24**	**24**	**25**	**25**	**25**	**25**	**25**	**25**	**25**

Source: NMCC 2014a.

Note: Units owned based on fleet buildup and replacement.

2.2.2 Ore Processing

Ore processing would be the same as for the Proposed Action with one exception: the processing rate would be 25,000 tpd. A depiction of the proposed mining process is shown in Figure 2-8.

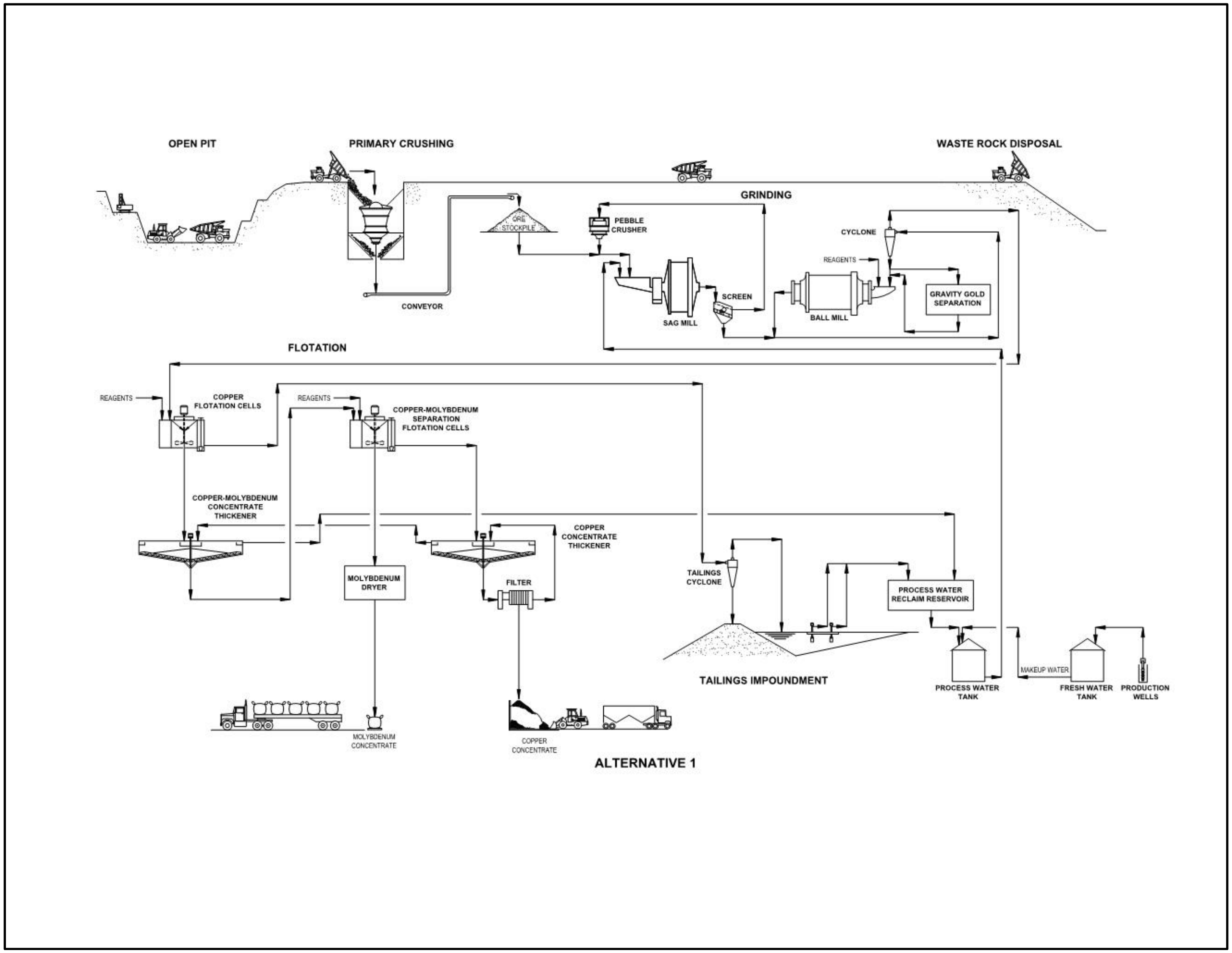
2.2.3 Mine Facilities

The primary mine facilities would be the same as the Proposed Action with the exception of the elimination of those facilities associated with tailings thickener (tailings cyclone thickener and tailings glandseal water tank) (NMCC 2014a). These facilities would not be required because the use of a gravity discharge disposal method would be implemented. The proposed mine and facility layouts are shown in Figures 2-9 and 2-10.

Equipment in the concentrator building is expected to consist of the following (NMCC 2014a):

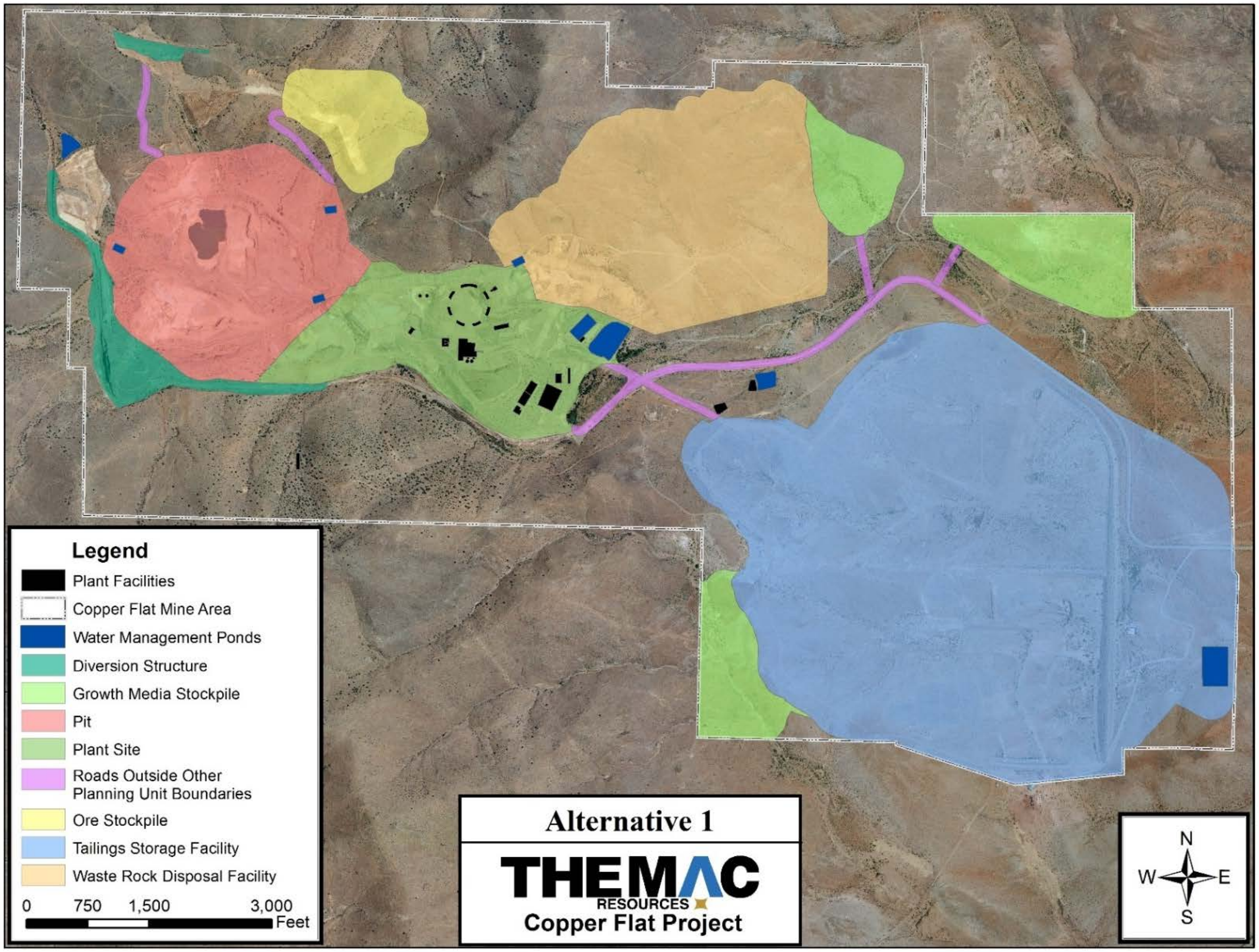
- Primary crushing - Same as with the Proposed Action.
- Grinding - Same as with the Proposed Action except instead of an 18-foot by 24-foot ball mill there would be one 24-foot-diameter by 35-foot-long ball mill, 12,700 hp.
- Flotation - Same as with the Proposed Action.
- Concentrate - Same as with the Proposed Action.

Figure 2-8. Mining Process – Alternative 1



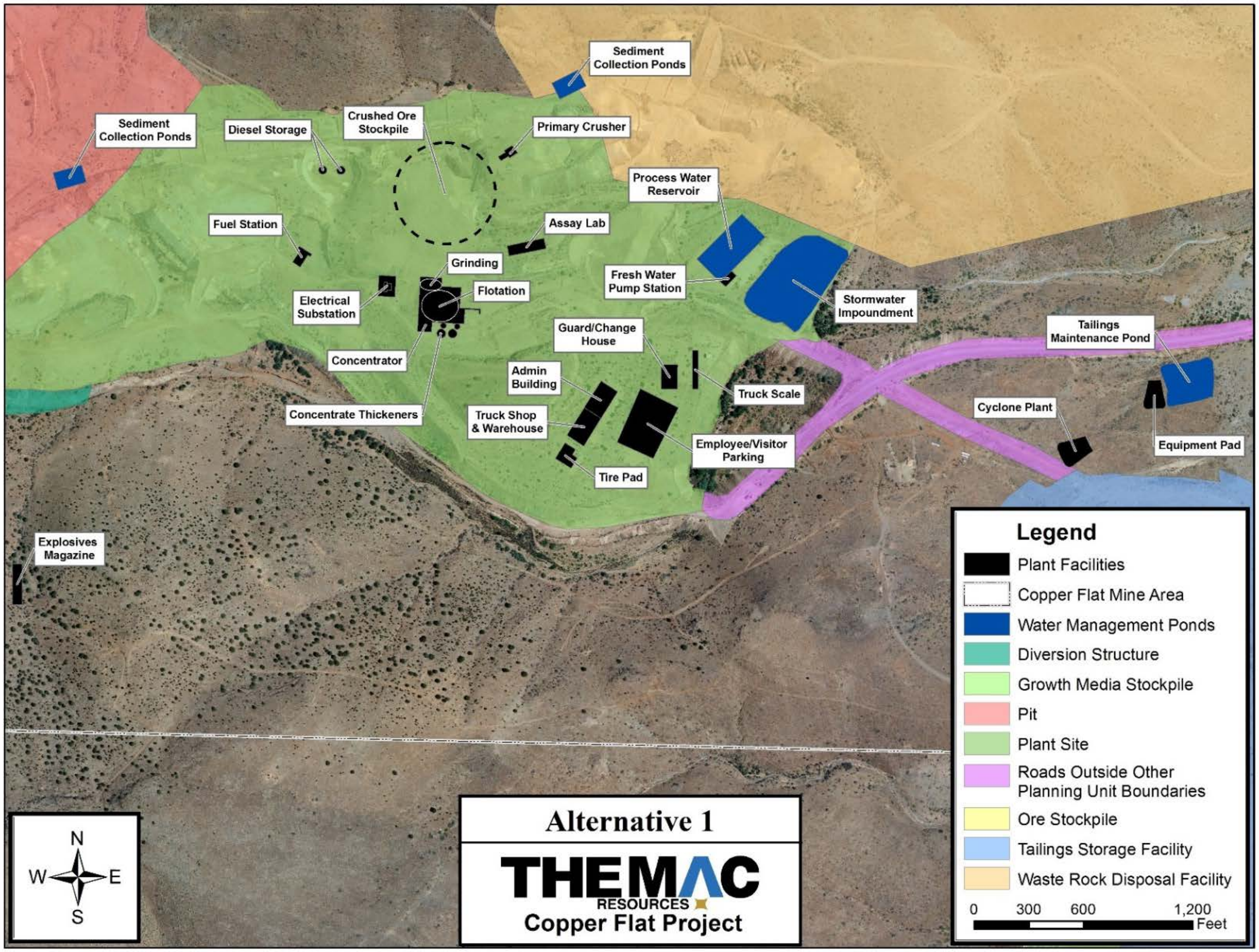
Source: NMCC 2012c.

Figure 2-9. Mine Layout – Alternative 1



Source: NMCC 2015a.

Figure 2-10. Mine Facilities – Alternative 1



Source: NMCC 2012d.

2.2.3.1 Tailings Storage Facility

The existing TSF at Copper Flat was constructed by Quintana Minerals to serve their 1982 mining operation. The storage facility received 1.2 million tons of material and was essentially reclaimed in 1986. The TSF remains in place and is located southeast of the former plant site. NMCC proposes to construct a new lined TSF over the area used by previous operations for tailings storage. Tailings would be transported from the mill via slurry pipeline and deposited in the new TSF. Ancillary facilities associated with the TSF would include a tailings slurry delivery system, a tailings solution reclaim and recycling system (barge pump system), and an underdrain seepage return system.

Approximately 100 million tons of tailings are expected to be stored over the life of the project for this alternative. Tailings deposition would be approximately 25,000 tpd. During progressive settlement, water would be pumped from the TSF and returned to the process circuit. The total expected water recovery by reclaim systems would be a nominal 70 percent.

The size and location of the storage facility pool would vary during the life of the project. The size of the pool would be affected by pre-deposition grading in the storage facility, the amount of tailings deposited, precipitation, evaporation rates, seepage rates into the designed embankment seepage collection system, infiltration into underlying soils and water recycling rates. The location of the pool would migrate within the storage facility as tailings beaches form. Tailings deposition would be managed to force the pool away from the embankment toward the upstream reaches of the storage facility. The TSF would be fenced to restrict access.

TSF design: The TSF would be designed and would be constructed and maintained to prevent adverse impacts to the hydrologic balance and adjoining property and to assure the safety of the public. Water reporting to the TSF would be recovered from the pool of water that would form in the storage facility and be returned to the mill process water system for reuse. Precipitation would also contribute to the volume of water in the storage facility. The height of the embankment would be designed so that the storage facility completely contains both the normal operating volume of water and the amount of stormwater runoff from 100 percent of the PMP. The U.S. Department of Commerce (1988) estimates the 72-hour PMP depth is approximately 26 inches in the vicinity of the mine area. The TSF was designed in accordance with the design and dam safety guidelines and regulations of the OSE Dam Safety Bureau.

TSF process: The use of a high rate thickener as utilized in the Proposed Action constrains operations for an increased rate of ore processing. This constraint would only be alleviated by significantly increasing the footprint of the TSF. Instead, this alternative proposes to use a gravity discharge disposal method for tailings slurry that is not thickened.

The tailings from the proposed re-opening of the mine would be contained in a new TSF, which would be constructed at the same location as the previous Quintana operation at the site. The new TSF would be expanded approximately 1,000 feet to the east of the existing unlined TSF. The TSF would be constructed with a synthetic HDPE liner and drainage system to limit the opportunity for seepage to impact the groundwater, as required by the NMED.

Tailings from a sump located at the concentrator would be transported by gravity flow to a cyclone plant with pump station at the periphery of the TSF. Following cyclone separation of the sand fraction, cyclone underflow and overflow would be delivered to the TSF in separate piping systems.

Delivery of the underflow sand would require pumping through the life of the facility. Delivery of the cyclone overflow would be by gravity until the later stages of the operation. Following cyclone classification, the underflow (sands) and overflow (fine-grained tailings) would be routed to a pumping station with separate pump streams for the underflow and the overflow tailings. The underflow sand would be discharged on the dam crest and downstream dam slope and used for dam construction in a centerline construction scheme. Cyclone overflow would be routed to the interior of the TSF. Sand line spigots would be used to deposit the cyclone underflow in paddocks (bermed areas) or on the downstream slope of the sand dam.

Primary considerations for effective dam construction practices include adequate drainage and compaction of the underflow sand. Industry experience indicates that compaction to a relative density of 60 percent (equivalent to approximately 90 percent of ASTM D698 maximum dry density) would result in low potential for liquefaction under static and seismic loading conditions. Meeting compaction requirements would require that the underflow sand be placed or spread in thin lifts and exposed to evaporation and drainage prior to compaction. Process water would be reclaimed from reclaim pumps on barges located in the supernatant pond in the TSF and in a seepage collection pond. Reclaim water would be returned to the process water storage reservoir in the process facilities area. Reclaim pump capacity on both barges would be approximately 11,000 gpm, which is generally equivalent to the maximum rate at which process water is delivered to the cyclone plant and tailings distribution system in whole tailings slurry. All process water make-up requirements can be met by pumping from either reclaim location. In the event of a significant storm event where excess stormwater is in storage, delivery of water from external sources can be suspended and stormwater can be returned to the process facilities and consumed as bound water in the tailings.

Entrainment represents the most significant water loss and is estimated on the basis of the final, post-deposition dry density for cyclone underflow, cyclone overflow, and whole tailings, and the relative production rates for each material.

The estimated process water recovery rate averaged 8,552 gpm. Given the average whole tailings slurry water content of 10,801 gpm, the average make-up water requirement for 25,000 tpd ore processed is estimated to be 2,249 gpm or approximately 119 gallons per ton of ore processed assuming a 92 percent plant utilization rate.

TSF monitoring: TSF monitoring would be the same as for the Proposed Action.

2.2.3.2 Ancillary Facilities

The ancillary facilities would be the same as for the Proposed Action.

2.2.3.3 Sanitary Wastewater Treatment

The sanitary wastewater treatment facilities would be similar to the Proposed Action. Sewage waste would be disposed of through a septic tank and leach field system permitted by the NMED. The waste system would be connected to project buildings. Sierra County would require a septic system permit designed by a qualified New Mexico licensed professional engineer. The exact location of the septic system has not been identified. Appropriate percolation tests would be conducted to prepare the necessary septic system designs for the project. Sanitary waste during the construction phase of the project would be collected in a system of portable chemical toilets. These would be periodically cleaned and emptied by a licensed contractor and the waste transported off-site for disposal.

2.2.4 Waste Rock Disposal Facility

As with the Proposed Action, the WRDF would be located adjacent to the open pit in an area used for waste rock disposal by the previous operator on the east side of Animas Peak. This disposal area would be expanded to cover approximately 237 acres, and at the end of the mine life, the height of the disposal area would be at 5,775 feet above sea level. Total material contained in the WRDF at the end of the expected life of the project would be approximately 60 million tons. The low-grade stockpile would cover an area of approximately 41 acres and include about 3 million tons of rock assaying less than 0.20 percent copper. As with the Proposed Action, the WRDF would be regraded and reclaimed to blend into the surrounding topography to the extent practicable.

2.2.5 Project Workforce and Schedule

The estimated operational life required to recover the proven minerals (copper, molybdenum, gold, and silver) is 11 years. Labor requirements for the mine are displayed below in Table 2-18.

Table 2-18. Mine Personnel Requirements – Year One – Alternative 1

Table 2-18. Mine Personnel Requirements – Year 1 – Alternative 1	
Work Type	**Number of Employees**
Mine salary	10
Mine operators	52
Mobile maintenance	26
Mine tech services	4
Process salary	8
Process operators	30
Process maintenance, electricians, etc.	17
Process tech services	6
Administration	17
Total mine workforce	**170**

Source: NMCC 2014a.

2.2.6 Electrical Power

The electrical power supply would be the same as the Proposed Action.

For most aspects of the operation, unit power demand (kilowatt hours per ton [kwh/ton]) is constant among all plans. This is the result of unit operations and material processed being the same between all plans. The difference between the three plans is seen when power demand is presented as total power used in a given time period (hour, day, or year). Power used is a function of the processing rate and, therefore, the power need for a specific period increases as more tons are processed in that same period. Because of the increased processing rate, the electrical demand would increase. The plant electrical load requirement for the 25,000 tpd processing rate (9.1 million tpy) is tabulated below in Table 2-19.

Table 2-19. Summary of Average Project Electrical Demand

Table 2-19. Summary of Average Project Electrical Demand		
Activity	**Power Demand (kWh/ton)**	**Power Demand (GWh/Year)**
Crushing	0.38	3.46
Grinding	15.71	142.96
Flotation	2.50	22.75
Molybdenum plant	0.14	1.27
Concentrate filtering	0.16	1.46
Tailings system	0.50	4.55
Reagent system	0.24	2.18
Water system	2.69	24.48
Ancillaries	0.05	0.46
Total	**22.37**	**203.57**

Source: NMCC 2014a.

As with the Proposed Action, an emergency generator would be installed on-site for backup power in the event of power loss to maintain critical systems and to aid in a controlled shut down. On-site power distribution would include one 25-kV distribution line. Because the configuration and size of these distribution lines, standard raptor proof protective designs would be incorporated into the line design and line upgrade, as presented in the Rural Electrification Administration guidelines. This design would be used for the entire length of the distribution line within the mine area.

2.2.7 Water Supply

The water supply descriptions and defining classifications for Alternative 1 are the same as the Proposed Action. Differences between Alternative 1 and the Proposed Action are seen in quantities of water use and supply.

2.2.7.1 Water Use

Total water use for the Copper Flat mine, including all recycled water, would be approximately 18,674 AFY on average. Total water use is presented below in Table 2-20.

Table 2-20. Total Water Use – Alternative 1

Table 2-20. Total Water Use - Alternative 1		
	Alt 1*	**Proposed Action***
Average annual water use during ore processing (AF)	18,674	13,370
Average water used to process 1 ton of material (gallons)	667	682
Total water use – life of mine (AF)	214,000	212,000

Source: NMCC 2018c.

Note: * Includes recycled water.

Ninety-five percent of the water used would be for processing copper ore. The other 5 percent of water use would be for dust control, maintenance, laboratory, and domestic use. Average annual water use by process is presented below in.

Table 2-21. Water Use by Process – Alternative 1

Table 2-21. Water Use by Process – Alternative 1				
Water Use	Acre-Feet per Year			Percent of Total
	Recycled	Non-recycled	Total	
Ore Processing:				
Reclaimable TSF water	12,845	0	12,845	69%
Water retained in tailings	0	4,144	4,144	22%
Evaporation	0	703	703	4%
Concentrates	0	13	13	<1%
Subtotal	**12,845**	**4,860**	**17,705**	**95%**
Dust control	0	726	726	4%
Other	0	242	242	1%
Total use	**12,845**	**5,828**	**18,674**	**100%**

Source: NMCC 2018c.

Note: Columns may not sum exactly due to rounding.

2.2.7.2 Water Sources

Table 2-22 and Figure 2-11 shown below summarize the sources of water that would be used at Copper Flat for Alternative 1.

Table 2-22. Water Sources – Alternative 1

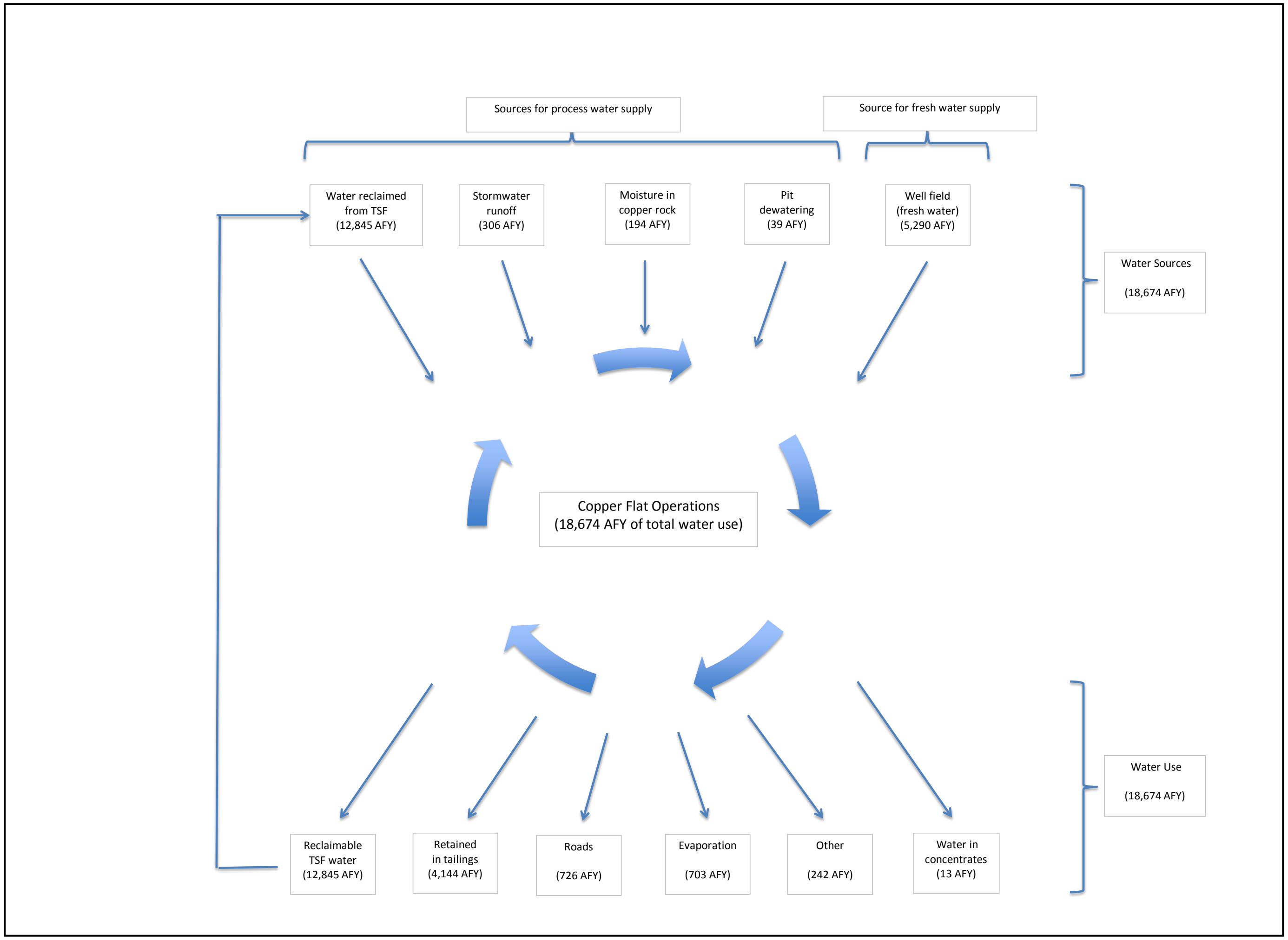
Table 2-22. Water Sources – Alternative 1				
Water Source	Acre-Feet per Year			Percent of Total
	Recycled	Non-recycled	Total	
Process Water:				
Water reclaimed from TSF	12,845	0	12,845	69%
Stormwater	306	0	306	2%
Moisture in the ore	194	0	194	1%
Pit dewatering	39	0	39	>1%
Subtotal	**13,384**	**0**	**13,384**	**72%**
Fresh water during mine operation (groundwater wells)	0	5,290	5,290	28%
Total use	**13,384**	**5,290**	**18,674**	**100%**

Source: NMCC 2018c.

Note: Columns may not sum exactly due to rounding.

Process Water Sources: The source, description, and operation of the process water sources would be the same as described in the Proposed Action. Process water sources would provide 13,384 AFY of water used by this alternative, or 72 percent of the total need. Stormwater management and use would be the same as described in the Proposed Action. Pit water management and use would be the same as described in the Proposed Action.

Figure 2-11. Copper Flat Water Sources and Water Use – Alternative 1



Source: THEMAC 2015.

Fresh water source: The source and operation for fresh water supply and delivery to the mine would be the same as described in the Proposed Action. The description of the four production wells and delivery system is the same as described in the Proposed Action. Fresh water would provide for 5,280 AFY (28 percent) of the total water used for this alternative.

2.2.7.3 Water Conservation

Water conservation activities would be the same as described in the Proposed Action.

2.2.7.4 Water Recycling

Water recycling activities would be the same as described in the Proposed Action.

2.2.7.5 Decreasing Water Demand

Activities to decrease water demand would be the same as described in the Proposed Action.

2.2.8 Growth Media

Growth media would be addressed in the same manner as the Proposed Action.

2.2.9 Borrow Areas

Borrow areas with this alternative would be addressed the same as with the Proposed Action.

2.2.10 Inter-Facility Disturbance

Inter-facility disturbance with this alternative would be the same as with the Proposed Action.

2.2.11 Fencing and Exclusionary Devices

Fencing and exclusionary devices employed with this alternative would be the same as with the Proposed Action.

2.2.12 Haul Roads and On-Site Service Roads

Haul roads and on-site service roads with this alternative would be the same as with the Proposed Action.

2.2.13 Transportation

Transportation measures employed with this alternative would be the same as with the Proposed Action. Exceptions would be for increased levels of activities for concentrate shipments because of the increased processing rate. The proposed schedule for concentrate shipments would be:

- Copper concentrate shipment schedule (hauling weekdays only) would be:
  - Years 1–5: ship 12 to 16 truckloads per day, 5 days per week; and
  - Years 6 +: ship 8 to 12 truckloads per day, 5 days per week.
- Molybdenum concentrate shipment schedule (hauling weekdays only) would be:
  - Life of mine: ship three truckloads per month (NMCC 2014a).

2.2.14 Exploration Activities

The exploration activities with this alternative would be the same as with the Proposed Action.

2.2.15 Reclamation and Closure

The reclamation and closure measures employed with this alternative would be the same as with the Proposed Action. Solution flow from underdrainage during ore processing would be 1,600 gpm under this alternative. The draindown rate at 6 months following process shutdown would be 1,100 gpm.

2.2.16 Environmental Protection Measures

The environmental protection measures employed with this alternative would be the same as with the Proposed Action with one exception:

- In reagent management there would not be any use of AERODRI 100 (ethanol, sodium dioctyl sulfosuccinate, 2-ethylhenanol).

2.3 ALTERNATIVE 2: ACCELERATED OPERATIONS – 30,000 TONS PER DAY

In 2013, NMCC followed the standard industry practice of conducting a definitive feasibility study, which follows and refines the preliminary feasibility study, to further fine-tune the internal plan of development for the Copper Flat mine. This study applied a more detailed approach to evaluating the mine processing circuit and overall initiative. The definitive feasibility study found that the mine would be more efficient with an increase to the TSF capacity and an increase to the annual ore processing rate. Alternative 2, as defined in this EIS, is based on the definitive feasibility study for Copper Flat and has a TSF that fits in the same footprint as the Proposed Action but with a larger volume for storage. Alternative 2, as defined in the EIS, has a 30,000 tpd plan with a 12-year mine life, but remains within the mine area evaluated under the Proposed Action. Additional details related to mine development planning and engineering prepared since the release of the DEIS may be found in the NPDES permit and the MORP (NMCC 2017a).

40 CFR 1500-1508 specifies the requirements for an EIS. In these regulations, it is stated:

> "**§1502.14 Alternatives including the proposed action.** This section is the heart of the environmental impact statement. Based on the information and analysis presented in the sections on the Affected Environment (§1502.15) and the Environmental Consequences (§1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public. In this section agencies shall:
>
> (e) Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference."

In accordance with the requirements stated in these regulations, the BLM has designated Alternative 2 as the Preferred Alternative. This alternative has the same general scale and scope of the Proposed Action but proposes to process 25 million tons of ore more than the Proposed Action and Alternative 1. The other main differences are derived from an increase in the process rate to improve project economics and increases in efficiency where possible. Table 2-23 shown below briefly describes the differences between the Proposed Action and this alternative.

Table 2-23. Summary of Differences Between Proposed Action and Alternative 2

Table 2-23. Summary of Differences Between Proposed Action and Alternative 2	
No Change from Proposed Action	**Changes from Proposed Action**
• General scale and scope of the operation • Mining process o Open pit o Drill, blast, loader, truck o Type of equipment used • Mineral beneficiation process o Crush, grind, sulfide flotation, concentrate filtering o Type of equipment used • Tailings storage o Conventional slurry o Raised TSF o Centerline construction with tails sand o Fully lined o Monitoring systems • Type of mine & process equipment used • Three final products o Copper concentrate with gold & silver o Molybdenum concentrate o A small amount of coarse gold concentrate • Concentrate handling, shipping methods, shipping route, destination • Operating schedule (24 x 7) • Size of the mine area • Location and siting of the proposed facilities • Reuse of existing infrastructure and site grading • Reuse of existing diversion structures • Ongoing exploration • Concurrent reclamation practices • Reclamation standards and methods (with updates to new regulations) • Planned water conservation activities standard aspect of operating plan • Water source, storage, and delivery/distribution systems • Surface and groundwater protection methods • Standards for groundwater monitoring around facilities • Power, transmission, and distribution systems • Growth media borrow and storage plans • Fencing and exclusionary devices • General viewshed • Construction workforce required • Construction and mine workforce skill requirements • No heap leach • No on-site smelting/refining • No placer mining	• Process rate increased to nominal 30,000 tpd to further improve project economics to meet minimum finance requirements • Total life of mine tons processed increased 25 million tons due to exploration success • Mine life shortened to 12 years due to higher process rate • Whole tailings thickener removed from tailings flowsheet in order to improve TSF stability • Non-process water use decreases due to more efficient designs • Annual water use increases due to higher process rate • Duration of water use decreases due to higher process rate. • Total water use over the life of the mine increases slightly due to higher process rate. • Total disturbance footprint reduced due to more efficient designs • Number and disturbance footprint of rock storage piles reduced due to more efficient design • Power requirements increase due to increased process rate. • Alternate power source selected • Concentrate loads trucked on NM-152 and US I-25 increase due to higher process rate • Lime silo increased to 300-ton capacity due to increased processing rate. • Mine workforce increases due to increased process rate • A package wastewater treatment plan proposed instead of septic tanks and leach field • Reclamation & closure: At time of closure, the BLM would determine whether buried pipelines and electrical conduits would be left in place.

Source: NMCC 2017a.

This section highlights only those activities that would change as a result of accelerating the operations. The source for this section is NMCC 2013 - Alternative 2 – Summary Plan of Operations, NMCC, dated October 10, 2013. Additional information has been collected which updates the Summary Plan. That information is included and is referenced separately.

The project would directly impact 1,444 acres as shown below in Table 2-24. Of this, 630 acres would be public land and 814 acres would be private land. Disturbance at ancillary facilities would be the same as the Proposed Action.

Table 2-24. Summary of Proposed Disturbance Within the Mine Area – Alternative 2

Table 2-24. Summary of Proposed Disturbance Within the Mine Area – Alternative 2	
Disturbance	**Total (Acres)**
TSF	633
Open pit	161
WRDFs	289
Haul roads	34
Plant site area	139
Growth media stockpiles	114
Diversion structures	33
Exploration	40
Total disturbance	**1,444***
Public land	630
Private land	814

Source: NMCC 2014a.

Note: *Totals are rounded for simplicity.

The Accelerated Operations Alternative proposes to increase material processing at the mine from 17,500 tpd to 30,000 tpd. Annually, the mining operation would process an estimated 10.8 million tons of copper ore mill feed. The operations include the phases and activities summarized below. In general, these phases are sequential, but there would be some overlap as the activities of an earlier phase continue during the implementation of subsequent phases.

- Pre-construction (permitting) - 6 years (estimated);
- Construction (site preparation) - 2 years;
- Operations (mineral beneficiation) - 12 years;
- Closure/reclamation - 3 years; and
- Post-closure monitoring, care, and maintenance – 12(+) years.

As with the Proposed Action, the plant facilities would be constructed at the site of the original Quintana plant site, and, to the extent practicable, would use most of the original concrete foundations. The plant site, which would include the crusher, concentrator, assay lab, mine shop, warehouse, security, and administration buildings, would occupy approximately 114 acres and would be located between the open pit and the TSF area. Scheduled operations and saleable products would be the same as with the Proposed Action.

2.3.1 Mine Operation - Open Pit

As with the Proposed Action, the mining of new ore would entail the expansion of the existing open pit, and the Copper Flat ore body would be mined by a multiple bench, open pit method. Over the life of the project, this alternative would produce approximately 125 million tons of copper ore, 33 million tons of waste rock, and 3 million tons of low-grade copper ore (less than 0.20 percent copper). The existing pit would eventually be enlarged to a diameter of approximately 2,800 feet with an ultimate depth of approximately 1,000 feet. The area of the pit would be expanded to 165 acres. The existing diversion of Greyback Arroyo, located south of the pit, would not be altered by the proposed pit expansion.

The processing of the ore would be the same as with the Proposed Action. As with the 17,500 tpd that would be processed under the Proposed Action, mine equipment types would consist of standard off-the-shelf units. Table 2-25 below summarizes the major mine equipment units that would be present on-site throughout the life of the mine. As with Alternative 1, the amount of equipment would be greater due to the accelerated rate of mining compared to the Proposed Action.

Table 2-25. Major Pieces of Mining Equipment

Table 2-25. Major Pieces of Mining Equipment												
Equipment	Year of Operation											
	-1	1	2	3	4	5	6	7	8	9	10	11
Blast hold drill, 45,000 lb.	1	3	3	3	3	3	3	3	3	3	3	3
Loader, 17 yd^3	1	2	2	2	2	2	2	2	2	2	2	2
Haul truck, 100 tons	2	8	9	10	10	10	10	10	10	10	10	10
Track dozer, 410 HP (D9T)	1	3	3	3	3	3	3	3	3	3	3	3
Wheel dozer, 354 HP (824H)	1	1	1	1	1	1	1	1	1	1	1	1
Motor grader, 14’ (16M)	1	2	2	2	2	2	2	1	1	1	1	1
Water truck, 10,000 gal.	2	2	2	2	2	2	2	2	2	2	2	2
Pioneer drill	1	1	1	1	1	1	1	1	1	1	1	1
Backhoe, 2 yd^3	1	1	1	1	1	1	1	1	1	1	1	1
Total	**11**	**23**	**24**	**25**	**25**	**25**	**25**	**24**	**24**	**24**	**24**	**24**

Source: NMCC 2017a.

Note: Units owned based on fleet buildup and replacement.

2.3.2 Ore Processing

Ore processing would be the same as for the Proposed Action except for the following:

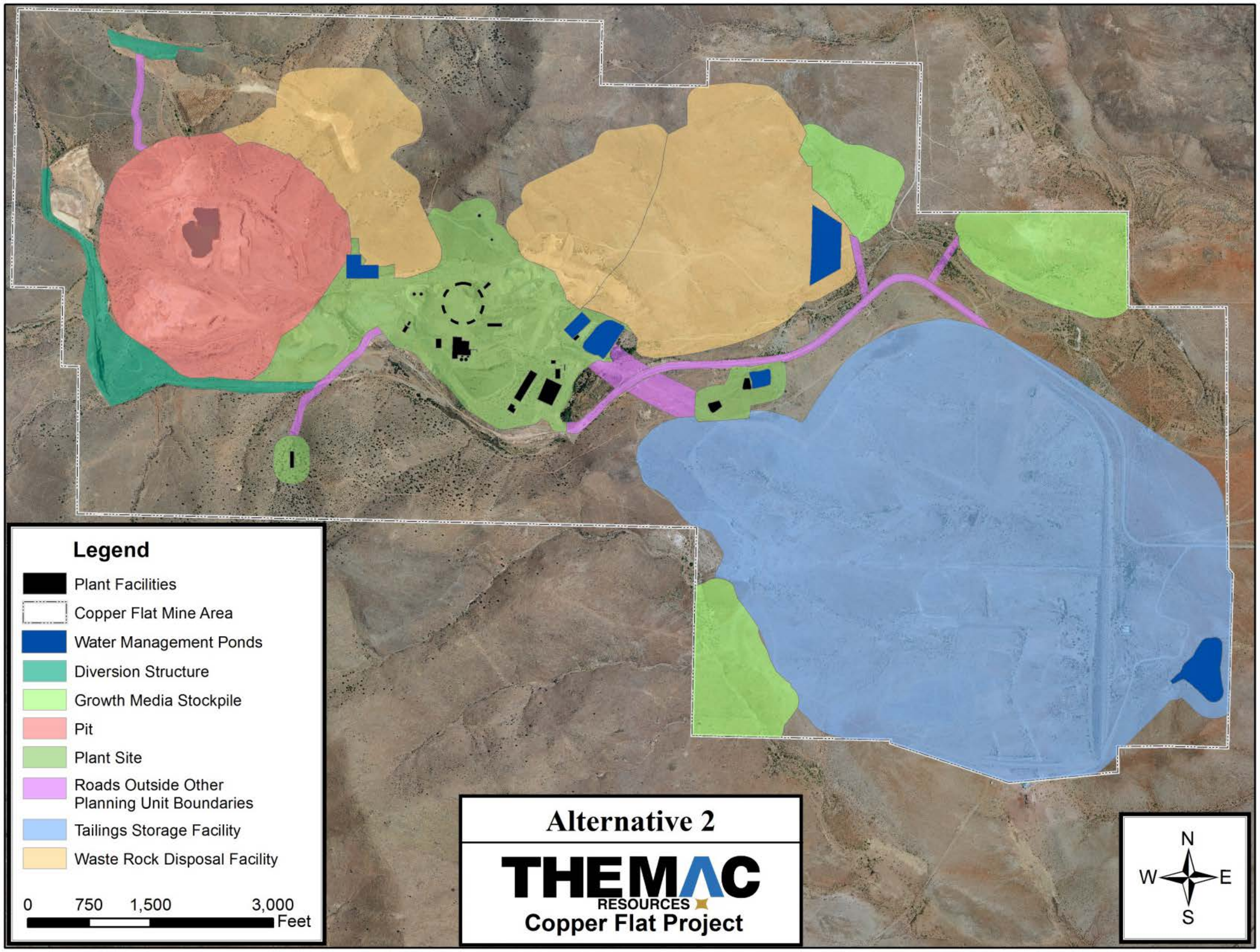
- The processing rate would be 30,000 tpd.
- Storage capacity of the lime silo would increase to 300 tons due to the increased processing rate.

The mining process for Alternative 2 is the same as Alternative 1, as shown above in Figure 2-8 (NMCC 2013).

2.3.3 Mine Facilities

The mine facilities would be the same as the Proposed Action with the exception of the elimination of those facilities associated with tailings thickener (concentrate thickeners, tailings cyclone thickener, and tailings glandseal water tank) (NMCC 2014a). These facilities would not be required because of the use of a gravity discharge disposal method. A general depiction of the facility layout is shown in Figure 2-12.

Figure 2-12. Mine Layout – Alternative 2



Source: NMCC 2015a.

Equipment in the concentrator building is expected to consist of the following (NMCC 2014a):

- Primary crushing – Same as Proposed Action.
- Grinding
  - One 32-foot-diameter x 14-foot-long SAG mill, 11,000 hp;
  - One 24-foot-diameter x 35-foot-long ball mill, 15,000 hp;
  - One 4.5-foot cone crusher, 300 hp (grinding circuit pebble crusher);
  - One vertical grinding mill, 125 hp (copper regrind);
  - One vertical grinding mill, 20 hp (moly regrind);
  - One 12- x 16-foot double deck vibrating screen;
  - One primary cyclone cluster with eight 33-inch-diameter cyclones;
  - One cyclone feed pump, 1,200 hp;
  - Two gravity gold concentrators;
  - One 48-inch x 470-foot-long reclaim conveyor;
  - One 36-inch x 89-foot-long SAG mill oversize conveyor;
  - One 36-inch x 257-foot-long pebble crusher feed conveyor; and
  - One 36-inch x 101-foot-long pebble crusher product conveyor.
- Flotation
  - Six 9,000-ft3 bulk rougher flotation machines (copper/moly);
  - Fourteen 180-ft3 cleaner flotation machines (copper);
  - Two 800-ft3 column flotation machines (copper);
  - Eight 25-ft3 separation flotation machines (moly);
  - Four 10-ft3 cleaner flotation machines (moly); and
  - Two 40-ft^3 column flotation machines (moly).
- Concentrate
  - One 16-foot-diameter bulk concentrate high rate thickener (copper/moly);
  - One 16-foot-diameter concentrate high rate thickener (copper);
  - Two automatic filter presses (copper); and
  - One 4-dstph disk filter (moly).
- Tailings – Not required.

2.3.3.1 Primary Crushing Facilities

The primary crushing facility operation would be the same as for the Proposed Action.

2.3.3.2 Grinding

Grinding would be the same as for the Proposed Action.

2.3.3.3 Flotation and Concentration

Flotation and concentration would be the same as for the Proposed Action.

2.3.3.4 Tailings Storage Facility

As with Alternative 1, NMCC proposes to construct a new TSF to overlay the Quintana TSF area. The new TSF would occupy the site of the old facility as well as extend approximately 1,000 feet to the east of the existing Quintana starter dam. The Quintana TSF was an unlined facility. The new TSF would be underlain by a geomembrane liner and tailings drainage collection system.

Approximately 125 million tons of tailings are expected to be stored over the life of the project for this alternative. Tailings deposition would be approximately 30,000 tpd. During progressive settlement, water would be pumped from the TSF and returned to the process circuit. The total expected water recovery by reclaim systems would be a nominal 70 percent. Water reporting to the TSF would be recovered from the pool of water that would form in the storage facility and be returned to the mill process water system for reuse. Precipitation would also contribute to the volume of water in the storage facility. The height of the embankment would be designed to contain the normal operating volume of water completely within the storage facility, plus the amount of stormwater runoff from 100 percent of the PMP as required by the OSE.

TSF design: The proposed method of construction for the new TSF is by centerline raises with cycloned tailings sand. Initial construction would include a toe berm to buttress the tailings embankment and a starter dam. Coarse sand (cyclone underflow) would be placed on the embankment while the tailings slimes (thickened cyclone overflow) would be discharged to the TSF interior. A geomembrane liner would be placed beneath the starter dam and anchored on the crest of the toe berm. An underdrain system would be used beneath the tailings dam and would be continuous beneath the total TSF. It would consist of (from bottom to top) prepared foundation, 12-inch liner bedding fill, 80-mil HDPE geomembrane, overliner drainage collection layer with internal drainage pipe network and a filter fabric.

The TSF would be constructed in a phased manner. During initial construction phases, diversion ditches would be constructed to divert stormwater from upstream catchment areas within the area contributory to the TSF. The contributory area is approximately equivalent to the ultimate TSF footprint, as only minor peripheral areas drain into the TSF. At final build out, minimal potential exists for surface water run-on from external areas. Throughout most of the life of the facility, stormwater management requirements would be limited to direct precipitation.

The new TSF design would comply with the design and dam safety guidelines and regulations of the OSE Dam Safety Bureau. The NMED Ground Water Quality Bureau is the permitting authority for the State of New Mexico DP program. The NMED has provided guidance on anticipated design requirements for the TSF liner system, which have been incorporated into the design.

TSF process: Tailings would be transported from a sump located at the flotation plant and delivered via slurry pipeline to be cycloned at the northwest perimeter of the TSF.

The cyclone underflow (coarse sands) would be delivered to the TSF and used for dam construction. Two cyclone underflow pipelines would be used to deliver sand to the dam. One leg of the pipeline would run around the north side of the TSF, and the other leg would be routed around the south side of the TSF. Each leg is sized to transport 100 percent of the cyclone underflow. This allows for continuous availability of sand delivery to the dam. Cyclone underflow sand would be discharged through spigots placed every 300 to 400 feet. Each spigot would include a valve to allow manual placement of the sands on the dam as required for dam construction. The underflow pipelines would also have isolation valves strategically placed to allow for isolation and relocation of the pipe as the dam rises.

The cyclone overflow would be routed to the interior of the TSF for permanent storage. When the cyclone plant is not in operation, whole tailings would be routed directly to the TSF. Water would be reclaimed from the TSF via barge-mounted pumps placed in the supernatant pool inside the TSF as well as from the TSF underdrain collection and return system. This water would be recycled to the process water reservoir for reuse in the milling operation.

The size and location of the TSF pool would vary during the life of the project. The size of the pool would be affected by pre-deposition grading in the TSF, the amount of tailings deposited, and precipitation, evaporation rates, and flow rates into and through the underdrain system. The location of the pool would migrate within the TSF area as tailings beaches form. Tailings deposition would be managed to force the pool away from the embankment toward the upstream reaches of the TSF. The TSF area would be fenced to restrict access.

TSF monitoring: The TSF would be regulated by the OSE Dam Safety Bureau for safety of operations. The design and operation of the TSF dam is subject to approval of the OSE, including the closure inspection. The OSE requires monthly reports of the tonnages deposited into the TSF along with readings of the piezometers, settlement devices, and settlement monuments that monitor movement.
The Ground Water Quality Bureau of the NMED requires a monthly report of tonnages of tails discharged along with analyses of the tailings to identify possible contaminants. Samples of water from new monitor wells proposed for downstream of the tailings dam would be analyzed quarterly, or per specific conditions of an NMED groundwater DP, and the results sent to the NMED Ground Water Quality Bureau. These samples would be used to identify any leakage from the new, lined TSF. Abatement plans would be implemented should leakage and contamination be detected.

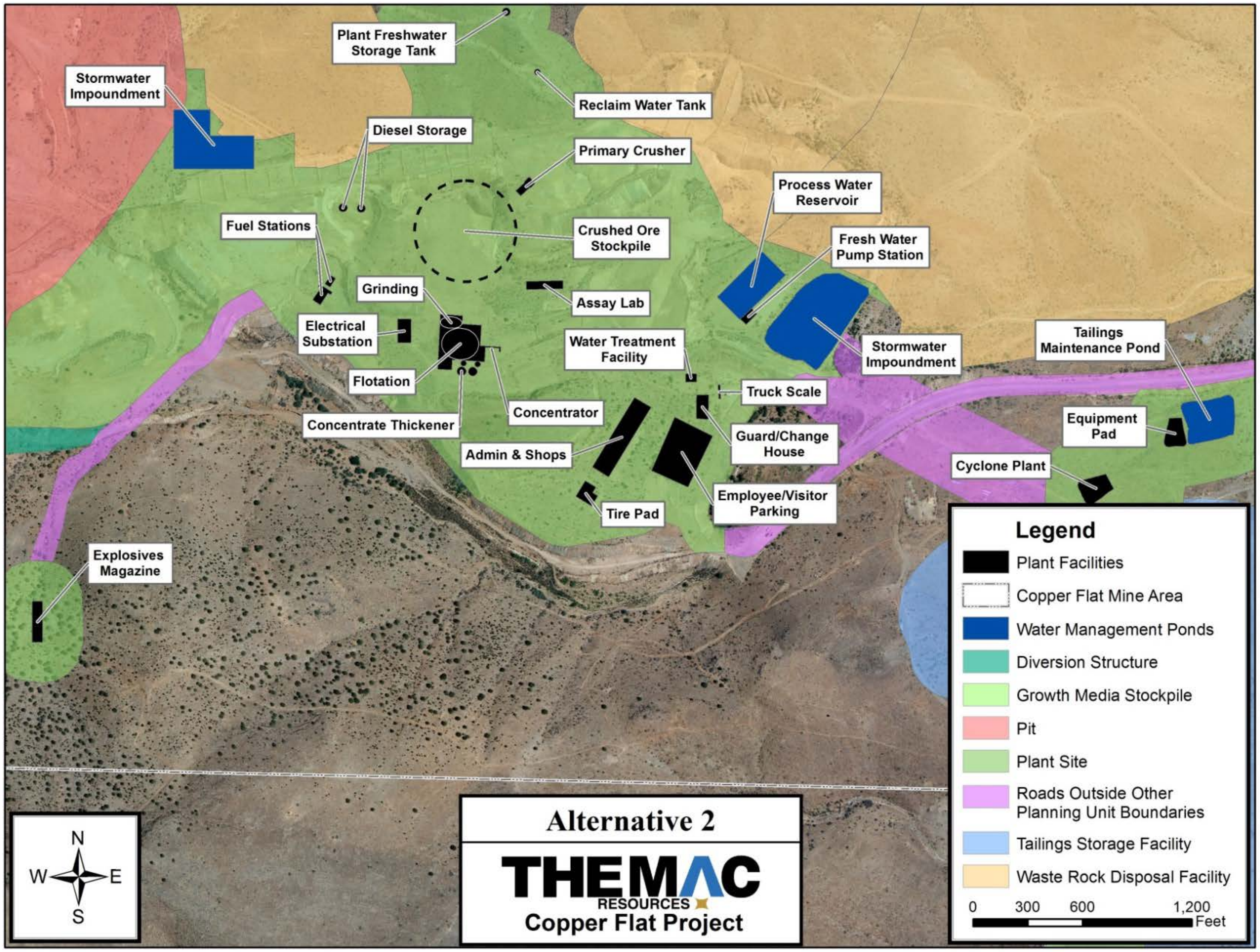
2.3.3.5 Ancillary Facilities

The ancillary facilities would be the same as for Alternative 1 with one exception. A 30-acre electrical substation site on New Mexico State Trust land is proposed to replace an existing electrical substation, as shown below. (See Figures 2-13 and 2-14). The substation is described in further detail in Section 2.3.6, Electrical Power.

2.3.3.6 Sanitary Wastewater Treatment

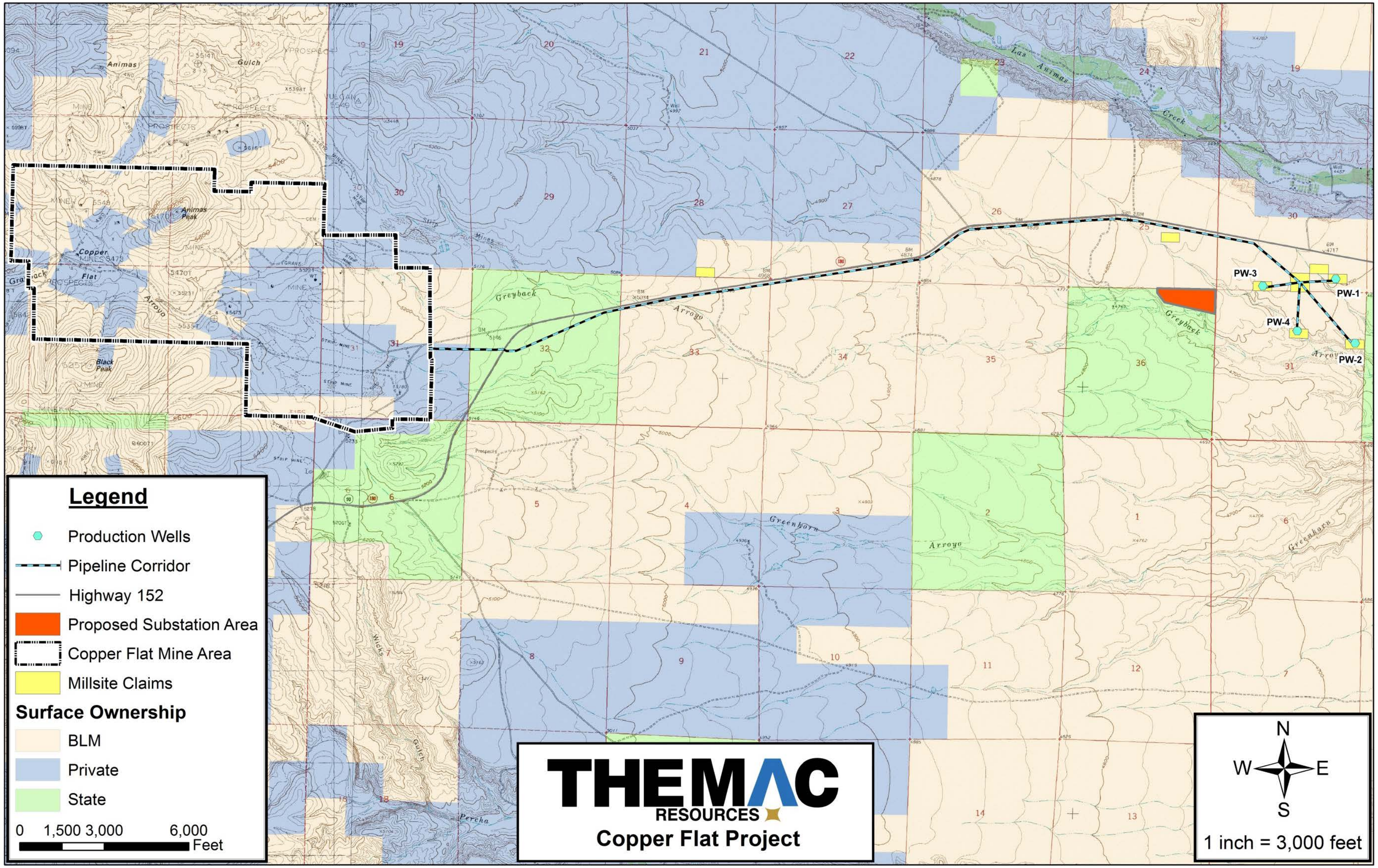
A packaged water treatment plant would be installed at the mine to accommodate liquid sanitary wastes generated from the mine office, shower, and restroom facilities. The location of the plant would be on a pre-existing concrete slab in the mine plant area (NMCC 2014a).

Figure 2-13. Mine Facilities – Alternative 2



Source: NMCC 2015a.

Figure 2-14. Ancillary Facilities – Alternative 2



Source: NMCC 2015c.

2.3.4 Waste Rock Disposal Facility

As with the Proposed Action, the WRDF would be located adjacent to the open pit in an area used for waste rock disposal by the previous operator on the east side of Animas Peak. In this alternative, the disposal area would be expanded to cover approximately 155 acres, and at the end of the mine life, the height of the disposal area would be at 5,725 feet above sea level. Total material contained in the WRDF at the end of the expected life of the project would be approximately 33 million tons. The low-grade stockpile discussed as a feature of other alternatives would not be a feature of Alternative 2. As with the Proposed Action, the WRDF would be regraded and reclaimed to blend into the surrounding topography to the extent practicable.

2.3.5 Project Workforce and Schedule

The estimated operational life required to recover the proven minerals (copper, molybdenum, gold, and silver) is 12 years. Labor requirements for the mine are displayed below in Table 2-26. Increases over the Proposed Action reflected in this table are due to the higher processing rate.

Table 2-26. Mine Personnel Requirements - Year One – Alternative 2

Table 2-26. Mine Personnel Requirements - Year 1 – Alternative 2	
Work Type	**Number of Employees**
Mine salary	12
Mine operators	83
Mobile maintenance	43
Mine tech services	8
Process salary	12
Process operators	38
Process maintenance, electricians, etc.	35
Process tech services	11
Administration	28
Total mine workforce	**270**

Source: NMCC 2014a.

2.3.6 Electrical Power

Power for the project would be furnished by Tri-State Generation & Transmission (Tri-State) through its member system, Sierra Electric Cooperative. Tri-State proposes to furnish power to the Copper Flat mine area via the construction of a new 345/115-kV substation that would interconnect to the existing El Paso Electric 345-kV transmission line between Springerville and Macho Springs substations, and the existing Tri-State 115-kV transmission line between Caballo substation and the mine. The existing Tri-State 115-kV transmission line previously served the mine area until the 1980s and is not in service at this time.

The new substation is planned as a 345-kV, three-breaker ring bus substation, expandable to a future breaker-and-a-half configuration, with a 345/115-kV, 100 mega volt amp transformer bank and single breaker on the 115-kV low-side. This new primary substation would be located on a 30-acre site on State Trust land south of NM-152 and east of the production wells. Utilizing this new substation at the intersection of the 345-kV line and the 115-kV line, Tri-State would deliver power to the mine area via their existing 115-kV transmission line. Initial assessment indicates some pole replacement and structure modifications would be required in order for the transmission line to carry the Copper Flat mine's expected 40 megawatts (MW) of load. Tri-State would also require that a new 115-kV switch be installed at the Copper Flat mine.

For most aspects of the operation, unit power demand (kWh/ton) is constant between all plans. This is the result of unit operations and material processed being the same between all plans. The difference between the three plans is seen when power demand is presented as total power used in a given time period (hour, day, or year). Power used is a function of the processing rate and, therefore, the power need for a specific period increases as more tons are processed in that same period. Because of the increased processing rate, the electrical demand would increase. The plant electrical load requirement for 30,000 tpd processing rate (10.8 million tpy) is tabulated below in Table 2-27.

Table 2-27. Summary of Average Project Electrical Demand – Alternative 2

Table 2-27. Summary of Average Project Electrical Demand – Alternative 2		
Activity	**Power Demand (kWh/ton)**	**Power Demand (GWh*/Year)**
Crushing	0.38	4.10
Grinding	15.71	169.67
Flotation	2.50	27.00
Molybdenum plant	0.14	1.51
Concentrate filtering	0.16	1.73
Tailings system	0.50	5.40
Reagent system	0.24	2.59
Water system	2.69	29.05
Ancillary facilities	0.04	0.43
Total	**22.36**	**241.49**

Source: NMCC 2014a.

Note: * = gigawatt hours.

As with the Proposed Action, a new secondary substation for mine operation would be constructed within the mine area. Also, an emergency generator would be installed on-site for backup power in the event of power loss to maintain critical systems and to aid in a controlled shut down. On-site power distribution would include one 25-kV distribution line. Because of the configuration and size of these distribution lines, standard raptor proof protective designs would be incorporated into the line design and line upgrade, as presented in the Rural Electrification Administration guidelines. This design would be used for the entire length of the distribution line within the mine area.

2.3.7 Water Supply

The water supply descriptions and defining classifications for Alternative 2 are the same as the Proposed Action. Differences between Alternative 2 and the Proposed Action would be evident in quantities of water use and supply.

2.3.7.1 Water Use

Total water use under Alternative 2 for the Copper Flat mine, including all recycled water, would be approximately 22,210 AFY on average. Total water use is presented below in Table 2-28.

Table 2-28. Total Water Use – Alternative 2

Table 2-28. Total Water Use - Alternative 2		
	Alternative 2*	Proposed Action*
Average annual water use during ore processing (AF)	22,210	13,370
Average water used to process 1 ton of material (gallons)	661	682
Total water use – life of mine (AF)	257,000	212,000

Source: NMCC 2018c.

Note: * Includes 72% recycled water.

Ninety-six percent of this water would be used for processing copper ore. The other 4 percent of water use would be for dust control, maintenance, laboratory and domestic use. Average annual water use by process is presented below in Table 2-29.

Table 2-29. Water Use by Process – Alternative 2

Table 2-29. Water Use by Process - Alternative 2				
	Acre-Feet per Year			Percent of Total
Water Use	Recycled	Non-recycled	Total	
Ore processing:				
Reclaimable TSF water	15,504	0	15,504	70%
Water retained in tailings	0	4,973	4,973	22%
Evaporation	0	752	752	3%
Concentrates	0	13	13	<1%
Subtotal	**15,504**	**5,738**	**21,242**	**96%**
Dust control	0	726	726	3%
Other	0	242	242	1%
Total use	**15,504**	**6,706**	**22,210**	**100%**

Source: NMCC 2018c.

Note: Columns may not sum exactly due to rounding.

Technical basis for water use figures: The figures presented in Table 2-28, Table 2-29, Table 2-30, and Figure 2-15 are averages. During mine operation, rates would fluctuate by month and by year due to differences in weather and operation rates as the mine life advances. The water balance figures rely on BMPs in the industry for mine engineering design and scientific analysis as well as the physical properties of ore at Copper Flat and known Quintana history.

Calculations are conservative and flexible by design to account for expected variation in precipitation, ore processing rates, and equipment maintenance. Figure 2-15 illustrates Copper Flat water sources and water use for Alternative 2. The sources of water supply are estimated based on a variety of industry-recognized factors:

- Water volume estimated to be reclaimed from the TSF is based on engineering design for ore processing and the tailings facility, known properties of the ore at Copper Flat based on lab bench tests, industry BMPs for mine feasibility design engineering, and professional judgment and experience.
- Stormwater runoff estimates are based on climate data from Hillsboro and site-specific data collected from a weather station at Copper Flat, as well as industry standard runoff coefficients.

- Moisture in copper rock was calculated using laboratory testing of ore at Copper Flat and industry-recognized protocol.
- Pit dewatering amounts are based on the assessment of the groundwater hydrology model which employs known physical properties of the surrounding crystalline bedrock.

The volume of water recycling at the TSF would be at a high level for two reasons: 1) the presence of the facility reclaim system; and 2) the TSF liner would be equipped with an underdrain collection and pump back system. The TSF and pumps for the recycling system are sized for maximum flow capacity with spare pumps included in the design. In 2015, Golder & Associates completed a feasibility study for the TSF (NMCC 2017a). The water reclaim system is discussed in detail in Section 8.0 of that report and illustrated in Drawings 27 and 28 of the report. The TSF water balance is discussed in Section 9.0 of the report (NMCC 2018a).

2.3.7.2 Water Sources

Table 2-30 and Figure 2-15 shown below summarize the water sources that would be used at Copper Flat under Alternative 2.

Process water sources: The source, description, and operation of the process water sources under Alternative 2 would be the same as described in the Proposed Action. Process water sources would provide 16,105 AFY of water used by this alternative, which would be 72 percent of the total need. Stormwater management and use would be the same as described in the Proposed Action. Pit water management and use would be the same as described in the Proposed Action.

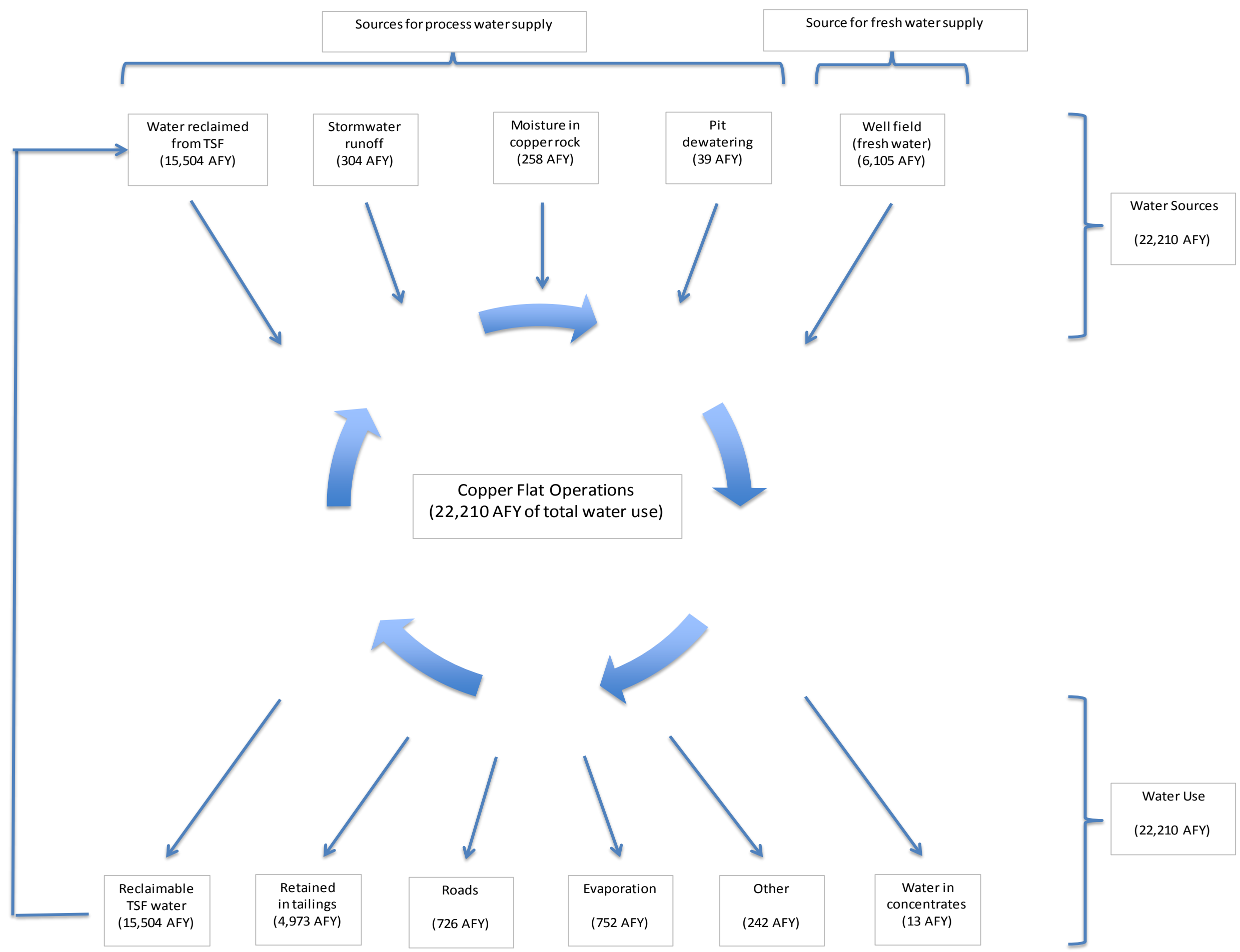
Table 2-30. Water Sources – Alternative 2

Table 2-30. Water Sources - Alternative 2				
Water Source	Acre-Feet per Year			Percent of Total
	Recycled	Non-recycled	Total	
Process water:				
Water reclaimed from TSF	15,504	0	15,504	70%
Stormwater	304	0	304	1%
Moisture in the ore	258	0	258	1%
Pit dewatering	39	0	39	>1%
Subtotal	**16,105**	**0**	**16,105**	**72%**
Fresh water during mine operation (groundwater wells)	0	6,105	6,105	28%
Total use	**16,105**	**6,105**	**22,210**	**100%**

Source: NMCC 2018c.

Note: Columns may not sum exactly due to rounding.

Figure 2-15. Copper Flat Water Sources and Water Use – Alternative 2



Source: THEMAC 2015.

Fresh water source: The source and operation for fresh water supply and delivery to the mine under Alternative 2 would be the same as described in the Proposed Action. The description of the four production wells and delivery system is the same as described in the Proposed Action. Fresh water would provide for 6,105 AFY (28 percent) of the total water use for this alternative.

2.3.7.3 Water Conservation

Water conservation activities under Alternative 2 would be the same as described in the Proposed Action.

2.3.7.4 Water Recycling

Alternative 2 proposes a package wastewater treatment plant to process sanitary wastewater versus septic systems proposed in the Proposed Action and Alternative 1. Following treatment, plant effluent would be reused as process make-up water or for dust control as allowed by regulation in order to reduce fresh water needs. Assuming 200 personnel and visitors are typically on-site on a daily basis and assuming a usage rate of 25 gallons of water per day per person, gray water reuse would supply approximately 5,000 gallons of water per day (about 5.6 AFY).

All other water recycling activities would be the same as described in the Proposed Action.

2.3.7.5 Decreasing Water Demand

Activities to decrease water demand under Alternative 2 would be the same as described in the Proposed Action.

2.3.8 Growth Media

Growth media would be addressed in the same manner as the Proposed Action. Details of growth media considerations can also be found in the MORP Reclamation and Closure Plan (NMCC 2017a).

2.3.9 Borrow Areas

Borrow areas with this alternative would be addressed the same as with the Proposed Action.

2.3.10 Inter-Facility Disturbance

Inter-facility disturbance with this alternative would be the same as with the Proposed Action.

2.3.11 Fencing and Exclusionary Devices

Fencing and exclusionary devices employed with this alternative would be the same as with the Proposed Action.

2.3.12 Haul Roads and On-Site Service Roads

Haul roads and on-site service roads with this alternative would be the same as with the Proposed Action.

2.3.13 Transportation

Transportation measures employed with this alternative would be the same as with the Proposed Action. Exceptions would be for increased levels of activities for concentrate shipments because of the increased processing rate. The proposed schedule for concentrate shipments would be:

- Copper concentrate shipment schedule (hauling weekdays only) would be:
  - Years 1–6+ ship: 14 to 19 truckloads per day, 5 days per week.
- Molybdenum concentrate shipment schedule (hauling weekdays only) would be:
  - Life of mine: ship three truckloads per month (NMCC 2014a).

2.3.14 Exploration Activities

The exploration activities with this alternative would be the same as with the Proposed Action.

2.3.15 Reclamation and Closure

The reclamation and closure measures employed with this alternative would be the same as with the Proposed Action with one exception:

Ancillary project facilities: All surface pipelines, poles, and commercial signage would be removed. At time of closure, the BLM would determine whether buried pipelines and electrical conduits would be left in place. Solution flow from underdrainage during ore processing under this alternative would be 1,800 gpm and the draindown rate at 6 months following process shutdown would be 1,200 gpm.

The Reclamation and Closure Plan contained in the MORP contains specific reclamation design details, including reclamation cover requirements as shown in Table 2-31 below.

Table 2-31: Estimated Reclamation Cover Requirements

Table 2-31. Estimated Reclamation Cover Requirements						
				Cover Source		
Facility	Regraded Surface Area[1] (acres)	Cover Thickness (ft)	Cover Requirement (reclamation cy)	Direct Haul (cy)	Windrow / Berm Next to Facility (cy)	Growth Media Stockpiles (cy)
EWRSP-1[2]	17.5	3	84,700	84,700	0	0
EWRSP-2A[2,3]	8.3	0	0	0	0	0
EWRSP-2B[2,3]	5.1	3	24,684	24,684	0	0
EWRSP-3	19.5	3	94,574	0	0	94,574
EWRSP-4[2]	22.6	3	109,481	27,370	0	82,111
WRSP-1	41.9	3	202,796	0	0	202,796
WRSP-2 and WRSP-3	171.8	3	831,512	0	0	831,512
TSF	564.4	3	2,731,696	150,000	0	2,581,696
Plant area (excluding EWRSP-3)	78.9	0.5	63,646	0	0	63,646
Surface impoundments[4]	31.3	0.5	25,249	0	0	25.249
Open pit[5]	165.3	0	0	0	0	0
GMSP-1	29.3	0	0	0	0	0
GMSP-2	31.6	0	0	0	0	0
GMSP-3	14.1	0.5	11,374	0	0	11,374
Ancillary facility areas[6]	19.7	0.5	15,891	0	0	15,891
West pit buildup	6.9	15.0	166,980	166,980	0	0

Table 2-31. Estimated Reclamation Cover Requirements (Concluded)						
				Cover Source		
Facility	Regraded Surface Area[1] (acres)	Cover Thickness (ft)	Cover Requirement (reclamation cy)	Direct Haul (cy)	Windrow / Berm Next to Facility (cy)	Growth Media Stockpiles (cy)
Plant area perimeter cover	19.9	3.0	96,316	0	0	96,316
TSF pipeline cut fill	0.7	30.0	33,880	0	0	33,880
Misc. horizontal construction fill & cover[7]	100	0.5	80,667	0	20,000	60,667
Surface impoundment backfill[8]	44.2	NA	427,000	0	320,000	107,000
Foundation backfill[9]	NA	NA	80,000	0	0	80,000
Total	**1,393.0**	**-**	**5,080,446**	**453,734**	**340,000**	**4,286,711**

Source: NMCC 2017a

Notes:

[1] Regraded areas based on reclamation and closure designs presented in Attachment E1.

[2] EWRSP-1, EWRSP-2B, a portion of EWRSP-2A, and the outslope of EWRSP-4 will be reclaimed during the pre-production phase of mine operations. The top surface of EWRSP-4 will be reclaimed following cessation of mining.

[3] The portion of the EWRSP-2A that lies within the footprint of proposed WRSP-1 and will be incorporated into this new stockpile. The portion of EWRSP-2A located outside of the OPSDA boundary will be relocated to the top of EWRSP-2B and the disturbed areas will be ripped and seeded. EWRSP-2B includes 5.1 acres of waste rock stockpile that will get covered and 7.6 acres of disturbed area that will get ripped and seeded.

[4] Impacted Stormwater Impoundment A and the Process Water Reservoir cover requirements are included within the Plant Area and are excluded in the cover volume calculation. The TSF underdrain collection pond gets incorporated into the TSF evaporation pond and is included in the 22.3-acre total TSF evaporation pond area.

[5] Open pit area and associated disturbed area around the pit perimeter that will be ripped and seeded.

[6] Includes ancillary facilities and structures not already included in one of the specific facilities listed. Includes haul and access roads, electrical power distribution system; storm water and sediment control structures; equipment storage areas; pipeline corridors; pump stations; tanks; explosives magazine and associated access road; and fencing.

[7] NMCC calculation for WRSP storm water ditches & miscellaneous roads, pipelines, power lines, ditches. Fill and cover. 20,000 cy stored in windrows adjacent to alignments.

[8] NMCC calculation based on water volume + 2 additional feet to account for freeboard volume.

[9] Foundation backfill by NMCC.

cy - Cubic yards.

lcy - Loose cubic yards (reclamation cover).

NA - Not applicable.

2.3.16 Environmental Protection Measures

The environmental protection measures employed with this alternative would be the same as with the Proposed Action with these exceptions:

- In reagent management, there would not be any use of AERODRI 100 (ethanol, sodium dioctyl sulfosuccinate, and 2-ethylhenanol).
- This alternative proposes a package treatment plant for on-site water treatment of water used in sanitary facilities and offices. Following treatment, plant effluent would be reused either as process make-up water or used for dust control as allowed by regulation, which would reduce fresh water needs. Assuming 200 personnel and visitors are typically on-site on a daily basis and assuming a usage rate of 25 gallons of water per day per person, gray water reuse would supply approximately 5,000 gallons of water per day (about 5.6 AFY).
- A 30-acre electrical substation site on New Mexico State Trust land is proposed to replace an existing electrical substation. The new substation would be constructed, owned, and operated by the electric utility company. Because this land would be disturbed, NMCC has performed cultural resource, wildlife, vegetation, and paleontology surveys to establish baseline conditions for these ancillary facilities as a basis for further evaluation.

2.4 NO ACTION ALTERNATIVE

NEPA requires consideration of a “no action” alternative. Under the No Action Alternative, the project would not be constructed and NMCC’s proposed open pit mining operations would not occur. The environmental, social, and economic conditions described as the affected environment would not be affected by the construction, operation, reclamation, or closure of the mine. Local employment and economic revenue would slightly increase as a result of this alternative. Existing uses such as grazing and recreation would continue at current levels. The mine area would be reclaimed according to BLM standards and to NMED requirements pertaining to disturbances associated with site exploration.
Under the No Action Alternative, the Stage 1 Abatement Plan (JSAI 2013a) would continue to be implemented to define site conditions, investigate known areas of groundwater and surface water contamination at the site, and define the extent and magnitude of groundwater contamination. Stage 2 of the abatement plan, also to be implemented under the No Action Alternative, would address selection and design of an effective treatment option to abate ground water contamination. Stage 2 would include a feasibility study to analyze abatement alternatives. The project area for the abatement plan includes the mine permit area plus a one-mile buffer. For implementation of the abatement plan, NMCC would be required to obtain relevant permits from the BLM and the State regarding any resource-affecting activities that occur on targeted lands.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED

NEPA provides guidance on the development of alternatives. Reasonable alternatives include those “that are practical or feasible from technical and economic standpoints and using common sense, rather than simply desirable from the standpoint of the applicant” (CEQ 2007). All reasonable alternatives must fulfill the project’s purpose and need and must address significant environmental issues. The selection of alternatives under NEPA criteria includes consideration of a reasonable range of alternatives that meet the project purpose and need and that are economically and technically feasible.

Several alternatives suggested during scoping have been eliminated from detailed study. These alternatives were evaluated using the following criteria to determine if further review was necessary. According to the BLM NEPA Handbook, an action alternative can be eliminated from detailed analysis if:

- It is ineffective (it would not respond to the purpose and need).
- It is technically or economically infeasible (consider whether implementation of the alternative is likely given past and current practice and technology; this does not require cost-benefit analysis or speculation about an applicant's costs and profits).
- It is inconsistent with the basic policy objectives for the management of the area (such as, not in conformance with the land use plan).
- Its implementation is remote or speculative.
- It is substantially similar in design to an alternative that is analyzed.
- It would have substantially similar effects to an alternative that is analyzed.

Based upon these criteria, the following alternatives were considered but eliminated from further study.

2.5.1 Dry Stack Tailings Disposal

Dry stack tailings disposal was considered as an alternative to the conventional method proposed in order to achieve the following potential benefits (note: collectively, M3 2012 and CDM Smith Inc. 2013 are the sources for this section):

- Reduction of water consumption;
- Avoidance of the permitting, construction, and operation of a tailings dam regulated by the OSE;
- Allowance for concurrent reclamation to reduce erosion of stored tailings and mitigate the visual impact of the TSF; and
- Potential reduction of the footprint area of the TSF.

Dewatering tailings to higher degrees than paste produces a filtered wet (saturated) and dry (unsaturated) cake. These filtered tailings are normally transported by conveyor or truck, deposited, spread, and compacted to form an unsaturated tailings deposit. This type of tailings storage produces a stable deposit usually requiring no retention binding and is referred to as 'dry stack.' Three dry stack options were considered:

- Option 1: Dry stack tailings with a waste rock buttress;
- Option 2: Dry stack tailings mixed with waste rock; and
- Option 3: Dry stack tailings with no buttress.

Under option 1, waste rock would be transported with mine haul trucks to the TSF to create a buttress against which the tailings are stacked, reducing the amount of waste rock that is transported to the WRDF. Under option 2, waste rock would be sized (crushed) at the edge of the pit and transported via conveyor to the filter plant where it would be combined with tailings for stacking, nearly eliminating waste rock transported to the WRDF. Option 3 reduces the slope angles to enable placement of dry stack tailings without a buttress.

These options were developed for the construction of the dry stack TSF in order to assess the process and how it would affect slope stability, compaction requirements, and area of impact. These options were also developed to assess costs associated with preparation of the foundation of the TSF, construction of ponds and drainage diversions to contain liquids and sediments impacted by the tailings, and diversion of stormwater from running onto the TSF.

For each of the options, mining and processing of the ore would be the same. Distinctions occur in the waste rock handling, water supply, water reclamation, stormwater management, and tailings disposal aspects of the project. Under the Proposed Action, a thickener would be used, and process water would be reclaimed at the TSF in a seepage collection system and from a supernatant water pond on the surface of the TSF (thickeners would not be used in either of the alternatives). Under the dry stack options, a high-rate thickener, filter plant, and conveying system would be used to enable stacking of dry tailings at the TSF. Water would be reclaimed at the thickener with a contribution of water recovered from the filter plant. More water would be reclaimed in the dry stack options, reducing the amount of fresh make-up water needed to be pumped from the well field.

The dry stack option differs from the Proposed Action from downstream of the concentrator building. The tailings slurry would be thickened and filtered before being discharged to a conveying system for delivery and stacking of the tailings on the dry stack TSF.

Additional equipment required under this option includes a high-rate tailings thickener and six plate-and-frame tailings filters with associated piping, pumps, tanks, agitators, and conveyors.

Tailings would flow by gravity from the concentrator tailings sump to the tailings thickener. A high-rate thickener would be used to decrease the water content from 70 percent to approximately 35 percent. Water content would then be reduced to approximately 15 percent by plate-and-frame filtration and conveyed by a stationary and mobile conveyor system to a mobile stacker. The underflow of thickened tailings would gravity flow to the tailings filter feed tank. A tailings filter feed pump would then be used to transfer the thickened tailings to one of six tailings filters. The tailings would be dewatered to a moisture range of 12 to 18 percent before discharging the filter cake to the accompanying tailings filter discharge conveyor. Water reclaimed from the thickening and filtering processes is estimated to total 10,475 gpm.

Dewatered tailings would be discharged from these conveyors to the tailings transfer conveyor, which discharges either to the stacking system or bypass stockpile served by a fixed stacker. Tailings would be stockpiled at this location when the mobile stacking system is down and moved by heavy equipment to their final location on the TSF. Under normal operations, discharge from the tailings transfer conveyor would go to the mobile stacking system, which consists of a fixed conveyor to the central portion of TSF, a series of "grasshopper" mobile conveyors, and to a mobile stacker that would place the tailing on the surface of the TSF. Tailings would be placed in 25-foot lifts. Water recovered from the filter plant would then be pumped back up to the tailings thickener for settling and reclamation. Dry stack tailings storage would allow for the lower slopes of the TSF to be reclaimed while the upper portion is in operation (concurrent reclamation).

Dry stack tailings would incur increased operating costs for the thickener (flocculant), filtration, and tailings conveying and stacking, but would be partially reduced by the decreased pumping cost for water supply and reclamation and operation of the tailings cyclone plant. Dry stacking also requires additional water consumption for dust suppression because the tailings are deposited with low moisture content. Dry stack operations depend upon the operation of the filter plant to remain in production. A failure in the filter plant would require the entire plant to shut down because there is no alternative for tailings disposition.

Additionally, the dry stack tailings disposal method is not considered reasonable because its implementation is economically infeasible (reducing the internal rate of return below 15 percent).

2.5.2 Tailings Thickener Alternatives

Another set of alternatives that was considered was the use of tailings thickeners at various stages in the tailings storage process to enhance water conservation.

The Copper Flat TSF water balance model has water inputs from the tailing overflow and underflow, direct precipitation within the TSF limits, and precipitation run-on from un-diverted up-gradient areas. The model has water losses of evaporation from the supernatant pond, the tailings beach, the sand embankment areas, and water locked-up or entrained within the tailings mass. Of these losses, the most significant is the water locked-up or entrained within the tailings mass.

Additional water conservation can be achieved by reducing the volume of water loss due to lock-up. Water loss due to lock-up is a function of the density and saturation of the tailings mass. By increasing the density of the tailings, the volume of water loss is reduced, assuming no change in tailings saturation. One method of achieving an increase in the tailings density is to thicken the slurry being deposited. The following sections present alternatives to the process flow in which a thickener would be added to the process at different stages. Specific aspects of the alternatives discussed in this section differ from the procedure suggested in the Proposed Action, but the same operating principals, risks, and opportunities apply to all tailings thickener alternatives, including the Proposed Action. All of these alternatives were eliminated from further consideration because they would be at a level of a return on investment that would be considered economically infeasible.

Thickening excess whole tailings: In this alternative, tailings which do not require cycloning would be routed through a high-rate thickener prior to deposition within the TSF. The thickener would allow reclamation of water within the mineral processing circuit prior to tailings deposition into the TSF. Thickening the whole tailings that did not have to be cycloned would reduce the volume of water deposited and therefore reduce the potential loss of water due to evaporation and water locked-up in the tailings.

Current analysis shows a need for increasing the volume of sand needed for the TSF embankment. This leads to a reduction in the amount of whole tailings that can run through tailings thickener and makes the TSF embankment larger. The estimate for the additional volume of sand required for the TSF embankment would be 44.76 tons, a substantial increase. In order to produce this required sand volume, the cyclone plant must operate 96.5 percent of the time.

Based on the volume of sand required to construct the TSF embankment, this alternative is not considered technically viable. For the current configuration, the only tailings that would be processed by the thickener are those produced during the 3.5 percent of the time that the cyclones are not operating (this equates to approximately 4 tons of tailings over the mine life).

Thickening cyclone overflow: This alternative incorporates a thickener after the tailings have been processed by the cyclones. The underflow tailings (sand) would be pumped to the TSF for use in constructing the embankment, as currently proposed. However, the overflow tailings would be pumped to a thickener which would reclaim some of the water, thereby increasing the solids content of this tailings stream. The thickened overflow tailings would then be pumped to the TSF for deposition.

In this alternative, it has been assumed that a thickener is used to increase the solids content of the overflow tailings from 19.6 to 50 percent. This could result in a density increase on the order of 5 to 11 pounds per cubic foot during the operating life of the facility. If a density increase of 8 pounds per cubic foot is assumed, the water loss due to lock-up during operations is estimated to be reduced by approximately 15 percent. This calculation assumes that the thickener is 100 percent efficient in the production of thickened tailings and available 100 percent of the time. Since it is not reasonable to assume that the equipment would not encounter operational upsets or have down-time for maintenance, it is reasonable to assume that the actual realized water conserved with this alternative would be on the order of 10 to 12 percent of the total water reclaimed from the TSF. In order to achieve the thickening of the overflow tailings as stated above, a thickener with a diameter in the range of 250 feet would be required. Alternatively, two thickeners with diameters in the range of 175 to 200 feet could be used in order to improve availability and reduce the likelihood of unthickened tailings being deposited into the TSF.

Flocculants would be required to be utilized in the thickener operation with a dosing rate on the order of 25 grams per ton of ore. There would be significant operational risk associated with this alternative. Additional complexity is added to the operations which would require additional personnel, metering, and monitoring components. Approximately 85 percent of the material would be smaller than 75 microns and 60 percent of the material will be smaller than 37 microns. This would mean the overflow tailings would be a very fine-grained tailings material. The lack of sand and coarser materials in the overflow tailings increases the time the tailings are in the proposed thickener and the amount of flocculant required to be used in order to achieve the desired solids content. Normal variation in the tailings production rate at either the processing or cyclone plant would likely result in upset conditions at the thickener or thickened tailings being at a lower than desired density. In order to prevent a release of tailings or process solutions during these upset conditions, some portion of the overflow tailings would bypass the thickener and be deposited directly into the TSF. The result would be that the desired water conservation is not achieved. Additional operational risks include pumping fine-grained tailings back to the processing plant. This would result in the process pond filling with slimes and increasing the risk of a process solution release due to reduced capacity of the pond. It would also result in an economic risk associated with a degraded copper concentrate and a lower amount of copper in the concentrate.

Thickening whole tailings prior to cycloning: This alternative incorporates a thickener before the tailings have been processed by the cyclone plant, at the very beginning of the process. The whole tailings would be thickened, reclaiming water within the mineral processing circuit. The tailings would then be pumped to the cyclone plant for underflow/overflow separation prior to discharging into the TSF. The tailings would be thickened to 50 percent prior to pumping to the cyclone plant. The underflow tailings are required to have less than 20 percent fine particles in order adequately drain. The thickened whole tailings, when cycloned, would generate underflow tailings with more than 31 percent fine particles. Therefore, modification to the proposed cyclone plant would be required in order to produce underflow tailings which meet the required geotechnical characteristics.

These tailings could be processed with a cyclowash added to each cyclone. The cyclowash is an additional component added to the cyclone which allows water to be added directly into the cone of the cyclone. This additional water facilitates the overflow/underflow separation and increases the amount of fine particles which are removed from the underflow tailings. In general terms, the whole tailings would be thinned out during the cycloning process after they have been thickened at the processing plant. The water required by the cyclowash could be supplied by the water recovered from the supernatant pond and seepage pond. Additional piping, valves, controls, and operating staff would be required to incorporate this equipment and ensure the system is operating properly.

Similar to thickening of cyclone overflow, the estimated reduction in water loss for this alternative assumes 100 percent efficiency and availability of the cyclowash equipment. If this is not achieved, neither the underflow nor the overflow tailings produced would meet the design requirements. This would result in: 1) an insufficient volume of sand being produced to construct the embankment; or 2) areas within the embankment having sand that contains fine particle contents in excess of 20 percent. Both of these are significant risks that should be considered before incorporating into the design and operation as they could require significant time, effort, and costs to mitigate. An insufficient volume of sand would require a change in the embankment design and possible importation of embankment fill materials. If the cyclowash equipment did not produce the required quality of sand, it is possible that additional drains in the embankment would be required in order to prevent elevated pore pressures and instability from developing.

2.5.3 Backfilling the Pit

Backfilling the pit at Copper Flat was considered in response to public comments suggesting that this alternative be considered. The concerns to be addressed are primarily related to post-mining water quality in the pit lake. After discussions with NMCC, it was determined that backfilling the pit is not viable for a number of reasons:

- The Copper Flat pit would be mined in sequence vertically, and it would not be possible to backfill portions of it as mining continues. The spatial characteristics of the mineral deposit results in a mine plan that does not support backfilling sections of the open pit during mining.
- Mine plans for Copper Flat project removing approximately 158 million tons of material from the pit. Of this, about 74 percent (113 million tons) would be deposited in the lined tailings facility and would not be suitable for backfill material.
- Backfilling the pit after mining is not economically viable. Because the majority of material removed from the pit is processed and sent to the TSF, additional material would have to be mined to provide backfill material at the end of mining. Assuming a reasonable swell factor, the volume of additional material needed for backfill (material in addition to the non-ore material mined from the pit), excavating for backfill would likely create a pit approximately 50 percent the size of the planned open pit; after producing backfill the new excavation would also require reclamation. Moving 45 million tons of existing mined material back to the pit would easily add approximately $50 million to project costs. Producing an additional 50 million tons for backfill to completely fill the pit could easily add at least another $100 million in costs due to added mining, administrative, and reclamation costs.

In response to concerns about post-mining water quality, NMCC has chosen to rapidly refill the pit with water to minimize oxidation of chemicals in the pit lake walls that would increase the level of contamination of the pit lake.

2.6 SUMMARY

Table 2-32 below summarizes the differences between each of the alternatives—Proposed Action, Alternative 1 (Accelerated Operations – 25,000 Tons per Day), Alternative 2 (Accelerated Operations – 30,000 Tons per Day), and the No Action Alternative. Table 2-33 below summarizes the assessed impacts associated with the Proposed Action and each alternative for each resource area. A more complete description of the impacts is provided in Chapter 3.

Table 2-32. Summary of Differences Between All Alternatives

Table 2-32. Summary of Differences Between All Alternatives		
Change from No Action to Proposed Action	**Change from Proposed Action to Alternative 1**	**Change from Proposed Action to Alternative 2 (Preferred Alternative)**
• General scale and scope of the operation • Mining process o Open pit o Drill, blast, loader, truck o Type of equipment used • Mineral beneficiation process o Crush, grind, sulfide flotation, concentrate filtering o Type of equipment used • Tailings storage o Conventional slurry o Raised TSF o Centerline construction with tails sand o Fully lined o Monitoring systems • Type of mine & process equipment used • Three final products o Copper concentrate with gold & silver o Molybdenum concentrate o A small amount of coarse gold concentrate • Concentrate handling, shipping methods, shipping route, destination • Operating schedule (24 x 7) • Size of the mine area • Location and siting of the proposed facilities • Reuse of existing infrastructure and site grading • Reuse of existing diversion structures • Ongoing exploration • Concurrent reclamation practices • Reclamation standards and methods (with updates to new regulations) • Planned water conservation activities standard aspect of operating plan • Water source, storage, and delivery/distribution systems • Surface and groundwater protection methods	• Process rate increased to nominal 25,000 tpd to improve project economics • Mine life shortened to 11 years due to higher process rate • Whole tailings thickener removed from tailings flowsheet in order to improve TSF stability • Non-process water use decreases due to more efficient designs • Annual water use increases due to higher process rate • Duration of water use decreases due to higher process rate • Total water use over the life of the mine increases slightly due to higher process rate • Total disturbance footprint reduced due to more efficient design • Number and disturbance footprint of rock storage piles reduced due to more efficient design • Power requirements increase due to increased process rate • Concentrate loads trucked on NM-152 and US I-25 increase due to higher process rate	• Process rate increased to nominal 30,000 tpd to further improve project economics to meet minimum finance requirements • Total life of mine tons processed increased 25 million tons due to exploration success • Mine life shortened to 12 years due to higher process rate • Whole tailings thickener removed from tailings flowsheet in order to improve TSF stability • Non-process water use decreases due to more efficient designs • Annual water use increases due to higher process rate • Duration of water use decreases due to higher process rate. • Total water use over the life of the mine increases slightly due to higher process rate. • Total disturbance footprint reduced due to more efficient designs • Number and disturbance footprint of rock storage piles reduced due to more efficient design • Power requirements increase due to increased process rate. • Alternate power source selected • Concentrate loads trucked on NM-152 and US I-25 increase due to higher process rate • Lime silo increased to 300-ton capacity due to increased processing rate. • Mine workforce increases due to increased process rate • A package wastewater treatment plan proposed instead of septic tanks and leach field

Table 2-32. Summary of Differences Between All Alternatives (Concluded)		
Change from No Action to Proposed Action	**Change from Proposed Action to Alternative 1**	**Change from Proposed Action to Alternative 2**
• Standards for groundwater monitoring around facilities • Power, transmission, and distribution systems • Growth media borrow and storage plans • Fencing and exclusionary devices • General viewshed • Construction workforce required • Construction and mine workforce skill requirements • No heap leach • No on-site smelting/refining • No placer mining		• Reclamation & closure: At time of closure, the BLM would determine whether buried pipelines and electrical conduits would be left in place.

Source: Summarized from internal FEIS data.

Table 2-33. Summary of Impacts

Table 2-33. Summary of Impacts				
Resource Area	**Propose-d Action**	**Alternative 1**	**Alternative 2 (Preferred Alternative)**	**No Action Alternative**
Air Quality	Not Significant	Not Significant	Not Significant	Not Significant
Climate Change and Sustainability	Not Significant	Not Significant	Not Significant	Not Significant
Water Quality	Not Significant	Not Significant	Not Significant	Not Significant
Surface Water Use	Significant	Significant	Significant	Not Significant
Groundwater Resources	Significant	Significant	Significant	Significant
Mineral and Geologic Resources	Significant	Significant	Significant	No Effect
Soils	Significant	Significant	Significant	Not Significant
Hazardous Materials and Solid Waste/Solid Waste Disposal	Not Significant	Not Significant	Not Significant	Not Significant
Wildlife and Migratory Birds	Significant	Significant	Significant	Not Significant
Vegetation, Invasive Species, and Wetlands	Significant	Significant	Significant	Not Significant
Threatened and Endangered Species/Special Status Species	Significant	Significant	Significant	Indeterminate
Cultural Resources	Significant	Significant	Significant	Significant
Visual Resources	Significant	Significant	Significant	No Effect
Land Ownership and Land Use	Not Significant	Not Significant	Not Significant	No Effect
Recreation	Significant and Not Significant	Significant and Not Significant	Significant and Not Significant	Significant and Not Significant
Special Management Areas	Not Significant	Not Significant	Not Significant	No Effect
Lands and Realty	Not Significant	Not Significant	Not Significant	No Effect
Range and Livestock	Significant	Significant	Significant	No Effect
Transportation and Traffic	Significant	Significant	Significant	Not Significant
Noise and Vibrations	Not Significant	Not Significant	Not Significant	Not Significant
Socioeconomics	Significant	Significant	Significant	Not Significant
Environmental Justice	Significant	Significant	Significant	Not Significant

Table 2-33. Summary of Impacts (Concluded)				
Resource Area	Proposed Action	Alternative 1	Alternative 2 (Preferred Alternative)	Resource Area
Human Health and Public Safety	Not Significant	Not Significant	Not Significant	Not Significant
Utilities and Infrastructure	Not Significant	Not Significant	Not Significant	Not Significant
Paleontology	No Effect	No Effect	No Effect	No Effect

Source: Summarized from internal FEIS data.

2.7 BEST MANAGEMENT PRACTICES

BMPs involve either industry standard practices accepted as indicators of good quality performance or are adopted by NMCC as standard operating procedures to be implemented regardless of potential effects to resources that may result from mining activities. The BMPs to be implemented are summarized below and are grouped by the resource most relevant to them. For clarity, the BMPs are again described in Chapter 3 within the resource section for which they primarily apply.

Air quality:

- Water would be applied on haul roads and other disturbed areas, and other dust control measures would be used as per accepted and reasonable industry practice.
- Disturbed areas and stockpiles would be seeded with an interim seed mix to limit fugitive dust emissions from unvegetated surfaces where appropriate.
- Crusher and conveyor drop points would utilize the NMED- and MSHA-approved Sonic Misting System, which are considered to be the Best Available Control Technology (BACT).
- Deposition of tailings would utilize spigotting or cyclone discharge. Using this procedure, the surface would be wet, thereby eliminating or reducing fugitive dust.
- The lime storage would be fitted with a baghouse for capture of fugitive dust during loading of the lime bin. The sample preparation lab would be equipped with fans and filters.
- As necessary, control of fugitive dust in the vicinity of the tailings pond would be attained by watering, sprinkling, and vegetation.
- Drilling operations would be done wet or with other efficient dust control measures as set by the MSHA/SMI, and New Mexico mining and exploration permit requirements.
- Combustion emissions from mobile mining machinery and support vehicles would be controlled by manufacturer pollution control devices.

Water quality:

- Methods would be used to limit erosion and reduce sediment in runoff during construction, operations, and initial stages of reclamation and would include:
    - Surface stabilization measures — dust control, mulching, riprap, temporary and permanent revegetation/reclamation and restoration, and placing growth media;
    - Runoff control and conveyance measures — hardened channels, runoff diversions; and

  - Sediment traps and barriers check dams, grade stabilization structures, sediment detention, sediment/silt fence and straw bale barriers, and sediment traps.

- Stormwater pollution would be managed using seeding and mulching of disturbed areas, silt fences, straw bale check dams, diversion ditches with energy dissipaters, and rock check dams.
- Surface runoff from the area around the administration/mine office, concentrator, assay building, reagent storage, and tailings thickener would be controlled by surface grading and directed to a containment pond to be used for mineral processing make-up water or dust control at the site.
- Water erosion controls, such as berms and diversion ditches, would divert runoff away from the WRDFs and control water inflow onto waste rock disposal piles.
- Runoff from the WRDFs and the low-grade ore stockpile would be controlled by diverting the runoff water into collection ditches and then recycling it into the process water system. No discharge is expected to occur from the WRDFs.
- The final grading plan for the WRDFs would be designed to eliminate surface water run-on, improve runoff, reduce infiltration, minimize visual impacts, and facilitate revegetation through back-grading or crowned grading. Surface runoff velocity dissipaters would be constructed to reduce velocities and minimize undue erosion and soil loss.
- The bottom of the TSF would be lined and an underdrain seepage return system would be used to prevent seepage of tailings liquids into underlying groundwater.
- Chemicals used in the mining process would be stored out of the elements and with containment provisions, as required, to prevent release of harmful chemicals to the environment.
- A Spill Prevention Control and Countermeasures (SPCC) plan would be developed to manage spills and prevent releases to the environment.

Surface water resources:

- NMCC would use diversions, berms, and other BMPs to prevent stormwater from areas outside the mine from running on to mine areas and facilities.

Mineral and geologic resources:

- Surface stabilization measures would be employed, including dust control, mulching, riprap, temporary and permanent revegetation/reclamation, and placing growth media.
- Runoff control and conveyance measures would be employed, such as hardened channels, runoff diversions.
- Sediment traps and barriers, such as check dams, grade stabilization structures, sediment detention, sediment/silt fence and straw bale barriers, and sediment traps, would be used.
- Revegetation of disturbed areas would reduce the potential for wind and water erosion. Following construction activities, areas such as cut and fill embankments and growth media/cover stockpiles would be seeded as soon as it is practicable and safe. Contemporaneous reclamation would be used to the extent practicable to accelerate revegetation of disturbed areas.
- All sediment and erosion control measures would be inspected periodically and repairs performed as needed.

Wildlife and migratory birds:

- Consideration would be given to neighbors regarding their land use requirements including cattle grazing, alternate energy generation such as wind and solar, and reestablishment and enhancement of original botanical and zoological species inhabitants.
- During the course of operations, NMCC would periodically review and update the geochemical and hydrogeological predictions, mine waste characterization studies, and pit lake studies to incorporate new information accumulated during operations to minimize impacts to wildlife.
- NMCC would construct BLM-approved barbed wire fencing to prevent livestock from entering the WRDFs and TSF. Wildlife exclusion fences would be constructed around the pit and other water and solution ponds to keep out wildlife such as deer, antelope, and smaller animals. This fencing would meet NMDGF standards for wildlife exclusion fencing that require an 8-foot-high fence, chain link or welded wire material, with finer mesh at the bottom to exclude smaller animals.
- To the extent practicable, NMCC would investigate and utilize other mitigation actions, such as exclusionary devices. These devices could include, but are not necessarily limited to, bird balls and netting, to prevent deleterious exposure of birds to toxic chemicals or conditions used or created by mining and mineral processing operations.
- Pending monitoring information, either gates or cattle guards or both would be installed along roadways within the proposed mine area as appropriate.

Vegetation and non-native invasive species:

- All equipment would be pressure washed before being moved on-site to eliminate the possibility of introduction of noxious weeds.
- On-site biological monitoring in areas of noxious weed concern or presence would be conducted before, during, and after project activities. NMCC would be responsible for providing the monitoring.
- Vehicle and equipment parking would be limited to within construction limits or approved staging areas.
- Heavy equipment would be cleaned and weed-free before entering the mine area.
- Monitoring and follow-up treatment of exotic vegetation would occur after project activities are completed.
- All gravel and fill material imported on-site would need to be source-identified to ensure that the originating site is noxious weed free.
- During the reclamation phase of the project, all areas disturbed by construction would be reseeded with a BLM-approved seed mix.

Threatened and endangered species and special status species:

- Ground clearing and other mine development activities would be avoided during breeding and nesting season (generally March 1 through August 31) until the area is surveyed by a qualified biologist to confirm the absence of nests (on the ground and in burrows and vegetation) and nesting activity to avoid impacting migratory birds.
- Active nests (containing eggs or young) would be avoided until they are no longer active or the young birds have fledged. The area to be avoided around the nest would be appropriate to the species, and the size of the avoided area would be confirmed by a BLM biologist.

Range and livestock:

- The proposed mine area would be fenced to prevent injury or loss of livestock from mining operations. The location of the boundary fence would maintain connectivity for livestock movement throughout the Copper Flat Ranch allotment.
- Health and safety training of mine workers would include the provision of information on livestock open range and operation of vehicles to reduce the risk of collisions with livestock.

Noise and vibrations:

- NMCC would coordinate with local authorities regarding the movement of oversized loads or heavy equipment.
- Proper hearing protection would be worn at all times.
- Primary crushing and crushed ore stockpile feeders would be located below grade where feasible.
- Below grade level rock crushing equipment and production facilities would be utilized.
- NMCC would notify nearby townships and residents who may experience blast noise.

CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 INTRODUCTION

Chapter 3 describes the current environment for resource areas that may be affected by the Proposed Action and alternatives; and the potential environmental effects associated with the Proposed Action and alternatives. Resource areas include air quality; climate, climate change, and sustainability; water quality; surface water use; groundwater resources; mineral and geologic resources; soils; hazardous materials and solid waste/solid waste disposal; wildlife and migratory birds; vegetation, invasive species, and wetlands; threatened, endangered, and special status species; cultural resources; visual resources; land ownership and land use; recreation; special management areas; lands and realty; range and livestock; transportation and traffic; noise and vibrations; socioeconomics; environmental justice; human health and public safety; utilities and infrastructure; and paleontology.

3.1.1 Affected Environment

The affected environment summarizes the current physical, biological, social, and economic environments of the area within and surrounding the mine project boundary. For each resource area, the bounds of the area for analysis that could be impacted by the Proposed Action and alternatives are defined. The elements or components of the resource area that may be potentially affected are described.

For some resources, the geographic area of the affected environment for this analysis extends the mine area (i.e., area within the mine project boundary) to encompass Sierra County; for some resources, the geographic area extends Sierra County to include the surrounding counties. However, many of the resources potentially affected by the Proposed Action and alternatives are located within the mine area, or where most of the project components (e.g., mine pit and facilities, waste rock disposal facility, haul roads) are located.

3.1.2 Environmental Effects

The analysis for each resource area begins by explaining the methodology used to characterize potential impacts, including any assumptions made. The impacts analysis considers how the condition of a resource would change as a result of implementing each of the alternatives; and describes the types of impacts that would occur (direct, indirect, beneficial, adverse). The types of impacts are defined in Section 3.1.2.1, Types of Impacts. The significance of impacts is assessed using four parameters (magnitude, extent, duration, and likelihood of occurrence), and is explained in Section 3.1.2.2, Copper Flat EIS Significance Criteria.

3.1.2.1 Types of Impacts

The terms “impacts” and “effects” are used interchangeably in this chapter. According to the Council on Environmental Quality’s (CEQ) NEPA Regulations at 40 CFR 1500-1508, direct and indirect effects are defined as:

Direct effects: Effects that are caused by the action and occur at the same time and place (1508.8(a)).

Indirect effects: Effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.” Indirect effects also include “induced changes” in the human and natural environments (1508.8(b)).

In other words, direct impacts are those that are caused directly by the Proposed Action or alternatives, such as loss of mineral and geologic resources through the mining process. Indirect impacts are those follow-on effects induced by the initial impact, such as effects of this habitat conversion on wildlife species in the project area.

Identified impacts may be either adverse or beneficial. The CEQ Guidelines that govern NEPA implementation describe the need for identifying and differentiating between adverse and beneficial impacts, but do not offer a definition of these terms. For the Copper Flat EIS, the following definitions have been used by NEPA analysts:

Adverse impacts: Those impacts, which in the perception of an expert resource analyst, are regarded by the general population as having a negative and harmful effect on the analyzed resource. An adverse impact causes a change that moves the resource away from a desired condition or detracts from its appearance or condition.

Beneficial impacts: Those impacts, which in the perception of an expert resource analyst, are regarded by the general population as having a positive and supportive effect on the analyzed resource. A beneficial impact constitutes a positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

The adverse impact may be to the natural environment (e.g., decrease in available groundwater) and the beneficial impact may be to the human environment (e.g., economic benefits, such as an increase in jobs). Or the opposite may be true: The adverse impact may be to the human environment and the beneficial impact may be to the natural environment. Or, both adverse and beneficial impacts may occur to a single resource area. Adverse and beneficial impacts from the Proposed Action and alternatives are not combined into a single, net impact. Rather, adverse and beneficial impacts are assessed separately because an action may result in a significant adverse impact even though there may be an overall beneficial effect (40 CFR 1508.27).

3.1.2.2 Copper Flat EIS Significance Criteria

Similar projects and documentation were reviewed to ascertain the activities associated with mining that could potentially cause environmental impacts, and the types of impacts they could cause. Research was supplemented by professional judgment concerning impacts of typical concern for any large project.

Criteria were defined as a means of measuring the size of the impact and its significance. A structured framework is required to support conclusions concerning the significance of each of these effects and to systematically integrate individual resource assessments. For example, construction projects generally require some grading and soil disturbance. This disturbance of the soil could be important in and of itself, and it could also affect air quality (by creating fugitive dust), water quality (through erosion of the bare soil and sediment deposition in the surface water), terrestrial resources (through the removal of vegetation and wildlife habitat), and land resources (such as through the removal of prime agricultural soils).

The significance of impacts was determined systematically by assessing four parameters of environmental impact: magnitude (how much), extent (sphere of influence), duration, and likelihood of occurrence. Each parameter was divided into three levels as follows:

Magnitude:
- major
- moderate
- minor

Duration:
- long term
- medium term (intermittent)
- short term

Extent:
- large
- medium (localized)
- small (limited)

Likelihood:
- probable
- possible
- unlikely

For each type of impact identified, definitions of each of the terms listed above were prepared. These are summarized for individual resources in Appendix A. The method of analysis for each impact was as quantitative as possible, given the amount of reliability of the data and the apparent importance of each issue. The overall significance of each impact was then determined by referring to the guidelines shown below. (See Table 3-1.) For example, any impact that conformed to the definitions of major magnitude, medium extent, long-term duration, and probable likelihood was judged to be a significant impact. The following table lists the definitions of the parameters for each type of impact.

Table 3-1. Criteria for Rating Impacts

Table 3-1. Criteria for Rating Impacts				
Level of Impact				
Impact Rating	**Magnitude**	**Extent**	**Duration**	**Likelihood**
Significant	Major	Large or medium	Any level	Probable
	Major	Large or medium	Long-term	Possible
	Major	Any level	Medium-term, intermittent, or short-term	Possible
	Moderate	Large or medium	Any level	Probable
	Major	Small	Any level	Probable
	Major	Small	Long-term	Possible
	Moderate	Large	Any level	Possible
	Moderate	Medium or small	Any level	Possible
	Moderate	small	Any level	Probable
	Major	Large	Any level	Unlikely
	Major	Medium or small	Long-term	Unlikely
	Minor	Large	Any level	Probable
	Minor	Medium or small	Long-term	Probable
	Major	Medium or small	Medium-term, intermittent, or short-term	Unlikely
Not significant	Minor	Medium	Medium-term or intermittent	Probable
	Minor	Large	Any level	Possible
	Minor	Medium or small	Long-term	Possible
	Moderate to minor	Any level	Any level	Unlikely
	Minor	Medium	Short-term	Probable
	Minor	Small	Medium-term, intermittent, or short-term	Probable
	Minor	Medium or small	Medium-term, intermittent, or short-term	Possible

Source: Internal data developed by Solv for EIS evaluation.

3.2 AIR QUALITY

This section discusses the affected environment and the potential impacts to air quality that would occur under each alternative.

3.2.1 Affected Environment

Because air quality is measured and regulated on a regional level, the air quality analysis in this Environmental Impact Statement (EIS) utilizes air quality data from the El Paso-Las Cruces-Alamogordo Interstate Air Quality Control Region (AQCR) (AQCR 153) (40 Code of Federal Regulations [CFR] 81.82). AQCR 153 encompasses four counties in New Mexico as well as several counties in Texas and includes those portions of Sierra County where the Proposed Action would occur.

The U.S. Environmental Protection Agency (USEPA) Region 9 and the New Mexico Environment Department (NMED) regulate air quality in New Mexico. The Clean Air Act (CAA) (42 United States Code [USC] 7401-7671q), as amended, gives USEPA the responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) that set acceptable concentration levels for six criteria pollutants: particulate matter (coarse particles [PM_{10}] and fine particles [$PM_{2.5}$]), sulfur dioxide (SO_2), carbon monoxide (CO), nitrous oxides (NO_x), ozone (O_3), and lead. Short-term standards (1-, 8-, and 24-hour periods) have been established for criteria pollutants that contribute to acute health effects, while long-term standards (annual averages) have been established for criteria pollutants that contribute to chronic health effects. Each State has the authority to adopt standards more strict than those established under the CAA. In general, New Mexico accepts the Federal standards; however, as shown in Table 3-2, the State has lower standards for SO_2, CO, and NO_2, as well as a standard for total suspended particulate (TSP) (NMED 2002).

The NMED has the authority to issue permits for the construction and operation of new or modified stationary source air emissions in New Mexico. NMED air permits are required for any facility that will emit or currently emits regulated pollutants in excess of *de minimis* thresholds (usually 10 tons per year) and must comply with the CAA. In June of 2013, the NMED issued a New Source Review permit for the proposed Copper Flat mine (NSR Permit No. 03655-M3). A full list of the applicable air quality regulations referenced by the Air Permit is included in Appendix B.

3.2.1.1 Monitored Levels of Criteria Pollutants

The NMED monitors levels of criteria pollutants at representative sites in each region throughout New Mexico. Until 2015, concentrations of criteria pollutants were monitored at the closest monitoring station in Grant County, approximately 20 miles west of the mine. Data from this monitoring station are presented in Table 3-2. However, the Grant County monitor was decommissioned in 2015, and there are no longer active NMED monitoring stations near the mine (NMED 2018a). New Mexico Copper Corporation (NMCC) conducted a year-long ambient particulate monitoring program consisting of two low-volume PM_{10} particulate samplers at the mine. Each sampler ran once every 6 days for a full 24-hour period from midnight to midnight. Both sites collected 58 samples between October 1, 2010 and September 30, 2011. The average 24-hour PM_{10} concentration for this period was 17.5 micrograms per cubic meter ($\mu g/m^3$), and the maximum 24-hour PM_{10} concentration was 68 $\mu g/m^3$ (Intera 2012). These levels are well below the PM_{10} NAAQS of 150 $\mu g/m^3$.

Table 3-2. NAAQS, State Standards, and Monitored Levels of Criteria Pollutants

Table 3-2. NAAQS, State Standards, and Monitored Levels of Criteria Pollutants

Pollutant	Primary/ Secondary	NAAQS	NMAQS	Monitored Data near Sierra County[1]
CO				
1-hour[2] (ppm)	Primary	35	13.1	<no data>
8-hour[2] (ppm)		9	8.7	<no data>
NO_2				
1-hour (ppb)	Primary	100	100	6[6]
24-hour (ppm)	N/A	N/A	0.10	<no data>
1-year (ppb)	Primary and Secondary	53	53	<no data>
O_3				
8-hour[3] (ppm)	Primary and Secondary	0.070	0.070	0.058
SO_2				
1-hour[2] (ppb)	Primary	75	75	1.0
3-hour[2] (ppm)	Secondary	0.5	0.5	<no data>
24-hour[2] (ppm)	N/A	N/A	0.10	<no data>
$PM_{2.5}$				
24-hour[4] (μg/m^3)	Primary and Secondary	35	35	3[6]
1-year[5] (μg/m^3)	Primary	12	12	<no data>
1-year[5] (μg/m^3)	Secondary	15	15	<no data>
PM_{10}				
24-Hour[2] (μg/m^3)	Primary and Secondary	150	150	44.0
Pb				
Rolling 3-month average (μg/m^3)	Primary and Secondary	0.15	0.15	<no data>
TSP				
24-hour (μg/m^3)	N/A	N/A	150	<no data>
Annual geometric mean (μg/m^3)	N/A	N/A	60	<no data>

Source: NMED 2002; USEPA 2014a, 2018.

Notes: N/A = not applicable; ppm = parts per million, ppb = parts per billion, TSP = total suspended particulates; μg/m^3 = micrograms per cubic meter.

[1] Until 2015, concentrations of criteria pollutants were monitored at the closest monitoring station in Grant County, approximately 20 miles west of the mine. However, the Grant County monitor was decommissioned in 2015, and there are no longer active NMED monitoring stations near the mine (NMED 2018a).

[2] Not to be exceeded more than once per year.

Table 3-2. NAAQS, State Standards, and Monitored Levels of Criteria Pollutants

[3] The 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations over each year must not exceed 0.075 ppm.

[4] The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor must not exceed 35 µg/m^3.

[5] The annual mean, averaged over 3 years.

[6] Air quality data are from air monitors located approximately 60 miles to the southeast of the mine area in Las Cruces, New Mexico (NMED 2018b).

3.2.1.2 Attainment Status

Federal regulations designate Metropolitan Statistical Areas, counties, or partial counties within AQCRs in violation of the NAAQS as nonattainment areas; AQCRs not in violation of the NAAQS are designated as attainment areas. The USEPA has designated Sierra County as an attainment area for all criteria pollutants (USEPA 2014b). Because the project is in an attainment area, the General Conformity Rule requirements do not apply to the project. The General Conformity Rule, established under the CAA, ensures that the actions taken by federal agencies do not interfere with a State's plans to attain and maintain the NAAQS.

3.2.1.3 National Air Toxics Assessment

The USEPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies hazardous air pollutant emissions by county in the United States. The purpose of the NATA is to identify areas where hazardous air pollutant emissions result in high health risks and further emissions reduction strategies are necessary. A review of the results of recent NATA documents shows that cancer, neurological, and respiratory risks in the project area are well below national levels (USEPA 2011).

3.2.1.4 Class I Areas

The CAA outlines different levels or classes of air quality protection. Generally, Class I areas are the most pristine, and any substantial emission sources in or near them have strict limits set by regulatory agencies. The USEPA provides rigorous safeguards to prevent deterioration of the air quality in Class I areas as specified in 40 CFR 81.421(e). The Prevention of Significant Deterioration (PSD) program designates USEPA Mandatory Class I areas at all international parks, all national wilderness areas, national memorial parks that exceed 5,000 acres, and all national parks that exceed 6,000 acres in existence on August 7, 1977. There are several Class I areas within 250 miles of the mine. (See Table 3-3.) Appendix B provides additional information about the air modeling performed for these Class I areas.

Table 3-3. Class I Areas Near the Proposed Mine

Table 3-3. Class I Areas Near the Proposed Mine		
Area Name	**Acreage**	**Distance (Miles)**
Gila Wilderness Area	433,690	28
Salt Creek Wilderness Area	8,500	186
Carlsbad Caverns National Park	46,435	188
Bandelier Wilderness Area	23,267	205

Source: USEPA 2014c.

3.2.1.5 Overview of Permitting Requirements

The CAA, as amended in 1990, mandates that states develop a State Implementation Plan (SIP) that explains how the state will comply with the Clean Air Act and achieve and maintain attainment of the NAAQS. The New Mexico SIP was initially approved in 1970 and is revised as needed to comply with new Federal or State requirements when new data improves modeling techniques, when a specific area's attainment status changes, or when an area fails to reach attainment (NMAC 2017); it applies to industrial sources, commercial facilities, and residential development activities. Regulation occurs primarily through a process of reviewing engineering documents and other technical information, applying emission standards and regulations in the issuance of permits, performing field inspections, and assisting industries in determining their compliance status.

The NMED implements programs for permitting the construction and operation of new or modified stationary sources of air emissions in New Mexico. NMED air permits are required for many industries and facilities in New Mexico that emit regulated pollutants in excess of *de-minimis* thresholds. The NMED sets permit rules and standards for emissions sources based on the amount and type of pollutants emitted (criteria pollutants or hazardous air pollutants).

The mine would require various permits to construct. There are three types of construction permits available through the NMED for the construction and temporary operation of new emissions sources: PSD permits in attainment areas; major new source construction permits in nonattainment areas (Nonattainment New Source Review (NNSR)); and minor new source construction permits (Title V permits). Notably, mobile and off-road sources of air emissions do not require air permits, but are regulated through tailpipe emissions programs or through manufacturing and design regulations.

As discussed under Section 3.2.1, the NMED issued a NSR permit for the proposed Copper Flat mine in June of 2013 that classified the proposed mine as a PSD Minor and Minor New Source. While only the PSD and minor new source permits (Title V) apply to the Proposed Action, the three types of construction permits are described below for completeness.

Prevention of Significant Deterioration: The PSD regulations specify that major new stationary sources within an air quality attainment area must undergo PSD review. A Source that has the potential to emit greater than 250 tons per year (tpy) of a single criteria pollutant is considered a "major source" and is subject to the PSD review requirements (20.2.74 New Mexico Administrative Code [NMAC], adopted pursuant to 40 CFR 51.166 and 20.2.74 NMAC). Sources subject to PSD review are typically required to complete the following:

- Best Available Control Technology (BACT) review for regulated hazardous air pollutants and designated categories;
- Predictive air dispersion modeling;
- Establishing procedures for measuring and recording emissions and process rates;
- Meeting the New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants requirements; and
- A public involvement process.

Appendix B contains additional information about the PSD limits used for this air quality analysis.

Nonattainment New Source Review: NNSR permits are required for any major new sources or major modifications to existing major sources in a nonattainment area. Because the mine is in an attainment area, the NNSR regulations do not apply.

Minor New Source Review: A minor new source construction permit is required to construct minor new sources, to perform minor modifications to existing sources, and to construct major sources not subject to NNSR or PSD permit requirements. A synthetic minor permit allows a facility to avoid major source requirements by accepting Federally-enforceable limits below the major source thresholds. The Minor New Source Review permit process also ensures that there would not be an exceedance of any NAAQS or New Mexico Ambient Air Quality Standards (NMAAQS). The Minor New Source Review permitting process typically takes 30 days for determination of completeness, then 90 days for the permit to be granted or denied (20.2.72.207 NMAC). Sources subject to Minor New Source Review could be required to complete the following:

- Maximum available control technology review for regulated hazardous air pollutants and designated categories;
- Predictive air dispersion modeling as required by 20.2.72.203 NMAC; and
- Establishment of procedures for measuring and recording emissions and process rates.

In addition to a construction permit, the mine would require an operating permit. Under State and Federal operating permit regulations, a Title V permit is required for facilities whose emissions exceed the major source threshold of 100 tpy of criteria pollutants.

3.2.2 Environmental Effects

This section discusses the results of the air dispersion modeling performed for the NMED air permit (required under 20.2.72.203 NMAC) and the potential impacts to air quality that would result under each alternative. Additional information about the air modeling methodology and results is included in Appendix B. Notably, the air modeling was performed using input data from Alternative 1 (25,000 tons of copper ore per day scenario); however, due to the similar activities that would occur under all action alternatives, the results were used to estimate the impacts under the Proposed Action and Alternative 2.

3.2.2.1 Proposed Action

Short- and medium-term, minor, small extent, and probable adverse effects would be expected under the Proposed Action. Short-term effects would be limited to fugitive dust and heavy vehicle emissions during site preparation, while medium-term effects would be due to fugitive dust and heavy vehicle emissions during mine operation and reclamation. The Proposed Action would not exceed major source thresholds outlined in the PSD regulations, generate emissions that would exceed the NAAQS or NMAAQS at any nearby location, or contribute to a violation of any State, Federal, or local air regulation. The following subsections discuss the potential air emissions generated by mine development/operation and reclamation, the potential impacts to local air quality and Class I areas, and applicable permitting requirements. Overall, impacts would not be significant.

3.2.2.1.1 Mine Development and Operation

Mine development activities that would affect air quality include soil stripping, blasting, and construction of the TSF and concentrator. In addition, heavy equipment exhaust emissions would be generated during construction and site preparation. Particulate matter emissions levels from development activities would vary, and impacts off-site would depend on the construction location and the daily wind and weather. While controls, such as road watering, would reduce the amount of fugitive dust emissions from construction and site preparation activities, some level of fugitive dust emissions would be unavoidable due to the nature of the activities. These activities may require an air quality permit from the NMED, which would require that watering or other measures be taken to limit fugitive dust emissions. Although some impacts would occur, they would be transitory, temporary, and controlled through best management practices (BMPs) required by the NMED. The air quality permit issued by NMED would require controls that would ensure air emissions would not exceed any NAAQS or NMAAQS.

Mine operation activities may affect air quality, primarily from the generation of fugitive dust from the use of haul roads, crushing activities, materials storage and handling, and wind erosion from stockpiles of soil. In addition, some fugitive dust would be generated by land clearing, earth moving, scraping, truck loading, drilling, and blasting. Other pollutants emitted would include NO_x, CO, and SO_2 from heavy equipment exhaust, generators, personal vehicles, and other mobile equipment used on-site (i.e., small and medium trucks). The estimated total direct and indirect emissions associated with the Proposed Action and Alternatives 1 and 2 are presented below. (See Table 3-4.) Because Sierra County is in attainment, no emissions inventory is required or available; however, it is expected that the emissions from the proposed facility would be a small fraction of the total county-wide emissions. A detailed breakdown of mine operational emissions and the methodology used for the calculations are included in Appendix B.

Table 3-4. Estimated Operational Emissions

Table 3-4. Estimated Operational Emissions							
Estimated Annual Emissions (tpy)							
Proposed Action – 17,500 tons of copper ore per day	**NO_X**	**CO**	**SO_2**	**VOC**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
Uncontrolled facility totals[1]	28.8	113.6	3.4	<0.1	2,725.3	804.7	90.3
Allowable facility totals[2]	28.8	113.6	3.4	<0.1	348.2	117.8	25.6
Alternative 1 - 25,000 tons of copper ore per day							
Uncontrolled facility totals[1]	54.4	214.4	6.4	<0.1	5,145.3	1,519.2	170.4
Allowable facility totals[2]	54.4	214.4	6.4	<0.1	657.4	222.4	48.3
Alternative 2 - 30,000 tons of copper ore per day							
Uncontrolled facility totals[1]	65.3	257.3	7.7	<0.1	6,174.4	1,823.0	204.5
Allowable facility totals[2]	65.3	257.3	7.7	<0.1	788.8	266.9	57.9

Source: NMED 2014a.

Note: CO = carbon monoxide; NO_x = nitrous oxides; PM_{10} = particulate matter; $PM_{2.5}$ = fine particles; SO_2 = sulfur dioxide; TSP = total suspended particulates; VOC = volatile organic compound.

[1] Uncontrolled facility totals are the emissions that would be generated if air quality practices (i.e., dust control measures) were not implemented. These values were calculated using a predictive air model, as required by 20.2.72.203 NMAC.

[2] Allowable facility totals are the emissions allowed under the NMED Air Permit. Dust control measures such as water application on haul roads, chemical dust suppressant application, and dust collectors would be used to reduce emissions to the allowed levels (see Appendix B).

Permitting and regulatory review: During the final design stage and the permitting process, the actual equipment, controls, or operating limitations would be selected to keep the potential emissions below the PSD major source thresholds (discussed in Appendix B); the emissions from the project would also be included in the regional emissions inventory, ensuring that it would not interfere with the ability of the State to maintain the NAAQS or NMAAQS. The air quality permitting process would ensure that air impacts from the mine would not cause or contribute to violations of State or Federal standards.

The modeling performed for the air permit demonstrated compliance with all applicable ambient air quality standards. (See Appendix B.) Because the controlled process emissions under the Proposed Action would be below the 250 tpy PSD permitting threshold, a minor source construction permit was applied for in February 2013, and the permit was issued in June of 2013 (NSR Permit No. 03655-M3).

The permit emission limitations were based on the 25,000 tons of copper ore per day mine operating scenario (presented as Alternative 1 in this EIS) and would cover all mine activities under the Proposed Action. Although the mine would be considered a PSD minor source, it would be required to submit a Title V operating permit application because the CO and PM_{10} emissions would exceed 100 tpy. As a Title V major source, the facility would be required to submit an emissions inventory on an annual basis.

Class I areas: During the air permitting process, the PSD increment under the 25,000 tons of copper ore per day mine operating scenario (the operating rate for Alternative 1) was estimated for all pollutants at the nearest Class I areas. A PSD increment is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant and, in general, is the ambient concentration existing at the time that the first complete PSD permit is submitted. The nearest Class I area is Gila Wilderness Area, approximately 28 miles away. Air modeling was performed, and no model results were above USEPA-proposed Significant Impact Levels for any of the pollutants presented in Table 3-4. Emissions from the mine would rapidly decrease to background levels and would have no effect on nearby Class I areas. See Appendix B for additional information about the modeling performed for Class I Areas.

3.2.2.1.2 Construction/Operation of Copper Storage Shed

The copper concentrate storage shed would be constructed on a leased parcel of land approximately 45 road miles from the project site near the rail line that passes through Rincon. During construction and operation activities, use of heavy equipment would generate air emissions similar in nature to those during the mine development discussed above. However, while air emissions would be generated from constructing and operating the copper storage shed, the emissions would be much less than the air emissions generated by mine development and operation. (See Table 3-4.)

3.2.2.1.3 Mine Closure/Reclamation

Reclamation and revegetation would stabilize exposed soil and control fugitive dust emissions. As vegetation becomes established, particulate emission levels would return to what is typical for a dry, desert environment. Equipment use, vehicular traffic, and associated emissions would essentially cease following mine closure. Once reclamation was successfully completed (approximately 23 years after construction activities begin), ambient pollutant concentrations would return to existing (i.e., pre-mining operation) levels.

3.2.2.2 Alternative 1: Accelerated Operations – 25,000 Tons of Copper Ore per Day

Short- and medium-term, minor, small extent, and probable adverse effects would be expected under Alternative 1. The air quality effects from mine development, operation, closure, and reclamation would be similar in nature, but at a slightly greater level than those outlined under the Proposed Action. Short-term effects would be limited to fugitive dust and heavy vehicle emissions during site preparation, while medium-term effects would be due to fugitive dust and heavy vehicle emissions during mine operation and reclamation. Alternative 1 would not exceed major source thresholds outlined in the PSD regulations, generate emissions that would exceed the NAAQS or NMAAQS at any nearby location, or contribute to a violation of any State, Federal, or local air regulation. Overall, impacts would not be significant.

The total direct and indirect emissions associated with Alternative 1 are outlined in Table 3-4. A detailed description the emission modeling is included in Appendix B. Controlled process emissions under Alternative 1 would be below the 250 tpy PSD permitting threshold; therefore, a minor source construction permit was applied for as discussed in 3.2.2.1, Proposed Action, with permit emission limitations based on the 25,000 tons of copper ore per day operating scenario of Alternative 1. During the air permitting process, the PSD increment was estimated for all pollutants at the nearest Class I areas. Air modeling was performed, and no model results were above USEPA-proposed Significant Impact Levels. The Significant Impact Levels used for the analysis are discussed further in Appendix B.

Similar to the Proposed Action, the mine construction, operations, and reclamation activities would be accomplished with compliant practices and products, in full compliance with current New Mexico regulatory requirements. These requirements, as well as all emission controls and BMPs, would be identical to those outlined under the Proposed Action.

3.2.2.3 Alternative 2: Accelerated Operations – 30,000 Tons of Copper Ore per Day

Short- and medium-term, minor, small extent, and probable adverse effects would be expected under Alternative 2. The air quality effects from mine development, operation, closure, and reclamation would be similar in nature, but slightly greater than Alternative 1. Short-term effects would be limited to fugitive dust and heavy vehicle emissions during site preparation, while medium-term effects would be due to fugitive dust and heavy vehicle emissions during mine operation and reclamation. Alternative 2 is not expected to exceed major source thresholds outlined in the PSD regulations, generate emissions that would exceed the NAAQS at any nearby location, or contribute to a violation of any State, Federal, or local air regulation. Overall, impacts would not be significant.

However, because the modeled emissions estimates shown in Table 3-4 were based on the 25,000 tons of copper ore per day operating scenario of Alternative 1 and do not cover all activities under Alternative 2, an air permit revision, including an updated dispersion modeling analysis, would be required if Alternative 2 were ultimately selected. During the air permitting process, the PSD increment would be estimated for all pollutants at the nearest Class I areas, and as with Alternative 1, it is likely that model results would be below USEPA-proposed Significant Impact Levels. The Significant Impact Levels used for the analysis are discussed further in Appendix B.

It is estimated that the total direct and indirect emissions associated with Alternative 2 would begreater than the emissions outlined in Table 3-4. A detailed discussion of how these emissions were estimated is included in Appendix B. Except for CO and PM_{10}, controlled process emissions under Alternative 2 would be below the 250 tpy PSD permitting threshold, and the potential to emit CO and PM_{10} would only be slightly higher than the major source threshold. It is expected that if Alternative 2 were ultimately selected, controls or permit limitations would be put in place to ensure that CO and PM_{10} emissions would remain below the threshold. Overall, the potential air quality impacts under Alternative 2 would be less than significant. As with Alternative 1, NMCC would be required to submit a Title V application and annual emission inventories because the CO and PM_{10} emissions would exceed 100 tpy.

As with the Proposed Action and Alternative 1, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements, and with compliant practices and products. These requirements, as well as all emission controls, BMPs, and mitigation measures, are identical to those outlined under the Proposed Action.

3.2.2.4 No Action Alternative

Under the No Action Alternative, the proposed mine plan of operations (MPO) would not be approved, and mining activities would not occur at the site. However, if the No Action Alternative is selected, a sulfate plume that resulted from previous Quintana mining activities would be cleaned up according to the Stage 1 Abatement Plan (JSAI 2013a). The cleanup activities would require operation of motorized equipment onsite and therefore, would generate air emissions; however, because of the limited scale of the cleanup activities compared to the construction and operation of the mine, the overall impact would be less than the Proposed Action; therefore, adverse effects would be short-term, minor, of small extent, and probable. Overall, impacts would not be significant.

3.2.3 Mitigation Measures

BMPs would be required and implemented for activities associated with the Proposed Action. Appropriate emission control equipment would be installed and operated in accordance with the air quality construction permit. Air quality and dust control BMPs for mine operations may include the following:

- Water would be applied on haul roads and other disturbed areas and other dust control measures would be used as per accepted and reasonable industry practice.
- Disturbed areas and stockpiles would be seeded with an interim seed mix to minimize fugitive dust emissions from unvegetated surfaces where appropriate.
- Crusher and conveyor drop points and deposition of tailings would utilize spigotting or cyclone discharge. The surface would be wetted by implementing NMED and Mine Safety and Health Administration (MSHA)-approved Sonic Misting Systems, which are considered to be the BACT.
- The lime storage would be fitted with a baghouse for capture of fugitive dust during loading of the lime bin. The sample preparation lab would be equipped with fans and filters.
- Deposition of tailings would be wetted by spigotting or cyclone discharge. By this procedure, the surface would be wet, thereby eliminating or reducing fugitive dust. As necessary, control of fugitive dust in the vicinity of the tailings pond would be attained by watering, sprinkling, and vegetation.
- Drilling operations would be done wet or with other efficient dust control measures as set by the MSHA/the New Mexico Office of the State Mine Inspector, and New Mexico mining and exploration permit requirements.
- Combustion emissions from mobile mining machinery and support vehicles would be controlled by manufacturer pollution control devices.

3.3 CLIMATE, CLIMATE CHANGE, AND SUSTAINABILITY

3.3.1 Affected Environment

This section describes the current climatic conditions of the mine area and the current state of knowledge regarding climate change. The following paragraphs also discuss the responsibility of Federal agencies to meet Federal mandates and regulations related to climate change and sustainability.

3.3.1.1 Mine Area Climate

The mine area is located in an arid to semiarid climate regime typified by dry windy conditions and limited rainfall. Temperature data for the mine area show a wide daily and seasonal variability, which is typical of dry climates. The warmest temperatures occur in June and July and the coldest temperatures usually occur in December and January. In spring and fall, daily maximum temperatures are moderate, typically averaging 65 to 85 degrees Fahrenheit (°F). Nights are cooler, with low temperatures averaging 32 to 50°F. Summer maximum temperatures are generally in the 90s to low 100s (°F) and winter minimum temperatures are generally in the 20s or 30s. Temperatures have reached above 100°F in every month from May to September and have occasionally dipped below zero in December, January, and February. Daily temperature fluctuations of 30°F are common throughout the year (Intera 2012).

Table 3-5 shows meteorology normals from the nearest New Mexico State University-monitored climate station for the 30-year period from 1981-2010 for Hillsboro, New Mexico, which is the closest observation site to the proposed mine area for which normals are available. This station is located approximately 5 miles to the southwest of the mine area (NMSU 2012).

Table 3-5. Meteorology Normals 1981-2010

Table 3-5. Meteorology Normals 1981-2010													
Hillsboro, New Mexico	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual Averages**
Average temperature (°F)	40.2	44.1	50.0	57.2	65.5	73.4	76.0	73.8	67.9	58.2	47.2	39.5	57.8
Average max temperature (°F)	55.2	59.9	66.4	74.4	83.1	91.3	91.2	88.2	83.5	74.5	63.1	54.2	73.8
Average min temperature (°F)	25.3	28.2	33.5	39.9	47.8	55.5	60.7	59.4	52.3	41.8	31.2	24.7	41.7
Average precipitation (inches)	0.62	0.48	0.37	0.37	0.75	0.87	2.29	2.80	2.03	1.29	0.78	1.03	1.14

Source: NOAA 2012.

Precipitation is divided between summer thunderstorms associated with the Southwest Monsoon and winter rain and snowfall as Pacific weather systems drop south into New Mexico. Precipitation at the mine area averages about 13 inches per year (ranging from nearly 3 inches in 1956 to over 20 inches in 1986). As much as half of the annual precipitation occurs in the form of intense thunderstorms during July, August, and September when moist air enters the region from the Gulf of Mexico. Summer thunderstorms can result in heavy rainfall and flash floods. Average monthly precipitation in January through June is typically 0.50 inch or less. Snowfall is possible from October through April, but most likely (greater than 1 inch) between December through February (Intera 2012). Table 3-5 also shows average precipitation for the 30-year period from 1981-2010 for Hillsboro, New Mexico.

Evaporation exceeds precipitation in southwestern New Mexico. Pan evaporation data, the most commonly collected data, are correlated with lake evaporation (i.e., free water surface evaporation) to predict evaporation from reservoirs and lakes. Lake evaporation at the mine area is estimated to be approximately 58 to 65 inches per year, and pan evaporation is estimated to be approximately 80 to 90 inches per year (Intera 2012). (See Table 3-6.)

Table 3-6. Net Evaporation Summary - October 2010 through September 2011

Table 3-6. Net Evaporation Summary - October 2010 through September 2011		
Month	**Monthly Net Evaporation (inches)**	**Cumulative Net Evaporation (inches)**
October	3.959	3.959
November	1.152	5.111
December	***	***
January	***	***
February	***	***
March	***	***
April	9.562	14.673
May	11.146	25.819
June	14.249	40.069
July	10.339	50.407
August	5.938	56.345
September	6.181	62.526
Total		**62.526**

Source: Intera 2012.

Note: *** = Evaporation offline from 11/10/10 at 0900 through 04/02/2011 at 0700 for winter months.

3.3.1.2 Climate Change

Climate is the composite of generally prevailing weather conditions of a particular region throughout the year, averaged over a series of years. According to the United Nations (U.N.), climate change refers to a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or land use. Climate change research reports from the U.N. Intergovernmental Panel on Climate Change (IPCC), U.S. Climate Change Science Programs Science Synthesis and Assessment Products, and the U.S. Global Change Research Program conclude that the Earth's climate is changing, and this change is expected to accelerate (USDA 2009). Some observed changes include shrinking of glaciers, thawing of permafrost, later freezing and earlier break-up of ice on rivers and lakes, lengthening of growing seasons, shifts in plant and animal ranges, and earlier flowering of trees (IPCC 2007).

Average global temperature increases may be associated with human-induced increases in greenhouse gas (GHG) emissions released into the atmosphere as a result of combustion. GHGs, which include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_x), water vapor, and several trace gases, trap radiant heat reflected from the Earth, causing the average temperature to rise. The predominant GHGs emitted in the U.S. are CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. In the U.S., anthropogenic GHG emissions come primarily from burning fossil fuels. Although GHG levels have varied for millennia (along with corresponding variations in climate conditions), recent more dramatic increases contribute to overall climate change. Increased CO_2 concentrations also lead to preferential fertilization of growth of specific plant species.

Energy-related CO_2 emissions from the combustion of petroleum, coal, and natural gas accounted for 81.5 percent of total U.S. anthropogenic GHG emissions in 2016. Anthropogenic CH_4 emissions from landfills, coal mines, oil and natural gas operations, and agriculture accounted for 10 percent of U.S. emissions. N_2O emitted through fertilizers, burning of fossil fuels, and from industrial and waste management processes accounted for 5.6 percent of total emissions. Several human-made gases accounted for 2.9 percent of the GHG emissions total (USEPA 2016).

In 2016, U.S. GHG emissions totaled 6,546 million metric tons of carbon dioxide equivalents (CO_2e). Carbon dioxide equivalent or "CO_2e" is a term for describing different GHGs in a common unit. For any quantity and type of GHG, CO_2e signifies the amount of CO_2 which would have the equivalent global warming impact. U.S. emissions decreased by 2 percent from 2015 to 2016. This decrease was driven in large part by a decrease in CO2 emissions from fossil fuel combustion. Gross GHG emissions in 2016 were higher by 2.8 percent compared to 1990 levels (USEPA 2016).

Concentrations of CO_2 in the atmosphere are naturally regulated by numerous processes collectively known as the carbon cycle. The movement of carbon between the atmosphere and the land and oceans is dominated by natural processes, such as plant photosynthesis. While these natural processes can absorb some of the anthropogenic CO_2 emissions produced each year (measured in carbon equivalent terms), the Earth's positive imbalance between emissions and absorption results in the continuing growth in GHGs in the atmosphere.

Climate change will impact regions differently and warming will not be equally distributed. Greater impacts are expected at higher latitudes, in the tropics and subtropics, than are expected in the mid-latitudes. Warming of surface air temperature over land will likely be greater than over oceans. Frequency of warm days and nights will increase and frequency of cold days and cold nights will decrease in most regions. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. Increases in the duration, intensity, and extent of extreme weather events are predicted. The frequency of both high and low temperature events is expected to increase. Near- and long-term changes are also projected in precipitation, atmospheric circulation, air quality, ocean temperatures and salinity, and sea ice cover. Climate change is expected to persist for many centuries even if emissions of CO2 are stopped but continued increases in concentrations may accelerate the rate of climate change in the future (BLM 2016).

The predominant GHGs emitted in the United States are CO2, CH4, N2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Anthropogenic GHG emissions come primarily from burning fossil fuels, which accounted for 94% of CO2 emissions in 2011. Globally, the United States accounted for approximately 18% of the CO2 added to the atmosphere through the combustion of fossil fuels in 2010 (EPA 2013).

3.3.1.3 Sustainability

Sustainability and smart growth work to meet the needs of the present without compromising the ability of future generations to meet their own needs. To reduce environmental impacts and address limited resources, the BLM follows sustainability mandates related to several topics to promote sustainable planning, design, development, and operations. These topics are as follows:

- Guiding Principles for Sustainable Federal Buildings;
- Use of recovered/recycled content and biobased products;
- Energy conservation;
- Renewable energy;
- Water conservation;
- Construction and demolition debris; and
- Sustainable operations and maintenance.

Project activities to which these topics pertain include the construction of new facilities at the project site and the proper use of all equipment related to construction, operation, and decommissioning. Project activities would be carried out in accordance with Federal, State, and local laws and regulations, as well as BMPs designed specifically with environmental protection, and thus sustainability, in mind.

3.3.1.4 Regulatory Requirements Related to Climate Change and Sustainability

The following Federal mandates and regulations shape the BLM's responsibilities related to climate change and sustainability:

- The Energy Independence and Security Act of 2007;
- The Energy Policy Act of 2005;
- EO 13352, "Facilitation of Cooperative Conservation";
- The Federal Leadership in High Performance and Sustainable Building Memorandum of Understanding (MOU) 2006; and
- Pollution Prevention Act, 42 USC § 13101 *et seq.*

3.3.2 Environmental Effects

According to NASA (2016), on a global scale, climate change is likely to have many adverse effects, including the following:

- Global warming;
- Increase in the duration of the frost-free season;
- Changes in precipitation patterns, namely an increase in heavy precipitation events;
- Increased droughts and more intense heat waves (periods of abnormal hot weather lasting days to weeks);
- Stronger and more intense hurricanes; and
- A rise in sea level of 1-4 feet.

In the southwestern U.S., where the Copper Flat project would take place, climate change is predicted to cause increased heat, drought, and insect outbreaks, all of which can increase the rate and severity of wildfires. These effects will likely result in declining water supplies and reduced agricultural yields (NASA 2016). The potential impacts of the Proposed Action and alternatives are described below.

3.3.2.1 Proposed Action

Short- and medium-term, minor, small extent, probable, adverse effects to climate change and sustainability would be expected under the Proposed Action. Short-term effects would be due to heavy vehicle emissions and the construction of facilities during site preparation, while medium-term effects would be due to heavy vehicle emissions and operation of facilities during mine operation and reclamation. The Proposed Action would not contribute to a violation of any Federal, State, or local regulation associated with emissions, climate, or sustainability. Overall, impacts would not be significant.

3.3.2.1.1 Mine Development and Operation

Mine development activities that would affect climate change include the use of heavy equipment that creates exhaust emissions during construction and site preparation and the construction of facilities at the site. Impacts off-site would depend on the construction location and the daily wind and weather. Although some impacts would occur, they would be transitory, temporary, and controlled through BMPs described in Section 3.2, Air Quality.

Emission of pollutants such as NO_x, CO, and SO_2 would occur during operation of facilities due to exhaust emissions from heavy equipment, generators, personal vehicles, and other mobile equipment used on-site (i.e., small and medium trucks). The Proposed Action would use an estimated 150,000 gallons of fuel per year (equal to 22.40 lbs of CO_2e per gallon of diesel). Thus, approximately 1,680 tons of CO_2e would be emitted from vehicle use each year. Other total direct and indirect emissions associated with the Proposed Action are outlined in Section 3.2, Air Quality. A detailed breakdown of mine operational emissions is included in Appendix B.

NMCC submitted an air quality permit application for Copper Flat mine under New Mexico State regulation 20.2.72 NMAC on February 21, 2013 and received a New Source Review Air Quality Permit #0365-M3 on June 25, 2013. As part of the permit application, it was determined that GHG emissions were below major source thresholds of 100,000 tpy, which would have required permitting as a major source of GHGs. The determination was based on the anticipated emissions from regulated stationary sources permitted under Air Quality Permit #0365-M3. These sources include blasting and chemical reactions that could potentially produce GHGs. The main identified source of GHGs from regulated sources was blasting. To determine the annual GHG emission rate, NMCC used an emission factor (0.17 tons GHG/ton of ammonium nitrate and fuel oil [ANFO]) from a document published by the Commonwealth of Australia and the annual tons of ANFO anticipated to be used by the Proposed Action. As stated in the permit application, the amount of prill (pelletized mining product) to be used per year was 3,650 tpy. Prill makes up approximately 90 percent of the content in ANFO, which, for the Proposed Action, would amount to 4,055 tpy of ANFO.

The following calculation is the estimated amount of GHGs that would occur from blasting annually format the Copper Flat mine under the Proposed Action.

GHG (tpy) = 0.17 tons GHG/ton of ANFO * 4055 tons of ANFO/yr = 689 tons

As stated in the permit application, the amount of chemicals to be used would be 12,319 tpy. Even though chemical reactions from use of these chemicals may not generate GHGs, it was conservatively estimated that all chemicals could produce an equal amount of GHGs. Thus, the maximum estimated total of GHGs from regulated sources at Copper Flat mine under the Proposed Action would be:

689 tpy blasting + 12,319 tpy chemical reaction = 13,008 tpy

This amount (13,008 tpy) is well below the major source threshold of 100,000 tons GHG (CTS 2016). Thus, further analysis for New Mexico Regulation 20.2.72 NMAC is not required.

Construction of facilities at the mine site would have minor and adverse impacts to climate change due to building emissions related to energy use. Impacts to sustainability would be minor and adverse due to the consumption of materials, water, and energy at the facilities, reduction of impervious surface, and the generation of solid waste.

Impacts of climate change on groundwater: Groundwater responds rapidly to local stresses or inputs (e.g. pumping of wells) but slowly to regional climate changes. Moreover, natural climate is variable, and any imprint from climate change is very difficult to determine from that variability on a local scale.

Based on the consensus of the various models discussed in Section 3.6, Groundwater Resources, the primary projected climate change impact for the region surrounding the proposed permit area is that the future water resources in the Rio Grande would experience an overall decrease in total supply due to a higher rate of evapotranspiration (ET) in the contributing basins, and a seasonal shift from less spring runoff (less snowmelt) to more summer runoff (more thunderstorm precipitation).

Permitting and regulatory review: Permitting scenarios may vary based on the final design, timing of the project, and the types of controls ultimately selected. These may differ in specific features from the ones described in this EIS. During the final design stage and the permitting process, the actual equipment, controls, or operating limitations would be selected to reduce the potential to emit below the major source threshold.

Permitting requirements for proposed stationary sources are based on their overall potential to emit criteria pollutants. The project is designed to limit emissions below major source thresholds (i.e., to be permitted as a synthetic minor source) and PSD review is not required.

3.3.2.1.2 Mine Closure/Reclamation

Equipment use, vehicular traffic, facility operation, and associated emissions would essentially cease following mine closure. Once reclamation is successfully completed, ambient pollutant concentrations would return to existing (i.e., pre-mining operation) levels.

3.3.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Impacts on climate change and sustainability from Alternative 1 would be adverse, medium- and long-term, minor, of small extent, and would occur with probable likelihood. The effects from mine development, operation, closure, and reclamation would be similar in nature, but at a somewhat greater level than those outlined under the Proposed Action. Alternative 1 would still not exceed major source thresholds outlined in the PSD regulations, generate emissions at any nearby location, or contribute to a violation of any State, Federal, or local regulation related to air emissions, GHG emissions, climate, or sustainability. Overall, impacts would not be significant.

Emissions from vehicle use associated with the project are assumed to be the same under all alternatives. These emissions are described under Section 3.3.2.1.1, Mine Development and Operation. Emissions resulting from blasting and the use of chemicals under Alternative 1 are anticipated to occur at rates, respectively, 1.33 and 1.43 times higher than under the Proposed Action. This would result in emissions of 919 tpy of GHGs from ANFO, 17,599 tpy of GHGs from the use of chemicals, and 1,680 tpy of GHGs from the use of diesel fuel to power project-related vehicle use. (See Table 3-7).

Table 3-7. Estimated GHG Emissions Under Alternative 1

Table 3-7. Estimated GHG Emissions Under Alternative 1		
Project Component	Emissions of CO_2e (tpy)	Rate Compared to Proposed Action
Use of ANFO	919	1.33 times greater/year
Chemical reactions	17,599	1.43 times greater/year
Use of vehicles/diesel fuel	1,680	NA

Source: NMCC 2014a.

Note: GHG emissions are assumed to be the same between the Proposed Action and Alternative 1.

As with the Proposed Action, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements, with compliant practices and products. These requirements, as well as all emission controls, and BMPs would be identical to those outlined under the Proposed Action.

3.3.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Medium- and long-term, minor, small extent, and probable adverse effects on climate change and sustainability would be expected under Alternative 2. The effects from mine development, closure, and reclamation would be similar in nature and level as the Proposed Action, but impacts from accelerated operations would be similar to Alternative 1. Alternative 2 would not likely exceed major source thresholds outlined in the PSD regulations, generate emissions at any nearby location, or contribute to a violation of any State, Federal, or local air, climate, or other regulation related to sustainability. Overall, impacts would not be significant.

The total direct and indirect emissions associated with Alternative 2 are outlined in Table 3-4, and a detailed breakdown of emissions is included in Appendix B. The potential to emit CO_2 would only be slightly higher than the major source threshold. It is expected that if Alternative 2 were ultimately selected, controls or permit limitations would ensure that CO_2 emissions impacting climate would remain below the threshold.

As with the Proposed Action and Alternative 1, mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements, with compliant practices and products. These requirements, as well as all emission controls, BMPs, and mitigation measures are identical to those outlined under the Proposed Action.

3.3.2.4 No Action Alternative

Under the No Action Alternative, the proposed MPO would not be approved, and mining activities would not occur at the site. However, if the No Action Alternative is selected, a sulfate plume that resulted from previous Quintana mining activities would be cleaned up according to the Stage 1 Abatement Plan (JSAI 2013a). Although cleanup activities would generate air emissions as a result of the operation of vehicles and equipment, because of the limited scale of the cleanup activities compared to the construction and operation of the mine, the overall adverse impact would be less than the Proposed Action; therefore, adverse impacts would be short-term, minor, of small extent, and with probable likelihood. Overall, impacts would not be significant.

3.3.3 Mitigation Measures

Although there are no active regulations that would require GHG mitigations for the proposed project, NMCC has identified in its air permit an array of monitoring and compliance measures that would be taken, which do involve measures related to the minimization of GHG emissions.

BMPs, as described in Section 3.2, Air Quality, would be required and implemented for activities associated with the Proposed Action. These BMPs would serve to reduce emissions of GHGs and dust, slightly lessening adverse impacts to climate change. For example, combustion emissions from mobile mining machinery and support vehicles would be controlled by manufacturer pollution control devices.

No mitigation measures for climate change and sustainability beyond regulatory requirements described in the Proposed Action have been identified for any alternative.

3.4 WATER QUALITY

The following sections describe water quality in the proposed mine area and the predicted effects on water quality from the Proposed Action and alternatives. Proposed mitigations for water quality impacts are also discussed.

3.4.1 Affected Environment

Mining at the Copper Flat deposit has occurred intermittently over the last century, and previous mining activities have affected water quality. The most extensive previous mining activities at Copper Flat occurred in the early 1980s during the time that Quintana Minerals operated a mine at this location. Quintana Minerals constructed a mineral processing facility, tailings storage facility (TSF), waste rock areas, and an open pit during a brief period of operation. Quintana's mining activities ceased in 1982 after only 3 months of production as a result of low metals prices. The mine was placed in temporary cessation for several years and was reclaimed in 1986.

Mining-related environmental laws have become more stringent in the past several decades; mine water quality management practices that are currently commonplace were not well-developed in the early 1980s when Quintana operated the mine. Mining practices during that period caused adverse effects to both groundwater and surface water quality in the Copper Flat mine area.

Characterization of the affected environment for water quality is pertinent for several reasons. It defines the baseline water quality in the mine area, which could be affected either beneficially or adversely by the Proposed Action or alternatives. It also provides insight into the natural geochemical characteristics of the ore body and the various mechanisms that may release contaminants into the environment.

3.4.1.1 Boundary of Analysis Area

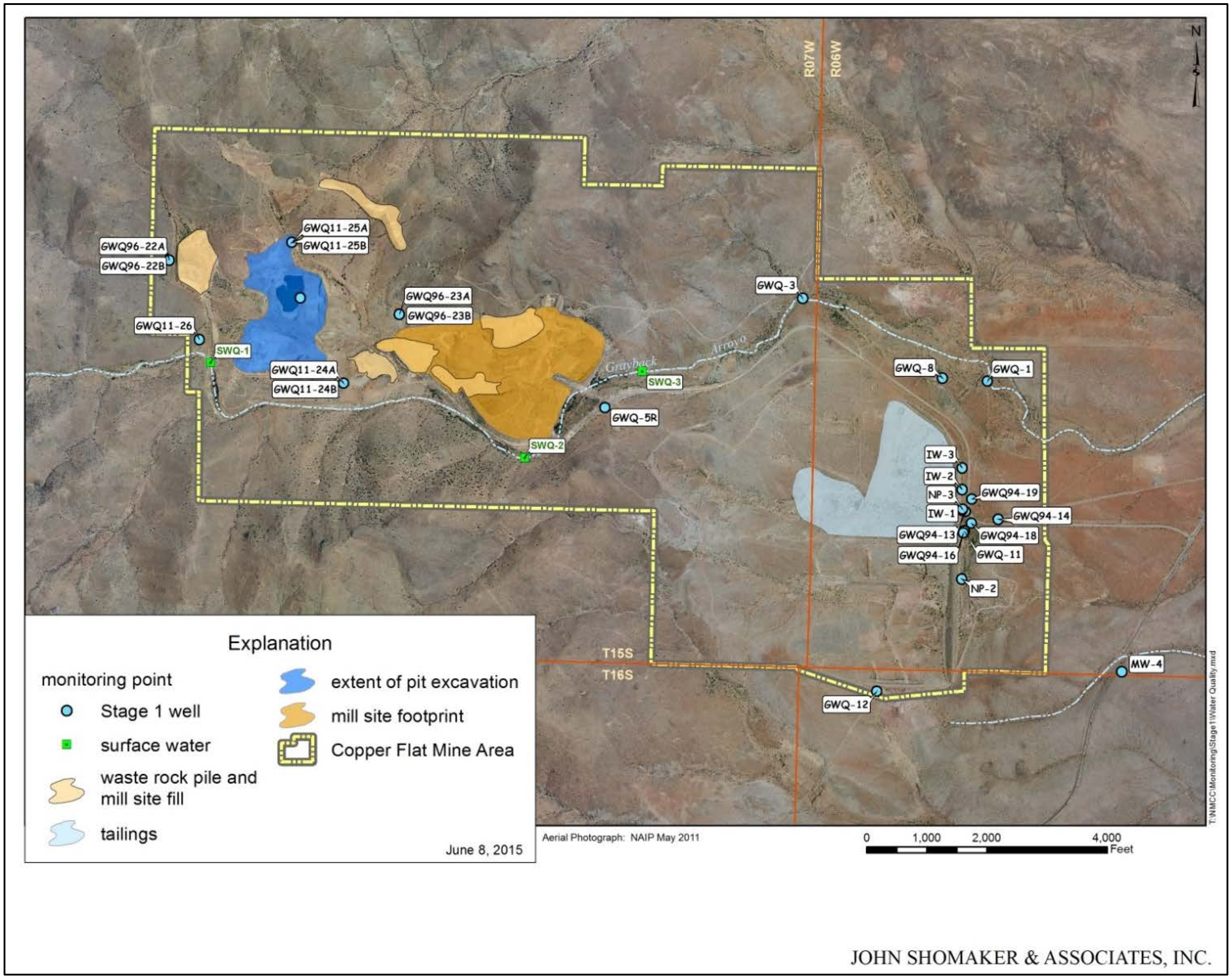
The geographic boundary of the analysis and the relevant media (i.e., surface water and groundwater) were determined based on analysis of the water quality issues identified during scoping. Potential effects to water quality would occur within the primary mine permit area, which includes the mine pit, waste rock storage areas, the mineral processing facility, and the TSF. (See Figure 3-1.) Therefore, the following analysis focuses on this area.

The primary mine permit area encompasses portions of the land listed in the legal description below.

New Mexico Principal Meridian, New Mexico
T. 15 S., R. 6 W.,
secs. 30 and 31.
T. 16 S., R. 6 W.,
sec. 6.
T. 15 S., R. 7 W.,
secs. 25, 26, 27, 35, and 36.

The analysis area is entirely within the Greenhorn Arroyo watershed. The proposed mining-related disturbance would occur within the Greyback Arroyo watershed, which is a tributary within the Greenhorn Arroyo watershed.

Figure 3-1. Location of Selected Baseline Surface Water and Groundwater Sampling Sites



Source: JSAI 2013a.

Although the water supply wells for the proposed mine are located outside of the primary mine disturbance area, effects to water quality are not anticipated to be caused by pumping of water from the supply wells. Therefore, the area of the supply wells is not included within the geographic bounds of the water quality effects analysis.

3.4.1.2 Potentially Affected Media and Indicators

The media that will be evaluated for water quality impacts are defined as follows:

- Surface water includes the pit lake and ephemeral streams within the geographic boundary of the effects analysis.
- Groundwater includes water located beneath the surface of the primary mine disturbance area within the zone of saturation.

The measurement indicator for surface water and groundwater quality was defined based on comparison of existing water quality and expected future water quality analysis with applicable water quality standards set forth by the State of New Mexico. This measurement indicator is the number of water quality parameters that exceeded applicable standards during the baseline monitoring period or that are expected to exceed applicable standards in the future.

For example, if surface water or groundwater quality exceeds the applicable State water quality standard for cadmium and copper, but meets other applicable water quality standards, a measurement indicator of 2 would be applied. If the water quality meets all applicable water quality standards, a measurement indicator of zero would be applied. Accordingly, a lower value of the measurement indicator indicates water with relatively better water quality, whereas a higher value of the measurement indicator indicates water with relatively lower water quality. This approach to measuring water quality will be applied in the following sections, which define the water quality characteristics of the affected environment and assess the potential effects to water quality of the Proposed Action and the alternatives.

3.4.1.3 Description of Affected Environment

Adverse water quality effects have been observed previously in four locations within the primary mine disturbance area:

- Surface water in the pit lake;
- Surface water in Greyback Arroyo;
- Groundwater in the vicinity of the existing pit; and
- Groundwater in the former mineral processing and TSF areas.

Additional information regarding the existing condition of surface water and groundwater quality in a larger region surrounding the Copper Flat mine is provided in previous reports, including the Baseline Data Characterization Report for Copper Flat Mine, Sierra County, New Mexico (Intera 2012); Copper Flat MPO (THEMAC 2011); and Conceptual Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico (JSAI 2012).

Surface water in the pit lake: A lake is present year-round in the existing open pit, which was constructed by Quintana Minerals in the early 1980s. This feature is called a pit lake in commonly used mining terminology. Pit lakes are an important water quality concern at numerous metal mines in the U.S. (NRC 1999; Castedenyk and Eary 2009; Shevenell et al. 1999).

The existing pit lake has a surface area of approximately 5 acres and a maximum depth of approximately 35 feet. The pit lake contains approximately 60 acre-feet (AF) of water (20 million gallons). The water level in the pit lake varies seasonally, and generally ranges from approximately 5,435 to 5,450 feet above mean sea level (amsl), with a corresponding range in surface area of 5 to 14 acres (JSAI 2013a). Pit lake water levels are generally highest in the winter and are relatively lower in the summer (Intera 2012).

The presence of a perennial lake in the semi-arid climate present at the Copper Flat mine suggests that the pit lake is in hydrologic communication with groundwater, and that inflows of groundwater into the pit lake provide a source of water to the lake. Inflows of water to the pit lake include discharges of groundwater from the crystalline bedrock aquifer and periodic inflows of stormwater runoff. The outflows are primarily due to evaporation, because the pit lake does not discharge to surface water.

Five groundwater monitoring wells are present in the area of the pit lake. The general direction of groundwater flow can be estimated by evaluating the water level in the monitoring wells in relation to the elevation of the water surface in the pit lake. Measurements of monitoring well water levels presented in the baseline design report (Intera 2012) show that groundwater was flowing into the pit lake in the fall of 2011. In general, it is thought that groundwater flows into the pit lake throughout the year and is subsequently evaporated, creating an evaporative sink or “terminal lake”. This conclusion is supported by the evaluation of evaporation versus precipitation in the area and results of groundwater modeling (JSAI 2012).

The pit lake water contained high total dissolved solids (TDS), which ranged from 7,770 to 9,680 milligrams per liter (mg/L) in samples collected during 2010 and 2011. The TDS concentration in the pit lake water increased from approximately 3,500 mg/L to 9,500 mg/L during the period of 1989 to 2011 based on available data. The concentrations of cadmium, copper, manganese, selenium, and sulfate also increased over the period of 1989 to 2011 based on the available data. This increasing trend in TDS is caused, in part, by concentration through evaporation, which removes water from the pit lake but does not remove TDS. Periodic dissolution and flushing of products of mineral oxidation from the highwalls surrounding the pit lake also affect pit lake water quality.

In New Mexico, if the pit lake were designated as or combined with surface waters of the State, then the pit lake water quality would be subject to the requirements of the Federal Clean Water Act, as amended, as well as associated State surface water quality standards. The Clean Water Act requires establishment of use designations for surface water bodies and water quality standards that are applicable to the designated uses. This facet of the Clean Water Act is administered by the State of New Mexico. The surface water quality standards and use designations are adopted by the New Mexico Water Quality Control Commission and are then approved by the USEPA. The surface water quality standards are reviewed every 3 years and revised if necessary.

The Copper Flat pit lake would be located entirely on private land and would not combine with other surface waters of the State (pending a determination by the State via permit issuance); therefore, the surface water quality standards of 20.6.4 NMAC do not apply to the pit lake. The pit lake water quality standards will be established by the Mining and Minerals Division (MMD) of the New Mexico Energy, Minerals and Natural Resources Department (NMEMNRD). According to the MMD standards at New Mexico Administrative Code (NMAC) 19.10.6.603, there are two performance standards that apply to the pit lake. They include:

- Operations must be planned and conducted to minimize change in the hydrologic balance in both the permit area and potentially affected areas; and
- Reclamation must result in a hydrologic balance similar to pre-mining conditions.

Pre-mining water quality conditions (i.e., baseline conditions) are developed through NMAC 19.10.6.602.D.(13)(g)(v) which requires a determination of the probable hydrologic consequences of the operation (see Appendix C, Probable Hydrologic Consequences Report) and reclamation on both the permit area and affected areas. The determination considers the hydrologic regime, and the quantity and quality of surface and groundwater systems that may be affected by the proposed operations, including the dissolved and suspended solids under seasonal flow conditions. In meeting these regulations, NMCC must demonstrate that post-mining hydrologic conditions are similar to baseline conditions. The baseline conditions for the future Copper Flat pit lake will be similar to existing water quality conditions.

Therefore, water quality standards for the pit lake will be set at levels similar to the existing conditions and the measurement indicator for surface water quality within the pit lake is zero. The goal is for the Proposed Action and alternatives to yield a measurement indicator of zero.

Post-closure pit lake water quality is also regulated by 20.6.7 NMAC, Groundwater Protection – Supplemental Permitting Requirements for Copper Mine Facilities. NMAC 20.6.7.33(D) requires that pit lakes in which evaporation from the surface of the open pit water body is expected to exceed the water inflow shall be considered hydrologic evaporative sinks. Water quality in these pit lakes is not subject to New Mexico groundwater quality standards at 20.6.2.3103 NMAC. If water is predicted to flow from a pit lake into groundwater, the groundwater quality standards at 20.6.2.3103 would apply to the pit lake. Based on the current conceptual understanding of the groundwater flow system at the pit lake, it is thought that the groundwater quality standards at 20.6.2.3103 NMAC do not apply to the existing pit lake (pending a determination by the State via permit issuance).

Surface water in Greyback Arroyo: The pit lake, waste rock disposal facilities (WRDFs), former mineral processing area, and TSF are located within the Greyback Arroyo watershed. Surface water is ephemeral within the Greyback Arroyo in the vicinity of the primary mine disturbance area.

Surface water quality in the Greyback Arroyo watershed has been historically monitored at three surface water quality stations: SWQ-1, SWQ-2 and SWQ-3. (See Figure 3-1.) Sampling site SWQ-1 is located upstream of the mining and minerals processing area (MMPA), sampling site SWQ-2 is located adjacent to and south of the MMPA, and sampling site SWQ-3 is located downstream of the MMPA. These historical sampling sites were also monitored during the baseline sampling program conducted during 2010 through 2011.

Surface water was present infrequently at the baseline sampling sites within the Greyback Arroyo as described below:

- SWQ-1 was dry during all baseline sampling events.
- Pooled water was present at SWQ-2 during two of the four sampling events, but surface water flow was not measurable.
- Pooled water was present at SWQ-3 during three of the four sampling events, but the flow was not measurable.

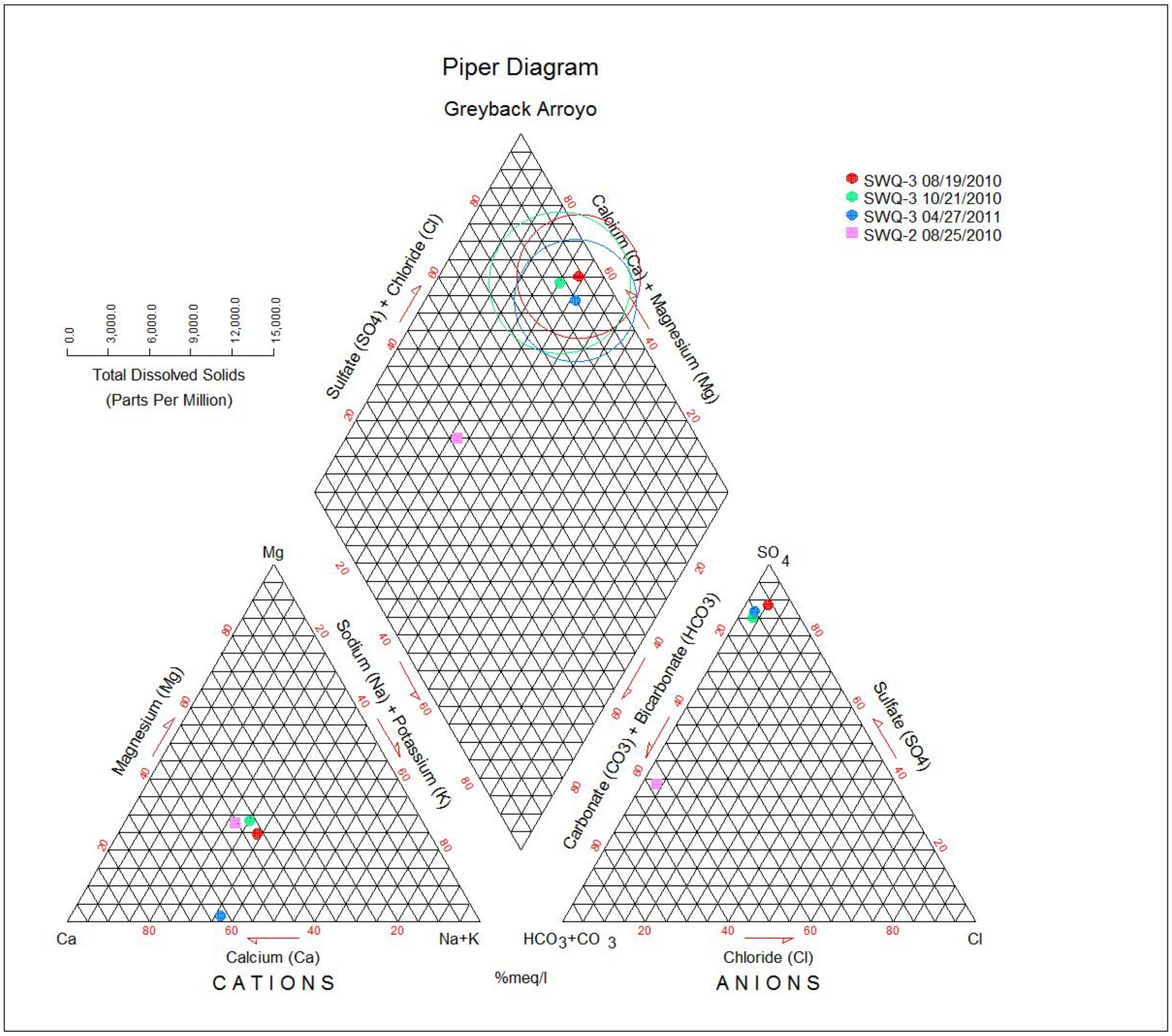
Effects to water quality caused by natural weathering and mining of ore bodies containing sulfide minerals can be evaluated through analysis of the water chemistry. In general, many natural surface waters are characterized as calcium-bicarbonate waters with low concentrations of TDS. Sodium may also be present as the major cation depending on the natural geology of the area; these waters are termed sodium-bicarbonate waters. TDS is a measure of the total amount of dissolved substances in the water. Water quality effects associated with mining of sulfide ore bodies can lead to development of acidic water and increases in TDS caused by oxidation of sulfide minerals and dissolution of the products of sulfide oxidation into the water. These water quality effects can be identified by examining concentrations of major ions in the water. For example, oxidation of sulfide minerals and subsequent dissolution of the products of sulfide mineral oxidation can increase the relative contribution of sulfate in the water, and sulfate can replace bicarbonate as the major anion in the water. Natural weathering of sulfide ore bodies can also produce similar major ion signatures, so the presence of high TDS calcium-sulfate type water does not independently prove that waters are mining-influenced.

Surface water quality data collected from the Greyback Arroyo during the baseline sampling events were evaluated by using Piper diagram analysis to identify major ion signatures, which may indicate waters affected by natural weathering or mining of the Copper Flat ore deposit. A Piper diagram is a graphical method to evaluate the dominant cations (positively charged ions) and anions (negatively charged ions) in the water. The TDS is also shown on the Piper diagram as a circle surrounding the water quality data point, with the diameter of the circle scaled in a relative manner to the TDS concentration.

Piper diagram analyses for surface water sites in Greyback Arroyo show that surface water present at site SWQ-2 in August 2010 was calcium-bicarbonate type water with relatively low TDS. (See Figure 3-2.) This water does not show effects of natural weathering or mining of the Copper Flat ore deposit. In contrast, Piper diagram analysis of samples collected from site SWQ-3 in August 2010, October 2010, and April 2011 show that water at that location is calcium-sulfate type water with relatively higher TDS concentrations. The data from site SWQ-3 suggest that surface water in that portion of Greyback Arroyo is affected by natural weathering of the Copper Flat ore body and previous mining of the ore body. It is likely that the observed major ion chemistry is a result of a combination of both natural and anthropogenic causes.

Surface water quality standards apply to ephemeral surface water within Greyback Arroyo. (See Table 3-8.) Secondary contact water quality standards relate to E. coli bacteria, which are not likely to be associated with the existing or proposed mining disturbance. Therefore, secondary contact water quality standards are not addressed in this section.

Figure 3-2. Piper Diagram of Baseline Surface Water Samples Collected in Greyback Arroyo



Source: Intera 2012.

Note: Surface water in ephemeral streams in New Mexico is classified with the following use designations: Limited aquatic life; Livestock watering; Wildlife habitat; and Secondary contact.

Table 3-8. Surface Water Quality Standards Applicable to Ephemeral Surface Water in Greyback Arroyo for Selected Analytes

Water Quality Parameter	Use Designation		
	Limited Aquatic Life	Livestock Watering	Wildlife Habitat
pH	6.6 to 9.0 su	NA	NA
Arsenic	340 µg/L	200	NA
Aluminum[1]	10,071 µg/L (total recoverable)	NA	NA
Cadmium[1]	5.38 µg/L	50	NA
Chromium[1]	NA	1,000 µg/L	NA
Copper[1]	50 µg/L	500 µg/L	NA
Lead[1]	280 µg/L	100 µg/L	NA
Manganese[1]	4,738 µg/L	NA	NA
Mercury		10 µg/L	0.77 µg/L
Molybdenum	7,920 µg/L (total recoverable)	NA	NA
Nickel[1]	1,510 µg/L	NA	NA
Nitrate/nitrite	132 mg/L	NA	NA
Selenium	20 µg/L	NA	5 µg/L
Silver[2]	35 µg/L	NA	NA
Zinc[2]	564 µg/L	NA	NA
Vanadium	NA	100 µg/L	NA
Radium 226 + Radium 228	NA	30 pCi/L	NA

Source: NMAC 2017.

Notes: [1] Chronic and acute standards shown where applicable. Hardness dependent standards assume a hardness of 400 mg $CaCO_3$ per liter.

[2] Aquatic life standards are acute standards assuming a hardness of 400 mg/L calcium carbonate equivalent.

Units: µg/L = microgram per liter, mg/L = milligram per liter, pCi/L = picocurie per liter.

NA: not applicable.

Based on the available baseline data collected during 2010 and 2011, surface water quality in Greyback Arroyo met applicable standards with the exception of copper (80 mg/L), which slightly exceeded the standard during one of the three sampling events. It is unknown if this is a result of natural weathering of the ore body or previous mining activities. Therefore, the water quality measurement indicator for the existing condition ranges from zero to 1. (See Appendix D and E for relevant water quality data.)

Groundwater quality in the vicinity of the existing pit: Groundwater quality in the vicinity of the existing pit is variable, with groundwater at some monitoring wells showing likely effects of previous mining. Pertinent water quality standards for groundwater are shown below. (See Table 3-9.)

Table 3-9. Groundwater Quality Standards for Selected Analytes

Water Quality Parameter	Standard
pH[2]	6 to 9 su
TDS[2]	1,000 mg/L
Sulfate[2]	600 mg/L
Fluoride[1]	1.6 mg/L
Aluminum[3]	5 mg/L
Cadmium[1]	0.01 mg/L
Cobalt[3]	0.05 mg/L
Copper[2]	1 mg/L
Manganese[2]	0.2 mg/L
Selenium[1]	0.05 mg/L
Zinc[2]	10 mg/L

Source: NMAC 2018.

Notes: 1. Human Health Standards (NMAC 20.6.2.3103 A).

2. Other Standards for Domestic Water Supply (NMAC 20.6.2.3103 B).

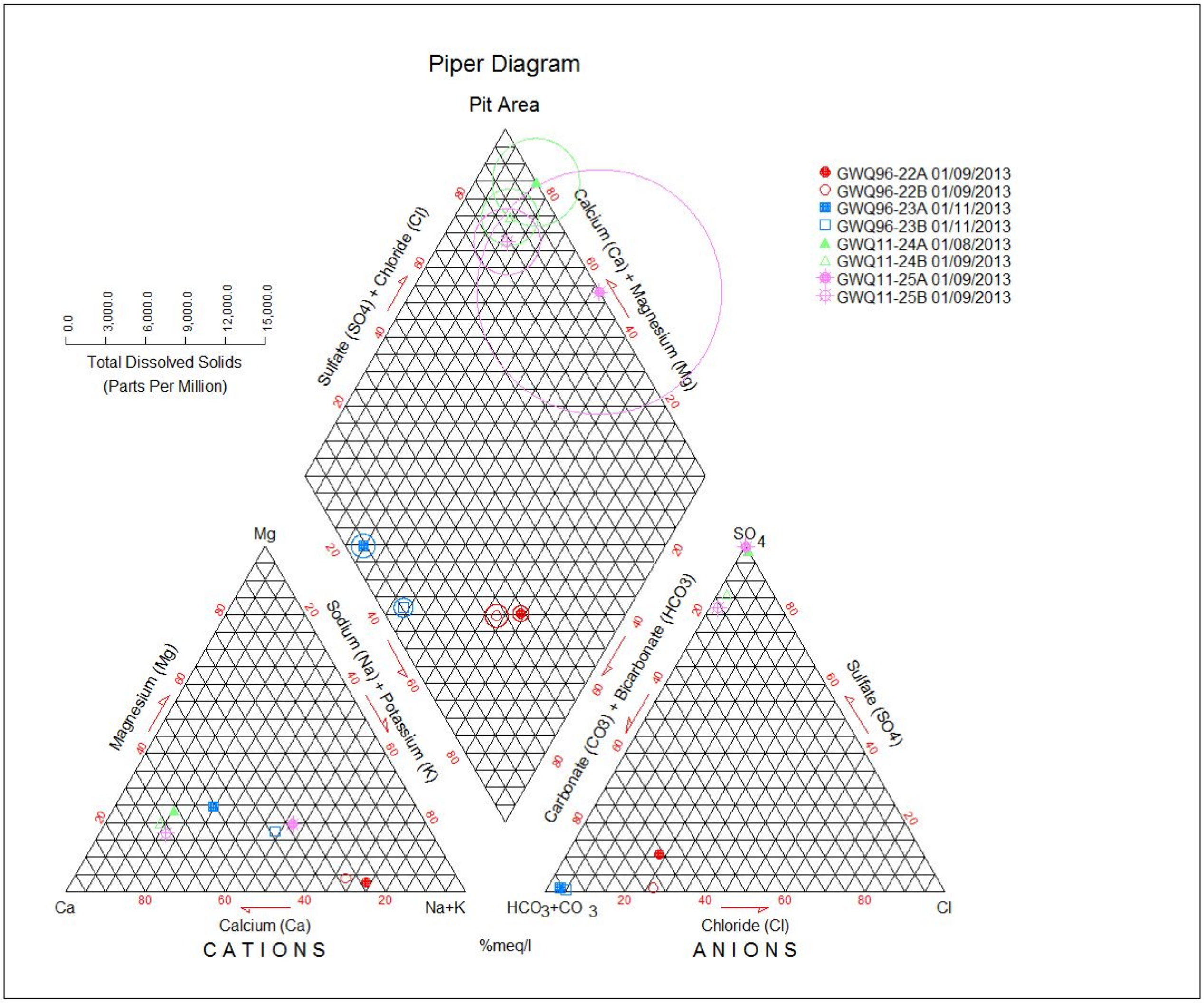
3. Standards for Irrigation Use (NMAC 20.6.2.3103 C).

Units: mg/L = milligram per liter, su = standard units.

During 2013, groundwater samples were collected from four wells in the vicinity of the mine pit. (See Figure 3-1.) Water quality in these wells was monitored in 2013 as part of the Stage 1 Abatement Plan. Detailed information regarding this sampling is included in the Status Report for Stage 1 Abatement at the Copper Flat mine area near Hillsboro, New Mexico (JSAI 2013a). Summary information focused on assessment of major ion ratios and measurement indicators is presented in the following paragraphs. Piper diagram analyses for these monitoring wells are shown below. (See Figure 3-3.)

Monitoring wells GWQ96-22a and GWQ96-22b are co-located west and upgradient from the mine pit. Groundwater at this location is sodium-bicarbonate water with relatively low TDS concentrations compared to other wells in the pit area. In the 2013 samples, water at GWQ96-22a and GWQ96-22b exceeded the New Mexico groundwater quality standards for fluoride [3.07 mg/L and 3.32 mg/L] only. Based on the sodium-bicarbonate major anion signature, relatively low TDS, and upgradient location with respect to the mine pit, the elevated fluoride concentrations are considered a result of natural conditions. The measurement indicator at monitoring wells GWQ96-22a and GWQ96-22b is 1 (i.e., fluoride).

Figure 3-3. Piper Diagram of Baseline Groundwater Samples Collected in Area of the Existing Pit



Source: Intera 2012.

Monitoring wells GWQ96-23a and GWQ96-23b are co-located east and downgradient of the mine pit. These wells exhibit a sodium/calcium-bicarbonate signature with relatively low TDS. During the 2013 sampling programs (JSAI 2013a), water quality at GWQ96-23a and GWQ96-23b exceeded New Mexico groundwater quality standards for fluoride [2.0 mg/L and 2.05 mg/L] only, which is similar to the upgradient water quality at GWQ96-22a and GWQ96-22b. Based on the presence of bicarbonate as the dominant anion, the relatively low TDS, and similar fluoride concentrations to upgradient groundwater, it is reasonable to conclude that groundwater quality at GWQ96-23a and GWQ96-23b is not affected by previous mining. The measurement indicator at monitoring wells GWQ96-23a and GWQ96-23b is also 1 (i.e., fluoride).

Monitoring wells GWQ11-24a and GWQ11-24b are co-located on the southeast side of the mine pit. In contrast to water quality at the previously discussed monitoring wells, the water at GWQ11-24a and GWQ11-24b is calcium-sulfate water, which contains relatively higher concentrations of TDS.

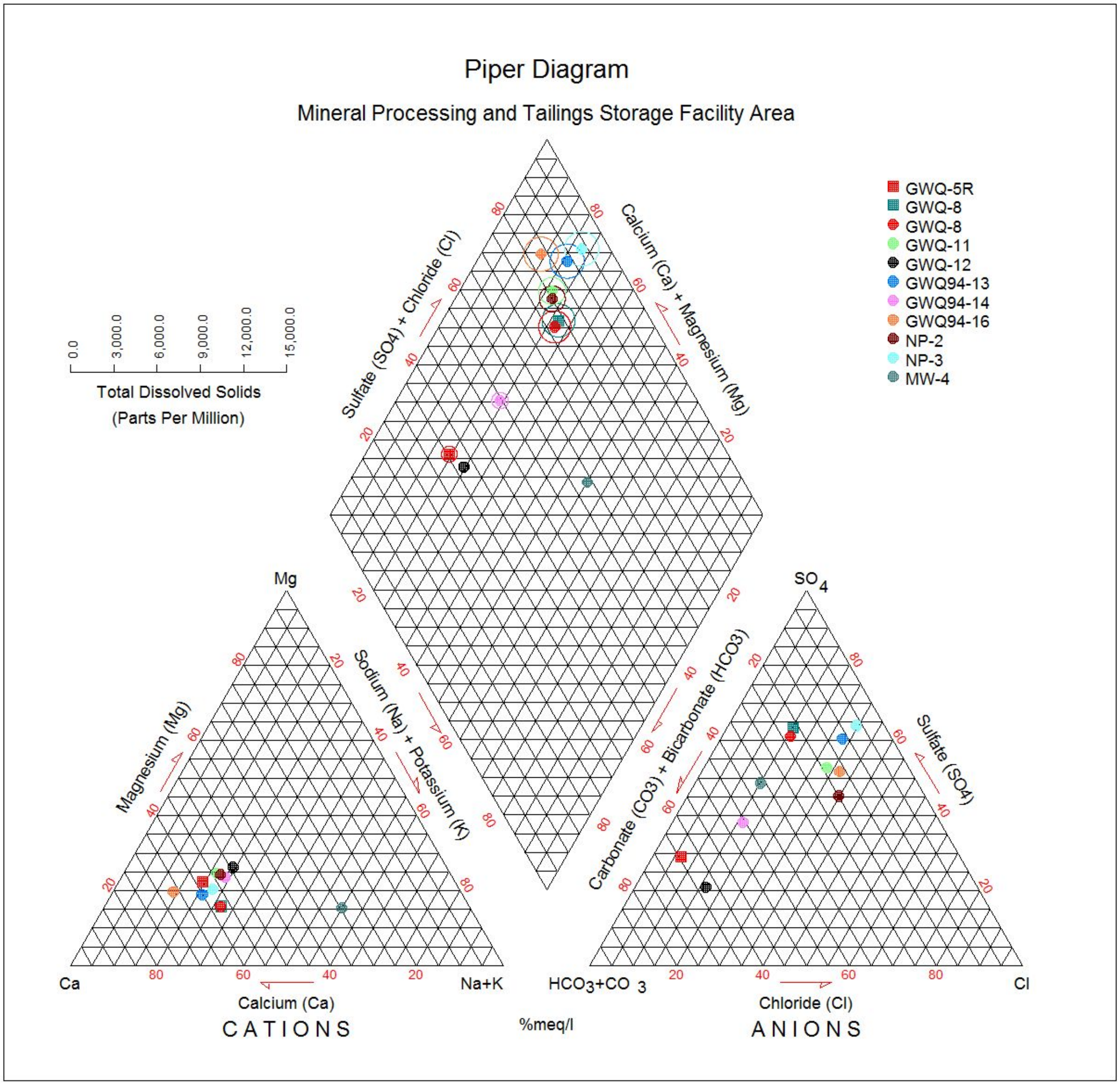
During the 2013 sampling program, water quality at GWQ11-24a (the shallower of the paired monitoring wells) did not meet New Mexico groundwater quality standards for pH, TDS, sulfate, fluoride, aluminum, cadmium, cobalt, copper, and manganese, providing a measurement indicator of 9. Water quality at GWQ11-24b (the deeper of the paired monitoring wells) did not meet New Mexico groundwater quality standards for TDS, sulfate, fluoride, and manganese providing a measurement indicator of 4. Based on the presence of sulfate as the dominant anion in this water rather than bicarbonate, the relatively higher TDS, and the exceedance of New Mexico groundwater quality standards for one or more metals, groundwater at both GWQ11-24a and GWQ11-24b is thought to be influenced by previous mining and natural groundwater conditions within the ore body. Groundwater quality at GWQ11-24a shows relatively greater impacts from mining with a measurement indicator of 9. The observed water quality effects at this location may be due to oxidation of sulfide minerals in near-surface rock units and leaching of previous products of sulfide mineral oxidation with subsequent infiltration to the water table.

Monitoring wells GWQ11-25a and GWQ11-25b are co-located on the north side of the mine pit. Groundwater at GWQ11-25a is calcium-sulfate water and groundwater at GWQ11-25b is sodium-sulfate water. The TDS concentrations at both locations are elevated with respect to the upgradient well pair, GWQ96-22a/GWQ96-22GWQ-22b. Based on the presence of sulfate as the dominant anion and elevated TDS concentrations, groundwater at both GWQ11-25a and GWQ11-25b is thought to be influenced by previous mining.

Groundwater quality at the shallower of the two wells, GWQ11-25a, does not meet New Mexico groundwater quality standards for pH, TDS, sulfate, fluoride, aluminum, cadmium, cobalt, copper, manganese, and zinc, providing a measurement indicator of 10. In contrast, water quality at GWQ11-25b exceeds New Mexico groundwater quality standards for only TDS, sulfate, and fluoride, for a measurement indicator of 3. The shallow groundwater at GWQ11-25a is relatively more affected by mining than the deeper groundwater at GWQ11-25b, which is the same relationship observed at GWQ11-24a and GWQ11-24b. This relationship supports the hypothesis presented above that the source of the contaminants in the water is attributable to oxidation of sulfide minerals in near-surface rock units and leaching of previous products of sulfide mineral oxidation with subsequent infiltration to the water table.

Groundwater in the former mineral processing and TSF areas: Groundwater quality at some monitoring wells located downgradient from the former mineral processing area and the TSF also show evidence of mining influenced water (MIW) (JSAI 2014a). Potential mining-related effects to groundwater in these areas include elevated concentrations of sulfate and TDS, but the metals concentrations meet the groundwater quality standards shown in Table 3-9. Selected groundwater quality monitoring locations in the former mineral processing and TSF areas are show in Figure 3-1 and Piper diagram analyses of water quality samples collected at these locations are shown in Figure 3-4.

Figure 3-4. Piper Diagram of Baseline Groundwater Samples Collected in Mineral Processing and TSF Area



Source: Intera 2012.

Two monitoring wells are located in the Greyback Arroyo area between the former mineral processing area and the TSF: GWQ-5R and GWQ-3. GWQ-5R monitors groundwater quality within the crystalline bedrock aquifer, whereas GWQ-3 monitors groundwater quality within the Santa Fe Group sediments aquifer. Groundwater at GWQ-5R is calcium-bicarbonate water with relatively low TDS. Groundwater at this location meets New Mexico groundwater quality standards. (See Table 3-9.) In contrast, groundwater at GWQ-3 is calcium-sulfate water with elevated concentrations of TDS.

Groundwater at GWQ-3 exceeded the New Mexico groundwater quality standard for TDS and sulfate during the 2013 sampling event associated with the Stage 1 Abatement Plan (JSAI 2013a). Accordingly, the value of the water quality measurement indicator is zero at GWQ-5R and 2 at GWQ-3.

During the Quintana Minerals mining operations, tailings were placed into the permanent TSF constructed east of the other mine surface facilities. Adverse effects to groundwater underlying the TSF have been documented in a series of groundwater monitoring wells as described by Intera (2012). Currently, groundwater located within a zone extending up to 1,000 feet downgradient of the TSF exceeds New Mexico groundwater quality standards for sulfate and TDS. Water quality at nine monitoring wells in this area was reviewed to assess the existing conditions of groundwater to support the effects analysis. Table 3-10 summarizes the water quality characteristics and measurement indicators for these wells.

Table 3-10. Water Quality Characteristics and Measurement Indicators for Wells in the TSF Area

Table 3-10. Water Quality Characteristics and Measurement Indicators for Wells in the TSF Area		
Monitoring Well	**Water Quality Characteristics**	**Value of Water Quality Measurement Indicator (TDS)**
GWQ-8	Calcium-sulfate water with elevated TDS	1
GWQ-11	Calcium-sulfate water with moderate TDS	0
GWQ-12	Calcium-bicarbonate water with low TDS	0
GWQ94-13	Calcium-sulfate water with elevated TDS	1
GWQ94-14	Calcium-bicarbonate water with low TDS	0
GWQ94-16	Calcium-sulfate water with elevated TDS	1
NP-2	Calcium-sulfate water with moderate TDS	0
NP-3	Calcium-sulfate water with elevated TDS	1
MW-4	Sodium-sulfate water with low TDS	0

Source: Intera 2012.

The tailings were pumped into the unlined tailings facility as a slurry of water and tailings, and the pore water contained in the tailings slurry drained over a period of years following placement. The existing effects to water quality present in the TSF area are thought to be primarily related to initial dewatering of the tailings, and infiltration of this MIW into groundwater underlying the facility. It is possible that ongoing discharges of MIW from the TSF are occurring, but no site-specific data regarding ongoing seepage of MIW from the TSF are available.

3.4.2 Environmental Effects

An analysis of the water quality effects of the proposed expansion of Copper Flat mine is presented below for the Proposed Action and accelerated processing action alternatives identified as Alternatives 1 and 2.

3.4.2.1 Proposed Action

The Proposed Action would have long-term, minor, small extent, unlikely, and adverse effects on water quality. The following sections address potential effects of the Proposed Action with respect to the pit lake water quality and potential effects of the Proposed Action to surface water and groundwater quality in the proposed mine area. Overall, impacts would not be significant.

Pit lake water quality: Under the Proposed Action, the existing open pit would be enlarged to facilitate production of 96 million tons of ore, 37 million tons of waste rock, and 19 million tons of low-grade ore. In total, approximately 152 million tons of rock would be excavated from the open pit over approximately 16 years. The enlarged open pit would be approximately ½ mile in diameter and 900 feet deep. Reclamation at the open pit would consist of mitigating unstable pit walls by blasting or other safe methods, selective placement of soil on the benches above the anticipated water elevation of the post-mining pit lake, construction of water bars within the pit to mitigate erosion, and construction of fences or other barricades to limit public access to the area.

A pit lake is expected to re-form in the open pit after mining is complete as a result of inflows from groundwater and precipitation. Groundwater is expected to flow into the pit lake continuously after mining ceases. Periodic inflows of surface water would also occur when runoff from highwalls and slopes surrounding the open pit flows into the pit lake after major precipitation events. The pit lake is expected to form slowly over a period of decades to centuries, because of the semi-arid environment in the area. The inflow rate from groundwater would be highest in the initial decades after mining is complete when the gradient causing groundwater to flow into the pit is highest. As this gradient decrease over a period of decades, the groundwater inflow rate would also decrease, but groundwater would continue to flow into the pit lake. Ultimately, the water level of the pit lake would be controlled by the balance between inflows from groundwater and surface runoff and outflows from evaporation.

The time required for the pit lake to form was estimated by John Shomaker and Associates Inc. (JSAI) using a groundwater model developed to support the project (JSAI 2013b; JSAI 2013c). It is estimated that the pit lake would fill to an elevation of approximately 4,900 feet within 100 years after mining is complete. At that time, the depth of the pit lake would be approximately 200 feet. The total depth of the open pit would be approximately 900 feet; therefore, only the lower part of the open pit would be filled with water 100 years after mining ceases. As mentioned previously, the future pit lake water body will be confined to private land.

Predictions of the post-mining water quality of the pit lake include uncertainties that are not fully quantifiable with existing technologies (Kempton et al. 2000). Pertinent uncertainties include:

- The rate of mineral oxidation and associated contaminant release from mineralized rocks in the pit highwalls, which controls the chemistry of inflowing surface water (i.e., runoff from storm events);
- Potential seasonal or permanent stratification of the pit lake and associated uncertainties in the extent of seasonal mixing and other factors that control metal solubility;
- The chemistry and inflow rate of groundwater after mining is complete;
- The rate of removal of dissolved solids in the pit lake through adsorption and mineral precipitation reactions;
- The primary and secondary mineral species that will be present on pit highwalls and within the pit lake in the future, and the associated thermodynamic parameters for these minerals, which are used in the model; and
- Potential changes in climate that may occur in the future associated with either natural or anthropogenic factors.

Therefore, assessment of the post-mining pit lake water quality is evaluated in this document using a weight of evidence approach that includes evaluation of the water quality of the existing pit lake and predictive geochemical modeling of future pit lake water quality completed by SRK Consulting for THEMAC (SRK 2017).

The chemistry of the existing pit lake is useful to understand the potential chemistry of the new pit lake, because the existing pit lake has formed over the last approximately 30 years at the site and reflects site-specific geological, mineralogical, hydrogeological, and climatological conditions. The geology, mineralogy, and hydrology are expected to vary somewhat as the existing open pit is enlarged. For example, the sulfide oxidation rate of potentially acid generating rocks at depth in the mineral deposit is slower than the sulfide oxidation rate of rocks near the surface (SRK 2014; SRK 2013), the hydraulic conductivity at depth is likely to be lower than rocks relatively nearer to the surface, and the distribution of minerals that may affect water quality is expected to vary with depth. However, because an existing pit lake is present at the site, water sample data from the existing pit lake provides an empirical basis to evaluate potential water quality in the future pit lake.

The existing pit lake water is near-neutral pH, high TDS calcium-sulfate water with notable concentrations of four water quality parameters (cadmium, copper, manganese, and selenium). It must be noted that the applicable surface water quality standards for the pit lake will be determined by NMEMNRD and will be set at a level similar to existing conditions.

SRK (2017) completed predictive geochemical modeling of the post-mining pit lake water quality using current best practices. However, there is uncertainty regarding whether current best practices are sufficient to provide confident predictions of pit lake water quality decades or centuries in the future (Kempton et al. 2000; Kuipers, et al. 2006; Maest et al. 2006; Eary et al. 2009; and NRC 1999). This type of prediction approach was developed over the last approximately 20 years to assist land managers and other environmental regulatory authorities in understanding potential post-mining pit lake water quality to support mine permitting activities and disclosure of environmental effects of proposed mines in accordance with NEPA. The SRK (2017) predictive geochemical model is useful to understand the general water quality that may be present decades or centuries in the future, but the model predictions are only estimates and the level of uncertainty in the model predictions cannot be fully quantified (Kempton et al. 2000).

The details of the SRK predictive geochemical model are available in Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico (SRK 2017). The water quality predictions are summarized here with respect to the water quality measurement indicators. SRK (2017) predicts that the rapid refilling of the pit lake during the first six months post-closure will result in a better initial water quality leading to concentrations of the majority of the constituents similar to the water present in the existing pit lake. Based on this prediction, the value of the surface water quality measurement indicator for the Proposed Action would be zero.

Calcium and sulfate are major ions in the pit lake water, and forward-looking predictions of major ion concentrations are generally thought to be reliable in pit lake models that are developed using current best practices. Copper, lead, manganese, selenium, and zinc are trace ions in the water, and forward-looking predictions for the concentrations of these ions are relatively less reliable because of inherent uncertainties in existing prediction technologies (Eary and Shafer 2009). These inherent uncertainties support the use of the SRK predictions as only one component of the overall weight of evidence approach to assess future pit lake water quality.

However, the water quality standards that would apply 100 years in the future are also uncertain. There is potential that the applicable water quality standards may be different in the future. The applicable water quality standards could be modified through development of site-specific water quality standards. This approach involves identifying the biological species that could potentially be present in the water body, and developing site-specific water quality standards that are protective of species that have potential to be present in the water body. Development of site-specific water quality standards would also require approval by the New Mexico Water Quality Control Commission.

Because both the future pit lake water quality and the water quality standards that will apply to the pit lake decades or centuries in the future are uncertain, it is recommended that mitigations be developed to provide for post-mining compliance with water quality standards. These mitigations are proposed as: 1) modifications to the proposed MPO, which would be required prior to BLM approval; and 2) terms and conditions of approval for the proposed MPO, which would be stipulated by the BLM and NMCC.

The following modifications will be made to the proposed MPO prior to BLM approval:

- The proponent shall modify the MPO to include appropriate mitigations to protect pit lake water quality.
- The proponent shall provide a preliminary pit lake water quality management plan, which describes reclamation, water quality management, and monitoring activities that would be conducted to facilitate compliance with applicable water quality standards during the post-mining monitoring period.

The following terms and conditions of approval shall be stipulated for the proposed MPO:

- The pit lake water chemistry shall meet applicable water quality standards during the post-mining monitoring period, which is defined as 30 years after completion of reclamation at the Copper Flat mine.
- At least 1 year prior to mine closure, the proponent shall update the pit lake water quality management plan and provide the final plan to the BLM for review and approval. The final plan shall detail reclamation, water quality management, and monitoring activities that would be conducted to facilitate compliance with applicable water quality standards during the post-mining monitoring period.
- The proponent shall provide a cost estimate for implementation of the pit lake water quality management plan for BLM review and approval.
- The proponent shall provide a trust fund or other long-term funding mechanism in accordance with 43 CFR 3809.522(c), which will be sufficient to fund implementation of the pit lake water quality management plan for a period of at least 30 years.

The final pit lake water quality management plan would be developed and submitted to the BLM for review and approval towards the end of the active mining period, but no later than 1 year prior to closure of the mine. This would allow for consideration of the surface water and groundwater standards that apply to the pit lake at that time and would provide for incorporation of site-specific geochemical and hydrogeological data developed during the mine operations. This would reduce current uncertainties associated with: 1) predicting the future surface water and groundwater quality standards that would be applicable to the pit lake; 2) characterizing the geochemical characteristics of the pit highwalls, because the actual geochemical characteristics of the highwalls could be monitored and characterized as the pit is constructed; and 3) characterizing the post-mining hydrogeological conditions in the pit area. Therefore, the proposed timing for submittal and approval of the final pit lake water quality management plan would provide for an improved understanding and characterization of the factors that affect post-mining water quality in the pit lake, and improve the probability that the pit lake water quality management plan would be effective in preventing unnecessary or undue degradation as required by 43 CFR 3809 regulations for locatable mining operations.

The pit lake water quality management plan would include rapidly filling the pit lake with water at mine closure to the predicted ultimate water level rather than allowing it to fill naturally over a period of decades to centuries, and potentially conditioning this water with the addition of non-toxic alkaline or organic materials. Rapid filling would occur by pumping the mine production wells at approximately

3,000 gallons per minute (gpm) for about 6 months. This is a rate nearly the same as pumping requirements for mine operation; therefore, there would be no change to the predicted final drawdown of groundwater (see Section 3.6, Groundwater Resources) and the pumping would fit within the annual allowed NMCC water right. The total pumped volume would be about 2,200 AF, pumped into the bottom of the pit via a temporary high-density polyethylene (HDPE) pipe laid along the haul road. Rapid filling would introduce good quality water, dilute solutes derived from water-rock interaction, submerge walls and benches to limit oxidation of sulfide minerals, stabilize pit water quality, and create a steady state hydraulic sink in the near term rather than waiting for natural refilling of the pit. Starting water chemistry would resemble 98 percent supply well water and 2 percent stormwater runoff from the pit shell. Recovery of water levels would be delayed for 6 months to a year (NMCC 2015d).

Filling the pit lake with water at cessation of mining would reduce potential oxidation of sulfide minerals that are exposed on the pit floor and highwalls. Data presented in SRK (2013) shows that sulfide minerals are expected to be encountered in portions of the mine pit and that these minerals have the potential to oxidize and adversely affect water quality. However, the expected oxidation rate of these minerals is relatively slow based on kinetic testing and mineralogical analyses. If the pit lake is allowed to form naturally over a period of decades to centuries, these sulfide minerals would be exposed to atmospheric concentrations of oxygen (approximately 21 percent) for a long period. This could cause adverse effects to pit lake water quality when the pit lake eventually forms and the soluble products of sulfide mineral oxidation are transported into the pit lake. By filling the pit lake with water at the cessation of mining, potential oxidation of sulfide minerals in the floor and lower highwalls of the pit would be mitigated, because permanent submergence is an effective means to prevent sulfide mineral oxidation and the associated release of trace metals and other soluble constituents (INAP 2014). This is based on existing exploration and development drilling data. The geochemical characteristics of the ore body will would be far better defined as the mine is constructed. In the SRK Consulting pit lake modeling report, Table 3-1 (3D Surface Areas of Pit Wall Rock Material Types) and Figure 3-2 (Exposed Material Types in Final Pit Walls) provide information regarding the anticipated exposure of material types, oxidation, and surface area on the pit walls (SRK 2017).

Filling the pit lake with water during reclamation would also provide an opportunity to submerge additional acid generating materials that may be present in highwalls at elevations above the ultimate pit lake elevation. This could be accomplished with selective excavation and placement of these materials beneath the water level of the pit lake. Although the majority of the exposed highwalls are expected to contain rocks with relatively low potential for acid generation based on humidity cell testing, several rock units have relatively higher potential to generate acid and adversely affect water quality (transitional quartz monzonite porphyry, quartz feldspar breccia, and biotite breccia). It is anticipated that exposures of these rock units that remain in the pit highwalls at the end of the mine life may be mitigated by selective excavation using cast blasting or other approaches and placement into the base of the pit. Permanent submergence of these materials is an effective approach to mitigate sulfide oxidation and prevent adverse effects to pit lake water quality (INAP 2014).

It is expected that the pit lake water quality management plan would also include construction of vegetated soil covers over exposed rock surfaces and mine waste rock dumps to reduce the potential for adverse effects to pit lake water quality. Where feasible based on the slope of the pit highwalls, safety benches, and internal haul roads, a vegetated soil cover could be installed to limit interaction of precipitation with exposed rock surfaces within the pit that contain sulfide minerals. Discharges from mine waste rock dumps near the pit could also be a potential source of inflows of contaminated water into the pit lake, but these inflows are expected to be mitigated through placement of a vegetated soil cover over acid generating waste rock during reclamation.

As mentioned previously, it is also anticipated that the pit lake water quality management plan may include conditioning the water that is pumped into the pit lake with non-toxic alkaline or organic additives that would reduce the potential for adverse water quality affects to occur. Although most of the rock units that would be exposed in the pit highwalls both above and below the predicted final water level of the pit lake have been shown to oxidize very slowly, it is possible that some oxidation may occur over the estimated 16-year mine life. The oxidation process can lead to development of vestigial acidity, which is a term used to describe soluble products of sulfide oxidation that could form during active mining (Younger et al. 2002). Bicarbonate is a component of most natural waters that affects the buffering capacity of the water. The term 'buffering' refers to the ability of the water to resist pH changes, such as the potential reduction in pH that may occur in response to dissolution of vestigial acidity from mine rocks. By conditioning the water that is pumped into the pit lake with alkaline substances, the potential for pH changes in the pit lake caused by dissolution of vestigial acidity could be mitigated. Filling of the pit lake with water at the end of active mining coupled with conditioning of the water with alkaline additives was used at the Sleeper Mine pit lake in Nevada to mitigate potential adverse water quality affects associated with dissolution of vestigial acidity (Dowling et al. 2004), and alkaline additions to existing pit lakes have been used at numerous mine pit lakes in Germany and Sweden (Geller and Schultze 2013).

The pit lake water quality management plan may also include conditioning of the water during reclamation through the addition of natural organic materials, which have been shown to be effective in improving pit lake water quality through natural biological processes at the Gilt Edge Mine in South Dakota (Park et al. 2006) and at several pit lakes in Canada (Kalin and Wheeler 2013). An advantage of this approach is that the natural biological processes also generate alkalinity, which can offset periodic additions of vestigial acidity from exposed pit highwalls after reclamation is complete. Post-mining pit lake treatment could be achieved via pH adjustment (e.g., addition of lime or sodium hydroxide) and addition of organic materials (e.g., carbon sources such as molasses) to achieve reducing conditions and stimulate biological activity of sulfate reducing bacteria. This provides a sustainable approach for pit lake water quality management that does not require perpetual additions of alkaline materials (Geller and Schultze 2013).

It is expected that the overall pit lake management plan would be optimized though several processes including:

- Reducing, to the extent practicable, post-mining inflows of contaminated water caused by oxidation of sulfide minerals in pit highwalls;
- Filling of the pit lake with water to rapidly submerge sulfide minerals that would be exposed on the pit floor and lower highwalls;
- Selective excavation of acid generating rocks that would be exposed in the pit highwalls above the pit lake water level and submergence of these materials within the pit lake;
- Conditioning of the water pumped into the pit lake during reclamation with alkaline or organic materials designed to provide a sustainable source of alkalinity and reduce potential long-term pit lake management requirements; and
- Mitigation of potential inflows of contaminated water from exposed rock surfaces and mine waste rock dumps within and near the pit through placement of vegetated soil covers during reclamation.

Assuming that the recommended mitigations are implemented and effective, the expected value of the water quality measurement indicator for the pit lake would be zero and the pit lake would continue to meet applicable water quality standards set by NMEMNRD. This value of the pit lake water quality measurement indicator is the same as that for the existing condition.

Surface water and groundwater quality: Apart from potential water quality issues associated with the pit lake, there are other activities associated with the Proposed Action that could affect surface water or groundwater quality. These activities include:

- Construction, operation, and reclamation of waste rock disposal and low-grade stockpile facilities;
- Expansion of the existing mine pit and associated dewatering;
- Expansion, operation, and reclamation of the TSF;
- Non-point source pollution from disturbed areas of the mine area; and
- Spills or anticipated releases of hazardous substances into the environment.

The potential direct and indirect effects of these activities on surface water and groundwater quality are assessed in the following sections.

3.4.2.1.1 Mine Development and Operation

Waste rock is rock that would be excavated from the open pit that does not contain a sufficient quantity of copper, molybdenum, or other payable metals to profitably recover in the mineral processing plant. This rock is termed waste rock in common mining terminology. Both ore and waste rock would be produced from the open pit in varying proportions throughout the mine life depending on factors such as the design of the open pit (e.g., the required slope of the highwalls and the areal extent of the pit at various depths); the three-dimensional form of the ore body; and economic factors (e.g., metal prices, fuel prices, and other variable costs of production). Under the Proposed Action, waste rock would be placed into WRDFs near the open pit. Although waste rock does not contain a sufficient natural enrichment of payable metals to support economic production, it is common for waste rock to contain slightly enriched concentrations of metals or mineral assemblages with potential to affect the environment.

A low-grade stockpile would also be constructed under the Proposed Action. A low-grade stockpile consists of waste rock that contains concentrations of copper, molybdenum, or other payable metals that may be sufficient to warrant mineral processing at some time in the future. This processing may be done at the end of the mine life or during active mining. It is also possible that this rock would never be processed, and that the low-grade stockpile would be reclaimed in place at the end of the mine life.

The potential for waste rock or low-grade rock to affect the environment is based on several interrelated factors:

- Geochemical characteristics of the rock;
- Hydrological characteristics of the rock;
- Climate – in particular the amount of annual precipitation and evaporation at the mine;
- WRDF construction and reclamation practices; and
- Hydrological characteristics of the growth media used to cover the waste rock facilities during reclamation.

Detailed information regarding environmental characteristics of waste rock is provided in Geochemical Characterization Report for the Copper Flat Project, New Mexico (SRK 2013); Humidity Cell Termination Report for the Copper Flat Project, New Mexico (SRK 2014); and Baseline Characterization Report for Copper Flat Mine, Sierra County, New Mexico (Intera 2012).

The work conducted by SRK (2013; 2014) shows that the waste rock produced at the Copper Flat mine would exhibit varying geochemical characteristics based on the degree of previous weathering, variations in lithology and mineralization, and other factors. Characterization of the rock included detailed testing using a variety of methods designed to assess the potential for the rock to generate acid rock drainage

(ARD) or to produce leachate that contains concentrations of metals or other elements that exceed applicable water quality standards. This work was conducted using current best practices for characterization of mine rock, and the data are sufficient to support this NEPA evaluation.

A summary of the findings of the geochemical characterization program is presented below. (See Table 3-11.) The table includes data for two rock units that are defined based on geochemical characteristics. Transitional rock is partially oxidized near-surface rock that contains both partially oxidized sulfide minerals and products of previous sulfide mineral oxidation. Sulfide rock is relatively less weathered and occurs at greater depth.

Table 3-11. Summary of the Geochemical Characteristics of Waste Rock and Ore

Table 3-11. Summary of the Geochemical Characteristics of Waste Rock and Ore			
Rock Type	Degree of Oxidation		
	Lithology	**Transitional**	**Sulfide**
	Waste Rock	High potential to generate ARD or other deleterious leachate if sufficient percolation occurs. This rock was shown to be acid generating and to contain soluble products of previous sulfide mineral oxidation based on field paste pH analyses, modified Sobek acid base accounting, net acid generation tests, and humidity cell tests.	Moderate potential to generate ARD or other deleterious leachate if sufficient percolation occurs. The sulfide waste rock does contain sulfide minerals that could oxidize and affect the environment based on modified Sobek acid base accounting data and to a lesser extent, net acid generation tests. However, humidity cell testing showed that this rock is expected to oxidize slowly, and that neither acid generation nor release of other deleterious leachate would be expected in the short term (i.e., years to decades). The slow oxidation rate is attributed to encapsulation of sulfide minerals in other minerals, which markedly slows the rate of sulfide mineral oxidation.
	Ore	High potential to generate ARD or other deleterious leachate if sufficient percolation occurs. The transitional ore showed similar geochemical characteristics to the transitional waste rock based on modified Sobek acid base accounting, Net Acid Generation tests, and humidity cell tests.	Moderate potential to generate ARD or other deleterious leachate if sufficient percolation occurs. The geochemical characteristics of this rock are similar to the sulfide ore.

Source: SRK 2013, 2014.

Sulfide rock also contains sulfide minerals, but these sulfide minerals oxidize slowly relative to the transitional rock unit.

In general, the geochemical test work shows that near-surface transitional waste rock and low-grade ore is likely to generate ARD or other deleterious leachates if sufficient percolation occurs through the piles. This conclusion is supported by field and laboratory testing of representative samples collected from the existing waste rock dumps, surface exposures and drill core. In contrast, the sulfide waste rock and ore have potential to generate ARD and other deleterious leachate at some time in the future, but kinetic laboratory testing (i.e., humidity cell tests) suggests that it may take decades to centuries for the sulfide waste rock and ore to oxidize sufficiently to produce ARD or other deleterious leachates. The majority of the rock that would be excavated under the Proposed Action would be sulfide waste rock and ore with limited potential to adversely affect water quality in the short term. However, several million tons of transitional ore and waste rock are planned to be mined under the Proposed Action, and this volume of rock would have potential to cause adverse effects to water quality if leachate is produced.

As discussed previously, the geochemical characteristics of the rock is only one factor that controls the potential for the waste rock or low-grade ore to affect surface or groundwater quality. A second important factor is the climate of the mine area, particularly the ratio of precipitation to evaporation. Average annual precipitation in the mine area is estimated to be approximately 13 inches per year, with most precipitation occurring during the summer. In contrast, evaporation in the area is estimated to be approximately 64.6 inches (JSAI 2013a), which is approximately 5 times the annual precipitation. In addition, evaporation is highest in the summer months, when the majority of the annual precipitation occurs. Therefore, most of the precipitation that falls on the waste rock dumps and the low-grade stockpile is expected to evaporate, with only a small fraction of precipitation expected to percolate into the rock piles.

When rock is mined from an open pit, the blasting and mining process produces broken rock with a substantial water holding capacity. Discharge of leachate from the base of the rock piles would not be expected until this available water holding capacity is expended. The term “field capacity” refers to the volume of water that a soil or broken rock will hold by gravity prior to drainage of water by gravity. This water is held within the pores of the rock pile by surface tension. In arid and semi-arid areas of the western U.S., hydrological modeling has shown that it may take centuries before waste rock reaches field capacity and leachate generation commences (Kempton et al. 2000).

Run-on of stormwater from adjacent areas upslope from the planned waste rock dumps and the low-grade stockpile could increase the volume of water that enters the rock piles. Depending on the flow path of the stormwater, this water could cause generation of leachate from the pile during mine operations if it flowed into the rock piles, interacted with transitional waste rock or low-grade ore, and discharged. The Proposed Action would include construction of berms and diversion ditches to convey stormwater around the rock piles to reduce the potential for generation of leachate by this mechanism during operations. This stormwater would be collected and utilized in the mineral processing system to reduce the quantity of water that is required to be pumped from the groundwater supply wells.

Because the mine would be located in an area where annual evaporation greatly exceeds precipitation, the waste rock and low-grade ore would have substantial water holding capacity at the time it is placed, and berms and diversion ditches would be constructed to convey stormwater around the rock piles. Neither discharge of ARD nor other deleterious leachate from the waste rock dumps or low-grade stockpile would be expected during the life of the mine assuming that all berms and diversion ditches are properly designed, constructed, and maintained through the life of the mine. However, there is potential that the waste rock or low-grade ore would eventually reach field capacity, and that percolation could occur centuries in the future unless the rate of percolation of water into the pile is mitigated during reclamation.

The potential for the Proposed Action to cause generation of technologically enhanced naturally occurring radioactive materials (TENORM) was raised as an issue during public scoping. When naturally occurring radioactive materials in their undisturbed natural state (NORM) become purposefully or inadvertently concentrated either in waste byproducts or in a product, they become TENORM. TENORM is defined as any naturally occurring radioactive material whose radionuclide concentrations or potential for human exposure has been increased above levels encountered in the natural state as a result of human activities (NAS 1999). Trace quantities of naturally occurring radioactive elements are present in minerals associated with porphyry copper deposits, and some copper extraction and beneficiation operations concentrate these radioactive materials and produce TENORM.

In 1999, the USEPA developed a report to provide a better understanding of TENORM at copper mining and mineral processing sites (USEPA 1999). That report indicated that copper leach operations that use solvent extraction-electrowinning (SX-EW) circuits may extract and concentrate soluble radioactive materials producing TENORM. The radioactivity appears to be associated with copper mineralization that contains trace quantities of uranium. The USEPA report evaluated the potential to generate TENORM at copper mining and mineral processing sites and, in particular, evaluated two common mineral processing techniques: SX-EW and froth flotation.

Selection of SX-EW versus froth flotation to extract copper from ore is based on the natural mineralogy of the ore. Oxide ores are efficiently processed using the SX-EW process, usually using a heap leach or dump leach process. In contrast, ore deposits containing copper sulfide minerals are processed using the froth flotation process.

The SX-EW process consists of applying an acidic solution to a rock dump or heap leach pad to dissolve the copper (i.e., solvent extraction). The leachate is then recovered and pumped to holding ponds for processing at an electrowinning plant. Once the copper is removed from solution by electrowinning, the leach solution is recycled, additional sulfuric acid is added as needed, and the leach solution is pumped back to the rock dump or leach pad for another cycle of SX-EW. Because uranium is not recovered in the electrowinning process, the uranium may remain dissolved in the leach solution, and multiple leaching cycles may contribute to inadvertent concentration of uranium. This process may generate TENORM (USEPA 1999).

In the froth flotation process, copper sulfide ore is crushed and ground to liberate the copper minerals and increase the surface area of the minerals for flotation. The powdered ore is mixed with pine oil (the ‘collector chemical’), which reacts with the copper sulfide minerals to make them hydrophobic. The mixture is introduced into a water bath (aeration tank) containing a surfactant. Air is constantly forced through the slurry and the hydrophobic mix of copper and pine oil latches onto and rides the air bubbles to the surface, where it forms froth and is skimmed off. These skimmings are cleaned of the collector chemical and surfactant, producing copper concentrate. The remainder is discarded as tailings, or processed to extract other elements. TENORM is not generated during the froth flotation process. Under the Proposed Action (and all action alternatives), the froth flotation process would be used to process the copper ore. This is related to the natural mineralogy at Copper Flat, with copper occurring primarily in copper sulfide minerals. Because the froth flotation process does not concentrate uranium or other naturally occurring radioactive materials, generation of TENORM would not occur under the Proposed Action (or the other action alternatives).

3.4.2.1.2 Mine Closure/Reclamation

The proposed reclamation plan for the waste rock dumps and low-grade stockpile included in the Proposed Action consists of:

- Regrading waste rock dumps (and the low-grade stockpile if reclaimed in place) to blend with adjacent topography and reduce slopes to a grade of approximately 3h:1v or less;
- Establishing permanent stormwater diversions to route stormwater around waste rock dumps;
- Constructing slope breaks on waste rock dumps (and low-grade stockpile if reclaimed in place) to reduce erosion of growth media;
- Placing growth media over the cover materials in compliance with State requirements;
- Amendment of the growth media with fertilizer or organic matter; and
- Reseeding of native grasses, forbs, and shrubs.

The general term growth media is used in this evaluation rather than a more specific term such as topsoil, because various natural materials would be stockpiled during construction of the mine for use as growth media during reclamation. Primary considerations for selection of growth media are the quantity required to support reclamation and the available water holding capacity of the materials. Although the proposed MPO (THEMAC 2011) indicates that there is a potential shortage of available topsoil to stockpile during construction of the mine, a supplemental soils investigation has determined that cover materials sufficient to meet cover requirements of up to 36 inches will be obtained from within the Copper Flat mine area (THEMAC 2015).

All topsoil in areas that would be disturbed by the operation would be excavated and placed into stockpiles to store and preserve this important resource for reclamation. An important feature of topsoil is the presence of decomposed organic matter and bacteria, fungi, and other organisms that make the topsoil biologically active. These organisms are important to critical soil processes such as decomposition of organic matter and rendering nitrogen and other nutrients into plant-available forms. Commonly, when topsoil is stockpiled during mining or other land-disturbing activities, the biological activity of the soil and the organic matter content decreases over time (Munshower 1994). Accordingly, it is common practice during mine reclamation to amend stockpiled topsoil with fertilizer or organic matter.

The alluvial sediments that would be stockpiled are unlikely to contain sufficient organic matter, nutrients, and biological activity to support reclamation at the time of stockpiling, but they are likely to contain adequate fine-grained sediments (i.e., silt and clay) to provide water holding capacity when used as a growth media. These materials would also be amended with fertilizer and organic matter prior to use as a growth media, and would develop the biological activity associated with topsoil over time. Under the Proposed Action, the proponent would implement reclamation test plots during mine operations to optimize the type and quantity of soil amendments and the reclamation procedures required for use of alluvial sediments as growth media during final reclamation.

The proposed reclamation approach would decrease the amount of percolation that occurs through the waste rock dumps (and the low-grade stockpile if reclaimed in place) because the growth media would store water that percolates into the ground during precipitation events and hold that water until it is either evaporated or transpired by plants in a process termed ET. This would decrease the volume of water that would enter the waste rock or low-grade ore, and reduce the potential for leachate generation.

The reclamation approach proposed in the original MPO of applying 6 to 12 inches of soil to the surface of the regraded waste rock dumps (and low-grade stockpile, if necessary) has been revised to comply with current NMED rules for copper mines at NMAC 20.6.7.33F, which were implemented after submittal of the original MPO by NMCC. The Proposed Action in this EIS reflects compliance with current NMED rules for soil cover, and the governing MPO would be revised accordingly before mining operations commence. The geochemical testing of the waste rock and low-grade ore (SRK 2013, 2014) indicates that the transitional waste rock has the potential to generate deleterious leachate if sufficient percolation of water through the rock piles occurs. The geochemical testing also indicates that the sulfide waste rock and low-grade ore has potential to generate acid or deleterious leachate some unknown time in the future, although this rock was shown to oxidize slowly based on kinetic laboratory tests. NMAC 20.6.7.33F contains several minimum requirements for reclamation of waste rock and low-grade ore with potential to adversely affect water quality:

- Placement of a cover system consisting of up to 36 inches of earthen materials, or as may be allowable within State requirements, that are capable of sustaining plant growth;
- Ensuring that these materials have the water holding capacity to store at least 95 percent of the long-term average winter (December, January, and February) precipitation or at least 35 percent of the long-term average summer (June, July, and August) precipitation, whichever is greatest; and

- Other specific requirements for diversion of stormwater, cover system design, and construction quality assurance.

The purpose of the thicker soil cover required by the NMED copper rules is to provide a store and release cover that would reduce percolation of water through the rock piles to a point at which adverse effects to surface water or groundwater quality are unlikely. This type of cover utilizes the available water holding capacity of the soil layer to store water that falls as precipitation and infiltrates into the soil layer, and release of that water back to the atmosphere through ET. These store and release covers are gaining widespread acceptance for reclamation of landfills and mine areas in arid to semiarid climates (e.g., Benson et al. 2011; Williams et al. 2003; INAP 2014).

Installation of a thicker soil cover over the waste rock dumps during reclamation (and the low-grade stockpile if necessary) would reduce the volume of water that percolates through the waste rock and decrease the rate at which the moisture content of the rock would increase towards the field capacity. This would further reduce the potential that the reclaimed waste rock dumps or the low-grade stockpile would generate quantities of ARD or other deleterious leachates that would affect the environment. The performance of this mitigation approach would also require: 1) that run-on diversions remain functional during the post-reclamation period to reduce the potential that stormwater runoff from areas upslope of the reclaimed facilities interacts with the waste rock or low-grade ore and leads to generation of ARD or other deleterious leachates; and 2) that a self-sustaining vegetative layer develops on the reclaimed facilities, which would increase ET of water stored within the soil cover and reduce the potential for erosion of the soil cover over time.

Accordingly, the following mitigation measures are intended to address potential water quality effects that could be caused by the waste rock dumps or low-grade stockpile. These mitigations would be applied as terms and conditions of approval for the MPO:

- Run-on diversions designed to divert stormwater generated in areas upslope from the waste rock facilities during active mining would be: 1) designed to convey the 24-hour 100-year design storm event; 2) constructed prior to placement of any waste rock or low-grade ore in the facilities; and 3) inspected regularly and maintained throughout the life of the mine and post-mining monitoring period.
- Reclamation of the waste rock dumps (and the low-grade ore storage facility, if necessary) shall include run-on diversions designed to convey the 24-hour 100-year design storm event. These diversions shall be designed to facilitate a minimum of long-term maintenance during the post-reclamation period.
- Reclamation of the waste rock dumps (and the low-grade ore storage facility, if necessary) shall comply with all requirements of the State of New Mexico.

Assuming that these mitigations are applied and effective, adverse water quality effects caused by waste rock or low-grade stockpiles are not expected.

Expansion of the existing pit: During review of the current condition of groundwater quality near the existing mine pit, adverse effects to groundwater quality were identified at two locations. Paired shallow and deep monitoring wells are present in each of these locations, GWQ11-25a/GWQ11-25b. In each of these locations, adverse effects to water quality at the shallow wells were relatively more pronounced, although the data suggest that both the shallow and deep groundwater are influenced by mining at these locations. The elevated constituents in the deep groundwater could also be inherent in the ore deposit. These local areas of poor groundwater quality are within the capture zone of the existing evaporative sink at the pit lake, so this existing groundwater contamination is likely flowing into the pit lake and not migrating away from the existing pit. The specific cause of these local areas of poor groundwater quality is not known, but it is possible that lowering of the static groundwater level adjacent to the current pit and sulfide mineral oxidation and acid generation within the transitional rock units played a role in development of mining-influenced groundwater at these locations.

Based on the current presence of such contaminated groundwater within close proximity to the existing pit and the geochemical characteristics of the transitional waste rock and ore reported by SRK (2013; 2014), there may be localized areas near the mine pit where groundwater quality could be affected in the future by the Proposed Action. The measurement indicators for monitoring wells GWQ11-24a/GWQ11-24b and GWQ11-25a/GWQ11-25b range from 3 to 10, and potential effects of the Proposed Action to water quality in the local area of the open pit may be of similar magnitude.

Expansion of the pit will require dewatering and the water that is taken from the pit will be used for dust suppression on roads or temporarily stored in a TSF during times of surplus. These activities would require the approval of the NMED. There would not be significant potential for impacts to groundwater or surface waters resulting from the disposition of the water from the pit. Although there are constituents present in the pit water that would otherwise be of concern as discussed earlier, there are certain mitigating factors regarding the intended use. Dust suppression activities on roadways require the application of only enough water to wet the surface while not creating hazardous conditions for traffic on the roadways. For this reason, the water on the surface is not present for a long enough time or in sufficient quantities to pose a significant risk to groundwater. The application and evaporation of applied water would likely result in the deposition of certain constituents on the surface of roadways; however, the runoff from the roadways would be controlled by the surface runoff features. Because of the deficit resulting from high evaporation rates and low precipitation, storage of surplus water in a TSF would be temporary and for a very short duration.

The final pit lake is expected to be a terminal lake, and therefore groundwater near the open pit would continue to flow into the future pit lake rather than migrating away from the pit lake. In order for water to flow away from the pit into groundwater, the hydrologic gradient would have to be higher than surrounding groundwater. Groundwater model output (JSAI 2015) indicates that the highest water level downgradient (east) of the pit is 200 feet above the pit's long-term maximum water surface elevation. Filling the pit the additional 200 feet that would result in flow from the pit into surrounding groundwater would require about 6,800 AF of water. The wettest year on record at Hillsboro (21 inches of precipitation in 1941) would have generated an estimated 82 AF of runoff to the pit. If small areas of mining-influenced groundwater develop near the expanded open pit, it is likely that this groundwater would continue to flow into the pit lake.

Expansion, operation, and reclamation of TSF: Under the Proposed Action, the existing TSF would be expanded and modernized with additional environmental protection infrastructure. As discussed previously, groundwater downgradient from the existing TSF is affected by MIW, which has caused the groundwater to exceed New Mexico groundwater standards for TDS and leads to a water quality measurement indicator for the existing condition in this area of 2.

During the previous operations, no geomembrane liner was constructed prior to disposal of the tailings in the TSF. The tailings were pumped into the TSF as slurry of process water and tailings, and the tailings slurry dewatered by gravity over time, which resulted in discharge of the process water to groundwater. There is potential that some small amount of seepage still occurs from the existing TSF, but it is thought that most of the water that discharged from the TSF over the last approximately 30 years originated from dewatering of the initial tailings slurry.

Under the Proposed Action, the existing tailings area would be regraded, including salvaging the existing tailings for reuse as liner bedding material, and a low permeability geomembrane liner would be installed and an underdrain system would be installed to convey tailings seepage into collection ponds located south of the tailings dam. The primary purpose of this liner is to capture water that drains from the tailings slurry to prevent discharge of this process water to the environment and to improve water conservation at the mine by recycling this water back to the mineral processing circuit. This liner would also isolate the existing tailings, and mitigate the potential for additional seepage from the facility in the future. Over time, this would result in declining concentrations of TDS in groundwater downgradient from the TSF as natural attenuation processes including dilution and advection slowly disperse the existing TDS plume. This would result in an improvement of water quality as compared to the No Action Alternative, which can be quantified by an expected reduction in the water quality measurement indicator for the TSF area from 2 to zero.

After the expanded and modernized TSF was put into operation, tailings would continue to be pumped to the TSF as slurry. The rate at which the tailings dewater and consolidate is dependent on the grain size and other physical characteristics of the tailings. The fine-grained tailings would dewater slowly, and it is unlikely that the tailings would be entirely dewatered at cessation of active mining and subsequent reclamation of the TSF. Therefore, post-closure monitoring of the dewatering process and management of the water that seeps from the TSF after it is reclaimed would be required.

The required duration of this MIW monitoring and management requirement is unknown, but it could persist for years to decades after mine closure. Under the Proposed Action, this post-closure MIW seepage would be managed by periodically pumping the water from the collection facility and directing this to a small water holding area, and land then applied to reclaimed areas only if of suitable quality. The proposed post-closure seepage management approach has been amended to include the water holding area because the quality of the seepage without it would be unknown and would have created a post-closure environmental liability that would have required long-term maintenance of the site.

The following mitigation measures are intended to address the TSF. These mitigations would be applied as terms and conditions of approval for the MPO or as modifications to the proposed MPO, which would be required prior to approval.

- Prior to land application of seepage water from the TSF to reclaimed areas, the proponent would provide detailed chemical analyses of the water and an assessment of potential effects to vegetation or soils to the BLM. If the seepage water has the potential to adversely affect vegetation or soils, the proponent would propose an alternative management approach to the BLM for approval.
- The proponent shall obtain all necessary environmental permits from the State of New Mexico and the USEPA for management of seepage water.
- Prior to approval of the proposed MPO, the proponent shall modify the proposal to include a post-closure TSF seepage monitoring and management plan, and a cost estimate to complete this work.
- The cost of post-closure seepage monitoring and management shall be incorporated into a post-closure trust fund (or other long-term funding mechanism) established in accordance with 43 CFR 3809.552(c).

Non-point source pollution from disturbed areas on the mine area: The Proposed Action does not involve any point source discharges to surface water. However, there is potential for non-point source pollution to occur, which could be caused by stormwater interacting with disturbed areas of the mine such as haul roads, parking areas, equipment storage areas, or other ancillary facilities. Preliminary plans for stormwater pollution control facilities are described in the Proposed Action and include stormwater diversion structures at the waste rock dumps, low-grade stockpile, TSF, and in the area of the mineral processing plant. NMCC also proposes to manage stormwater pollution with the use of BMPs including seeding and mulching of disturbed areas, silt fences, straw bale check dams, diversion ditches with energy dissipaters, and rock check dams.

Potential non-point source pollution is regulated by the Clean Water Act as amended and associated State and Federal regulations. Prior to initiating construction or mining activities, NMCC would need to obtain a Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity. This permit will require preparation of a Stormwater Pollution Prevention Plan (SWPPP); installation and use of BMPs for prevention of non-point source pollution from mine facilities; and routine inspection, maintenance, and recordkeeping for all stormwater pollution control facilities. New Mexico's Surface Water Quality Bureau acknowledges that compliance with a SWPPP that meets the requirements of the stormwater permit is generally assumed to be protective of surface water quality (SWQB 2018).

The following mitigations address potential non-point source pollution. These mitigations would be applied as terms and conditions of approval of the proposed MPO.

- Prior to initiation of mine construction or other surface disturbing activities, the operator shall obtain a Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity and comply with all requirements of that permit.
- Prior to initiation of mine construction or other surface disturbing activities, the operator shall provide final designs for stormwater diversion structures and other associated BMPs to the BLM for review.
- The SWPPP and all associated inspection and maintenance records shall be available for inspection by the BLM upon request.

Because non-point source pollution is regulated by existing laws and regulations and the proponent must comply with those laws, potential effects to water quality from non-point source pollution are not considered to be significant.

Spills or other unanticipated releases: A preliminary spill contingency plan (SCP) is included in the proposed MPO as required by 43 CFR 3809.401(a)(2)(vi). Various laws apply to storage and use of petroleum products, explosives and other potentially hazardous substances at mine sites including:

- BLM regulations at 43 CFR 3809.401(a)(2)(vi) require submittal of SCPs as part of the MPO.
- USEPA regulations at 40 CFR Part 112 set forth additional requirements for storage of petroleum products including preparation of a Spill Prevention Control and Countermeasures (SPCC) Plan for facilities with above-ground oil storage of more than 1,320 gallons total.
- Regulations of the MSHA at 30 CFR Part 56 set forth additional requirements for storage and use of fuels and explosives at surface metal mines.

The preliminary SCP is adequate to support the proposed MPO and associated NEPA analysis. However, additional detail will need to be added to the plan, and the plan will need to be modified as necessary to reflect the final mine design prior to operations. Therefore, the following mitigation is to address potential water quality concerns that could be caused by spills or other anticipated releases of hazardous substances into the environment. This condition would be included as a term and condition of approval for the proposed MPO.

- Prior to commencement of mine construction, the operator shall provide an updated SCP that complies will all applicable State and Federal laws including 43 CFR 3809.401(a)(2)(vi), 40 CFR Part 112, and 30 CFR Part 56.

Because storage, use, management, and spill response for petroleum products, explosives, and other potentially hazardous substances is already addressed by existing laws and regulations, and the operator must comply with those laws, potential adverse effects to water quality associated with spills or other anticipated releases of hazardous substances to the environment are not considered to be significant.

Assuming that the recommended mitigations to protect water quality are applied in conjunction with approval of the proposed MPO, several beneficial effects would occur. These beneficial effects are summarized as follows:

- Water quality in the pit lake would be required to meet applicable water quality standards set by NMEMNRD, and a pit lake water quality management plan, contingency water treatment plan, and a long-term financial assurance (e.g., a trust fund) would be established in accordance with BLM regulations at 43 CFR 3809.552(c) to provide funding to implement the pit lake water quality management plan and to provide for treatment of the water if necessary. This would result in a water quality measurement indicator of zero for the pit lake.
- The existing TSF would be modernized with placement of a low-permeability liner, which would cover existing tailings and mitigate potential future discharges of MIW from the existing TSF. This would result in an improvement in the water quality measurement indicator for groundwater downgradient from the TSF from 1 (the existing condition) to zero (the anticipated future condition assuming that natural attenuation processes mitigate the existing TDS contamination in the years after the low permeability liner is installed).
- The waste rock dumps would be reclaimed in a manner that meets modern requirements for groundwater quality protection at the State level (e.g., placement of a 36-inch soil cover) and meets current BLM requirements for environmental protections as set forth in the 43 CFR 3809 regulations. This would decrease the risk that ARD or other deleterious leachate would be discharged from the existing waste rock dumps in the future.

3.4.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Alternative 1 would have long-term, minor, small extent, unlikely, and adverse effects on water quality. The following sections address anticipated water quality effects with respect to the pit lake, ephemeral surface water, and groundwater for Alternative 1. Overall, impacts are not expected to be significant.

Pit lake water quality: Direct and indirect effects associated with pit lake water quality are expected to be approximately the same for Alternative 1 as discussed for the Proposed Action. Alternative 1 would disturb 156 acres and reduce the mine life from 16 years to 11 years, which would reduce the length of time that sulfide minerals are exposed in the pit floor and mine highwalls. This would reduce the risk of adverse effects to water quality as compared to the Proposed Action. However, due to complexities related to the prediction of water quality effects that would result from interactions between the sulfide minerals and pit water (see also Section 3.4.2.1, Proposed Action), this relative reduction in the potential for adverse effects to water quality cannot be quantified. If no mitigation measures are applied to address future pit water quality, the pit lake water quality measurement indicator would be expected to increase above zero.

The recommended mitigations discussed for the Proposed Action are also recommended for Alternative 1. Assuming that these mitigations are implemented and effective, the expected value of the water quality measurement indicator for the pit lake would remain at zero, and the pit lake would continue to meet applicable water quality standards set by NMEMNRD.

Assuming the recommended mitigations are implemented and effective, likely effects to pit lake water quality associated with Alternative 1 are also classified as not significant.

Surface water and groundwater quality: Under Alternative 1, the mineral processing rate would be 25,000 tpd rather than 17,500 tpd as included in the Proposed Action. This would increase the rate of production of waste rock, both low-grade and ore, but the overall tons of rock produced would be the same as the Proposed Action. This increase in the production rate would decrease the mine life to approximately 11 years, because the available ore would be mined faster under Alternative 1. This would lead to some beneficial effects to water quality as compared to the Proposed Action, because the waste rock and low-grade stockpiles would be reclaimed approximately 11 years after mining commences rather than approximately 16 years after mining commences. Other aspects of the project associated with water quality would be the same as included in the Proposed Action. The relative benefits to water quality associated with Alternative 1 as compared to the Proposed Action cannot be quantified at the scale of the water quality measurement indicators, and therefore, the values of the measurement indicators developed for the Proposed Action also apply to Alternative 1.

It is recommended that the same mitigations to protect water quality recommended for the Proposed Action also be applied to Alternative 1, if selected. Assuming that these mitigations are applied, the significance of the effects to water quality for Alternative 1 would be the same as described for the Proposed Action.

3.4.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Alternative 2 would have long-term, minor, small extent, unlikely, and adverse effects on water quality. The following sections address anticipated water quality effects with respect to the pit lake, ephemeral surface water, and groundwater for Alternative 2. Overall, impacts would not be significant.

Pit lake water quality: Under Alternative 2, the ultimate pit would encompass approximately 161 acres, which is larger than the ultimate pit proposed for the Proposed Action and Alternative 1. The relatively larger size of the pit would result in a somewhat larger pit lake with relatively more surface area available for evaporation. This may affect the rate of evapoconcentration of dissolved solids within the water, but the associated effects on pit lake water quality are expected to be negligible when considered in relation to the measurement indicators and the inherent uncertainty of the pit lake model. The estimated mine life for Alternative 2 is approximately 11 years, which is 5 years shorter than the estimated mine life for the Proposed Action.

Alternative 2 would provide for production of approximately 125 million tons of ore, which is approximately 25 percent more ore than would be produced under the Proposed Action or Alternative 1. The production rate would increase to approximately 30,000 tpd, which would provide for a mine life of approximately 11 years. Alternative 2 would provide for mining and processing of a larger proportion of the ore body. This may result in exposure of rocks in the final pit highwalls that contain a relatively lower proportion of sulfide minerals as compared to the Proposed Action or Alternative 1, because the known ore deposit would be more completely mined. Therefore, Alternative 2 would have a relatively lower potential to cause adverse water quality affects as compared to the Proposed Action or Alternative 1. However, due to complexities related to the prediction of water quality effects that would result from interactions between the sulfide minerals and pit water (see also Section 3.4.2.1, Proposed Action), this relatively lower risk of adverse water quality effects cannot be quantified, and the measurement indicators discussed for the Proposed Action would remain the same. Accordingly, if no mitigations were applied, the measurement indicator for pit lake water quality would be expected to increase above zero.

The mitigations recommended for the Proposed Action are also recommended for Alternative 2. If these mitigations are implemented and are effective, the estimated value of the pit lake water quality measurement indicator for Alternative 2 would be zero, and the pit lake would continue to meet applicable water quality standards set by NMEMNRD. Assuming the recommend mitigations are implemented, the likely effects to pit lake water quality associated with Alternative 2 also would be classified as not significant.

Surface water and groundwater quality: Although the total tonnage of ore produced under Alternative 2 would be higher than Alternative 1, the proposed tonnage of waste rock produced would be relatively lower. Under Alternative 2, 36 million tons of waste rock and low-grade ore would be produced, whereas approximately 63 million tons of low-grade ore and waste rock would be produced under the Proposed Action and Alternative 1. Therefore, potential adverse effects of the WRDFs would be somewhat lower for Alternative 2 as compared to the Proposed Action or Alternative 1. Other aspects of Alternative 2 that are relevant to water quality would be the same as included in the Proposed Action.

Although Alternative 2 would be relatively more protective of water quality as compared to the Proposed Action or Alternative 1, these relative effects cannot be quantified at the scale of the water quality measurement indicators. The values of the measurement indicators and the anticipated level of significance of the effects to water quality would be the same as described for the Proposed Action.

3.4.2.4 No Action Alternative

The No Action alternative would have long-term, minor, small extent, unlikely, and adverse effects on water quality. The environmental effects of the No Action Alternative are addressed to provide a baseline for evaluation of effects associated with the action alternatives. Under the No Action Alternative, the proposed MPO would not be approved and a Stage 1 Abatement Plan under the New Mexico Water Quality Act to address current water contamination at the Mine would continue to be implemented. Thus, the existing conditions and resulting effects to water quality described in Section 3.4.1, Proposed Action, are anticipated to be improved, although the specific degree of improvement is unknown. No additional mining or reclamation of the mine would occur under the No Action Alternative.

If any of the action alternatives are selected, additional mining would occur in accordance with modern mining regulations including BLM regulations at 43 CFR 3809. Current regulations for environmental protection during mining, reclamation of disturbed areas, and post-closure site management are more stringent than the regulations that applied in the 1980s during the Quintana mining operations at the site. Overall, impacts would not be significant.

3.4.3 Mitigation Measures

Mitigation measures for water quality are described within the subsections of 3.4.2, Environmental Effects, for the Proposed Action and each alternative.

3.5 SURFACE WATER USE

Surface water resources are described in both their existing condition and the predicted effects from the Proposed Action and alternatives in the following sections; 3.5.1 Affected Environment, 3.5.2 Environmental Consequences, and 3.5.3 Mitigation Measures.

3.5.1 Affected Environment

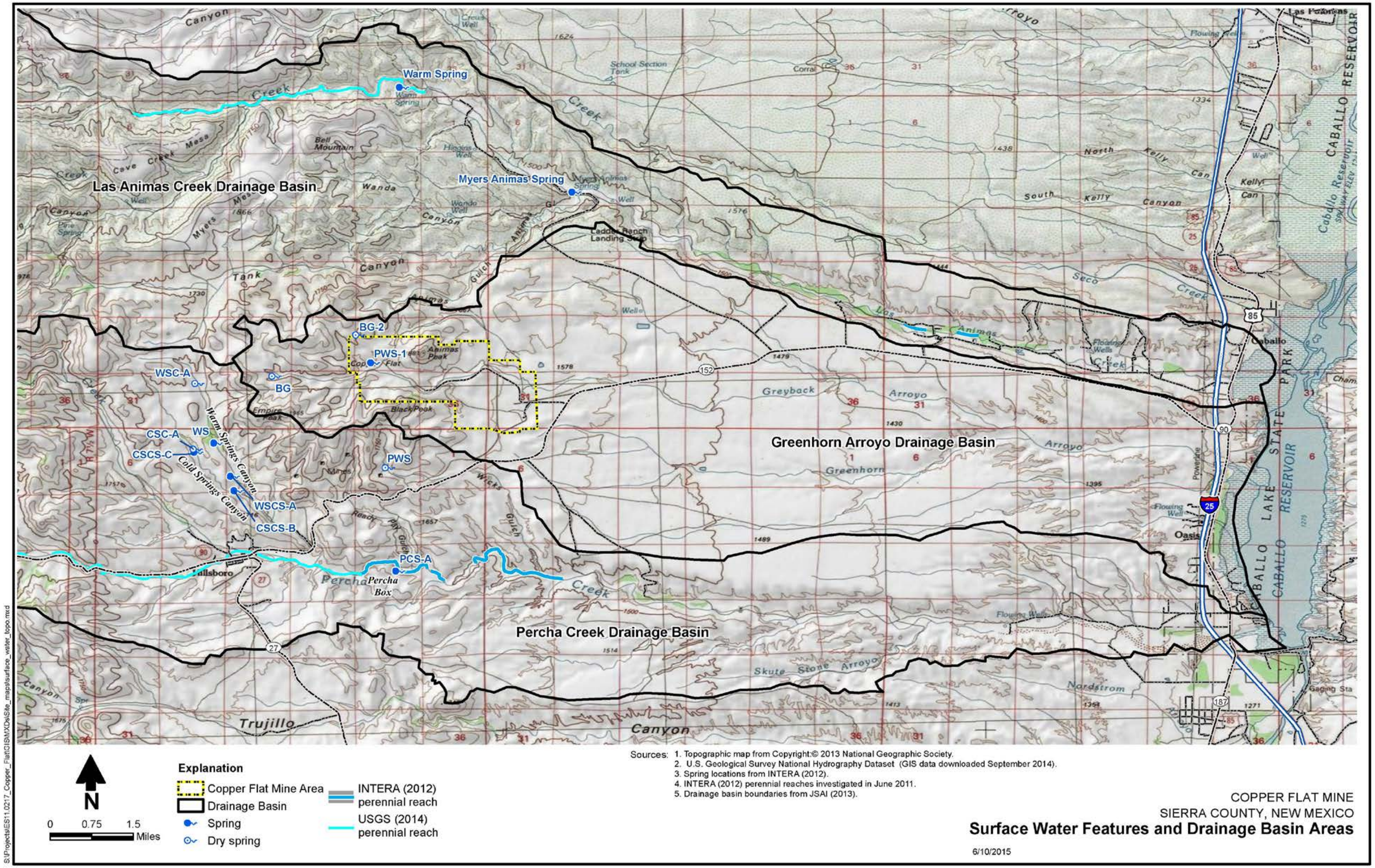
The Copper Flat mine area is within the Creosote Rolling Upland and Grass Mountain of southern New Mexico, a warm arid region where annual evaporation greatly exceeds annual precipitation. Precipitation generally comes in the form of local, high-intensity summer (July through September) rain showers. These storms are typically of short duration. Annual precipitation in the area of Copper Flat ranges from 5 to 20 inches per year, averaging approximately 13 inches per year (JSAI 2013b). Daily precipitation of 1 inch or more occurs twice per year on average, with daily storm events of greater than 2 inches expected about every 5 years (JSAI 2013b). The 100-year 24-hour storm event is about 3.6 inches (NOAA 2014).

Within the project area, estimated annual potential ET, which includes evaporation and plant transpiration, ranges from 60 to 65 inches per year (JSAI 2013b). Actual ET is less and depends on water availability and climatic conditions such as temperature, sun, and wind exposure. Evaporation from the Copper Flat pit lake is approximately 65 inches per year (JSAI 2013b).

The Copper Flat project area lies within the Lower Rio Grande watershed of south-central New Mexico. This approximately 5,000-square-mile watershed, located east of the Continental Divide, extends from the Elephant Butte reservoir to the Mexico, New Mexico, and Texas international boundary (USGS 2014). The watershed is dominated by the Rio Grande and the Elephant Butte and Caballo Reservoirs, which lie along the river. Caballo Reservoir, located at the eastern margin of the proposed project area, is an earthen dam reservoir constructed in the late 1930s. The estimated storage capacity of the reservoir is 343,990 AF (USBR 2018a). The average volume of water stored in the reservoir between January 1, 2015 and December 31, 2017 was 38,061 AF (USBR 2018b), approximately 11.1 percent of the total capacity.

Headwaters to the Rio Grande are fed by the Rocky Mountains in Colorado. Numerous tributary drainages within the Lower Rio Grande watershed also contribute water to the Rio Grande. However, none of these drainages provide perennial flow; they contribute flow primarily during storm events. The mine area is located within the Greenhorn Arroyo drainage basin, a topographic basin within the Lower Rio Grande watershed. This basin contains small, ephemeral washes (arroyos) that drain generally from west to east toward Caballo Reservoir; major washes include the Greyback and Greenhorn arroyos. Surface water runoff at Copper Flat is generated predominantly by precipitation at higher elevations (Davie and Spiegel 1967). The Percha Creek and Las Animas Creek topographic drainage basins are located immediately south and north, respectively, of the Greenhorn Arroyo drainage basin. Both Percha Creek and Las Animas Creek flow from west to east toward Caballo Reservoir and have ephemeral, intermittent, and perennial reaches. Three drainage basins and their associated surface water features are located in the area of the Copper Flat mine, as shown on the figure below. (See Figure 3-5.)

Figure 3-5. Surface Water Features and Drainage Basin Areas



Source: NGS 2013; USGS 2014; Intera 2012; JSAI 2013b.

The following subsections provide a description of each of the three drainage basins based on information documented in existing reports. These reports include recent baseline characterization and groundwater supply and modeling studies (Intera 2012; JSAI 2012 and 2013b), a previous EIS (BLM 1999), and other historical documents (Davie and Spiegel 1967; Newcomer et al. 1993).

3.5.1.1 Greenhorn Arroyo Drainage Basin

The Copper Flat mine area lies within the Greenhorn Arroyo drainage basin. The area of this drainage basin is approximately 35,000 acres, including a 230-acre watershed that drains to the existing open mine pit (JSAI 2013b). Current surface water use within this basin is primarily livestock watering.

Major washes within the Greenhorn Arroyo drainage basin include the Greenhorn and Greyback Arroyos, as shown on the figure above. (See Figure 3-5.) Several smaller arroyos are tributaries to these two larger arroyos, which drain to the east and converge approximately 8 miles east of the Copper Flat mine. The Greyback Arroyo is the predominant surface water drainage feature in the area of the mine. It originates west of the mine and was rerouted around the southern perimeter of the mine area during the earlier mining activities in the 1980s. Before mining in the 1980s, the Greyback Arroyo ran directly through the current mine area. An arroyo that is tributary to the Greyback Arroyo is located just north of the existing waste rock disposal facilities that are situated north of the pit lake. The arroyo runs along the north side of Animas Peak, and its confluence with the Greyback Arroyo is located east of the mine site. The Greenhorn Arroyo is located south of the Greyback Arroyo.

From August 2010 through April 2011, stormwater flows were monitored at three locations along Greyback Arroyo within the proposed mine area as part of the baseline characterization study (Intera 2012). Stormwater flows during this period were minimal, with dry conditions often observed. In March 1993, Newcomer et al. (1993) (as cited in Intera 2012) recorded a surface water flow rate of 0.028 cubic feet per second (cfs) (20 AFY) in the Greyback Arroyo east of the former plant area.

Springs and seeps have been identified within the Greenhorn Arroyo drainage basin (Newcomer 1993; BLM 1999; Intera 2012). The baseline characterization study monitored springs located north and west of the open pit and identified several seeps emanating from the fractured bedrock of the open pit highwalls shortly after precipitation events, as shown on the figure above. (See Figure 3-5.) Flow rates at these features were minimal; the springs were dry, and pit wall seepage was too low to accurately measure flow during routine monitoring events (Intera 2012). Previously reported seeps and springs (BLM 1999; Newcomer et al. 1993) were dry during the baseline characterization study. Below average precipitation during the period of the baseline characterization study was likely a factor in the low flow rates and dry conditions observed at the springs and seeps. Precipitation recorded at the mine between October 2010 and September 2011 was 4.82 inches.

The existing open pit has filled with water to form a small pit lake. The pit lake covers approximately 5.2 acres and holds approximately 60 AF of water (Intera 2012). The water level at the pit lake is influenced by several factors, including the following:

- Stormwater runoff to the open pit;
- Groundwater inflow from the adjacent saturated bedrock; and
- Evaporation from the lake surface.

3.5.1.2 Las Animas Creek Drainage Basin

The Las Animas Creek drainage basin is adjacent to and north of the Greenhorn Arroyo drainage basin. The basin is approximately 84,000 acres (JSAI 2013b) and is drained by Las Animas Creek, as shown on the figure above. (See Figure 3-5.) This creek originates in the Black Range Mountains west of the project area and flows to the east toward Caballo Reservoir – a distance of approximately 32 miles. Like other drainages in the region, Las Animas Creek is deeply incised into an east-sloping alluvial plain. Springs have been identified within Las Animas Creek basin (Davie and Spiegel 1967). Several are present along Las Animas Creek, including Warm and Myers Animas springs.

Surface water flow characteristics in Las Animas Creek vary; the creek has ephemeral, intermittent, and perennial reaches. Las Animas Creek does not contribute perennial surface water flow to the Rio Grande. Surface water flow rates were measured in August 2010, November 2010, January 2011, and April 2011 along Las Animas Creek and ranged from 0.04 to 7.09 cfs (30 to 5,140 AFY) (Intera 2012). The greatest flow rates were generally recorded just downstream of Warm Spring in August when precipitation was high. During the period of the baseline characterization study, two short perennial reaches located 4 to 6 miles west of Caballo Reservoir were monitored, and Las Animas Creek was predominantly a stream that loses flow to groundwater (Intera 2012). Historical surface water flow rates of Las Animas Creek range from less than 1 to 60.3 cfs (700 to 43,700 AFY) (Davie and Spiegel 1967; ABC 1998 [as cited in Intera 2012]). The higher flow rates are most likely associated with snowmelt and late summer precipitation.

From 2010 and 2011, the flow rate at Warm Spring was nearly constant, ranging from approximately 0.73 to 1.1 cfs (530 to 800 AFY) (Intera 2012). Historical flow rate measurements vary from 0.007 cfs (5 AFY) (Newcomer 1993) to 0.81 cfs (590 AFY) (Davie and Spiegel 1967). A second, unnamed spring was identified during the 2010-2011 baseline characterization study (Intera 2012). This spring is located 3 miles downstream of Warm Spring and is designated as Myers Animas Spring on U.S. Geological Survey (USGS) topographic maps.

The Ladder Ranch uses water from the upper portion of Las Animas Creek basin for irrigation and to fill stock ponds (Intera 2012). This includes both surface water from Las Animas Creek and groundwater pumped from the shallow alluvium. Local residents use water resources in the lower portion of Las Animas Creek basin for agricultural and domestic purposes. A number of diversion ditches and return flow ditches exist along the lower portion of Las Animas Creek. In addition, many residents have shallow wells (OSE 2014b), some of which are artesian. The use of diversion ditches and shallow wells along Las Animas Creek causes local and seasonal changes in alluvial groundwater levels and surface water flows (Davie and Spiegel 1967; Intera 2012).

3.5.1.3 Percha Creek Drainage Basin

The Percha Creek drainage basin encompasses approximately 77,000 acres (JSAI 2013b) and is located immediately south of the Greenhorn Arroyo basin. The basin is drained by Percha Creek, which originates in the Black Range Mountains and flows to the east toward Caballo Reservoir, as shown on the figure above. (See Figure 3-5.) Surface water flow characteristics in Percha Creek vary but are considered intermittent in many reaches (BLM 1999). Percha Creek is intermittent in the area of Hillsboro and perennial east of Hillsboro in an area known as the Percha Box, a steep-walled reach of the creek that is incised into Paleozoic carbonate rocks (BLM 1999) as shown in Figure 3-5. The creek is perennial through the box due to its geological structure. Downstream of the Percha Box, the creek is ephemeral, as the surface geology changes from carbonate rocks to alluvial sands and gravels. At the east end of the creek, artesian groundwater conditions create local springs and flowing wells near Caballo Reservoir (BLM 1999). Percha Creek does not contribute perennial flow to the Rio Grande.

Between 2010 and 2011, surface water flow rates along perennial reaches of Percha Creek ranged from 0.002 to 7.45 cfs (1 to 5,400 AFY) (Intera 2012). The highest surface water flow rates were recorded in August when precipitation was high. Three separate perennial reaches were observed in the area of and immediately downgradient of the Percha Box, as shown on the above figure. (See Figure 3-5.) The reaches range from approximately 0.2 mile to 2 miles in length (Intera 2012). During the period of the baseline characterization study, the creek exhibited both losing and gaining reaches, with surface water flow decreasing significantly downstream of the Percha Box, eventually disappearing as the creek enters the Tertiary Palomas Basin alluvial gravels and sands. Earlier surface water investigations report perennial flow characteristics in the area of the Percha Box, with measurable flow rates ranging from approximately 0.3 to 1 cfs (200 to 700 AFY) (SRK 1995; ABC 1996).

Several springs have been identified in the Percha Creek drainage basin (Intera 2012). Springs exist in Warm Springs and Cold Springs canyons and the Percha Box, as shown on the figure above. (See Figure 3-5.) Warm Springs and Cold Springs canyons are tributary drainages to Percha Creek and are located northwest of the Percha Box. Between 2010 and 2011, surface water flow rates at springs in these canyons ranged from 0 cfs (0 AFY) (i.e., stagnant water or dry conditions) to 0.75 cfs (540 AFY), with the highest flow rates recorded in August (Intera 2012). The flow rate at a spring monitored within the Percha Box was nearly constant, ranging from 0.41 to 0.64 cfs (300 to 460 AFY) (Intera 2012), and exhibited little seasonal variability. Springs are also present at the eastern terminus of Percha Creek.

Water resources within the Percha Creek drainage basin are used for domestic purposes, livestock, and irrigation (Intera 2012). Many of the residents of Hillsboro and the surrounding area have shallow alluvial wells (OSE 2014b). Some residents also divert surface water for irrigation. Ranches east of Hillsboro obtain stock water from shallow alluvial wells or diversion ditches when surface water is available. The shallow wells are generally located in the alluvium along Percha Creek.

3.5.2 Environmental Effects

The following subsections discuss expected environmental effects associated with the Proposed Action and alternatives, including the No Action Alternative. The evaluation of environmental effects is based primarily on predictive groundwater flow modeling. JSAI (2013 and 2014) developed a calibrated numerical groundwater flow model of the Copper Flat area that simulates groundwater/surface water interactions along portions of Las Animas and Percha Creeks and the Rio Grande upstream and downstream of Caballo Dam. Pit dewatering is also considered in the model simulations.

This model was used to predict impacts to surface water resources caused by groundwater pumping associated with the proposed operation of the Copper Flat mine (JSAI 2014b and 2014c). These impacts consist of a reduction in groundwater discharge to Las Animas Creek, Percha Creek, and the Rio Grande, including Caballo Reservoir. Tables 3-12 and 3-13, shown below, summarize expected surface water depletions due to predicted reductions in groundwater discharge. Reductions in groundwater discharge to these surface water features were estimated by comparing groundwater modeling simulation results for the Proposed Action and two mining alternatives to simulation results without mining; the simulation without mining is intended to represent background conditions (JSAI 2014a). For example, of the 13,370 AFY of water that would be used at the mine, 3,802 AF would be supplied by groundwater pumped from the mine's well field, as shown in the previous chapter. (See Table 2-11). The majority of the water used by the mine would be recycled. The predictive groundwater modeling simulation for the Proposed Action includes the 3,802 AFY of groundwater pumping. Results of this simulation are compared to the simulation without mining to determine the Proposed Action depletions presented below in Tables 3-12 and 3-13. Similar approaches are used to estimate the depletions associated with the two action alternatives; these depletions are also provided below in Tables 3-12 and 3-13.

Operational information presented in the MPO (THEMAC 2012) was also evaluated to assess potential impacts from stormwater management at the mine. Stormwater at the mine would be managed in accordance with a SWPPP. In New Mexico, industrial facilities can apply for stormwater permit coverage under the State-wide general permit NMR050000 issued by the USEPA (NMED 2014b).

Table 3-12. Predicted Surface Water Depletion Rates at End of Mining and 100 Years After Closure Due to the Proposed Action and Two Mining Alternatives

Table 3-12. Predicted Surface Water Depletion Rates at End of Mining and 100 Years After Closure Due to the Proposed Action and Two Mining Alternatives

Surface Water Feature	Rate (AFY)					
	Proposed Action		Alternative 1		Alternative 2	
	End of Mining	100 Years After Closure	End of Mining	100 Years After Closure	End of Mining	100 Years After Closure
Caballo Reservoir (upstream of dam)	810	23	941	23	1,095	25
Rio Grande (downstream of dam)	663	2	806	4	936	3
Las Animas Creek [1]	13	1	14	1	17	1
Percha Creek [1]	19	3	20	3	24	4

Source: JSAI 2014a, 2014b.

Notes: End of mining values represent maximum depletion rates, which occur 3 months after the cessation of mining. Closure values are for 100 years after mining.

[1] Predicted surface water depletion rates of Las Animas and Percha Creeks include water available for surface water flows and ET.

Table 3-13. Predicted Cumulative Surface Water Depletion Volumes Due to the Proposed Action and Two Mining Alternatives

Table 3-13. Predicted Cumulative Surface Water Depletion Volumes Due to the Proposed Action and Two Mining Alternatives

Surface Water Feature	Volume (AF)		
	Proposed Action	Alternative 1	Alternative 2
Caballo Reservoir (upstream of dam)	9,102	7,110	8,519
Rio Grande (downstream of dam)	7,299	5,625	6,840
Las Animas Creek [1]	143	114	138
Percha Creek [1]	184	137	168

Source: JSAI 2014a, 2014b.

Notes: Predicted cumulative surface water depletion volumes at 3 months post mining.

[1] Predicted surface water depletion rates of Las Animas and Percha Creeks include water available for surface water flows and ET.

3.5.2.1 Proposed Action

The Proposed Action would have long-term, minor to moderate, large extent, probable, and adverse effects. Overall, impacts would be significant. The Proposed Action, to process ore at a nominal throughput of 17,500 tpd, is predicted to reduce groundwater discharge to Las Animas and Percha Creeks, Caballo Reservoir, and Rio Grande below Caballo Dam, decreasing the amount of water available for surface water flow and plant ET. The predicted depletions are not expected to have substantial impacts to the surface water flow characteristics at or vegetation along Las Animas and Percha Creeks; the reductions are relatively small, and the majority of the creeks' reaches within the Palomas basin, where most of the depletions occur, are ephemeral. However, the predicted reductions in groundwater discharge are expected to have a more notable effect on the Rio Grande, reducing surface water flows and potentially the amount of water stored behind Caballo Reservoir. Tables 3-12 and 3-13 report predicted depletion rates and cumulative depletion volumes, respectively, at the surface water features at the end of mining.

Impacts to springs located west of the Animas Uplift (e.g., Warm Springs) are not expected based on predicted drawdown of the groundwater flow model. Some of the bedrock seeps and springs at the open pit could be impacted, possibly going dry during mining operations as the open pit is dewatered; however, bedrock seeps at the open pit that only flow in response to precipitation events are not expected to be impacted by mining operations. In addition, flow rates at springs located at the eastern terminus of Percha Creek may decline due to anticipated drawdown and reduced hydrostatic pressure in this area from pumping at the well field.

Stormwater management at the mine is not expected to have a substantial effect on surface water quantities in the Greyback and Greenhorn Arroyos. Proposed mining operations and the expansion of the open pit would not alter the existing Greyback diversion channel; stormwater flows captured in the Greyback Arroyo upgradient of mine facilities would continue to be diverted around the mine. In addition, to the extent practical, stormwater would be directed away from mine-impacted areas and allowed to follow natural drainage paths. Stormwater that does come in contact with mine-impacted areas would be captured and used as process water; stormwater harvesting from mine facilities is estimated to be approximately 304 AFY. (See Table 3-14.)

The perimeter dam associated with the TSF would be used for the placement and management of tailings during mining operations; the dam's purpose is not flood control. A permit would be obtained from the OSE for dam construction and operation. The TSF would be designed to contain inflows and direct precipitation associated with the 72-hour probable maximum precipitation (PMP) event, which is 26 inches for the site. Diversions would be constructed for run-on control and sized to convey the peak discharge associated with the 72-hour PMP. A permanent spillway capable of passing the design storm would be required at closure after the tailings surface has been regraded and a reclamation cover is in place. A review of aerial photographs shows no human habitations in or adjacent to Greyback Wash between the TSF and Caballo Lake (Golder 2010).

Table 3-14. Summary of Water Supply Sources and Contributions

Table 3-14. Summary of Water Supply Sources and Contributions

Source	Contribution (AFY)		
	Proposed Action	Alternative 1	Alternative 2
Well field	3,802	5,290	6,105
Stormwater	304	306	304
Moisture in ore	129	194	258
Pit dewatering	39	39	39
Total	**4,274**	**5,829**	**6,706**

Source: NMCC 2012d.

Note: Table does not include water reclaimed from TSF.

3.5.2.1.1 Mine Development and Operation

Water would be used during operation of the mine for ore processing, dust suppression, and other activities. Ore processing would require about 93 to 96 percent of the water used. The majority, approximately 70 percent, of the water used by the mine would be recycled. The remaining 30 percent would be consumed primarily through evaporation, retention in tailings and mineral concentrate, and dust suppression applications and would need to be replaced. The Proposed Action would consume approximately 4,274 AFY of water, as summarized in the table above. (See Table 3-14.)

The majority (89 percent) of the water consumed would be replaced by groundwater pumped from the well field located approximately 8 miles east of the Copper Flat mine. Other sources of water would include stormwater captured at mine facilities, pit dewatering water, and moisture present in the ore. The contribution from each source for the Proposed Action and two mining alternatives is summarized above. (See Table 3-14.)

A 5.2-acre lake currently exists within the open pit. During mining operations, this pit lake would be pumped down, and the open pit would be continually dewatered to facilitate safe mining operations. The existing pit lake would be reduced to a much smaller operational sump, where water flowing into the pit would be managed. Sources of water to the open pit would include groundwater inflow and stormwater runoff. Water removed from the open pit would be used for dust suppression on roads, as shown in the table above. (See Table 3-14.)

Pumping of groundwater from the well field is expected to minimally reduce groundwater discharge to both Las Animas and Percha Creeks, resulting in a slight decrease in the amount of water available for perennial surface water flow and plant ET. Under the Proposed Action, maximum depletion rates of 13 and 19 AFY are predicted for Las Animas Creek and Percha Creek, respectively, at shortly after the end of mining, as shown above. (See Table 3-12.) Most of the impacts from the Proposed Action would be to the lower portions of the creeks (i.e., within the Palomas Basin). Estimated existing flow and ET rates to lower portions of Las Animas and Percha Creeks are 4,848 and 2,630 AFY, respectively, as shown in Section 3.6, Groundwater Resources. (See Table 3-17a.) Therefore, the predicted maximum depletions reduce groundwater discharge rates by only 0.3 and 0.7 percent, respectively. These small reductions are not expected to have substantial impacts on vegetation or surface water flows, as most of the creeks' reaches within the Palomas Basin are ephemeral.

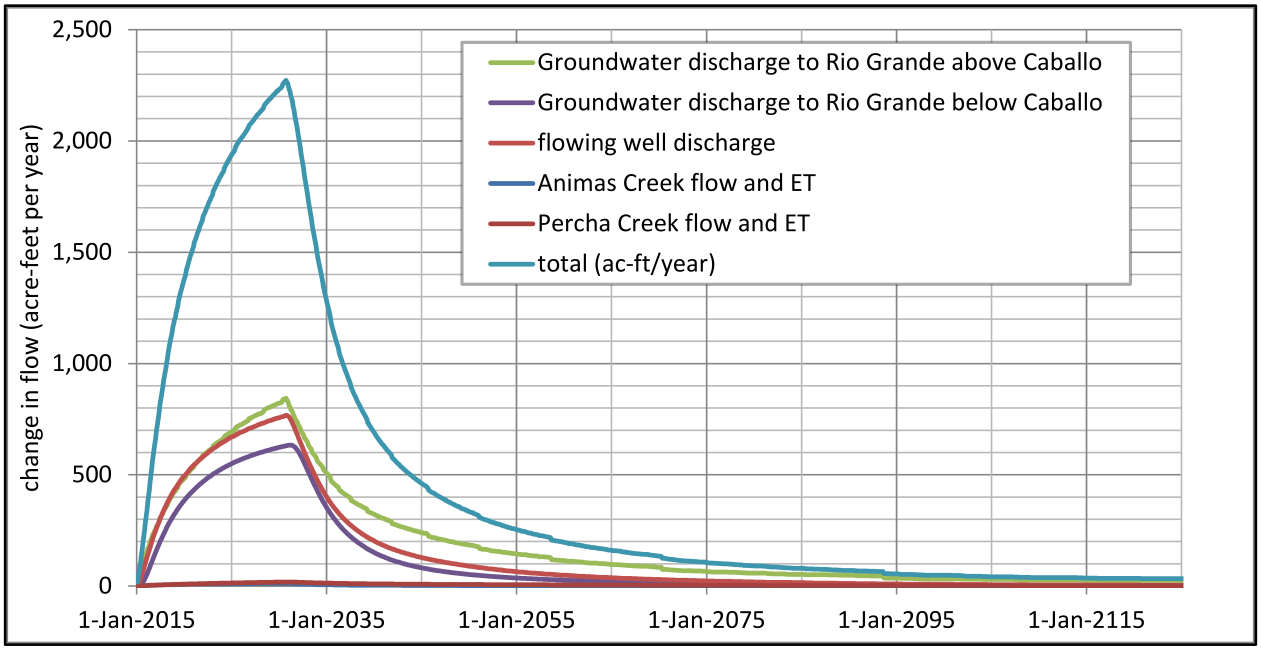
Predicted maximum depletions for the Proposed Action to upper Las Animas Creek and at the Percha Box are 1 to 2 AFY. These depletions are not expected to impact Warm Springs or any springs west of the Animas Uplift based on predictions of where drawdown is simulated. Springs along the alluvial valleys are considered perched discharges and not directly connected to regional groundwater. Bedrock seeps in the immediate area of the mine could be impacted and possibly go dry.

Predicted maximum depletion rates at Caballo Reservoir and Rio Grande below Caballo Dam are 810 and 663 AFY, respectively (JSAI 2012), as shown above. (See Table 3-12.) These maximum depletion rates occur shortly after the end of mining. The total predicted maximum depletion rate (1,473 AFY) is 12.5 percent of the estimated groundwater discharge rate (11,795 AFY [JSAI 2014a]) from the Copper Flat mine study area to the Rio Grande and Caballo Reservoir. This would likely reduce surface water flows in the Rio Grande and potentially the amount of water stored behind the Caballo Reservoir.

Changes in water balance components are anticipated due to groundwater pumping associated with the mine, including depletions at Caballo Reservoir, the Rio Grande, and Las Animas and Percha Creeks, as shown below. (See Figure 3-6.) The depletions would steadily increase during mining, peak at the end of mining, and then decline once mining ceases.

Mining and concentrating operations would not discharge to surface water courses in the Greenhorn Arroyo drainage basin, such as the Greyback and Greenhorn Arroyos. Stormwater runoff from mine facilities would be captured in settling ponds and used as process water. This is expected to supply approximately 304 AFY of water, as shown above. (See Table 3-14.) NMCC would use diversions, berms, and other BMPs to prevent stormwater from areas outside the mine from running on to mine areas and facilities.

Figure 3-6. Change in Water Balance Components Due to Proposed Action



Source: NMCC 2018b.

Note: The term "flowing wells" is equivalent to the term "artesian wells."

The proposed mining operation is not expected to substantially impact surface water resources within, and vegetation associated with, the Greenhorn Arroyo Drainage Basin drainages, including those located west of the mine site. The Greenhorn Arroyo Drainage Basin drainages are ephemeral, flowing in direct response to high-intensity rainfall events. They are hydraulically separated from groundwater and, therefore, would not be impacted by open pit dewatering or groundwater pumping.

3.5.2.1.2 Mine Closure/Reclamation

The Copper Flat mine would be reclaimed to conditions similar to those present before the reestablishment of mining. The objective of the reclamation plan is to achieve a self-sustaining ecosystem without the need for perpetual care. Reclamation and revegetation of mine areas and facilities would stabilize exposed soil, minimizing erosion and contributions of suspended solids to surface water courses. Disturbed areas would be regraded to blend in with the surrounding topography as much as practicable. Drainage channels, ditches, and earthen water control structures would be revegetated and protected from erosion by riprap, sediment traps, or other types of BMPs.

The existing Greyback diversion channel would be left in place at closure and would continue to divert stormwater flows around the southern perimeter of the mine area. In addition, stormwater diversions at the waste rock disposal areas would remain, and if necessary, be lined with riprap to prevent erosion. The mine would attempt to maintain the existing riparian area located in the Greyback Wash east of the mine area during both mine operations and at closure. This riparian area is believed to have been created during the previous mining operation through the collection of stormwater and alterations to surface water drainage patterns. The mine would restore the stormwater collection pond that is believed to have created the riparian area; however, the exact configuration that led to the creation of the riparian area is not known and complete restoration may not be possible.

Dewatering of the open pit would cease at closure. Groundwater inflow and stormwater runoff from within the perimeter of the pit would begin to form a pit lake. The expected size of the pit lake after mining would be larger than the existing one, as mining would expand the area and depth of the open pit. The pit lake is expected to eventually cover 18.6 surface acres and be approximately 200 feet deep. The size of the lake would fluctuate annually and seasonally depending on climatic conditions, such as precipitation and air temperature. The estimated maximum water loss from the pit lake would be about 100 AFY, assuming an average evaporation rate of 65 inches per year.

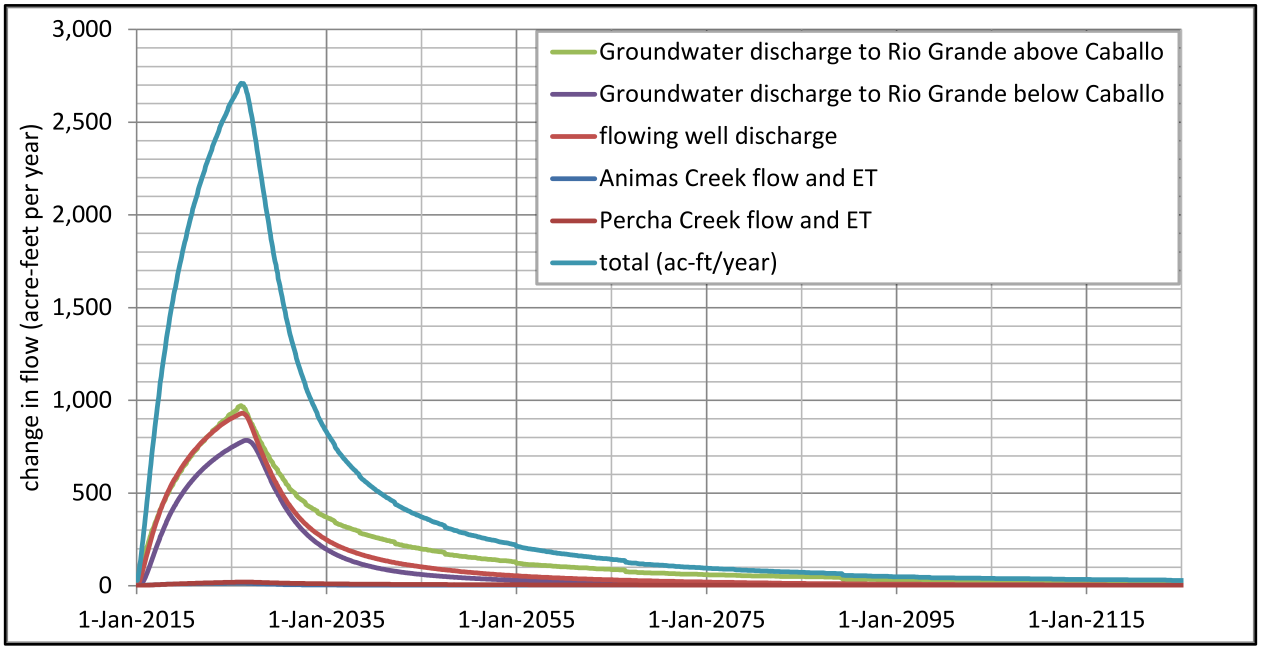
Once mining stops and water is no longer needed for mineral beneficiation and other mining activities, pumping of groundwater from the supply wells located east of the mine would stop. Consequently, groundwater levels of the Santa Fe Group aquifer are expected to rebound, stream depletion rates would decline, and depletions themselves would slow, as summarized above. (See Table 3-13 and Figure 3-6.)

3.5.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

The effects from mine development, operation, closure, and reclamation under Alternative 1 would be similar in nature to those outlined under the Proposed Action – that is, long-term, minor to moderate, large extent, probable, and adverse effects. Overall, impacts would be significant. However, predicted reductions in groundwater discharge to surface water resources and resultant depletions to surface water flows and volumes would be different, as summarized above. (See Tables 3-12 and 3-13.) Alternative 1 would consume approximately 5,829 AFY of water; approximately 5,290 AFY (91 percent) would be supplied from the well field, as shown above. (See Table 3-14.)

Alternative 1 is predicted to result in greater surface water depletion rates than the Proposed Action due to its increased groundwater demand, as summarized above. (See Table 3-12.) However, cumulative depletion volumes would be less than the Proposed Action due to the shorter mine life, as shown above. (See Table 3-13.) Predicted maximum depletion rates at Las Animas and Percha Creeks are 14 and 20 AFY, respectively; predicted maximum depletion rates at Caballo Reservoir and the Rio Grande below Caballo Dam are 941 and 806 AFY, respectively. (See Table 3-12.) These predicted maximum depletion rates represent 0.3, 0.8, and 14.8 percent reductions in groundwater discharge to Las Animas Creek, Percha Creek, and the Rio Grande and Caballo Reservoir, respectively. Expected surface water depletions are associated with Alternative 1, as shown below. (See Figure 3-7.) Once mining and associated pumping of groundwater from the supply well field stops, surface water depletions are predicted to decline. Except for Caballo Reservoir, depletions at 100 years after closure are predicted to be approximately 4 AFY or less, as shown above. (See Table 3-12.) The predicted depletion at Caballo Reservoir at 100 years after closure is 23 AFY.

Figure 3-7. Change in Water Balance Components Due to Alternative 1



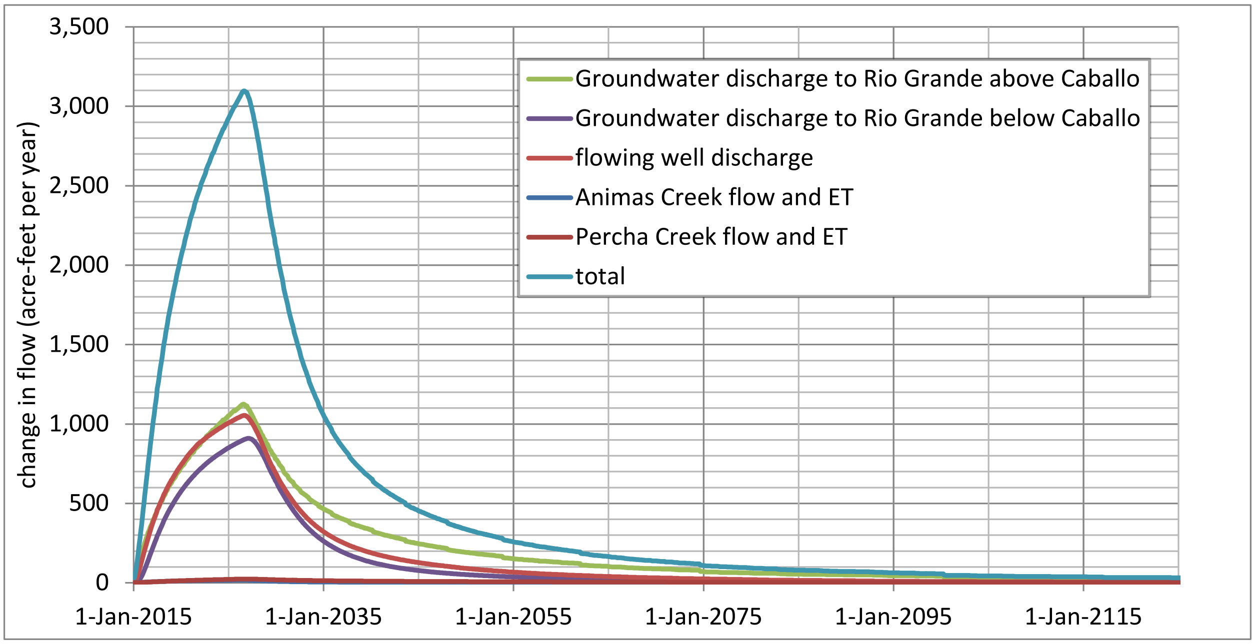
Source: NMCC 2018b.

3.5.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

The effects from mine development, operation, closure, and reclamation under Alternative 2 would be similar in nature to those outlined under the Proposed Action – that is, long-term, minor to moderate, large extent, probable, and adverse effects. Overall, impacts would be significant. However, predicted reductions in groundwater discharge to surface water resources and resultant depletions to surface water flows and volumes would be different, as shown above. (See Tables 3-12 and 3-13.) Alternative 2 would consume approximately 6,706 AFY of water; approximately 6,105 AFY (91 percent) would be supplied from the well field, as shown above. (See Table 3-14.)

Alternative 2 is predicted to result in greater surface water depletion rates than both the Proposed Action and Alternative 1 due to its greater groundwater demand, as shown above. (See Table 3-12.) However, cumulative depletion volumes would be lower than the Proposed Action due to the shorter mine life, as shown above. (See Table 3-13.) Predicted maximum depletion rates at Las Animas and Percha Creeks are 17 and 24 AFY, respectively; predicted maximum depletions at Caballo Reservoir and the Rio Grande below Caballo Dam are 1,095 and 936 AFY, respectively, as shown above. (See Table 3-12.) These predicted maximum depletion rates represent 0.4, 0.9, and 17.2 percent reductions in groundwater discharge to Las Animas Creek, Percha Creek, and the Rio Grande and Caballo Reservoir, respectively. Figure 3-8 below shows expected surface water depletions associated with Alternative 2. (See Figure 3-8.) Once mining and the pumping of groundwater from the supply well field stops, surface water depletions are predicted to decline, similar to the Proposed Action and Alternative 1. Depletions at 100 years after closure are predicted to be approximately 4 AFY or less, except for at Caballo Reservoir, where the predicted depletion is 25 AFY, as shown above. (See Table 3-12.)

Figure 3-8. Change in Water Balance Components Due to Alternative 2



Source: NMCC 2018b.

3.5.2.4 No Action Alternative

The No Action Alternative would avoid potential reductions in groundwater discharge to surface water resources and resultant surface water depletions at the Rio Grande, including Caballo Reservoir, and at Las Animas and Percha Creeks.

In addition, the No Action Alternative would avoid changes to existing hydrologic conditions at the open pit. These changes include pumping down the existing pit lake during the operational period to facilitate mining and allowing a larger pit lake to eventually form once mining operations cease. The No Action Alternative would also avoid potential impacts to seeps and springs located in the immediate vicinity of the open pit and at the eastern terminus of Percha Creek.

Abatement actions would be implemented to remediate a plume underlying the former TSF. These actions are still in the planning stages, but would likely involve some form of runoff control to minimize dispersion of the plume. This may have an adverse effect on surface water patterns in this vicinity that would be short-term, minor, of medium extent, and likely to occur. Overall, impacts would not be significant.

3.5.3 Mitigation Measures

The predicted impacts to surface water resources are adverse and significant and would be compensated for through mitigation requirements of OSE. NMCC has committed to work with OSE to incorporate into their OSE permit “all monitoring, offsets, and replacement requirements deemed necessary to avoid impairment to other water users and impacts to the Rio Grande” (NMCC 2017b). NMCC would fully offset calculated and actual depletions to the Rio Grande resulting from mining operations by obtaining water for the offset through a surface water lease executed with the Jicarilla Apache Nation for a period of 15 years (NMCC 2017c). The 15-year period would start when the crushing of ore begins. After 15 years, the lease would have to be extended or another water source secured. The BLM may authorize this mine project; any operations are premised on the acquisition of necessary water rights under the authority of the OSE for the life of the mine plan. In an August 24, 2017 letter to the BLM, NMCC reaffirmed to fully offset depletions to the Rio Grande to ensure no net effect on the river due to proposed mining operations, including offsets for any depletions beyond year 29 (NMCC 2017d). Offsets for these later years would be obtained by taking one or more of the following actions: extending the Jicarilla Apache Nation water lease; securing another lease of equally effectual water; or securing and permanently retiring water rights that physically affect the river today.

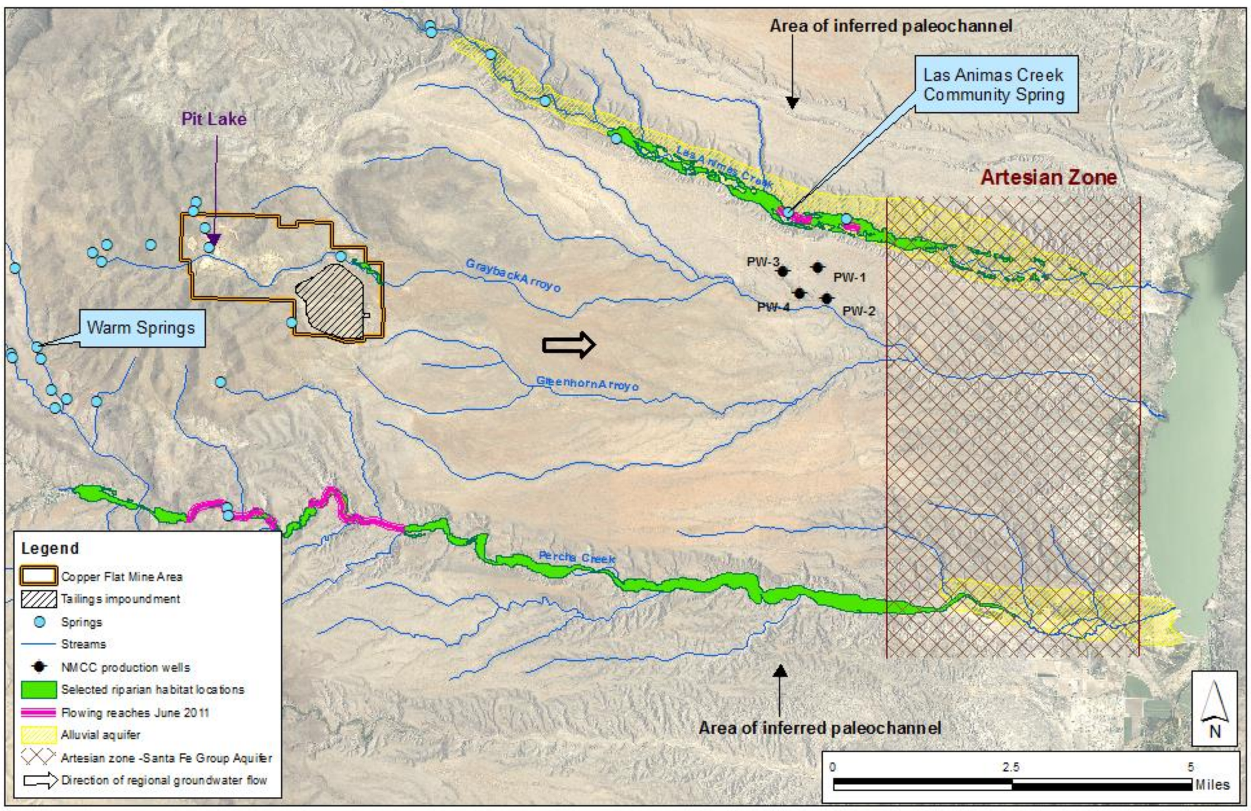
3.6 GROUNDWATER RESOURCES

This section presents a discussion of the groundwater resources in the proposed mine area and the area near the water supply well field for the proposed mine. The hydrogeology of these areas and existing users of groundwater are presented. The section also includes an analysis of the environmental effects of the Proposed Action and alternatives, including a detailed discussion of the methodology used to analyze the effects.

3.6.1 Affected Environment

Groundwater resources within the affected environment include those near the Copper Flat mine area and those near the water supply wells, as shown below. (See Figure 3-9.) Related geologic information is discussed in Section 3.7, Mineral and Geologic Resources. (See Figures 3-23 and 3-24.) References used in compiling information on area groundwater include Davie and Spiegel (1967); Wilson et al. (1981); BLM (1999); JSAI (2011); Intera (2012); Jones et al. (2012); and Jones et al. (2013).

Figure 3-9. Hydrologic Features in Project Area



Source: Intera 2012; Jones et al. 2013.

3.6.1.1 Regional Hydrogeology

The principal water-bearing materials of the project area include the coarser sediments in the Santa Fe Group of the Palomas Basin and Warm Springs Valley, and saturated alluvium in the principal drainages. As documented in Jones et al. (2012), groundwater recharge occurs primarily in the uplands, where periodic rainfall and snowmelt are greater than elsewhere, and along the arroyos and losing stream reaches where ephemeral and intermittent surface flows can seep downward. Regional-scale groundwater flow is west to east, from about 5,800 feet amsl at the western edge of the Warm Springs graben to less than 4,200 feet amsl at Caballo Reservoir.

Except near the mine, data on water levels are sparse, making it difficult to accurately map the water table. The water level information that is available (e.g., Wilson et al. 1981, Plate 5) indicates that contours are closely spaced in the Animas Uplift and westernmost Palomas Basin, which indicates a relatively steep water level gradient and is evidence of lower transmissivity of the aquifer in those locations.

Contour spacing is much wider around the NMCC well field, which indicates the water table gradient is flatter and the aquifer has a higher transmissivity and better potential to supply wells. The gradient steepens again east of the well field, indicating more restricted water movement toward Caballo Reservoir, as a result of substantial clays in the Santa Fe Group east of the well field.

Groundwater discharge is primarily to the Rio Grande valley, including river alluvium and Caballo Reservoir. Some discharge occurs locally to springs, to tributary streamflow, and to riparian vegetation along tributaries (primarily Las Animas and Percha Creeks). Discharge also occurs to area wells, most of which withdraw small amounts of water in comparison to the large production expected from the NMCC wells.

3.6.1.2 Hydrogeology of the Mine Pit Area

JSAI (2011) estimates hydraulic conductivity of the saturated crystalized bedrock in the mine area to be in the range of 0.05 to 0.1 feet per day, with the higher values in the fractured monzonite. These values are consistent with the findings of DBSA (1998). This equates to a transmissivity of no more than 10 square feet per day for each 100 feet of thickness, which is low. Because the rocks in the uplift are poorly transmissive, most groundwater from the highly transmissive Santa Fe Group sediments in the Warm Springs Valley flows around the uplift northeast toward Las Animas Creek or southeast toward Percha Creek. Disturbed areas at the mine area, such as areas of waste rock, are likely more permeable than the natural material. These areas may be locations of minor recharge to the local groundwater system.

The existing pit was excavated to below the local water table, and thus required dewatering for mining to occur. The pit lake elevation is currently as much as 100 feet below the regional groundwater table. Reflecting the low transmissivity of the bedrock, inflows to the lake are small despite the high gradient. Thus, pumping rates for dewatering were no more than 50 gpm for the Quintana pit (Jones et al. 2013). In the absence of pumping for dewatering, the level of water in the pit lake reflects an approximate balance in which evaporation is the only depletion. Evaporation is offset by the inflows from precipitation, local runoff, and groundwater. Net outflow to groundwater does not occur at the pit.

3.6.1.3 Hydrogeology of the TSF

A portion of the existing TSF overlies Santa Fe Group materials. Local hydrologic conditions in this area have been extensively studied as part of a program to abate elevated levels of dissolved solids in groundwater caused by seepage from the existing tailings. Information below is taken from Intera (2011), which was submitted by NMCC to the NMED.

Seepage from the western part of the TSF flows directly into gravels of the Santa Fe Group. In the eastern part of the TSF, the Santa Fe is overlain by a shallow clay layer which in turn is beneath surficial stream terrace gravels. These gravels include old placer workings. Seepage from the eastern part of the TSF flows eastward through the gravels that overlie the clay, creating a water level mound that is higher than the regional water table. Tests on both the shallow and deeper gravels indicate a hydraulic conductivity of 1 to 5 feet per day.

A fault lies east of the TSF. The fault may act as a barrier to groundwater flow from the mound that occurs beneath the tailings. It may limit the extent of a sulfate plume that extends east of the TSF in the shallow gravels. For additional information on the existing plume, see Section 3.4.2, Water Quality, Environmental Effects.

3.6.1.4 Hydrogeology of the Palomas Basin in the Vicinity of the Supply Well Field

The existing water supply wells are located within the Palomas Basin on a mesa between Animas Creek (north) and Greyback Arroyo (south), about 8 miles due east of the mine and within 6 miles of Caballo Reservoir to the east. Dunn (1982) documents that the production wells were located following an exploration program that determined this to be the nearest location to the mine with sediments that have both sufficient thickness and permeability to support large capacity supply wells. The location coincides with a graben and paleo-channel. (See Figure 3-9.)

Figure 3-10 is a cross-section along Lower Las Animas Creek near the supply wells. In addition to showing the graben in which the supply wells are located, the figure shows a shallow clay layer that serves as a perching horizon that would isolate flows in Las Animas Creek from direct effects of pumping of the mine supply wells. The presence of a clay layer is demonstrated in well logs and in aquifer test results. The cross-section also shows a substantial amount of clay east of the well field that is responsible for the artesian conditions found in many wells between the supply well field and the Rio Grande.

Groundwater flow in the area depicted by the cross-section is consistent with the overall flow in the Palomas Basin, which is west to east toward the Rio Grande valley. In the well field area, the slope of the water table is less than 20 feet per mile, compared to 150 feet per mile near the mine (Wilson et. al., 1981). As previously noted, this difference in gradient is due to the differences in transmissivity in different parts of the aquifer.

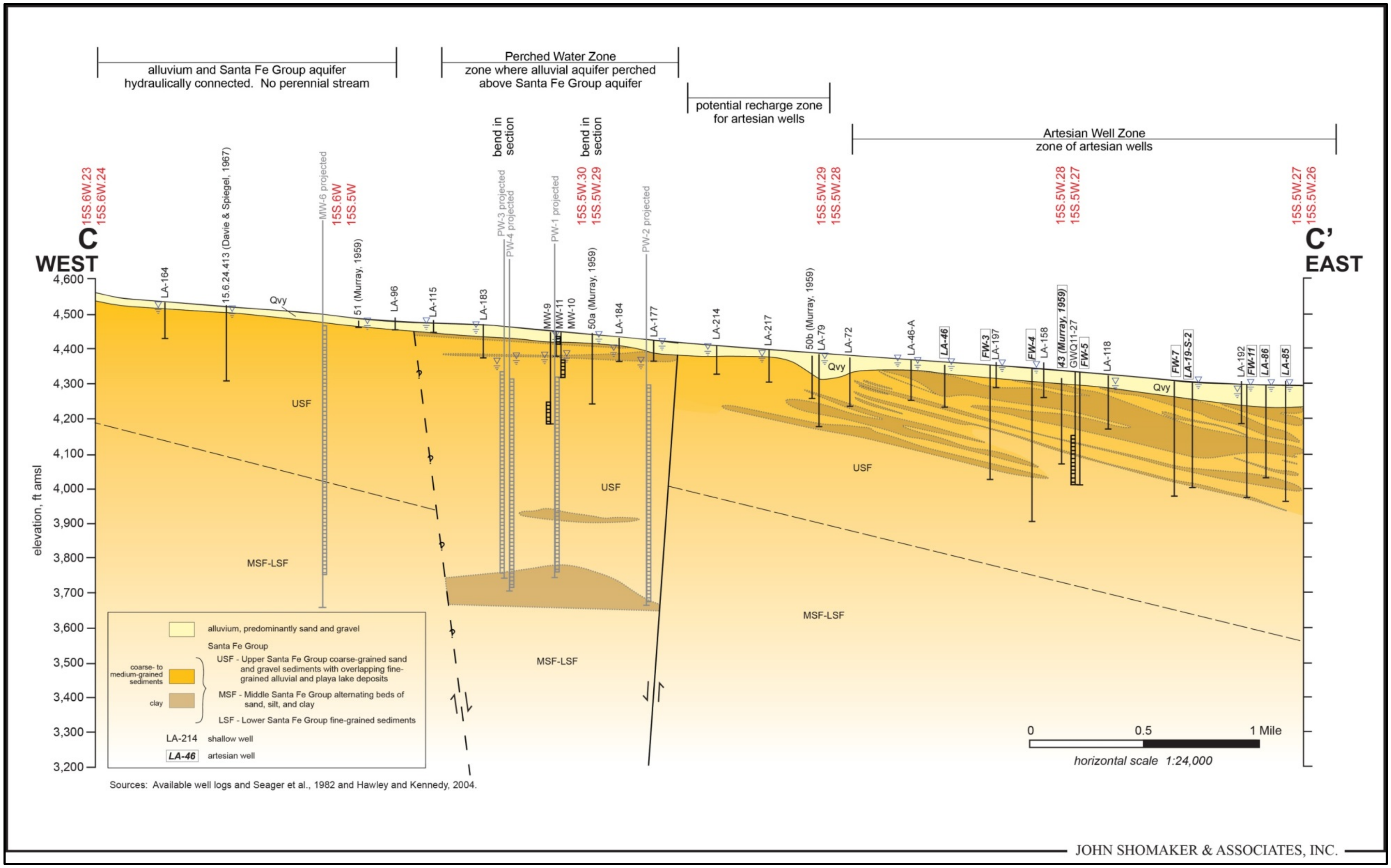
The 4 large-diameter (16-inch) production wells were originally tested to have individual well yields on the order of 1,000-2,000 gpm (Dunn 1982). Wilson et al. (1981) indicates that the wells penetrate a thickness of 950 to 1,000 feet of sand and gravel before encountering any thick clay beds. According to data in Intera (2012), the wells are typically screened over the bottom 600 feet. Depths to water exceed 300 feet, and the average static water level in the wells is at 4,380 feet amsl.

Aquifer tests of the supply wells conducted by NMCC in 2012 resulted in a generalized estimate of the transmissivity of the upper 1,000 feet of the Santa Fe Group to be 20,000 square feet per day (i.e., hydraulic conductivity was estimated at 20 feet per day) (JSAI 2014a). This is higher than the 11,000 square feet per day reported in BLM (1999), but that reference did not specify aquifer thickness and thus cannot be directly compared to the recent test result. DBSA (1998) also indicated a possible value of 11,000 square feet per day.

3.6.1.5 Hydrogeology of Alluvial Valleys in the Vicinity of the Mine and Well Field

The alluvial valleys potentially affected by the Copper Flat mine and well field are those streams and arroyos that drain the area near the mine and supply wells: Las Animas Creek, Percha Creek, Greyback and Greenhorn Arroyos, and the Rio Grande including Caballo Reservoir.

Figure 3-10. Cross-Section North of Supply Well Field



Source: NMCC 2018b.

Las Animas Creek: The only published report specific to the hydrology of Las Animas Creek is Davie and Spiegel (1967). This reference provides information on area groundwater for both pre-development and the historic conditions resulting from the development of surface irrigation systems and drilling of artesian wells and was an important source of information used to construct the groundwater model used in this analysis. In the area near the project well field, the valley of Las Animas Creek is locally underlain by alluvial materials in the range of 20-60 feet thick. The materials contain shallow groundwater that is generally close enough to the land surface to be within the riparian root zone. Intera (2012) provides the results of a seepage study along Las Animas Creek. In most areas the creek is a losing stream (water losses exceed water gains when there is runoff) and a source of recharge to the water moving in the underlying alluvium. Reaches with perennial flow occur near the water supply well field; the stream dries up below these reaches, as shown above. (See Figures 3-9 and 3-10.)

Wilson et al. (1981) observed that the static water levels in the area of what is now the project well field were 25 to 50 feet lower than the water table in the Las Animas alluvium. That relationship is also shown in Intera 2012, is consistent with BLM (1999), and is illustrated by several triangular symbols on Figure 3-10 above that indicate a shallow water table in the area labeled 'Perched Water Zone'. The data indicate that perched alluvial groundwater occurs in Las Animas Creek in the reach near the supply wells. This perched water has quite limited hydraulic connection to the main aquifer that will be directly impacted by the supply wells. Hydrology within the perched layer reflects localized conditions such as seepage from irrigation canals and irrigated fields and pumping of domestic and other small capacity wells. The amount of downward seepage from the perched groundwater to the Santa Fe Group sediments is considered small (BLM 1999) and is independent of water levels in the Santa Fe Group.

The clays in the Santa Fe Group east of the well field created artesian conditions, in which water levels were above the land surface before the aquifer was developed (Intera 2012). In that area there are large capacity irrigation wells that penetrate several hundred feet or more into the permeable materials of the Santa Fe Group. Artesian flows of up to a few hundred gpm have been reported in these wells at various points in time. Pressures have declined over time, and some wells no longer flow (Jones et al. 2013). However, such wells can still produce several hundred gpm if pumped. According to Jones et al. (2012), the decline in artesian pressure may be due in part to poor well construction that resulted in leakage upward from the artesian zone by means of flow in and around the well casings.

Percha Creek: Near the supply wells, the valley of Percha Creek is underlain by alluvial materials up to 50 feet thick that contain groundwater (Wilson et al. 1981). The primary area where groundwater supports riparian vegetation or surface flow is in and just downstream of the Percha Box, where Paleozoic bedrock is at the surface and groundwater flows to the surface. Elsewhere the stream is typically dry and flow that does occur (e.g., from storm runoff) provides recharge to groundwater.

Many wells are found near Percha Creek near Hillsboro, New Mexico. These wells typically draw from shallow alluvium or from silts and clays in the Santa Fe Group (Seager et al. 1984) and yields are generally low. Data are not available on the water table elevation in the Percha Creek alluvium in the area of the supply wells, and the extent of perched conditions (if any) is not defined. Some artesian wells do occur near the downstream end of the creek, where the hydrogeology is similar to that in lower Las Animas Creek.

Arroyos: Alluvium is found along Greyback and Greenhorn Arroyos and consists primarily of sand and gravel; thickness varies between 5 and 50 feet (Intera 2012). Alluvium in Greyback Arroyo may be locally and seasonally saturated in the vicinity of the mine. Hydrologic conditions in arroyos near the supply wells have not been defined. No wells are known to obtain their supply from arroyo alluvium.

Rio Grande: Wilson et al. (1981) provide information on hydrogeology along the Rincon Valley. Alluvium deposited by the Rio Grande underlies the valley, including Caballo Reservoir. The material is up to 100 feet thick and overlies clays in the Santa Fe Group. Water levels are generally within 15 feet of the ground surface, with a flow direction south at the same slope as the ground surface (about 5 feet per mile). Specific capacities of wells in the Rincon Valley average 50 gpm per foot, a value which indicates a high hydraulic conductivity. Flow from the Palomas Basin to the discharge zone along the Rio Grande Valley is presumably affected by the elevation of water in Caballo Reservoir, but details on this relationship are not established.

Springs: Numerous springs are known to occur in the vicinity of the proposed mine and supply well field, as shown above. (See Figure 3-9.) In this area, spring flows can originate in several ways.

- Most springs occur along the main creeks upstream of the well field where groundwater discharges from perched horizons, or from the emergence of shallow groundwater that overlies low permeability materials (e.g., Percha Box).
- Several small seeps and springs are located in the area of the mine pit (Intera 2012). These are higher in elevation than the regional water table and are interpreted as discharge from local perched water.
- Springs in Warm Springs Valley (including Warm Springs itself) are understood as an emergence of water due to the barrier effect of the Animas Uplift. Consequently, the generally eastward flow of groundwater in the valley is diverted around the low permeability rocks in the uplift, south to toward Percha Creek and north toward Las Animas Creek. Upflow of deep geothermal water along faults is an additional source of spring flow (Kelley et al. 2013).

Many of the springs have been observed to be dry at times; flow is thus often intermittent or ephemeral. However, limited data on “NWS” spring on Las Animas Creek indicate a measured flow of 0.7 to 1.1 cfs (Intera 2012). Water from NWS spring is warmer than in other local springs and is believed to have a deep source. None of the published reports identify any springs that discharge from groundwater that is in direct hydrologic communication with the NMCC supply wells, pit lake, or TSF.

3.6.1.6 Existing Uses of Groundwater

The New Mexico OSE maintains records on wells and water use. There is no compilation of data specific to the Palomas Basin. The New Mexico Water Rights Reporting System (NMWRRS) is the designation of OSE’s database which contains scanned copies of various documents in the State’s water rights files. Kevin Myers, staff hydrologist at OSE provided the results of a search of the NMWRRS database for the area. The search identified nearly 700 separate points of diversion or well locations, mostly located along the valleys and in the area where artesian wells are found. Mr. Myers indicated the OSE files identify a large number of claimed or permitted water rights that total in excess of 6,000 AFY, most of which are for irrigation use; in addition, many domestic and stock wells are listed.

The NMWRRS database includes information as reported by drillers and well owners, which commonly does not reflect any process of independent quality control to ensure the files are complete or the content not originating with the agency is accurate. In this instance, documents relating to the Quintana Mine water rights were not found in the database and location coordinates for some irrigation wells do not appear to correspond to areas where irrigated land is observed on air photos. Moreover, there are no data that indicate the amount of groundwater pumping that actually occurs within the area.

For some files, the database can provide unverified information on actual water use. The Hillsboro Mutual Domestic Water Consumers Association has the largest water right not associated with mining or irrigation. This water right totals 217.75 AFY. Actual use was about 30 AFY in 2001, the most recent year when data from all three community wells were found in the OSE files.

3.6.2 Environmental Effects

Identification of potentially significant impacts: Because the project requires pumping of large quantities of groundwater, impacts to groundwater are expected to be significant at times in certain locations. The following are the potential causes of such impacts:

- Pit dewatering during mining to provide pit access, and rapid refill after mining ceases.
- Mine operations involving water management, such as infiltration from the waste rock and TSFs; and
- Pumping of the supply wells.

Specific impacts to groundwater resources of potential significance were identified through professional judgment of the EIS team, review of comments submitted during project scoping, reports prepared by NMCC, and consideration of comments on the DEIS, including those of State cooperating agencies. The potential impacts that require evaluation are changes in the regional water budget from the causes noted above, as reflected in the following:

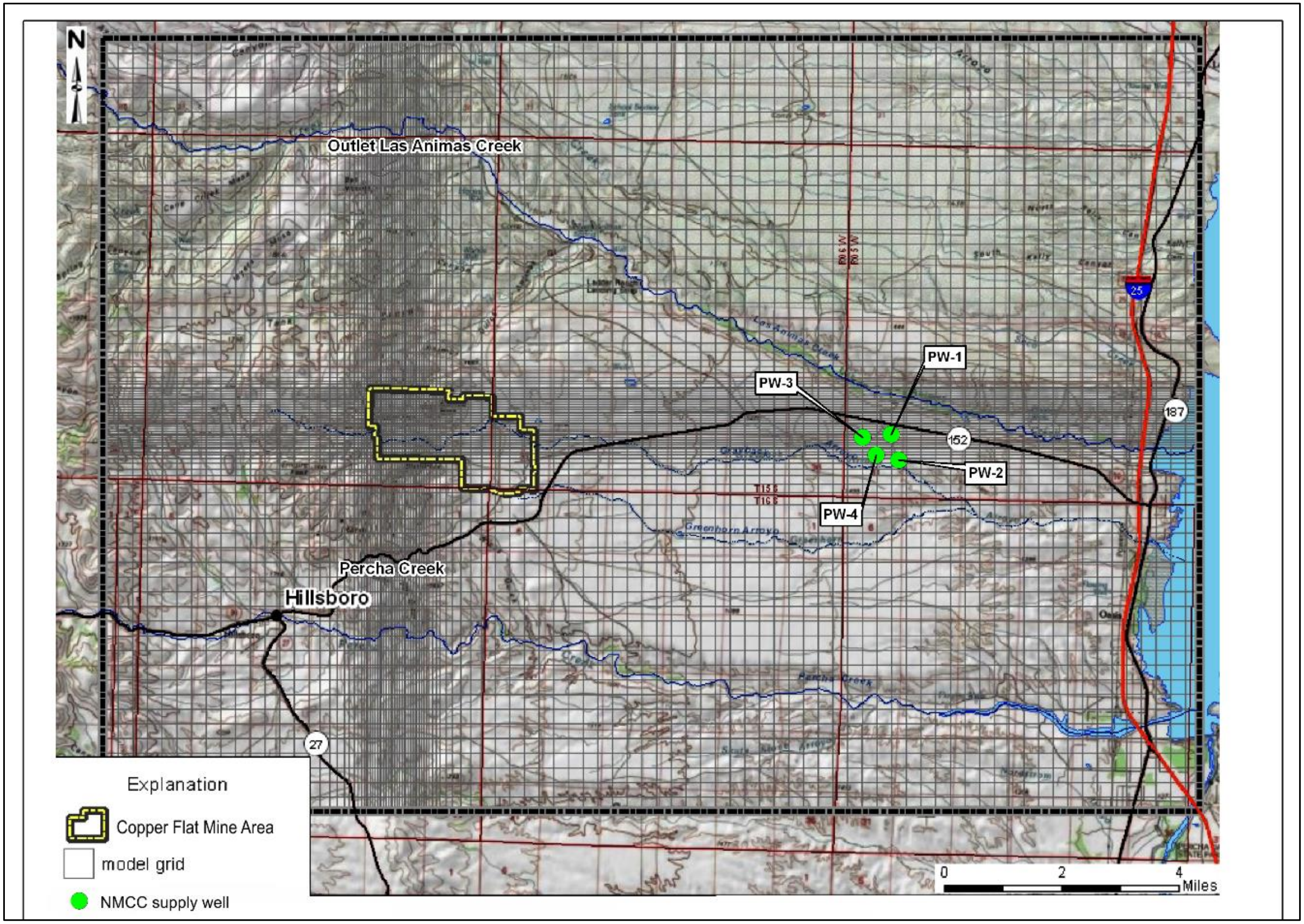
- Removal of water from storage and the resulting drawdown at wells, including community supply wells (e.g., Hillsboro), stock and domestic wells (e.g., Ladder Ranch, Pitchfork Ranch), artesian irrigation wells (e.g., along lower Las Animas and Percha creeks);
- Reductions in groundwater discharge to surface water supplies, including tributary streams such as Las Animas Creek, the Rio Grande, and Caballo Reservoir; and
- Other potential water table effects, such as reductions in discharge of individual springs and lowering of water levels in riparian corridors, especially in locations that provide important wildlife habitat.

Method for quantification of impacts: For a regional scale evaluation of groundwater impacts from a large project, an appropriate tool is a calibrated groundwater flow model. JSAI (2014) describes the model developed for NMCC; the cited documentation report is provided in Appendix F of this FEIS. JSAI reports that its model was calibrated to match regional groundwater contours and specific well hydrographs. The JSAI report provides substantial detail beyond the summary provided in this EIS.

Description of the groundwater model: JSAI used a modified version of the USGS MODFLOW code. The JSAI model has 4 layers, with a grid of 87 rows and 109 columns, as shown below. (See Figure 3-11.) Layer 1 represents the shallow alluvium along larger tributaries and in the Rio Grande valley. Layers 2 through 4 primarily represent bedrock in the uplifts, and the Santa Fe Group aquifer elsewhere.

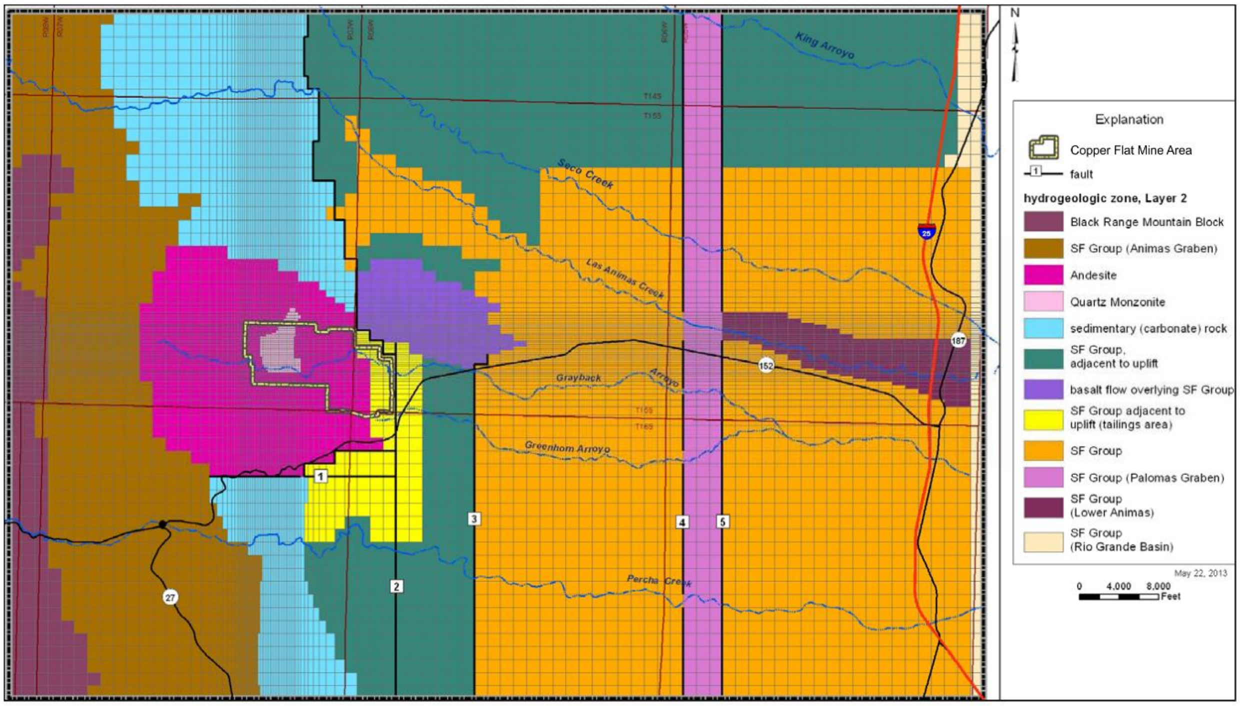
Mine-related pumping occurs largely in layer 2 of the model, which is the shallowest aquifer in all areas of the model except along the major streams near the Rio Grande. Layer 2 is 1,000 feet thick in most areas of the model and is the part of the model where pumping impacts will be concentrated, as shown below. (See Figure 3-12.)

Figure 3-11. Domain and Grid of Groundwater Flow Model Developed for NMCC



Source: Modified from Figure 6.1 in JSAI 2014a.

Figure 3-12. Layer 2 Hydrogeologic Zones, JSAI Model



Source: From Figure 6-3 in JSAI 2014a.

For purposes of impact prediction, among the most critical inputs to the model are the aquifer hydraulic properties, especially for the areas of the mine and well field where impacts will be greatest. Table 3-15 reproduces the values used in the JSAI model. Most entries in the table represent typical values for the types of materials indicated.

Table 3-15. Modeled Aquifer Parameters

Table 3-15. Modeled Aquifer Parameters						
Hydrogeologic Unit	Transmissivity (ft^2/day)	Saturated Thickness (ft)	Hydraulic Conductivity (ft/day)	Vertical Anisotropy (ratio)	Specific Yield (5)	Storage Coefficient (%)
Layer 1						
Alluvium / SF Group	2,400	50	48	1.25E-04	10%	
Alluvium / SF Group (Lower Animas and Rio Grande Basin)	10,000	200	50.0	160E-04	10%	
Layer 2						
Black Range Mountain Block	2	1,000	0.002	0.01	0.1%	0.1%
SF Group (Animas Graben)	500	500	1.000	0.01	10%	10%
Andesite	2	1,000	0.002	0.01	0.1%	0.1%
Quartz Monzonite	2	1,000	0.002	0.01	0.1%	0.1%
Sedimentary (carbonate) rock	80	1,000	0.080	0.01	0.5%	0.5%

Table 3-15. Modeled Aquifer Parameters (Concluded)						
Hydrogeologic Unit	Transmissivity (ft^2/day)	Saturated Thickness (ft)	Hydraulic Conductivity (ft/day)	Vertical Anisotropy (ratio)	Specific Yield (5)	Storage Coefficient (%)
SF Group adjacent to uplift, edge of basin	200	1,000	0.200	1.0	5%	5%
SF Group adjacent up uplift (Upper Animas)	40	200	0.200	0.01	5%	5%
Basalt flow overlying SF Group	0.2	200	0.001	0.01	1%	1%
SF Group	900	1,000	0.900	0.01	10%	0.1%
SF Group (Palomas Graben)	10,000	1,000	10.000	1.0	10%	0.2%
SF Group (Animas Creek above graben)	2,000	200	10.000	0.0001	10%	0.1%
SF Group (Lower Animas)	20,000	1,000	20.000	0.01	10%	0.1%
SF Group (Rio Grande Basin)	20,000	1,000	20.000	1.0	10%	0.1%
Layer 3						
Black Range Mountain Block	2	2,000	0.001	0.01		0.01%
Bedrock (Graben)	700	1,000	0.700	0.01		0.01%
Andesite	2	2,000	0.001	0.01		0.01%
Quartz Monzonite	2	2,000	0.001	0.01		0.01%
Sedimentary (carbonate) rock	100	2,000	0.050	0.01		0.01%
SF Group, adjacent to uplift	400	2,000	0.200	0.01		0.4%
SF Group (Palomas Graben)	8,000	2,000	4.000	1.0		0.4%
SF Group, lower Animas	10,000	1,000	10.000	0.01		0.1%
SF Group (Rio Grande Basin)	800	2,000	0.400	0.01		0.4%
Layer 4						
Black Range Mountain Block	3	3,000	0.001	0.01		0.01%
Bedrock (Graben)	100	2,000	0.050	0.01		0.01%
Andesite	3	3,000	0.001	0.01		0.01%
Quartz Monzonite	3	3,000	0.001	0.01		0.01%
Sedimentary (carbonate) rock	150	3,000	0.050	0.01		0.01%
SF Group (Palomas Graben)	2,000	3,000	0.667	0.01		1%
SF Group (Rio Grande Basin)	2,000	3,000	0.667	0.01		0.6%

Source: From Table 6.1 in JSAI 2014a.

Note: Wilson et al. (1981) cites alluvial thickness of up to 100 feet.

JSAI's professional judgment, constrained by such data as may be available, is the basis for other aspects of model construction. As described in the cited JSAI report, these include estimates of the historic and existing water budget, the location and effects of faults, and the nature of the external boundaries.

Evaluation of groundwater model: The BLM's groundwater consultant, Lee Wilson and Associates (LWA), reviewed the JSAI groundwater model. The review included meetings with JSAI, in which hydrologists from the BLM and the New Mexico OSE also participated. The objective of the review was to determine whether the model is appropriate for use in the BLM's impact predictions. One purpose of the review process was to confirm that the predictions made by the JSAI model were comparable in location and magnitude to those used in a previous EIS conducted for the Copper Flat mine (BLM 1999). The JSAI model predicts impacts that are generally equal to or greater than reported in that earlier EIS. JSAI's model uses a modification of the USGS MODFLOW code. Model results reported in this EIS were verified by LWA using a conversion of the JSAI model into MODFLOW 2005. JSAI relied on aquifer tests at the well field to obtain a reliable estimate of transmissivity in the area where the project will have its greatest impact. Other inputs to the model reflect JSAI's professional judgment, supported by the aquifer test results and/or the published literature.

Specific confirmation of model construction for the entire study area is not possible due to the sparsity of existing data. For example, data do not exist to confidently map the regional water table except at a gross scale, hence calibration of the model to match regional water gradients was necessarily approximate. The model is calibrated to the general direction of groundwater flow and the overall regional water table gradient. Model inputs are consistent with what is known about the geology and hydrology of the rock units found in the area, especially near the wellfield.

Because many model parameters are based on limited data, JSAI was asked to do three sensitivity runs of its model with alternative assumptions about hydrogeology. JSAI memos summarizing the results of these model runs are provided in Appendix G.

1) One sensitivity scenario assumed that the fault between the proposed mine pit and the Percha Box would not impede groundwater flow. This was done to test if the model construction might be underestimating impacts to Hillsboro and the Percha Box. The results confirmed that construction of the model is appropriate and did not indicate potential impacts significantly greater than reported in this EIS.
2) Another scenario assumed that the ratio of vertical to horizontal hydraulic conductivity in the Santa Fe Group is not 1:1 as in the JSAI model, but 1:100 as is more commonly found in New Mexico and could be a value interpreted from the NMCC aquifer tests. This was done to test if model construction might strongly affect the prediction of where and how much water level decline would occur in area wells. The results identified no basis to modify parameters of the JSAI model.
3) A third scenario assumed specified flow conditions at the northern General Head Boundary (GHB) of the model, to test the possible magnitude of a shift of impacts from outside to inside the model area if the GHB supply did not increase during mining. The results represent a worst-case estimate of how much impact the project could have on the Rio Grande if the northern boundary provides less water than simulated in the adopted model. The results of this evaluation are consistent with the EIS finding that the pumping of the supply wells would have significant impacts on the Rio Grande.

Other issues were identified in review of the model and discussed with JSAI. These included use of a high elevation for Caballo Reservoir, high water levels simulated near the south boundary, and alternative interpretations of the north and south boundaries. In the judgment of LWA, none of these issues were determined to preclude use of the model for prediction of impacts with confidence. This is mostly because the impact predictions are based on a modeled comparison of conditions with and without a mine, rather than on a match between modeled and observed data. Thus, model results reflect a change in conditions, and any issues in model construction do not affect the comparability of the before and after conditions, so the interpretation of impacts is not greatly impacted by such issues.

Based on its review, the BLM considers the JSAI model to be suitable for this NEPA analysis.

Application of groundwater model: The hydrologic principle of predicting mine impacts is that the volume of water pumped for pit dewatering and mine operations must be balanced by water removed from aquifer storage as reflected in a decline in the water table, by reduced discharge to streams or vegetation, or by increased flow across a model boundary. Thus, the primary application of the model is to quantify the character, location, magnitude, and timing of effects to storage or flow, for both the time while pumping occurs and after mining ceases.

The primary model results used in the EIS are: a) maps and graphs showing drawdown (water level effects) caused by pumping; b) graphs showing streamflow and other depletions over time caused by pumping; and c) tables that quantify the impacts to the regional water budget caused by pumping. This array of results is directly responsive to issues raised by the public in the scoping process and to comments received on the DEIS.

Model runs were conducted for the Proposed Action and two alternatives. Specific input quantities used in the model runs are shown below. (See Table 3-16.) Because the alternatives have different ore production rates, the rates of groundwater pumping differ by a factor of about 1.7 when comparing Alternative 2 (highest rate of mining) to the Proposed Action (lowest rate of mining). Alternative 1 is intermediate. The difference in total volume of water pumped is less marked than the difference in pumping rates, with the quantity for Alternative 2 being nearly 20 percent higher than Alternative 1, with the Proposed Action in between.

Table 3-16. Factors Used in Groundwater Modeling of Mining Scenarios

Table 3-16. Factors Used in Groundwater Modeling of Mining Scenarios			
	Proposed Action	**Alternative 1**	**Alternative 2**
Mining rate (tpd)	17,500	25,000	30,000
Mining duration (years/months)	15 yrs 8 months	10 yrs 11 months	11 yrs 5 months
Project duration (years/months)	25 yrs 3 months	20 yrs 6 months	21 yrs 0 months
Average supply pumping (ore processing) (gpm)	2,357	3,272	3,780
Summer maximum supply pumping (gpm)	2,800	3,723	4,224
Winter minimum supply pumping (gpm)	1,968	2,888	3,388
Total supply pumping for ore processing (AF)	59,432	57,645	69,484
Average supply pumping during ore processing (AFY)	3,802	5,290	6,105
Average pit dewatering rate (after initial 4.5 months) (gpm)	27	28	28
Average rate for reclamation use (AFY)	1,276	1,276	1,276
Total supply pumping for project duration (AF) – end of mining + 12 years	63,711	61,923	73,853

Source: JSAI 2014a; JSAI 2017.

JSAI used the model to simulate groundwater flow and the regional water budget for a variety of conditions. In this EIS, model results are presented by comparing a future without mining to effects of future mining and post-mining conditions for different mining scenarios. While flow from existing artesian wells is simulated in the model, return flows from such wells is not, nor does the model simulate any effects from pumping of conventional wells of other ownership. Thus, model results are effectively the change in conditions directly resulting from the NMCC mine, and not a simulation of the cumulative impact of all water uses.

Much of the modeled impact from the NMCC production well field is in the form of flow across the northern and southern model boundaries (GHBs). In tables and graphs presented below, these components of the water balance are presented as follows: a) the flow across the south boundary is included in "groundwater discharge to the Rio Grande below Caballo Dam"; and b) the flow across the north boundary is labeled "Inflow to graben from north of model area". The model does not quantify how much of the north boundary inflow would be taken from storage, and how much by a reduction in discharge to the Rio Grande. For purposes of a worst-case assessment, the assumption in the EIS is that the entirety represents a river impact; this has the effect of treating the GHB flow the same at both the north and south ends of the graben. To the extent that both GHB flows are supplied from storage, the project would have a smaller maximum effect on the river, but the impacts would extend over a somewhat longer timeframe than assumed in the EIS.

Model results could potentially include thousands of maps, graphs, and tables, such as drawdown graphs for every single model cell. For this EIS, model outputs have been selected to provide a useful representation of impacts over space and time. Impacts are presented first for the Proposed Action, with a focus on the largest impacts. The subsequent discussion of impacts from Alternatives 1 and 2 is abbreviated, because the alternatives have almost the same effect as the Proposed Action. Appendix H provides additional detail in the form of drawdown graphs for locations receiving less impact than the locations discussed in the body of the EIS.

3.6.2.1 Proposed Action

Impacts to the regional water budget, including flows of the Rio Grande, would be long-term, major, of large extent, probable, and adverse. Water budget impacts would begin to reduce once mining ends. Impacts to water levels caused by the supply well field would be long-term, moderate, of medium extent, probable, and adverse. Regional drawdown impacts would begin to reduce once mining stops. Impacts to water levels caused by the pit would be long-term, major, of small extent, probable, and adverse. Overall, impacts on groundwater resources would be significant.

3.6.2.1.1 Mine Development and Operation

Impacts to groundwater occur from development/operation through closure/restoration.

Water budget: Table 3-17 below quantifies aspects of the regional water budget resulting from the well field component of the Proposed Action, as extracted from the model output files. Subsequent discussions further illustrate and explain these impacts. Table 3-17a addresses annual effects.

- The first column in Table 3-17a quantifies the rate at which proposed mining is predicted to cause depletions of streams, reductions in flows of artesian wells, reductions in ET rates, and flow drawn in across the northern model boundary. The values are for 3 months after mining and pit refill ceases, which is approximately the time of maximum impact to streams and wells. The flow effects are thus the consequence of water refilling the aquifer after mining. This is water that in the absence of mining would have flowed to the Rio Grande. The total flow impact of 2,762 AFY is approximately in balance with the rate at which refill occurs. Water budget impacts in lower Animas and Percha Creeks, below any diversions, are included in the Rio Grande impacts above and below Caballo Dam, respectively.

- The quantity of water identified in Table 3-17a as discharge from flowing wells is a reduction in flow that would otherwise potentially contribute to the Rio Grande, and thus would add to the Rio Grande impacts. The reduction in flow would reduce the supply of water to irrigated land in the artesian zone. In turn, this would result in reduction in irrigated acreage, or replacement of the lost irrigation supply by pumping of the artesian wells, or a combination of the two. The effects of possible irrigation replacement pumping are discussed separately.
- The second column in Table 3-17a quantifies the same effects as the first column but calculated as of 100 years after mining ceases. The table indicates that after mining is over, the aquifer would recover and the effects from mining would eventually disappear.
- The third column in Table 3-17a provides flow quantities in the absence of the project; the values in columns 1 and 2 are the changes in that baseline.
- Table 3-17a does not include the flow resulting from pit deepening and dewatering. That impact is modeled at 21 AFY at the end of mining,
- Table 3-17b quantifies the model results for the cumulative volume of water that is removed from storage or depleted from streams and flowing wells during the life of the mine. The storage term includes 672 AF of drainage to the pit.

Table 3-17. Regional Water Budget for the Proposed Action

Table 3-17a. Change in Flow, Acre-Feet Per Year from Well Field Pumping			
Parameter	**Decrease from No Mine, 3 Months After End of Mining**	**Decrease from No Mine, 100 Yrs After Mining**	**Flow Rate with No Mine**
Groundwater discharge to Rio Grande above Caballo Dam	815	23	10,561
Groundwater discharge to Rio Grande below Caballo Dam	665	2	1,234
Discharge from flowing wells	769	4	2,030
Animas Creek ET and flow reduction	13	1	4,848
Percha Creek ET and flow reduction	19	3	2,630
Inflow from graben north of model area	481	3	2,184
Total change in flow terms	**2,762**	**36**	

Source: NMCC 2018b.

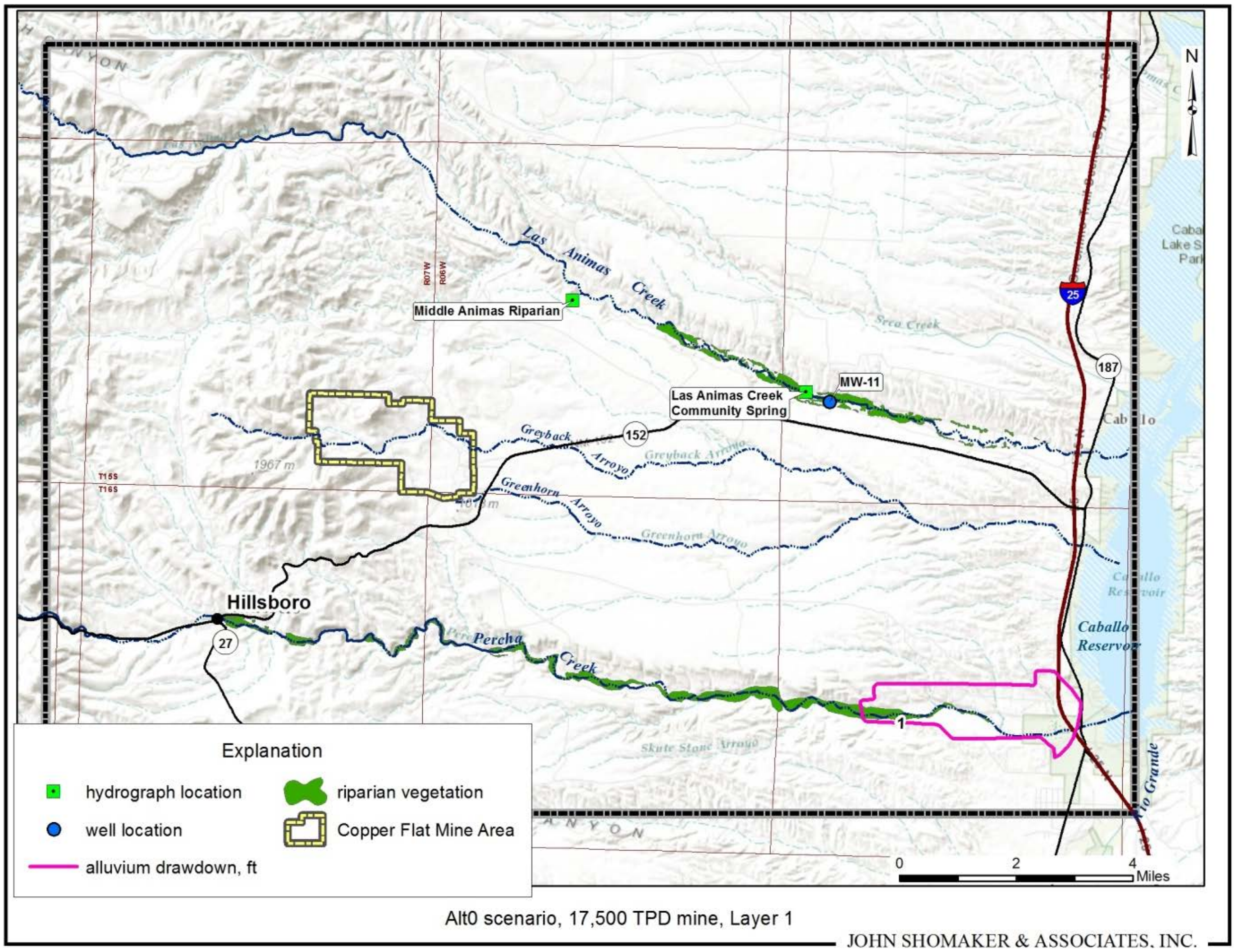
Table 3-17b. Cumulated Change in Volume from Well Field, Acre-Feet	
Parameter	**Volume Change EOM +12 years (AF)**
Storage	15,151
Rio Grande above Caballo Dam	15,137
Rio Grande below Caballo Dam	11,027
Flowing wells	13,550
Animas Creek flow and ET	216
Percha Creek flow and ET	342
Inflow from graben north of study area	8,288
Total	**63,711**

Source: NMCC 2018b.

Drawdown: Table 3-17b indicates that during active mining, a large quantity of water would be removed from aquifer storage. The removal of water from storage would cause a decline in water levels in the affected aquifer. Figure 3-13a provides a map showing the drawdown or decline in water levels in model layer 1 (shallow alluvial aquifer) expected to result from the Proposed Action. Figure 3-13b is the equivalent drawdown map for model layer 2 (upper portion of Santa Fe Group aquifer). Figure 3-13c is a map of drawdown in layer 2 that would occur in addition to those shown in Figure 3-13b in the event that private wells in the lower valley of Las Animas Creek were pumped to offset the effects from pumping the NMCC supply wells. Figure 3-13d is a map of the layer 1 drawdowns at 12 years following the cessation of pumping. For this and other alternatives the remnant drawdown along Percha Creek may be an artifact of the model. Figure 3-13e is a map of the layer 2 drawdowns at 12 years following the cessation of pumping; the contour interval is 10 feet, and as a result no contours are shown around the well field.

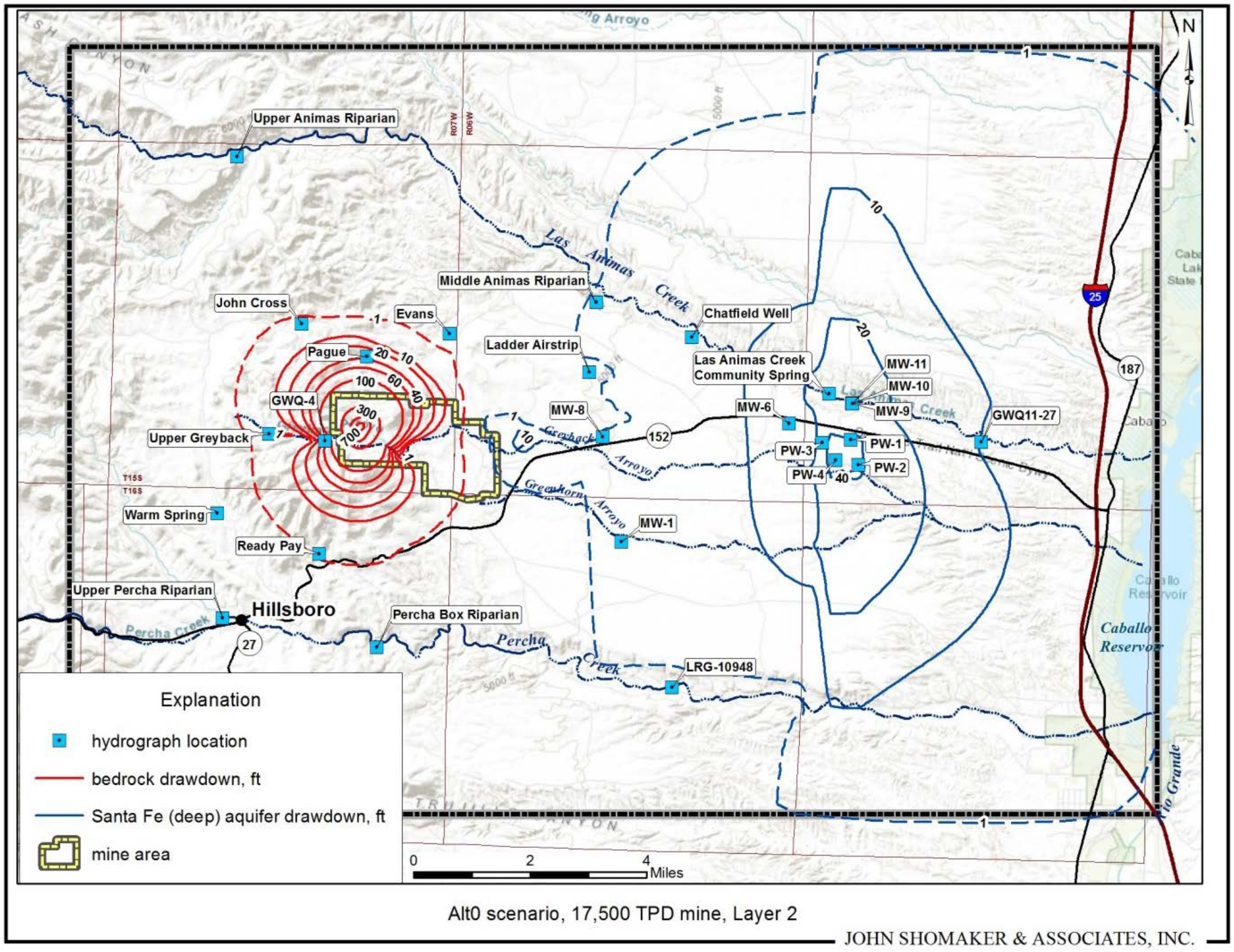
The maps reflect conditions at the end of mining and pit refill, when impacts are at or near their maximum. Impacts to layer 1 of the model would be small and only in locations where the alluvial groundwater is direct hydrologic communication with the Santa Fe Group (Figure 3-13a). Drawdown of up to 1.5 feet is simulated in the shallow aquifer along Percha Creek southeast of the well field, and in a small area in the Rio Grande alluvium east of the well field near Caballo Reservoir. The model predicts drawdowns in the shallow alluvium along Las Animas Creek to be no more than a few inches. In general, the clays found in the Santa Fe Group east of the well field limit the impacts to the shallow aquifers along the tributary streams, and instead lead to greater impacts to artesian wells and the Rio Grande than might otherwise occur. The perched alluvium along parts of Percha Creek would not be affected by the project.

Figure 3-13a. Map of Water Level Declines in Layer 1 at End of Mining – Proposed Action



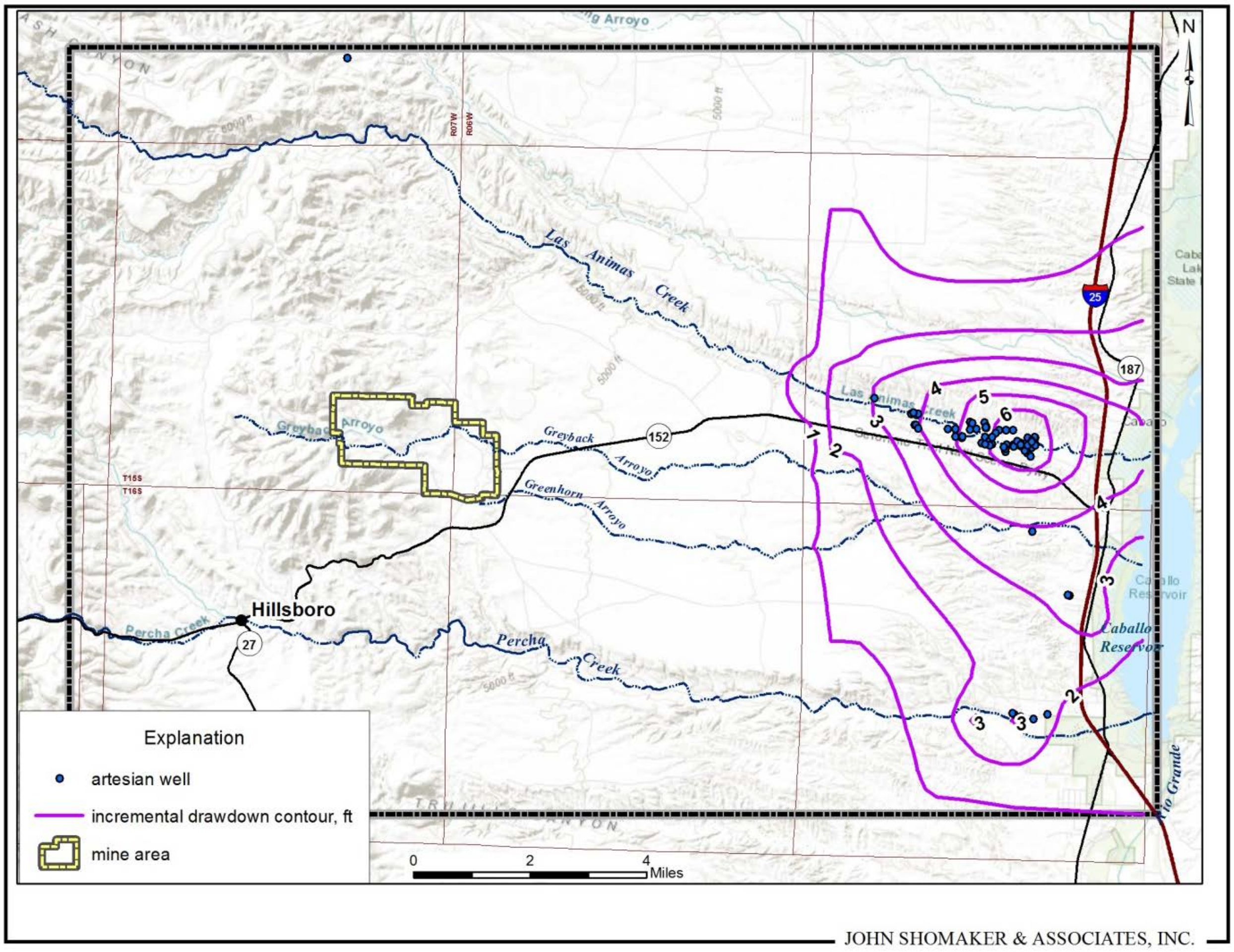
Source: NMCC 2018b.

Figure 3-13b. Map of Water Level Declines in Layer 2 at End of Mining - Proposed Action



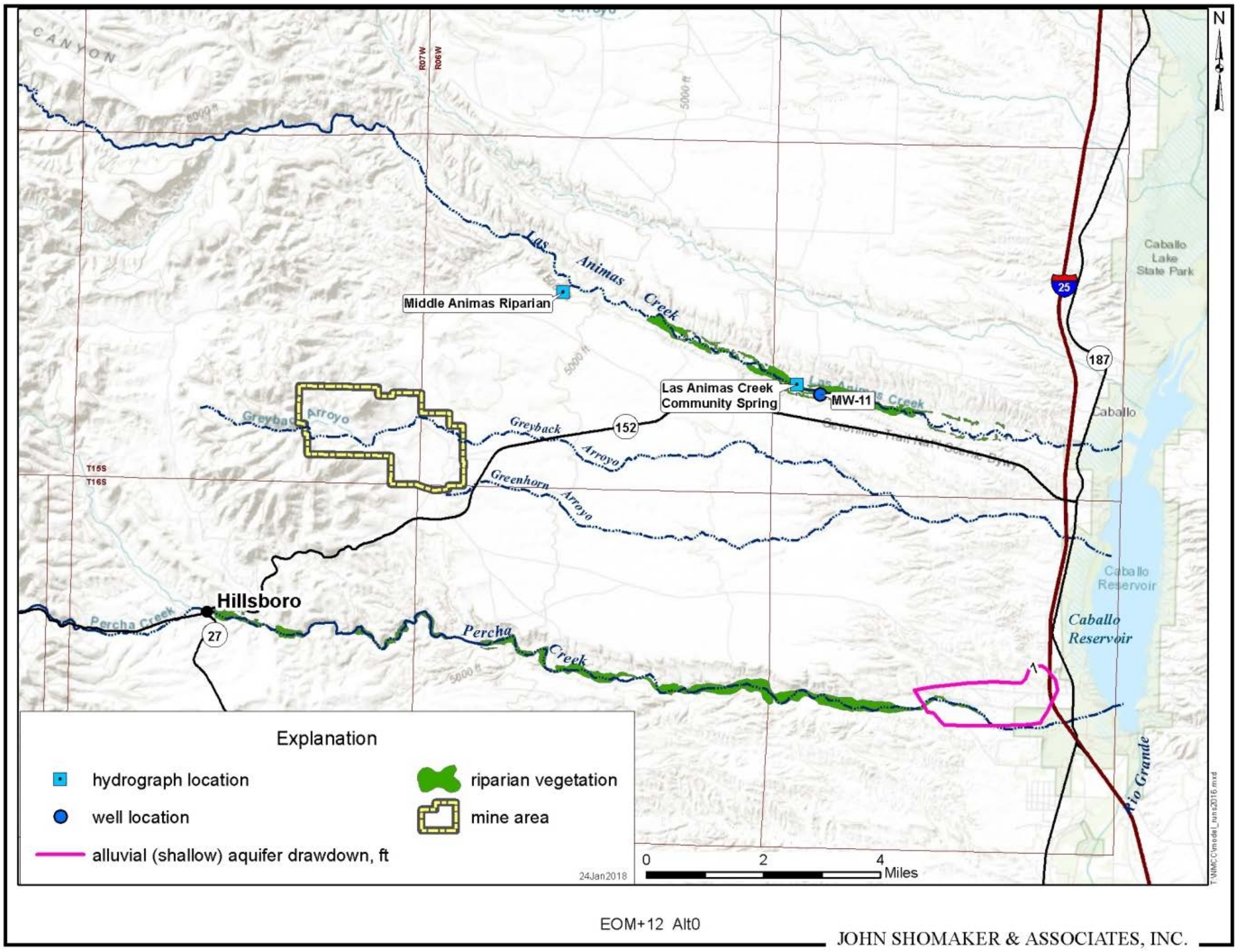
Source: NMCC 2018b.

Figure 3-13c. Map of Water Level Declines in Layer 2 at End of Mining, Proposed Action, Resulting From Potential Increased Pumping of Artesian Wells



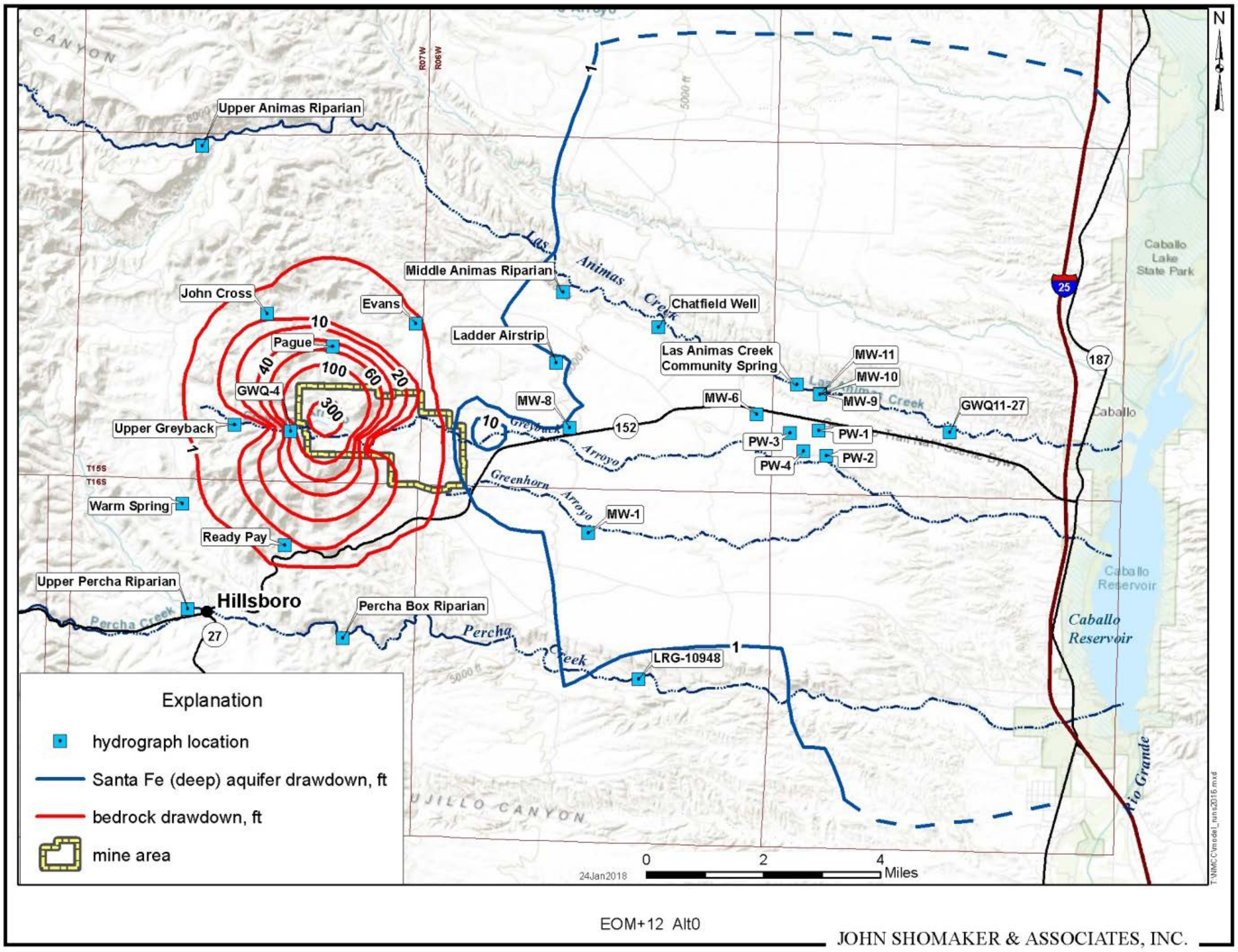
Source: NMCC 2018b.

Figure 3-13d. Drawdown Contour Map, Proposed Action, Layer 1, EOM+12



Source: NMCC 2018b.

Figure 3-13e. Drawdown Contour Map, Proposed Action, Layer 2, EOM+12



Source: NMCC 2018b.

Much larger impacts are predicted to occur in layer 2 (Figure 3-13b). The impacts in layer 2 are summarized below.

- The regional direction of groundwater flow (from the western uplands eastward toward the Rio Grande) would be modified near the pit (bedrock aquifer) and well field (Santa Fe Group aquifer). In those locations, flow would divert toward the center of the cone of depression formed by NMCC pumping, even to the point that in areas east of the pumping centers, the flow direction could be completely reversed from eastward to westward.
- A deep (>700 feet) and steep-sided cone of depression is predicted to occur in the andesite bedrock aquifer at the mine as the pit is progressively excavated and continually dewatered. The depth of the cone would slightly exceed the depth of the pit, which must be pumped dry for safe mining. Based on the model results, effects would not reach the area of Hillsboro because the areal extent of the drawdown impact is limited by the low hydraulic conductivity of the bedrock. Compared to drawdown at the existing pit, the impact would be deeper, and larger in areal extent. The pit would be occupied by a lake simulated to have an area of 18.6 acres and an annual evaporation loss of about 100 AFY. The lake level would stabilize at an elevation at which groundwater inflow plus runoff and direct precipitation offsets lake evaporation.

- The evaporation loss would act in a manner equivalent to ongoing pumping, so that a deep but narrow drawdown cone at the pit would be permanent and continue to slowly expand over time, even after mining has ceased.
- A much smaller and shallower (<20 feet) cone of depression is shown along Greyback Arroyo about 2 miles east of the pit. This is the simulated result of groundwater flowing beneath the arroyo being intercepted by the pit and is an impact that would grow over time. Field data do not exist to confirm such subflow, but to the extent the impact does occur, it would be localized. If the subflow does not actually exist then the water level decline at the pit could be slightly larger than is currently simulated.
- A regionally extensive cone of depression is predicted to occur in the Santa Fe Group aquifer around the supply wells. The maximum impact is within the area of the well field at the end of mining and is on the order of 45 feet. Drawdowns inside the pumping wells would be larger. The cone of depression would be elongated north-south due to the effect of faults to the west of the supply wells and clays in the aquifer to the east. For example, the contour that shows a water level decline of 10 feet at the end of mining extends more than 3.5 miles east toward the Rio Grande and about 5 miles to the north and south of the well field. The extent, if any, to which such drawdowns may impair existing wells would be determined by the New Mexico OSE.

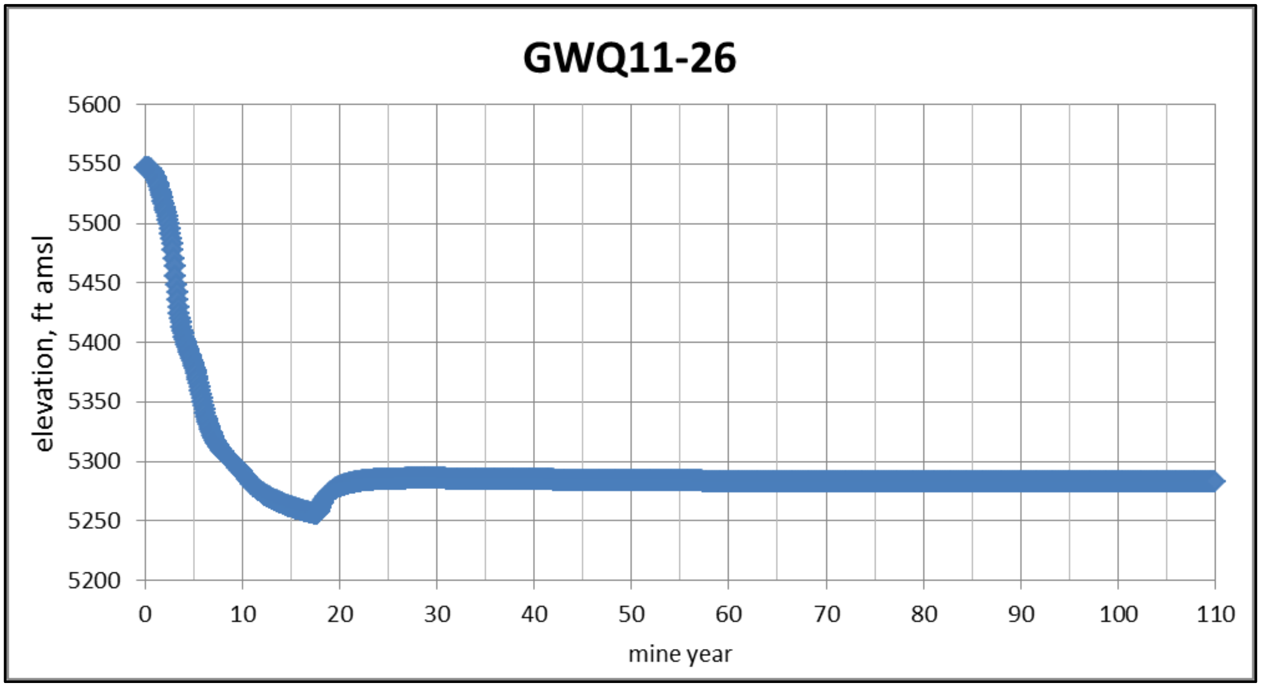
The nature of drawdown resulting from the project can also be illustrated using well hydrographs. Well hydrographs are plots of water levels at specific locations over time. The hydrographs provided in this EIS extend through the period of mining and pit refill, and beyond to 100 years from the end of mining. Hydrographs thus indicate the trend in water levels that lead to the drawdown conditions shown on Figure 3-13a, 3-13b, 3-13d, and 3-13e and water level changes after that time. The possible additional drawdown shown in Figure 3-13c is not included in the hydrographs.

Figure 3-14 provides two hydrographs for well locations labeled on Figure 3-13b, one near the mine pit which shows the largest direct effect of the pit on the surrounding area; and one in the heart of the production well field, which shows the maximum impact from pumping for water supply.

- The hydrograph for GWQ11-26 is for a location near the edge of the mine pit. With excavation and dewatering of the nearby pit, water levels in the andesite bedrock unit at this location would fall nearly 300 feet. After cessation of pumping, continued evaporation from the permanent pit lake would have an ongoing effect on the surrounding area, such that water levels at this location would recover only slightly, as shown below. (See Figure 3-14a.)
- The hydrograph for PW-1 is for a NMCC production well. The graph shows a progressive decline in water levels in the Santa Fe Group aquifer to a maximum of about 40 feet of drawdown in the adjoining aquifer at the end of mining. Water levels would begin to recover once pumping stops, and substantial recovery would be observed within 15 years. Effects from possible area pumping to replace the lost artesian flow are not included in this hydrograph, as shown below. (See Figure 3-14b.)

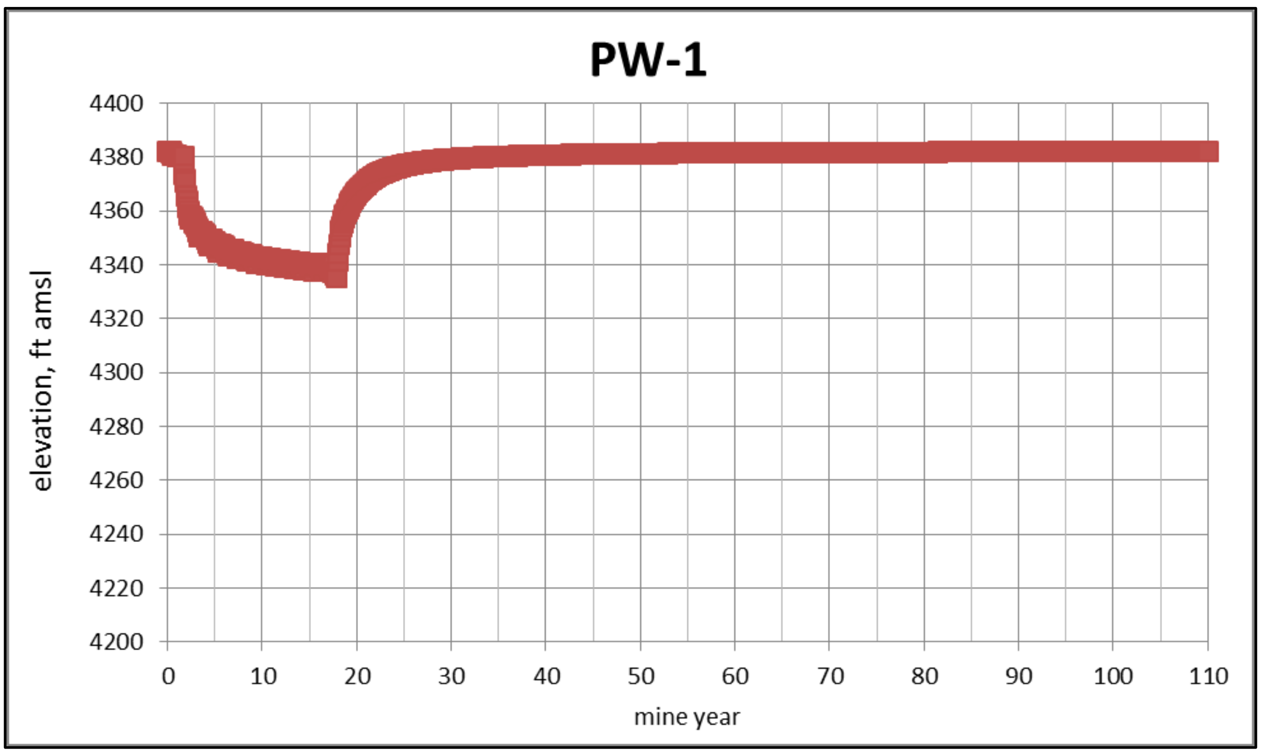
Additional hydrographs are provided in Appendix H. The locations of the hydrographs are shown by labeled symbols on Figures 3-13a and 3-13b. Hydrographs for locations near the pit are similar to Figure 3-14a; impacts would decrease rapidly away from the pit but would be permanent within the bedrock aquifer. Hydrographs for wells in the Santa Fe Group aquifer east of the mine are similar to Figure 3-14b; impacts decrease gradually away from the supply wells and show relatively rapid recovery. Hydrographs for wells in layer 1 show essentially no change.

Figure 3-14a. Projected Water Level at GWQ11-26, Proposed Action



Source: NMCC 2018a.

Figure 3-14b. Projected Water Level at PW-1, Proposed Action

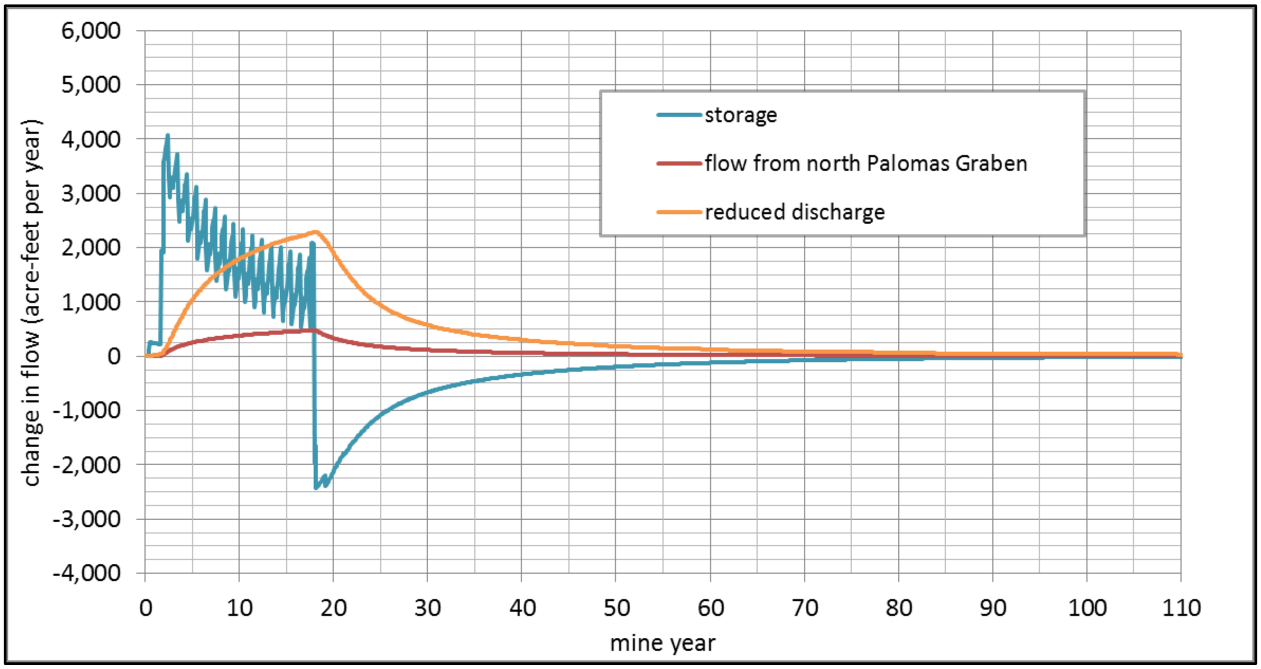


Source: NMCC 2018a.

Impacts to individual private wells, other than artesian wells, are not simulated in the model. Drawdowns can impact pumping costs and well yield. Measurable impacts to well yield would be expected only to wells that: a) draw their water from the Santa Fe Group aquifer; b) are close enough to the production wells that impacts to water levels might be measured in tens of feet; and c) are so shallow such drawdown would impede production (i.e., penetrate only several tens of feet into the aquifer). At this time, the BLM has identified no such wells. The OSE has the authority to address any impacts of NMCC pumping that would impair wells of other ownership.

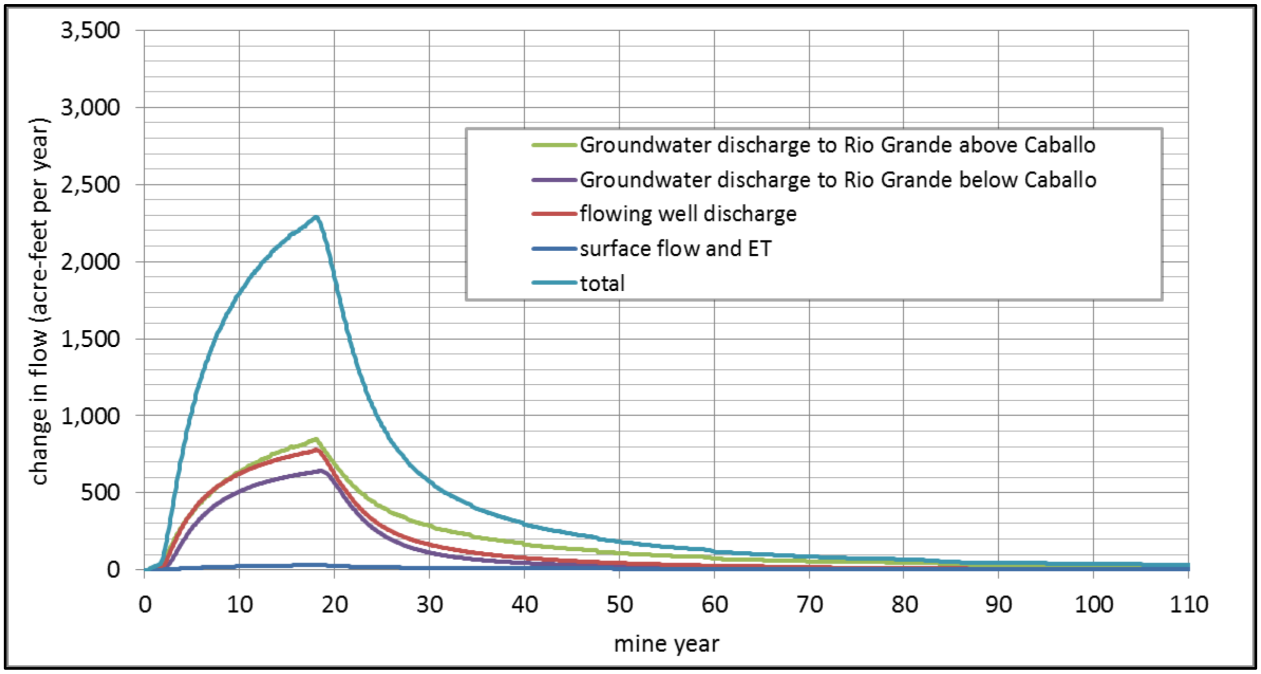
Impacts to regional water budget: Figures 3-15a and 3-15b shown below illustrate the simulated effect of the Proposed Action on the components of the regional water budget over time. Figure 3-15a separates out impacts to the depletion of storage, the simulated direct effects on discharge to the Rio Grande which is further broken out in Figure 3-15b, and flow across the northern model boundary, some portion of which would have a river impact. The reductions in flow are shown as increasing steadily once mining begins, peaking at the end of mining and pit refill, then declining fairly rapidly once mining is over, but continuing on for decades. Additional water budget impacts would occur should owners of artesian wells increase their pumping to compensate for decreased artesian flow.

Figure 3-15a. Impacts of Proposed Action on Water Budget



Source: NMCC 2018b.

Figure 3-15b. Breakout of "Reduced Discharge" Impact in Figure 3-15a



Source: NMCC 2018a.

Note: The term "flowing well" is equivalent to "artesian well."

Streamflow impacts: Construction of the JSAI model effectively results in almost all streamflow depletions being accounted to the Rio Grande. In Table 3-17a shown above, the maximum impact "to Rio Grande" is 1,480 AFY. Other flow changes in the table may also include a component of Rio Grande impact and the actual maximum river impact could exceed 2,500 AFY. Measures that might be taken by NMCC to mitigate or offset depletion effects are not considered in this quantification.

A simple check on the model was made by computing Rio Grande streamflow effects using an analytical method (Glover-Balmer equation), which is often applied by the New Mexico OSE. The results are consistent with the projections made by the model.

Impacts on other components of the water budget: Water budget impacts beyond those discussed above would include the following:

- The groundwater model simulates a small subflow in the alluvium along Greyback Arroyo. The simulated impact of the mine pit would be to deplete about 20 AFY of this flow, which in effect would be a permanent reduction in recharge to the Santa Fe Group aquifer.
- ET is a water balance term that represents shallow groundwater directly taken up by riparian or wetland vegetation. Shallow groundwater in riparian areas is often sustained by recharge from streamflow. Riparian vegetation in the model area is at least partly dependent on this groundwater supply and associated streamflow. Areas of such vegetation are shown in green on Figure 3-13a and are largely limited to the Rio Grande corridor, Las Animas Creek, and the upper reaches of Percha Creek in and above Percha Box.
- Mine operations (primarily the production wells) are simulated as causing a small reduction (maximum of 30 AFY) in ET and streamflow in areas of riparian vegetation (See Table 3-17a). Impacts to flow in Upper Las Animas Creek and to Percha Box are each estimated to reach a maximum of 1 to 2 AFY. Additional small ET impacts would be expected to occur along lower

Percha Creek, but the model simulates the creek as flowing in that location, and thus calculates impacts as a reduction in streamflow.

- The model does not simulate existing spring discharges nor does it compute potential changes to those discharges. Based on predictions of where drawdown is simulated to occur, no impacts are predicted to Warm Springs or any springs west of the Animas Uplift. Springs along the alluvial valleys are understood as perched discharges, that is, the local geology is such that the springs are not directly connected to the deep groundwater. Consequently, impacts to such springs are not expected. Bedrock seeps in the immediate area of the mine could be impacted, potentially to the point that flow ceases permanently.

Impacts specific to the tailing ponds and waste rock disposal areas are not addressed in JSAI's regional model. The expected impacts are seepage in small amounts that could locally reduce the amount of drawdown that is now predicted. All such impacts are predicted to be within the mine area.

3.6.2.1.2 Mine Closure/Restoration

Water level recovery would occur after mining and pit refill are complete. Recovery in the bedrock near the mine pit would be limited. Recovery in the Santa Fe Group would eventually (over decades) be essentially complete. The post-mining water budget is quantified above in Table 3-17a, column entitled "Decrease from no mine, 100 yrs after mining" and post-mining water levels are illustrated above (along with changes during mining) in Figure 3-14. (See also Figure 3-22.)

3.6.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Impacts under Alternative 1 would be similar to those under the Proposed Action. Impacts to the regional water budget, including flows of the Rio Grande, would be long-term, major, of large extent, probable, and adverse. Water budget impacts would begin to reduce once mining ends. Impacts to water levels caused by the supply well field would be long-term, moderate, of medium extent, probable, and adverse. Regional drawdown impacts would begin to reduce once mining stops. Impacts to water levels caused by the pit would be long-term, major, of small extent, probable, and adverse. Overall, impacts on groundwater resources would be significant.

3.6.2.2.1 Mine Development and Operation

Refer to Section 3.6.2.1.1 for a general discussion of the tables and figures that illustrate model results.

Alternative 1 is the same as the Proposed Action in the total amount of ore that would be mined and water that would be withdrawn, but different in that the rate of mining would be faster, the duration of mining would be less, and thus well pumping and dewatering would occur at higher rates for a shorter period. Table 3-18 below provides the water budget for Alternative 1 in the same format as Table 3-17 above. Figure 3-16a below provides a map showing the drawdown or decline in water levels in the alluvial aquifer (model layer 1) expected to result from Alternative 1. Figure 3-16b below is the equivalent drawdown map for the portion of the Santa Fe aquifer that is in model layer 2. Figure 3-16c below is a map of drawdowns in layer 2 in addition to those shown below in Figure 3-16b, that would occur in the event that private wells in the lower valley of Las Animas Creek were pumped at an additional 930 AFY in order to replace the reduction in artesian flow that would result from the pumping of the NMCC supply wells. Figure 3-16d below is a map of the layer 1 drawdowns at 12 years following the cessation of pumping. Figure 3-16e below is a map of the layer 2 drawdowns at 12 years following the cessation of pumping; the contour interval is 10 feet, and as a result no contours are shown around the well field. Figure 3-17 below provides hydrographs showing drawdown in wells GWQ11-26 and PW-1 over time. Figure 3-18 below illustrates predicted water depletions over time. Additional hydrographs are provided in Appendix H for locations shown below on Figures 3-16a and 3-16b.

The higher mining rate of Alternative 1 is predicted to cause water declines and streamflow depletions to reach their maximum level earlier than for the Proposed Action, with recovery also occurring earlier. The concentration of more pumping in a shorter time would cause higher maximum impacts to the regional water budget. For example, the total water balance depletion "to Rio Grande" from Alternative 1 is 1,760 AFY, but in consideration of other flow changes, the maximum impact could exceed 3,000 AFY. Water level declines at the pit would be essentially the same as for the Proposed Action, but at the well field the declines would reach a maximum of around 60 feet, roughly15 feet more than for the Proposed Action.

Table 3-18. Regional Water Budget for Alternative 1

Table 3-18a. Change in Flow, Acre-Feet Per Year			
Parameter	**Decrease from No Mine, 3 Months After End of Mining**	**Decrease from No Mine, 100 Years After Mining**	**Flow Rate with No Mine**
Groundwater discharge to Rio Grande above Caballo Dam	950	23	10,561
Groundwater discharge to Rio Grande below Caballo Dam	810	4	1,234
Discharge from flowing wells	935	4	2,030
Animas Creek ET and flow reduction	15	1	4,848
Percha Creek ET and flow reduction	21	3	2,630
Inflow from graben north of model area	581	3	2,184
Total change in flow terms	**3,312**	**38**	

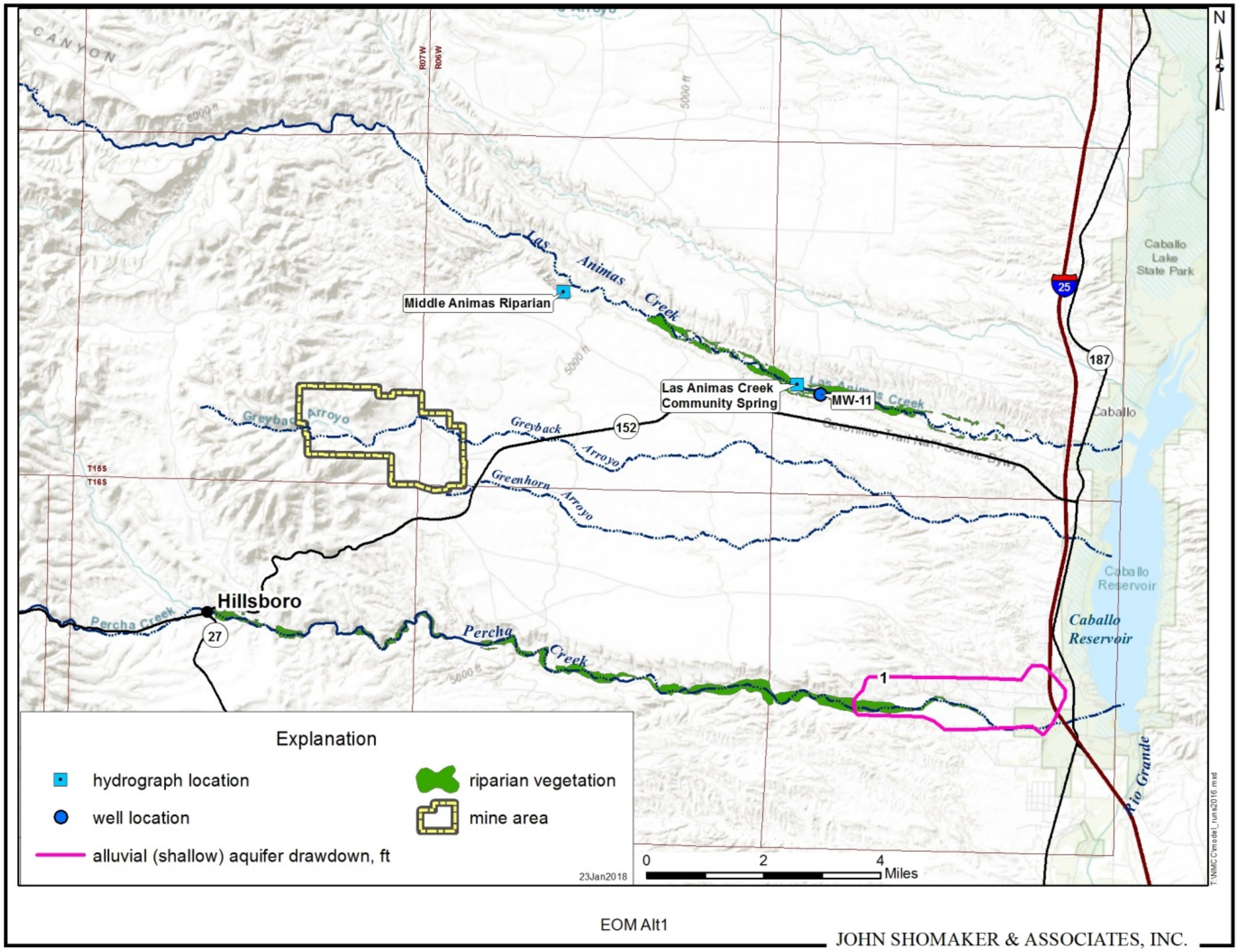
Source: NMCC 2018b.

Table 3-18b. Cumulated Change in Volume from Well Field, Acre-Feet	
Parameter	**Volume Change EOM + 12 years (AF)**
Storage	16,214
Rio Grande above Caballo Dam	14,026
Rio Grande below Caballo Dam	10,520
Flowing wells	12,811
Animas Creek flow and ET	202
Percha Creek flow and ET	312
Inflow from graben north of study area	7,838
Total	**61,923**

Source: NMCC 2018b.

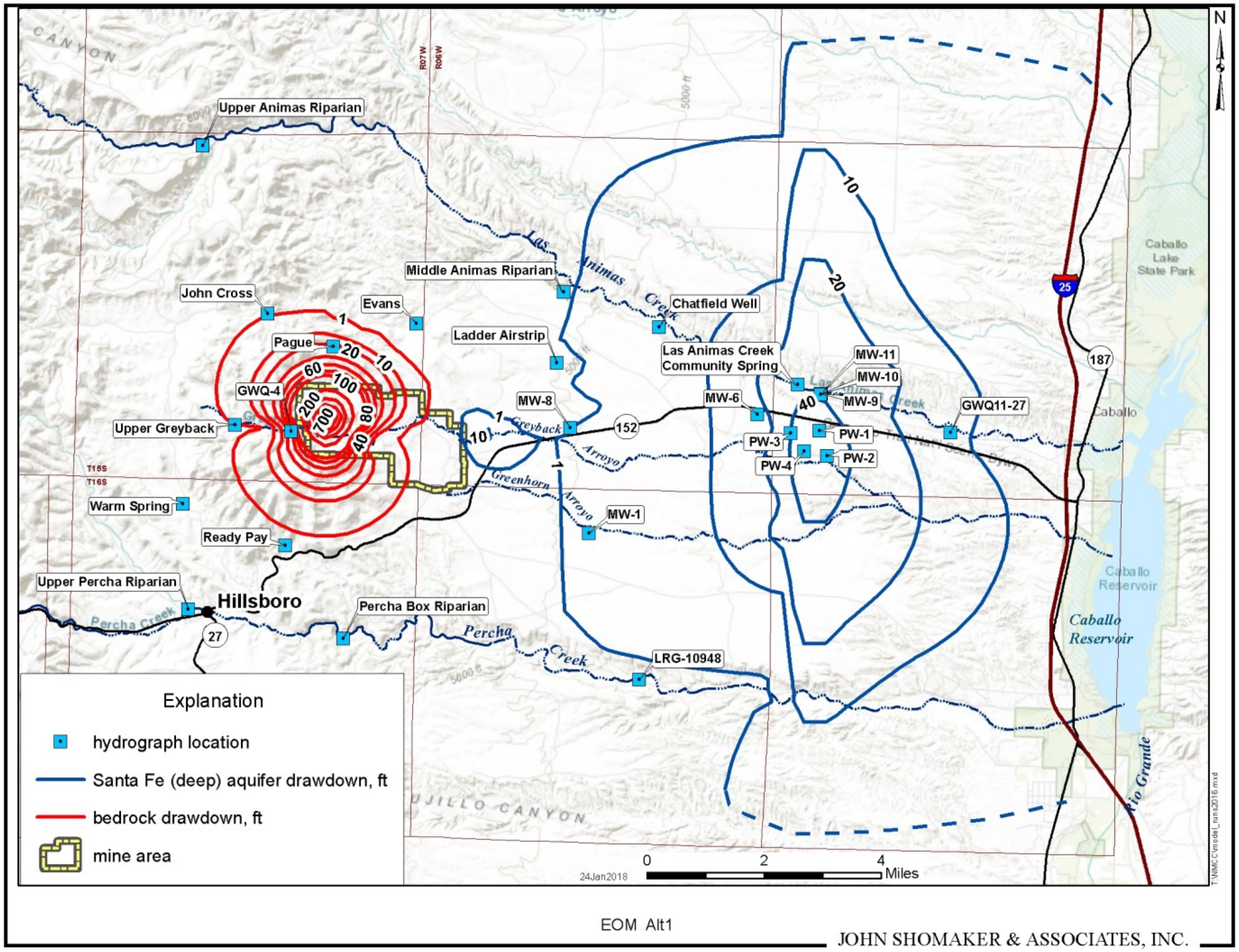
The storage change in Table 3-18b includes 466 AF of drainage to the pit; the remainder is the effect of the supply well pumping.

Figure 3-16a. Map of Water Level Declines in Layer 1 at End of Mining – Alternative 1



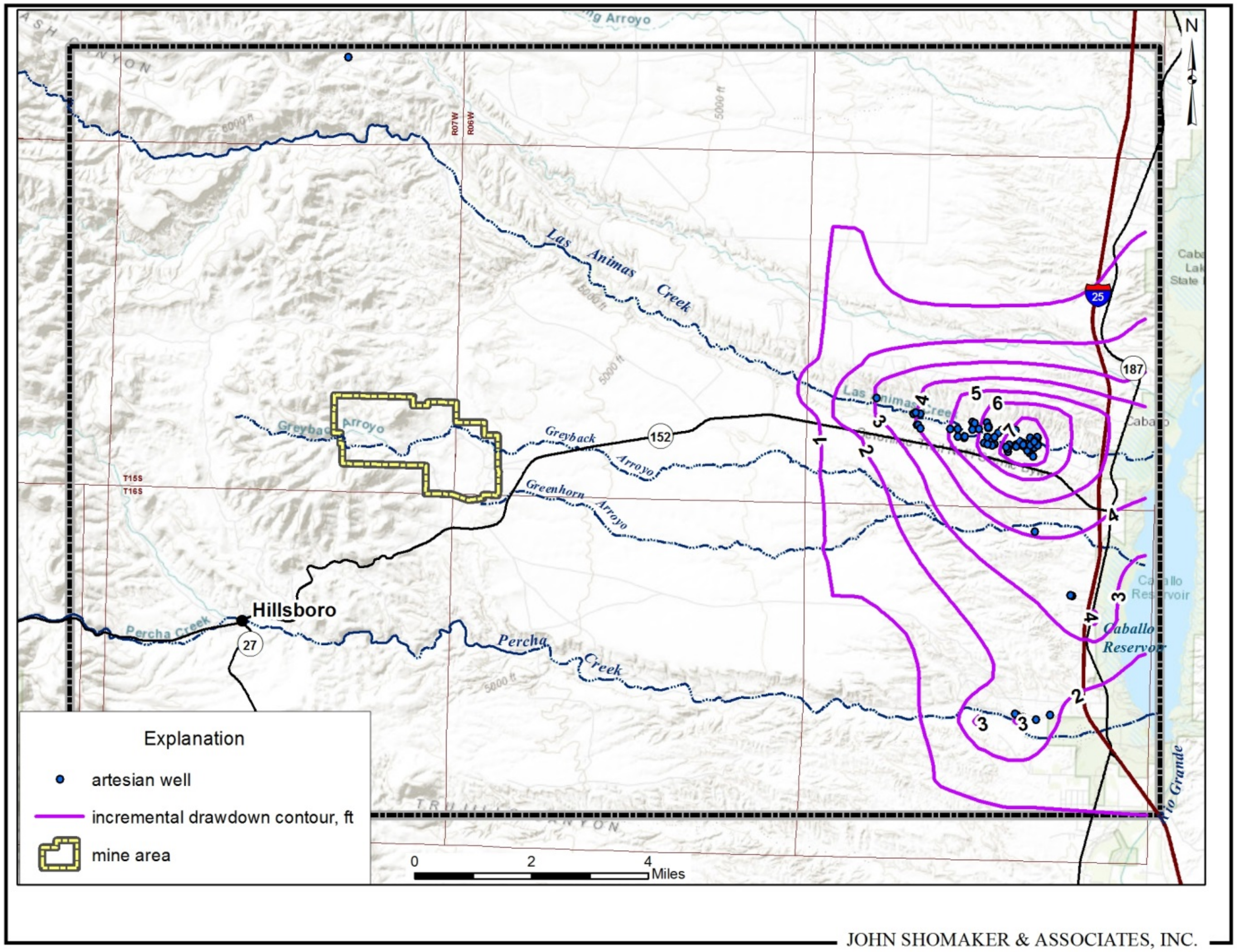
Source: NMCC 2018b.

Figure 3-16b. Map of Water Level Declines in Layer 2 at End of Mining – Alternative 1



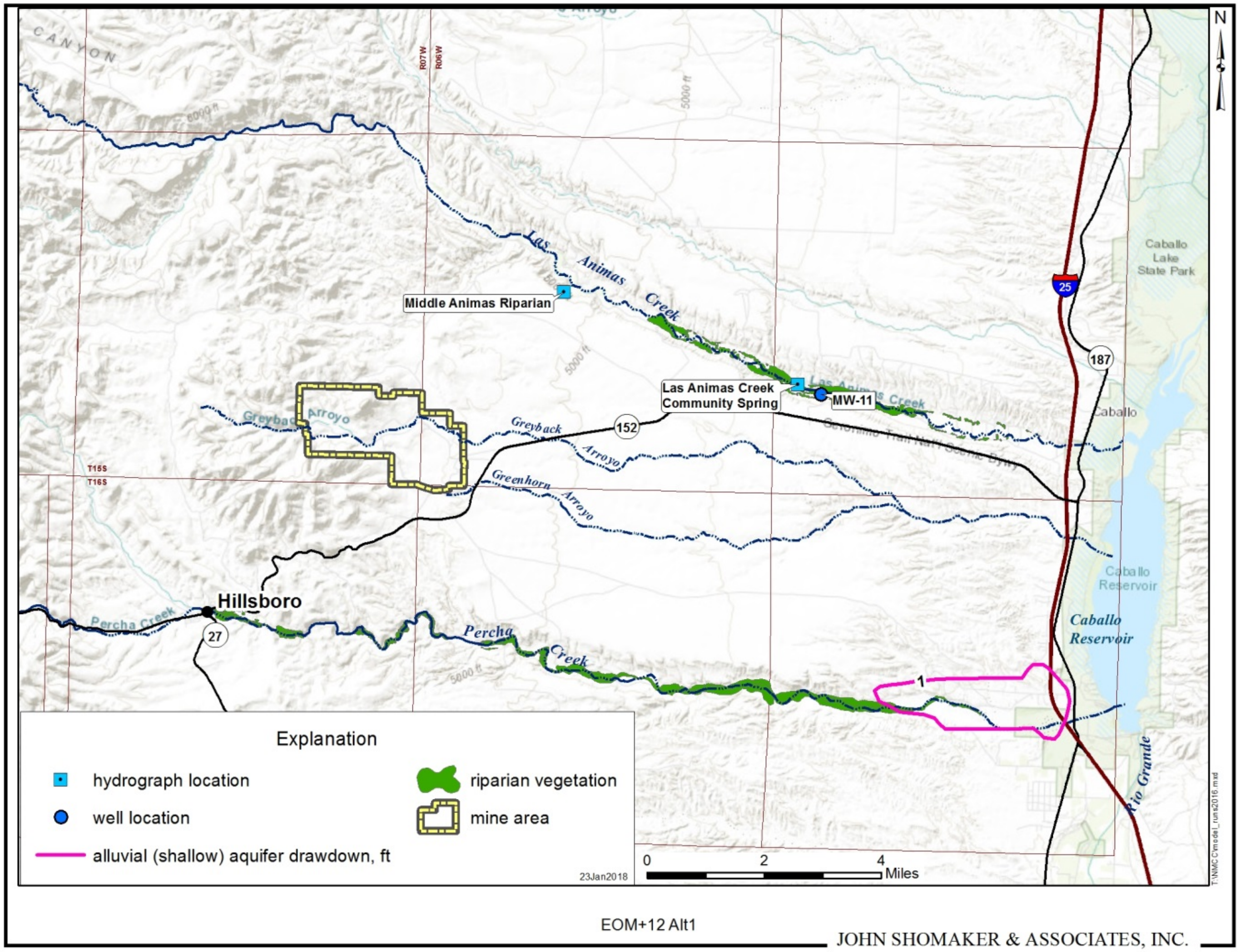
Source: NMCC 2018a.

Figure 3-16c. Map of Water Level Declines in Layer 2 at End of Mining, Alternative 1, Resulting From Potential Increased Pumping of Artesian Wells



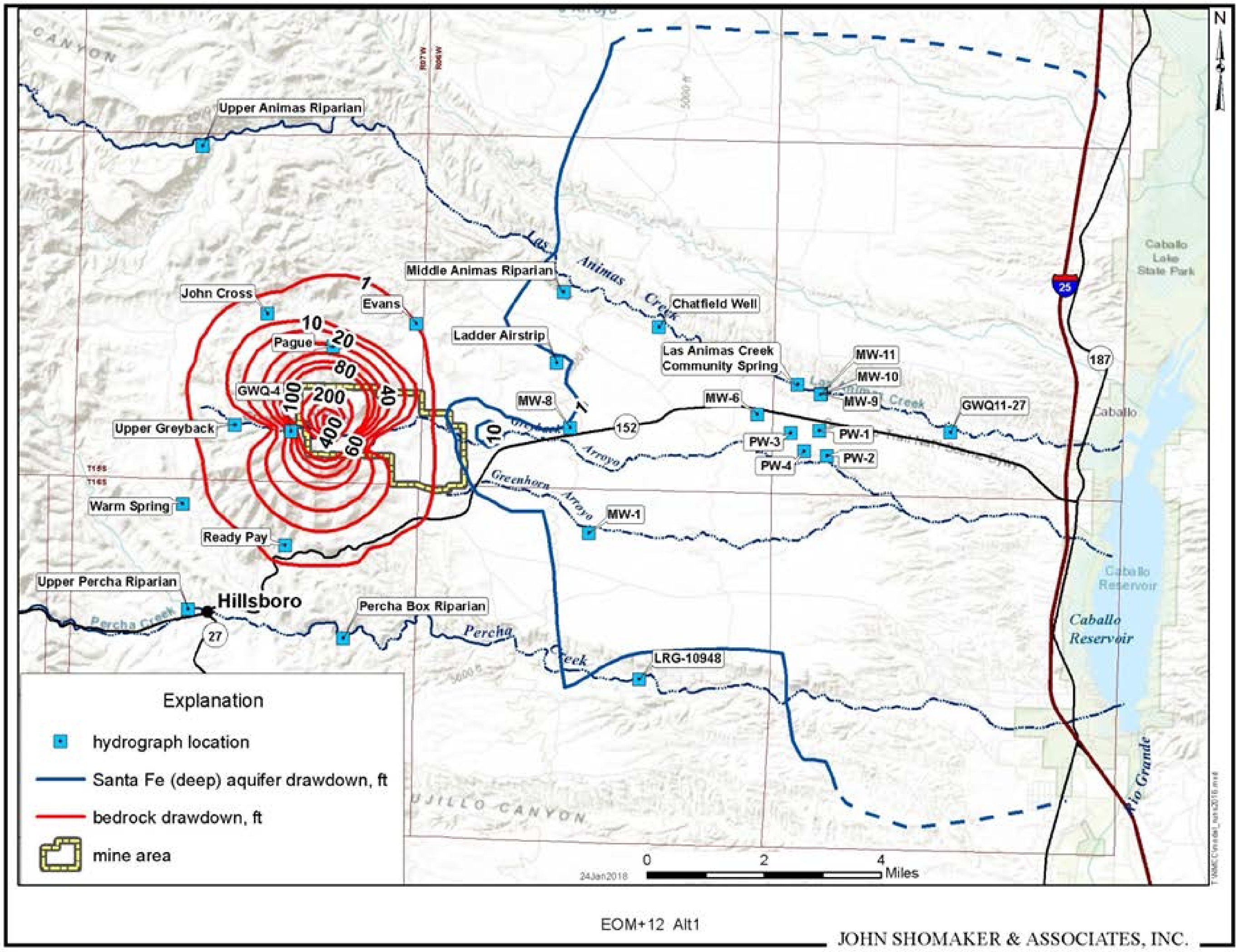
Source: NMCC 2018b.

Figure 3-16d. Drawdown Contour Map, Alternative 1, Layer 1, EOM+12



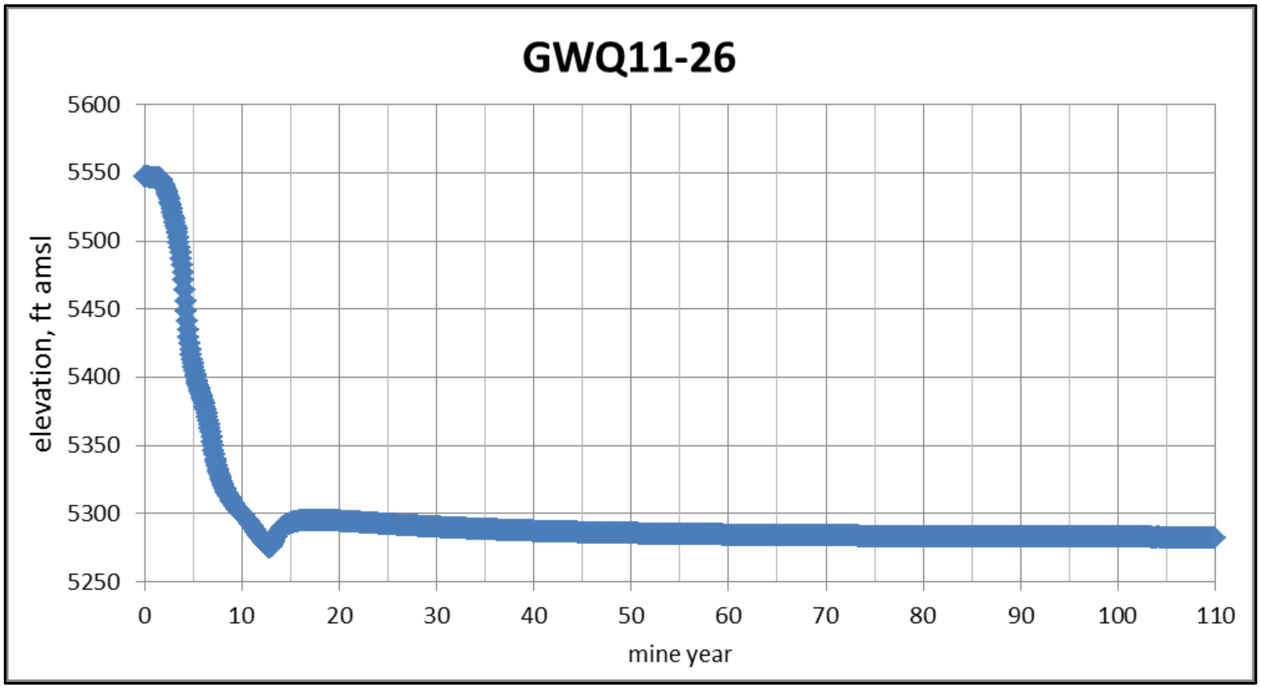
Source: NMCC 2018b.

Figure 3-16e. Drawdown Contour Map, Alternative 1, Layer 2, EOM+12



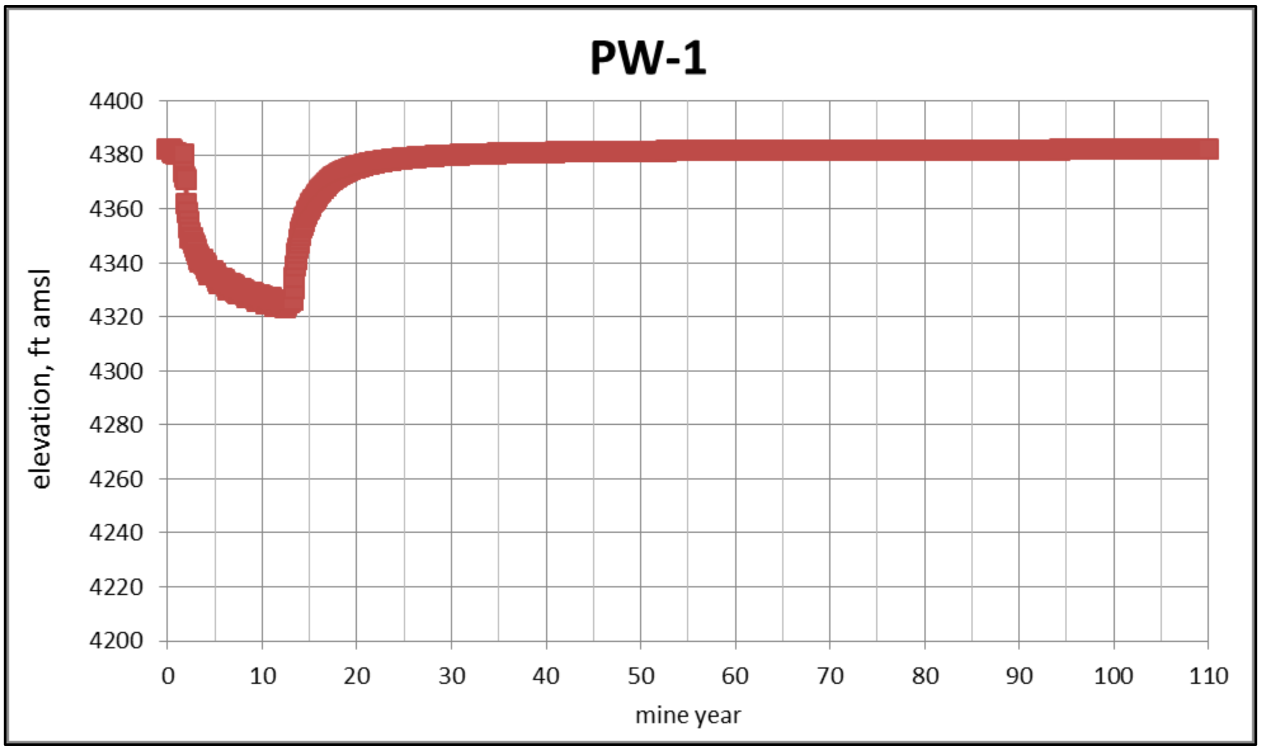
Source: NMCC 2018b.

Figure 3-17a. Projected Water Level at GWQ11-26 – Alternative 1



Source: NMCC 2018b.

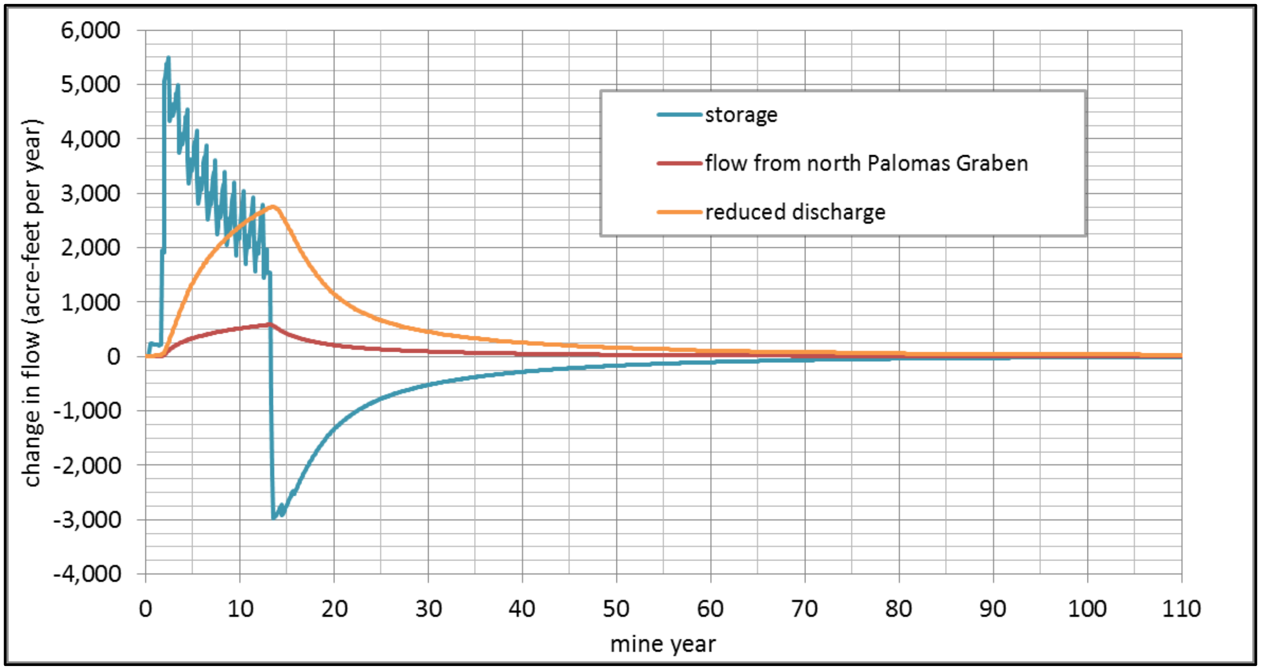
Figure 3-17b. Projected Water Level at PW-1 – Alternative 1



Source: NMCC 2018b.

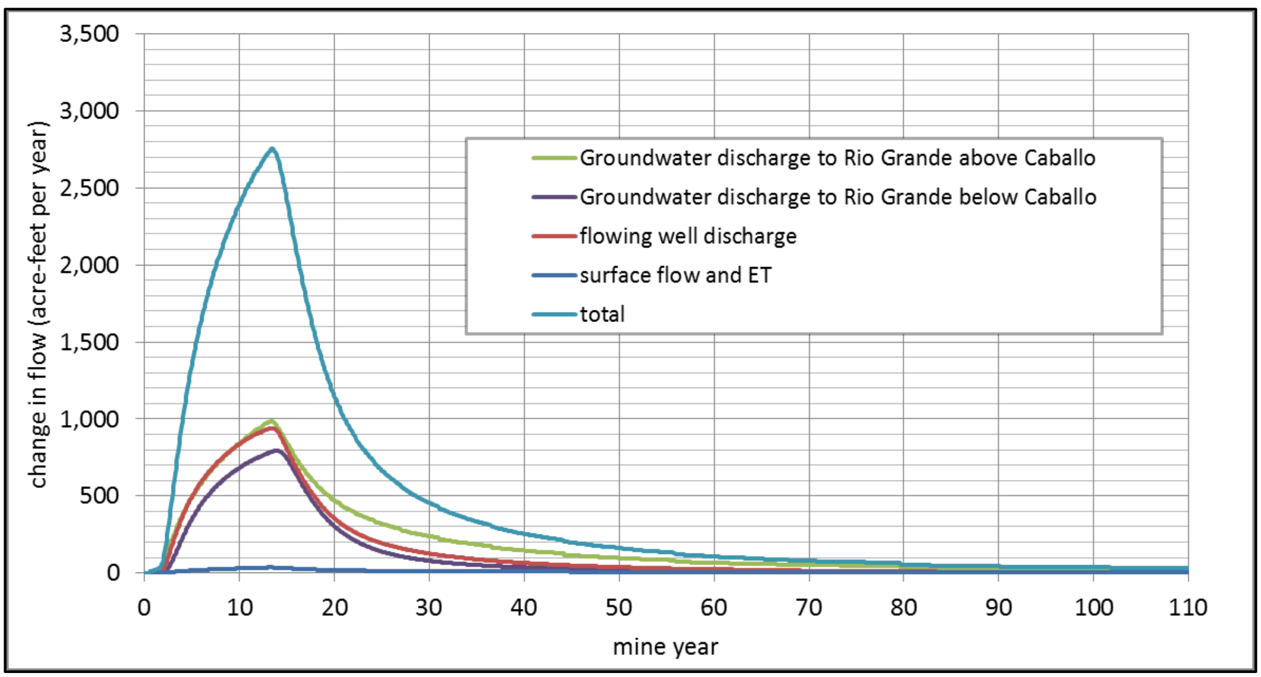
Impacts to regional water budget: Figure 3-18a below illustrates the simulated effect of Alternative 1 on the components of the regional water budget over time. The impacts are generally greater and peak earlier than for the Proposed Action.

Figure 3-18a. Impacts of Alternative 1 on Water Balance Components



Source: NMCC 2018b.

Figure 3-18b. Breakout of "Reduced Discharge" Impact in Figure 3-18a



Source: NMCC 2018b.

3.6.2.2.2 Mine Closure/Restoration

Water level recovery would occur after the end of mining and pit refill. Recovery in the bedrock near the mine pit will be limited. Recovery in the Santa Fe Group will eventually (over decades) be complete. The post-mining water budget is quantified above in the Table 3-17a, column entitled "Decrease from no mine, 100 yrs after mining", and post-mining water levels are illustrated above (along with changes during mining) in Figure 3-17. (See also Figure 3-22.)

3.6.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Impacts under Alternative 2 would be similar to those under the Proposed Action and Alternative 1. Impacts to the regional water budget, including flows of the Rio Grande, would be long-term, major, of large extent, probable, and adverse. Water budget impacts would begin to reduce once mining ends. Impacts to water levels caused by the supply well field would be long-term, moderate, of medium extent, probable, and adverse. Regional drawdown impacts would begin to reduce once mining stops. Impacts to water levels caused by the pit would be long-term, major, of small extent, probable, and adverse. Overall, impacts on groundwater resources would be significant.

3.6.2.3.1 Mine Development and Operation

Refer to Section 3.6.2.1.1 for a general discussion of the tables and figures that illustrate model results.

Alternative 2 would entail higher groundwater pumping rates than the Proposed Action or Alternative 1, and an intermediate timeframe. Table 3-19 below provides the water budget for Alternative 2 in the same format as Tables 3-17 and 3-18 above. Figure 3-19a below provides a map showing the drawdown or decline in water levels in the alluvial aquifer (model layer 1) expected to result from Alternative 2. Figure 3-19b below is the equivalent drawdown map for the portion of the Santa Fe aquifer that is in model layer 2. Figure 3-19c below is map of drawdowns in layer 2 in addition to those shown in Figure 3-19b, that would occur in the event that private wells in the lower valley of Las Animas Creek were pumped at an additional 1,060 AFY in order to replace the reduction in artesian flow that would result from the pumping of the NMCC supply wells. Figure 3-19d below is a map of the layer 1 drawdowns at 12 years following the cessation of pumping. Figure 3-19e below is a map of the layer 2 drawdowns at 12 years following the cessation of pumping; the contour interval is 10 feet, and as a result no contours are shown around the well field. Figures 3-20a and 3-20b below provide hydrographs showing drawdown in wells GWQ11-26 and PW-1. Additional hydrographs are provided in Appendix H.

As expected, Alternative 2 would have a larger impact than the Proposed Action and Alternative 1. The maximum impact "to Rio Grande" is 2,072 AFY, but in consideration of other flow changes, the maximum impact could exceed 3,500 AFY. Water level declines at the pit would be essentially the same as for the Proposed Action, but at the well field the declines would exceed 70 feet, the greatest of the alternatives evaluated.

Table 3-19. Regional Water Balance for Alternative 2

Table 3-19a. Change in Flow, Acre-Feet Per Year			
Parameter	**Decrease from no mine, 3 months after end of mining**	**Decrease from no mine, 100 yrs after mining**	**Flow Rate with No Mine**
Groundwater discharge to Rio Grande above Caballo Dam	1,106	25	10,561
Groundwater discharge to Rio Grande below Caballo Dam	966	3	1,234
Discharge from flowing wells	1,060	4	2,030
Animas Creek ET and flow reduction	18	1	4,848
Percha Creek ET and flow reduction	24	4	2,630
Inflow from graben north of model area	680	3	2,184
Total change in flow terms	**3,854**	**40**	

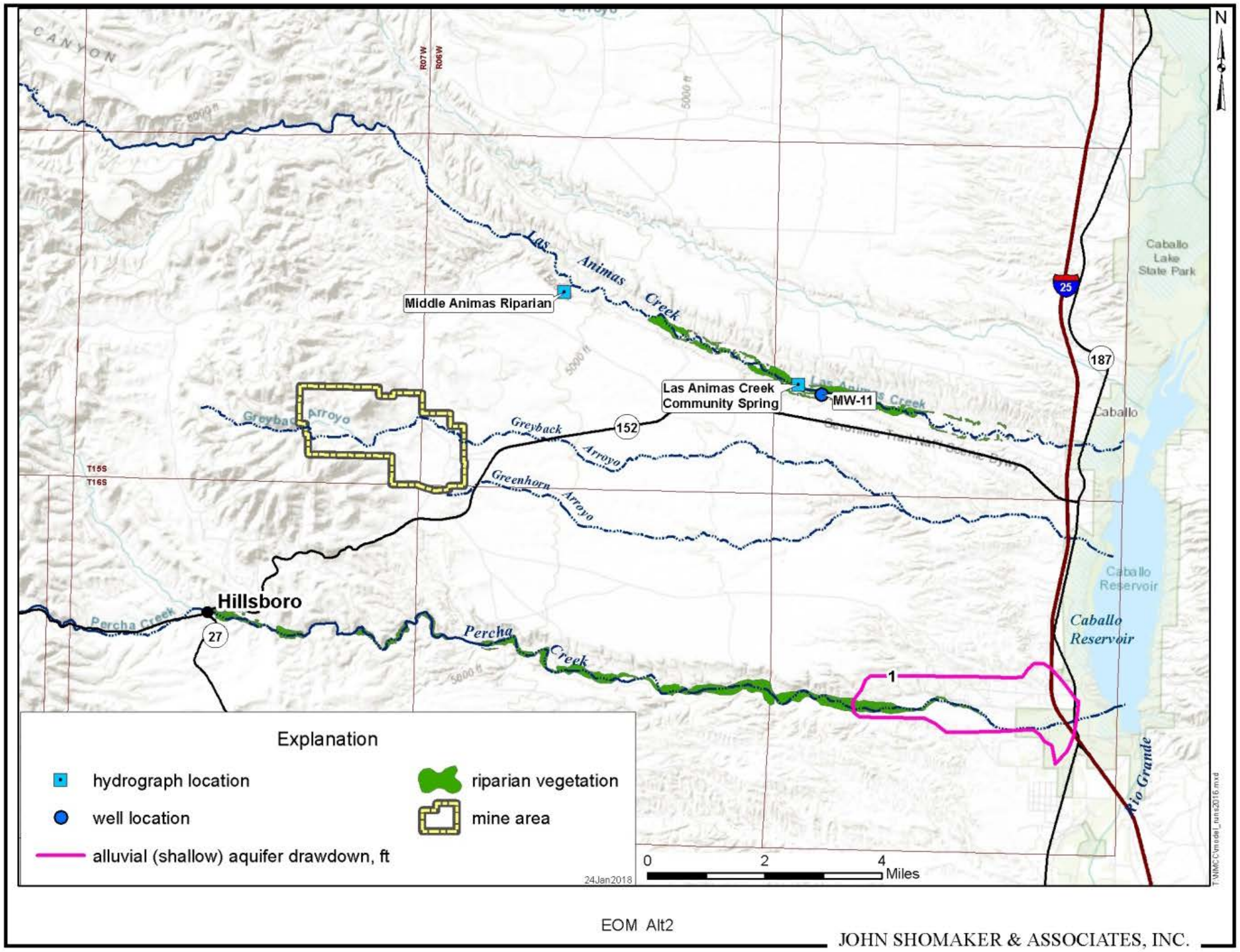
Source: NMCC 2018b.

Table 3-19b. Cumulated Change in Volume from Well Field, Acre-Feet	
Parameter	**Volume Change EOM + 12 (AF)**
Storage	19,226
Rio Grande above Caballo Dam	15,707
Rio Grande below Caballo Dam	13,669
Flowing wells	15,211
Animas Creek flow and ET	241
Percha Creek flow and ET	377
Inflow from graben north of model area	9,422
Total	**73,853**

Source: NMCC 2018b.

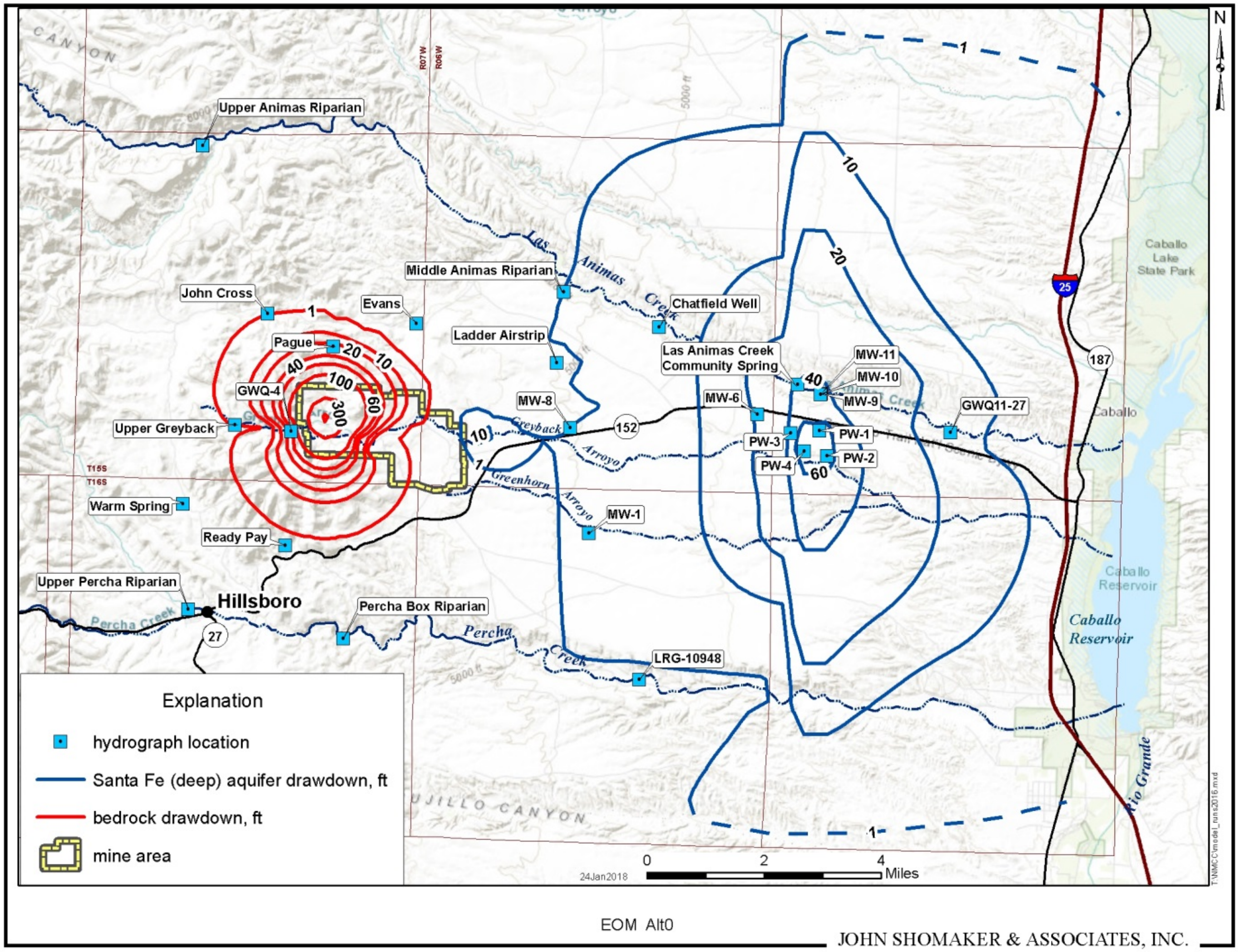
The storage change in Table 3-19b above includes 489 AF of drainage to the pit; the remainder is the effect of the supply well pumping.

Figure 3-19a. Map of Water Level Declines in Layer 1 at End of Mining – Alternative 2



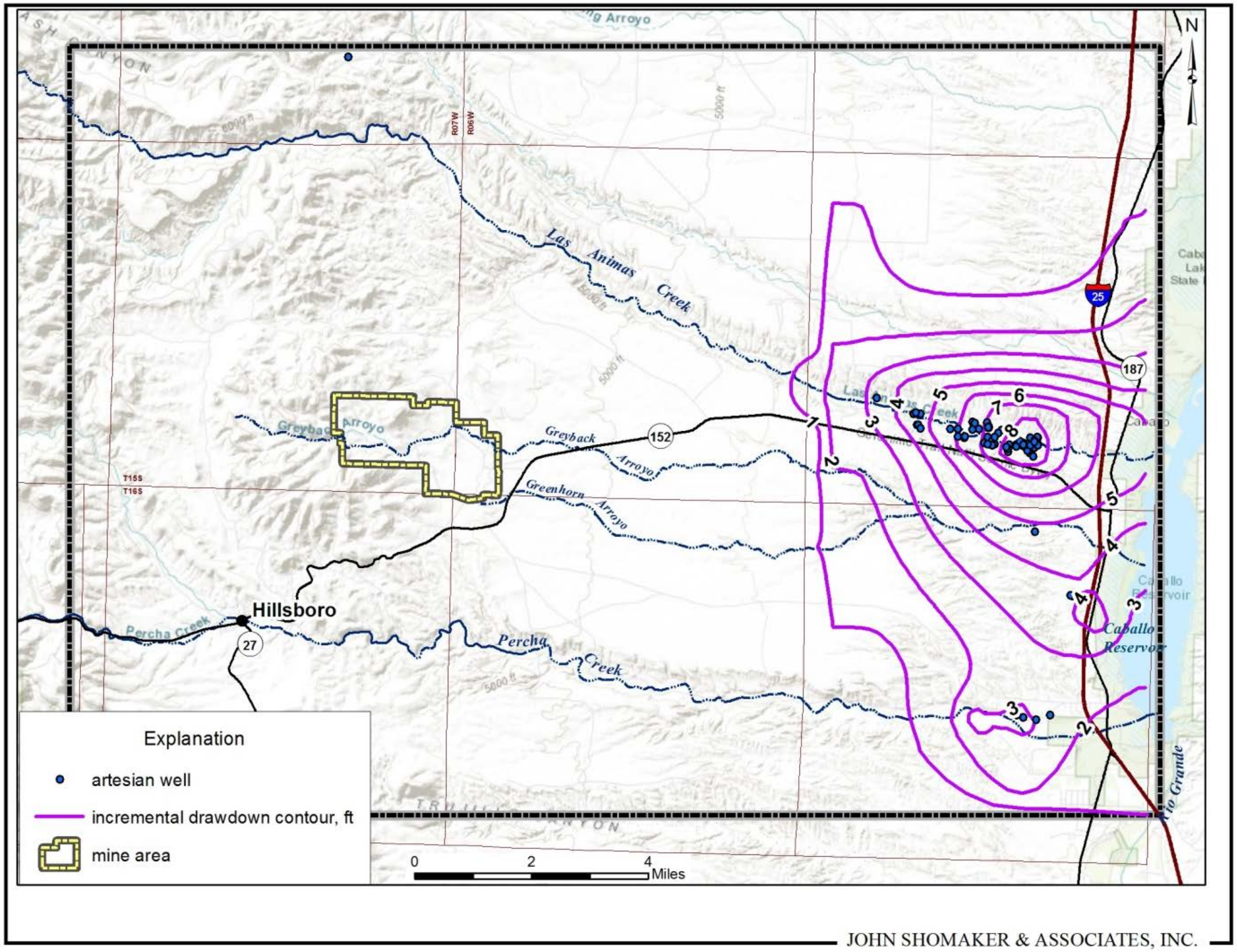
Source: NMCC 2018b.

Figure 3-19b. Map of Water Level Declines in Layer 2 at End of Mining – Alternative 2



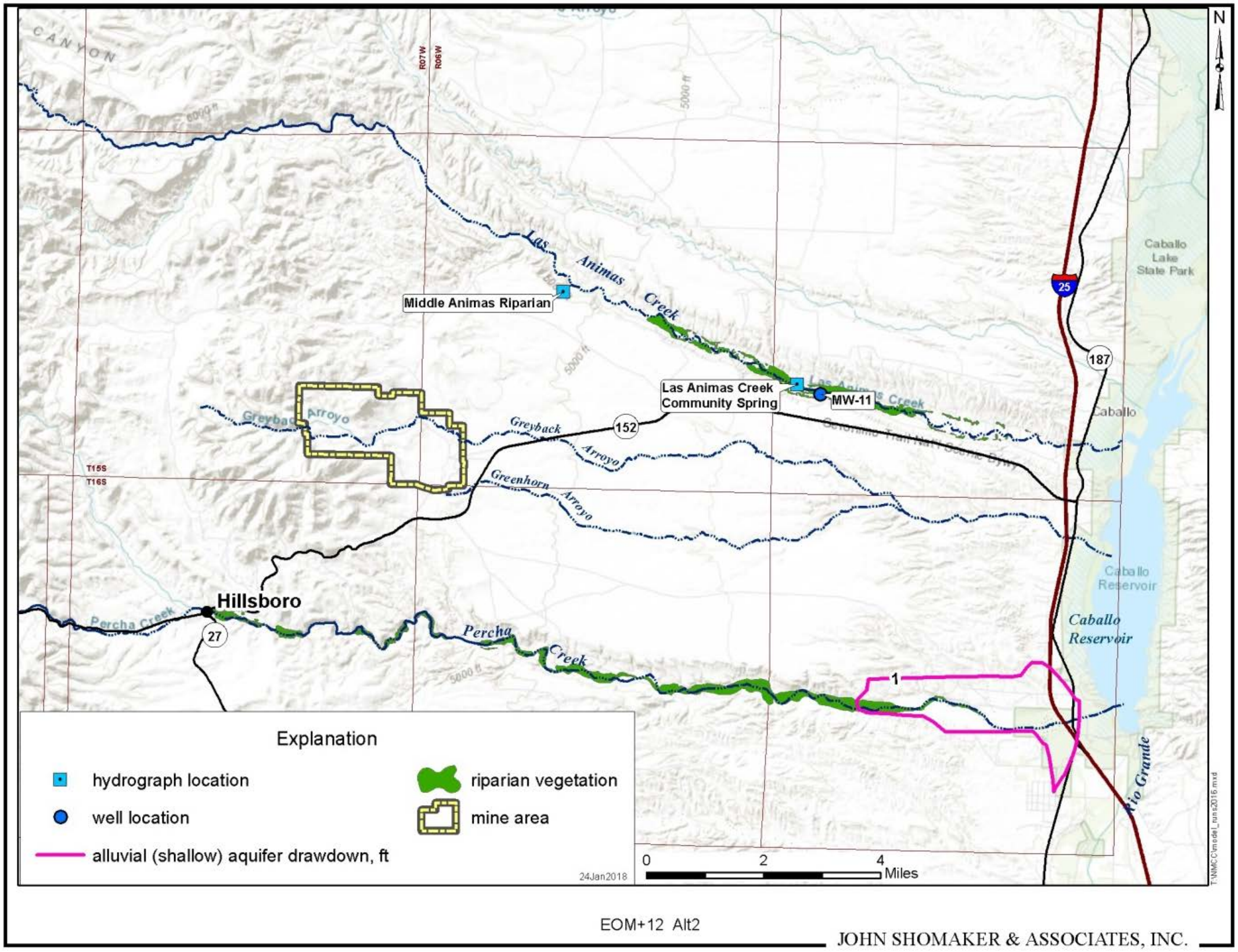
Source: NMCC 2018b.

Figure 3-19c. Map of Water Level Declines in Layer 2 at End of Mining, Alternative 2, Resulting From Potential Increased Pumping of Artesian Wells



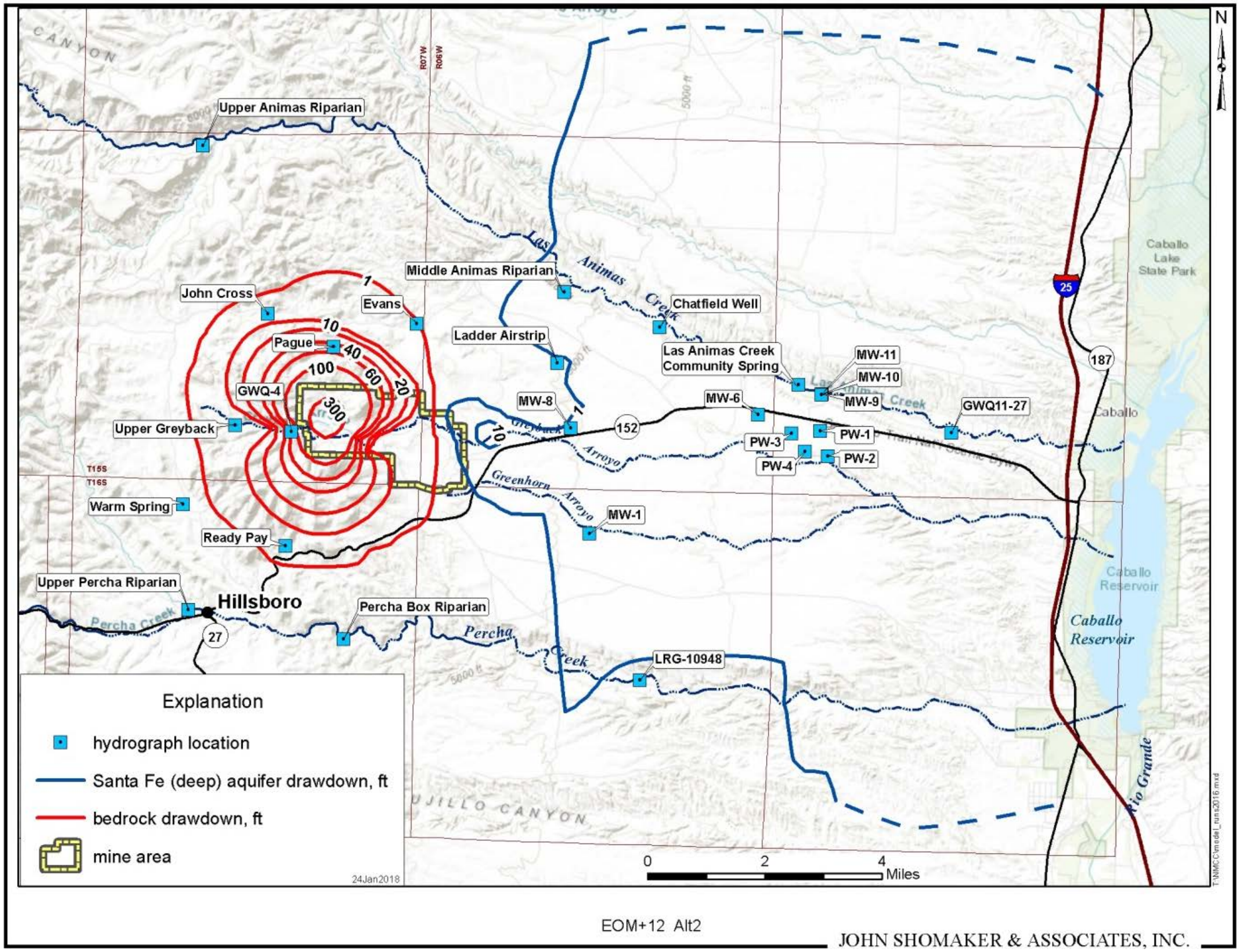
Source: NMCC 2018b.

Figure 3-19d. Drawdown Contour Map, Alternative 2, Layer 1, EOM+12



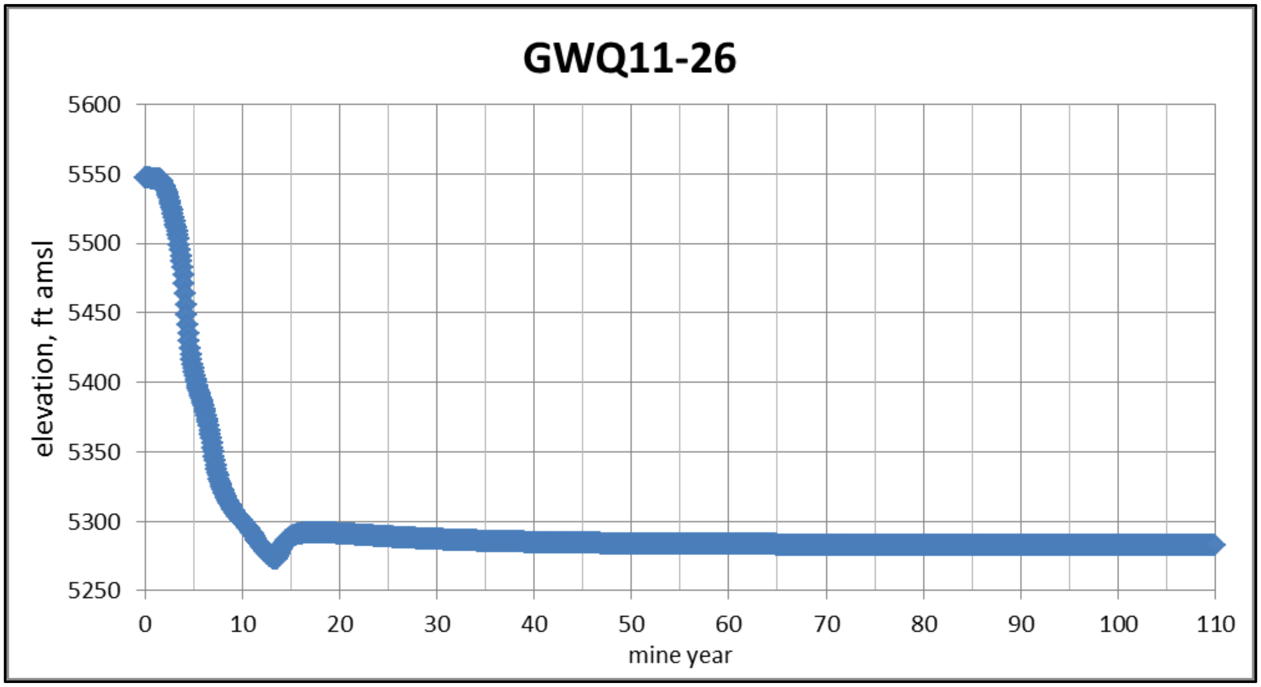
Source: NMCC 2018b.

Figure 3-19e. Drawdown Contour Map, Alternative 2, Layer 2, EOM+12



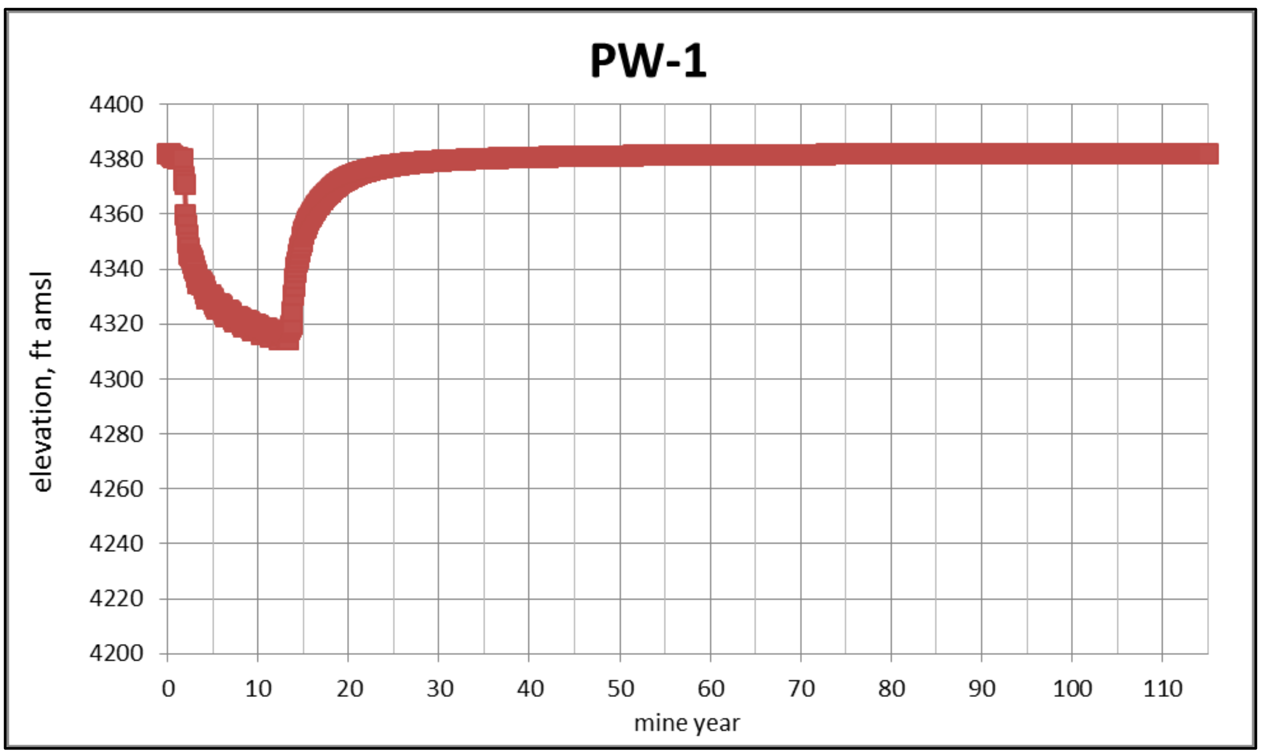
Source: NMCC 2018b.

Figure 3-20a. Projected Water Level at GWQ11-26 – Alternative 2



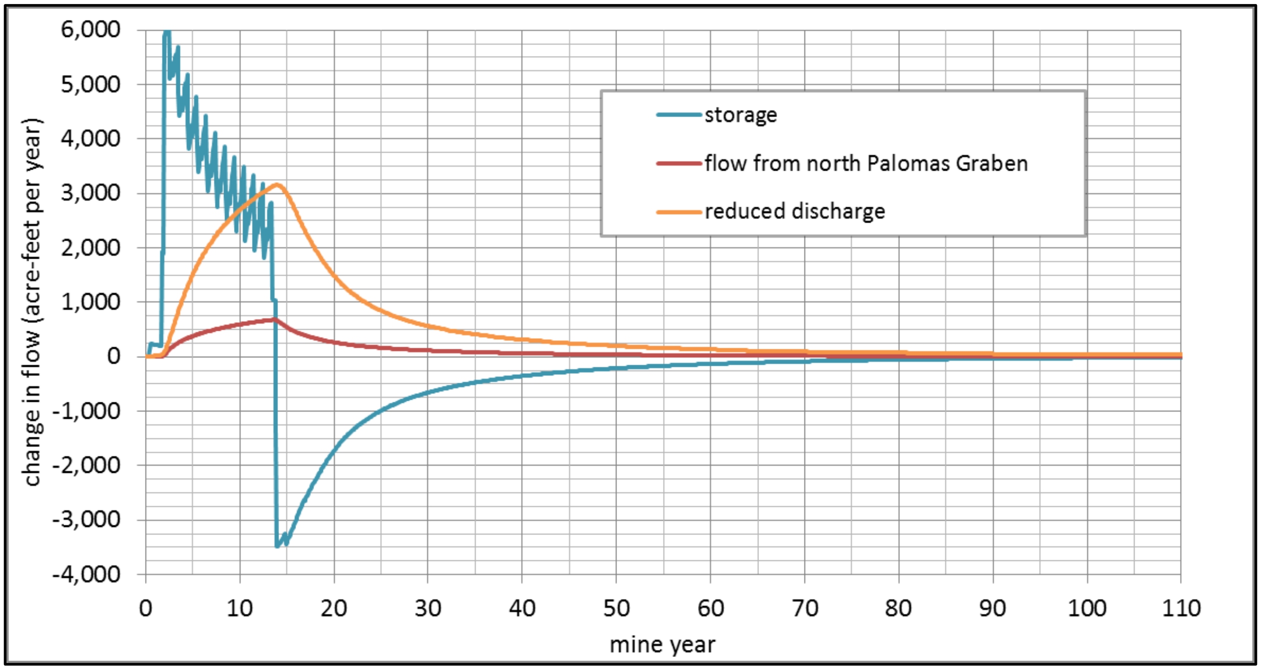
Source: NMCC 2018b.

Figure 3-20b. Projected Water Level at PW-1 – Alternative 2



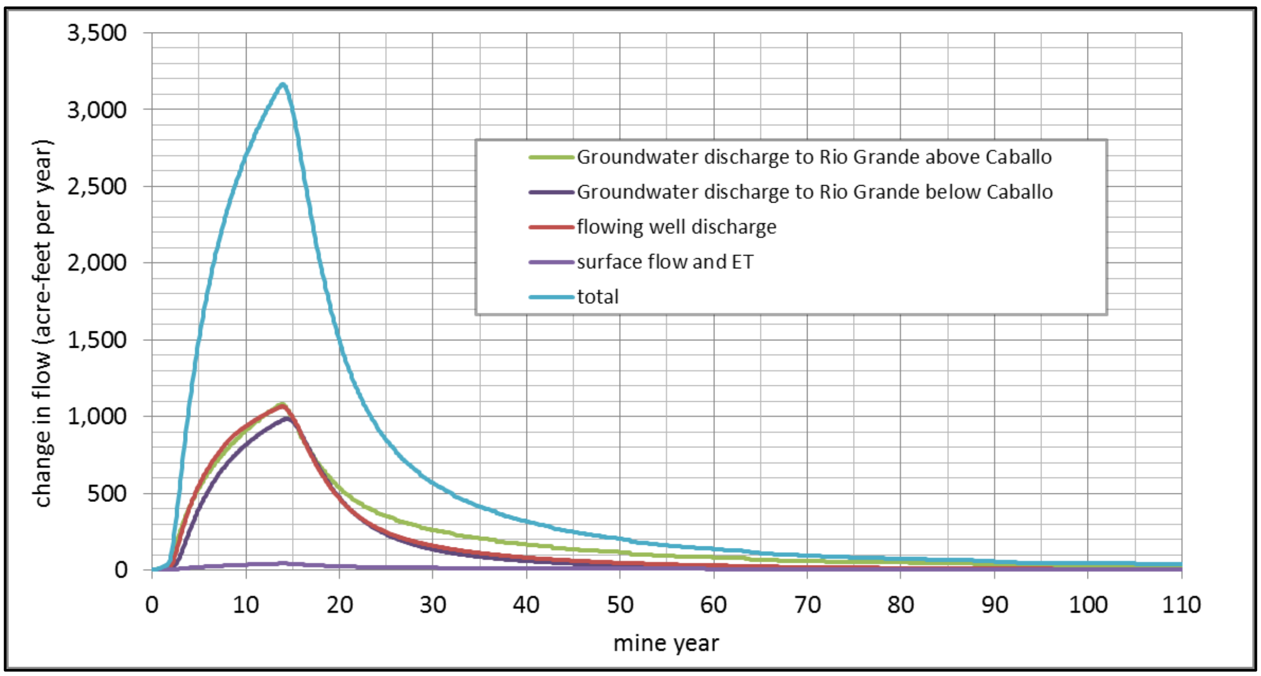
Source: NMCC 2018b.

Figure 3-21a. Impacts of Alternative 2 on Water Balance Components



Source: NMCC 2018b.

Figure 3-21b. Breakout of "Reduced Discharge" Impact in Figure 3-21a



Source: NMCC 2018b.

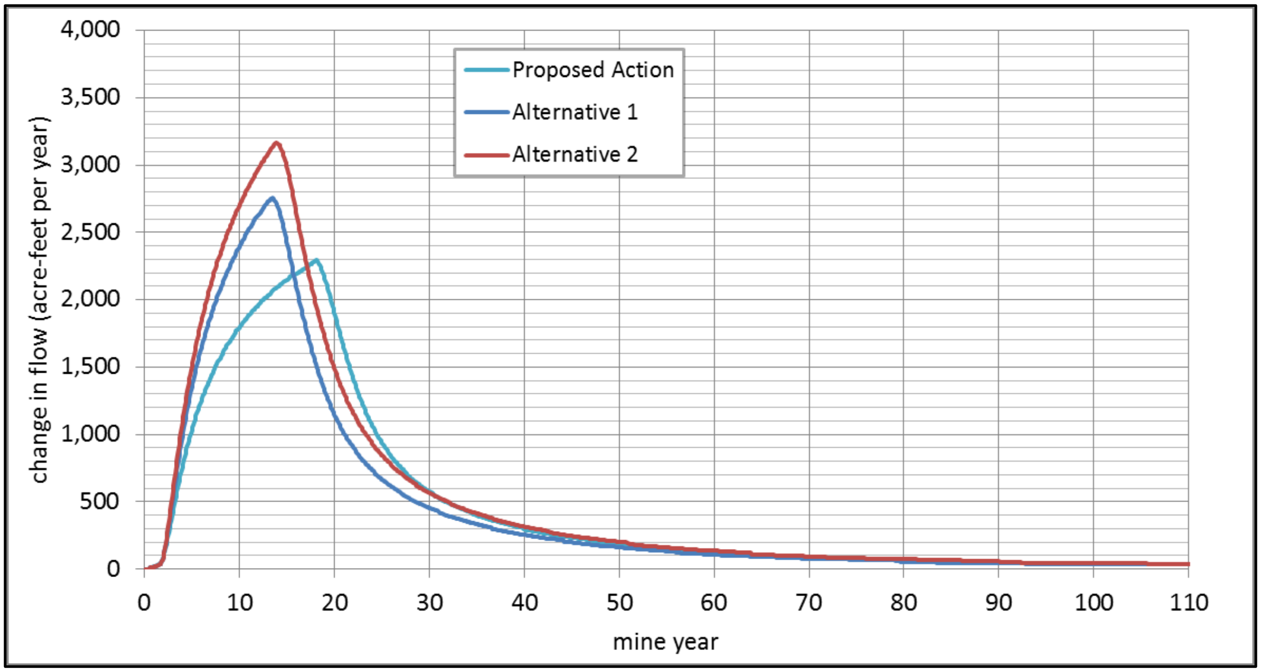
3.6.2.3.2 Mine Closure/Restoration

Water level recovery would occur after mining ceases. Recovery in the bedrock near the mine pit would be limited. Recovery in the Santa Fe Group would eventually (over decades) be complete. The post-mining water budget is quantified above in the Table 3-19a column entitled "Decrease from no mine, 100 yrs after mining" and post-mining water levels are illustrated above (along with changes during mining) in Figures 3-19a through 3-19d. (See also Figure 3-22.)

3.6.2.3.3 Summary of Groundwater Assessment

Comparison of alternatives: The alternatives differ primarily as to the timing and rate at which the regional water budgets would be affected. Figure 3-22 below compares the three alternatives with respect to total changes in (depletions of) flow, which are mostly reduced flow to the Rio Grande and reduced flow of artesian wells. The time signal of impacts is similar, in that impacts would increase rapidly once mining begins, and decline rapidly once mining ends. Peak depletions would occur later for the Proposed Action than for the alternatives because the pace of mining in the Proposed Action would be slower. In all alternatives the impact to flow depletions is a large share of total pumping. The largest peak impact shown below in Figure 3-22 is from Alternative 2; the smallest from the Proposed Action.

Figure 3-22. Comparison of Total Regional Water Budget Impacts of Alternatives



Source: NMCC 2018b.

Confidence in predictions of impacts: The choice of a model used to predict impacts to groundwater is only partially constrained by data, and the resulting estimates of effects are necessarily approximate. However, the general character and magnitude of impacts is reasonably known.

- A deeper mine pit would require dewatering and lowering of groundwater levels near the mine. Impacts of a deeper mine pit would be limited because the ore body is embedded in relatively impermeable bedrock. This is shown by the past history of the Quintana mine, and by aquifer tests.
- Pumping of the supply wells would lead to lowering of water levels and to a reduction in stream flows. These predicted impacts are consistent with observations of effects of wells that draw from the Santa Fe Group throughout the Rio Grande Valley of New Mexico.

Sensitivity tests provided in Appendix G indicate the range of predicted impacts based on certain changes to the model. These tests confirm that the model provides a reasonable evaluation of impacts, even if the details may include a degree of uncertainty.

3.6.2.4 No Action Alternative

Compared to existing conditions, there would be no change in the regional water budget from mining if the project is not implemented. Some water would continue to be depleted due to evaporation from the mine pit, and a drawdown cone would continue to exist around that pit. Hydrologic effects from abatement of contamination at the existing tailings ponds would occur as directed by the State of New Mexico.

Under the No Action Alternative, the Stage 1 Abatement Plan would continue to be implemented to define site conditions, investigate known areas of groundwater and surface water contamination at the site, and define the extent and magnitude of groundwater contamination. Stage 2 of the abatement plan, also to be implemented under the No Action Alternative, would address selection and design of an effective treatment option to abate groundwater contamination. Stage 2 would include a feasibility study to analyze abatement alternatives. Stage 2 would have a direct and beneficial impact on groundwater resources, since the groundwater targeted by the abatement would undergo remediation. Depending upon the remedy selected, the impacts would likely belong-term, moderate, of small extent, probable, and adverse. Overall, impacts would be significant.

3.6.3 Mitigation Measures

In a March 23, 2017 letter from NMCC to the BLM (NMCC 2017b), NMCC committed to fully offsetting calculated and actual depletions to the Rio Grande resulting from mining operations, which would be evaluated by OSE and addressed as a condition for permit approval. In a subsequent letter to the BLM on June 29, 2017 (NMCC 2017c), NMCC confirmed that the offset was to be provided with water obtained from a lease executed with the Jicarilla Apache Nation for a period of 15 years from when ore crushing would begin. After that, the lease would be extended or another water source secured that would provide offsets to year 29. The BLM may authorize this mine project and any operations are premised on the acquisition of necessary water rights under the authority of the OSE for the life of the mine plan. Thereafter, NMCC would retire an existing water right that holds a legal entitlement to deplete water from the river in an amount equal to NMCC’s effects on the river at the time of retirement.

In an August 24, 2017 letter to the BLM (NMCC 2017d), NMCC reaffirmed their intent to fully offset all NMCC pumping impacts on the Rio Grande, including years beyond year 29 with actual water, “wet offsets,” to ensure no net effect on the river would occur due to the proposed operation of Copper Flat. NMCC would accomplish this by taking one or more of the following actions: extending the previously described Jicarilla Apache Nation water lease; securing another lease of equally effectual water; or securing and permanently retiring water rights that physically affect the river today. Regarding the permanent retirement of a water right, the offset would continue to have a positive effect on the Rio Grande as the NMCC effects on the river decline and entirely cease.

The BLM EIS team coordinated with the agencies that have direct permitting oversight of the Copper Flat mine at the State level. In September 2014, the BLM consulted with the NMED and OSE with specific reference to potential well monitoring programs that would be used to evaluate and manage actual mine impacts. The OSE has the responsibility for measuring, appropriating, and distributing the public waters of the state. NMCC's appropriation of water is thus subject to the OSE's conclusion that any water appropriation by NMCC would not impair existing water rights, is not contrary to conservation of water within the State, and is not detrimental to the public welfare of the State.

The BLM understands that a particular concern is the seasonal flow that occurs along the perched reach of Las Animas Creek, which supports irrigation, vegetation, and habitat. No direct impact to the highly valued resource in this reach is expected to result from the project. This conclusion results from the fact that the shallow groundwater in the reach is not hydrologically connected to the regional aquifer which is the source of water to the wells that would supply the project, although it is subject to a small reduction in water supply due to upstream effects. Indeed, the perched water table would not exist if there were a connection to the main regional aquifer, which at present lies at substantial depth below the river. Extensive monitoring is proposed to validate ongoing hydrologic conditions.

3.7 MINERAL AND GEOLOGIC RESOURCES

Mineral and geologic resources are described in both their existing condition and the predicted effects from the Proposed Action and alternatives in the following sections: 3.7.1, Affected Environment; 3.7.2, Environmental Consequences; and 3.7.3, Mitigation Measures.

3.7.1 Affected Environment

The information base for describing the geology of the project area is extensive, and much of it is best presented in the context of specific impact issues, such as groundwater use or quality. The regional context for those resource-specific discussions is presented below and is based primarily on the following references: Wilson et al. (1981); Seager et al. (1984); Dunn (1982); BLM (1999); JSAI (2011); Intera (2012); and Jones et al. (2012). The geologic history of the area and the associated mineralization are summarized in the table below. (See Table 3-20.)

3.7.1.1 Regional Geologic Setting

The project is located on the western margin of the Rio Grande Rift, the easternmost region of the Basin and Range geologic and topographic province that characterizes much of the southwestern U.S. The Rift is a relatively young north-south geologic structure that bisects New Mexico and extends from southern Colorado to western Texas. Throughout most of the Rift length, a thick volume of sediments have been deposited within a series of down-faulted troughs. These sediments were eroded from adjacent mountains, such as the Animas Uplift, or carried by the ancestral Rio Grande. The basin fill sediments in the Rift are referred to as the Santa Fe Group. The Rift materials have been extensively affected by internal faulting and by volcanic activity.

Three north-south trending geologic zones are shown below on a geologic map of the project area. (See map in Figure 3-23.) West to east, these three zones are the Warm Springs Valley, Animas Uplift, and Palomas Basin. Alluvial valleys that drain toward the Rio Grande represent a fourth geologic zone as shown below in the simplified geologic cross-section of the area. (See cross-section in Figure 3-24.) More detailed maps and cross-sections are provided in BLM 1999.

Warm Springs Valley: Warm Springs Valley occupies a tilted and partially down-faulted geologic zone (a “half-graben”) that lies between the Black Range Mountains on the west and the Animas Uplift on the east. The half-graben is up to 4 miles wide and is filled with alluvial sediments of the Santa Fe Group that overlay older sedimentary and igneous rocks. These sediments have a substantial dip eastward toward the Animas horst as a result of faulting on the east side of the graben.

Animas Uplift: The Copper Flat ore body is located within the Animas Uplift, which is a raised fault block (or “horst”) that creates the Animas Hills. The fault block is about 2 to 4 miles wide and, as shown on the map and cross-section, is bounded on both sides by near vertical north-south trending normal faults. Within the uplift, remnants of a Cretaceous age volcano about 4 miles in diameter and at least 3,000 feet deep serve as the primary host rock for the igneous intrusions in which copper mineralization occurs. Volcanic rocks (e.g., andesite) associated with the intrusive event surround the volcanic core; older limestone occurs farther north and south. The Cretaceous volcanic activity occurred approximately 75 million years before present. The faulting that uplifted the area and juxtaposed sedimentary rocks against igneous rocks began about 25-30 million years before present.

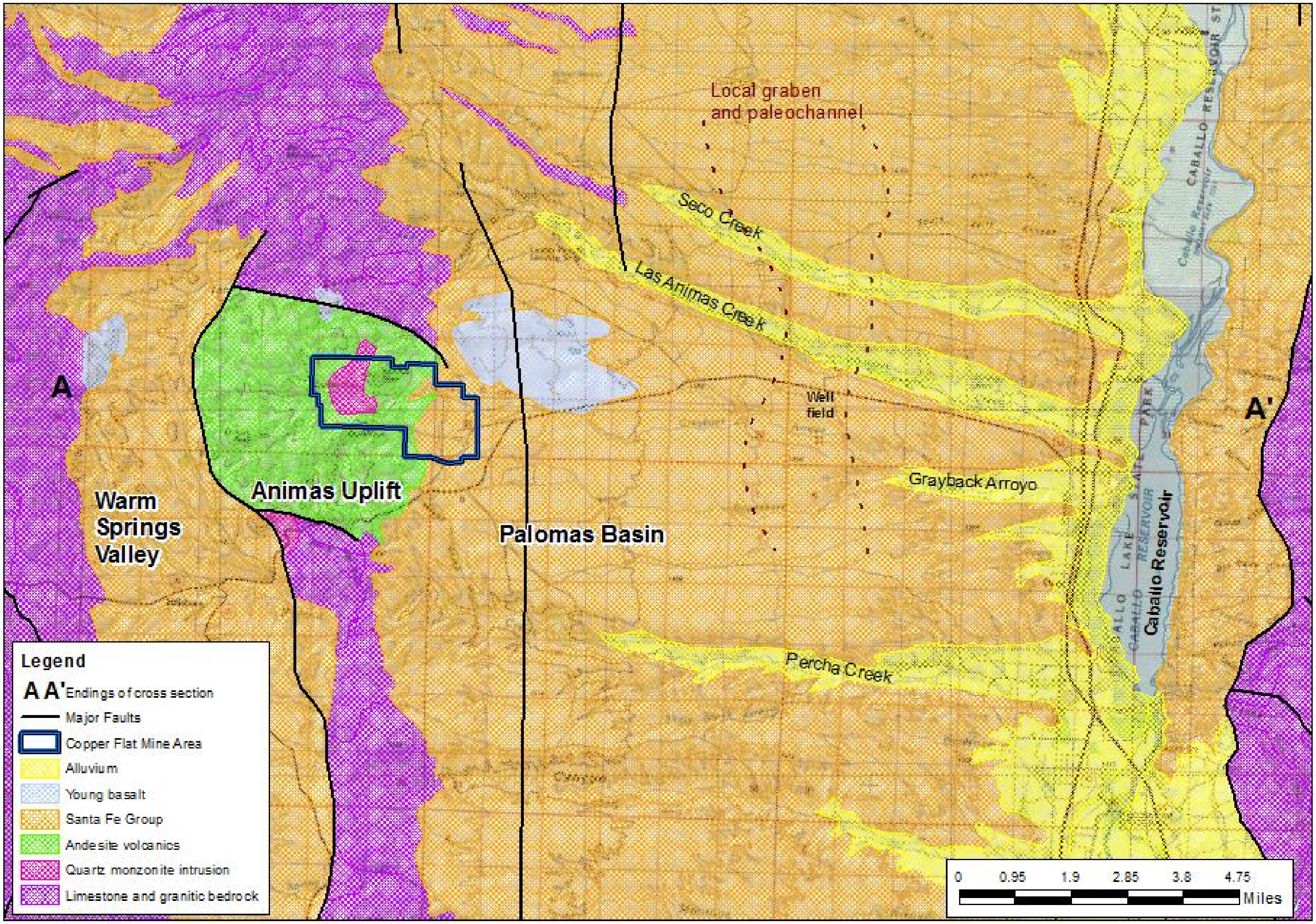
Palomas Basin: The Palomas Basin extends east from the Animas Uplift about 20 miles with the area of interest for this EIS being the 13 miles from the Uplift to Caballo Reservoir on the Rio Grande. The Palomas Basin is a typical basin (“graben”) along the rift and contains a thick sequence (several thousand feet) of alluvial sediments that are typical of the Santa Fe Group. Older bedrock occurs beneath the Santa Fe Group. The Santa Fe sediments are dominated by old alluvial fan deposits that originate from the west and that grade into increasingly fine (clay) materials to the east. Well-sorted axial river sands and gravels occur near the Rio Grande.

Table 3-20. Geologic History of the Copper Flat District

Geologic Time (in millions of years before present)	Geologic Settings	Mineralization
Precambrian Era (570-1500)	Metamorphism and intrusion of granites	Not mineralized in project area.
Paleozoic Era (225-570)	Deposition of marine and near-shore clastic and carbonate sediments in bank, platform, and deltaic environments. Limestone and dolomites dominate with lesser shales and evaporites.	Not mineralized during this time period – mineralized during the Cretaceous.
Mesozoic Era (65-225)	Early deposition of shales and sandstones followed by extensive andesitic volcanism, plutonism, and formation of porphyry copper deposits from Arizona to southcentral New Mexico	Extensive mineralization of the andesites and especially the porphyritic intrusives associated with the andesites. Copper and gold/silver mineralization at Copper Flat. Minor lead and zinc replacement mineralization of Paleozoic carbonate rocks near Hillsboro and upper Percha Creek (the Box).
Cenozoic Era (0-65) **Early-Middle Tertiary** (25-40)	Development of large volcanic cauldrons and eruption of extensive volcanic fields of lava and ash. Formation of Emory and Good Sight-Cedar Hills Cauldrons.	Mineralization in gold and silver along ring faults of large cauldrons. Formation of Kingston, Fairview, and Chloride districts.
Late Tertiary (10-25)	Inception of rifting in the Rio Grande Valley. Formation of the present rift valley structure and the Palomas Basin. Deposition of the Rincon Valley Formation of the Santa Fe Group.	No mineralization.
Late Tertiary-Quaternary (1-10)	Entrenchment of the Rio Grande due to renewed rifting. Deposition of the Palomas Formation alluvial fan gravels and sands. Formation of a paleo-graben within Palomas Basin between Copper Flat and Rio Grande.	Formation of the Las Animas placer gold deposits in Greyback Arroyo and Dutch and Hunkidori Gulches.
Quaternary (0-1)	Continued downcutting of streams that flow to the Rio Grande. Formation of paleo-stream terraces and recent stream deposits.	No mineralization.

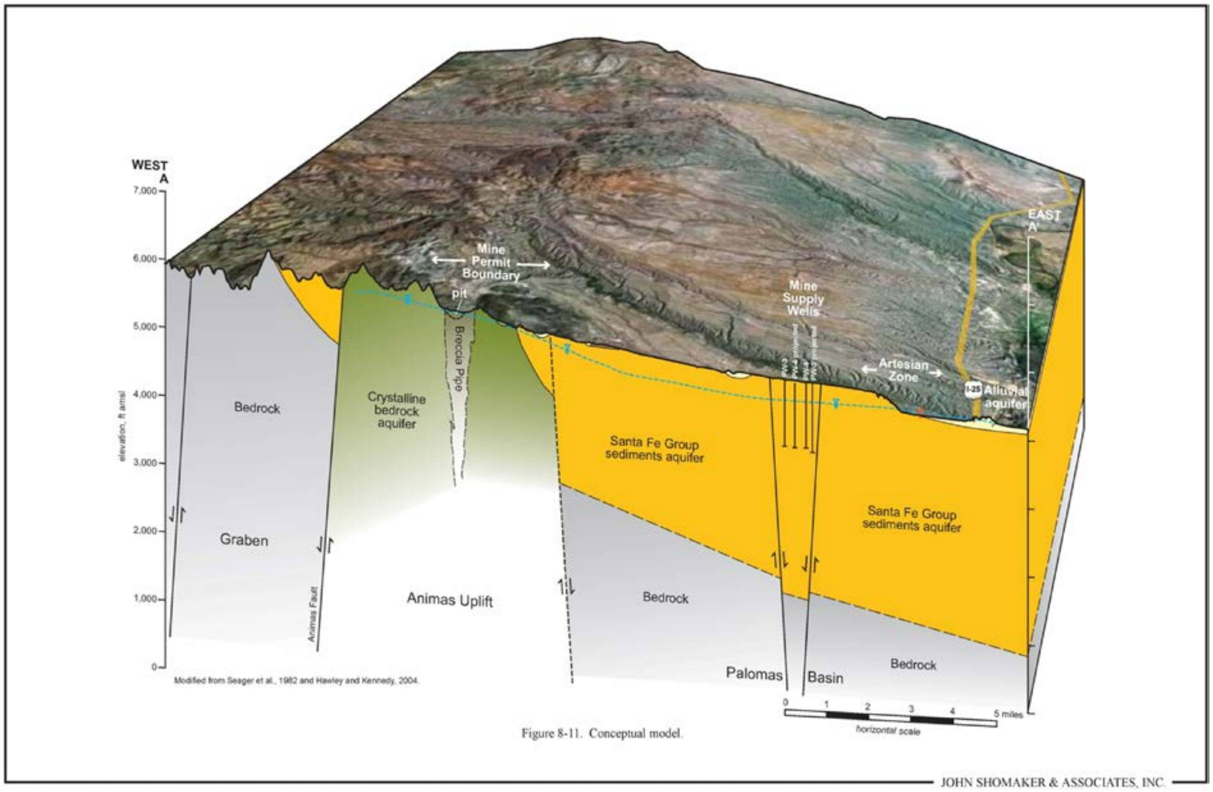
Source: BLM 1999.

Figure 3-23. Geologic Map of Project Area



Source: Modified From JSAI 2012 and Seager et al. 1982.

Figure 3-24. Simplified Geologic Cross Section



Source: Modified from Intera 2012, Figure 8-11.

The Santa Fe Group materials are stratified and in general dip to the east. In some locations, volcanic basalts occur within or atop the Santa Fe Group sediments. Faulting is common within the sediments of the Palomas Basin.

Alluvial valleys: In addition to the 3 north-south geologic zones described above, there are several west-to-east arroyos or valleys which contain thin (up to 50 feet thick) deposits of modern alluvium. These include Greyback Arroyo, which runs through the project site, as well as the drainages of Las Animas Creek to the north and Percha Creek to the south. Sediments in these tributary valleys include channel and floodplain gravels, sands, and silts. Old stream terrace deposits parallel and cap the uplands along many of the drainages. Placer gold has been found at the base of some of these deposits. Thicker (up to a few hundred feet) alluvium trends north to south along the Rio Grande.

3.7.1.2 Mine Area Mineral Resources

McLemore (2001) provides considerable technical detail on the Copper Flat ore deposits. The Cretaceous age volcano that is part of the Animas Uplift is the host rock for the Copper Flat ore body. It lies along a structural lineament that extends to Arizona and along which many other copper deposits are located.

The copper mineralization at Copper Flat is concentrated within a quartz monzonite porphyry that intruded the volcanic vent (in geologic terms, the quartz monzonite rocks are a "stock"). The highest grade ore is found in a breccia pipe (a chimney like structure filled with angular rock fragments) that is near the center of this intrusion. The pipe has been extensively explored with core holes, and is mapped at the land surface as less than 20 acres in extent, and extending more or less vertically to a depth of at least 1,000 feet. Based on analogies to copper deposits elsewhere, the breccia intrusion penetrated upwards to within 1-2 kilometers (km) below the surface of the then active volcano, and has since been exhumed through erosion of the overlying rocks.

Dikes and mineralized veins that radiate out from the breccia pipe along faults and fracture zones; these are mostly oriented northeast-southwest. The veins are locally ore-bearing and have been a primary target of mining in the historic Hillsboro Mining District.

Mineralization related to the intrusion consists chiefly of pyrite (iron sulfide) and chalcopyrite (copper iron sulfide), with lesser amounts of molybdenite and trace amounts of galena and sphalerite. The deposit contains appreciable amounts of silver, gold, and molybdenum. Non-ore minerals present from the original stock include quartz and calcite. The ore body rocks have been eroded to create a topographic low (Copper Flat). Prior to mining, a thin layer of soil and debris ("colluvium") overlay the volcanic bedrock; this is still present in unmined areas.

A relatively thin (20- to 50-foot) cap of leached and oxidized rock was reported to overlie the ore body. This material was stripped during mining activities conducted by Quintana in the early 1980s, and disposed of in waste piles at the mine area. The remaining ore is primarily unoxidized with little secondary enrichment.

3.7.1.3 Earthquake Hazards

The Rio Grande Rift is a zone of moderate seismicity, with frequent small to moderate earthquakes observed in the Socorro area. The BLM (1999) indicates that no active faults have been identified at the project site. Table 3-3 of that document indicated that the nearest earthquake of magnitude 5.0 or above was 65 miles from the site (in the Socorro area), with an effective peak horizontal ground acceleration at the mine area of 0.02g. An 1887 quake of magnitude 8.0 at a distance of 155 miles had an acceleration of 0.03g. Similar distant seismic activity can be expected in the future.

3.7.2 Environmental Effects

This section presents the analysis of environmental effects resulting from implementation of the Proposed Action and three alternatives.

3.7.2.1 Proposed Action

Long-term, major, large extent, probable, and adverse effects would be expected under the Proposed Action which would remove a large quantity of existing geologic materials; 152 million tons of ore and other material would be extracted during the life of the mine. The total quantity of waste generated is estimated at 37 million tons. Land disturbance would be 1,586 acres, of which 745 acres would be on public land. The pit area would be approximately 169 acres with a bottom about 900 feet below ground surface. The possibility exists that the steep side slopes of the pit would be subject to ongoing erosion or mass wasting, leading to accumulation of material in the pit bottom. Overall, impacts would be significant.

3.7.2.1.1 Mine Development/Operation

The primary impact to geology from the Proposed Action would be caused by enlargement of the existing pit, removal of copper bearing ore and associated material, creation of new surficial materials in the form of waste rock piles and tailings, and overall site disturbance.

Based on the analysis in BLM (1999), there would be no loss of placer gold facilities, as most placer workings are already covered by the current tailings facility, and the remaining resources are not economically recoverable at current gold prices. Waste piles are not projected to cover any known mineral resources.

The BLM (BLM 1999) reported on the potential that a major earthquake could impact the site, with the primary concern being potential failure of the tailings dam. The following is quoted from that document (p. 4-1) and is based on an evaluation by Quintana consultant SHB (SHB 1980).

> SHB "estimated that a magnitude 6.0 earthquake 15 miles from the site is the most conservative maximum credible earthquake predicted for the mine area. This would result in an estimated P-wave acceleration of 0.15 times the acceleration of gravity at the site of the TSF. The evaluation of SHB (SHB 1980) compared the proposed TSF dam at Copper Flat to similar Chilean tailings dams and hydraulic fill and sandy embankments that have experienced earthquakes. Their evaluation indicated that the proposed tailings dam should experience only cracks and that major liquefaction flow would not be expected under the maximum credible earthquake for the project site. Buildings and structures located at the mine area would be designed to meet the New Mexico State Engineer's Office seismic design criteria".

3.7.2.1.2 Mine Closure/Reclamation

No impacts to geology or mineral resources are anticipated as a result of mine decommissioning, removal of facilities, dewatering of the tailings facility, or reclamation of waste rock disposal areas.

3.7.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Long-term, major, large extent, probable, and adverse effects would be expected under Alternative 1. Impacts to geology from Alternative 1 would be identical in character to those that would result from the Proposed Action. The dimensions of the impact would vary slightly. For Alternative 1,163 million tons would be extracted during the life of the mine. The total quantity of waste generated is estimated at 60 million tons. Land disturbance would be 1,401 acres, of which 644 acres would be on public land. The pit area would be approximately 156 acres with a bottom about 900 feet below ground surface. All other impacts described in Section 3.7.2.1, Proposed Action, would also apply to Alternative 1. Overall, impacts would be significant.

3.7.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Long-term, major, large extent, probable, and adverse effects would be expected under Alternative 2. Impacts to geology from Alternative 2 would be identical in character to those that would result from the Proposed Action. The dimensions of the impact would vary somewhat. For Alternative 2, 161 million tons would be extracted during the life of the mine. The total quantity of waste generated is estimated at 33 million tons. Land disturbance would be 1,444 acres, of which 630 acres would be on public land. The pit area would be approximately 161 acres with a bottom about 1,000 feet below ground surface. All other impacts described in Section 3.7.2.1, Proposed Action, would also apply to Alternative 2. Overall, impacts would be significant.

3.7.2.4 No Action Alternative

Under the No Action Alternative, there would be no impacts of mining on the pit or other site conditions. Impacts from ongoing abatement of contamination at the existing tailing piles are not relevant to geologic resources as discussed above.

3.7.3 Mitigation Measures

While NMCC would apply BMPs to its operations, such practices would not be considered as mitigation of the impacts to geology discussed above.

3.8 SOILS

Mineral and geologic resources are described in both their existing condition and the predicted effects from the Proposed Action and alternatives in the following sections: 3.7.1, Affected Environment; 3.7.2, Environmental Consequences; and 3.7.3 Mitigation Measures.

3.8.1 Affected Environment

Soil is a collective term for the inorganic and organic substrate covering bedrock in which vegetation grows and a multitude of organisms reside. Soils are surveyed nationwide by county. Soil resources provide a foundation for both plant and animal communities by establishing a substrate for plant growth and vegetative cover for animal habitat and feeding. These resources are equally important in both terrestrial and aquatic environments.

Soil properties at any given site are determined by five factors: 1) physical and mineralogical composition of the parent material; 2) climate under which the soil material accumulated and has existed since accumulation; 3) plant and animal life atop and within the soil; 4) topography, or the "lay of the land"; and 5) length of time that these forces of soil formation have acted on the parent material.

3.8.1.1 Soil Associations

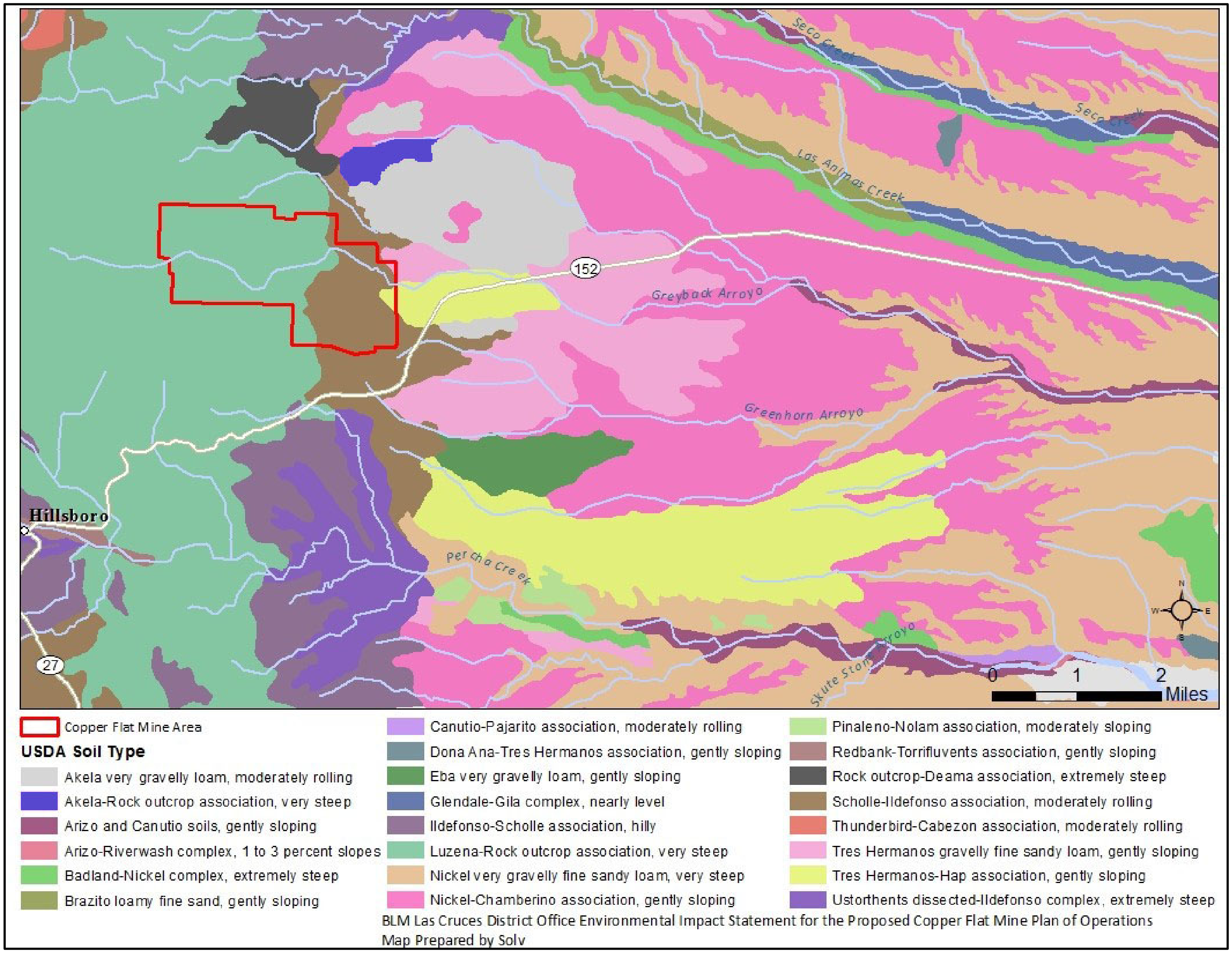
Based on a Natural Resource Conservation Service (NRCS) soil survey, four soil associations are present within the proposed mine area, as shown in the figure below. (See Figure 3-25.) Descriptive and interpretive data for each soil association was derived from the *Soil Survey of Sierra County, New Mexico* (NRCS 1984) and summarized on the table below. (See Table 3-21.) Vertical soil profiles for each soil association are detailed in NRCS (1984).

The largest portions of the proposed mine area are classified as the Luzena-Rock Outcrop association, very steep; and the Scholle-Ildefonso association, moderately rolling. The Tres Hermanos gravelly fine sandy loam, gently sloping; and the Tres Hermanos-Hap association, gently sloping, are also found on smaller portions of the site.

The Luzena-Rock Outcrop association is located on the westernmost portion of the proposed mine area and encompasses the largest portion of the site. The Luzena-Rock Outcrop association occurs on hills and low mountains with slopes ranging from 5 to 55 percent. Luzena-Rock Outcrop association soils are generally shallow, approximately 14 inches deep with very gravelly and cobbly loams and clay loams, and with 30 percent of the surface consisting of stone, cobbles, and gravel. The native vegetation that typically establishes on these soils consists predominantly of a variety of grasses and scattered shrubs and juniper.

Further east, the proposed mine area lies within the Scholle-Ildefonso association. This soil occurs on gentle slopes, piedmonts, and mountain toe slopes, with slopes ranging from 1 to 15 percent. This soil consists of a mixture of alluvium and various textures that include gravelly to very gravelly loams and clay loams. These soils are greater than 60 inches deep and are well-drained. The native vegetation that typically establishes on Scholle-Ildefonso association soils consists primarily of grass species.

Figure 3-25. Soils at the Proposed Copper Flat Mine Area



Source: USDA 2011.

Table 3-21. Summary of Soils in the Copper Flat Mine Area

Table 3-21. Summary of Soils in the Copper Flat Mine Area											
Soil Survey Map ID	**Soil Association**	**Soils**	**Depth to Calcium Carbonate in profile (in)**	**Depth to Bedrock (in)**	**Slope (%)**	**Available Water Capacity[1]**	**Surface Layer pH**	**Topsoil**	**Water Erosion Hazard[2]**	**Wind Erosion Hazard**	**Suitability for Reclamation[3]**
4	Akela	Akela very gravelly loam	3	4-20	1-15	0.07-0.09	7.4-8.4	Poor	0.10	Very slight	Poor
13	Arizo and Canutio soils	Arizo very gravelly sandy loam	0	>60	1-9	0.05-0.07	7.4-8.4	Poor	0.10	Moderate	Limited
		Canutio very gravelly sandy loam	0	>60	1-9	0.04-0.08	7.9-8.4	Poor	0.10	Moderate	Limited
16	Badland-Nickel complex	Badland	N/A	>60	35-150	N/A	N/A	N/A	N/A	N/A	Not rated
		Nickel very gravelly fine sandy loam	0	>60	15-55	0.07-0.09	7.4-8.4	Poor	0.10	Moderate	Poor
23	Brazito	Brazito loamy fine sand	0	>60	0-5	0.06-0.10	7.4-8.4	Fair	0.20	High	Limited
26	Canutio-Pajarito association	Canutio very gravelly sandy loam	0	>60	1-5	0.04-0.08	7.9-8.4	Poor	0.10	Moderate	Limited
		Pajarito gravelly sandy loam	0	>60	1-9	0.09-0.11	7.4-8.4	Fair	0.15	Moderate	Limited
37	Glendale-Gila complex	Glendale silty clay loam	0	>60	0-3	0.16-0.21	7.9-8.4	Fair	0.37	Moderate	Limited
		Gila very fine sandy loam	0	>60	0-3	0.16-0.18	7.9-8.4	Poor	0.55	High	Limited
53	Luzena-rock outcrop association	Luzena gravelly loam	9	7-20	5-55	0.11-0.12	6.1-7.3	Poor	0.20	Very slight	Poor
		Rock outcrop	N/A	N/A	5-55	N/A	N/A	N/A	N/A	N/A	Not rated

Table 3-21. Summary of Soils in the Copper Flat Mine Area (Concluded)

Soil Survey Map ID	Soil Association	Soils	Depth to Calcium Carbonate in profile (in)	Depth to Bedrock (in)	Slope (%)	Available Water Capacity1	Surface Layer pH	Topsoil	Water Erosion Hazard2	Wind Erosion Hazard	Suitability for Reclamation3
62	Nickel	Nickel very gravelly fine sandy loam	0	>60	10-65	0.07-0.09	7.9-8.4	Poor	0.10	Moderate	Limited
63	Nickel-Chamberino association	Nickel very gravelly fine sandy loam	0	>60	1-7	0.07-0.09	7.9-8.4	Poor	0.10	Moderate	Limited
		Chamberino gravelly loam	1	>60	1-5	0.06-0.10	7.9-8.4	Poor	0.20	Slight	Limited
67	Pinaleno-Nolam association	Pinaleno very gravelly sandy loam	28	>60	3-15	0.04-0.07	6.1-7.8	Poor	0.10	Moderate	Limited
		Nolam very gravelly loam	8	>60	1-7	0.04-0.06	7.9-8.4	Poor	0.10	Very slight	Limited
76	Scholle-Ildefonso association	Ildefonso gravelly loam	0	>60	1-15	0.06-0.08	7.4-8.4	Poor	0.20	Slight	Limited
		Scholle very gravelly loam	10	>60	1-15	0.09-0.12	7.4-7.8	Poor	0.10	Very slight	Limited
79	Thunderbird-Cabezon association	Thunderbird loam	N/A	20-40	1-10	0.16-0.18	6.6-7.8	Poor	0.37	Slight	Limited
		Cabezon gravelly clay loam	N/A	4-20	1-15	0.13-0.15	6.1-7.3	Poor	0.15	Very slight	Limited
81	Tres Hermanos	Tres Hermanos gravelly fine sandy loam	0	>60	1-9	0.11-0.13	7.4-8.4	Poor	0.15	Moderate	Limited
82	Tres Hermanos-Hap association	Tres Hermanos gravelly loam	0	>60	1-10	0.11-0.13	7.4-8.4	Poor	0.20	Slight	Limited
		Hap very gravelly loam	20	>60	1-7	0.10-0.14	6.6-7.3	Poor	0.10	Very slight	Limited

Source: NRCS 1984.

Notes: [1] Inches of water per inch of soil.

[2] Values range from 0.02 to 0.69; the higher the value, the more susceptible to water erosion.

[3] Based on the requirements for rangeland seeding.

A very small portion on the easternmost portion of the proposed mining area lies within the Tres Hermanos gravelly fine sandy loam, gently sloping, and Tres Hermanos-Hap association, gently sloping. Tres Hermanos soils are deep and well-drained. They typically have a light brown gravelly sandy loam or sandy clay loam surface layer about 8 centimeters (cm) (3 in) thick. The subsoil is reddish brown calcareous gravelly light clay loam about 60 cm (24 in) thick. The substratum to more than 150 cm (60 in) is a very gravelly loam high in lime. Tres Hermanos soils occur on fan terraces with slopes of 2 to 15 percent. These soils have moderate available water capacity, moderate permeability and moderate shrink-swell. They are moderately alkaline and calcareous throughout. Runoff is medium to rapid and the hazard of erosion is moderate.

Ten additional soil units occur outside the mine area that may be affected by project actions. Soils along Las Animas Creek are the Badland-Nickel complex, extremely steep; the Glendale-Gila complex, nearly level; and the Brazito loamy fine sand, gently sloping. Soils along Percha Creek are the Nickel very gravelly fine sandy loam, very steep; the Pinaleno-Nolam association, moderately sloping; the Badland-Nickel complex, extremely steep; the Arizo and Canutio soils, gently sloping; the Canutio-Pajarito association, moderately rolling, the Thunderbird-Cabezon association, moderately rolling, and the Akela very gravelly loam, moderately rolling. Soils in between the two creeks, including along NM-152, are the Tres Hermanos-Hap association, gently sloping; the Akela very gravelly loam, moderately rolling; the Tres Hermanos gravelly fine sandy loam, gently sloping; the Nickel-Chamberino association, gently sloping; the Nickel very gravelly fine sandy loam, very steep; and the Arizo and Canutio soils, gently sloping.

3.8.1.2 Soil Suitability for Reclamation

The following properties are considered unsuitable criteria when determining what soils are suitable growth medium for reclamation: greater than 60 percent clay, less than 0.5 percent organic matter content, greater than 35 percent coarse material by volume, salinity values greater than 15 milliohms per cm, greater than 15 percent sodium adsorption ratio, pH values less than 4.5 and greater than 9.0, calcium carbonate content greater than 40 percent, and slope steepness greater than 40 percent (USDA 1993).

Soils in the southwest are dominated by calcium carbonate, too much of which can cause problems for plant establishment. The amount or percent that prohibits seed germination can vary and depends on plant type. However, seed mixes that are used for reclamation comprise a variety of species, including some that could germinate under conditions with calcium carbonate. Caliche is a hardened natural cement of calcium carbonate that binds other materials and generally forms when minerals leach from the upper layer of the soil and accumulate in the lower layers, although it can also be found on the surface. The above referenced standard (USDA 1993) for calcium carbonate is the appropriate standard for considering the suitability of caliche in soil covers.

A successful reclamation program is dependent, in part, upon the quantity and quality of material available for use during the reclamation process. To this end, soil surveys of the Copper Flat baseline study area were conducted to assess the quantity and quality of available topdressing material that would be available for mine reclamation (THEMAC 2011). Three suitability categories were identified based on such factors as slope, texture, sand/silt/clay content, water holding capacity, percent cobbles/boulders, calcium carbonate accumulations, pH, and salinity: good, fair, and unsuitable. Each pedon (defined as the smallest volume of soil that contains all the soil horizons of a particular soil type) included in the NMCC (2012) report received a good or fair rating. The suitability criteria standards for these soil and landscape features have been adapted from those used by the NRCS and MMD. They were modified by project soil scientists to reflect the conditions that exist within the Copper Flat area. Tailings substrata were considered unsuitable as topdressing because of their processed origins, though none of the available element levels were present in amounts likely to be toxic to plants or to bioaccumulate in animals as they were within or below the normal ranges of these elements commonly found in soil (THEMAC 2011).

3.8.2 Environmental Effects

Soils can be altered through three processes: 1) physical degradation, such as wind and water erosion, and compaction; 2) chemical degradation such as toxification, salinization, and acidification; and 3) biological degradation, which includes declines in organic matter, carbon, and the activity and diversity of soil fauna. While there are few applicable regulations regarding soils, proper conservation principles can reduce erosion, decrease turbidity, and generally improve water quality.

3.8.2.1 Proposed Action

Long-term, moderate, of medium extent, and probable adverse effects to soils would be expected under the Proposed Action. Anticipated impacts to soil resources include the potential loss of productive topdressing in disturbed areas, increased wind and water erosion, loss of native soil profiles, and potential for contamination of soils from spills of chemicals during transportation, storage, and use. After closure of the mine and completion of reclamation procedures, soils would be stabilized and largely restored to their pre-mine condition. Overall, impacts of the Proposed Action on soils would be significant.

3.8.2.1.1 Mine Development and Operation

Mine development activities that would remove, compact, and otherwise destroy or disturb soils include drawdown of groundwater, expansion of the existing open pit, and construction of:

- Haul and secondary mine roads;
- WRDFs;
- Low-grade ore stockpiles;
- The mill and associated processing facilities;
- The TSF;
- Ancillary buildings;
- A suitable water supply network;
- Growth media stockpiles; and
- Surface water diversions.

There would be no impacts to soils from the production wells, which already exist. All roads, power lines, and foundations for the production wells are in place. No additional disturbance would occur during the project, and the well area would be left as it currently exists after closure of the mine. Approximately 1,586 acres of soils on both public and private lands would be directly affected. While 910 acres of the proposed mine area have previously been disturbed from past mining activities, the proposed mining activities would impact 676 acres of undisturbed land within this boundary.

The Proposed Action would result in adverse impacts on soils from clearing, grubbing, grading, construction of mine facilities, and mine operation. Mining operations would modify the surrounding landscape by exposing previously undisturbed earthen materials. Erosion of exposed soils, extracted mineral ores, tailings, and fine material in waste rock piles can result in substantial sediment loading to surface waters and drainage ways. In addition, spills and leaks of hazardous materials and the deposition of contaminated windblown dust can lead to soil contamination and toxicity. These impacts would be controlled to an acceptable level through the diligent application of BMPs, which would utilize various measures and structures such as straw bales and silt fencing to minimize the transport and loss of soil from erosion and storm runoff. Sedimentation control structures would be installed prior to construction and a SWPPP in compliance with the USEPA and State of New Mexico requirements would be implemented.

During construction and preparation activities, growth media would be removed and stockpiled wherever possible and reused in the area where it was salvaged. The soils to be removed above the rock layer would be stockpiled and protected for use in reclamation of the site. Caliche, which acts as a moisture holder in desert soil, drying out the soil above, causes problems for plant establishment. Too much caliche, generally greater than 10-20 percent, is not appropriate for surface layers of a soil cover (Vinson 2014). Soils with too much surface caliche result in low plant productivity and diversity; however, where the caliche occurs 5 inches below ground surface, plant growth is not a problem. Thus, a suggested BMP is to stockpile soils with more than 10-20 percent caliche separately from those with less caliche. Then during reclamation, soils with more caliche would be laid down first, and soils that have less caliche laid on the surface.

Measures to stabilize and protect growth medium stockpiles and embankments would be implemented to minimize soil loss and limit disturbance to soils on-site. Any growth media remaining in a stockpile for one or more planting seasons would be seeded with an interim seed mix to stabilize the material by reducing erosion and minimizing establishment of undesirable weeds. Additionally, the establishment of a temporary vegetative cover may aid in reestablishing biological activity in the soil.

Exposure and disturbance of soils could increase the potential for accelerated soil erosion from sites affected by construction. Construction and mining activities would impede soil development, including soil structure and profile development. Excavation, transportation, and placement of growth medium also could promote the breakdown of soil aggregates into loose soil particles, increasing the potential for wind and water erosion of stockpiled soils. Blading or excavation of remaining subsoil materials to achieve desired grades and soil conditions for the facilities could result in steeper slopes on exposed soils, mixing of soil materials, and the additional breakdown of subsoil aggregates. Soil biological activity (especially with mycorrhizea-root association) and nutrient cycling would be substantially reduced or eliminated during stockpiling as a result of anaerobic conditions created in deeper portions of the stockpiles.

Although stripping, stockpiling, and redistribution adversely affect soil characteristics, including alterations of soil profiles and soil structures, the benefits of using soil for revegetation outweigh the adverse effects of soil handling. Reclamation and revegetation efforts would return some areas of soil disturbance to a productive state following construction, thereby reducing the duration and magnitude of impact. Loss of soil or discontinuation of natural soil development, decreased infiltration and percolation rates, decreased available water-holding capacities, breakdown of soil structures, and loss of organic material as a result of the Proposed Action would be lessened by natural soil development over the long-term.

Mining dust changes the texture of soils as does the addition of contaminants like metals. Acid mine drainage is a potentially severe pollution hazard that can contaminate surrounding soil, groundwater, and surface water. Runoff from mines into surrounding environments alters the pH of the receiving soils, contaminates soils with trace elements, and ultimately deteriorates soil fertility. Runoff protections would be in place in accordance with the stormwater management plan that would prevent pollution that may cause an exceedance of the applicable standards (see Section 3.4.2.1.2, Mine Closure/Reclamation, under the subtitle *Non-point Source Pollution from Disturbed Areas on the Mine Area*). Studies have shown that trace metals remain in the soil for a long time, ranging from hundreds to thousands of years. Direct impacts to soil from the release of mill reagents or leach solutions during operation of the facility would be minimized with the continued use of the spill prevention and dust control measures that are currently in place.

If pit water is used for dust suppression, high TDS, sulfates, metals, etc. contained in the water would contaminate soils. Such impacts could range from negligible to moderate depending on contaminant concentrations. Any water used for dust suppression would be tested pursuant to the DP and no water containing high levels of the listed contaminants would be used for dust suppression. For application of impacted water for dust suppression inside the pit lake area, pit water can be applied as dust suppression without treatment as long as this water is applied inside the hydrologic containment area. If the impacted water adversely affects the soils to a condition that could not support vegetation, then the application of 36 inches of growth media at feasible reclamation areas (24 inches over foundations or concrete) would likely be required. Outside of the hydrologic containment area, NMCC's DP would likely include limitations on the quality of water that could be used for dust suppression. Any surface runoff from dust suppression would need to be contained such that it would not impact surface waters.

Potential indirect effects of soil destabilization and erosion would be dust generation and off-site deposition. Wind erosion of disturbed soils could result in deposition of soil particles off-site. Off-site stream sedimentation would be minimized by the use of erosion control practices such as the placement of sediment catchment basins around the base of soil stockpile and dump slopes. Dust generated by vehicular traffic would be reduced by using dust abatement techniques such as the application of wetting and binding agents on haul roads. Erosion from growth medium stockpiles would be kept at a minimum with the practice of interim seeding.

Mining operations would involve the drawdown of groundwater. However, none of the hydric soils at the mine site or elsewhere in the action area would be affected by that drawdown. Hydric soils in the wetlands along the site's arroyos, streams, and creeks do not rely on groundwater but have an alternative source of water, such as flooding or a perched water table. Two locations within the proposed mine area boundary meet wetland conditions as defined by the Clean Water Act (i.e., dominance by hydrophytic vegetation, hydric soils, and wetland hydrology). One of these areas is a small cattail wetland adjacent to the pit lake. This wetland is not considered jurisdictional because there is no significant connection to a jurisdictional, navigable waterway. The second area, a small patch that may meet the general wetland criteria that is dominated by Goodding's Willow, is located within the mine site in Greyback Arroyo just east of the easternmost land bridge where the pit access road crosses Greyback Arroyo.

Neither of the two wetlands at the mine site would experience hydric soils changes. Hydric soils of the small cattail wetland adjacent to the pit lake would be removed since pumping of the pit lake would be necessary prior to mining and continuously throughout the life of the mine, with bedrock water drawdown in this area greater than 100 feet. (See Figures 3-13a-c.) This small wetland would be mined out when the pit is deepened to 900 feet below the current surface, so no surface soils would remain. The second wetland area, near the main mine entrance, would not be affected by drawdown associated with the Proposed Action because it would be outside of the drawdown area. (See Figures 3-13a-c.) This area overlies the andesite bedrock of the Animas Uplift. As a result, there is no aquifer underlying the surface.

Effects on shallow groundwater (riparian) systems along Las Animas Creek and Percha Creek are projected to be minimal, with a maximum of less than two feet of groundwater-level change on Percha Creek and less than one foot of groundwater-level change on Las Animas Creek (JSAI 2017).

There would be no effects to any hydric soils at Percha Creek near Hillsboro as no water drawdown is expected where they occur. The downstream end of Percha Creek, where drawdown of groundwater in the shallow alluvium could be 0.5 to 1.5 feet by the end of mining, is dominated by upland soils and vegetation. Groundwater drawdown that could affect the shallow alluvium of Percha Creek would not occur in any area of the creek that supports riparian vegetation or hydric soils.

Perched alluvial groundwater under Las Animas Creek has limited hydraulic connection to the main aquifer that would be directly impacted by pumping of the supply wells. Hydrology within the perched layer reflects localized conditions such as seepage from irrigation canals and irrigated fields, and pumping of small capacity private wells. The groundwater model predicts drawdown in the shallow alluvium along Las Animas Creek to be unmeasurable after mining ceases. Because the groundwater drawdown of the shallow alluvium (12 AFY) would be so small relative to depletion of groundwater and the existing flow plus ET of the vegetation (4,848 AFY), there would be no change to the riparian plant community or any hydric soils adjacent to Las Animas Creek.

Modeling analysis indicated that pumping of the aquifer for dewatering for mine operations would not affect hydric soils, surface water, or riparian vegetation in the Greyback Arroyo or its tributaries, Warm Springs and Cold Springs canyons. The riparian vegetation and associated hydric soils along Greyback Arroyo is typical of ephemeral floodplains. There is no phreatophytic vegetation, which depends on groundwater, because the water depth is far below rooting depth. There is no reasonable basis to expect impacts on hydric soils in Warm Springs, Cold Springs, or the canyons fed by these springs.

3.8.2.1.2 Mine Closure/Reclamation

Although the original physical structure of the landscape post-mining may be irreplaceable, the Copper Flat project site would be reclaimed to achieve a self-sustaining ecosystem appropriate for the climate, environment, and land uses of the area. The New Mexico Mining Act requires the preparation of a reclamation plan for submittal and approval. The objective of the reclamation plan is to return the project site to conditions similar to those present before reestablishment of the mine. The reclamation plan is summarized in Chapter 2 of this document.

Contemporaneous reclamation of disturbed surface areas would be an integral part of the mining operation. Because concurrent reclamation reduces erosion, provides early impact mitigation, limits costs, and reduces final reclamation work, NMCC would maximize this type of reclamation at the Copper Flat project. Additionally, upon closure of the mining operations, previously unreclaimed facilities would be reclaimed.

As part of reclamation operations, disturbed areas would be stabilized by grading with earth-moving equipment to conform to the geomorphic character of the region and the surrounding area, including shaping, berming, and grading to final contour. Slope reclamation would incorporate the practice of minimizing slope lengths and gradients, while conforming to the geomorphic character of the surrounding areas to minimize the potential for excessive erosion. Both runoff and “run-on” (surface water running onto an exposed site) would be diverted from reclaimed areas to prevent erosion. Re-establishing vegetation would serve to stabilize underlying soils.

With sufficient growth medium material available, up to 36 inches would be placed during reclamation, unless NMCC can demonstrate that a thinner cover would resist erosion, sustain vegetation, and be equally protective of groundwater. Soils to be salvaged for reclamation cover that are deficient in nitrogen, phosphorus, and potassium would require over 25,000 pounds per acre of amendments to create fertile growth media.

After soil redistribution, biological activity in soils would slowly increase, eventually reaching pre-salvage levels. Placement of soil over waste rock would change the character and texture of the original soil profiles. Although new soil profiles would develop over time, the original character of the native soil would be permanently changed.

Reclamation vegetation rooting depth and the available water-holding capacity of the soil may be limited in the growth medium. Ripping or otherwise loosening compacted surfaces prior to placement of growth medium and revegetation would aid in reclamation by reducing the interface between the compacted surface and growth medium, increasing the rooting depth and water-holding capacity of the growth medium at the reclaimed site. Loss of soil fertility, soil microorganisms, and vegetative productivity would be minimized after successful reclamation. Reclaimed areas would be susceptible to erosion until the site stabilizes over time.

The Proposed Action would use the upstream construction method for the tailings dam embankment. There are a number of common failure modes to which embankments may be vulnerable. These include slope failure from rotational slide, overtopping, foundation failure, erosion, piping, and liquefaction. Each failure mode may result in partial or complete embankment failure (USEPA 1994). Routine monitoring and preventive maintenance are crucial in order to assure proper performance of TSFs. The OSE would approve the safety aspects of the dam.

3.8.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Long-term, moderate, of medium extent, and probable adverse effects to soils would be expected under Alternative 1. Implementation of Alternative 1 would result in the disturbance or loss of up to 1,401 acres of soils over the life of the mine. Direct effects on soil resources would be similar to those described under the Proposed Action and include the potential loss of productive topdressing in disturbed areas, increased wind and water erosion, loss of native soil profiles, and potential for contamination of soils from spills of chemicals during transportation, storage, and use. Within these areas, soils would likely be destroyed or disturbed and would require diligent implementation of the BMPs, SWPPP, Mining Operations and Reclamation Plan (MORP), and mitigation measures to contain and minimize this impact. Overall, impacts of Alternative 1 on soils would be significant.

Mine closure and reclamation effects would also be similar to those described under the Proposed Action. Alternative 1 would use the centerline construction method for the tailings dam embankment. Potential effects include the chance for failure of the embankment due to seepage from the TSF. The OSE would approve the safety aspects of the dam.

3.8.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Long-term, moderate, of medium extent, and probable adverse effects to soils would be expected under Alternative 2. Implementation of Alternative 2 would result in the disturbance or loss of up to 1,444 acres of soils over the life of the mine. Direct effects on soil resources would be similar to those described under the Proposed Action and include the potential loss of productive topdressing in disturbed areas, increased wind and water erosion, loss of native soil profiles, and potential for contamination of soils from spills of chemicals during transportation, storage, and use. Within these areas, soils would likely be destroyed or disturbed and would require diligent implementation of the BMPs, SWPPP, and mitigation measures to contain and minimize this impact. Overall, impacts of Alternative 2 on soils would be significant.

Mine closure and reclamation effects would also be similar to those described under the Proposed Action. Alternative 2 would use a centerline construction method for the tailings dam embankment. Potential effects include the chance for failure of the embankment due to seepage from the TSF. The OSE would approve the safety aspects of the dam.

3.8.2.4 No Action Alternative

Under the No Action Alternative, there would be no disturbance of soils from clearing, grubbing, grading, and other project-related activities at the mine area. No soils would be disturbed or removed, except for removal and/or treatment of contaminated soils that are described in the Stage 1 Abatement Plan (JSAI 2013a). Impacts from abatement would be short-term, minor, of small extent, probable, and adverse. The

No Action Alternative would otherwise not have any new impacts on soils. The same current conditions and impacts would still occur (i.e., pollutant migration through wind and water). Groundwater pumping would not occur. Therefore, there would not be any mining-produced impacts to riparian soils and vegetation. Current pit water would not be used for dust suppression and pollutants within pit water would not be introduced on the soil surface. Additional acreage of soil disturbance would not occur and would remain in its current condition. Overall, impacts would not be significant.

3.8.3 Mitigation Measures

BMPs would be used to limit erosion and reduce sediment in precipitation runoff from proposed project facilities and disturbed areas during construction, operations, and initial stages of reclamation. BMPs that would be used during construction and operation to minimize erosion and control sediment runoff would include:

- Surface stabilization measures – dust control, mulching, riprap, temporary and permanent revegetation/reclamation, and placing growth media;
- Runoff control and conveyance measures – hardened channels, runoff diversions;
- Sediment traps and barriers – check dams, grade stabilization structures, sediment detention, sediment/silt fence and straw bale barriers, and sediment traps;
- Application of water to control dust on haul roads and other disturbance areas;
- All disturbed areas would be regraded and shaped to a final contour that achieves positive drainage and reconstructs slopes with lengths and gradients that would provide long-term stability;
- Revegetation of disturbed areas would reduce the potential for wind and water erosion;
- Following construction activities, areas such as cut and fill embankments and growth media/cover stockpiles would be seeded as soon as it is practicable and safe;
- Contemporaneous reclamation would be maximized to the extent practicable to accelerate revegetation of disturbed areas; and
- All sediment and erosion control measures would be inspected periodically and repairs performed as needed.

3.9 HAZARDOUS MATERIALS AND SOLID WASTE/SOLID WASTE DISPOSAL

Hazardous materials and solid waste/solid waste disposal information is described for both the existing condition and the predicted effects from the Proposed Action and alternatives in the following sections: 3.9.1, Affected Environment; 3.9.2 Environmental Consequences; and 3.9.3 Mitigation Measures.

3.9.1 Affected Environment

Existing conditions at the mine site that would be affected by the Proposed Action and alternatives are described below.

3.9.1.1 Mine Area

Previous mining operations utilized hazardous materials and generated non-hazardous and hazardous wastes. After mining operations ceased in 1982, the mine facilities remained on a "care and maintenance" status until 1986, when the facilities were sold and dismantled and the site was reclaimed (BLM 1999). All on-site surface facilities were removed; however, some of the former infrastructure, including building foundations, power lines, and water pipelines, were left in place.

NMCC has no record, nor is there any evidence, of a landfill on-site. There is no evidence of previous hazardous material spills, and there are no stored chemicals remaining on-site. Neither hazardous nor non-hazardous waste are currently generated or disposed of at the site. The private land is not open to the public for safety and security reasons. Gates and fences have been installed within patented land boundaries. Existing diversion ditches and berms prevent stormwater from outside of the mine areas from contacting the disturbed areas of the mine site by routing stormwater from the west around the mine and back to the natural surface water course at a location near the tailings facility.

Applicable regulatory requirements: Federal, State, and local regulations establish management and reporting requirements for hazardous materials and solid waste that would be applicable to the proposed project. The statutes to be followed would include, but would not be limited to:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (40 CFR 300);
- Oil pollution prevention (40 CFR 112);
- RCRA (disposal of solid and hazardous waste) (40 CFR 258 - 40 CFR 272);
- Hazardous Materials Regulations 49 CFR Subtitle B (hazardous materials and oil transportation);
- Chapter 74, Article 4 NMSA 1978 of the New Mexico Hazardous Waste Act;
- 20.7.3 NMAC (liquid waste disposal and treatment regulations);
- 20.5 NMAC (aboveground and underground storage tank regulations);
- 20.4.1 NMAC (hazardous waste management);
- 20.9 NMAC (solid waste management rules); and
- 92.011 Sierra County Ordinance (waste disposal requirements).

Hazardous materials: Specific hazardous materials and quantities to be used during operations would be determined prior to the beginning of mining operations. Issues relating to the presence of hazardous materials may include the accidental releases of these materials during transportation, storage, handling, and use at the Copper Flat project. The environmental resources that could be potentially affected by these hazardous materials if they are accidentally released include air, water, soil, and ecological resources. Such a release could also impact human health and safety as discussed in Section 3.24, Human Health and Public Safety.

The following materials would commonly be utilized during mine operations:

- Fuels – diesel fuel, gasoline, oils, greases, anti-freeze, and solvents used for equipment operation and maintenance;
- Propane;
- Degreasing solvents;
- Plant reagents – sodium hydrosulphide, sodium hydroxide, acids, flocculants, and antiscalants used in processing plant applications;
- Blasting agents – ammonium nitrate, fuel oil, ANFO, emulsions, blasting caps, initiators and fuses, and other high explosives used in blasting; and
- Others – assay chemicals, and other hazardous waste generated primarily through use and disposal of the hazardous materials.

All petroleum products and reagents used would be stored in aboveground storage tanks (ASTs) within secondary containment as required by Federal, State, and local requirements and regulations. ASTs would be registered with the NMED Petroleum Storage Tank Bureau and an AST operations and maintenance plan would be developed per NMAC 20.5.5.9 for AST systems. The anticipated volume of diesel stored at the site would be less than 500,000 gallons, to be contained in two 248,690-gallon ASTs constructed per 20.5.4 NMAC. The tanks would be installed on lined pads, which would consist of gravel underlain by a plastic liner. The pad area would be surrounded by berms to provide secondary containment for the largest vessel in case of rupture. Surface piping would lead from each tank to the fuel dispensing area. The refueling hoses would be equipped with overflow prevention devices and secondary containment. Fuel oil would be kept in a 7,106-gallon-capacity tank (10 feet tall with an 11-foot diameter) and would also be surrounded by secondary containment constructed of a geo-synthetic membrane with a minimum thickness of 60 mils, plus 10 percent to account for potential stormwater that may be present. The secondary containment system would be in compliance with the current edition of an industry standard or code of practice developed by the NMED as detailed per 20.5.4 NMAC.

Antiscalants, or chemicals used in the mineral separation frothing process, would be used during mining operations. Less than 2,000 gallons of antiscalants would be stored in appropriate ASTs that meet industry standards.

Blasting components including ammonium nitrate and diesel fuel would be stored on-site in bins and tanks per regulatory standards. NMCC anticipates utilizing two explosives magazines (one for boosters and one for blasting caps), each no larger than 8 feet by 8 feet with 1,000-pound capacities. In addition, NMCC would utilize one 75-ton-capacity, 3,000-square-foot silo for storage of ammonium nitrate. All explosive materials would be stored away from the plant site in compliance with MSHA, SMI regulations, the NMAC 20.4.2 Hazardous Waste Permit and Corrective Action Fees, and U.S. Department of Homeland Security requirements. Proper inventory records of daily transactions would be maintained, and regular inspections would be conducted.

Reagents would be maintained in the reagent building, a structure made with concrete block walls and a metal roof, slab on grade construction, and a 6-inch-thick concrete floor. On-site reagent storage would include the following:

- Lime storage: A 200-ton-capacity silo (24 feet tall and 20 feet in diameter) would funnel lime into a lime feed pump tank and from there into two holding tanks.
- Xanthate (K.Amyl) (or equivalent): Flotation reagent Xanthate would be kept in drums and transferred to a mixing tank, then to a holding tank, and finally to the head tank.
- AEROFLOAT 238 (or equivalent): Aerofloat is used as a flotation promoter. It would be received in 50-gallon drums with a storage capacity of 2,800 gallons. It would be kept in drums and transferred to a mixing tank, then to a holding tank, and finally to a head tank.
- MIBC (or equivalent): MIBC would be transferred from trucks to a holding tank and, as needed, to a head tank.
- AERODRI 100: Used as a filter and dewatering aid, Aerodri 100 would arrive on-site in 500-pound drums. The reagent would be fed directly from the drums into the milling process.
- Sulfuric Acid: Use of small amounts (less than 100 pounds) of sulfuric acid would be limited to the laboratory.

Empty reagent drums would not be disposed of on-site but would be recycled by the reagent supplier. Per 40 CFR 273, empty drums would not be stored to await pick up for a period of longer than 1 year.

A nuclear density gauge would be used to measure slurry density during processing. NMCC would not provide or use the gauge. The gauge would be used on-site by an appropriately licensed contractor per the safety and regulatory requirements of the Nuclear Regulatory Commission and other Federal and State requirements.

Hazardous waste: The Copper Flat facility would be a small quantity generator of hazardous waste as defined in 40 CFR 260.10. Small quantity generators generate more than 100 kilograms, but less than 1,000 kilograms, of hazardous waste per month. The generation of small quantities of hazardous waste at the facility would occur through the life of the project. Management of hazardous materials at the Copper Flat mine area would comply with all applicable Federal, State, and local requirements. Requirements include the inventorying and reporting requirements of Title III of CERCLA, also known as the Emergency Planning and Community Right to Know Act, and in accordance with regulations identified in 40 CFR 262 Standards Applicable to Generators of Hazardous Waste and 20.4.1 NMAC, Hazardous Waste Management.

Non-hazardous solid waste: Non-hazardous solid wastes that would be generated at the site include waste paper, wood, scrap metal, used tires, and other domestic trash. Liquid waste would include sanitary waste and separated water from mobile equipment washing. Non-hazardous waste generated during mining operations would be recycled or placed in a permitted State and county-approved on-site Class III solid waste landfill on private land that would operate for the life of the mine. Materials that are recyclable, such as scrap metal, would be sold and transported off-site. Sanitary liquid waste would be handled and disposed of through two existing septic tanks and a leach field system permitted by the NMED.

3.9.1.2 Transportation

Access from the site is by 3 miles of all-weather gravel road and 10 miles of paved highway (NM-152) east to I-25, near Caballo Reservoir. The 10 miles on NM-152 to I-25 is a two-lane highway that is mostly straight and relatively flat and does not include any sharp turns or significantly adverse grades. I-25 is the primary north-south interstate highway. There are no perennial water crossings between the mine area and I-25 on NM-152. I-25 crosses the Rio Grande south of Caballo Reservoir.

The transport of hazardous materials and hazardous wastes on public roadways is controlled by U.S. DOT regulations. Any transport of such materials to or from the mine site must be done in compliance with these regulations to protect public safety. All hazardous materials and waste would be transported by commercial carriers contracted by NMCC in accordance with the hazardous substances shipping requirements of CFR Title 49 and in compliance with the Federal Motor Carrier Safety Regulations of the DOT, parts 383, 390, 397, and 399.

In the event of a release, the transportation company would be responsible for response and cleanup. NMCC would specify that the contract carriers be licensed and inspected as required by the New Mexico Department of Public Safety/Motor Transportation Division and the DOT. The permits, licenses, and certificates are the responsibility of the carrier. CFR Title 49 requires that all shipments of hazardous substances be properly identified and placarded. Shipping documents must be accessible and include safety data sheets that contain information describing the hazardous substance, immediate health hazards, fire and explosion risks, immediate precautions, firefighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

Hazardous wastes would also be transported from the project site to be properly disposed of in accordance with RCRA regulations. Transportation of these waste streams would adhere to all applicable State and Federal regulations including requirements for hazardous waste manifests with shipments, labeling or using placards, and emergency information requirements.

3.9.2 Environmental Effects

The effects on hazardous materials and solid waste/solid waste disposal caused by implementation of the Proposed Action and alternatives are described in the following sections.

3.9.2.1 Proposed Action

Short-term, minor, small extent, possible to unlikely, and adverse effects would be expected under the Proposed Action. The use and management of hazardous materials required for operation of the Copper Flat project are discussed in Sections 2.1.13, Transportation and 2.1.16, Environmental Protection Measures. The short-term minor adverse effects would be limited to an accidental release during standard facility operations and for mine closure and reclamation. No long-term adverse effects would be anticipated due to the required response actions that would be taken in the event of an accidental release. Overall, these impacts would not be significant.

3.9.2.1.1 Mine Development and Operation

Mine development and operations activities would utilize both hazardous and non-hazardous materials and would generate non-hazardous and small amounts of hazardous waste. Because safety measures and compliance procedures imposed by regulations listed in Section 3.9.1, Affected Environment, would be in place for the life of the project, accidental hazardous materials releases would be unlikely. Although a release is unlikely, the potential effect of an accidental release during development and operations would range from not significant to significant depending on the type of material, size, and location of a release.

A spill, release, or discharge of a hazardous or other material or emissions during handling, use, or storage has the potential to cause harm to the environment or to the public. As described in Sections 2.1.13, Transportation and 2.1.16, Environmental Protection Measures, and in conformance with regulatory requirements, measures would be taken for proper management and storage of hazardous materials. Section 3.24, Human Health and Public Safety, also describes the requirements of personnel to handle all hazardous materials. Stormwater would be diverted around mining operations and there would be zero discharge from on-site precipitation; therefore, the potential for a release to impact surface waters on-site are low.

On-site spills: Over the life of the proposed project, small or limited spills of oils and lubricants may occur. These releases could occur during operations, for example, as a result of a bad connection on an oil supply line, from equipment failure, or from mishandling during transfer operations. Impacts of such minor spills could include contamination of surface soils. Spills of this nature would most likely be small, localized, and contained. Potential reagent spills would be contained by curbs in the reagent mixing and storage areas. A floor sump pump would be used to return the spilled material either to the storage tank or into the milling process as necessary. Formal Materials Safety Data Sheets (MSDSs) for the reagents would be posted and readily available, in accordance with MSHA's Hazard Communication for the Mining Industry (30 CFR Part 47).

The potential for spills of both hazardous and non-hazardous materials would be further mitigated with the implementation of a SPCC plan. The SPCC plan describes the reporting requirements and response actions that would take place in the event of a spill, release, or other upset condition, as well as procedures for cleanup and disposal. The plan would be posted and distributed to key site personnel and would be used as a guide in the training of employees. The plan would also address mitigation of potential spills associated with project facilities as well as activities of on-site contractors. The SPCC plan would be reviewed and updated every 3 years at a minimum, and whenever major changes are made in the management of the materials addressed in the plan. Inspection and maintenance schedules and procedures for tanks at the site, as well as all piping connecting the facility with the tailings pond, would be set forth in sections of the SPCC plan addressing hazardous materials and petroleum products. In addition, the implementation of a health and safety manual and hazard communication program would provide employees with education and awareness of hazardous materials management; thereby further minimizing the potential for spills at the mine area.

Transportation spills: In the event of a release, the transportation company, licensed and inspected as required by the New Mexico Department of Public Safety/Motor Transportation Division and the DOT, would be responsible for response and cleanup. Local and regional law enforcement and fire protection agencies also may be involved initially to secure the site and protect public safety. In the event of an accident involving the release of hazardous material, CFR Title 49 Parts 171.15 and 171.16 require that the carrier notify local emergency response personnel and the U.S. DOT National Response Center. Compliance with these and other regulatory requirements are strictly enforced and would be met by NMCC and their contracted carriers, so adverse effects would be unlikely.

Hazardous materials storage would have secondary containment as described in these sections to address spill prevention and materials would be managed and handled per regulations as outlined in this section. The SPCC plan would address spills of not only diesel but all hazardous materials during the operations. The SPCC plan describes the reporting requirements and response actions that would take place in the event of a spill, release, or other upset condition, as well as procedures for cleanup and disposal. A spill, release, or discharge of any hazardous or other material during transportation, if not recovered in a timely manner, has the potential to cause pollution of waters of the State. There is the potential for a release to occur during transport of hazardous material; however, the potential is unlikely, as described below.

Traffic associated with the proposed Copper Flat project is estimated as follows:

- Concentrate shipments: An estimated ten trips per day would be made for the shipment of concentrate (hazard type: heavy metal) by trucks to smelters and port facilities. The miles per trip are estimated to be 41 to the railhead at Rincon, New Mexico.
- Incoming supplies: Vendor, equipment, and service suppliers are anticipated to take in, total, an average of 10 to 15 trips per day by truck to the mine for delivery of gasoline, diesel fuel, explosives, solvents, and other hazardous materials, as well as other miscellaneous supplies, such as office

supplies (NMCC 2012d). The miles per trip will vary depending on the location of the vendor but is assumed to be from El Paso, 125 miles from the site.

- Outgoing waste shipments: The mine is expected to generate only small quantities of hazardous wastes. These would be stored on-site until a sufficient quantity has been accumulated to warrant pickup by a licensed hauler. It is assumed that one pickup per month would be required.

The impact of an accidental release would depend on the location of the release in relation to populations and local activities, the quantity released, and the nature of the released material. The possibility of accidental release during delivery depends on factors such as skill and state of mind of the driver, type and condition of vehicle used for delivery, and traffic conditions and road type. Most of these factors are qualitative and even incidental. This evaluation considers only quantitative factors. The possibility of an accident resulting in the release of a process material, product, or hazardous material was determined by using a national statistical estimated release rate that was based on miles traveled, traffic volumes, and type of roadway (Abkowitz et al. 1984). The rate used is a composite of those factors and is estimated to be 0.28 releases per million vehicle miles traveled. Mileage is estimated to Rincon, New Mexico or to El Paso, Texas.

The potential for releases are as follows:

- Concentrate: 10 trips/day x 365 days/year x 41 miles/trip = 149,650 miles/year x 16 years for operation = 2,544,050 total miles x 0.00000028 = 0.67 releases in 16 years.
- Incoming supplies: 15 trips/day x 365 days/year x 125 miles/trip = 684,375 miles/year x 16 years for operation = 11,634,375 total miles x 0.00000028 = 3.07 releases in 16 years.
- Outgoing waste shipment: 1 trip/month x 12 month/year x 125 miles/trip = 1,500 miles/year x 16 years = 25,500 total miles x 0.00000028 = 0.007 releases in 16 years.

Thus, the potential for an accidental release during transport is estimated to be very low. An accidental release could range from a minor oil spill on the project site where cleanup equipment would be readily available to a large spill during transport possibly involving a release of diesel fuel or other hazardous substance (e.g., concentrate). Some of the chemicals could have immediate adverse effects on water quality and aquatic resources if a spill were to enter a surface water body. However, considering the anticipated transport routes and the small number of river or wetland crossings along the routes, the probability of a spill into a waterway is low. A large-scale release of hazardous liquids delivered to the site by tanker truck (7,500-gallon-capacity), such as diesel fuel, acid, or other hazardous substances, could have implications for public health and safety. The location of the release would again be the primary factor in determining its significance. As indicated, the probability of a release anywhere along a proposed transportation route was calculated to be low, and the probability of a release within a populated area would be lower yet.

In addition to location, the potential hazard presented by the material released is a factor in determining the significance of a release. A qualitative evaluation of the substances to be shipped indicates that the probability of causing significant harm is low for most substances. For example, though some of the material such as ANFO is an explosive, it will only detonate under specific conditions, such as when ignited with detonators, heat, or sudden shock wave in a confined space. Spill situations would be responded to per CFR Title 49 as necessary to prevent or minimize any exposure from occurring, such as by restricting site access and conducting immediate containment and removal. In the event of a release during transport, the commercial transportation company would be responsible for first response and cleanup. Local and regional law enforcement and fire protection agencies also may be involved initially to secure the site and protect public safety. In the event of an accident involving the release of hazardous material, CFR Title 49 Parts 171.15 and 171.16 require that the carrier notify local emergency response personnel and the U.S. DOT National Response Center. Compliance with these and other regulatory requirements would be met by NMCC and their contracted carriers.

As described in Section 2.1.13, Transportation, all hazardous materials and waste would be transported by commercial carriers contracted by the NMCC in accordance with the hazardous substances shipping requirements of CFR Title 49 and in compliance with the Federal Motor Carrier Safety Regulations of the DOT, parts 383, 390, 397, and 399. In the event of a release, the transportation company would be responsible for response and cleanup. NMCC would specify that the contract carriers be licensed and inspected as required by the New Mexico Department of Public Safety/Motor Transportation Division and the DOT. The permits, licenses, and certificates are the responsibility of the carrier. CFR Title 49 requires that all shipments of hazardous substances be properly identified and placarded. Shipping documents must be accessible and include safety data sheets that contain information describing the hazardous substance, immediate health hazards, fire and explosion risks, immediate precautions, firefighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers. Hazardous wastes would also be transported from the project site to be properly disposed of in accordance with RCRA regulations. Transportation of these waste streams would adhere to all applicable State and Federal regulations including requirements for hazardous waste manifests with shipments, labeling or using placards, and emergency information requirements.

3.9.2.1.2 Mine Closure/Reclamation

Surface facilities, equipment, and buildings related to the proposed mining project would be removed as part of reclamation of the mine area after mining operations have ceased approximately 16 years from commencement. All hazardous materials would be removed using management procedures per Federal, State, and local regulatory requirements and as detailed in the SPCC.

Hazardous materials: Regulated hazardous materials on-site at the time of closure would be disposed of as follows:

- Asbestos-containing materials (ACMs) – A detailed survey of ACMs (e.g., pipe and electrical insulation in utility tunnels , siding, hot water heating system insulation, lube system insulation, floor tile) would be conducted prior to demolition. Appropriate controls would be put in place or ACMs would be removed intact, properly packaged, and disposed per NMED regulations and approval in the on-site demolition landfill. ACM locations in the landfill would be noted on the property deed. Any ACMs found in utility tunnels would be sealed before the utility tunnel is sealed.
- Partially used paint, chemical, and petroleum products would be collected and transported to a hazardous waste disposal facility.

The reagent suppliers under contract to NMCC would remove any reagents remaining at closure. It would be the responsibility of the contractor to remove and properly dispose of nuclear density gauges per Federal and State regulations. In many cases, the suppliers of chemicals and equipment would be responsible for furnishing tanks, drums, or other storage devices, and would therefore be required to remove and dispose of those tanks during closure. Those tanks for which NMCC would be responsible would be disposed of as follows:

- Tanks would be cleaned to remove remaining materials and sludge;
- Remaining materials and sludges and wash materials would be sent to an appropriate recycling or waste disposal facility;
- Large ASTs would be tested for lead paint prior to demolition; where found, disposal/recycling would be modified to accommodate the lead content;
- All tanks would be disassembled for disposal or recycling, as appropriate;

- Below-grade foundations would be left in place and buried; and
- Smaller ASTs would be cleaned and removed without disassembly.

No hazardous materials would be disposed of in the on-site landfill. No hazardous materials would remain at the Copper Flat project site.

Non-hazardous solid waste: Demolition waste such as asphalt, metals, and concrete would be removed and recycled to the extent possible. Demolition waste from structure removal that is not recycled would be disposed in the on-site landfill. Once demolition is completed, the solid waste landfill would be closed per NMED Solid Waste Bureau requirements. A post-closure care plan would be submitted as part of the facility permit for the mine landfill meeting the requirements of 20.9.6 NMAC. At closure, septic tanks and leach fields would be decommissioned.

3.9.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Short-term, minor, small extent, possible to unlikely, and adverse effects would be expected under Alternative 1. The effects from mine development, operation, closure, and reclamation would be similar to those outlined under the Proposed Action. Transportation shipments for waste removal and disposal, storage of hazardous materials, accidental spills or releases, and waste generation would be as described for the Proposed Action.

As with the Proposed Action, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current Federal, State, and local regulatory requirements. Primarily because of anticipated compliance with applicable regulations, overall, these impacts would not be significant. BMPs would be identical to those outlined under the Proposed Action.

3.9.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Short-term, minor, small extent, possible to unlikely, and adverse effects would be expected under Alternative 2. The effects from mine development, operation, closure, and reclamation would be similar to those outlined under the Proposed Action. Transportation shipments for waste removal and disposal, accidental spills or releases, storage of hazardous materials, and waste generation would be as described for the Proposed Action. Hazardous materials would be transported and managed in the same way as described in the Proposed Action.

As with the Proposed Action, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current Federal, State, and local regulatory requirements. Primarily because of anticipated compliance with applicable regulations, overall, these impacts would not be significant. BMPs would be identical to those outlined under the Proposed Action.

A packaged wastewater treatment plant would be installed at the mine to accommodate sanitary wastewater generated from the mine office, shower, and restroom facilities. The effluent would be treated, discharged would to the lined TSF, and recycled back to the mill with the tailings process water. Waste solids would be transported for off-site disposal in accordance with applicable regulations.

3.9.2.4 No Action Alternative

No direct or indirect adverse effects would be anticipated during the installation of groundwater wells installed to monitor existing groundwater contamination due to the required response actions that would be taken in the event of an accidental release.

As part of the No Action Alternative BMPs, well installation would be conducted per NMED Monitoring Well Guidelines (Revision 1.1, March 2011) for monitoring well construction to prevent hazardous materials from entering the well or area surrounding the well.

The Stage 1 abatement process would proceed toward a remedy that may involve the handling and disposition of hazardous waste contamination. If the contaminated waste is designated for off-site disposal, the applicable regulations identified above for handling, storage, transport, and disposal would require compliance similar to the Proposed Action and alternatives. The effects would be long-term, minor, of large extent, unlikely, and adverse. If on-site treatment or natural attenuation is selected as a remedy, the potential contact with hazardous wastes is greatly reduced. Overall, impacts would not be significant.

3.9.3 Mitigation Measures

No mitigation measures for hazardous materials management beyond BMPs and regulatory requirements described in the Proposed Action are necessary to minimize the effects for any alternative.

3.10 WILDLIFE AND MIGRATORY BIRDS

This section discusses the predicted effects from the Proposed Action and alternatives on wildlife and migratory birds. Mitigation measures for potential impacts are also discussed.

3.10.1 Affected Environment

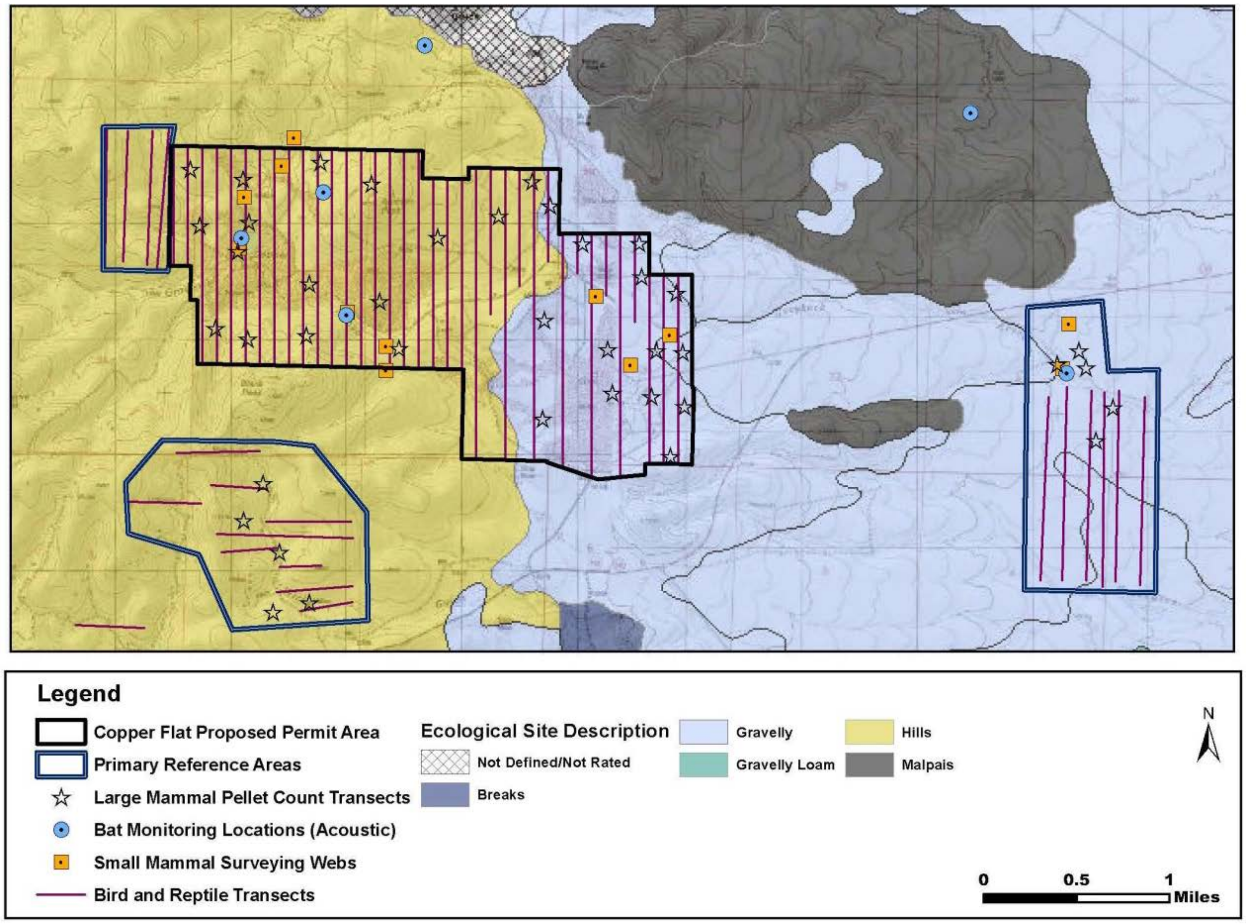
This section describes common wildlife likely to be found in the proposed project area. Special status species that are protected under Federal or State law are discussed in Section 3.12, Threatened, Endangered, and Special Status Species.

A wildlife assessment was conducted by Parametrix Inc. in 2011 for the proposed mine project that included three target areas: 1) the Copper Flat mine area; 2) off-site reference areas; and 3) surrounding riparian habitats along Las Animas Creek and Percha Creek. The wildlife assessment included surveys for special status species; birds; large, medium, and small mammals; bats; and reptiles and amphibians. (See Figure 3-26). The wildlife assessment is included as Chapter 5 of NMCC's Baseline Data Report (Intera 2012). The original survey was expanded in 2014 to include 11 more sites (GSA 2015). These additional sites included nine millsite claims plus two potential alternative sites under evaluation for electrical substation construction. This section presents the findings of the Baseline Data Report (Intera 2012) as well as regional information from State and Federal land management agencies. Complete information about survey methodology and findings can be found in the 2011 Parametrix report. (See Appendix I.)

The wildlife species found within a given area reflect the habitat characteristics of that location. Vegetation communities used as wildlife habitat in the project area are described in Section 3.11, Vegetation, Invasive Species, and Wetlands. The majority of the proposed millsites are located in areas with existing developments such as production wells or monitoring wells and each of the sites is bisected by a road (GSA 2015). Affected habitats are primarily Chihuahuan desert scrubland (CDS) with a plant community that has deviated from its ecological potential (as described in the ecological site report for Gravelly). However, small portions of the millsite boundaries include draws and arroyo habitats that contain relatively unique microhabitats for the area. As indicated by the results of the wildlife survey, the arroyo habitats and draws contain a higher biological diversity and abundance than the surrounding creosote flats (GSA 2015).

There are also heavily disturbed areas at the mine site, some of which have been reclaimed (THEMAC 2012). There is relatively little water on the mine area, except for the man-made pit lake, the area immediately east of the tailing dam where surface water collects, a stock pond in the southern portion of the site, and intermittent pools created by storms in the bottom of Greyback Arroyo. Greyback Arroyo, though ephemeral, does support some riparian vegetation such as willows and saltcedar, which provide important wildlife habitat. Surveys were also conducted in Animas and Percha Creeks to be used as off-site reference areas to provide comparison areas with the arroyo, CDS, and grassy hills sites (Intera 2012). With the exception of the stock pond, most of the area has very little perennial water. Because of the presence of water at the pond, this location was chosen for bat surveys. During the 2010 and 2011 field surveys, 30 wildlife species or signs of these species were observed within the proposed mine area.

Figure 3-26. Copper Flat Mine Baseline Data Characterization Report Wildlife Survey Areas



Source: GSA 2017.

3.10.1.1 Fisheries and Aquatic Invertebrates

The Baseline Data Report describes all relevant wildlife surveys and includes a brief qualitative analysis of some of the seeps and springs in the area surrounding the mine area (Intera 2012). No fish surveys were included in the sampling and analysis plan for baseline data collection (Intera 2012) because no fish habitat was located within the mine area. An attempt was made during summer 2011 to complete a qualitative wildlife habitat assessment at each of the springs that had been previously visited by hydrologists. At that time, private landowners did not grant the biologists permission to access the springs near Animas Creek or the cluster of springs near Warm Springs and Cold Springs canyons. Permission to access the springs near Warm Springs and Cold Springs canyons was later granted (May 2013), at which time a field biologist completed a qualitative resource survey at these sites, and also visited springs that were identified by hydrologists on public land just west of the mine permit and along Percha Creek. Biologists did not observe amphibians or fish within or near any of the springs, though an unidentified fish species was common in portions of Percha Creek (Intera 2012).

3.10.1.2 Birds, Including Migratory Species

Surveys identified 46 species of birds during the breeding season, and eight additional species were encountered during other work and a winter bird survey (Intera 2012). The number of bird species recorded in the Parametrix study was 39 in the arroyo habitat, 15 in the CDS, 38 in the grassy hills, four in the pit lake habitat, and 21 in the disturbed areas/waste rock pile habitat (Intera 2012). Thirty-four species were recorded during the millsite surveys (GSA 2015). The table below lists both the bird species recorded during the Parametrix surveys and the potential species based on the habitat present. (See Table 3-22.)

Seven cactus wren bird nests were identified within the mine area during the 2010 and 2011 biological surveys. During an August 2011 survey, an active raptor nest was observed in the windmill at well site MW-2, and there are additional structures on the project site that provide habitat for nesting birds.

Table 3-22. Bird Species Recorded or Likely Present at Copper Flat Mine Area, Las Animas Creek, and Percha Creek

Table 3-22. Bird Species Recorded or Likely Present at Copper Flat Mine Area, Las Animas Creek, and Percha Creek								
	Copper Flat Mine Area				Las Animas/Percha Creeks			
Species	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win
Canada Goose	○		○	○				•
Gadwall	○		○	○				•
Mallard	○		○	○	○	○	○	•
Northern Shoveler	U		○	○				•
Northern Pintail	○		○	○				•
Cinnamon Teal	R		○	○				
Blue-winged Teal	R		○	○				
Canvasback	U		○	○				
American Widgeon	R		○	○				
Green-winged Teal	○		○	○				•
Redhead	○		○	○	•			•
Ring-necked Duck	○		○	○				•
Common Merganser	○		○	○		•		•
Scaled Quail	○	○	○	R	○	○	○	•
Scaled Quail	○	○	○	R	○	○	○	•
Gambel's Quail		A			•	•	•	•
Montezuma Quail	○	○	○	○	•	○	○	•
Ring-necked Pheasant								•
Wild Turkey					•	•	○	○
Pied-billed Grebe								•
Black-crowned Night Heron		R				○		
Cattle Egret						○		
Snowy Egret					•		•	
Great Blue Heron	U	○	○	○	•	○	○	•
Green Heron					•			
White-faced Ibis						•		
Turkey Vulture		U				•	•	
Bald Eagle						•		•

Table 3-22. Bird Species Recorded or Likely Present at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Continued)

Species	Copper Flat Mine Area				Las Animas/Percha Creeks			
	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win
Golden Eagle				R				
Northern Harrier		○		R	•			•
Sharp-shinned Hawk	○	○	○	○	•	○	○	•
Cooper's Hawk	○	○	○	○	•	○	○	•
Swainson's Hawk		R					•	
Red-tailed Hawk	○	U	○	U	•	•	○	•
Ferruginous Hawk	○		○	○	○	•	○	•
Gray Hawk						•		
Zone-tailed Hawk					•	•		
Common Black Hawk					•	•		
Golden Eagle	○	○	○	R	•			
American Kestrel	○	R	○	R	•	○	•	•
Merlin	○		○	○	○		○	•
Peregrine Falcon					•	•		
Prairie Falcon	○	○	○	○				•
Sora					•			
American Coot						○		
Sandhill Crane							○	•
Killdeer	U	○	○	○	•	•	•	
Black-necked Stilt						○		
American Avocet						○		
Spotted Sandpiper	○	○	○	○		○		
Common Snipe						○		○
Ring-billed Gull								•
Rock Dove	○	○	○	○	○	○	○	•
European Collared-Dove	○	○	○	○	•	○	•	•
White-winged Dove	U	U	○	○	•	•	•	•
Mourning Dove	C	C	C	C	•	•	•	•
Common Ground Dove						○		
Yellow-billed Cuckoo						•		
Greater Roadrunner	○	R	○	○	•	○	○	•
Western Screech-Owl	○	○	○	○	•	○	○	•
Great Horned Owl	○	R	○	○	•	•	○	•
Barn Owl	○	○	○	○	○	○	○	•
Burrowing Owl	○					•		
Northern Pygmy Owl	○	○	○	○	○	○	○	•

Table 3-22. Bird Species Recorded or Likely Present at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Continued)								
Species	Copper Flat Mine Area				Las Animas/Percha Creeks			
	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win
Mexican Spotted Owl					•			
Elf Owl					•	•		
Lesser Nighthawk		○				•		
Common Poorwill		○			•	•		
White-throated Swift		R			•	•		
Black-chinned Hummingbird		R			•	•	•	
Broad-tailed Hummingbird		R					•	
Belted Kingfisher					•	•	•	•
Lewis's Woodpecker								•
Red-headed Woodpecker					•			•
Red-naped Sapsucker								•
Acorn Woodpecker					•	•	•	•
Red-naped Sapsucker					•		•	•
Yellow-bellied Sapsucker								•
Ladder-backed Woodpecker				R	•	•		•
Downy Woodpecker	○	○	○	○	•	○	○	•
Hairy Woodpecker	○	○	○	○	•	○	○	○
Northern Flicker	○	R	○	○	•	○	•	•
Western Wood-Pewee		C				•	•	
Hammond's Flycatcher					•			•
Willow Flycatcher					•			
Brown-crested Flycatcher						•		•
Eastern Phoebe								•
Black Phoebe		R			•	•		•
Say's Phoebe	○	C	○	U	•	•	•	•
Vermilion Flycatcher		○			•	•		•
Ash-throated Flycatcher		C				•		
Brown-crested Flycatcher						•	•	
Dusky Flycatcher					•			
Dusky-capped Flycatcher						•		
Cassin's Kingbird						•	•	
Western Kingbird		C				•	•	
Loggerhead Shrike	○	R	○	○	•	•	○	•
Bell's Vireo						•		
Plumbeous Vireo						•		
Warbling Vireo							•	

Table 3-22. Bird Species Recorded or Likely Present at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Continued)

Species	Copper Flat Mine Area				Las Animas/Percha Creeks			
	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win
Hutton's Vireo		○		○			•	•
Steller's Jay								•
Western Scrub-Jay	○	○	○	○	○	○	•	•
American Crow	○	○	○	○	○	○		•
Chihuahua Raven				U	•	○	•	•
Common Raven	○	C	○	C	•	○	•	•
Horned Lark	○	R	○	○	•	○	○	•
Northern Rough-winged Swallow		○			•	•		
Violet-green Swallow	○	C	○		•	•	○	
Barn Swallow	○	R	○		•	•	•	
Cliff Swallow		○				•		
Mountain Chickadee				○				•
Bridled Titmouse	○	○	○	○	•	•	○	•
Juniper Titmouse	○	R	○	○				•
Verdin	R			R	•		•	•
Bushtit	○	○	○	U	○	○	○	○
Red-breasted Nuthatch								•
White-breasted Nuthatch					•	•	•	•
Brown Creeper	○	○	○	○	○	○	○	•
Cactus Wren	○	U	○	○	•	○	•	•
Rock Wren	C	C	C	C	•			•
Canyon Wren	U	C	○	○		•		
Bewick's Wren	○	○	○	U	•	•	•	•
House Wren	○							•
Winter Wren								•
Black-tailed Gnatcatcher	○					•		
Blue-Gray Gnatcatcher		○					•	
Golden-crowned Kinglet								•
Ruby-crowned Kinglet	○	○	○	U	•	○	○	•
Eastern Bluebird								•
Western Bluebird	○	○	○	○	•	○	○	•
Mountain Bluebird	○	○	○	C			•	
Townsend's Solitaire				R	•			•
Hermit Thrush					•			•
Rufous-backed Robin					•			•

Table 3-22. Bird Species Recorded or Likely Present at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Continued)								
	Copper Flat Mine Area				Las Animas/Percha Creeks			
Species	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win
American Robin	○	U	○	R	•	•	○	•
Northern Mockingbird	○	C	○	○	•	•	○	•
American Dipper						•		
Curve-billed Thrasher	○	U	○	○	•		•	•
Crissal Thrasher	○	U	○	○	•			•
Bendire's Thrasher	○	○	○		○	○	○	
Brown Thrasher		R						•
Sage Thrasher				R				
European Starling	○	○	○	○	•	•	•	•
American Pipit								•
Sprague's Pipit			○					
Cedar Waxwing					•			•
Phainopepla	○	○	○	○	•	○	•	•
Orange-crowned Warbler	○	○	○				•	•
Black-throated Gray Warbler	○				○			
Lucy's Warbler		○			•	•		
Virginia's Warbler		○			•		•	
Grace's Warbler						•		
MacGillivray's Warbler							•	
Northern Parula					•			
Yellow-rumped Warbler	○	R	○	○	•	○	•	•
Red-faced Warbler						•		
Wilson's Warbler	○	○	○				•	
Pine Warbler								•
Tennessee Warbler					•		•	
Yellow-breasted Chat		○				•		
Chestnut-collared Longspur				R				•
Green-tailed Towhee		R		R				•
Spotted Towhee		R		R	•	○	○	•
Rufous-crowned Sparrow		A		C	•			•
Canyon Towhee		C		A	•	•	•	•
Chipping Sparrow	○	○	○	A	•	○	○	•
Brewer's Sparrow	○		○	C	•		•	•
Vesper Sparrow	○	○	○	○				•
Lark Sparrow		○					•	
Black-throated Sparrow	○	A	○	C	•		•	•

Table 3-22. Bird Species Recorded or Likely Present at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Continued)								
	Copper Flat Mine Area				Las Animas/Percha Creeks			
Species	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win
Black-chinned Sparrow	○					•		
Sage Sparrow	○		○	A				•
Baird's Sparrow	○							•
Grasshopper Sparrow				R				•
Clay-colored Sparrow								•
Lark Bunting	○		○	○	•			
Indigo Bunting						•		
Lazuli Bunting					•			
Varied Bunting						•		
Song Sparrow				R	•		•	•
Lincoln's Sparrow	○		○	○	•		•	•
White-crowned Sparrow	○		○	A	•		•	•
White-throated Sparrow								•
Swamp Sparrow								•
American Tree Sparrow								•
Dark-eyed Junco	○	○	○	C	•		•	•
Summer Tanager					•	•	•	•
Hepatic Tanager					•			
Western Tanager					•			
Northern Cardinal						○		
Pyrrhuloxia				○	•	•		•
Blue Grosbeak		C			•	•	•	
Red-winged Blackbird	○	○	○	○	•	○	•	•
Western Meadowlark	○	U	○	R	•	○	○	•
Yellow-headed Blackbird	○	○		○				•
Brewer's Blackbird	○	○	○	○				•
Rusty Blackbird								•
Common Grackle					•			
Great-tailed Grackle	○	○	○	○	•	○	○	•
Brown-headed Cowbird		U				•		•
Hooded Oriole	○				•	•		
Bullock's Oriole	○						•	
Scott's Oriole	○					•		
Purple Finch								•
Cassin's Finch		R	○	R				•
House Finch	○	C	○	○	•	•	•	•

Table 3-22. Bird Species Recorded or Likely Present at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Concluded)								
	Copper Flat Mine Area				Las Animas/Percha Creeks			
Species	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win
Red Crossbill								•
Pine Siskin	○	○	○	○				•
Lesser Goldfinch		U		C	•	•	•	•
Lawrence's Goldfinch								•
American Goldfinch			○		•			•
Evening Grosbeak								•
House Sparrow		U			•	•	•	•

Source: GSA 2017.

Notes: A=Abundant, C=Common, U=Uncommon, R=Rare;
○ = Not recorded but likely occurs in proper habitat;
• = observed, observation method along Las Animas/Percha Creeks did not yield relative commonality.

3.10.1.3 Mammals

Mule deer (*Odocoileus hemionus*) signs were encountered on 16 of the 30 (53 percent) transects surveyed (Intera 2012). Most of the signs were in the western half of the mine area, in the grassy hills habitat, though signs were found in all parts of the mine. Deer were frequently observed in the Greyback Arroyo and in other arroyos on the site. Desert cottontail (*Sylvilagus audubonii*) signs were found on 29 of 30 (97 percent) of the survey transects, black-tailed jackrabbit (*Lepus californicus*) signs were found in 23 of 30 (77 percent) of the transects, and predator or other signs were found on four of 30 (13 percent) of the transects. In addition, one pronghorn (*Antilocapra americana*) was encountered on the transects on the southeastern portion of the Copper Flat mine area. Also, signs of collared peccary (*Pecari tajacu*), mountain lion (*Puma concolor*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), and fox (likely gray fox [*Urocyon cinereoargenteus*]) were noted during field work. Other large to medium mammals are likely present in the Copper Flat mine area but were not encountered during surveys. (See Table 3-23 for a full list of all mammals encountered during surveys.) The list of these mammals was developed by consulting range maps and species lists in published reports, and by consulting with local experts (Intera 2012).

A total of 86 individuals of eight species of small mammals were trapped at the Copper Flat mine area: brush mouse (*Peromyscus boylii*), desert cottontail, Merriam's kangaroo rat (*Dipodomys merriami*), Northern grasshopper mouse (*Onchomys leucogaster*), Mearn's grasshopper mouse (*Onychomys arenicola*), rock pocket mouse (*Chaetodipus intermedius*), white-footed mouse (*Peromyscus leucopus*), and white-throated woodrat (*Neotoma albigula*) (Intera 2012). Diversity of small mammals was highest in creosote rolling uplands, where six species were trapped. The greatest number of animals trapped per effort was in the arroyo site, followed by the CDS and grassy hills sites. Diversity overall, however, was greatest in the CDS habitat, followed by the grassy hills and arroyo habitats. Although a relatively high density of individuals was trapped in the arroyo site, only two species were encountered: brush mouse and one unknown species that escaped. Six species of small mammals were trapped in the CDS and five in the grassy hills.

A total of 12 species of bats was detected at the Copper Flat mine area and at least three other species were not detected, but likely occur in the region and have appropriate habitat at or near the Copper Flat mine area (Intera 2012). The number of calls by species at each site was also analyzed to provide an index of short-term relative abundance. However, these results should be interpreted with caution as more calls does not necessarily correlate with more individuals using a site (for example, 100 calls could mean one bat calling 100 times or 100 bats calling once). However, it can be relatively safe to assume that more calls and more activity indicate a higher density of prey. The most species and most calls were detected at the pit lake, where insects provide the greatest feeding opportunities. The second highest abundance and diversity of calls were from the grassy hills, followed by the arroyo. In addition to feeding habitat at the lake, roosting habitat is provided by crevices in the rocky hills at the Copper Flat mine area and, probably more importantly, by the many abandoned mine shafts.

Table 3-23. Mammal Species Recorded or Possible at Copper Flat Mine Area, Las Animas Creek, and Percha Creek

Table 3-23. Mammal Species Recorded or Possible at Copper Flat Mine Area, Las Animas Creek, and Percha Creek

Species	Scientific Name	Encountered or Possible at Copper Flat Mine Area	Known or Possible at Las Animas/ Percha Creeks
Large Mammals			
Pronghorn	*Antilocapra americana*	•	
Coyote	*Canis latrans*	•	•
Elk	*Cervus elaphus*	○	•
Bobcat	*Lynx rufus*	•	•
Mule Deer	*Odocoileus hemionus*	•	•
White Tailed Deer	*Odocoileus virginianus*		○
Collared Peccary	*Pecari tajacu*	○	•
Mountain Lion	*Puma concolor*	•	•
Gray Fox	*Urocyon cineroargenteneus*	•	•
American Black Bear	*Ursus americanus*	○	•
Bats			
Pallid Bat	*Antorzus pallidus*	• e	•
Townsend's Pale Big-eared Bat	*Corynorhinus townsendii*	• e	○
Big Brown Bat	*Eptesicus fuscus*	• e	•
Spotted Bat	*Euderma maculatum*	○	○
Allen's Big-eared Bat	*Idionycteris phyllotis*	○	○
Silver-haired Bat	*Lasionycteris noctivagans*	• e	•
Western Red Bat	*Lasiurus blossevillii*	• e	○
Southern Hoary Bat	*Lasiurus cinereus*	• e	•
Southwestern Myotis	*Myotis auriculus*	○	○
California Myotis	*Myotis californicus*	• e	•
Arizona Myotis	*Myotis occultus*		○
Fringed Myotis	*Myotis thysanodes*	• e	•
Long-legged Myotis	*Myotis volans*	• e	○
Yuma Myotis	*Myotis yumanensis*	• e	•
Canyon Bat	*Parastrellus hesperus*	• e	○

Table 3-23. Mammal Species Recorded or Possible at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Continued)			
Species	**Scientific Name**	**Encountered or Possible at Copper Flat Mine Area**	**Known or Possible at Las Animas/ Percha Creeks**
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	• e	•
Medium-sized Mammals			
Ringtail	*Bassariscus astutus*		○
Coatimundi	*Nasua narica*		○
American Beaver	*Castor canadensis*		○
American Hog-nosed Skunk	*Conepatus leuconotus*	○	○
Black-tailed Jackrabbit	*Lepus californicus*	•	○
Hooded Skunk	*Mephitis macroura*	○	○
Striped Skunk	*Mephitis mephitis*	○	○
Long-tailed Weasel	*Mustela frenata*	○	○
Raccoon	*Procyon lotor*	○	○
Western Spotted Skunk	*Spilogale gracilis*	○	○
Desert Cottontail	*Sylvilagus audubonii*	•	○
Kit Fox	*Vulpes macrotis*	○	
American Badger	*Taxidea taxus*	○	○
Small Mammals			
Merriam's Kangaroo Rat	*Dipodomys merriami*	•	○
Ord's Kangaroo Rat	*Dipodomys ordii*	○	○
Banner-tailed Kangaroo Rat	*Dipodomys spectabilis*	○	○
North American Porcupine	*Erethrizon dorsaturn*		○
Mogollon Vole	*Microtus mogollonensis*	○	
House Mouse	*Mus musculus*	○	○
White-throated Woodrat	*Neotoma albigula*	•	○
Mexican Woodrat	*Neotoma mexicana*	○	
Southern Plains Woodrat	*Neotoma micropus*	•	
Desert Shrew	*Notiosorex crawfordi*	○	○
Mearn's Grasshopper Mouse	*Onchomys arenicola*	•	
Northern Grasshopper Mouse	*Onchomys leucogaster*	•	○
Silky Pocket Mouse	*Peognathus flavus*	•	
Brush Mouse	*Peromyscus boylii*	•	
Cactus Mouse	*Peromyscus eremicus*	○	
White-footed Mouse	*Peromyscus leucopus*	•	○
Piñon Mouse	*Peromyscus truei*	○	
Western Harvest Mouse	*Reithrodontomys megalotis*	○	○

Table 3-23. Mammal Species Recorded or Possible at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Concluded)			
Species	**Scientific Name**	**Encountered or Possible at Copper Flat Mine Area**	**Known or Possible at Las Animas/ Percha Creeks**
Arizona Gray Squirrel	*Sciurus arizonensis*		○
Tawny-bellied Cotton Rat	*Sigmodon fulviventer*		○
Hispid Cotton Rat	*Sigmodon hispidus*		○
Spotted Ground Squirrel	*Spermophilus spilosoma*	○	
Rock Squirrel	*Spermophilus variegatus*	○	○
Cliff Chipmunk	*Tamias dorsalis*	○	
Botta's Pocket Gopher	*Thomomys bottae*	○	

Source: Intera 2012.

Notes: • = Detected; ○ = Not detected but habitat present and species occurs in the region;
e = part of the echolocation survey.

3.10.1.4 Reptiles and Amphibians

Pitfall and funnel trapping of reptiles and amphibians was not successful (Intera 2012). Mine area soils were too rocky to effectively dig pitfall traps, and constructed wire mesh funnel traps failed to trap any reptiles. During walking transects and other survey efforts, nine species of reptiles were encountered at the mine area: coachwhip (*Masticophis flagellum*), whiptail lizard (*Cnemidophorus* sp.), bullsnake (*Pituophis melanoleucus*), Texas horned lizard, roundtail horned lizard (*Phrynosoma modestum*), desert spiny lizard (*Sceloporus magister*), black-tailed rattlesnake (*Crotalus molossus*), lesser earless lizard (*Holbrookia maculata*), and rock rattlesnake (*Crotalus lepidus*). Whiptails were the most abundant species seen, but field staff were unable to capture one to identify the species (six species occur in Sierra County). Parametrix also identified likely or possibly occurring species at the mine area based on expected range and the habitat present (Intera 2012). Up to 43 species of reptiles and amphibians that are known to occur in Sierra County have suitable habitat present at the mine area. (See Table 3-24.)

Table 3-24. Reptile and Amphibian Species Recorded or Possibly Occurring at Copper Flat Mine Area, Las Animas Creek, and Percha Creek

Table 3-24. Reptile and Amphibian Species Recorded or Possible at Copper Flat Mine Area, Las Animas Creek, and Percha Creek			
Species	**Scientific Name**	**Copper Flat Mine Area**	**Las Animas or Percha Creeks**
Salamanders			
Tiger Salamander	*Ambystoma tigrinum*	•	•
Frogs and Toads			
Couch's Spadefoot Toad	*Scaphiopus couchii*	○	○
Plains Spadefoot	*Spea bombifrons*	○	
New Mexico Spadefoot	*Spea multiplicata*	○	○
Great Plains Toad	*Bufo congnatus*	○	○

Table 3-24. Reptile and Amphibian Species Recorded or Possible at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Continued)			
Species	**Scientific Name**	**Copper Flat Mine Area**	**Las Animas or Percha Creeks**
Green Toad	*Bufo debilis*	○	
Arizona Toad	*Bufo microscaphus*		○
Red-spotted Toad	*Bufo punctatus*	○	○
Woodhouse's Toad	*Bufo woodhouseii*	○	○
Canyon Tree Frog	*Hyla arenicolor*		•
Bullfrog	*Rana catesbiana*		•
Chiricahua Leopard Frog	*Rana chiricahuensis*		•
Plains Leopard Frog	*Rana blairi*		•
Northern Leopard Frog	*Rana pipiens*		○
Turtles			
Ornate Box Turtle	*Terrapene ornata*		○
Lizards			
Collared Lizard	*Crotaphytus collaris*	○	○
Greater Earless Lizard	*Cophosaurus texanus*	○	
Lesser Earless Lizard	*Holbrookia maculata*	•	
Texas Horned Lizard	*Phrynosoma cornutum*	•	
Short-horned Lizard	*Phrynosoma douglasii*	•	
Roundtail Horned Lizard	*Phrynosoma modestum*	•	
Clark's Spiny Lizard	*Sceloporus clarkii*	○	
Desert Spiny Lizard	*Sceloporus magister*	•	
Crevice Spiny Lizard	*Sceloporus poinsetti*	○	
Prairie Lizard	*Sceloporus undulatus*	○	○
Tree Lizard	*Urosaurus ornatus*	○	○
Side-blotched Lizard	*Uta stansburiana*	•	
Chihuahuan Spotted Whiptail	*Cnemidophorus exsanguis*	○	○
Checkered Whiptail	*Cnemidophorus grahamii*	○	○
Little Striped Whiptail	*Cnemidophorus inornatus*	○	
New Mexico Whiptail	*C. neomexicanus*	○	
Western Whiptail	*Cnemidophorus tigris*	○	
Desert Grassland Whiptail	*Cnemidophorus uniparens*	○	○
Many-lined Skink	*Eumeces multivirgatus*		○
Great Plains Skink	*Eumeces obsoletus*	○	○
Madrean Alligator Lizard	*Elgaria kingii*	○	○
Snakes			
Texas Blind Snake	*Leptotyphlops dulcis*	○	
Western Blind Snake	*Leptotyphlops humilis*	○	
Glossy Snake	*Arizona elegans*	○	

Table 3-24. Reptile and Amphibian Species Recorded or Possible at Copper Flat Mine Area, Las Animas Creek, and Percha Creek (Concluded)			
Species	**Scientific Name**	**Copper Flat Mine Area**	**Las Animas or Percha Creeks**
Glossy Snake	*Arizona elegans*	○	
Ringneck Snake	*Diadophus punctatus*		○
Western Hooknose Snake	*Gyalpion canum*	○	
Western Hognose Snake	*Heterodon nasicus*	○	
Night Snake	*Hypsiglena torquata*	○	○
Common Kingsnake	*Lampropeltis pyromelana*		○
Coachwhip	*Masticophus flagellum*	•	
Striped Whipsnake	*Masticophus taeniatus*	○	
Gopher Snake	*Pituophis melanoleucus*	•	○
Longnose Snake	*Rhinochelius lecontei*		○
Big Bend Patchnose Snake	*Salvadora deserticola*	○	
Mountain Patchnose Snake	*Salvadora grahamiae*	○	
Ground Snake	*Sonora semiannulata*		○
Plains Black-headed Snake	*Tantilla nigriceps*	○	
Blackneck Garter Snake	*Thamnophis cyrtopsis*		○
W. Terrestrial Garter Snake	*Thamnophis elegans*		○
Checkered Garter Snake	*Thamnophis marcianus*		○
Lyre Snake	*Trimorphodon biscutatus*	○	
W. Diamondback Rattlesnake	*Crotalus atrox*	○	○
Rock Rattlesnake	*Crotalus lepidus*	•	
Blacktail Rattlesnake	*Crotalus molossus*	•	○
Western Rattlesnake	*Crotalus viridis*	○	
Massassagua Rattlesnake	*Sistrurus catenatus*	○	

Source: Intera 2012.

Note: • = Encountered during Copper Flat Baseline Data Report wildlife surveys or reported from other recent wildlife surveys in the study area;
○ = Not encountered but habitat present and species occurs in Sierra County.

3.10.1.5 Bats

Various wildlife sampling strata in an echolocation survey that included the arroyo, CDS, grassy hills (referred to as Chihuahuan desert grassland [CDG] in the survey) and disturbed areas such as the pit lake and tailing dam, showed that the pit lake had the highest relative activity level measured (GSA 2013), with over 2,000 mean echolocation sequences captured per day. The arroyo stratum had 335 mean echolocation sequences measured per day, while fewer sequences were captured per day in the grassy hills stratum (78). Higher activity was measured at each of the three on-site strata (grassy hills, CDS, and arroyo) than their off-site analogs. (See Table 3-25).

Table 3-25. Mean Number of Echolocation Sequences Recorded per Day Based on Analysis of Sonobat Data

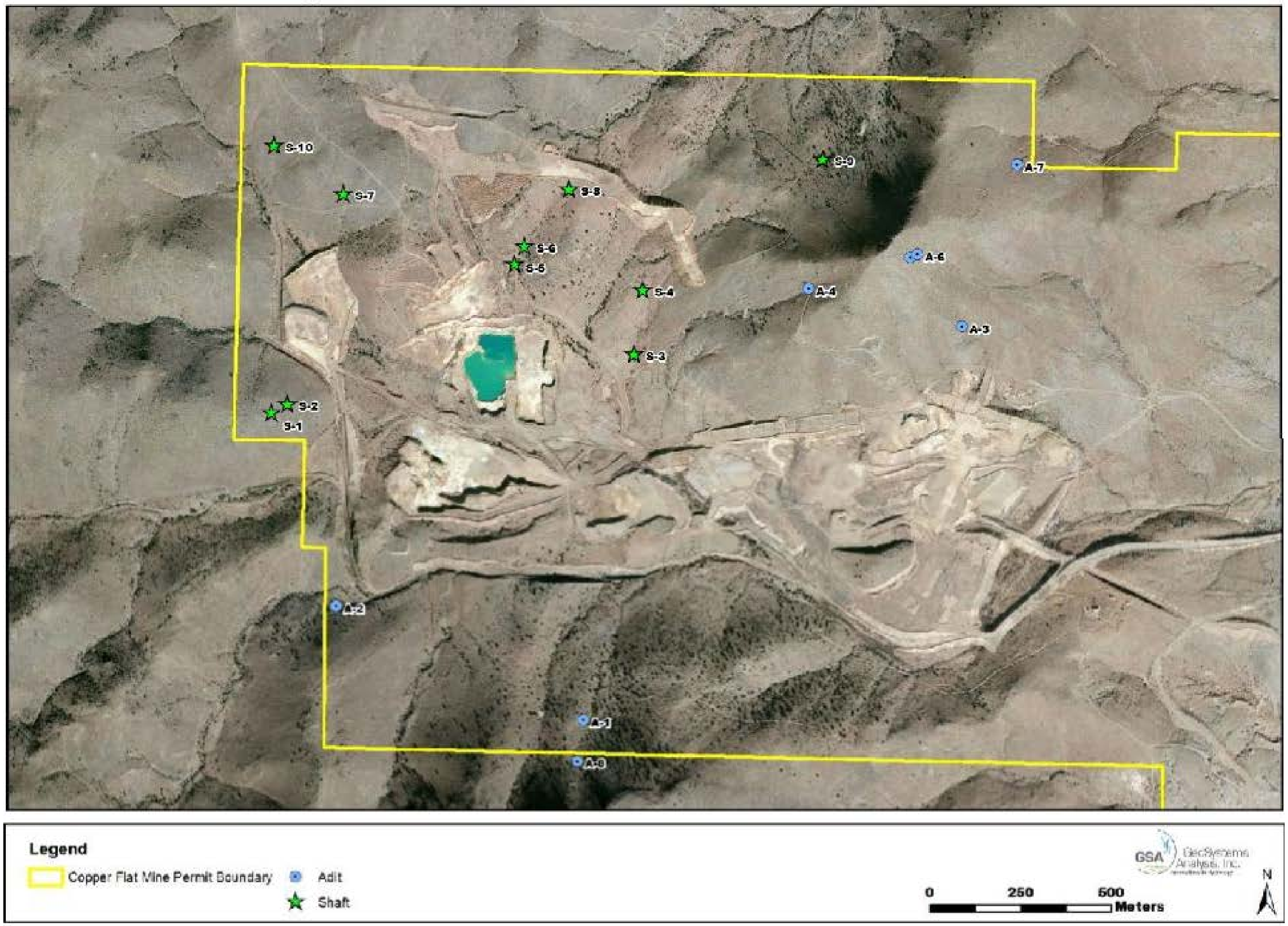
Table 3-25. Mean Number of Echolocation Sequences Recorded per Day Based on Analysis of Sonobat Data			
Bat Activity on the Mine Site		Bat Activity at Off-site Locations	
Stratum	**Sequences Captured per Day**	**Stratum**	**Sequences Captured per Day**
Arroyo On	335.1	Arroyo Off	49.1
CDG On	78.4	CDG Off	32.6
Pit lake On	2,039.3	Stock tank Off	518.6

Source: GSA 2013.

Staff biologists visited all the historic mine features (shafts and adits) identified using locations provided by NMCC. (See Figure 3-27). A total of ten shafts and seven adits technically fall within the Copper Flat mine area but one additional adit was also surveyed because it was only about 50 feet from the permit area boundary and it looked like a promising feature for bat use.

Despite the fact that no evidence of hibernation-season use was seen, several adits did show sign of significant bat use. Heavy deposition of bat feces was identified at two complex adits located on the north slope of Black Peak. Other evidence of bat use includes surface staining from repeated roost use and urination, as well as the presence of prey item waste materials, including insect/beetle elytra, etc. Other adits had a small amount of sign, possibly evidence of temporary use as night roosts, etc., but this is expected of any rock crevice, cave, or mine feature in the Southwest and is not necessarily indicative of relative importance of the feature to local bat populations. The two adits identified as possibly significant habitat resources for bats at the project site were actively surveyed (using mist-netting) for bat use during the warm season of mid May 2013. As most bats are occupying breeding season habitat by this time, capture of pregnant females in close proximity to these adits would warrant assumption that these features are maternity habitats, and, therefore, of large at least local population-level significance.

Figure 3-27. Historic Mine Adits and Shafts Monitored for Bat Use



Source: GSA 2013.

3.10.1.6 Wildlife Use of the Pit Lake

Game cameras with night vision sensors were installed along the pit lake perimeter in August 2012 and left in place until May 2013 to capture ungulate and carnivore use (GSA 2013). These cameras also sometimes captured waterfowl use. A biologist conservatively identified photos to the species, family, class, or order; depending on the image clarity, distance from the camera, and wildlife discernibility. When more than one species of waterfowl was present, unidentified/mixed waterfowl was attributed in the database. A table summarizing the game camera captures is included below. (See Table 3-26.)

Overall, waterfowl visitation (listed in Table 3-26 as canvasback, mallard, or unidentified/mixed waterfowl) triggered the game cameras most frequently. Waterfowl caused the cameras to trigger more than 100 times through the capture period. The higher frequency of waterfowl captures versus other types of wildlife can be partially attributed to the fact that one of the cameras was placed in a location with a clear view of the water's surface and intended to only capture waterfowl. A waterfowl photo was first captured on September 3, 2012, and visitation was photographed regularly (two to six times per month) through April 2013. Coyotes were the second most regular visitors with 37 total captures. The cameras recorded a variety of birds including spotted sandpiper, great blue heron, and others. Mule deer triggered the cameras a total of 11 times and were captured drinking from the lake on one photo. Cattle were regular visitors as well, particularly from September through January. Striped skunk (16 triggers), Rock squirrel (10), and mice (16) were each captured on multiple occasions. A gray fox was confirmed on one photo, and another photo appeared to also capture a gray fox.

Table 3-26. Summary of Game Camera Observations from the Pit Lake

Table 3-26. Summary of Game Camera Observations from the Pit Lake

Species	Sum of Individuals within a Photo	Total Number of Camera Triggers	Species	Sum of Individuals within a Photo	Total Number of Camera Triggers
Canine (Gray fox)	1	1	Mule deer	17	11
Canvasback	5	2	Odonata	1	1
Chipping sparrow	1	1	Rock squirrel	10	10
Cow	89	26	Rock wren	4	4
Coyote	40	37	Rodent	3	3
Dove	3	2	Say's Phoebe	2	2
Gray fox	1	1	Spotted sandpiper	1	1
Great Blue Heron	11	11	Striped skunk	16	16
Horned lark	1	1	Unidentified avian	14	14
Lepidopteran	1	1	Unknown close-up	3	3
Mallard	39	13	White-winged dove	3	3
Mouse	16	16	Unidentified/mixed waterfowl	434	103
			Grand Total	**716**	**283**

Source: GSA 2013.

3.10.2 Environmental Effects

This section presents the impacts of the Proposed Action and alternatives, including the no action alternative, to common wildlife and wildlife habitat in the proposed project area. This section covers species that are not considered special status, meaning Federally-listed or New Mexico State-listed threatened or endangered species. It covers species that are generally common; as such, if individual members of these species are killed or displaced, or if their habitat is altered, it is unlikely that the local population or the species overall would be adversely affected. Impacts to wildlife special status species are discussed in Section 3.12, Threatened, Endangered, and Special Status Species.

3.10.2.1 Proposed Action

Impacts under the Proposed Action are expected to be long-term, minor, of medium extent, probable, and adverse as well as long-term, minor, medium extent, probable, and beneficial. Impacts from mining activities would result from: 1) the conversion of habitat and forage areas; and 2) noise and light disturbances from mining activities. Habitat conversion can result in either: 1) adverse impacts from the loss or degradation of habitat or from fragmenting large sections of habitat; or 2) habitat enhancement from maintenance and reclamation activities that focus on providing natural and native habitat for wildlife species. Habitat fragmentation is the process by which habitat loss results in the division of large, continuous habitats into smaller, more isolated remnants (Didham 2010). Such fragmentation reduces the total amount of usable habitat for wildlife species and disrupts movement among habitat areas. In addition, habitat fragmentation causes the isolation of less mobile species, a decline in habitat specialists, and facilitates invasion by generalist species (Marvier et al. 2004). Habitat alteration occurs when surface-disturbing activities directly or indirectly change the composition, structure, or function of the habitat. Habitat loss is caused by surface-disturbing activities or other activities that degrade or remove habitat. Habitat displacement occurs when land-use activities force wildlife to move into other habitats, thereby increasing stress on individual animals and increasing competition for habitat resources. Any surface-disturbing actions could lead to habitat alteration, fragmentation, displacement, or loss; limit the amount of usable habitat for special status species and wildlife; and restrict movement among habitat areas. Overall, impacts on wildlife would be significant.Direct and indirect impacts are expected to result from Copper Flat mine site construction and operation activities, ancillary facilities construction and operation, and from truck and other traffic on the access roads, all of which could affect individual animals and habitat conditions but, because of the localized scale of the mining project, would not likely affect animal populations.

For migratory bird species, loss of habitat would reduce forage, cover, perches, and nesting areas. Most surface disturbance under the Proposed Action would occur within or adjacent to previously disturbed areas. Because these areas have experienced disturbance and the poor quality soils are slow to recover, it is unlikely these areas contain high quality foraging or nesting habitats for migratory birds and other wildlife species.

3.10.2.1.1 Mine Development and Operation

Mine construction would take 2 years, and operations would occur for 16 years. Losses of mammals, birds, reptiles, or amphibians would be minimal as a result of the project. Animal numbers of the common species found at the site prior to construction are limited by the fact that the site is less than 2,200 acres as compared to Sierra County's more than 2,700,000 acres. It is probable that adverse effects to wildlife would be expected under the Proposed Action during the construction and operations phases that could not be ameliorated until after operations cease. Proposed project activities that would disturb less than 1,600 acres on the mine site and less than 100 acres of land for ancillary facilities nearby would cause localized disruptions to foraging, dispersal movement, or breeding behavior of some individual animals. A few individual animals may be killed during these activities because they are driven out of their foraging territories and are made more susceptible to predation, but these losses would not be expected to impact entire populations or a species as a whole. There is currently extensive acreage of undeveloped land containing habitat in nearby areas where wildlife can temporarily relocate for cover and forage albeit likely competing with conspecifics in those areas.

Land conversion: Some mining facilities already exist in the mine area. The mining pit would be enlarged to approximately 2,800 feet by 2,800 feet with an ultimate depth of approximately 900 feet. The area of the pit would be expanded from 102 acres to 119 acres. The existing diversion of Greyback Arroyo, which is south of the pit, would not be altered with the proposed pit expansion. For the Proposed Action, approximately 57 percent of the proposed disturbance would take place in areas already disturbed during the previous operations, which may adversely impact marginal habitat that occurs in these locations. New disturbance of previously undisturbed land would be kept to a minimum, thus a minimum amount of wildlife habitat would be altered. Approximately 37 percent of the new disturbance would be related to the tailings and waste rock facilities. The utility corridor, access road, and surface water diversions were developed during the previous operations, and no further disturbance is anticipated with these facilities. The majority of the haul roads were also developed during previous operations and only minor additional disturbance would be related to haul road construction. Adverse impacts from habitat conversion would also occur during project activities where brush would be cleared along existing access roads.

Noise and light disturbance: Noise would occur from mine operation machinery, blasting, and vehicles. Blasting would be limited to daylight hours. Noise can impact species by startling individuals or masking natural sounds that animals are generating or hearing (Blickley and Patricelli 2010). These impacts result in displacing wildlife species directly or interfering with wildlife communication both between members of the same species and between individuals of different species (such as predator-prey interactions). Noise is discussed fully in Section 3.21, Noise and Vibrations.

Artificial night lighting affects animal foraging behavior, reproduction, movement, and species interactions (such as predator-prey and pollinator-plant relationships) (Longcore and Rich 2004). Bats and other nocturnal mammals respond to increased nighttime light by reducing or shifting their periods of activity, traveling shorter distances, and consuming less food (Longcore and Rich 2005). Diurnal (day-active) and nocturnal wildlife could be attracted to, or displaced from, habitats affected by night lighting. Bat species are likely to be attracted to insect activity around lights and could benefit from concentrated prey. However, night lighting increases the risk of predation for small, nocturnal mammals and decreases food consumption when animals reduce foraging activities to remain concealed in an artificially lit environment (Beier 2005). Night lighting may also increase the risk of animal mortality from vehicle collisions (Longcore and Rich 2005).

Based on 2010 and 2011 field surveys and a review of the project description, the following impacts could potentially occur to wildlife and habitat present within the mine area, though ongoing monitoring would continually assess actual impacts.

Since flowing portions of Percha Creek would not be impacted by mining activities (see Section 3.6, Groundwater Resources), the unidentified fish species that occurs in portions of Percha Creek would not experience impacts from mining activities.

Bats were identified at the pit lake by their vocalizations. Mining operations require that the pit lake be pumped out and the bottom of the pit kept dry. Pumping of the pit lake would therefore be necessary prior to mining and continuously throughout the life of the mine. Reducing the lake size may reduce insect forage and water availability for bat species, which could result in minimal adverse impacts to some bat species. The Ground Water Quality Bureau of NMED requires a monthly report of tonnages of tailings discharged along with analyses of the tailings to identify possible contaminants. These samples would be used to identify any leakage from the new, lined TSF. Abatement plans would be implemented should leakage and contamination be detected to prevent impacts to wildlife such as bats from contamination (THEMAC 2011).

The Proposed Action calls for pumping water from the pit lake due to inflow, which was measured at an average of 24 gpm during previous mining operations. Hydrogeologic and geochemical modeling indicates the post-closure pit lake water quality should be similar to that of the current pit lake. Sanitary liquid waste would be disposed of in leach fields and septic tanks. During the course of operations, NMCC would periodically review and update the geochemical and hydrogeological predictions, mine waste characterization studies, and pit lake studies to incorporate new information accumulated during operations. With the use of BMPs, the pit lake should not be contaminated in a way that would cause adverse effects from acute or chronic toxicity on wildlife.

None of the wren nests were located within the area proposed for vegetation clearing on existing access roads (Intera 2012). The raptor nest at well site MW-2 would not be removed or disturbed, and the Proposed Actions would not be expected to affect the nest.

Due to the presence of bird nests in the proposed project corridor as identified in site surveys, clearing of vegetation would be scheduled to take place outside of the bird breeding season (roughly March through August) (Intera 2012). Land clearing and surface disturbance would be timed to prevent destruction of active bird nests or birds' young during breeding season to comply with the Migratory Bird Treaty Act. If surface disturbing activities are unavoidable during the avian breeding and nesting season, NMCC would employ a qualified biologist to survey the areas proposed for disturbance for the presence of active nests or nesting activities immediately prior to the disturbance. If active nests are located, or if other evidence of nesting is observed (mating pairs, territorial defense, carrying nesting material, transporting of food), NMCC would work with the biologist and BLM to develop a work plan to allow construction activities to continue without impacting the identified nesting area during the nesting and breeding season. If it is not feasible to avoid adverse effects to active bird nests during construction, then coordination with the USFWS would be required and a permit would be applied for to move or disturb the active nest.

3.10.2.1.2 Mine Closure/Reclamation

The Copper Flat project site would be reclaimed to achieve a self-sustaining ecosystem appropriate for the local climate, topography, soil characteristics and land uses of the area. The objective of the reclamation plan is to return the project site to conditions similar to those present before the reestablishment of the mine. One goal of the reclamation plan is to revegetate disturbed areas with a diverse mixture of appropriate plant species in order to achieve a self-sustaining ecosystem or other approved post-mining land use.

Most of the impacts due to habitat loss would be reversed during mining reclamation. Because reclamation includes the entire mine area, and 52 percent of the area consists of previously disturbed land, conversion to natural habitat would have beneficial impacts on wildlife and migratory birds due to the increase in potential habitat and habitat connectivity. These beneficial impacts would not occur until after the completion of reclamation. Common species are expected to return to the mining area in the long-term after reclamation occurs.

Contemporaneous reclamation of disturbed surface areas would be an integral part of the mining operation. Both public and private land would be reclaimed. At the completion of mining activities, the site would be restored to conditions and standards that meet approved post-mining land uses. These uses would include native plant communities similar to surrounding undisturbed areas for wildlife habitat, and grazing land potentially suitable for livestock. Once reclamation is successfully completed, wildlife populations at the mine site would be expected to return to existing (i.e., pre-mining operation) levels.

3.10.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

As with the Proposed Action, and for the same reasons, impacts during mining construction, operation, and active reclamation would be expected to be long-term, minor, of medium extent, probable, and adverse. There would also be long-term, minor, medium extent, probable, and beneficial impacts to wildlife and migratory birds from reclamation activities that can enhance or restore habitat so that more habitat is available for wildlife to use. The effects from mine development, operation, closure, and reclamation would be similar in nature and level as the Proposed Action. As with the Proposed Action, mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements and with compliant practices and products. These requirements, as well as BMPs and mitigation measures, would be identical to those outlined under the Proposed Action. Post-reclamation impacts would be expected to be long-term, minor, of medium extent, probable, and beneficial. Overall, impacts would be significant.

3.10.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

As with the Proposed Action, and for the same reasons, impacts during mining construction, operation, and active reclamation would be expected to be long-term, minor, of medium extent, probable, and adverse. There would also be long-term, minor, medium extent, probable, and beneficial impacts to wildlife and migratory birds from reclamation activities that can enhance or restore habitat so that more habitat is available for wildlife to use. The effects from mine development, operation, closure, construction and operation of an electrical substation, and reclamation would be similar in nature and level as Alternative 1. As with the Proposed Action and Alternative 1, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements, with compliance practices and products. These requirements, as well as BMPs and mitigation measures, are identical to those outlined under the Proposed Action. Post-reclamation impacts would be expected to be long-term, minor, of medium-extent, probable, and beneficial. Overall, impacts would be significant.

3.10.2.4 No Action Alternative

The No Action Alternative would avoid potential direct and indirect impacts of the Proposed Action to wildlife and migratory bird species. The only new impacts would be those associated with the Stage 1 abatement actions. These would be of a lesser magnitude and extent than the action alternatives with impacts that are expected to be short-term, minor, of medium extent, probable, and adverse. Overall, impacts would not be significant.

3.10.3 Mitigation Measures

In addition to the BMPs listed in Section 2.7, Best Management Practices, for wildlife and migratory birds, the following BMP would be required and implemented for activities associated with the Proposed Action.

Fencing: Wildlife exclusion fences would be constructed around the pit and other water and solution ponds to keep out wildlife such as deer, antelope, and smaller animals. This fencing would meet NMDGF standards for wildlife exclusion fencing that require an 8-foot-high fence, chain link or welded wire material. The bottom portion of the eight-foot chain link fence should be finer meshed and wrapped in a durable and corrosion-resistant material that would exclude small mammals and other terrestrial species and should extend from ground level to a height of at least three feet. Additionally, the bottom of the fence should be buried to prevent animals from digging underneath.

NMCC would monitor the fences on a regular basis and repairs would be made by NMCC as needed. In the event that livestock manage to enter the proposed mine area via a gate or opening in a fence, the grazing permittee would be contacted immediately. NMCC would assist as requested in moving these animals out of the proposed mine area.

3.11 VEGETATION, INVASIVE SPECIES, AND WETLANDS

This section describes vegetation, invasive vegetative species, and wetlands in the Copper Flat mine area and the potential environmental effects of the Proposed Action and the No Action Alternative on these resources. Vegetation both within the mine area boundary and outside the mine area boundary where mining-related activities would occur is discussed.

3.11.1 Affected Environment

The Copper Flat mine area is located within the foothills of the Black Range, which is a major north-south mountain chain in south-central New Mexico. To the west, the Black Range rises sharply above the Rio Grande Valley and Caballo Reservoir, which lie east of the Copper Flat mine area. The vegetation of the Copper Flat mine area is typical CDS in the lower elevations with an increasing grass component evident as elevations and slope increase. Much of the approximately 2,200-acre area was previously disturbed during mining ventures. Mining activities and infrastructure, combined with previous mining-related activities, have contributed to the disturbance of approximately 690 acres within the Copper Flat mine area (THEMAC 2011). Calculations based on digitized high-resolution 2009 aerial photography indicate that the total existing disturbed area is 910 acres, or 41.6 percent of the total proposed mine area (THEMAC 2011).

Some of the previously disturbed mine area has been reclaimed. There are no definitive records of the reclamation efforts that occurred after the Quintana operation, although from a review of correspondence it appears that some reclamation was conducted in either 1987 or 1988 (Emmer 2014). Revegetation was inconsistent, patchy, and yielded variable results. Reseeding efforts were limited to 46 acres in the north tailings pond and 8 acres to the east side of the plant site yard. The majority of disturbed land at the proposed mine site is currently sparsely covered by vegetation.

Vegetation data within the proposed mine boundary, pipeline corridor, Percha Creek, and Las Animas Creek were collected and described by Parametrix, Inc. within the 2010 and 2011 growing seasons. Both a noxious weed survey and a wetland survey were conducted. However, because the 2010 growing season was wetter than average, the vegetation cover and production results could be inflated (THEMAC 2011). Information gathered during these surveys provides the baseline data for the proposed mine area, pipeline corridor, Las Animas Creek, and Percha Creek.

As described in Section 2.0, Proposed Action and Alternatives, there are nine individual 5-acre millsite parcels (45 acres total) outside the mine area but essential to mining operations that would be used for staging, equipment, well pads, booster tanks, pumping systems, truck access, and structures to maintain the water supply pumping stations. There is also a 30-acre area where an electrical substation would be built to supply the increased power needed for accelerated processing under Alternative 2. Vegetation data from a 2015 survey performed for the nine individual 5-acre millsites and the 30-acre electrical substation area are included and discussed in this section.

Endangered, threatened, and special status plant species are discussed in Section 3.12, Threatened, Endangered, and Special Status Species.

3.11.1.1 Vegetation Within the Mine Area

Within the proposed mine area, there are highly disturbed areas because of previous mining activity, with little to no vegetation in places and areas with no topsoil. Some areas remain completely denuded of vegetation even after many years of mine inactivity. Areas where reclamation (seeding) took place, as well as areas on the periphery of the mining activity that were disturbed to a lesser degree, retain topsoil and support healthy stands of vegetation. Outside the mine area boundary, relatively intact vegetation communities are present.

The history of repeated disturbance in the mine area has dramatically affected vegetation communities. Current vegetation community distribution in the previously mined areas is perhaps more strongly correlated with previous land use than with the biotic or abiotic factors that typically render the distribution of vegetation types or vegetation potential. The “baseline” landscape for portions of the mine area includes a tailings dam, barren areas, various roads, a diversion channel, pit and pit lake, waste rock piles, prospector mining disturbance, grazing, and other disturbed areas. However, relatively intact vegetation communities are also still present within the mine area.

The vegetation of the mine area has been classified variously as semi-desert grassland and steppe (USGS 2004), CDS (Dick-Peddie 1993), and Hills Ecological Site (NRCS 2014). Using the data in Appendix I, the 2011 Biological Resources Survey Report by Parametrix, for the purposes of this analysis, the area has been characterized as a grassy hills area, a shrubland area, and an arroyo/ riparian area. There is a significant difference in shrub density, grass cover, and species diversity among the tailings dam, waste rock pile, grassy hills, shrubland, and arroyo/riparian land cover types (THEMAC 2011). Vegetation communities and vegetation found within each land cover type are discussed below. The type of vegetation and land cover, the acreage and percentage of each vegetation and land cover type, and the total aerial cover of each vegetation land cover type are listed in Table 3-27. The distribution of these major vegetation and land cover types are shown in Figure 3-28. Note that there are wetlands present within the proposed mine area boundary. These are discussed below along with the land cover types.

Table 3-27. Vegetation Cover Types Within the Proposed Mine Area

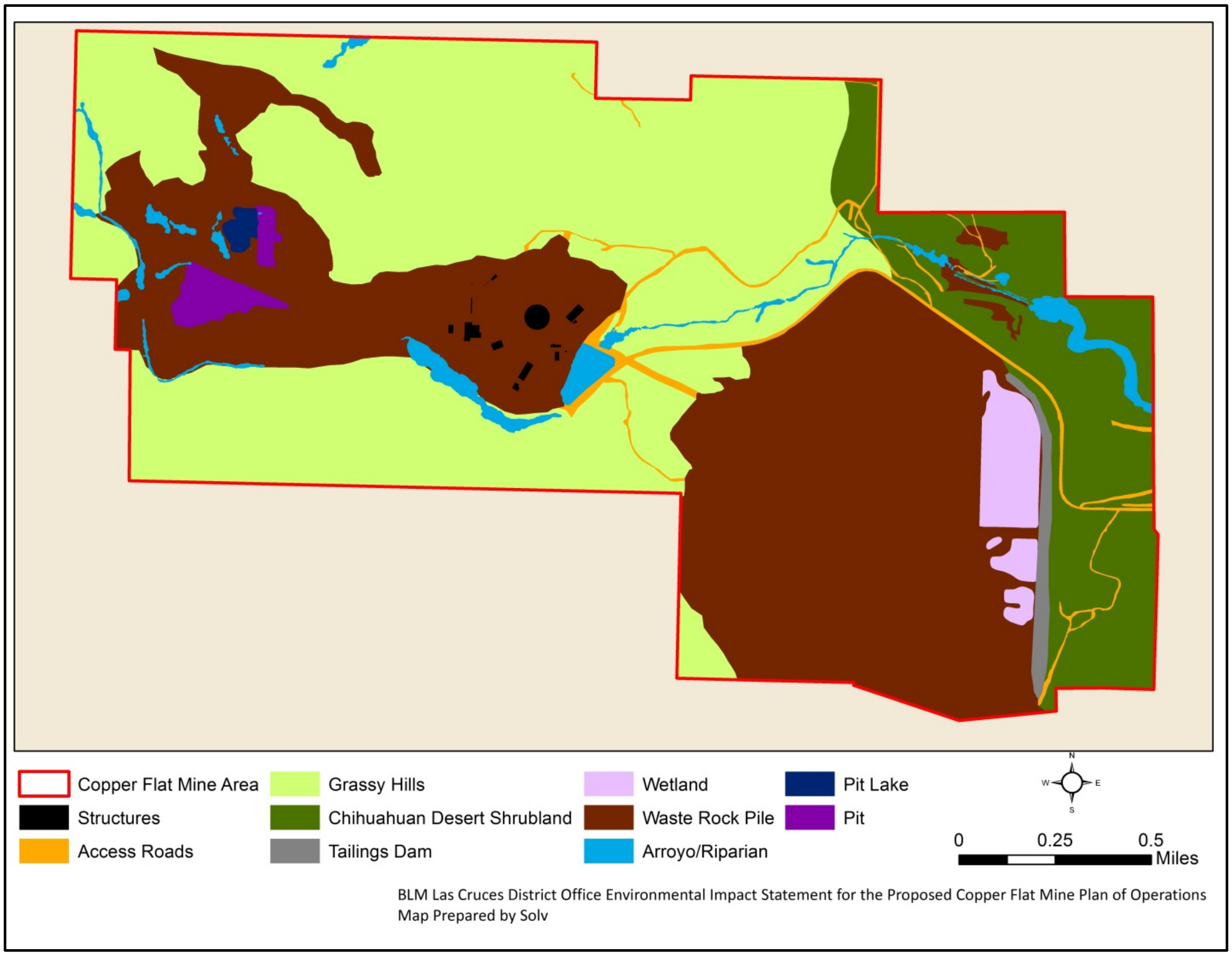
Table 3-27. Vegetation Cover Types Within the Proposed Mine Area

Land Cover	Acreage (Percent)	Total Vegetation Cover (Percent)
Grassy hills	932.9 (42.6)	64
CDS	260.9 (11.9)	42
Arroyo riparian	50.5 (2.3)	25
Access road*	36.5 (1.7)	--
Pit	21.4 (1)	4
Pit lake*	5 (0.23)	--
Tailings dam	16.6 (0.76)	34
Disturbed areas/waste rock piles	865.7 (39.5)	39

Source: THEMAC 2011.

Note: *Land cover types devoid of vegetation.

Figure 3-28. Land Cover Map of the Proposed Mine Area



Source: THEMAC 2011.

Grassy hills: Grassy hills cover 932.9 acres (or 42.6 percent) of the proposed mine area, making them the most abundant vegetative community, albeit highly disturbed. It is dominated by warm season grasses with typical northern Chihuahuan Desert shrubs. Two grass species, black grama (*Bouteloua eriopoda*) and sideoats grama (*B. curtipendula*), are the most abundant. Other perennial grass species found in this area include tobosa grass (*Pleuraphis mutica*), Harvard's three-awn grass (*Aristida harvardii*), cane bluestem (*Bothriochloa barbinodis*), blue grama (*Bouteloua gracilis*), hairy grama (*B. hirsute*), and fluff grass (*Dasyochloa pulchella*). The most abundant annual species found in this community is threadstem chinchweed (*Pectis filipes*). Shrubs include broom snakeweed (*Gutierrezia sarothrae*), cat-claw mimosa (*Mimosa aculeaticarpa*), honey mesquite (*Prosopis glandulosa*), spiny dogweed (*Thymophylla acerosa*), and creosote bush (*Larrea tridentata*). In areas devoid of vegetation, litter (partly decomposed leaves, twigs, or other plant parts) and cobble-sized rock are evenly distributed across the ground. Small oak or netleaf hackberry (*Celtis laevigata*) woodlands are present in isolated drainages on the northern and western portions of the proposed mine area. One-seed juniper (*Juniperus monosperma*) is most common on hill slopes with a north-facing aspect on the western half of the site (THEMAC 2011).

Chihuahuan Desert shrubland: Shrubland covers 260.9 acres (or 11.9 percent) of the proposed mine area and is composed primarily of shrub species characteristic of the Chihuahuan Desert. This area has experienced limited disturbance, except from grazing and isolated pockets of prospector mining. The most prominent shrub species found within this vegetative community are honey mesquite, tarbush (*Flourensia cernua*), and creosote bush. Grass species composition is relatively even and includes black grama grass, sideoats grama, fluff grass, bushy muhly grass (*Muhlenbergia porteri*), and tobosa grass. The most common perennial forb is small whitemargin sandmat (*Chamaesyce albomarginata*). Annual plant species include six weeks grama (*Bouteloua barbata*) and woolly honeysweet (*Tidestromia lanuginosa*) (THEMAC 2011).

Arroyo/riparian areas: Arroyo areas within the proposed mine boundary, covering 49.8 acres (or 2.3 percent) occur along Greyback Arroyo, the diversion channel, and pit lake. The arroyo vegetative cover has the highest woody plant density within the proposed mine area. The majority of vegetation within this land cover consists of shrubs, with Emory's baccharis (*Baccharis emoryi*) being the most abundant. Burro bush (*Hymenoclea monogyra*) is also frequent in Greyback Arroyo. Grasses make up 24 percent of the relative vegetation cover, with vine mesquite (*Panicum obtusum*) being the most abundant. Other vegetation found in Greyback Arroyo includes desert willow (*Chilopsis linearis*), Goodding's willow (*Salix gooddingii*), cottonwood (*Populus fremontii*), fourwing saltbush (*Atriplex canescens*), and the noxious weed saltcedar (*Tamarix* spp.).

A small cattail community was found along the fringe of the pit lake, and although no open water was present in this community during mine area surveys, it had relatively high soil moisture. Cottonwood , Goodding's willow, netleaf hackberry, Emory's oak (*Quercus emoryi*), honey mesquite, saltcedar, Apache plume (*Fallugia paradoxa*), rubber rabbitbrush (*Ericameria nauseousus*), velvet ash (*Fraxinus velutina*), single soapberry (*Sapindus saponaria*), and little walnut (*Juglans microcarpa*) were also encountered in this area (THEMAC 2011).

Pit: The pit makes up 21 acres (or 1 percent) of the proposed mine area. The most common ground surface in this location is crushed, cobble-sized rock. During mine area surveys (THEMAC 2011), plant cover was very low, with no annual plants encountered due to past disturbance from mine activity and subsequent loss of soil. A portion of this area is covered with perennial grasses; the three most common grasses encountered during mine area surveys were Harvard's three-awn, silver bluestem (*Bothriochloa laguroides*), and sideoats grama. Other vegetation found in this area includes forbs and shrubs. The most common shrub found was California brickelbush (*Brickellia californica*) (THEMAC 2011).

Tailings dam: The tailings dam area accounts for 16.6 acres (or 0.76 percent) of the proposed mine area. Based on current vegetation distribution and diversity, it is likely that this area was seeded during previous reclamation efforts (though gravel is the most prominent ground cover). During mine area surveys, perennial plants were the most abundant type of vegetation found in the tailings dam area. Of these, silver bluestem was the most abundant. Honey mesquite, broom snakeweed, and feather dalea (*Dalea formosa*) were the most abundant shrubs encountered (THEMAC 2011).

Disturbed areas/waste rock piles: Disturbed areas/waste rock piles account for 865.7 acres (or 39.5 percent) of the proposed mine area. The vegetation community found within the disturbed areas/waste rock piles is the most variable due to previous mining activities and associated reclamation efforts. Scraped areas, mining waste dumps, waste rock piles, and placer mining overburden are scattered throughout this land cover. Grasses, particularly graminoids, are the most common vegetation type found in the disturbed areas/waste rock piles. The most dominant species are sideoats grama, cane bluestem, black grama, and fluff grass. Shrubs found in this area include honey mesquite, broom snakeweed, and feather dalea. The most dominant perennial forb in this area is spreading buckwheat. Annual plant species include sixweeks grama, threadstem chinchweed, and tansy aster (*Machaeranthera tanacetifolia*). Besides vegetation, the groundcover in this area consists of bare soil, litter and gravel, and rock and bedrock (THEMAC 2011).

Wetlands: During mine area surveys (Intera 2012), two locations within the proposed mine area boundary appeared to meet wetland conditions as defined by the Clean Water Act (i.e., dominance by hydrophytic vegetation, hydric soils, and wetland hydrology). One of these areas is a small cattail wetland adjacent to the pit lake (see description above under Arroyo/Riparian Areas). The second wetland area, a patch dominated by Goodding's willow and estimated to be 1.5 acres, is located within the mine in the bottom of Greyback Arroyo just below the culvert where the pit access road crosses Greyback Arroyo. Seep willow (*Baccharis salicifolia*) also occurs here.

Formal wetland delineations were not conducted; however, NMCC has had informal discussions with the U.S. Army Corps of Engineers, and those discussions would continue moving toward the issuance of a 404 permit. The Corps determined that the cattails in the pit are not jurisdictional. Although the possibility of jurisdiction exists for the Goodings willow dominated wetland, based on conversations with the Corps, jurisdictional assertion is unlikely.

3.11.1.2 Vegetation Outside the Mine Area Boundary

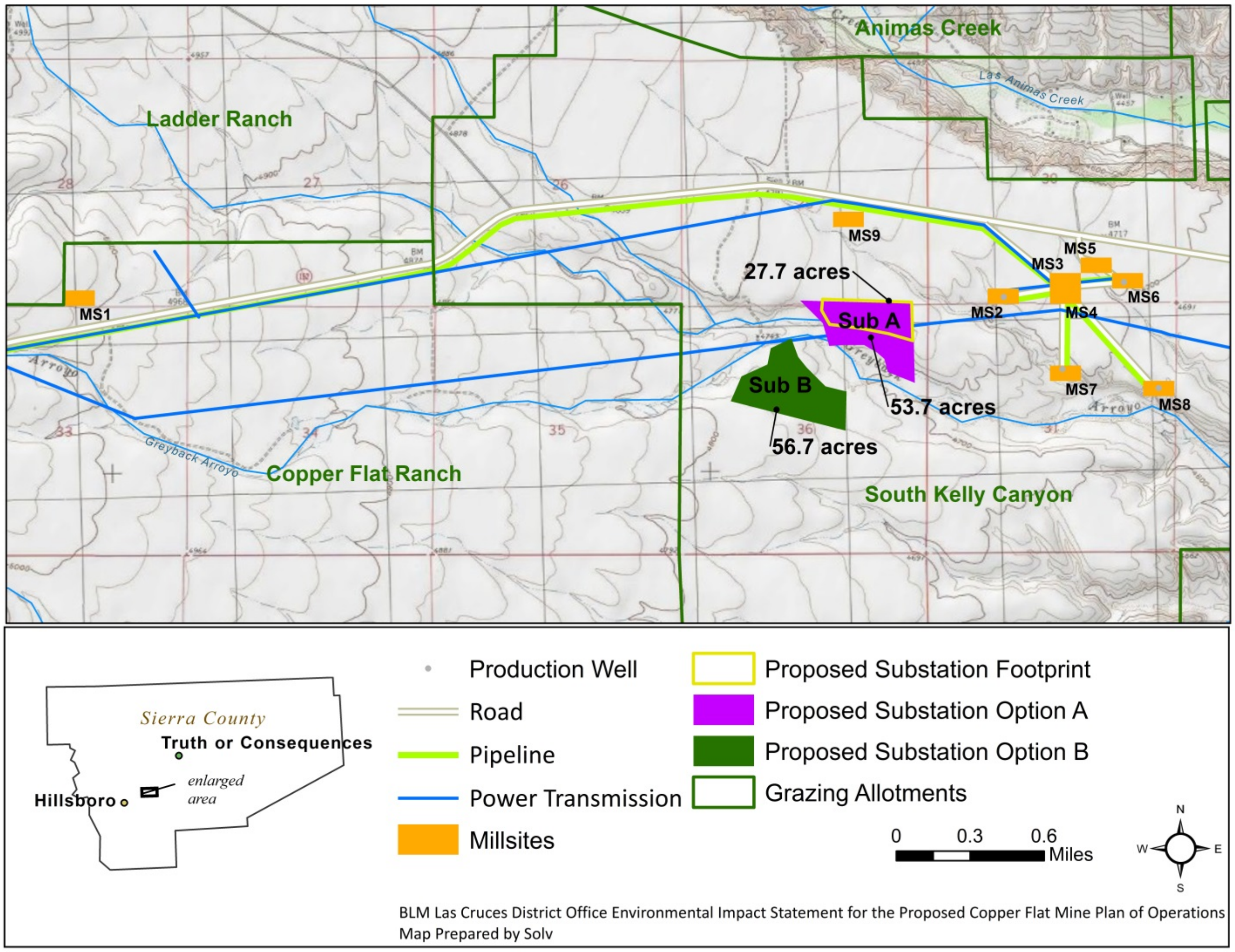
This section describes vegetation that is found in areas affected by the mining project that are outside the mine area. These areas include millsites, an electrical substation, pipeline corridor, Las Animas Creek and Percha Creek.

Millsites and substation site: The nine 5-acre millsites and the 30-acre substation location (see Figure 3-29) were the subjects of spring 2015/fall 2016 biological surveys that yielded 156 plant species, most of which were native. At the time of the surveys, the exact location of the substation was unknown, so two candidate locations were surveyed that were identified in the surveys as Option A and Option B. No special status plant species, wetlands, springs/seeps, noxious weeds, adits/shafts, or other biological features critically unique to the region were observed. The majority of the proposed millsites are located in areas with existing developments, such as production wells or monitoring wells, and each of the sites is bisected by a road. Five typical vegetation types were described for the broad millsite and substation survey area: creosotebush shrubland, draw vegetation, arroyo vegetation, grassland flat, and tobosa grass swale (GSA 2017).

The affected habitats are primarily CDS with a plant community that has deviated from its ecological potential (as described in the ecological site report for Gravelly) (GSA 2017). However, perhaps unintentionally, small portions of the millsite boundaries include draws and arroyo habitats that contain relatively unique microhabitats for the area. As indicated by the survey, the arroyo habitats and draws contain a higher biological diversity and abundance than the surrounding creosote flats. Avoiding disturbance in draws or in the arroyo during future developments in this area would be mitigative (GSA 2017). A detailed description of survey findings follows Figure 3-29.

- **Creosotebush shrubland:** Most of the survey area is dominated by creosotebush flats. In addition to creosotebush, other shrubs regularly observed included tarbush, mariola (*Parthenium incanum*), Christmas cactus (*Cylindropuntia leptocaulis*), purple prickly pear (*Opuntia macrocentra*), honey mesquite, and longleaf jointfir (*Ephedra trifurca*). Common forbs in this type include snakeweed, dwarf desertpeony (*Acourtia nana*), desert marigold (*Baileya multiradiata*), spreading fleabane (*Erigeron divergens*), Indian rushpea (*Hoffmannseggia glauca*), Coulter's horseweed (*Laennecia coulteri*), bristly nama (*Nama hispidum*), fiveneedle prickly leaf (*Thymophylla pentachaeta*), and skyblue phacelia (*Phacelia caerulea*). Bush muhly, burrograss (*Scleropogon brevifolius*), and fluff grass are the most common grasses. Creosotebush shrubland is the most dominant community through all of the millsites and in the substation Option A area. The southern portion of the substation Option B area is composed of creosote hills that transition into a creosote flat on the southernmost edge of the site.

Figure 3-29. Millsite and Substation Survey Areas



Source: NMCC 2015e.

- **Arroyo vegetation:** The bottom of Greyback Arroyo is dominated by honey mesquite, singlewhorl burrobrush (*Ambrosia monogyra*), and Apache plume. Tall shrubs and trees such as littleleaf sumac (*Rhus microphylla*), netleaf hackberry, whitethorn acacia (*Acacia constricta*), and desert willow are also present; primarily in the arroyo bottom or in the confluence of the arroyo bottom with the draws. The trees and taller shrubs appear to diversify the habitat at the site because they add significant vertical structure. Common forbs and grasses include sideoats grama, low woolly grass, rose heath (*Chaetopappa ericoides*), and absinth leaf bahia (*Bahia absinthifolia*). This type only intersects two small corners of the substation Option A site. The arroyo vegetation type is not present in the substation Option B site and the millsites.

- **Draws:** Side slopes of the draws that feed into Greyback Arroyo are dominated by honey mesquite and tobosa grass. Other species often found on draw slopes include sideoats grama, feather dalea, and longleaf jointfir. The draw bottoms contain similar species as the arroyo vegetation type but individuals are typically shorter statured and littleleaf sumac and catclaw mimosa are more prominent than in the arroyo type. The draw vegetation type intersects portions of the Substation Options A and B sites, and millsites 7 and 8.

- **Grassland flat:** The northern half of the Substation Option B site contains a large area dominated by annual grasses, tobosa grass, halfmoon milkvetch (*Astragalus allochrous*), and honey mesquite. Annual grasses, primarily six-weeks grama, compose most of the plant cover in this type.

- **Tobosa grass swale:** A tobosa grass swale has developed in a narrow zone where finer textured soils have accumulated over the gravelly loams that are more characteristic of the mine area. This vegetation type crosses through millsite 5 (MS5) and the small depression eventually drains into a draw vegetation type. Honey mesquite is the most common woody plant in this type.

Pipeline corridor and NM-152: Much of the area proposed for the pipeline corridor consists of existing roads, associated rights-of-way (ROWs), a power utility corridor, and well sites. Within this corridor, 67 plant species were observed during surveys. The dominant species observed were creosote bush, fluff grass, weeping lovegrass (*Eragrostis curvula*), spreading buckwheat, tarbush, broom snakeweed, tobosa grass, and honey mesquite (THEMAC 2011).

Las Animas Creek: Las Animas Creek, located in the Caballo Lake watershed approximately 4 miles north of the proposed mine boundary, contains variable stream flow, including ephemeral, intermittent, and perennial reaches along approximately 40 total river miles. The Las Animas Creek vegetation study area for this EIS fell entirely on private land. A property adjacent to the mine, Ladder Ranch, did not grant access permission for this study; as a result, the study area for Las Animas Creek includes the riparian habitats along approximately 7 river miles of the creek from the eastern Ladder Ranch boundary to I-25.

Riparian habitat along Las Animas Creek is extensive alongside the upper and middle reaches of the creek. Here the surficial geology consists of bedrock with inter-bedded clays that retard downward flow of surface waters, thereby sustaining a perched surface aquifer in the creek alluvium. This perched water table supports substantial riparian tree growth, including an ecologically important stand of Arizona sycamores (*Plantanus wrightii*) with cottonwoods, netleaf hackberry, velvet ash, Goodding's willow, and coyote willow (*Salix exigua*). Understory vegetation along the creek consists of burro bush and baccharis communities (THEMAC 2011). The Arizona sycamore is an important bird tree in this area, providing habitat for many species including woodpeckers and owls (Firefly Forest 2015). This tree can only be found along riparian corridors (NPS 2012) and is the most abundant co-dominant species along Las Animas Creek. Although habitat for the Arizona sycamore has been disturbed in this area, the population appears to be in good condition (THEMAC 2011). In the lower reach of Las Animas Creek, where the surficial geology does not have the shallow inter-bedded clays that would support a perched aquifer and the artesian well system does not contribute directly to creek flows, there is no riparian vegetation growth of any note. There are some minor patches of wetland emergent vegetation in the artesian-well fed ponds.

Percha Creek: Percha Creek lies approximately 2 miles south of the proposed mining boundary. Like Las Animas Creek, it has ephemeral, intermittent, and perennial sections. Percha Creek lies in the Caballo Lake watershed and enters Caballo Lake on the south end of the reservoir. The reach surveyed for the vegetation study also includes Percha Box, a steep-walled canyon with perennial flows. The Percha Creek study area includes the riparian habitats along approximately 15 river miles from Hillsboro, New Mexico to just above I- 25. Most of the study area was on private land with the exception of the Percha Box reach and a small section of State Trust land. Percha Box is carved through a portion of BLM property.

Riparian and arroyo riparian vegetation communities along Percha Creek included burro bush, Apache plume, baccharis, cottonwood, Goodding's willow, coyote willow, netleaf hackberry, little walnut, velvet ash, desert willow, honey mesquite, cat-claw acacia (*Acacia greggii*), whitethorn acacia, and cat-claw mimosa. Streamside patches of cattail were also observed along the Percha Box (Intera 2012).

3.11.1.3 Additional Vegetation Concerns in the Affected Environment

Invasive species: *EO 13112 - Invasive Species* directs Federal agencies to make efforts to prevent the introduction and spread of invasive plant species, detect and monitor invasive species, and provide for the restoration of native species. Invasive species are usually destructive, difficult to control or eradicate, and generally cause ecological and economic harm. A noxious weed is any plant designated by a Federal, State, or county government as injurious to public health, agriculture, recreation, wildlife, or property. Noxious weeds in New Mexico can be found on rangeland and wild land. The Noxious Weeds Management Act directs the New Mexico Department of Agriculture (NMDA) to develop a noxious weed list, identify methods of controlling designated species, and educate the public about noxious weeds. It is also the role of the NMDA to coordinate weed management among local, State, and Federal managers (NMDA 2012).

During the 2010 and 2011 surveys of the proposed mine area, saltcedar (*Tamarix chinensis*), a State-listed noxious weed, was encountered with some frequency within the proposed mine boundary (THEMAC 2011). The total area of saltcedar patches mapped in the mine area was approximately 30 acres. This shrub or shrub-like tree has numerous large branches and scale-like leaves. Its deep, extensive root system extends to the water table and can extract water from unsaturated soil layers. Saltcedar has spread throughout the southwestern United States, including New Mexico, where it is especially pervasive. It occurs in every major watershed in New Mexico and in a variety of community types, especially those dominated by cottonwood and willow. It is found in floodplains, arroyos, alkali sinks, and playas. This species out-competes native species as it is more drought-tolerant and less palatable to grazing animals than native species. Saltcedar is usually associated with changes in geomorphology, hydrology, soil salinity, fire regimes, plant community composition, and native wildlife density and diversity (Zouhar 2003).

Tree of heaven (*Ailanthus altissima*) and Siberian elm (*Ulmus pumila*) were both observed as single individuals growing at the base of the tailings dam. Both occurrences were isolated and minimal; only one pole-sized Siberian elm tree was observed, as was a small patch of tree of heaven, likely composed of one individual connected with rhizomes below ground.

Three State-listed noxious weeds were observed in the Las Animas Creek study area including Siberian elm, saltcedar, and tree of heaven. Two State-listed noxious weed species, tree of heaven and Siberian elm, were classified as co-dominants in the Percha Creek study area (THEMAC 2011).

Restoration of native species: In 2005, the BLM in New Mexico launched the Restore New Mexico initiative with the goal of restoring grassland, woodland, and riparian areas to a healthy and productive condition. To date, it has applied restoration treatments on over 3 million acres, including public, State, and private lands. This initiative has become a widely successful restoration and reclamation program involving numerous agencies, organizations, ranchers, and industry groups. Landscape restoration in New Mexico has focused on controlling invasive brush species, improving riparian habitat, reducing woodland encroachment, and reclaiming abandoned oil and gas well pads (BLM 2014).

In November 2014, a grassland restoration treatment of approximately 5,546 acres, targeting creosote bush, was completed for Copper Flat Allotment No. 16079 as part of the Restore New Mexico initiative (Gentry 2014) in partnership between the NRCS and the NMDGF with the Hillsboro Pitchfork Ranch LLC to improve habitat conditions upstream of the mine pit in the Grayback Arroyo system. Although this treatment is entirely outside of the proposed mine area, the long-term result of the treatment will be to reduce existing invasive species, with the objective of increasing more desirable herbaceous vegetation. This, in turn, will benefit the watershed by stabilizing soil and ultimately increase forb, grass, and favorable shrub production, resulting in increased and improved habitat for a variety of wildlife.

3.11.2 Environmental Effects

Vegetation resources are described in both their existing condition and the predicted effects from the Proposed Action and alternatives in the following sections: 3.11.2.1, Affected Environment; 3.11.2.2, Environmental Consequences; and 3.11.2.3, Mitigation Measures.

3.11.2.1 Proposed Action

Medium- and long-term, minor to moderate, of medium extent, and probable adverse effects would be expected under the Proposed Action, primarily to upland vegetation. Medium-term effects would be due to vegetation disturbance in the course of surface activities; however, ongoing reclamation activities would allow most of this vegetation to recover. Long-term effects would occur due to vegetation removal for the duration of the project. Impacts on wetland and riparian vegetation communities caused by deep groundwater drawdown would either not occur or would be negligible because of the minimal effect that drawdown in the deep aquifer would have on surface water or the shallow alluvial aquifers. The environmental effects to vegetation during mine development and operation and mine closure/reclamation are described below. Overall, impacts would be significant.

3.11.2.1.1 Mine Development and Operation

Mine development activities that would affect vegetation include clearing and grading activities associated with construction, operation, and maintenance. Both woody and herbaceous (non-woody) vegetation would be cleared and grubbed in constructing haul and secondary mine roads as well as mining facilities, essentially eliminating that vegetation for the approximately 16-year duration of the Copper Flat project. Approximately 1,586 acres of vegetation on both public and private lands would be directly affected. While 910 acres of the area within the proposed mine boundary have previously been disturbed from mining activities, the proposed mining activities would also impact 676 acres of undisturbed land within this boundary. Outside the mine area boundary, up to 45 acres would be permanently cleared of vegetation for millsite construction.

Under the Proposed Action, all of the natural plant communities would be disturbed, but the degree of disturbance would vary (i.e., direct impacts due to mining activity vs. indirect impacts caused by water drawdown). The grassy hills, shrublands, and arroyo/riparian areas would be directly impacted to some extent within the mine area boundary. Disturbed vegetation within the boundaries of past mining activities would also be impacted. To minimize the area disturbed, reclamation would be conducted concurrently with mining operations where feasible.

Adverse effects to vegetation within and surrounding the proposed mine area boundary and proposed pipeline corridor, as well as vegetation along NM-152, would also be expected from soil compaction and erosion, dust pollution, accidental spills, and the potential influx of invasive species.

Construction and operation of the proposed mine would result in soil compaction of the proposed mine site and surrounding area. Excessive soil compaction impedes root growth and limits the amount of soil available for roots, decreasing a plant's ability to take up nutrients and water. Soil compaction also increases water runoff and soil erosion. Surface water runoff and sediment from areas disturbed by construction could adversely affect local vegetation by exposing soils and transporting sediment off-site (UMN 2001). Though the proposed mine could result in an increase in soil compaction, erosion, and water runoff, the proposed site has already experienced soil compaction from past mining activities. The NPDES Stormwater Program requires that all construction projects that exceed 1 acre of disturbance develop SWPPPs and erosion and sedimentation control plans which minimize the potential for contamination of surface or groundwater resources (USEPA 2011). This plan, along with proposed

BMPs, would help control erosion on the mine site. Soil impacts are discussed further in Section 3.8, Soils.

During construction and operation of the mine, adverse effects to local off-site vegetation may occur because of fugitive dust emissions from construction machinery and worker traffic along unpaved roads. Dust can reduce photosynthesis by reducing the amount of light penetrating through the leaves of vegetation. Dust emissions could also increase the growth of plant fungal disease (NZME 2001). Dust from construction-related activities would be short-term, and after construction, local off-site vegetation would be expected to recover in a reasonable amount of time.

Invasive plant species can quickly colonize areas with disturbed soil conditions. Surface disturbance and construction activities could facilitate the establishment and spread of invasive plant species and noxious weeds. Aggressive non-native species could become established if ground disturbance during construction is extensive and long in duration. Construction equipment could aid in the introduction of invasive species by transporting an invasive species from one area to another; however, NMCC would comply with strict weed control stipulations imposed on projects conducted on public lands. All equipment must be pressure washed before being moved on-site; thus, there should be no introduction of noxious weeds. Additionally, the project's reclamation plan described in Section 2.1.15, Reclamation and Closure includes procedures to reduce the risk for problematic infestations of invasive plant species. However, even with a comprehensive array of diligent precautions, the potential for noxious weeds to become established would remain a substantive threat.

Possible spills of fuels and other material could cause shifts in population structure, abundance, diversity, and distribution of plant species. Depending on the type of material spilled, the effect on the environment could remain long after a spill event (USFWS 2004). Possible spills during construction of the proposed mine would be expected to be small and would be quickly contained.

Impacts on the small cattail wetland adjacent to the pit lake would be long-term and moderate since pumping of the pit lake would be necessary prior to mining and continuously throughout the life of the mine with bedrock water drawdown in this area greater than 100 feet. (See Figure 3-14b.) This small wetland would be mined out when the pit is mined and deepened. The second wetland area near the main mine entrance, which contains Goodding's willow, would be outside of the drawdown area. (See Figure 3-14b.) This area overlies the andesite bedrock of the Animas Uplift. As a result, there is no aquifer underlying the surface. Vegetation in the second wetland area does not rely on discharge from a shallow aquifer, but on runoff in Greyback Arroyo that feeds the shallow subsurface (Emmer 2015).

There would be no effects to riparian vegetation at either Las Animas or Percha Creek as no water drawdown is expected where riparian vegetation occurs. The downstream end of Percha Creek, where drawdown of groundwater in the shallow alluvium could be 0.5 to 1.5 feet by the end of mining, is dominated by burro bush and honey mesquite, both upland species.

In the lower reach of Las Animas, as noted in the groundwater analysis described in more detail in Section 3.6, Groundwater Resources, ancillary calculations and site inspection have indicated that water from the artesian wells does not create surface creek flows in the lower reach, but is consumed in pond and irrigation ET and subsurface alluvial recharge, which eventually flows into Caballo Reservoir. This is because the artesian wells have been employed for crop irrigation purposes by landowners along the lower reach where the well water is retained in a number of irrigation ponds or otherwise seeps back into the subsurface alluvial flows to Caballo Reservoir. Because artesian water is captured to such a great extent in this system, surface creek flows occur only immediately after substantive rainfall events.

3.11.2.1.2 Mine Closure/Reclamation

Revegetation of the mine site, in accordance with Appendix E of the MORP Revision 1 document (NMCC 2017a), would be consistent with the requirements of 19.10.6.603.G.(3) NMAC; these requirements include historic post-mining land uses as identified by the BLM in its land management plan consistent with the surrounding land uses of the Copper Flat site. The MORP's Reclamation and Closure Plan is designed to re-establish grazing in the area and allow for long-term use of the reclaimed areas by wildlife known to historically use the area, without affecting the potential for other uses such as mining and recreation. Revegetation success is discussed in more detail in Section 5.7 of MORP Revision 1 (NMCC 2017a).

The standards by which revegetation success will be measured are set forth in 19.10.6.603.G.(3) NMAC. NMCC does not propose to revegetate pit walls as they would self-vegetate with native flora over time, providing a self-sustaining ecosystem appropriate for the surrounding area, i.e., steep-canyon wildlife habitat. Additionally, Federal and State safety rules and regulations prohibit access to benches left in the pit walls for purposes of revegetation due to restrictions regarding work under rock highwalls and ingress/egress limitations (NMCC 2017a).

Upon closure of the mine, final reclamation would be conducted to restore original vegetation communities to disturbed areas. Revegetation activities would be done in accordance with the project's reclamation plan (NMCC 2017a). Reclamation procedures would also involve annual monitoring and appropriate modifications of revegetation guidelines in accordance with site-specific findings to maximize the potential for revegetation success. It is anticipated that reclamation efforts would be able to achieve a stable, perennial vegetation cover that would: 1) protect disturbed soils from erosion; and 2) provide suitable forage for livestock and wildlife habitat.

Reclamation activities would include revegetating disturbed areas with a diverse mixture of appropriate plant species in order to achieve a self-sustaining ecosystem or other approved post-mining land use. Tree- and shrub-dominated vegetation types in the proposed mine area would be converted to grass/forb-dominated vegetation types immediately following reclamation. Over the long-term, shrubs and trees would become reestablished and increase in abundance within the majority of disturbed areas as a result of reclamation and natural recolonization.

After pit lake pumping activities end, a lake is expected to reform as recharge refills the local cone of depression developed from pit lake pumping. Although it is not likely that the small cattail wetland currently adjacent to the pit lake would re-establish in the same exact location, it is possible that new wetlands would form in the area with riparian and water-loving plant species (willows, cottonwood, cattails, sedges, etc.), which may be introduced in shallow areas near the shoreline of the pit lake.

Seed mixtures: Table 3-28 provides the proposed interim seed mix for disturbed areas planned for contemporaneous reclamation (primarily associated with the seeding of the stockpiled growth media). It also shows the final seed mixtures proposed for the grazing and wildlife post-mining land uses. The seed mixtures include native warm and cool season grasses, perennial shrubs, and forbs (NMCC 2017a).

Table 3-28. Interim and Final Reclamation Seed Mixes

Scientific Name	Common Name	PLS/ac[1]	
		Interim	Final
Grasses - Warm Season			
Bothriochloa barbinodis	Cane bluestem	0.15	0.20
Bouteloua curtipendula	Sideoats grama	1.00	1.10
Bouteloua gracilis	Blue grama	0.20	0.25
Pleuraphis jamesii	Galleta	0.75	1.10
Leptochloa dubia	Green sprangletop	0.15	0.20
Seteria vulpiseta	Plains bristlegrass	0.20	0.30
Sporobolus cryptandrus	Sand dropseed	0.03	0.04
Grasses - Cool, Intermediate Season			
Achnatherum hymenoides	Indian ricegrass	0.60	1.30
Eragrostis intermedia	Plains lovegrass	0.05	0.04
Hesperostipa newmexicana	NM feathergrass	0.70	0.50
Shrubs			
Atriplex canescens	Four-wing saltbush	0.30	1.75
Ericamerica nauseosus	Rubber rabbitbrush	0.10	0.35
Fallugia paradoxa	Apache plume	--	0.10
Krascheninnikovia lanata	Winterfat	0.15	0.70
Forbs			
Dalea candida	White prairie clover	0.10	0.40
Linum lewisii	Blue fax	0.15	0.35
Ratibida colomnifera	Prairie coneflower	--	0.10
Sphaeralcea ambigua	Desert globemallow	0.10	0.40
Total		**4.73**	**9.18**

Source: NMCC 2017a.

Notes: [1] Rate is in pounds of pure live seed (PLS) per acre; substitutions may change seeding rates.

Table 3-29 provides the primary functions and attributes of each proposed plant species that would be used for seeding. The seed mixes are designed for application prior to the summer rains, and the seeding would be completed shortly ahead of and during the summer monsoon season (July through September). The overall target seed rate for final seeding is expected to vary, but would range from about 40 to 60 seeds per square foot. Interim seedings for growth media stockpiles and other temporary stabilization seedings target a seed density of 30 seeds per square foot. If interim seeding results show that one or more species has not performed well, a list of alternate species that may be substituted is included in Table 3-30 (NMCC 2017a).

Table 3-29. Functions and Attributes of Primary Proposed Plant Species

Species	Character[1]	Attributes and Function
Cane bluestem	N, P, W, G	Bunchgrass providing ground cover and forage
Blue grama	N, P, W, G	Drought resistant sod grass providing ground cover and forage
Sideoats grama	N, P, W, G	Drought tolerant bunchgrass providing ground cover and forage
Galleta	N, P, W, G	Bunchgrass providing erosion control and early spring/late fall forage
Green sprangletop	N, P, W, G	Erect bunchgrass; aggressive short-lived nurse plant with forage value
Plains lovegrass	N, P, I, G	Bunchgrass providing ground cover and early spring forage
Plains bristlegrass	N, P, W, G	Palatable bunchgrass with valuable seed for upland birds and small mammals
NM needlegrass	N, P, C, G	Persistent bunchgrass providing ground cover and forage
Sand dropseed	N, P, W, G	Drought tolerant bunchgrass adapted to sandy sites
Indian ricegrass	N, P, C, G	Tufted grass providing forage/seed to birds and small mammals
Apache plume	N, P, S	Mid-height shrub providing browse, cover and erosion control
Four-wing saltbush	N, P, S	Slightly evergreen shrub providing cover/forage for wildlife and livestock
Winterfat	N, P, HS	Low shrub providing nutritious winter browse
Rubber rabbitbush	N, P, S	Mid-height shrub providing cover and erosion control
Desert globemallow	N, P, F	Persistent mid-height forb providing browse for deer and antelope
Prairie coneflower	N, P, F	Red- and yellow-flowered forb attracting pollinators
White prairie clover	N, P, F	Nitrogen-fixing forb with lower water requirements providing forage and ground cover
Blue flax	N, P, F	Persistent blue-flowered forb, nutritious seed for ground birds

Source: NMCC 2017a.

Notes: [1]N=Native; P=Perennial; W=Warm season; C=Cool season; I-Intermediate season; G-Grass; S-Shrub; HS-Half shrub; F=Forb.

Table 3-30. Alternative Plant Species for Seed Mixtures

Scientific Name	Common Name
Grasses	
Andropogon saccharoides	Silver bluestem
Aristida purpurea	Purple three-awn
Bouteloua eriopoda	Black grama
Eragrositis curvula	Weeping lovegrass
Digitaria californica	Arizona cottontop
Hesperostipa comata	Needle and thread
Heterotheca contortus	Tanglehead
Panicum obtusum	Vine mesquite
Pleuraphis mutica	Tobosa
Sporobolus contractus	Spike dropseed
Shrubs	
Calliandra eriophylla	Fairyduster
Isocoma tenuisecta	Burroweed
Lycium pallidum	Wolfberry
Nolina microcarpa	Beargrass
Forbs	
Baileya multiradiata	Desert marigold
Coreopsis lanceolata	Lanceleaf tickseed
Machaeranthera tanacetifolia	Prairie aster
Penstemon parryii	Parry’s penstemon

Source: NMCC 2017a.

3.11.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Medium- and long-term, minor to moderate, of medium extent, and probable adverse effects to vegetation would be expected under Alternative 1. Implementation of Alternative 1 would result in the disturbance or loss of up to 1,401 acres of vegetation over the life of the mine. As in the Proposed Action, up to 45 acres would be permanently cleared of vegetation for millsite construction activities at the nine millsite locations. Overall, impacts would be significant.

Direct effects on vegetation resources would be similar to those described under the Proposed Action and include medium-term and long-term loss of vegetation associated with construction, operation, and maintenance of the Copper Flat project, degradation of vegetation due to trampling, soil compaction, spills, increased access, introduction of invasive and nonnative species, and loss of wetland and riparian vegetation. Mine closure and reclamation effects would also be similar to those described under the Proposed Action.

Indirect effects could occur as a result of water table decline. Effects on wetlands would be the same as under the Proposed Action with the small wetland adjacent to the pit lake being mined out and no effect on the wetland area which contains Goodding’s willow near the main mine entrance. (See Figure 3-17b.)

No or minimal adverse effects to riparian and aquatic vegetation along Las Animas Creek from water table drawdown would occur. There would be no effects to riparian vegetation at Percha Creek as no water drawdown is expected where riparian vegetation occurs.

3.11.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Medium- and long-term, minor to moderate, medium extent, and probable adverse effects to vegetation would be expected under Alternative 2. Implementation of Alternative 2 would result in the disturbance or loss of up to 1,444 acres of vegetation over the life of the mine. As in the Proposed Action, up to 45 acres would be permanently cleared of vegetation for millsite construction activities at the nine millsite locations and, under this alternative, as much as 30 additional acres would be cleared for substation construction. Overall, impacts would be significant.

Direct effects on vegetation resources would be similar to those described under the Proposed Action and include medium-term and long-term loss of vegetation associated with construction, operation, and maintenance of the Copper Flat project, degradation of vegetation due to trampling, soil compaction, spills, increased access, and introduction of noxious weeds and invasive and nonnative species, and loss of wetland vegetation. Mine closure and reclamation effects would also be similar to those described under the Proposed Action.

Indirect effects could occur as a result of water table decline. Effects on wetlands would be the same as under the Proposed Action with the small wetland adjacent to the pit lake being mined out and no effect on the wetland area which contains Goodding's willow near the main mine entrance. (See Figure 3-20b.)

There would be no or minimal effects to riparian vegetation at Las Animas Creek or Percha Creek.

3.11.2.2 No Action Alternative

Under the No Action Alternative, there would be no disturbance of the site's vegetation communities from clearing, grubbing, grading, or other project-related activities except for actions related to the cleanup of a sulfate plume created by previous mining activity under the Stage 1 abatement plan. Minor reclamation actions would be implemented to address disturbance from exploratory drilling and other incidental disturbance that may have occurred during the mine planning phases. Impacts from abatement and reclamation actions are expected to be short-term, minor, of medium extent, probable, and adverse. No additional vegetation and habitat would be disturbed or removed, and the existing vegetation communities described above would be expected to continue indefinitely. Natural and unnatural disturbances may occur in the area, as they have in the past, but overall the communities now present would be expected to remain. Over time, the effects of climate change may alter the vegetation composition and structure of the mine area, with some species and communities increasing in abundance while others decrease. Overall, impacts would not be significant.

3.11.3 Mitigation Measures

To prevent the introduction and minimize the spread of non-native vegetation and noxious weeds, mitigation measures would be implemented during project activities including:

- On-site biological monitoring in areas of noxious weed concern or presence would be conducted before, during, and after project activities. NMCC would be responsible for providing the monitoring.
- Vehicle and equipment parking would be limited to within construction limits or approved staging areas.

- Heavy equipment would be cleaned and weed-free before entering a mine area.
- Monitoring and follow-up treatment of exotic vegetation would occur after project activities are completed.
- All gravel and fill material imported on-site would be source-identified to ensure that the originating site is noxious weed-free.
- During the reclamation phase of the project, all areas disturbed by construction would be reseeded with the seed mixture described in Section 2.1.15.9

3.12 THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

This section analyzes impacts to those portions of the affected environment described previously in Sections 3.10 Wildlife and Migratory Birds and 3.11 Vegetation, Invasive Species, and Wetlands that have shown through field surveys, either the presence of, or the potential to provide habitat for, Federally-listed threatened and endangered (T&E) species, as well as other species that have been given special status by the State of New Mexico or by BLM. The section also summarizes the findings of a separate Biological Assessment (BA) that evaluated the impacts of the Preferred Alternative on the T&E species. Voluntary mitigation measures for potential effects are also discussed.

3.12.1 Affected Environment and Identification of Species Evaluated

Certain wildlife and plant species are provided special Federal protections under the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq*.) because of extremely low or declining populations from natural factors, loss of habitat or critical habitat features, and inadequate conservation measures. A species is listed as endangered if it is determined to be in danger of extinction throughout all or a significant portion of its range; as threatened if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Although endangered species are more imperiled, both endangered and threatened species are provided the same level of protection under the law. Special status species include those listed or proposed for listing under the ESA and species designated as sensitive by the BLM. Sensitive species are those requiring special management considerations to promote their conservation and reduce the likelihood and need for future listing under the ESA, and include Federal candidate species and delisted species in the 5 years following delisting (BLM 2008a).

There are numerous terrestrial and aquatic wildlife species and plants designated as special status species that are known to occur within Sierra County. As described in Section 3.10, Wildlife and Migratory Birds and Section 3.11, Vegetation, Invasive Species, and Wetlands, NMCC's biological resources contractor completed a biological study of the project site (including the proposed mine site, pipeline/NM-152 corridor, and Las Animas Creek and Percha Creek riparian areas) to identify the presence of special status wildlife and plant species and to evaluate the potential for and presence of habitat for special status species. The study consisted of searches of online databases, published books, and reports; communications with local experts to determine the potential occurrence and habitat needs of special status species in Sierra County; and limited, non-protocol field surveys of the mine area. Table 3-31 lists those special status species that were either observed or recorded in the vicinity of the project site or for which potential habitat was found to be present in the mine area.

One State-listed sensitive species, the loggerhead shrike (*Lanis ludovicianus*), was detected during the millsite and substation survey (NMCC 2015a). Potential habitat may be present in the mine area for 17 species described as sensitive or threatened by the State. Four of these species are also considered species of concern by the USFWS. The millsite and substation areas do not support potential habitat for any Federally-listed threatened or endangered species. Several BLM and State sensitive bat species were detected in the Copper Flat mine area during baseline data report surveys, and it is likely that those same species would be detected in the millsite and substation areas (particularly near the livestock watering tank identified in the survey as MS-9); however, a formal bat survey would be required to confirm that.

Table 3-32 lists other threatened or endangered wildlife and plant species identified by the USFWS that may occur in Sierra County in the vicinity of the project site (USFWS 2016a). These species were either included in the mine area biological survey and neither the species nor its habitat were observed, or the species was excluded from the biological survey because of lack of specific habitat features or requirements.

Table 3-31. Special Status Species Observed or with Potential Habitat in the Proposed Copper Flat Mine, Millsite, or Substation Areas

Common Name	Scientific Name	Status[1] Federal	Status[1] State	Status[1] BLM	Species Observed/ Recorded[2]	Potential Habitat[2]
Reptiles and Amphibians						
Chiricahua Leopard Frog	*Lithobates chiricahuensis*	T				3
Southwestern (Arizona) Toad	*Anaxyrus (Bufo) microscaphus*		S	S		3
Birds						
Common Black Hawk	*Buteogallus anthracinus*		T		3	3
Yellow-billed Cuckoo[3]	*Coccyzus americanus*	T	S	S	3	3
Bald Eagle	*Haliaeetus leucocephalus*		T	S	3	
Northern Aplomado Falcon	*Falco femoralis septent.*	NEP	E			1, 2, 3
Peregrine Falcon	*Falco peregrinus anatum*		T			1, 2
Arctic Peregrine Falcon	*Falco peregrinus tundrius*		T			1
Mexican Spotted Owl	*Strix occidentalis lucida*	T	S		3	
Loggerhead Shrike[4]	*Lanius ludovicianus excub.*		S		1, 3	1, 2, 3
Baird's Sparrow	*Ammodramus bairdii*		T	S	3	1, 2
Sprague's Pipit	*Anthus spragueii*			S		2
Bell's Vireo	*Vireo bellii arizonae*		T	S		3
Gray Vireo	*Vireo vicinior*		T			1
Western Burrowing Owl	*Athena cunicularia*			S		2
Mammals						
Allen’s Lappet-brown Bat	*Idionycteris phyllotis*			S		1, 2, 3
Townsend's Big-eared Bat	*Corynorhinus townsendii*			S	1, 3	1, 2, 3
Fringed Myotis Bat	*Myotis thysanodes*		S		1, 2, 3	1, 2, 3
Yuma Myotis Bat	*Myotis yumanensis yuman.*		S		1, 2, 3	1, 2, 3
Desert Pocket Gopher	*Geomys arenarius brevirostris*		S			1
Ringtail	*Bassariscus astutus*		S			2
Common Hog-nosed Skunk	*Conepatus leuconotus mearnsi*		S			1, 3
Western Spotted Skunk	*Spilogale gracilis*		S			1, 3
Plants						
Duncan’s Pincushion Cactus	*Escobaria duncanii*		E	S		1, 2
Sandberg Pincushion Cactus	*Escobaria sandbergii*		S			1, 2
Thurber’s Campion	*Silene thurberi*		S			1

Source: Intera 2012, BLM 2013, BLM 2011, USFWS 2016a

Notes: [1] T = threatened; E = endangered; C = candidate; S = sensitive; NEP = nonessential experimental population.

[2] 1 = mine site 2 = pipeline corridor 3 = Las Animas/Percha Creeks riparian areas.

[3] Western distinct population segment (DPS).

[4] Species detected in mine area, millsite, and substation surveys.

Table 3-32. Federally-listed Species Not Observed or with No Potential Habitat in Mine Area

Common Name	Scientific Name	Status[1]	Habitat
Reptiles and Amphibians			
Narrow-headed Garter Snake	*Thamnophis rufipunctatus*	T	Species strongly associated with clear, rocky streams using predominantly pool and riffle habitat that includes cobbles and boulders; species range in New Mexico is Gila River to Arizona border. Habitat is not in mine area.
Mammals			
Mexican Gray Wolf (in the wild) *	*Canis lupus baileyi*	E	Species inhabits evergreen pine-oak woodlands, pinyon–juniper woodlands, and mixed-conifer montane forests that are inhabited by preferred prey of elk, mule deer, and white-tailed deer. Mine area is not preferred habitat, and species not observed during surveys of mine area.
Fishes			
Gila Trout	*Oncorhynchus gilae*	T	Habitat restricted to a few isolated streams in the upper Gila River and San Francisco River drainages, which are outside mine area.
Rio Grande Silvery Minnow	*Hybognathus amarus*	E	Known to occur only in reach of Rio Grande from Cochiti Dam to headwaters of Elephant Butte Reservoir; which is outside the mine area.
Plants			
Todsen's Pennyroyal	*Hedeoma todsenii*	E	Plant grows in gypseous-limestone soils on north-facing slopes in piñon-juniper woodland; this type of habitat is not in mine area.

Source: USFWS 2016a; Intera 2012.

Notes: [1] T = threatened; E = endangered.

*The Turner Endangered Species Fund is conducting a captive breeding program for Mexican gray wolf reintroduction to the wild and manages an outdoor acclimation holding facility some 4.5+ miles from the mine site on the Ladder Ranch property. The Biological Assessment evaluates potential impacts to the wolves in that holding facility.

3.12.2 Effects on Threatened, Endangered and State- and BLM-listed Special Status Species

This section presents the impacts of the Proposed Action and alternatives, including the No Action alternative on Federally-listed Threatened and Endangered species and on New Mexico State-listed and BLM-listed special status species in the project area. Consistent with the scope of the BA and the USFWS biological opinion on the proposed Copper Flat mining project, impacts to Federally-listed species were evaluated for one alternative only--Alternative 2 (the Preferred Alternative). A summary of the findings of the BA analysis is presented at the end of Section 3.12.2.3 under Alternative 2. The effects determined in the Biological Assessment are applicable to both the Proposed Action and Alternative 1 and are more conservative within the context of the following statements. The higher ore production rate of Alternative 2 over eleven years of mining operations produces greater impacts than the

Proposed Action over sixteen years of mining operations and Alternative 1 over eleven years of mining operations because the higher Alternative 2 ore processing rate:

- would require a higher ongoing rate of groundwater pumping and resulting higher depletions of surface water flow;
- would cause a greater intensity for multiple resource – affecting activities such as truck traffic, mine worker activities, air emissions, noise, etc.;
- would require a higher level of blast activities to remove more ore for both the same and longer duration of mine operations;
- would cause post-mining pit lake effects to remain virtually the same for all alternatives, although these effects would be extended to the sixteenth year for the Proposed Action.

Effects on the Chiricahua leopard frog and the proposed mitigative conservation measure, as described for Alternative 2, occur relatively shortly after mine operations begin and persist throughout the period of mine operations.

3.12.2.1 Proposed Action

Long-term, minor, and small extent, adverse effects would be expected under the Proposed Action on NM State-listed or BLM-listed special status species that are not Federally-listed T&E species and that have been observed in the project site, or that could occur because potential habitat exists in the project site. Overall, these impacts would be significant.

3.12.2.1.1 Mine Development and Operation

Mine development and operation activities would impact a total of 1,586 acres (see Table 2-1) on both public and private lands within the proposed mine area boundary, of which approximately 57 percent has been previously disturbed from past mining activities. The remainder would be new surface disturbance (Intera 2012). As described in Section 3.11, Vegetation, Invasive Species, and Wetlands, the terrestrial plant communities that would be impacted by new surface disturbance within the mine boundary and through the pipeline/NM-152 corridor for utility and infrastructure support are not considered unique but represent some of the more common vegetation types in New Mexico.

Effects to riparian habitats, which are not widespread or common but occur only along water courses in New Mexico, would be minor and only a small amount of wetland habitat adjacent to the pit lake would be affected. These riparian habitat effects would include mining out the small wetland adjacent to the pit lake, but there would be no effect on the wetland area which contains Goodding's willow near the main mine entrance. In the lower reach of Las Animas Creek, flow to the artesian well-fed irrigation ponds would be measurably affected by mine pumping operations. These ponds have not been surveyed for presence of Federally listed species or habitat suitability but based upon consultation with the USFWS it would be assumed that the ponds have Chiricahua leopard frogs in them and that mine operations may affect, and would likely adversely affect this species.

The mine development activities could directly result in displacement of or mortality to any New Mexico-listed or BLM-listed special status species inhabiting the project site where potential habitat exists. Mobile species would likely avoid injury or mortality by leaving the area; however, less mobile or burrowing species might be more susceptible to injury or mortality from mine development activities. Removing 676 acres of CDG and CDS would impact any special status species inhabiting or using the project site; however, this type of habitat is the most common throughout the surrounding area, and no unusual plant communities necessary for special status species survival would be disturbed. Thus, removal of this common habitat type would not impact the special status terrestrial and avian species listed in Table 3-31 that could be present in the project site. Should nests be removed as described below in Section 3.12.3, Mitigation Measures, migratory birds that have a fidelity to past nesting areas could be affected during the following nesting season.

Special status bat species were recorded within the project site. The existing mine pit lake provides feeding habitat, and the crevices in the rocky hills and the abandoned mine shafts within the mine area boundary provide roosting habitat (Intera 2012). Mining operations would change the function and use of the pit lake, which would probably affect the presence and number of insects that serve as a food source for bats. However, lighting for nighttime mining operations could become a new attractant for insects. Shafts or adits that would be closed or re-opened for mining would eliminate potential roosting habitat for bats, but these effects would be minimized with the mitigation measures described in Section 3.12.3, Mitigation Measures. Noise from mining operations and increased human presence could also deter bats from using or returning to available roosting habitat.

Although general habitat requirements were present or marginally present in the project site for the special status plant species listed in Table 3-31, no plants were observed and none are expected to occur (Intera 2012). The only known New Mexico population of Duncan's pincushion cactus is more than 4 miles northeast of the project site (Intera 2012).

3.12.2.1.2 Mine Closure and Reclamation

Reclamation of the mine site after closure would aim to restore original vegetation communities to disturbed areas. Riparian areas would not likely be affected by groundwater drawdown, however, riparian locations may be replanted to replace any vegetation mortality that may have occurred during the conduct of the mining operation if such mitigation appears warranted from post-mining field surveys. Although reclamation of disturbed areas would increase available habitat for special status species over the long-term, the pre-mining conditions were not important habitat for special status species survivability. The mine pit lake would be expected to refill after pumping ceases and would become a likely food source for special status bat species.

It is unlikely that groundwater drawdown would change the composition of the riparian plant communities as discussed in Section 3.12.2.1.1, Mine Development and Operation. However, riparian species would be planted after mining operations cease to replace any riparian vegetation loss that may have occurred during the conduct of mining if such mitigation appears warranted from post-mining field surveys.

The likelihood and severity of possible effects to Federally-listed species were evaluated, and any measures necessary to mitigate adverse effects are being determined in consultation with the USFWS in compliance with Section 7 requirements of the ESA. Any necessary terms and conditions are also being determined in that process. That analysis addresses the potential effects of the preferred alternative (Alternative 2). The findings of that evaluation are summarized for Alternative 2 below.

3.12.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Long-term, minor, small extent, probable, and adverse effects would be expected under Alternative 1 on special status species that are not Federally-listed and that have been observed in the project site, or that could occur because potential habitat exists in the project site. Overall, these impacts would be significant. Alternative 1 would result in approximately 185 fewer acres of total surface disturbance (including existing and new disturbance) than the Proposed Action. (See Tables 2-1 and 2-16.) Direct and indirect impacts on special status species that could occupy the type of habitat found on the mine site would be similar to those described for the Proposed Action, but slightly less because less potential habitat would be disturbed.

The spatial extent of drawdown of the deeper groundwater table along Las Animas Creek near the water supply wells would be greater. However, the extent of the riparian area that could experience a change in plant community composition would still be considered negligible with no or discountable impacts expected to special status species that inhabit the affected area. Mine closure and reclamation impacts to special status species would also be similar to the Proposed Action.

The likelihood and severity of possible effects to Federally-listed species were evaluated and any measures necessary to mitigate adverse effects are being determined in consultation with the USFWS in compliance with Section 7 requirements of the ESA. In some cases, the US Fish and Wildlife Service finds that an action may adversely affect a species, but not jeopardize its continued existence. When this happens, the Service prepares a Biological Opinion with an incidental take statement for the proposed Federal project. Under most circumstances, the ESA prohibits take, which is defined as harming (includes killing) or harassing a listed species. Incidental take – take that results from a Federal action but is not the purpose of the action – may be allowed when the Service approves it through an incidental take statement. The statement includes the amount or extent of anticipated take due to the Federal action, reasonable and prudent measures to minimize the take, and terms and conditions that must be observed when implementing those measures. That analysis addresses the potential effects of the preferred alternative (Alternative 2). The findings of that evaluation are summarized for Alternative 2 below.

3.12.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

3.12.2.3.1 Impacts to NM State-listed and BLM-listed special status species

Long-term, minor, small extent, probable, and adverse effects would be expected under Alternative 1 on special status species that are not Federally-listed and that have been observed in the project site, or that could occur because potential habitat exists in the project site. Overall, these impacts would be significant. Alternative 2 would result in approximately 142 fewer acres of total surface disturbance (including existing and new disturbance) than the Proposed Action. (See Tables 2-1 and 2-24.) This would be offset to a minor degree by the loss of approximately 30 acres of habitat to substation construction outside the mine area. Direct and indirect impacts to special status species that could occupy the type of habitat found on the mine site would be the same as those described for the Proposed Action, but slightly lower because less potential habitat would be disturbed.

The spatial extent of drawdown of the deeper groundwater table along Las Animas Creek near the water supply wells would be greater. The extent of the riparian area that could experience a change in plant community composition would still be considered negligible with no or discountable impact on special status species that inhabit the affected area. Mine closure and reclamation impacts to special status species would also be significant and similar to the Proposed Action.

3.12.2.3.2 Effects Determinations for Federally-Listed T&E Species

Consistent with the scope of the BA and the USFWS biological opinion on the mining proposal, impacts to Federally-listed species were evaluated for Alternative 2 (the Preferred Alternative). Therefore, the summary of the findings of the BA analysis are presented for Alternative 2. The Final BA is included as Appendix J.

The USFWS Southwest Region defines the options for findings in a BA of the effects of a proposed project on listed species as follows: The effects determination should be a logical resolution justified by the analysis and consist of one of three choices: 1) no effect; 2) may effect but is not likely to adversely affect; and 3) may effect and is likely to adversely affect. A "no effect" determination is suitable for those actions that are anticipated to have no adverse effects to listed species or critical habitat. A "may affect but is not likely to adversely affect" determination is the appropriate conclusion when effects on listed species or critical habitat are expected to be discountable, insignificant, or completely beneficial. A "may affect but is not likely to adversely affect" determination requires written concurrence from the USFWS. A "may affect and is likely to adversely affect" determination is the appropriate conclusion if any adverse effect to listed species or critical habitat may occur as a direct or indirect result of a proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. A "may affect and is likely to adversely affect" determination requires formal consultation.

Federally-Listed Species for which the BA Finding was “No Effect”

The Proposed Action would have no effect on the following species listed in Table 3-32: the narrow-headed garter snake, the Mexican gray wolf in the wild, the Gila trout, the Rio Grande silvery minnow, and Todsen’s pennyroyal. These species were not observed in the Copper Flat Project biological survey and the mine area does not contain essential habitat elements or essential prey for these species.

Federally-Listed Species the Project May Affect

As discussed in Section 3.6, Groundwater Resources, and in the previous section on vegetation impacts, groundwater drawdown of the deep aquifer would have only a minimal effect on water in the shallow alluvium and would not likely cause a measurable effect on surface stream flows of either Las Animas Creek or Percha Creek in the reaches of these creeks that support riparian and aquatic vegetation and habitat. As such, it may affect three of the special status species listed in Table 3-31, including the Federally-listed Chiricahua leopard frog, yellow-billed cuckoo (Western DPS), or Mexican spotted owl. Nevertheless, the likelihood and severity of these possible incremental effects were evaluated and any measures necessary to mitigate adverse effects are being determined through consultation with the USFWS in compliance with Section 7 requirements of the ESA.

Chiricahua leopard frog: The Chiricahua leopard frog requires different habitats at each stage in the species’ life history to maintain a reproducing population. These habitats include: permanent or nearly permanent water that is free or relatively free from non-native predators and not overly polluted by livestock excrement or chemical pollutants; shallow water with emergent and perimeter vegetation that provide egg deposition, tadpole and adult thermoregulation sites and foraging sites; deeper water, root masses, and undercut banks that provide refuge from predators and potential hibernacula during the winter; substrate that includes some mud that allows for the growth of alga and diatoms (food for tadpoles) and to allow for hibernacula; and a diversity or complex of nearby aquatic sites including a variety of lotic and lentic aquatic habitats to provide habitat for breeding, post-breeding, and dispersing individuals (USFWS 2008). Potential habitat was observed but the frog itself was not observed during Parametrix reconnaissance-level field surveys in Percha Creek and Las Animas Creek (Intera 2012).

The project site is within Recovery Unit 8 (USFWS 2007) with extant populations of the frog. Las Animas Creek is occupied. The action area of the project includes the aquatic and riparian area along Las Animas Creek that could be affected by groundwater drawdown from mine operations and the area that covers the reasonable dispersal capability of the frog. Reasonable dispersal could be within 1 mile overland, 3 miles along an ephemeral or intermittent drainage, and 5 miles along permanent water courses from a known occupied habitat (USFWS 2008). Frog populations are known to occur in Cuchillo Creek and in at least three other drainages (and in dirt tanks in the vicinity of these drainages) in Sierra County (BLM 2013), but these would not be within a reasonable dispersal distance from the project site.

The BA determination for the Chiricahua leopard frog is that the Copper Flat mine operations may effect but would not adversely affect the Chiricahua leopard frog that may be living in the perennial sections of Las Animas Creek or in adjacent riparian areas but that the project may affect and would likely adversely affect any Chiricahua leopard frogs that may inhabit the artesian-well-fed irrigation ponds in the Las

Animas Creek floodplain. Because a voluntary conservation measure would be undertaken to compensate for any potential take of Chiricahua leopard frogs in the managed floodplain ponds, BLM concluded that the project may affect, but would not likely adversely affect the restoration of Chiricahua leopard frogs overall in Recovery Unit 8.

These determinations are based on the following:

1. In the portion of the lower Las Animas Creek where segments of the creek's surface flows are perennial and thus where riparian and aquatic vegetation that could support the frog is present, the proposed project groundwater pumping would cause some minimal incremental effect on streamflow. In this creek zone, there is no direct hydrologic connection between the shallow underlying perched aquifer that sustains the surface flow and the deep aquifer that would be pumped for mine operations. However, pumping would divert some minimal amount of surface water flowing from the upper Las Animas creek into the deeper aquifer before that flow reaches the perennial section. This effect would not be measurable and therefore would be discountable so far as causing adverse effects.
2. In the floodplain adjacent to the lowest reach of Las Animas Creek, where the floodplain is highly developed and managed for agriculture, deep aquifer flows to the artesian well-fed irrigation ponds would be measurably affected by mine pumping operations. These ponds have not been surveyed for presence of frogs or habitat suitability so it was assumed that one or more of the ponds contain Chiricahua leopard frogs. It is expected that landowners would attempt to maintain pond levels, and thus irrigation flows, by pumping the wells if diminished artesian flows affect maintenance of the irrigation water supply. However, in cases where a landowner does not find it feasible or cost effective to do so, any suitable frog habitat that may be present could be adversely affected which in turn may kill frogs or cause them to disperse. To compensate for these potential effects, NMCC would voluntarily fund a conservation measures to benefit the Chiricahua leopard frog in Recovery Unit 8. The additional Chiricahua leopard frog conservation measure proposed for the Copper Flat project would consist of NMCC, the project proponent, transferring funds in an amount agreed to by USFWS, BLM and NMCC to a third party entity to be approved by the USFWS. The funds will be used for the purchase or lease, and management of a conservation easement. The easement would conserve existing, occupied suitable habitat or provide suitable habitat for the establishment and continued support of a newly introduced or expanded local population of the Chiricahua leopard frog. The conservation easement would be located in Recovery Unit 8 as described in the Chiricahua leopard frog Final Recovery Plan (U.S. Fish and Wildlife Service. 2007. Chiricahua Leopard Frog (Rana chiricahuensis) Final Recovery Plan. Albuquerque, NM: U.S. Fish and Wildlife Service, Southwest Region).

Northern Aplomado falcon: The northern aplomado falcon that could occur in Sierra County is a nonessential experimental population, which is defined as a species proposed for Federal listing under Section 10(j) of the ESA. Suitable habitat for the falcon includes desert grasslands with scattered mesquite and yucca, and riparian woodlands in open grasslands, with minimal disturbance from agricultural and grazing practices. The CDG and CDS habitats that exist in the project site have been affected by grazing practices and lack some of the yucca/grassland habitat preferred by the falcon. Falcon releases have occurred in Sierra County along with grassland restoration projects in the vicinity, but these releases have not resulted in known aplomado falcon nests in the county (BLM 2013).

Mine construction or operation actions that would remove native desert grasses permanently or remove grasses but favor establishment of shrubs as revegetation species would adversely affect the potential for the area to support the Aplomado falcon. Mine development activities that would affect vegetation include clearing and grading activities associated with construction, operation, and maintenance. Both woody and herbaceous (non-woody) vegetation would be cleared and grubbed in constructing haul and secondary mine roads as well as mining facilities, eliminating that vegetation-for the approximately 16-year duration of the Copper Flat project.

Approximately 1,586 acres of vegetation on both public and private lands would be directly affected. While 910 acres of the proposed mine area have been disturbed from past mining activities, the proposed mining activities would also impact 676 acres of undisturbed land within this boundary. Outside the mine area boundary, up to 45 acres would be permanently cleared of vegetation for construction activities at the millsite locations. In eastern Mexico, home ranges were 2.6-9.0 km2 (642 to 2,224 acres), or 11-39 pairs/100 km2 (11-39 pairs/24,710 acres) (Hector 1988). In northern Chihuahua, 10 home ranges occupied approximately 400 km2 (10 home ranges occupied 98,842 acres), and individual home-range sizes based on radiotelemetry were 3.3- 21.4 km2 (815 to 5,288 acres) (Montoya et al. 1997). Therefore, it is possible that the proposed 676 acres of clearing might affect an area large enough to comprise the home range of one aplomado falcon, or portions of two or more falcons, if at some future date the aplomado falcon established a population in New Mexico.

Although mine development would remove some substantial acreage of grassland and shrubland vegetation, that vegetation is widespread and common throughout the area in Sierra County that the minimal potential habitat losses in the project area that would occur may affect but would not adversely affect the northern aplomado falcon or its preferred habitat.

Southwestern willow flycatcher: The southwestern willow flycatcher was not definitively detected during the 2011 or 2015 surveys of the project area, although a single willow flycatcher was identified in a spring survey of Las Animas and Percha Creeks. The bird may have been the southwestern subspecies; however, weighing against that possibility is the fact the species was not detected in the summer on the creeks and the habitat of the creeks is marginal for the southwestern subspecies. Further, available data for Las Animas and Percha Creeks riparian areas do not indicate historic or current presence of the species. The dense riparian habitat required for its nesting is not present in the project area on the creeks but is present along the Rio Grande. As noted previously, because the 2011 and 2015 surveys were not conducted according to a standard protocol that would be employed to locate a protected species, no conclusion about the presence or absence of the southwestern willow flycatcher in the project action area can yet be made.

The BA (Appendix J) found that designated critical habitat for the southwestern willow flycatcher occurs many miles northeast of the project's action area in a separate watershed, so the species critical habitat would not be affected by project activities. Because the subspecies nests along the Rio Grande and is known to occur in the area of Percha Dam, it is possible that reductions in groundwater flow volumes to Caballo Reservoir from pumping groundwater for mine operations might, if not mitigated, affect nesting pairs near the reservoir.

In the Rio Grande watershed, reservoirs capture and store native Rio Grande water and water piped from northwestern New Mexico via the San Juan-Chama Project. This water is designated for particular users and managed by the Rio Grande Compact. Elephant Butte and Caballo reservoirs, for example, hold Rio Grande Compact water for users in southern New Mexico and Texas. Heron, El Vado and Abiquiu reservoirs on the Chama River store water for cities like Albuquerque and Santa Fe, farmers and the six Middle Rio Grande pueblos.

Elephant Butte Reservoir is managed to maintain required water levels in Caballo Reservoir under the terms of the Compact so any loss of water to Caballo Reservoir from project pumping would be offset by increased flow from Elephant Butte Reservoir as part of their routine operations. Thus, the Caballo losses would shift to become Elephant Butte losses. To compensate for the Elephant Butte losses, NMCC has agreed to purchase water rights in the Rio Grande basin above the Caballo Reservoir to offset the total of all water losses due to project pumping**.**

The Jicarilla Tribe has affirmed that the water they have agreed to lease to NMCC, if it were not leased to NMCC, would still be released in the Rio Grande and so would not be diverted from some other place because of the NMCC lease. It would go into the Rio Grande via the San Juan Chama Project at Heron for use by some other lessee. The environmental impacts of the San Juan Charma Project were evaluated in an EIS in 2016 (BOR 2016). Therefore, because the water level in Caballo Reservoir would remain constant, the Copper Flat project may affect, but would not adversely affect the southwestern willow flycatcher.

Yellow-billed cuckoo (Western DPS): The disruption and changes to natural river and stream processes, which help the development and regeneration of riparian vegetation, have been identified as a threat to the yellow-billed cuckoo (Western DPS) (USFWS 2014). Lack of an adequate food supply is another threat for the cuckoo, which forages almost entirely in native riparian habitat. The cuckoo is primarily dependent on large caterpillars, which depend on cottonwoods and willows. A segment of Las Animas Creek, which is upstream of the area that could be impacted by groundwater drawdown, supports a diverse area of pole-sized sycamore, cottonwood, Gooding's willow, and coyote willow, and could be a food source for the cuckoo. Breeding habitat of the yellow-billed cuckoo consists of expansive blocks of riparian vegetation, especially cottonwood-willow woodland containing trees of various ages, including larger, more mature trees used for nesting and foraging (USFWS 2014). For these areas to remain as viable western yellow-billed cuckoo habitat, the dynamic transitional process of vegetation recruitment and maturity must be maintained, and without such a process of ongoing recruitment, habitat becomes degraded and is eventually lost (USFWS 2014).

The BA found that there would be no effect to yellow-billed cuckoo proposed critical habitat because the species critical habitat is located upstream of Caballo Reservoir along the Rio Grande and therefore not in the project action area. Should additional yellow-billed cuckoo critical habitat be proposed downstream to include the Caballo Reservoir, the additional critical habitat would be affected.

The proposed action may affect, but would not likely adversely affect the yellow-billed cuckoo near the Caballo Reservoir. The preferred alternative would not result in measurable changes in streamflow on Las Animas or Percha Creeks; therefore, no indirect effects from the potential alteration of surface flow volumes, stream characteristics, or riparian habitats along the two creeks would be expected. Reduced groundwater discharge to Caballo Reservoir could adversely affect lakeside vegetation used for nesting and foraging by the cuckoo. However, as described above, NMCC would fully offset the loss of water flow to Caballo Reservoir by purchase of water rights on the Rio Grande above Caballo Reservoir so there would be no net loss of flow or change in water levels due to the mining project. Because the potential effects of water loss to the Caballo would be fully compensated by the proposed purchase of offsets, the effects are discountable so would not add to the cumulative effects of any other actions affecting the yellow-billed cuckoo.

Mexican spotted owl: Historically, the Mexican spotted owl occupied low-elevation riparian forests, but it now typically breeds and forages in dense, old-growth mixed-conifer forests along steep slopes and ravines. The owl has been recorded in all montane regions in New Mexico and may occur in piñon-juniper and cliff habitats in Sierra County; however, there are no known nest sites or activity centers in the county (BLM 2013).

The BA (Appendix J) found that although the owl has been observed in the vicinity of the project site, the project would not likely cause any adverse change to the density or composition of the riparian plant community the owl is using for cover and foraging. Further, the dense riparian areas used by the owls are not located close enough to mining operations to be subject to light disturbance that might cause the owls to disperse, reducing their survival ability.

Supply well pumping for mining operations would affect the deep-water aquifer, but the surface waters in Las Animas creek that support riparian growth are sustained almost exclusively by other water sources, not the deep aquifer. Similarly, there would be no measurable effects to portions of Percha Creek where dense riparian growth currently exists. Pumping drawdown would affect the short reach of Percha Creek just west of Highway 25, but as is the case with the lower reach of Las Animas Creek, that reach does not support riparian growth.

Blasting noise may affect owls using riparian habitats along Percha or Las Animas Creeks in the winter or spring. However, the distance from the mine blast locations to riparian habitats along either of the creeks is greater than 3 miles. The bowl-shape of the mine site and pit, the rugged intervening terrain, which would act as a series of effective sound barriers similar to the sound walls used to shield homes from highway noise, and the fact that the riparian habitats are located in the deep-incised creek bottoms with surrounding steep hillsides would combine to diminish blast sound levels to minimally above background noise. Noise levels in the riparian areas along Percha and Las Animas Creek are expected to be less than 64 dB and in most of the habitat, less than 49 dB which is approximately background level.

Blast noise would not affect owls in their Protected Activity Centers (PACs) or other locations on the Gila National Forest because those locations are too distant from the mine site and blast noise would have dissipated before reaching them. By the time the sound reaches the PACs in the critical habitat, it would be below normal background.

Although the owl has been observed near the project site, the project would not likely cause any adverse change to the density or composition of the riparian plant community the owl is using for cover and foraging. Supply well pumping for mining operations would affect the deep Santa Fe aquifer, but the surface waters in Las Animas creek would not be measurably affected by the deep aquifer pumping as discussed previously in Section 4.4.1.2. Similarly, there would be no measurable effects to portions of Percha Creek where dense riparian growth currently exists. Pumping drawdown would affect the short reach of Percha Creek just west of Interstate Highway 25, but as is the case with the lower reach of Las Animas Creek, that reach does not support any more than sparse creekside growth.

Therefore the conclusion in the BA is that the project may affect, but would not adversely affect the Mexican spotted owl.

Ladder Ranch Species

Chiricahua Leopard frog on the Ladder Ranch: The Turner Endangered Species Fund has worked in partnership with the USFWS and the NMDGF to conserve Chiricahua leopard frog on the Ladder Ranch since 2001. TESF works to maintain and expand wild Chiricahua leopard frog populations on the Ladder Ranch and to maintain captive refugia and captive breeding facilities for on- and off-ranch frog populations. Ladder Ranch is home to the last large Chiricahua leopard frog population in New Mexico and plays a crucial role in the survival of this species. Numerous factors have been implicated in the range-wide decline of Chiricahua leopard frogs, including: disease, nonnative species invasions, habitat degradation, and an increase in the severity and duration of drought events. Perhaps in response to reduced natural habitat availability and drying climatic conditions, these frogs have been found to naturally colonize man-made livestock water tanks. This behavior prompted TESF to incorporate the Ranch's extensive stock-water infrastructure into a comprehensive Chiricahua leopard frog conservation program on the Ladder Ranch, which includes wild and captive population management, as well as captive breeding efforts

The BA determined that pumping of groundwater for mine operations that would be conducted in the lower reach of the Las Animas Creek would have no effect on the surface waters of the Las Animas Creek upstream on the Ladder Ranch nor would it affect the waters or riparian vegetation on any of the creek's tributaries which are also located upstream of the lower Las Animas reach where the pumping would be conducted; thus, there would be no impacts from loss of surface waters. Potential contamination of surface waters on the Ladder Ranch from the use of pit water for dust control on mine roads would not affect the frogs because the Ladder Ranch surface waters are in a local drainage that is entirely separate from the drainage of the mine roads. The mine roads watershed is the Greenhorn-Greyback Arroyo drainage. Therefore, the finding for the Chiricahua leopard frog populations on the Ladder Ranch is that the Copper Flat project would cause No Effect.

Mexican gray wolf in the Ladder Ranch holding facility: The Ladder Ranch is located in Mexican Gray Wolf Recovery Area 21B and has been involved in Mexican gray wolf recovery since 1997 when the Ladder Ranch Wolf Management Facility (LRWMF) was constructed. This pre-release facility is managed by TESF and the USFWS. Since this facility began operation in 1998, it has held over 100 wolves. As a member of the Mexican Wolf Species Survival Plan (SSP), TESF follows approved management guidelines administered in the U.S. and Mexico. The mission of the SSP is to reestablish the Mexican gray wolf in the wild through captive breeding, public education, and research. The LRWMF comprises five enclosures, ranging in size from 0.3 acres to approximately 0.70 acres. Caretaking of wolves at the facility is carried out by the TESF, though the facility is managed and supported financially by the USFWS. During 2016, 16 individual wolves were housed at the Ladder Ranch. Ten wolves were transferred to the Ladder Ranch while twelve wolves were transferred out. Six births and no deaths occurred at the Ladder Ranch in 2016. At year's end, the Ladder Ranch housed four Mexican gray wolves (USFWS 2016).

Ladder Ranch reinforces the wolves' natural avoidance behavior to humans by providing as much privacy and as little disturbance as possible. The concern for the Mexican gray wolf on Ladder Ranch is that noise and ground vibrations from blasting at the Copper Flat mine site could potentially adversely affect the wolf in its holding facility, impairing its ability to acclimate to the wild. The BA analyzed these potential effects and found that Copper Flat project may affect, but would not likely adversely affect the Mexican gray wolf at the Ladder Ranch wolf holding facility. This conclusion is based on the following points:

1. Wolves are not known to be highly sensitive to loud sounds. Their hearing is similar to humans at lower frequencies but attuned to a greater range of higher frequency sounds rather than the much lower frequency sounds of the airborne concussive noise of blasting.
2. The wolf holding facilities are a substantial distance away--more than 4.5 miles-- from the mine pit where blasting would occur.
3. There is a great deal of intervening mountainous terrain which would act as a muffling series of sound barriers much as the sound walls used to shield human communities from traffic and other loud noises.

Bolson tortoise in holding pens on the Ladder Ranch: The largest and rarest of the five North American tortoise species, the Bolson tortoise is thought to have once lived throughout most of the Chihuahuan Desert, but its current range is restricted to a small area in north central Mexico where the states of Durango, Chihuahua, and Coahuila meet. With their powerful front legs, tortoises dig burrows in which they spend over 85 percent of their time. Bolson tortoises dig burrows up to 8 meters long and 2 meters deep as refuge from predators and extremes of climatic and weather conditions, and surface activity is correlated with rainfall and temperature. Morafka *et al*. (1989) calculated that adult Bolson tortoises spend less than 1 percent of their entire lives on the surface, either basking or feeding along well-established trails near the burrow.

TESF (2018) describes their overall goal at Ladder Ranch as to establish independent, free-living, minimally managed Bolson tortoise populations in the northern portion of the Chihuahuan Desert, which constitutes their prehistoric range. To this end, Ladder Ranch aims to: 1) increase Bolson tortoise population size through robust captive breeding and head-start programs that protect juveniles until they reach a predator-resistant size; 2) release juvenile Bolson tortoises on the Ladder and Armendaris Ranches to establish wild populations. Successful breeding programs elsewhere in New Mexico have hatched over 400 juvenile tortoises since 2006. Hatchlings and juveniles are fed native forage in outdoor, predator-proof enclosures until they are large enough to be released (about the size of the native box turtle). It typically takes between 3 and 7 years or more for a hatchling Bolson tortoise to reach that size.

TESF commented that the blasting at the Copper Flat mine might cause the collapse of or damage the burrows of the Bolson Tortoise. According to Ladder Ranch, the Bolson tortoise burrows are located 2.5 miles from the mine site. A recent study of the potential effects of blasting and traffic vibrations on tortoises (Barneich et al. 2004) found that an impact of 0.4 inches per second peak particle velocity is a conservative estimate of the vibration level that could affect a tortoise burrow. A safe explosion distance would be 300 feet from the burrow to protect it from damage.

The finding of the analysis of potential impacts to Bolson tortoises and their burrows concludes that the Copper Flat project may affect, but would not likely adversely affect either the tortoise or the tortoise’s burrows on the Ladder Ranch for the following reasons.

Vibration effects:

- Ground vibrations from blasting would be attenuated at much shorter distances from the blast location than airborne noise levels; and
- Bolson tortoise burrows are located more than 8 times further distance from the mine (13,200 feet) than the distance (1,573 feet) at which the vibrations would be ten times *lower* than the conservative impact level.

Noise effects:

- Intervening terrain would greatly attenuate blasting noise; and
- Bolson tortoises spend only 1 percent of their time on the surface and there is a great deal intervening terrain that would attenuate surface noise levels so the tortoises are unlikely to hear the noise from blasting at ground level.

Southwestern willow flycatcher and yellow-billed cuckoo at Ladder Ranch: General species distribution and habitat information for the southwestern willow flycatcher and yellow-billed cuckoo were presented previously. Available data for Las Animas and Percha creeks riparian areas do not indicate historic or current presence of the southwestern willow flycatcher. The dense riparian habitat required for its nesting is not present in the project area along the creeks although it is present along the Rio Grande. The NMDGF reports the yellow-billed cuckoo as a summer resident of the riparian sycamore portions of Las Animas Creek. The NMDGF Southwest New Mexico Birding Trail Brochure for Site 33, Las Animas Creek, describes the creek as hosting Arizona sycamores, creating an ideal environment for southwestern riparian species such as yellow-billed cuckoo.

Ladder Ranch is extremely concerned about how wildlife restoration projects and ecotourism programs on the ranch would be impacted by the potential reduction in stream flows in Las Animas Creek and Cave Creek. Roughly 80 percent of all the wildlife on Ladder Ranch depends on these creeks for survival and these creeks are important migration corridors for birds, as well as nesting grounds for southwestern willow flycatchers and yellow-billed cuckoos on Las Animas Creek.

The hydrologic analysis of the effects of pumping groundwater for mining operations conducted for the EIS indicated that the surface waters of Las Animas Creek supporting the Arizona sycamores and other streamside vegetation would not be affected by any loss or reduction in the flow of surface waters that sustain creek-side vegetation. The permanent surface flows on the Las Animas Creek in the lower reach of the creek are not hydrologically connected with the deep groundwater that would be pumped for mining operations. Therefore, the riparian habitat that supports the yellow-billed cuckoo and other birds along Las Animas Creek would not be affected.

The two species could be affected by groundwater drawdown from mine project pumping that would reduce subsurface flows and therefore reservoir water levels in the Caballo Reservoir. However, that reduced level would be offset by inflow of waters from Elephant Butte Reservoir. This compensatory water flow would be provided through the project's purchase of water rights in the watershed of the Rio Grande north of Caballo Reservoir. Pumping drawdown of the deep aquifer in the lower reach of Las Animas Creek may affect but would not likely adversely affect the two species on the periphery of Caballo Reservoir.

The evaluation of potential effects concluded that there would be no effect on the two bird species on Ladder Ranch and that pumping drawdown of the deep aquifer in the lower reach of Las Animas Creek May Affect but Would Not Likely Adversely Affect the two species on the periphery of Caballo Reservoir.

The following is that basis for those conclusions:

- The hydrologic analysis of the effects of pumping groundwater for mining operations conducted for the EIS indicated that the surface waters of Las Animas Creek supporting the Arizona sycamores and other streamside vegetation would not be affected by any loss or reduction in the flow of surface waters that sustain creek-side vegetation.
- The permanent surface flows on the Las Animas Creek in the lower reach of the creek are not hydrologically connected with the deep groundwater that would be pumped for mining operations. Therefore, the riparian habitat that supports the yellow-billed cuckoo and other birds along Las Animas Creek would not be affected.
- The two species could be affected by groundwater drawdown from mine project pumping that would reduce subsurface flows and therefore reservoir water levels in the Caballo Reservoir. However, that reduced level would be offset by inflow of water provided through the project's purchase of water rights in the watershed of the Rio Grande north of Caballo Reservoir.

Other Species of Concern at Ladder Ranch and Las Animas Creek

Black-tailed prairie dogs: Ladder Ranch has been restoring black-tailed prairie dog colonies within two miles (10,560 feet) of the mine. Ladder Ranch is concerned that blasting and other mining operations could cause the collapse of burrows and alter behavior patterns. Similar to the discussion above for the Bolson tortoise, with burrows at a distance of two miles, blasting vibration effects would have diminished prior to reaching the colonies so as to be barely perceptible; thus, no impacts to black-tailed prairie dog burrows or behavior from such distant blast vibrations are expected to occur prairie dogs on Ladder Ranch.

Native fish species of concern: The USFWS completed 90-day findings on the Rio Grande chub (*Gila pandora*) and Rio Grande sucker (*Catostomus plebeius*) in 2016 (USFWS 2016a) and is presently conducting a 12-month finding that may lead to these species being listed. These species are found in small streams, such as Las Animas and Percha Creeks. In addition, Las Animas Creek supports the only population of Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*) in the Caballo geographic management unit (GMU). Further loss of Rio Grande cutthroat trout populations would likely trigger additional listing review.

None of the fish species of concern would be affected by implementation of the Copper Flat mine project. Pumping of the deep aquifer during mine operations would not affect flowing waters in Las Animas or Percha Creek because water levels in the creeks do not depend on the deep aquifer. Rather, water levels in these creeks vary depending on rainfall runoff and snowmelt from the contributing watersheds and on pumping of shallow wells screened in the surface alluvium underlying the creeks. The three fish species would not be affected by minimal changes in water levels in Caballo Reservoir caused by drawdown of subsurface flows to the reservoir. These fish depend on the colder water conditions of the flows in the tributary creeks and are not residents of the reservoir per se.

Summary of Findings of the Biological Assessment

Table 3-33 provides a summary of determinations of effect of the proposed project on Federally-listed, threatened, or endangered species. The BA is included as Appendix J.

Table 3-33. Summary of the Analysis of Effects on Federally Listed Species

Table 3-33. Summary of the Analysis of Effects on Federally Listed Species		
Species	**Listing Status**	**Determination of Effects***
Chiricahua Leopard Frog *Rana chiricahuensis*	Threatened	May Affect, is Not Likely to Adversely Affect Chiricahua Leopard Frog in Las Animas Creek May Affect, is Likely to Adversely Affect Chiricahua Leopard Frog in Irrigation Ponds on Las Animas Creek floodplain*
Narrow-headed Garter Snake *Thamnophis rufipunctatus*	Threatened	No Effect
Mexican Spotted Owl *Strix occidentalis lucida*	Threatened	May Affect, is Not Likely to Adversely Affect
Northern Aplomado Falcon *Falco femoralis septentrionalis*	Non-Essential Experimental Population	May Affect, is Not Likely to Adversely Affect
Yellow-billed Cuckoo *Coccyzus americanus*	Threatened	May Affect, is Not Likely to Adversely Affect
Southwestern Willow Flycatcher *Empidonax traillii extimus*	Endangered	May Affect, is Not Likely to Adversely Affect
Mexican Gray Wolf *Canis lupus baileyi)* in the wild	Endangered	No Effect
Gila Trout *Oncorhynchus gilae*	Threatened	No Effect
Rio Grande Silvery Minnow *Hybognathus amarus*	Endangered	No Effect
Todsen's Pennyroyal *Hedeoma todsenii*	Endangered	No Effect

Table 3-33. Summary of the Analysis of Effects on Federally Listed Species (Concluded)		
Species	**Listing Status**	**Determination of Effects**
Ladder Ranch Species		
Chiricahua Leopard Frog	Threatened	No Effect
Mexican Gray Wolf (in Ladder Ranch holding facility)	Endangered	May Affect, is Not Likely to Adversely Affect
Bolson Tortoise	Endangered	May Affect, is Not Likely to Adversely Affect
Southwestern Willow Flycatcher	Endangered	May Affect, is Not Likely to Adversely Affect
Yellow-billed Cuckoo	Threatened	May Affect, is Not Likely to Adversely Affect

Source: Summarized from internal FEIS data.

A voluntary conservation measure would compensate for potential take of Chiricahua leopard frogs.

3.12.2.4 No Action Alternative

Under the No Action Alternative, the project would not be constructed and NMCC's proposed open pit mining operations would not occur. The environmental, social, and economic conditions described as the affected environment would not be affected by the construction, operation, reclamation, or closure of the mine. The mine area would be reclaimed according to BLM standards, and to NMED requirements pertaining to disturbances associated with site exploration.

There may be possible new surface disturbance within and surrounding the mine area boundary in the area targeted by the Stage 1 abatement plan. The abatement process is still in the planning stages and no remedies are yet selected, so the magnitude, extent, duration, and likelihood of the impacts are not yet known and the impact significance is indeterminate. No groundwater depletions from supply well pumping under the No Action Alternative that might result in a loss or degradation of potential habitat available for use by special status species. Existing upland and riparian plant communities suitable as habitat for special status species would be expected to continue to survive. Natural disturbances such as fire and drought, and human disturbances such as development and groundwater use, would continue to occur in the area, but the habitat now present would be expected to remain for some time into the future.

3.12.3 Mitigation Measures

NM and BLM-listed Special Status Species: The special status bird species are provided protection from harm under the Migratory Bird Treaty Act, as discussed in Section 3.10, Wildlife and Migratory Birds. Therefore, mitigation measures applicable to migratory birds would also apply to special status bird species, including avoiding ground clearing and other mine development activities during breeding and nesting season (generally March 1 through August 31) until the area is surveyed by a qualified biologist to confirm the absence of nests (on the ground and in burrows and vegetation) and nesting activity to avoid impacting migratory birds. Active nests (containing eggs or young) would be avoided until they are no longer active or the young birds have fledged. The area to be avoided around the nest would be appropriate to the species, and the size of the avoided area would be confirmed by a BLM biologist.

Prior to starting mine development activities, a bat survey of old mine shafts would be conducted to determine the seasonal occupancy and type of roost habitat provided by the shafts, such as migratory, hibernaculum, breeding, or maternity. The survey results would guide the method and time of exclusion of bats before the shafts are closed or reopened. To avoid hibernation and maternity periods, exclusion is usually scheduled for early spring or late summer/early fall (April or September-October) (Brown et al.

no date). Eviction would not be attempted if the weather during any month becomes cold and windy, since the bats may not exit to forage during these conditions (Brown et al. no date).

Riparian species would be planted after mining operations cease to replace any riparian vegetation loss that may have occurred during the conduct of mining if such mitigation appears warranted from post-mining field surveys.

Threatened and Endangered Species: No specific measures are proposed to mitigate impacts to T&E species apart from those described above for special status wildlife populations, with the following exceptions.

1. Water rights would be purchased in the Rio Grande watershed above Elephant Butte Reservoir to offset losses of water to the Rio Grande system from mine operations pumping of the Santa Fe aquifer underlying Las Animas Creek. These voluntary purchases would mitigate water losses in Caballo for users of Caballo water for local purposes, as well as mitigate any potential impacts to Southwestern willow flycatcher and yellow billed cuckoo nesting in the Caballo reservoir perimeter.
2. New Mexico Copper Corporation would voluntarily fund a conservation measure to benefit the Chiricahua leopard frog in Recovery Unit 8 to compensate for potential take of the frog in artesian-well-fed irrigation ponds affected by operational deep aquifer pumping. The frog conservation measure proposed for the Copper Flat project would consist of the NMCC transferring funds in an amount agreed to by USFWS, BLM and NMCC to a third-party entity to be approved by the USFWS. The funds will be used for the purchase or lease, and management of a conservation easement to conserve existing, occupied suitable habitat or to provide suitable habitat for the establishment of, and continued support of a newly introduced or expanded local population of the Chiricahua leopard frog
3. As part of ongoing project environmental monitoring, NMCC will use monitoring wells to track changes in water levels at points along the Las Animas and Percha Creeks to determine if the hydrologic modeling analysis metrics were an accurate and adequate predictor of impacts to surface waters in the creeks, in the artesian wells, and in the surficial alluvium feeding Caballo Reservoir. Monitoring of blast noise and ground vibration at measured distances from the mine will also be done to determine if the noise and vibration levels predicted at the mine site in the analysis of noise and blasting impacts at various distances was accurate and adequate in predicting no effects to potentially affected species. Should any substantive deviation from the modeled predictors occur that would increase impacts to potential affected species, additional conservation measures would be considered.

3.13 CULTURAL RESOURCES

Cultural resources are described in both their existing condition and the predicted effects from the Proposed Action and alternatives in the following sections: 3.13.1, Affected Environment; 3.13.2, Environmental Consequences; and 3.13.3, Mitigation Measures.

3.13.1 Affected Environment

Cultural resources are physical manifestations of culture, specifically archaeological sites, architectural properties, ethnographic resources, and other historical resources relating to human activities, society, and cultural institutions that define communities and link them to their surroundings. They include expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, buildings, structures, objects, and districts, which are considered important to a culture, subculture, or community. Cultural resources can also include locations of important historic events and aspects of the natural environment, such as natural features of the land or biota, which are part of traditional lifeways and practices. In general, prehistoric resources are those that originate from cultural activities prior to the establishment of a European presence in New Mexico in the early 17th century. Historic resources are those that date from the period of written records, which began with the arrival of the Spanish in the region.

The National Register of Historic Places (NRHP) is a listing maintained by the Federal government of prehistoric, historic, and ethnographic buildings, structures, sites, districts, and objects that are considered significant at a national, State, or local level. Listed resources can have significance in the areas of history, archaeology, architecture, engineering, or culture. Cultural resources that are listed on the NRHP, or have been determined eligible for listing, have been documented and evaluated according to uniform standards and have been found to meet criteria of significance and integrity. Cultural resources that meet the criteria for listing on the NRHP, regardless of age, are called historic properties. Resources that have undetermined eligibility are treated as historic properties until a determination otherwise is made. More information on the evaluation of historic properties is provided later in this section.

3.13.1.1 Regulatory Framework

Federal laws and regulations: A number of Federal laws address cultural resources and Federal responsibilities regarding them. The long history of legal jurisdiction over cultural resources, dating back to the 1906 passage of the Antiquities Act (16 U.S.C. 431-433), demonstrates a continuing concern on the part of Americans for such resources. Cultural resources include historic properties, as defined in the National Historic Preservation Act (NHPA) (16 U.S.C. 470); cultural items, as defined in the Archeological and Historic Preservation Act (16 U.S.C. 469); cultural items and human remains, as defined by the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001); archaeological resources, as defined by the Archeological Resources Protection Act (ARPA) (16 U.S.C. 470aa-mm); the cultural environment, as defined by EO 11593, Protection and Enhancement of the Cultural Environment (36 Federal Register [FR] 8921); Indian sacred sites to which access is provided under the American Indian Religious Freedom Act (AIRFA) (42 U.S.C. 1996) and as defined in EO 13007, Indian Sacred Sites (61 FR 26771); and religious practices as addressed in AIRFA and the Religious Freedom Restoration Act (RFRA) (42 U.S.C. 2000bb). Similarly, Section 101(b)(4) of NEPA establishes a Federal policy for the conservation of historic and cultural aspects of the nation’s heritage. Requirements set forth in these laws, and their implementing regulations, define the BLM’s responsibilities for management of cultural resources.

Foremost among these statutory provisions is Section 106 of the NHPA. Section 106 of the NHPA requires Federal agencies to take into account the effect of their undertakings on historic properties. The

Advisory Council on Historic Preservation (ACHP) regulations that implement Section 106 (36 CFR Part 800) describe the process for identifying and evaluating resources; assessing effects of Federal actions on historic properties; and consulting to avoid, minimize, or mitigate those adverse effects. The NHPA does not mandate preservation of historic properties, but it does ensure that Federal agency decisions concerning the treatment of these resources result from meaningful consideration of cultural and historic values, and identification of options available to protect the resources.

The BLM has a series of manuals and handbooks that stipulate how the agency manages the cultural resources on land under its jurisdiction and provide the BLM with guidance on implementing actions in accordance with Federal statutes. The BLM also has executed a Programmatic Agreement (PA) with the ACHP and the National Conference of State Historic Preservation Officers that outlines how the agency will administer its activities subject to Section 106 of the NHPA. Each State that operates under the PA has a "protocol" agreement that defines how the BLM and that State's Historic Preservation Officer (SHPO) will operate and interact. The BLM Las Cruces District Office (LCDO) follows the PA and the New Mexico Protocol to meet its Section 106 responsibilities.

As a Federal agency, the BLM has a trust responsibility to American Indian tribes (Tribes) to protect tribal cultural resources and to consult with Tribes regarding those resources. Certain laws, regulations, and executive orders guide consultation with American Indians to identify cultural resources important to Tribes and to address tribal concerns about potential impacts to these resources. Section 101(d)(6) of the NHPA mandates that Federal agencies consult with Tribes and other Native American groups who either historically occupied the mine area or may attach religious or cultural significance to cultural resources in the region. The NEPA implementing regulations link to the NHPA, as well as AIRFA, NAGPRA, RFRA, EO 13007, EO 13175 *Consultation and Coordination with Indian Tribal Governments* (65 FR 67249), and the Executive Memorandum on Government-to-Government Relations with Native American Tribal Governments (59 FR 22951). This body of legislation calls on agencies to consult with American Indian tribal leaders and others knowledgeable about cultural resources important to them. BLM manual 8120 and Handbook H-8120-1 address tribal consultation specifically, and the subject is addressed in terms of Section 106 of the NHPA in the nationwide PA and New Mexico Protocol. The BLM consulted with Tribes during development of the draft EIS, and this consultation continued through development of the final EIS.

State statutes and rules: In addition to Federal legislation, the State of New Mexico has statutes and rules that address cultural resources. New Mexico's Cultural Properties Act (§18-6-1 through 17 NMSA 1978) addresses a number of cultural resource-related issues, including but not limited to, prohibiting destruction of significant cultural properties on private land without the owner's consent, and regulating excavation or disturbance of unmarked human burials on any land within New Mexico outside of Federal land. Section 18-6-8.1, Review of Proposed State Undertakings, states that "the head of any State agency or department having direct or indirect jurisdiction over any land or structure modification which may affect a registered cultural property shall afford the (SHPO a reasonable and timely opportunity to participate in planning such undertaking to preserve and protect, and to avoid or minimize adverse effects on, registered cultural properties". The implementing rule (4.10.7 NMAC) defines indirect jurisdiction as the issuance of an authorization, permit, or license by a State agency, entity, board, or commission for land modification on Federal, State, or private lands. Registered cultural properties are those listed on the State Register of Cultural Properties (SRCP).

The Prehistoric and Historic Sites Preservation Act (§18-8-1 through 8 NMSA 1978) addresses the protection of cultural properties listed on the SRCP or NRHP, stating that no State funds shall be spent on programs or projects that require the use of listed properties. Exceptions include when there is no feasible or prudent alternative to such use, or if all possible planning has occurred to preserve, protect, and minimize harm to the listed property. The implementing rule (4.10.12 NMAC) places the responsibility of the determination on the State agency, which is required to issue the determination in the form of a written record available to all interested parties.

Consultation with American Indians is also addressed by State statute. The New Mexico State–Tribal Collaboration Act (§11-18 NMSA 1978) stipulates that State agencies shall make a reasonable effort to collaborate with Indian nations, tribes, or pueblos in the development and implementation of policies, agreements, and programs of the State agency that directly affect American Indians. Pursuant to the Act, the NMED, NMEMNRD (of which the MMD is a part), and the New Mexico OSE developed the Tribal Collaboration and Communication Policy. The purpose of the policy is to foster, facilitate, and strengthen positive government-to-government relations between these agencies and New Mexico's Indian Nations, Tribes, and Pueblos.

3.13.1.2 Area of Potential Effect

The area of potential effect (APE) for cultural resources is the area within which impacts to cultural resources could occur as the result of a project or undertaking. This term, defined in the NHPA, is normally applied to Section 106 compliance for assessing effects to historic properties. An APE is defined as:

> ". . . the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." (36 CFR 800.16[d])

The BLM adopted this definition for assessing the potential impacts of the proposed project on cultural resources. The BLM determined that the proposed Copper Flat mine would have the potential to impact cultural resources through direct and indirect physical impacts to resources from mine activities.

Using the definition above, the APE for this project includes the areas within which direct land disturbance from construction, operations, and reclamation activities are planned to occur, as well as from exploration activities which are defined as potentially occurring anywhere within the mine area. This APE also includes those areas within which there is the potential for indirect impacts, including changes to erosion patterns, inadvertent damage, vandalism, and illegal artifact collecting. For the Proposed Action and Alternative 1, the extent for these types of impacts is the same and includes the mine area and the associated water supply pipeline and well field. For Alternative 2, the extent includes these same areas, plus the new substation proposed for State Trust Land.

The APE also includes areas where vibrations from blasting, drilling, or heavy equipment traffic could potentially impact resources. Critical distances for groundborne vibrations are established in Section 3.21, Noise and Vibrations. (See Table 3-48.) Blasting, and the associated blast hole drilling for placement of explosives, both of which would be confined to the open pit, could impact extremely fragile historic buildings and ruins within 792 feet. Heavy equipment traffic and exploration drilling, which would occur throughout the mine area, could impact such resources within 42 feet. The extent of the latter would be the same for the Proposed Action and the two action alternatives. The extent and location of the blasting and blast hole drilling would vary depending on the size and location of the open pit, which is anticipated to be 2,500 by 2,500 feet for the Proposed Action and 2,800 by 2,800 feet for each of the two action alternatives. The APE for vibration impacts under the Proposed Action and both action alternatives includes the mine area and the associated water supply pipeline and well field, plus a small area located outside the mine area southwest of the open pit.

3.13.1.3 Historical Context of the Mine Area

Cultural resources are best understood when viewed within their historical context. Contexts are the broad patterns or trends in history by which a specific resource is understood, and its meaning (and ultimately its significance) within prehistory and history is made clear (NPS 1990). The following section briefly describes the major patterns of prehistory and history for the area of the proposed Copper Flat mine and its vicinity. The text in this section is based on information presented in the archaeological survey report of the proposed mine project site (Okun et al. 2013).

Prehistory: The earliest identified human settlement in North America occurred during the Paleoindian period (approximately 12,500–6,000 B.C.). Archaeological evidence from this period indicates people had a nomadic lifestyle with a subsistence strategy focused on big game hunting. Although Paleoindian groups likely utilized small game and plant foods in addition to big game, a substantial change in the subsistence strategy to these food sources marks the transition to the Archaic period (6,000 B.C.–A.D. 500). People during this period were still mobile; however, mobility was more restricted in geographical extent and was often cyclical, usually tied to the seasons. Once productive resource procurement locations were identified, people returned to these locations on a seasonal basis. This was a time of increased population and decreased mobility, evidenced by greater numbers of sites than in the Paleoindian period, the appearance of more preserved residential structures and associated features, regional variation in artifacts, and the increased presence of grinding and milling tools long before the advent of domestic plant cultivation. During the latter part of the Archaic (1500 B.C.–A.D. 500), major changes were initiated with the acceptance of horticulture (e.g., maize) into the subsistence strategy and a higher degree of sedentism. In general, this portion of the Archaic is characterized by a shift from hunting and gathering as the prime subsistence economy to horticulture, and a much higher site density is noted.

As with most areas of the American Southwest, evidence of Paleoindian people in the region is sparse. Paleoindian sites in southwestern New Mexico are mostly known from the San Augustin Plains, a large intermountain basin bounded by the Tularosa, Mogollon, and San Mateo Mountains. Within the region of the proposed permit area, the frequency of Archaic sites increases throughout the Archaic period. Numerous artifacts diagnostic of the Late Archaic are the earliest artifacts found in the Copper Flat mine APE.

The Formative period (A.D. 200 to 1450), which is evidenced in the project vicinity by the Mogollon culture, bridges the gap between the Archaic period and Historic times. The Copper Flat mine is located within a cultural frontier between two branches of the Mogollon culture: the Jornada (lower Rio Grande Valley, Tularosa Basin, Sacramento Highlands, and desert regions of southern New Mexico) and the Mimbres (Mimbres Valley and Mogollon Highlands). Within each branch, similar cultural shifts are seen during this period. Housing styles evolved through various forms of pithouses and eventually to solely above-ground structures. Inhabitants aggregated into villages, usually located on valley floors, alluvial fans, or terraces near reliable water sources. Reliance on agriculture became prominent, and with expanding populations, settlement expanded into more marginal agricultural areas. Artifacts evolved over time, especially noticeable in the forms and décor of ceramics, and toward the end of the period they seem to indicate increasing contact with outside cultures to the north and the south of the region. A single Mogollon rock art site constitutes the only evidence of Formative-period use of the Copper Flat mine APE.

Late in the Formative period, extensive changes swept over the region, resulting in reduction in population, smaller site size, a return to higher mobility, and more strategic flexibility. Causes hypothesized by researchers include collapse of belief systems, regional abandonment followed by resettlement, and environmental degradation. At this time, southern New Mexico, including the mine area, became heavily influenced by Casas Grandes (a settlement located in northern Mexico) and the Salado culture (located in the Tonto Basin of Arizona). Such influence is exhibited by changes in settlement features, architectural traits, and artifact morphology and decoration. By the time the Spanish arrived in the area, Casas Grandes had been abandoned and few reports are made of inhabitants in the Rio Grande Valley in southern New Mexico.

History: Early Spanish exploration in southern New Mexico was largely limited to the Rio Grande corridor and along the Camino Real de Tierra Adentro (the "Royal Road to the Interior"). The Camino Real served as the route between Santa Fe, New Mexico and Mexico City and was used to transfer goods and supplies between those two areas. The Camino Real predominantly follows the Rio Grande through New Mexico. However, in the region of the Copper Flat mine, the Camino Real is located in the Jornada del Muerto, a dry valley located 30 miles east of the mine, on the far side of the Caballo Mountains. Thus, no trail-related settlements were established in the vicinity of the mine, and the region remained mostly uninhabited by non-Indians until the mid-19th century. At first, the major Spanish activity in southwestern New Mexico was mining of copper at the Santa Rita mine north of Silver City, started in 1800 and still in business today.

After the Mexican-American War (1846-1848), the U.S. government took an active role in making southern New Mexico a safe place for the development of commercial interests and settlement. A mining boom occurred in southwestern New Mexico in the 1860s, and the government established a line of military forts along the southern frontier designed to provide protection against the Apache. When the southern transcontinental railroad was completed in 1881, the formerly remote area of southern New Mexico was accessible to the rest of the country, opening it up for further expansion. Ranching developed as a main economic activity and attraction for settlers, and resulted in the establishment of many communities.

Sierra County's population in the mid-1800s was concentrated in established farming communities along the Rio Grande Valley and mining outposts in the Black Range. The first settlements in Sierra County were small farming villages established by Hispanic New Mexico families along the Rio Grande Valley around 1860. The first permanent settlements were located in Canada Alamosa and at Las Palomas along the Rio Grande, south of the present town of Truth or Consequences. By 1880, Las Palomas was the largest farming community in the area, with over 400 residents. In addition to farming, cattle ranching and sheep herding became important economic activities for the county in the 1880s.

Sierra County was the setting for a number of battles between the U.S. government and the Apache into the 1880s. Southern Apache from Canada Alamosa were moved to Fort Tularosa, then back to the Hot Springs Reservation in 1874. The Apache became frustrated with encroachments onto their reservation, ultimately abandoning the reservation and initiating a new period of raiding. The U.S. military staged campaigns to keep the Apache on the reservation; however, the Apache continued to raid the growing number of mining communities in the Black Range and the raids continued for half a decade. The long-standing conflict with the Apache finally ended with Geronimo's surrender in 1886.

A major historical development in Sierra County was the discovery of gold and silver in the Black Range. Communities such as Hillsboro, Lake Valley, Kingston, and Chloride were established in the 1870s but flourished in the 1880s and 1890s with the mining boom. This was the cause of the first major Anglo population influx into the county, and the arrival of the Atchison, Topeka, and Santa Fe railway brought multitudes of prospectors hoping to strike it rich. Hillsboro, located about 4 miles west of the Copper Flat mine project, was one of the largest towns in southern New Mexico by 1907 and was the county seat until 1938. The depletion of ore and the falling prices of precious metals during World War I ended the mining boom, and with the closing of the mines these towns soon shrank in population. Even with the decline in mining enterprises, there was a surge of prospectors during the Great Depression. Modest mining operations continued around Hillsboro, and limited mining exploration continued throughout the region. A new mining boom occurred in the 1970s due to government deregulation and the worldwide depletion of metal inventories, with exploration happening throughout the region. Many of the mechanically-excavated prospect pits within the project APE are likely associated with this flurry of exploration in the late 1970s.

3.13.1.4 Cultural Resource Investigations

Cultural resource investigations have been undertaken to develop the information needed to assess the potential impacts of the proposed project on cultural resources and to meet compliance requirements for applicable State and Federal regulations, particularly Section 106 of the NHPA. These investigations were conducted in accordance with State and Federal standards and included survey and tribal consultation.

The BLM instructed NMCC to conduct cultural resource surveys of the APE. NMCC contracted Parametrix Inc. to conduct two intensive, systematic pedestrian cultural resource surveys, and Okun Consulting Solutions to conduct an additional survey. The goal of these surveys was to identify archaeological and architectural resources that meet the criteria for listing on the NRHP.

The first survey encompassed 381 acres along the existing water supply pipeline and well field on BLM, private, and State Trust lands (Mattson and Okun 2011). This survey route extended into the proposed mine area. This survey was conducted to assess the potential effect on historic properties from activities intended to provide the BLM with information necessary for EIS analyses. The activities included aquifer testing and monitoring, pipeline testing and rehabilitation, discharge of water associated with the testing, and improvements to well access roads. The second survey encompassed the 2,190 acres within the mine area on BLM and private lands (Okun et al. 2013). This survey was conducted to assess the potential effect on historic properties from construction, operation, and reclamation of the proposed Copper Flat mine. The third survey included additional acreage surrounding nine existing water production wells (45 acres) and two possible locations for a new substation (100 acres) (Okun 2015). The BLM archaeologist conducted an additional survey immediately outside the mine area southwest of the location of the open pit to assess potential vibrations effects from blasting and drilling.

The surveys included background research to determine the prehistoric and historic contexts of the survey area and vicinity, site file searches for information on previously recorded archaeological and architectural resources, 100 percent-coverage pedestrian survey of the APE, and recording to State or BLM standards all identified resources aged 50 years or older.

For each survey, the BLM evaluated the identified archaeological and architectural resources for NRHP-eligibility, determined the potential for effects to eligible properties from the proposed Copper Flat mine, and submitted the reports and determinations to the New Mexico SHPO for review and concurrence.

3.13.1.5 Tribal Consultation

Consultation with Tribes is required under multiple Federal and State statutes. The purposes of consultation are to elicit from tribal representatives concerns for potential impacts from the proposed project on the Tribe or resources that are significant to the Tribe, and to identify possible mitigation measures to resolve or minimize potential impacts. Formal consultation under NEPA and Section 106 was initiated with a scoping letter sent to the public, including Tribes, on February 3, 2012. No responses to these letters were received from Tribes or tribal members, and no tribal representatives attended the public scoping meetings held on February 22, 2012, in Hillsboro, New Mexico and February 23, 2012, in Truth or Consequences, New Mexico. Tribal consultation letters were sent on November 7, 2012, to the Comanche Indian Tribe, Fort Sill Apache Tribe, Hopi Tribe, Isleta Pueblo, Kiowa Tribe, Mescalero

Apache Tribe, Navajo Nation, White Mountain Apache Tribe, Ysleta del Sur Pueblo, and Zuni Pueblo. (See Appendix K.) The letters described the proposed Copper Flat mine project and requested information from the Tribes on any concerns they had for potential impacts to tribally-significant resources.

Two Tribes provided responses:

- The Hopi Tribe sent a letter stating their desire to continue consultation because they believe that archaeological sites with which they are affiliated would potentially be impacted by the proposed project. They asked to receive copies of the final archaeological survey reports and the draft EIS.
- The White Mountain Apache Tribe stated that unless human remains or materials related directly to them were discovered, they were not interested in further consultation.

Tribal consultation has continued through the issuance of this final EIS and the BLM's Record of Decision (ROD) to ensure that Tribal concerns are understood and presented in the documentation, to identify appropriate mitigation measures, and to fulfill the requirements of relevant Federal and State statutes. Consultation with the Tribes regarding the proposed project would also continue beyond the ROD in the manner described in the Section 106 PA (Appendix L {Section 106 Programmatic Agreement}).

3.13.1.6 Evaluation of Resource Significance

The BLM evaluated the cultural resources identified in the surveys to determine if they are eligible for listing on the NRHP. The evaluation of resources located on State Trust Land was done in consultation with the State Land Office. Evaluation was conducted to determine those resources that have status as historic properties, which is needed in order to determine the effect of the project on historic properties under Section 106 of the NHPA and 36 CFR Part 800. Properties eligible for the NRHP must have significance in American history, archaeology, architecture, engineering, or culture. The guidelines for evaluation of significance can be found in 36 CFR 60.4. In order for a cultural resource to be considered significant, the resource must meet at least one of four significance criteria:

1. Association with events that have made a significant contribution to the broad patterns of our history.
2. Association with the lives of persons significant in our past.
3. Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.
4. Have yielded, or may be likely to yield, information important in prehistory or history.

The property must also possess integrity or the ability to convey its significance. The NRHP recognizes seven aspects or qualities that, in varying combinations, define integrity: location, design, setting, materials, workmanship, feeling, and association. In the case of properties that possess traditional cultural significance, it is also important to consider the integrity of relationship and condition.

3.13.1.7 Cultural Resources in the APE

As a result of the cultural resource surveys and tribal consultation, the BLM identified cultural resources located within the APE and determined the NRHP-eligibility of those resources. Information about these resources is derived from results of tribal consultation and the reports of the archaeological survey efforts (Mattson and Okun 2011; Okun et al. 2013; Okun 2015).

Archaeological resources: A total of 61 archaeological sites are located within the APE. Many of the sites are from the historic period; however, some of the sites are prehistoric in age and some sites have cultural remains from both prehistoric and historic use. Many of the sites are associated with the development of historic mining in the region. These sites include mining engineering features such as mine shafts, adits, prospect pits, waste rock piles, check dams, mine claims, and cairns; transportation features such as road beds and a rock-lined pack trail; and residential features such as standing buildings, ruins of stone structures and foundations, tent platforms, dugouts, privies, a cemetery, and individual graves. Most of these mining-related sites include a scatter of artifacts that consist of fragments or whole pieces of various mining or residential items, such as ceramic dishes, bottle glass, jar glass, window glass, cans, sheet metal, machine parts, corrugated metal, clothing items such as buttons or buckles, shoes, bullets, nails, wire, lumber, and horseshoes. Seven sites appear to be associated with ranching, farming, or homesteading and include stone structure ruins, rock corrals, a windmill, and tanks. Seventeen of the sites have artifacts or features associated with Native American settlement and use of the region. These sites include scatters of artifact debris from stone tool-making or pottery fragments, and rock art.

Thirty-seven of the sites have been determined individually eligible for the NRHP because of their significant association with the development of historic mining and settlement in the region, for their potential to provide important information about historic mining and settlement patterns, or for information on Native American land use. Fourteen of the sites have undetermined eligibility. In these cases, more information is needed in order for an eligibility determination to be made. Additional information on these sites could be gathered by conducting archival research, or through limited archaeological excavation to determine if archaeological deposits are present subsurface, determine the function of a particular feature, or determine the integrity of a site or feature. Ten of the sites have been determined not eligible for individual listing on the NRHP because they do not have a significant association with the patterns of history in the region and do not have features or artifacts that provide important information about the history or prehistory of the area.

A total of 618 isolated manifestations (IMs) were identified within the APE. IMs are those archaeological resources that do not meet the BLM's criteria for definition as a site. In general, IMs are thought to result from accidental or inadvertent deposition of a few artifacts or an isolated feature, whereas a site indicates purposeful use of a particular place. The IMs in the APE consist of isolated ceramic sherds, stone artifacts, or debitage from tool making, historic metal artifacts such as cans, buckets, barrel hoops, and tool parts, wooden building debris, historic glass and ceramic artifacts such as bottles and dishes, stone cairns, prospecting pits, mine claim markers, rock piles, check dams, tanks, hearths, and single-episode trash dumps. While the documented IMs provide information on the general prehistoric and historic use of the APE, these resources lack additional data potential and are not likely to increase our understanding of local or regional prehistory or history. Thus, the BLM has determined that none of the IMs are eligible for the NRHP.

Architectural resources: There are four historic-aged buildings located within the APE. The Hillscher House, located immediately west of the proposed tailings pond, was likely built between 1880 and 1930 and is associated with Max Hillscher, an individual significant in local history and the development of mining activities in the Copper Flat area during the early 20th century. Because of significant modifications made to the building and its poor-to-fair condition, the Hillscher House is considered not eligible individually for listing on the NRHP.

The Toney House, located immediately north of the tailings pond, resembles a northern New Mexico vernacular architectural style and was built sometime between 1900 and 1940. Although some limited modifications have been made to the building, these changes are consistent with the style of the building and were conducted more than 50 years ago, making them part of the building's history. Because of the intact condition of the building, its role as a prominent landmark for residents and miners in the early twentieth century, and its association with the development of mining in the area, the Toney House has been determined eligible for listing on the NRHP.

The Gold Dust building resembles a New Mexico vernacular architectural style and is estimated to have been built between 1900 and 1920. It is part of the historic mining town of Gold Dust and is located just outside the mine area immediately south of the proposed tailings pond. While it is in very poor condition, the historic architectural elements of the building are intact. Although some limited modifications have been made to the building, these changes were conducted more than 50 years ago, making them part of the building's history. Because the building is the only remaining structure of the late nineteenth- and early twentieth-century community of Gold Dust, and due to its association with the development of mining in the area, the Gold Dust building has been determined eligible for listing on the NRHP.

Greyback Shack is a single-room rock building that is within the late 1800s mining community of Placeres. It is located between two proposed topsoil stockpiles in the northeast portion of the mine area. It is estimated that the building was constructed between 1880 and 1920. Although the building is not consistent with any particular architectural style, it is similar to other structures dating to the same period in the Copper Flat area. Because it is not a good example of any particular architectural style, and due to its generally poor condition and lack of original architectural features, Greyback Shack is not individually eligible for listing on the NRHP.

Tribally-significant resources: None of the consulted Tribes has identified specific resources with cultural significance. The Hopi Tribe did indicate during scoping that they anticipated archaeological sites with which they are culturally affiliated would be impacted by the project.

Animas Hills Historic Mining District: Many of the resources identified within the APE are related to the extensive mining activity that occurred in this region from the 1870s through the Great Depression. Because of the similarities in the functions of these resources, and the features and artifacts present at them, the BLM suspected that these sites may together constitute an historic district – a concentration of sites, buildings, structures, and other resources that are unified historically and/or aesthetically by plan or development and form an entity that conveys a significant historic theme or period. As stated in the cultural resource survey report (Okun et al. 2013), "the historic resources within the project area are unified by the theme of mining, which was integral to the settlement and development of the local area and broader region, and thus possess the quality of historic significance."

After completion of the cultural resource surveys, the BLM instructed NMCC to explore the presence of a historic mining district within and surrounding the Copper Flat mine permit area. Based on NMCC's findings (Okun 2015), the BLM determined that a NRHP-eligible historic district is present in the Animas Hills surrounding the proposed mine permit area. The Animas Hills Historic Mining District is considered significant under Criterion A at the State and local levels for its role in the settlement, expansion of mining, and economic development of Sierra County and southern New Mexico. The district may exhibit significance under Criterion B at the State and local level for its association with W. H. Andrews, an important politician who was instrumental in establishing statehood for New Mexico, though this potential significance requires additional research. The district may be eligible under Criterion C for the distinctive engineering and vernacular architectural characteristics found in its mine shafts, mineral processing features, and intact historic buildings; however, additional research is necessary to demonstrate this significance. Finally, the Animas Hills Historic Mining District is considered eligible under Criterion D for its ability to provide important information relating to various historic research themes, including frontier mining technology and engineering, changes in mining technology over time, spatial organization of historic mining landscapes, development of local mining communities, social organization of the mining district, ethnicity and socio-economic status of miners and their families, and the timing of boom and bust cycles within the mining district. The period of significance for the district is 1877 to 1941, which incorporates the initial boom of mining activity in the late 19th century, as well as a second period of intensive activity in the 1920s and 1930s.

Historically, mining in the Animas Hills was centered on Copper Flat, with lode mines excavated to access underground veins of gold, silver, and copper. Small-scale prospecting and placer extraction were conducted along the eastern slopes of the hills, drainages, and alluvial fans to the east where mineral-rich surface deposits had collected. Mining activity historically spread out across the Animas Hills. While mining activities and development of associated settlements were conducted across this entire area, only approximately 25 percent of the Animas Hills has been surveyed for cultural resources. Because the integrity of resources outside of the surveyed areas could not be assessed, the BLM established the boundaries of the Animas Hills Historic Mining District, for now, to include only the northwestern portion of the Animas Hills surrounding Copper Flat. The district includes the Copper Flat mine permit area, as well as previously surveyed areas along Dutch Gulch and Greyback Arroyo which contain documented mining-related sites.

Individual cultural resources, both those that are evaluated as NRHP-eligible individually and those that lack individual distinction and are not eligible alone for the NRHP, can contribute to the broader historic significance of an NRHP-eligible district. Such resources are called "contributing elements." Within the APE for the proposed Copper Flat project, 46 archaeological sites and architectural properties are considered to be contributing elements to the significance of the Animas Hills Historic Mining District.

3.13.1.8 Section 106 Compliance Status

The BLM conducted cultural resource surveys and tribal consultation in an effort to identify cultural resources in the APE, to ascertain their NRHP eligibility, and to determine the effect of the project on eligible historic properties. The BLM submitted the cultural resource survey reports, the results of tribal consultation, the evaluation of the historic mining district, and BLM's determinations of eligibility and effect to the New Mexico SHPO for formal Section 106 review and consultation. Concurrence by the SHPO on the BLM's determinations of eligibility and effect was received. (See Appendix K.) The BLM consulted with the ACHP, the SHPO, the interested Tribes, and other consulting parties to develop a PA that resolves the adverse effects to historic properties. The signed PA is included in this final EIS (Appendix L {Section 106 Programmatic Agreement}) and will be incorporated into the BLM's ROD.

3.13.2 Environmental Effects

The following analysis details the anticipated direct and indirect effects of the project alternatives on cultural resources. Under the Proposed Action and each of the alternatives, the types of effects anticipated to historic properties within the APE are discussed, followed by the numbers of historic properties anticipated to be affected. Some of the properties identified within the APE are located away from the proposed areas of construction, operations, and reclamation and would not be affected by the proposed project. Potential effects arising from mine development, operation, and reclamation were identified through application of the Section 106 Criteria of Adverse Effects (36 CFR Part 800.5) to historic properties, and through consultation with Tribes to learn about potential impacts to Tribally-significant resources. These two methods are discussed further below. Although operations and reclamation activities would generally occur within those areas previously impacted by construction, the potential for effects to historic properties would remain during these subsequent phases, as described below.

Criteria of adverse effects: Section 106 of the NHPA requires Federal agencies to take into account the effects of their actions on any district, site, object, building, or structure included in, or eligible for inclusion in, the NRHP. Implementing regulations for Section 106 provide specific criteria for identifying effects on historic properties. Effects to historic properties listed, or eligible for listing, on the NRHP are evaluated with regard to the Criteria of Adverse Effects.

> "An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative." (36 CFR 800.5[a][1]).

Under Section 106 and its implementing regulations, types of possible adverse effects include:

- Physical destruction of or damage to all or part of a property;
- Physical alteration of a property;
- Removal of a property from its historic location;
- Change in the character of a property's use or of physical features within a property's setting that contribute to its historic significance;
- Introduction of visual, atmospheric, or auditory elements that diminish the integrity of a property's significant historic features;
- Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance; and
- Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of a property's historic significance (36 CFR 800.5[a][2]).

The BLM applied the Criteria of Adverse Effect to the activities proposed for mine development, operation, and reclamation to identify potential effects to historic properties identified within the APE.

Tribal consultation: As described above, the BLM engaged in consultation with Tribes to identify Tribally-significant resources and potential effects arising from the proposed project to these resources or associated traditional practices. This information assisted the BLM in analyzing the potential effects of the undertaking under NEPA and Section 106 of the NHPA.

Significance criteria: Types of effects, their duration, magnitude, extent, the likelihood of their occurrence, and the overall significance of the effects were determined based on the proximity of the property to mine facilities or infrastructure; proximity to construction, operations, or reclamation activities; and the presence of workers in the area. Because historic properties are a finite resource and cannot be regenerated, all physical impacts to historic properties are considered to be permanent in duration. Further information on how effect significance was determined can be found in the discussion of significance criteria in Section 3.1.1, Copper Flat EIS Significance Criteria.

3.13.2.1 Proposed Action

Long-term, minor to major, small to medium extent, and possible to probable adverse effects would be expected under the Proposed Action. The Proposed Action would result in direct and indirect physical impacts to historic properties during the construction, operations, and reclamation phases of the project. Overall, impacts would be significant.

3.13.2.1.1 Mine Development/Operation

Ground disturbance from construction activities would result in direct physical impacts to historic properties, specifically archaeological sites and historic structures. There would also be the potential for physical damage to buried archaeological resources that have not yet been identified or recorded, but could be discovered during earth-moving activities. Because the locations of planned facilities and features of the mine overlie the locations of known archaeological sites and historic structures, direct physical damage to historic properties would be probable. The magnitude of the damage would range from moderate to major, depending on the site, because construction would completely destroy some historic properties while only damaging portions of other properties.

Construction activities would include the use of heavy machinery for earth moving, hauling, and exploratory drilling. Analysis of the vibrations caused by these activities is detailed in Section 3.21, Noise and Vibrations, along with identification of critical distances wherein activities would cause impacts to historic structures. Based on the vibrations analysis and the location of historic structures, physical impacts to nearby historic structures would occur as a result of the vibrations generated by these activities. The impacts could include window breakage, cracking and breakage of plaster or mortar, or disarticulation of walls. Some historic structures would be in close vicinity to the sources of vibrations, others would be further away, and some structures are in better condition than others; thus, the likelihood for physical impacts from vibrations would range from possible to probable. For these same reasons, the magnitude of the impact would range from minor to major.

Construction could result in indirect physical impacts to historic properties. Construction of facilities and infrastructure, compaction of soils, and removal of vegetation would likely alter erosion patterns. As a result, new areas of erosion could develop on historic properties, moving soils and archaeological materials, thereby physically damaging those properties. The level of construction activities being undertaken at the mine area and the increased number of workers present would increase the chances that inadvertent physical impact could occur to historic properties that are planned for avoidance. The presence of workers in the area could also result in an increase in vandalism and illegal artifact collecting at historic properties. Under nominal conditions, impacts from erosion, inadvertent damage, vandalism, and illegal artifact collecting would not occur. These impacts would occur under anomalous situations. However, based on anecdotal observations for facilities of this type and size, they are anticipated to happen to some degree under the Proposed Action. Thus, the likelihood for each of these types of physical impacts to occur ranges from possible to probable. The resulting magnitude of these types of impacts would be dependent on how quickly the anomalous situation was discovered and measures taken to stop it. If discovered quickly, the impact would be minor; if too much time lapsed prior to discovery, the impact could be major.

Operational activities would include blast hole drilling, blasting, and the use of heavy machinery for earth moving and hauling. Based on the vibrations analysis in Section 3.21, Noise and Vibrations, and the location of historic structures, physical impacts to nearby historic structures would occur as a result of the vibrations generated by these activities. The impacts could include window breakage, cracking and breakage of plaster or mortar, or disarticulation of walls. Some historic structures would be in close vicinity to the sources of vibrations and others would be further away, and some structures are in better condition than others; thus, the likelihood for physical impacts from vibrations would range from possible to probable. For these same reasons, the magnitude of the impact would range from minor to major.

During the operational phase of the Proposed Action, indirect physical disturbance of historic properties could occur from changed erosion patterns, inadvertent impacts caused by mine workers, and vandalism or illegal artifact collecting by workers. In addition, there would continue to be the potential for physical damage to buried archaeological resources that have not yet been identified or recorded but could be discovered during maintenance or operational activities. As explained above for construction activities, each of these indirect impacts would be possible to probable, and would range from minor to major.

3.13.2.1.2 Mine Closure/Reclamation

Reclamation activities have the same potential for physical impacts to historic properties as operational activities. Vibration impacts to historic structures would occur as a result of the use of heavy machinery for earth moving and hauling. Changed erosion patterns, inadvertent impacts caused by mine workers, and vandalism or illegal artifact collecting by workers, as well as the potential for physical damage to buried archaeological resources that have not yet been identified or recorded, could all occur during the reclamation phase of the proposed project. As explained above for operational activities, each of these impacts would be possible to probable, and would range from minor to major in magnitude.

3.13.2.1.3 Summary of Impacts

Under the Proposed Action, direct impacts would result from ground disturbing activities and vibrations, and indirect impacts would occur from changes in erosion patterns, inadvertent damage, vandalism, and illegal artifact collecting. The impacts would originate during the construction, operations, and reclamation phases of the project. These impacts would occur to known historic properties and could extend to newly-discovered historic properties. Under the Proposed Action, direct impacts would be expected to occur to a total of 41 historic properties. Of these, 30 sites would be completely destroyed, three sites would have large portions damaged, and seven sites would have small portions damaged. One site would be at risk for damage from vibrations only. For the 10 sites where a portion would be damaged, the remaining portion would be at risk for indirect impacts. Four of these 10 sites would experience impacts from vibrations as well. Three historic properties would be at risk for indirect impacts only based on their proximity to the proposed project facilities and mine activities. Three of the architectural resources would be subject to effects from vibrations, while the fourth, the Toney House, would be demolished. Of the 55 historic properties in the APE (NRHP-eligible or undetermined), a total of 44 properties, or 80 percent, would be physically impacted. In addition, the impacts to individual historic properties, such as archaeological sites and historic structures, would also result in an overall impact to the Animas Hills Historic Mining District, for which most of the impacted individual properties are contributing elements. The impact of the Proposed Action on historic properties would be significant and would result in an adverse effect to historic properties as determined under Section 106 of the NHPA. (See Table 3-34.)

3.13.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Long-term, minor to major, small to medium extent, and possible to probable adverse effects would be expected under Alternative 1. The same types of physical impacts to historic properties as identified for the Proposed Action are anticipated to occur under Alternative 1. Overall, impacts would be significant.

Table 3-34. Summary of Anticipated Impacts Under the Proposed Action and Action Alternatives for Historic Properties

Table 3-34. Summary of Anticipated Impacts Under the Proposed Action and Action Alternatives for Historic Properties

Site Number	NRHP Eligible? (individually or contributing to district)	Anticipated Impacts		
		Proposed Action – 17,500 tpd	Alternative 1 – 25,000 tpd	Alternative 2 – 30,000 tpd
13121	Yes	complete destruction of site	complete destruction of site	complete destruction of site
13130	Yes	small portion of site damaged, indirect impacts	indirect impacts	small portion of site damaged, indirect impacts
13131	Yes	complete destruction of site	complete destruction of site	complete destruction of site
13135	Yes	small portion of site damaged, indirect impacts	small portion of site damaged, indirect impacts	complete destruction of site
50092	Yes	vibrations	vibrations	vibrations
82276	Yes	no impacts anticipated	no impacts anticipated	no impacts anticipated
82277	Yes	complete destruction of site	complete destruction of site	complete destruction of site
82278	Yes	small portion of site damaged, indirect impacts, vibrations	small portion of site damaged, indirect impacts, vibrations	small portion of site damaged, indirect impacts, vibrations
82279	Yes	small portion of site damaged, indirect impacts	small portion of site damaged, indirect impacts, vibrations	small portion of site damaged, indirect impacts, vibrations
82280	Yes	complete destruction of site	small portion of site damaged, indirect impacts	complete destruction of site
82281	Yes	large portion of site damaged, indirect impacts	small portion of site damaged, indirect impacts	large portion of site damaged, indirect impacts
82282	Yes	complete destruction of site	no impacts anticipated	no impacts anticipated
82334	No	---	---	---
110752	Yes	complete destruction of site	complete destruction of site	complete destruction of site
110753	Yes	complete destruction of site	complete destruction of site	complete destruction of site
110754	Yes	complete destruction of site	complete destruction of site	complete destruction of site
110755	Yes	complete destruction of site	complete destruction of site	small portion of site damaged, indirect impacts
110756	Yes	complete destruction of site	complete destruction of site	no impacts anticipated
110757	Yes	complete destruction of site	complete destruction of site	complete destruction of site
110758	Undetermined	complete destruction of site	complete destruction of site	complete destruction of site
110759	Yes	large portion of site damaged, indirect impacts, vibrations	large portion of site damaged, indirect impacts, vibrations	large portion of site damaged, indirect impacts, vibrations

Table 3-34. Summary of Anticipated Impacts Under the Proposed Action and Action Alternatives for Historic Properties (Continued)				
Site Number	NRHP Eligible? (individually or contributing to district)	Anticipated Impacts		
		Proposed Action – 17,500 tpd	Alternative 1 – 25,000 tpd	Alternative 2 – 30,000 tpd
110760	Yes	complete destruction of site	complete destruction of site	complete destruction of site
110761	No	---	---	---
110762	Yes	complete destruction of site	complete destruction of site	complete destruction of site
110763	Yes	no impacts anticipated	no impacts anticipated	no impacts anticipated
110764	Undetermined	complete destruction of site	complete destruction of site	no impacts anticipated
110765	Yes	complete destruction of site	complete destruction of site	complete destruction of site
110766	Yes	complete destruction of site	complete destruction of site	complete destruction of site
171036	No	---	---	---
171037	No	---	---	---
171038	Yes	no impacts anticipated	no impacts anticipated	no impacts anticipated
171039	No	---	---	---
171040	Undetermined	no impacts anticipated	no impacts anticipated	no impacts anticipated
171042	Yes	small portion of site damaged, indirect impacts	small portion of site damaged, indirect impacts	large portion of site damaged, indirect impacts
171043	Yes	complete destruction of site	small portion of site damaged, indirect impacts	large portion of site damaged, indirect impacts
171353	Yes	complete destruction of site	complete destruction of site	complete destruction of site
171354	Yes	complete destruction of site	complete destruction of site	complete destruction of site
171355	Yes	complete destruction of site	complete destruction of site	complete destruction of site
171356	Yes	complete destruction of site	large portion of site damaged, indirect impacts	complete destruction of site
171357	Yes	small portion of site damaged, indirect impacts	indirect impacts	large portion of site damaged, indirect impacts
171358	Undetermined	complete destruction of site	no impacts anticipated	no impacts anticipated
171359	Yes	indirect impacts	indirect impacts	indirect impacts
171360	Yes	large portion of site damaged, indirect impacts	large portion of site damaged, indirect impacts	large portion of site damaged, indirect impacts
171361	Yes	no impacts anticipated	no impacts anticipated	no impacts anticipated
171362	Yes	indirect impacts	indirect impacts	indirect impacts
171363	Yes	no impacts anticipated	no impacts anticipated	no impacts anticipated
171364	Yes	indirect impacts	no impacts anticipated	no impacts anticipated
171365	Yes	complete destruction of site	complete destruction of site	complete destruction of site

Table 3-34. Summary of Anticipated Impacts Under the Proposed Action and Action Alternatives for Historic Properties (Concluded)

Site Number	NRHP Eligible? (individually or contributing to district)	Anticipated Impacts		
		Proposed Action – 17,500 tpd	Alternative 1 – 25,000 tpd	Alternative 2 – 30,000 tpd
171366	Yes	complete destruction of site	no impacts anticipated	no impacts anticipated
171367	Yes	complete destruction of site	complete destruction of site	complete destruction of site
171368	Yes	no impacts anticipated	no impacts anticipated	no impacts anticipated
171369	Yes	complete destruction of site	no impacts anticipated	no impacts anticipated
171371	Yes	complete destruction of site	complete destruction of site	complete destruction of site
171372	Yes	small portion of site damaged, indirect impacts, vibrations	small portion of site damaged, indirect impacts, vibrations	small portion of site damaged, indirect impacts, vibrations
171373	Undetermined	no impacts anticipated	no impacts anticipated	no impacts anticipated
171374	Yes	no impacts anticipated	no impacts anticipated	no impacts anticipated
171375	Yes	complete destruction of site	complete destruction of site	complete destruction of site
171376	Yes	complete destruction of site	complete destruction of site	complete destruction of site
181501	Yes	no impacts anticipated	no impacts anticipated	no impacts anticipated
181502	No	---	---	---
181503	Undetermined	no impacts anticipated	no impacts anticipated	no impacts anticipated
Summary – number of historic properties impacted by alternative				
Completely destroyed		30	23	23
Large portion damaged		3	3	6
Small portion damaged		7	8	5
Vibration impacts only		1	1	1
Indirect impacts only		3	4	2
Total		**44**	**39**	**37**

Source: Summarized from internal data presented in greater detail in Appendices K and L.

Alternative 1 would result in physical impacts to historic properties during the construction, operations, and reclamation phases of the project. Direct impacts would result from ground disturbing activities and vibrations, and indirect impacts would occur from changes in erosion patterns, inadvertent damage, vandalism, and illegal artifact collecting. These impacts would occur to known historic properties, and could extend to newly-discovered historic properties. Under Alternative 1, direct impacts would be expected to occur to a total of 35 historic properties. Of these, 23 sites would be completely destroyed, three sites would have large portions damaged, and eight sites would have small portions damaged. One site would be at risk for damage from vibrations only. For the 11 sites where a portion would be damaged, the remaining portion would be at risk for indirect impacts. Four of these 11 sites would experience impacts from vibrations as well.

Four historic properties would be at risk for indirect impacts only, based on their proximity to the proposed project facilities and mine activities. Three of the architectural resources would be subject to effects from vibrations, while the fourth, the Toney House, would be demolished. Of the 55 historic properties in the APE (NRHP-eligible and undetermined), a total of 39 properties, or 71 percent, would be physically impacted. In addition, the impacts to individual historic properties, such as archaeological sites and historic structures, would also result in an overall impact to the Animas Hills Historic Mining District, for which most of the impacted individual properties are contributing elements. The impact of this alternative on historic properties would be significant, and Alternative 1 would result in an adverse effect to historic properties as determined under Section 106 of the NHPA. (See Table 3-34.)

3.13.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Long-term, minor to major, small to medium extent, and possible to probable adverse effects would be expected under Alternative 2. The same types of physical impacts to historic properties as identified for the Proposed Action are anticipated to occur under Alternative 2. Overall, impacts would be significant.

Alternative 2 would result in physical impacts to historic properties during the construction, operations, and reclamation phases of the project. Direct impacts would result from ground disturbing activities and vibrations, and indirect impacts would occur from changes in erosion patterns, inadvertent damage, vandalism, and illegal artifact collecting. These impacts would occur to known historic properties, and could extend to newly-discovered historic properties. Under Alternative 2, direct impacts would be expected to occur to a total of 35 historic properties. Of these, 23 sites would be completely destroyed, six sites would have large portions damaged, and five sites would have small portions damaged. One site would be at risk for damage from vibrations only. For the 11 sites where a portion would be damaged, the remaining portion would be at risk for indirect impacts. Four of these 11 sites would experience impacts from vibrations as well. Two historic properties would be at risk for indirect impacts only, based on their proximity to the proposed project facilities and mine activities. Three of the architectural resources would be subject to effects from vibrations, while the fourth, the Toney House, would be demolished. Of the 55 historic properties in the APE, a total of 37 properties, or 67 percent, would be physically impacted. In addition, the impacts to individual historic properties, such as archaeological sites and historic structures, would also result in an overall impact to the Animas Hills Historic Mining District, for which most of the impacted individual properties are contributing elements. The impact of this alternative on historic properties would be significant, and Alternative 2 would result in an adverse effect to historic properties as determined under Section 106 of the NHPA. (See Table 3-34.)

3.13.2.4 No Action Alternative

Under the No Action Alternative, the BLM would not approve NMCC's plan of operation, and there would be no effects from mine development, operation, and reclamation. Impacts to cultural resources already occurring from livestock management and access to the area by the public would continue; these include vandalism, trampling, and inadvertent damage.

Under the No Action Alternative, the Stage 1 Abatement Plan would continue to be implemented to define site conditions, investigate known areas of groundwater and surface water contamination at the site, and define the extent and magnitude of groundwater contamination. Stage 2 of the abatement plan, also to be implemented under the No Action Alternative, would address selection and design of an effective treatment option to abate groundwater contamination. Stage 2 would include a feasibility study to analyze abatement alternatives. The area considered for the abatement plan includes the mine permit area plus a one-mile buffer. Because there are already-identified historic properties within the mine permit area, the potential for additional buried properties, and the permit area extends out to a buffer that has not been previously surveyed for historic properties, there is the potential for direct physical impacts to historic properties from the abatement plan activities, specifically any ground disturbing activities. Indirect impacts from disturbance of historic properties could also occur from changed erosion patterns, inadvertent impacts caused by mine workers, and vandalism or illegal artifact collecting by workers. Because a portion of the abatement area has not been surveyed, and details about specific locations for ground disturbing activities are currently unknown and could change as contamination data are collected, evaluation of specific impacts is unfeasible. Long-term, minor to major, small to medium extent, and possible to probable adverse effects would be expected under the No Action Alternative. Overall, impacts would be significant.

For implementation of the abatement plan, NMCC would be required to obtain relevant permits from the BLM regarding any ground disturbing activities to occur on BLM-administered lands. The BLM's permit review process would include an assessment under Section 106 of the NHPA of the potential impacts of the activities on historic properties. The BLM's assessment could require cultural resource surveys of areas not previously surveyed, consultation with interested consulting parties, and consultation with the SHPO. If any historic properties would be impacted by the proposed abatement activities, the BLM would work with NMCC to avoid or minimize the impacts to the extent practicable. If impacts remain after this effort, the BLM would develop and implement appropriate mitigation actions.

3.13.3 Mitigation Measures

As described above, the BLM has determined that there would be a significant impact to historic properties from the Proposed Action and action alternatives, and any of the actions would result in an adverse effect to historic properties. The majority of these impacts would occur due to facility construction, surface activities at the mine area, removal of mineralized ore, and traffic. The Proposed Action and the action alternatives would each result in an adverse effect to historic properties as determined under Section 106 of the NHPA. In accordance with Section 106, the BLM conducted extensive consultation with the SHPO and other consulting parties to develop a PA that stipulates how the adverse effects to historic properties would be avoided, minimized, or mitigated. The ACHP chose not to participate in the consultation process, though they will receive a copy of the fully-executed PA in accordance with 36 CFR 800.6(b)(1). The other consulting parties included NMCC, New Mexico State Land Office, Hopi Tribe, and NMEMNRD. The consulting parties were provided multiple opportunities to review and comment on drafts of the PA, and all comments were addressed by the BLM. The fully-executed PA is included in the Final EIS as Appendix L, will be incorporated into the BLM's ROD, and will be made part of the MPO.

The PA presents the roles and responsibilities of the BLM (Lead Agency), NMCC, New Mexico State Land Office (as a land managing agency), and the SHPO in carrying out the stipulations of the agreement, and it describes multiple opportunities for the consulting parties to continue to review and provide input on the implementation of the PA. The PA stipulates that a Historic Properties Treatment Plan (HPTP) will be developed by NMCC that describes in detail the mitigations measures to be undertaken should one of the action alternatives be selected by the BLM in the ROD. The BLM, SHPO, and the consulting parties will have opportunities to review and comment on the drafts of the HPTP, and NMCC will make revisions under direction from BLM. The final HPTP will be incorporated into the PA and will become a binding condition of the MPO.

Specific mitigation elements designated in the PA and to be described in detail in the HPTP include:

- Collection of oral history and archival information to develop a detailed historic context for the permit area, complete with an annotated bibliography.
- A research design and data recovery plan to guide excavation of historic properties that would be subject to damage or destruction.
- A Burial Plan of Action that sets forth procedures for the treatment of marked and unmarked burials and graves encountered during the project.
- Documentation of standing buildings (per standards in Historic American Buildings Survey Level II/III), engineered features (per Historic American Engineering Record Level III), and the historic mining district as a whole (per Historic American Landscape Survey Level III)
- Development of interpretive materials for distribution to the public. These materials could include pamphlets, popular reports, interpretive displays, or outdoor signage. Public presentations in Hillsboro and Truth or Consequences are also included.
- Fencing of historic properties and activity areas to prevent impacts.
- Implementation of a monitoring program to ensure avoidance measures are effective and to modify such measures if not effective.
- Procedures for treatment of unanticipated discoveries of historic properties and discovery of unanticipated effects to historic properties.
- Historic property protection procedures including implementation of best management practices and conducting cultural resource sensitivity training of NMCC personnel and contractors.
- Curation of recovered cultural materials and associated records.

While the effects to the resources would remain, the PA and HPTP, and stipulations and measures contained within these documents, resolve these effects and reduce the significance of the impacts. The PA addresses all anticipated and unanticipated effects to historic properties from the project, and documents the BLM’s commitment to ensure these mitigation measures are implemented.

3.14 VISUAL RESOURCES

The goal of this section is to identify and describe the visual resources that would be impacted by the Proposed Action and other action alternatives. Visual resources result from the interaction between a human observer and the landscape they are observing. The subjective response of the observer to the various natural or artificial elements of a given landscape and the arrangement and interaction between them is fundamental to visual resources impacts analysis (USDA 2007).

A "viewshed" is a subset of a landscape unit and consists of all the surface areas visible from an observer's viewpoint. The limits of a viewshed are defined as the visual limits of the views located from the proposed project. A viewshed includes the locations of viewers likely to be affected by visual changes brought about by project features (Caltrans No date).

Visual resource management (VRM) objectives were developed through the White Sands Resource Management Plan (RMP) (1986), which provides the standards for the design and development of future projects. BLM-administered land is placed into one of four visual resource inventory (VRI) classes. These inventory classes represent the relative value of the visual resources. Classes I and II are the most valued, Class III represents a moderate value, and Class IV represents the least value.

According to BLM Manual 8341, Visual Resource Contrast Rating, the degree to which a management activity affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape. The contrast can be measured by comparing the project features with the major features in the existing landscape. The basic design elements of form, line, color, and texture are used to make this comparison and to describe the visual contrast created by the project. This assessment process provides a means for determining visual impacts and for identifying measures to mitigate these impacts. A project's visual contrast can be rated between none and strong (none: the element contrast is not visible or perceived; weak: the element contrast can be seen but does not attract attention; moderate: the element contrast begins to attract attention and begins to dominate the characteristic landscape; and strong: the element contrast demands attention, will not be overlooked, and is dominant in the landscape).

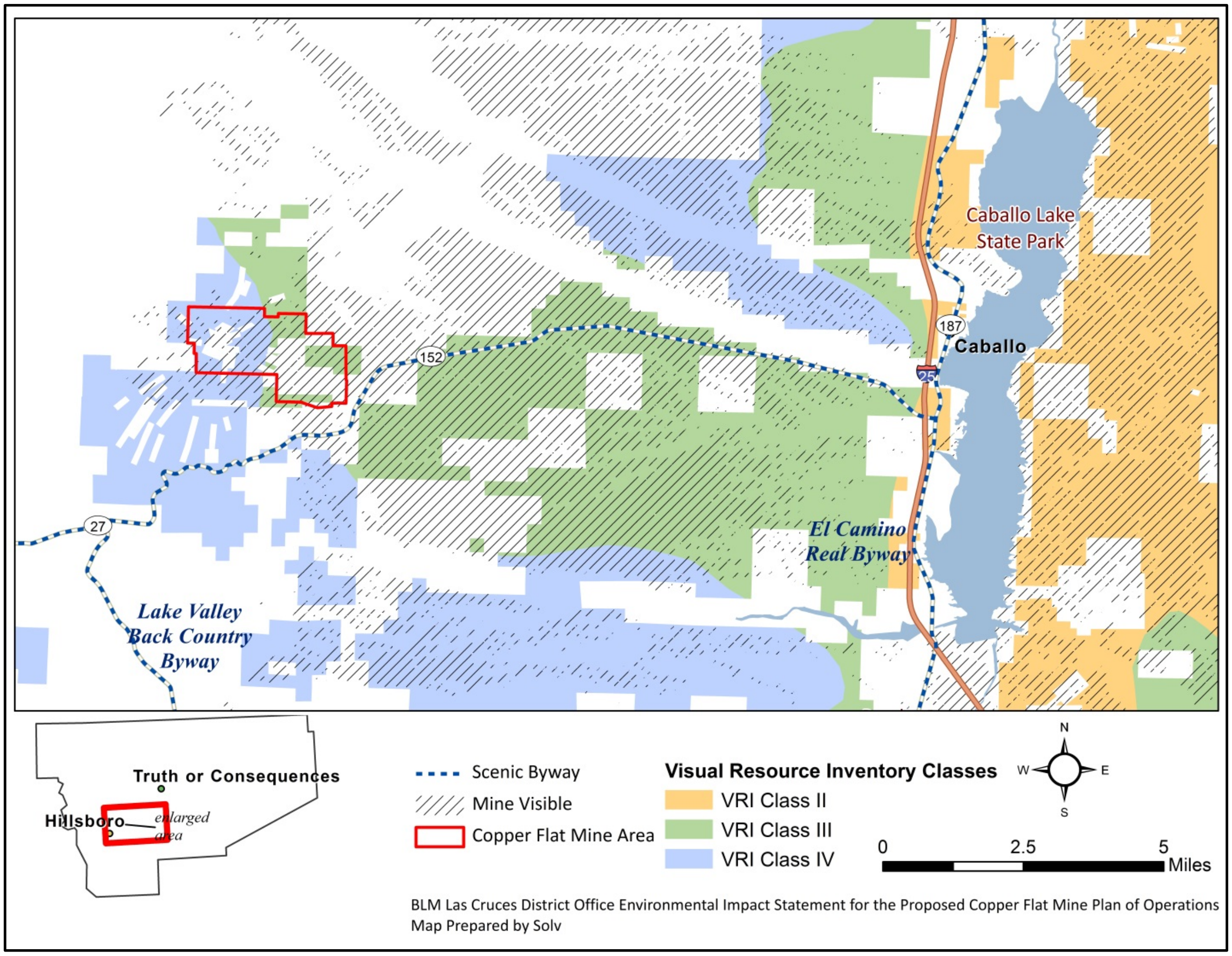
3.14.1 Affected Environment

The permit area is managed to VRM Class III and IV objectives (BLM 1986). (See Figure 3-30.) Class III objectives are to partially retain the existing character of the landscape. The level of change to the characteristic landscape can be moderate. Objectives of Class IV are to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

The BLM determines whether the potential visual impacts from proposed surface-disturbing activities or developments would meet the management objectives established for the area, or whether design adjustments would be required. A visual contrast rating process is used for this analysis, which involves comparing the project features with the major features in the existing landscape using the basic design elements of form, line, color, and texture (BLM 1984).

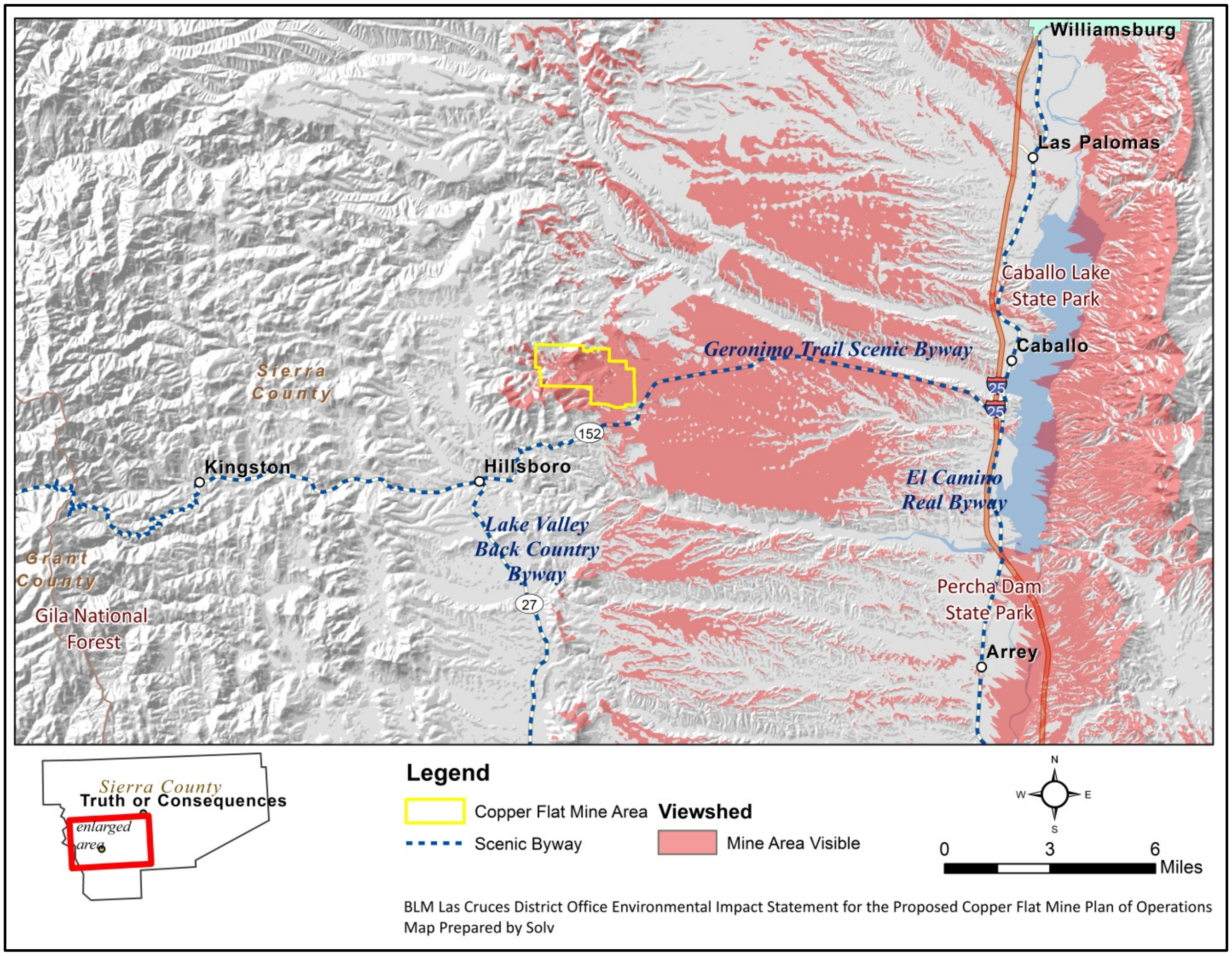
The APE for visual resource impact analysis is defined as the proposed mine area and the extent of the viewshed of the proposed facilities. For visual resources, APE is synonymous with the viewshed for the proposed project. (See Figure 3-31.)

Figure 3-30. BLM Visual Resource Inventory



Source: BLM 2010.

Figure 3-31. Viewshed of Proposed Copper Flat Mine



Source: BLM 2010.

The APE is in the Basin and Range province, has a landscape character typical to the province of broad, open basins bounded by prominent mountain ranges, and is covered by pinon-juniper vegetation (USFS 2009). This area is located within the foothills of the Black Range, which is a major north-south mountain chain in south-central New Mexico. To the west, the Black Range rises sharply above the Rio Grande Valley and Caballo Reservoir, which lie east of the Copper Flat mine area. Elevation at the main site ranges from approximately 5,200 to 5,500 feet amsl with Las Animas and Black peaks reaching elevations of 6,170 and 6,280 feet mean sea level, respectively. Photographs of the existing landscape character are shown in Figures 3-32 through 3-35. The Copper Flat mine area includes remnants of previous mining activity that may distract from the surrounding landscape. NM-152, which passes less than 0.50 mile south of the Copper Flat mine area, is a designated Backcountry Byway. Interpretive displays along this driving route emphasize the historical contributions of mining and ranching to the region. A kiosk, located within view of the Copper Flat mine, describes the former Quintana Minerals operation.

Figure 3-32. View of Mine from Main Road Exit

Source: Photo by Meghan Edwards 2012.

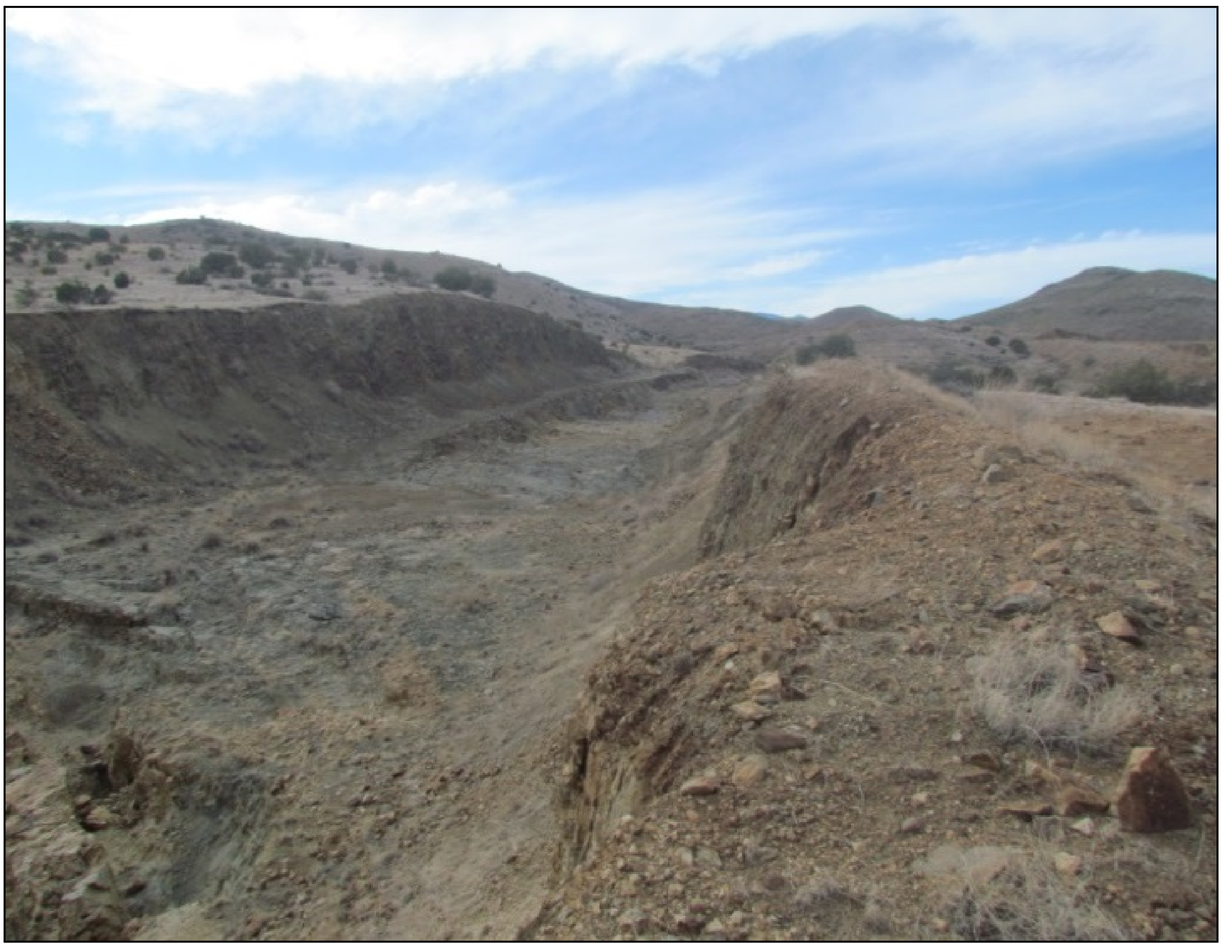
Figure 3-33. View of Tailing Pond and Tower

Source: Photo by Meghan Edwards 2012.

Clear skies with broad, open landscapes characterize the regional landscape setting of southern New Mexico, including the permit area. This type of landscape allows for long viewing distances. Consequently, maintenance of visual resources is a concern from nearby and distant viewing locations, including views from Federal land with high visual resource values, Federally-designated wilderness areas, recreation areas, major transportation routes, and population centers.

The majority of views of the landscape come from travelers on NM-152, who observe the mine in the middle ground of their view. (See Figure 3-31.) Observers in areas further than 5 miles away would be able to see the mine area within their background view. Viewers more than 5 miles from the mine area would most likely be travelers on I-25, which is not listed as a scenic byway, and the background views from this route would not likely garner much attention.

Figure 3-34. View of Diversion Drain Towards Pit



Source: Photo by Meghan Edwards 2012.

Figure 3-35. View of the Former Mill

Source: Photo by Meghan Edwards 2012.

In 1999, New Mexico enacted the Night Sky Protection Act [74-12-1 to 74-12-10 NMSA 1978]; its purpose is to regulate outdoor night lighting fixtures to preserve and enhance the state's dark sky while promoting safety, conserving energy, and preserving the environment for astronomy. The act requires that outdoor lighting be fitted with shielding that directs light downward, rather than upward or laterally. The act allows present lighting to remain throughout its useful life, but requires the installation of conforming lights whenever replacement would normally occur. Outdoor lighting fixtures necessary for worker safety at mining facilities are exempt from this Act, as listed at 74-12-7: Exemptions (4).

The International Dark Sky Association maintains a list of designated Dark Sky Places throughout the world. Communities apply for protection of these areas from artificial nighttime lighting in order to prevent light pollution, defined as any adverse effect of artificial light. The nearest designated Dark Sky Place (the Salinas Pueblo Missions National Monument) is located over 100 miles from the Copper Flat mine area (IDA 2017).

3.14.2 Environmental Effects

Because visual impacts are the response of an observer, and visual observers would most likely be located outside of the mine area, this section describes impacts experienced at the middle ground and farther due to changes to visual resources from proposed mining operations. The Proposed Action and alternatives would disturb approximately 1,500 acres of land, 900 acres of which are previously disturbed. Effects to the APE (viewshed) are determined by the degree of agreement with the VRM Class Objectives.

The mine area is located within gently rolling to hilly terrain that has been disturbed extensively as a result of historical mining activities. Vegetation in the area is generally dominated by creosote bush, tarbush, mesquite, littleleaf sumac, sideoats grama, and snakeweed. Existing visual contrasts generated by the open pit, waste rock disposal areas, and TSF dam constructed during past mining activities are historical features of the local topography and can be observed from many viewpoints in the vicinity.

In 1996, the BLM completed a draft EIS for mining activities. In order to assess the degree of visual contrast that would result from implementation of the proposed project, key observation points (KOPs) were selected at which changes to the characteristic landscape could be analyzed. KOPs are typically chosen along commonly traveled routes or at other likely observation points (BLM 1996). For the purposes of this analysis, two KOPs were chosen that provide views toward the Copper Flat mine: the southbound I-25 rest stop located approximately 3 miles north of the Caballo Lake exit (KOP 1), and the NM-152 interpretive kiosk, located adjacent to the Copper Flat mine (KOP 2). KOP 1 is located 10.5 miles east-northeast of the mine; KOP 2 is located less than 1 mile to the east of the mine area.

From KOP 1, the existing Copper Flat mine appears in background views to the west as a lightly colored band at the base of the Black Range foothills. The appearance of a light band is a result of earth disturbance associated with the existing eastern ore disposal area and TSF. Views of the plant area and pit are blocked by Animas Peak. From KOP 2 the mine appears in foreground middle ground views against a backdrop formed by Animas Peak. The eastern ore disposal area contrasts moderately with the color and form of the natural landscape and tends to attract the attention of motorists on NM-152. A dark horizontal line is created by dead vegetation along the east face of the tailings dam. Man-made structures are visible and include a decant tower, twin water storage tanks, and a single-story structure. The 1996 draft EIS contains BLM Visual Contrast Rating worksheets that include descriptions of the existing visual environment as viewed from these two KOPs (BLM 1996).

The transmission and water supply lines east of the Copper Flat mine cross a landscape dominated by the alluvial plains of the Rio Grande Valley. This area is relatively flat and dissected by small arroyos. Dominant vegetation includes creosote bush and tarbush. This area remains relatively natural in appearance, with the exception of NM-152, three transmission lines (including two related to the Proposed Action), and a windmill. This area is also classified by the BLM for Class III visual management.

3.14.2.1 Proposed Action

Construction and operations under the Proposed Action would last 16 years. Long-term effects are those that last more than 10 years. Therefore, visual impacts associated with the Proposed Action would be short- to long-term, minor to moderate, large, probable, and adverse during the construction and operations phase due to the contrast of the proposed mine in the Class IV VRM area as well as long-term, minor to moderate, large extent, probable, and beneficial during the reclamation phase. Overall, impacts would be significant.

3.14.2.1.1 Mine Development and Operation

Mine facilities, tailings, and WRDFs and activities would contrast with the existing landscape character, but not dominate the landscape in the middle ground. Previous mine disturbance is already apparent; therefore the change to the landscape would not be attention-demanding. The degree of contrast would be in the weak to moderate range. To minimize contrast, buildings and facilities would be painted in neutral colors to blend in with the surrounding landscape. The proposed mine buildings would comply with the objective for the Class III and IV areas within the mine area.

As described in Section 3.14.1, Affected Environment, any nighttime lighting used at the Copper Flat site would be exempt from compliance with the Night Sky Protection Act under 74-12-7: Exemptions (4) because the lighting would be required for mine worker safety. The Proposed Action would not impact any designated Dark Sky Places, the nearest of which is over 100 miles away.

3.14.2.1.2 Mine Closure/Reclamation

Effects to the landscape character during mine closure and reclamation would be beneficial because reclamation would help return the land to a state similar to the surroundings. The waste rock disposal areas would be regraded and reclaimed to blend into the surrounding topography to the extent practicable. Disturbed areas would be revegetated with a diverse mixture of plants appropriate to the local flora. These management activities would be consistent with the VRM class objectives, which allow for major modification. However, the intent would be to make the land blend in with the surroundings and not attract attention.

3.14.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Alternative 1 would include less disturbed land than the Proposed Action but would not incur fundamentally different effects to visual resources described under the Proposed Action. Construction and operations would last 12.5 years. Effects under Alternative 1 would be long-term, minor to moderate, of large extent, probable, and adverse during construction and operations, and beneficial following reclamation. Overall, impacts to visual resources would be significant.

3.14.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Visual effects under Alternative 2 would include less disturbed land than the Proposed Action but would not fundamentally differ from effects to visual resources incurred under the Proposed Action. Construction and operations would last 12-14 years. Effects under Alternative 2 would be long-term, minor to moderate, of large extent, probable, and adverse during construction and operations, and beneficial following reclamation. Overall, impacts to visual resources would be significant.

3.14.2.4 No Action Alternative

Under the No Action Alternative, the mine plan of operations would not be approved, and the landscape character would not change. Cleanup activities that would occur during remediation of the sulfate plume are not anticipated to create any visual impacts. Therefore, no impacts to visual resources would occur under the No Action Alternative.

3.14.3 Mitigation Measures

No mitigation measures for visual resources beyond regulatory requirements described in the Proposed Action have been identified for any alternative.

3.15 LAND OWNERSHIP AND LAND USE

This section provides information about the current land ownership and types of land use present within and surrounding the mine area, and provides an analysis of the potential impacts that could occur to land ownership and land use as a result of the Proposed Action, other action alternatives, and the No Action Alternative.

3.15.1 Affected Environment

For purposes of analysis within this resource section, the Copper Flat site is defined as the area within the boundary of the proposed mine. In addition to the Copper Flat site, the APE for land ownership and land use includes the proposed wells associated with the project, the pipeline, and the NM-152 highway corridor extending to I-25.

3.15.1.1 Local Context

The entire Copper Flat mine area lies within Sierra County. Sierra County is largely a rural community composed of varied physical makeup: rangeland, forests, multiple drainage-ways, and mountains. Historically, Sierra County's land has been used for agriculture, mining, and hot springs tourism. Tourism has expanded since the 1950s, especially water-based tourism that is prevalent along the nearby Elephant Butte and Caballo Lakes. The hot springs situated 20 miles northeast of the mine area near the town of Truth and Consequences draw a large number of visitors each year (see Section 3.16, Recreation). The mining history and associated ghost towns are also tourist draws in this area. Birding is a popular recreational activity in Sierra County with its location along the Rio Grande flyway and near the Bosque del Apache National Wildlife Refuge (NWR), approximately 62 miles to the north in Socorro County (Sierra County 2017; USGS 2011).

Sierra County's agriculture includes livestock (mostly cattle) and plants, such as vegetables and chiles. In 2002, most crop farming occurred in the Rio Grande floodplain southeast of Hillsboro. Federal land in the county is used for ranching, grazing, mining, and recreation (Sierra County 2006).

Many rights-of-way are present in the mine area and are an important land use issue (described further in Section 3.18, Lands and Realty). Utilities are another important land use issue (described in Section 3.25, Utilities and Infrastructure).

Land use ownership within the State of New Mexico, Sierra County, Grant County, the Copper Flat site, and the APE is compared below. (See Table 3-35.)

3.15.1.2 Area of Potential Effect (APE) and Copper Flat Site Land Use

As noted in Chapter 2, the Copper Flat site is approximately 30 miles southwest of Truth or Consequences and 5 miles northeast of Hillsboro. The APE is predominantly rural lands with mostly ranching activities (THEMAC 2011). There are no residents at the Copper Flat site. Figure 3-36 depicts surface land ownership in Sierra County.

The major ongoing use of the Copper Flat site has been grazing since previous operation of the mine ceased. Rangeland and livestock impacts are addressed in Section 3.19, Range and Livestock.

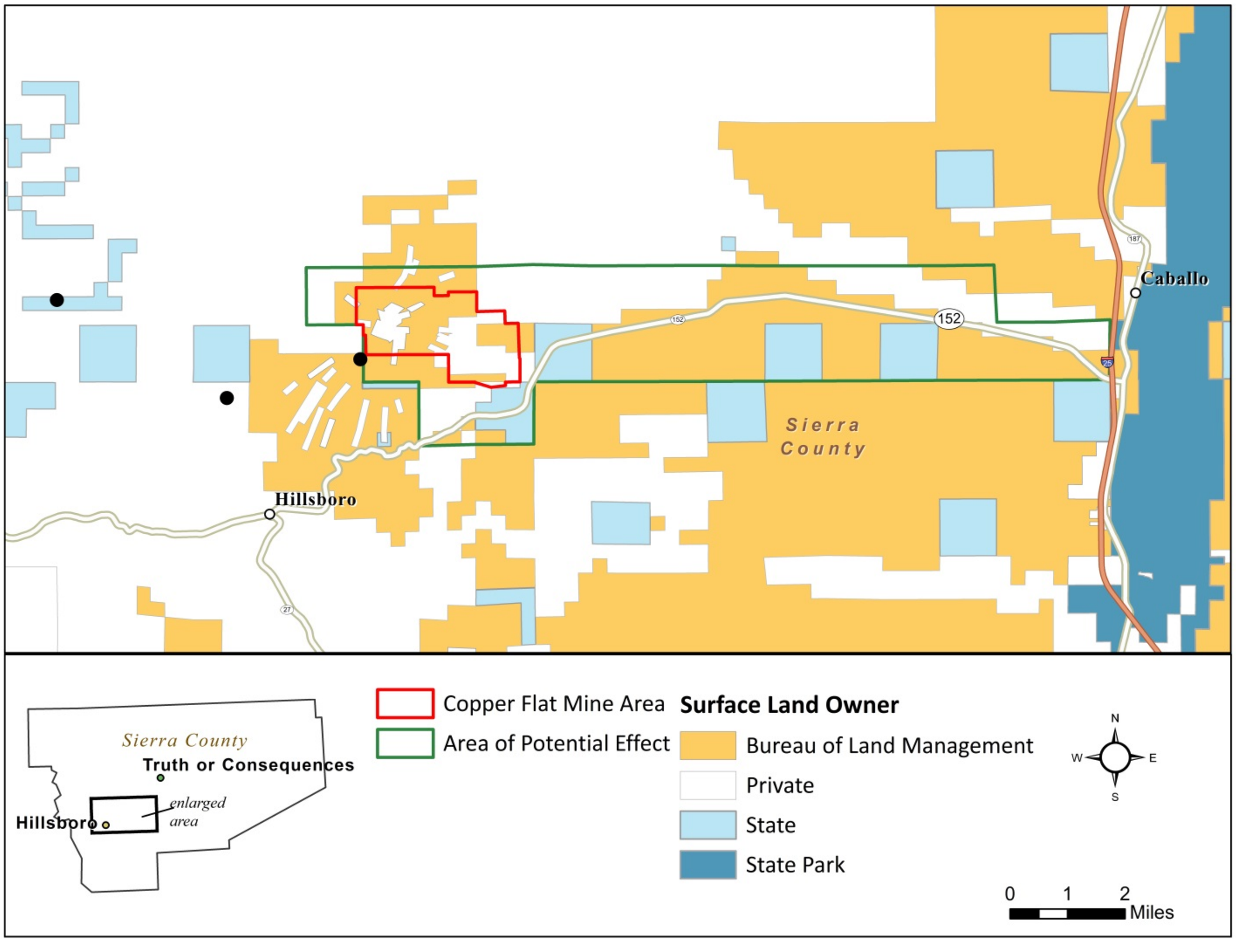
Table 3-35. Acreage and Percent Ownership for Surface Landowners in State, Counties, APE, and Mine Area

Table 3-35. Acreage and Percent Ownership for Surface Landowners in State, Counties, APE, and Mine Area										
	New Mexico		Grant County*		Sierra County		APE		Copper Flat Mine Area	
Landowner	Acres	Percentage	Acres	Percentage	Acres	Percentage	Acres	Percentage	Acres	Percentage
Private	34,043,470	44	976,136	38	681,871	25	6,104	39	961	44
NMDGF	199,569	0	2,413	0	0	0	0	0	0	0
New Mexico State Park	118,910	0	0	0	63,650	2	0	0	0	0
State of New Mexico	8,987,190	12	352,427	14	285,022	11	1,824	12	0	0
BLM	13,490,571	17	336,360	13	772,575	29	7,585	49	1,227	56
U.S. Bureau of Reclamation	54,559	0	0	0	63,424	2	0	0	0	0
U.S. Department of Defense	2,521,038	3	1,660	0	523,907	20	0	0	0	0
USDA Forest Service	9,221,432	12	879,899	35	378,543	14	0	0	0	0
Other Federal agencies	998,501	1	0	0.00	0	0	0	0	0	0
Tribal/Indian	8,191,250	11	0	0.00	0	0	0	0	0	0
Total	77,826,490	100	2,548,895	100	2,705,342	100	15,514	100	2,188	100

Source: BLM 2013; ESRI 2010.

Note: * Grant County is included for comparison as the closest county to the proposed project site. Grant County also has a history of mining.

Figure 3-36. Surface Landowners in the APE



Source: BLM 2012a.

3.15.1.3 Sensitive Land Uses Near Copper Flat Mine

Per the significance criteria outlined in Section 3.1, Introduction, the magnitude of impacts to land use are evaluated based on conflicts with existing land use plans. Several types of land uses near the Copper Flat mine may be sensitive to changes in nearby land use in and around the Copper Flat mine area and have the potential to create land use conflict. White Sands Missile Range is the closest military facility at 33 miles east of the APE boundary and 43 miles east of the Copper Flat mine area boundary (USGS 2011). Military uses can be affected by surrounding activities. New residential and commercial development, along with increasing competition for land, airspace, and water access, can constrain training, testing and other military base activities (NCSL 2013). For example, nighttime lighting from communities can reduce the effectiveness of night vision training. Similarly, airports are impacted by other land uses, especially ones that are sensitive to noise such as residences and schools (FAA No Date). The nearest airport is 18 miles northeast of the APE and 22 miles northeast of the Copper Flat mine area boundary (ESRI 2010).

Some wildlife and wildlife-related recreation are sensitive to nearby land uses. San Andres NWR is the closest NWR at 43 miles southeast of the APE and 53 miles southeast of the Copper Flat mine area boundary (USGS 2011). Impacts to Federally- and State-listed species are analyzed in Section 3.12, Threatened, Endangered, and Special Status Species.

There are some sites near the Copper Flat mine that are listed on the NRHP. Several of these are located in Hillsboro. The closest NRHP-listed site is 2.8 miles southwest of the APE and 3.2 miles southwest of the Copper Flat mine area boundary (NPS 2007). Impacts to cultural resources are analyzed in Section 3.13, Cultural Resources.

3.15.1.4 Land Management Guides

This section describes pertinent Federal, State, and local land management guidance.

BLM: The BLM manages public land for multiple uses including recreation; grazing; mineral extraction and processing; watershed management; fish and wildlife habitat; wilderness; and natural, scenic, scientific, and historical values. RMPs guide BLM land management. The land use decisions in the RMPs give direction to activities such as grazing, mining, and recreation.

The 1986 White Sands RMP provides the current guidance for BLM land management decisions in Sierra County. The White Sands RMP identifies the Copper Flat mine as a mineral resource and recognizes that it could again become a producing mine, although no mining has occurred at the site since 1982 (BLM 1986). The BLM LCDO is in the process of updating the White Sands RMP (now known as the Tri-County RMP). The update is currently in the draft stage and is anticipated to be completed in 2019.

Many regulations dictate energy and mineral resources management on BLM land. One example is the regulations developed under the Mining and Minerals Policy Act of 1970, which addresses domestic mining. From these various regulations and policies, the BLM devised 11 guiding principles for managing energy and mineral resources on its public land. Four relevant principles that relate to land use are listed below (BLM 2008b):

1. BLM land use planning and multiple-use management decisions will recognize that energy and mineral development can occur concurrently and sequentially with other resource uses, providing that appropriate stipulations or conditions of approval are incorporated into authorizations to prevent unnecessary or undue degradation, reduce environmental impacts, and prevent a jeopardy opinion.
2. Land use plans will incorporate and consider energy and geological assessments as well as energy and mineral potential on public land through existing energy, geology, and mineral resource data, and to the extent feasible, through new mineral assessments to determine mineral potential. The BLM will work cooperatively with surface owners and mineral operators in recognizing rights on split-estate land. In the absence of a surface owner agreement and in mining development of the Federal mineral estate on a non-Federal surface, the BLM will take into consideration surface owner mitigation requests from predevelopment to final reclamation.
3. The BLM will adjudicate and process energy and mineral applications, permits, operating plans, leases, ROWs, and other land use authorizations for public land in a timely and efficient manner and in a manner to prevent unnecessary or undue degradation. The BLM will require financial assurances, including long-term trusts, to provide for reclamation of the land and for other purposes authorized by law. Prior to mine closure, reclamation considerations should include partnerships to utilize existing mine infrastructure for future economic opportunities such as landfills, wind farms, biomass facilities, and other industrial uses.

New Mexico State Trust land: The New Mexico State Land Office is responsible for managing State Trust land to generate income but is also responsible for ensuring that land is maintained for future productive uses. No State trust land is located within the proposed Copper Flat mine boundary (see Figure 3-36), so no permitting from the State Land Office is required.

Sierra County: Sierra County has limited land use regulations or guidance on the development of private land (Sierra County 2006). For unincorporated areas of Sierra County, the county government does not issue permits, except for floodplain permits. Building permits are issued at the State level (Jones 2012).

Currently, Sierra County has no zoning ordinance. The County has a subdivision ordinance, the effective date of which is 2011. Other ordinances related to land use include: Flood Plain Ordinance amended in 2010; Economic Development Ordinance, 1997; Manufactured Housing Ordinance, 1997; and Illegal Waste Disposal Ordinance, 2010 (Sierra County 2017).

Private land in Sierra County is guided by the *Interim Land Use Policy of Sierra County of 1991*. This policy document covers land disposition, water resources, agriculture, timber and wood products, cultural resources, recreation, wildlife and wilderness, mineral resources, access and transportation, and monitoring and compliance. The policy states that the intent of Sierra County land use planning is "to protect the custom and culture of County citizens through protection of private property rights, the facilitation of a free market economy, and the establishment of a process to ensure self-determination by local communities and individuals" (Sierra County 2006).

Sierra County's Assessor Office has use codes for assessing land for tax purposes. The Copper Flat mine has been designated as "miscellaneous," which is the code for raw land not currently utilized. The same code is given for the land surrounding the mine (Whitney 2012), with the exception of Hillsboro Pitchfork Ranch LLC, which is designated as agricultural lands.

Other permits: Other permits would be required for a mining operation. The USACE would need to issue a Section 404 National Dredge and Fill permit. The Bureau of Alcohol, Tobacco, Firearms, and Explosives issues permits for use of explosives. NMEMNRD's Mining Act Reclamation Bureau is responsible for the mining permits. The NMED issues the air permits to construct and operate mines as well as groundwater discharge permits and liquid waste system discharge permits. Access permits for Gold Mine Road off of NM-152 would be required from the New Mexico Department of Transportation (NMDOT). A State Trust land permit would be necessary to build the proposed substation on State Trust land in Alternative 2. The New Mexico OSE manages the permits to appropriate water (THEMAC 2012).

3.15.2 Environmental Effects

The environmental effects to land use are determined based on whether proposed mining uses would conflict with or impact any of the other uses, plans, or agreements. Based on the four principles described previously in this section that regulate BLM actions regarding land use, it is unlikely that any proposed project activities would conflict with the BLM or other Federal land uses, plans, or agreements. Several State permits would be required for the proposed project. (See Table 1-1.) These permits would ensure compliance with existing land uses, plans, or agreements. Unincorporated land in Sierra County has no written zoning ordinance or permitting requirements.

The following is a list, by resource category, of potential impacts to land use from mining activities. However, 52 percent of the proposed mine area has been used previously for mining activities, so these impacts would be expected to be minor. These impacts relate to changes in land use due to impacts to the soil, water, or changing land use options during or after mining activities. More details on impacts to soil and water resources are found in Sections 3.8 (Soils), 3.5 (Surface Water Use), and 3.6 (Groundwater Resources).

Soils

- Change in soil productivity limiting future land use;
- Change in soil productivity impacting vegetation limiting future land use;
- Soil contamination caused by stockpiled mining materials so that future land uses are limited; and
- Dispersion of fine grain particulates and soils caused by trucks carrying materials thus changing mine closure liability and remediation requirements.

Water

- Spills/solubility causing groundwater contamination that limits future land use opportunities;
- Reduction in water availability from mine's water use, foreclosing other land uses for a time;
- Reduction in water availability from mine's water use, impacting other land uses such as ranching;
- Attraction of wildlife to discharge tailing pond, causing interference with surrounding land uses; and
- Degradation of water quality from leaking tailing ponds, impacting future land use opportunities.

Potential land uses

- Limit land use options during mining;
- Loss of appeal of area from change in character;
- Limit land use opportunities from degradation of air quality from stockpile;
- Climate change reducing water availability in rivers and wells causing foreclosure of other future uses for a time and impacting other land uses;
- Change in post-mining land uses from having reclamation for the existing site (pit);
- Provide more opportunities for future land use due to reclamation;
- Limit land use opportunities from land degradation, which may limit residential development or other development; and
- Change in post-mining land uses for the existing site's surface facilities.

3.15.2.1 Proposed Action

Under the Proposed Action, impacts would be short- and medium- term, minor, of small extent, probable and adverse during the life of the mine and reclamation activities. Impacts from reclamation activities may be beneficial due to enhancement of the area, though these impacts would comply with existing land use plans and would therefore be minor. Overall, impacts would not be significant.

3.15.2.1.1 Mine Development/Operation

Mining activities would follow BMPs to prevent soil or water impacts as described in Sections 3.8 (Soils), 3.5 (Surface Water Use), and 3.6 (Groundwater Resources). Any changes to soil or water conditions are unlikely to impact the mining area to the point where potential land use would conflict with land management plans by preventing planned land uses or permitting within or nearby the APE. Impacts to land use from changes to soil (Section 3.8, Soils) would be minimal due to lack of conflict with local, regional, State, or Federal land use plans.

Impacts to land use would occur due to changes in land use options during the life of the mine, but these impacts are expected under normal mining activities. Because the mining area is 4 miles from the nearest urban area (Hillsboro, New Mexico), impacts that limit development options would be expected to be minimal.

3.15.2.1.2 Mine Closure/Reclamation

The Copper Flat mine area would be reclaimed to achieve a self-sustaining ecosystem appropriate for the climate, environment, and land uses of the area. Any adverse impacts on neighboring land uses including cattle grazing, alternative energy generation infrastructure such as wind and solar, and reestablishment and enhancement of original botanical and zoological species habitants would be avoided. All post-closure land uses would be in conformance with BLM 1985 White Sands RMP and the Sierra County Comprehensive Land Use Plan (2017), or their successor plans. The project is designed to meet, without perpetual care, all applicable Federal and State environmental requirements following closure.

Major land uses occurring in the vicinity of the mine area are mining, grazing, and recreation. Following completion of mine closure and all reclamation activities, the mine area would continue to support these uses to a lesser degree. Proposed reclamation of the site should result in a successful program to restore the area to the productive land uses discussed above.

Following closure, the pit would partially fill with water from subsurface flow resulting in a permanent TSF (SRK 1995). Hydrogeologic and geochemical modeling indicates the post-closure pit lake water quality should be similar to that of the current pit lake (SRK 1995). Possible post-closure uses for the pit include a water reservoir for agricultural and grazing purposes.

Reclamation and revegetation efforts would return some areas of soil disturbance to a productive state following construction, thereby reducing the duration and magnitude of impact. Although the original physical structure of the landscape post-mining may be irreplaceable, the Copper Flat mine area would be reclaimed to achieve a self-sustaining ecosystem appropriate for the climate, environment, and land uses of the area. Impacts to land use from changes to water quality (Section 3.4, Surface Water Use) are also expected to be less than minor due to lack of conflict with local, regional, State, or Federal land use plans. While there are still some uncertainties regarding impacts to water quality (described in Section 3.4, Surface Water Use), the land use of the area would be unlikely to change due to any changes in water quality. NMCC would develop a pit lake management plan in order to comply with water quality regulations and monitor changes in water quality to the pit lake.

Land uses in and around the mining area would not be changed until after reclamation, and the final land use would be congruent with previous land use. Throughout the life of the mine, nearby land uses would be affected, but after reclamation these nearby areas should return to their pre-mining condition. Although the land use would change from inactive to active mining, the land use category would not change. In addition, permitting requirements would assure compliance with existing land use regulations. The land use category would not change and land use regulations would be followed.

3.15.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Impacts during mining construction, operation, and reclamation under Alternative 1 would be short- and medium- term, minor, of small extent, probable, and adverse. The effects from mine development, operation, closure, and reclamation under Alternative 1 would be similar in nature and level as the Proposed Action. As with the Proposed Action, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements. The regulatory requirements, BMPs, and mitigation measures to be followed under Alternative 1 would be identical to those outlined under the Proposed Action. Overall impacts would not be significant.

3.15.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Impacts during mining construction, operation, and reclamation under Alternative 2 would be short- and medium- term, minor, of small extent, probable, and adverse. The effects from mine development, operation, closure, and reclamation under Alternative 2 would be similar in nature and level as the Proposed Action. As with the Proposed Action and Alternative 1, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements. The regulatory requirements, BMPs, and mitigation measures to be followed under

Alternative 2 would be identical to those outlined under the Proposed Action. Overall impacts would not be significant.

3.15.2.4 No Action Alternative

The No Action Alternative would avoid potential direct and indirect impacts of the Proposed Action to land ownership and land use. Although cleanup activities related to the remediation of the existing sulfate plume at the Copper Flat site would occur under the No Action Alternative, this would not impact land ownership or land use.

3.15.3 Mitigation Measures

No mitigation measures for land ownership and land use beyond BMPs and regulatory requirements described in the Proposed Action have been identified for any alternative.

3.16 RECREATION

This section describes the recreational environment in the Copper Flat mine area and the potential environmental effects of the Proposed Action and the No Action alternative on this resource use. This section also provides details about the two Backcountry Byways located within the APE for recreation. All other special designation areas (Areas of Critical Environmental Concern [ACECs], National Historic Trails and Historic Trails not Congressionally designated, Wilderness Study Areas [WSAs], and Natural Landmarks) are discussed in Section 3.17, Special Management Areas.

3.16.1 Affected Environment

Sierra County is located in the BLM's TriCounty Planning Area consisting of Sierra, Otero, and Doña Ana counties, as described in the TriCounty Draft RMP/EIS. This planning area is the region within which the BLM will propose management decisions during the ongoing TriCounty Planning Area RMP/EIS effort, which will replace the outdated 1986 White Sands RMP that currently governs many decisions regarding recreation planning in Sierra County (Sierra County 2017).

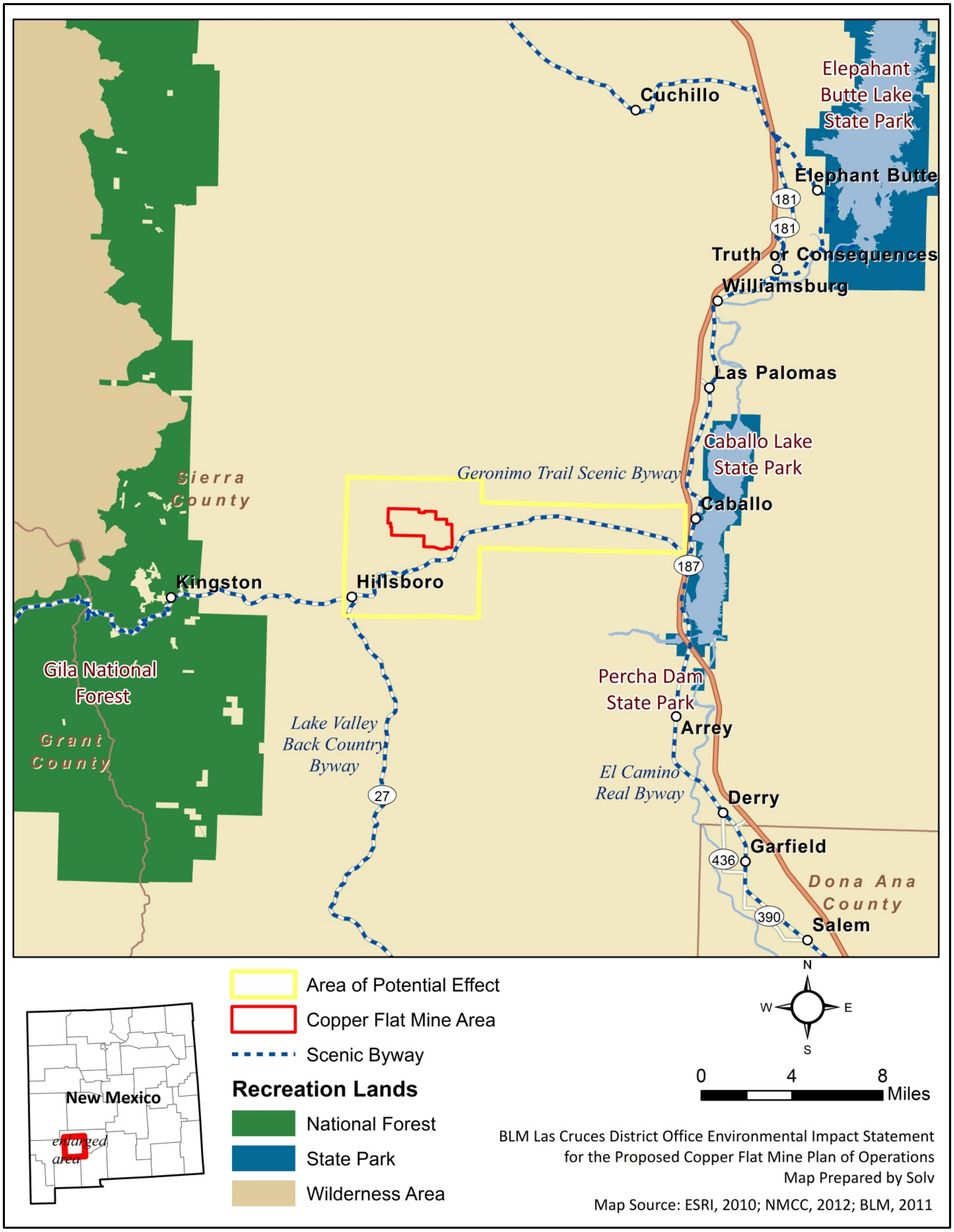
Since the discovery of hot springs early in the settlement of Truth or Consequences (formerly named Hot Springs, New Mexico) in the late 1800s, which drew visitors to local health and spa resorts formed around the hot springs, recreation has played an integral role in Sierra County's economy. Completion of the Elephant Butte Dam and Reservoir in 1916, which formed Elephant Butte Lake (New Mexico's largest lake), further expanded the County's number and types of recreational opportunities. Caballo Lake, Elephant Butte Lake, and Percha Dam combined attracted over 1.3 million visitors in 2016 (Sierra County 2017). Though low water levels have reduced tourism associated with the area's water-based recreational opportunities (boating, fishing, and water sports) over the past several years, two types of seasonal visitors come to Sierra County: winter visitors who come in October and leave in mid-March or April, and summer weekend visitors who come sporadically through September (Sierra County 2012). Visitors participate in recreational activities such as dispersed camping, use of recreational vehicle (RV) parks, golfing, hunting, fishing, birding, swimming, off-highway vehicle (OHV) use, picnicking, sightseeing, driving along scenic Backcountry Byways, and hiking. Visitors frequent Elephant Butte Lake State Park, Caballo Lake State Park, Percha Dam State Park, parts of the Gila and Cibola National Forests, the Black Range Mountains, Turtleback Mountain, and the banks of the Rio Grande.

Truth or Consequences, the county seat of Sierra County, still features ten commercial bathhouses managed within numerous spas, which have experienced a recent resurgence in popularity. The downtown Truth or Consequences area also features the Geronimo Springs Museum, Las Palomas Plaza, and various dining and lodging options (Sanchez 2012; Sierra County 2012). (See Figure 3-37.)

3.16.1.1 Backcountry Byways

The BLM Backcountry Byways program is a component of the National Scenic Byways system that focuses primarily on corridors along backcountry roads that have high scenic, historical, archaeological, or other public interest values. The Lake Valley Backcountry Byway and the Geronimo National Scenic Byway are the only listed byways found in the project's APE. The two byways intersect at NM-152, near the main access point for the Copper Flat mine. These byways provide opportunities for scenic views and are an integral part of the area's recreation and tourism.

Figure 3-37. Recreational Resources within the Project Vicinity



Source: ESRI 2010; THEMAC 2011; BLM 2011.

Lake Valley Backcountry Byway: The Lake Valley Backcountry Byway is a paved, winding byway managed by the BLM. It is approximately 43 miles long; 12 miles of the byway occur on public land. It begins about 18 miles south of Truth or Consequences at the junction of I-25 and NM-152 in western Sierra County and extends west along NM-152 to Hillsboro, New Mexico, where it intersects with the Geronimo Trail National Scenic Byway. From Hillsboro, the byway follows State Highway 27 through Lake Valley and terminates at Nutt, New Mexico, at the junction of State Highways 26 and 27 in northeast Luna County. The Black Range Mountains, Caballo Mountains, Cooke's Peak, and Las Uvas Mountains are observable from the route. (See Figure 3-38.) This Byway is located in an area formerly used for mining and ranching purposes during a historical settlement period. It has historical value and promotes tourism in the area (BLM 2012a).

Figure 3-38. View Along Lake Valley Backcountry Byway

Source: Takemytrip.com 2008.

Geronimo Trail Scenic Byway: The Geronimo Trail Scenic Byway is administered by the Federal Highway Administration and is named for Geronimo, a famous Apache warrior. This byway begins at the junction of New Mexico Highways 61 and 152 in Grant County, where it offers scenic views of the Black Range Mountains. (See Figure 3-39.) The byway then continues east along NM-152 out of the river valley and through the foothills towards Hillsboro, New Mexico. The portion of the byway that follows NM-152 is located in an area formerly used for mining, which promotes tourism through sightseeing tours of abandoned mines and ghost towns. From Hillsboro, it follows NM-152 east; this portion of the byway overlaps the Lake Valley Backcountry Byway until it meets Highway 85.

The byway then continues north along Highway 85 towards Truth or Consequences, where the Caballo Mountains and Caballo Lake can be seen. From Truth or Consequences, the byway extends north towards NM 52, then west following NM 52 towards the town of Winston, New Mexico. From Winston, the route continues north along NM 52 towards NM 59. The route follows NM 59 west through the Gila National Forest, ending in Beaverhead; this portion of the route provides opportunities for wildlife and scenic viewing (Pathways Consulting Services 2008).

Figure 3-39. View Along Geronimo Scenic Trail Byway

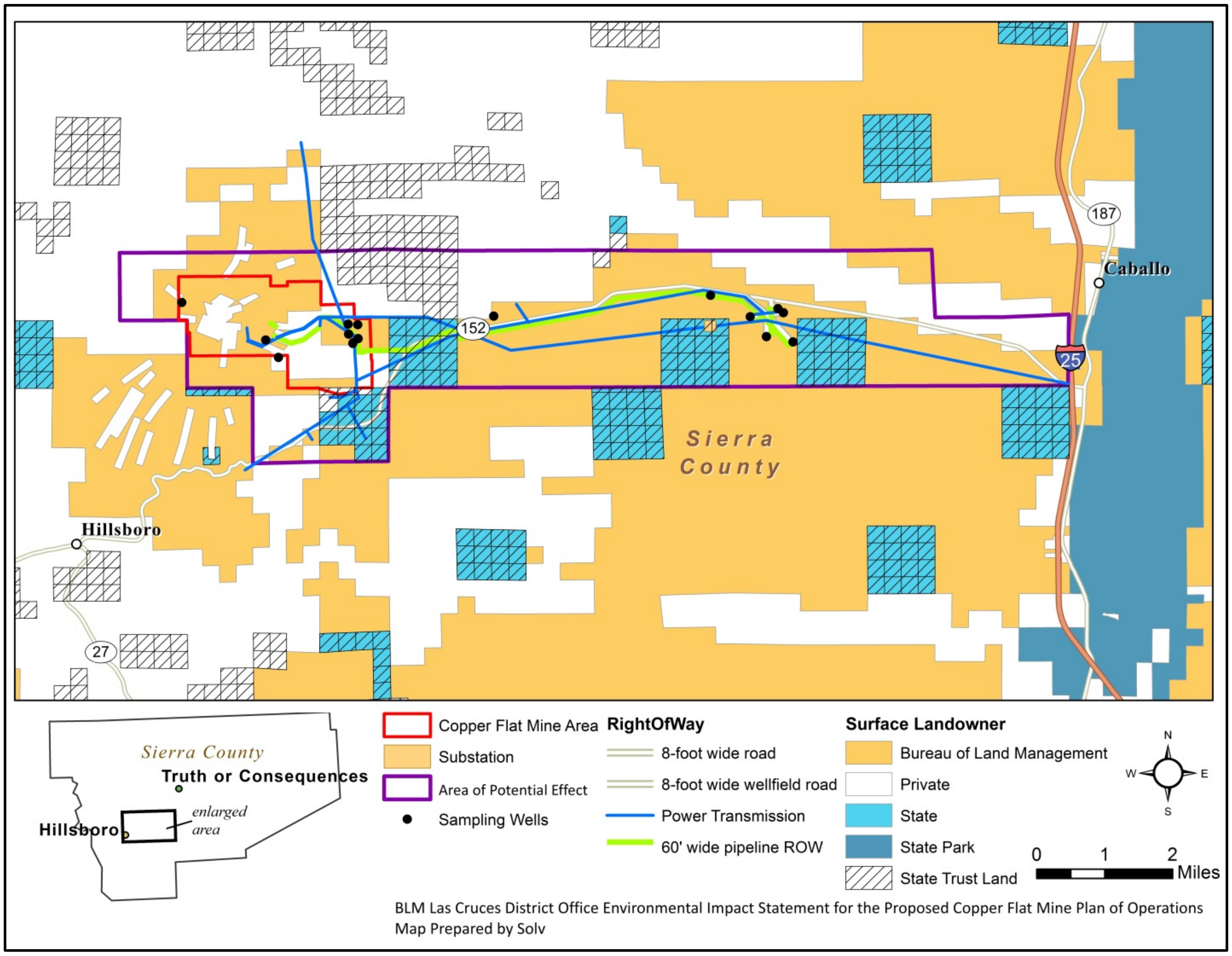
Source: RVdreams.com 2008.

3.16.1.2 Other Recreational Opportunities

Hunting: Small game and big game hunting is allowed in the APE on the BLM and State Trust land properties in Sierra County. The BLM manages 16,807 acres and the New Mexico State Land Trust manages 2,563 acres of land within the APE (Hewitt 2012). (See Figure 3-40.)

Hunting on State Trust land property is allowed if land is accessible by public road or across public land and not within 150 yards of a dwelling or building, not including abandoned or vacant buildings on public land (Sanchez 2012). The BLM enhances habitat on public lands in partnership with NMDGF through the Habitat Stamp program, which is authorized by the Sikes Act. The BLM also works closely with NMDGF officers in the enforcement of wildlife and fishing regulations. The NMDGF divides New Mexico into game management units to manage big game hunting within the State; the APE is located in game management unit 21b. A variety of species, from big game to small mammals and upland birds, may be hunted in the APE (BLM 2012a).

Figure 3-40. BLM and State Trust Land Properties Within the APE



Source: ESRI 2010.

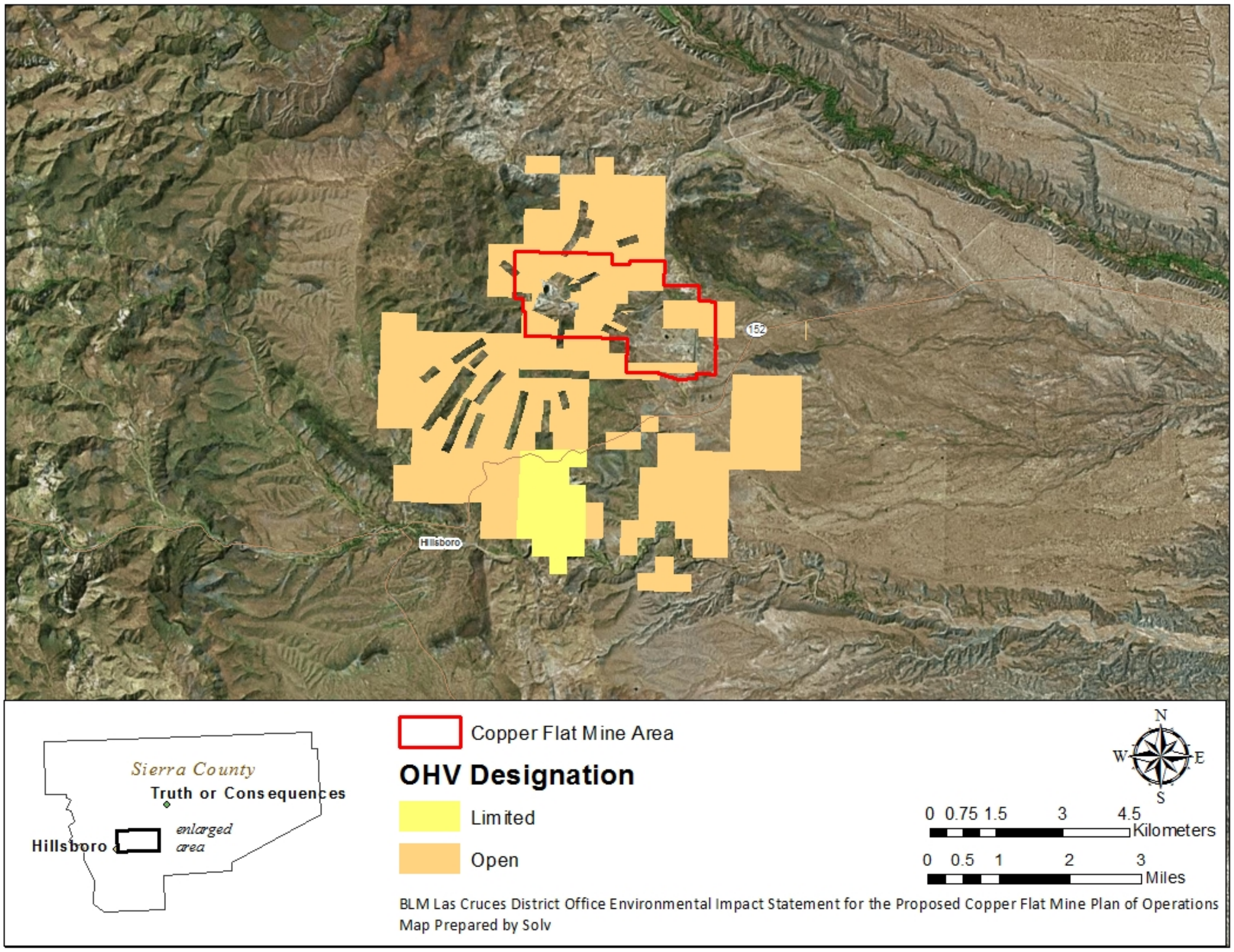
Hiking: BLM land in New Mexico is open to hiking and backpacking. With its arid, moderate climate, clean air, and scenic landscapes, Sierra County provides plenty of opportunities for hiking in places like Animas Peak Summit. Hiking locations within the APE do not have designated trails, which means visitors have to navigate their way through the landscape with a map, GPS, or compass.

Sightseeing: Sightseeing within the APE consists of scenic viewing from non-designated trails, BLM public land, State Trust land, and the APE's two scenic byways. Sightseeing also occurs in Hillsboro, New Mexico, home to several spots that accommodate tourism including restaurants, gift shops, galleries, museums, a bed and breakfast, and a saloon (Sierra County 2012).

OHV use: OHVs are used primarily for recreation and for transportation to recreation sites. Approximately 95 percent of the BLM-managed land in the APE is classified as open area (Hewitt 2012). An open area designation, according to the BLM's *Land Use Planning Handbook* requirements and 43 CFR 8340, is assigned to areas open to intensive OHV use where there are no compelling resource protection needs, user conflicts, or public safety issues to warrant limiting cross-country travel (BLM 2012a).

The remaining 5 percent of BLM land in the APE is within the Percha Creek riparian area and is classified as limited to existing roads to protect resource values (BLM 1986). Other limitations may include restrictions on the number or type of vehicles allowed in the area, restrictions on time or season of use, restrictions on non-permitted or unlicensed use, and limitations on the use of designated roads and trails (BLM 2012a). The State of New Mexico requires mandatory registration for all OHVs used on public land but does not require such registration on private land (NMDGF 2012). OHV use designations on public land within the APE are shown in Figure 3-41.

Figure 3-41. OHV Use Designations within the APE



Source: ESRI 2010.

3.16.2 Environmental Effects

The predicted effects to recreational resources from the Proposed Action and alternatives are described in the following sections; 3.16.2.1, Proposed Action; 3.16.2.2, Alternative 1; and 3.16.2.3, Alternative 2.

3.16.2.1 Proposed Action

Recreational impacts under the Proposed Action would be short- to long-term, minor, of small to medium extent, probable, and adverse. Overall, impacts to recreation would range from significant to not significant.

3.16.2.1.1 Mine Development and Operation

The Copper Flat mine was operational from April to June of 1982. In 1986, all on-site surface facilities were removed and a BLM-approved program of non-destructive reclamation was carried out. Most of the property's infrastructure including building foundations, power lines, and water pipelines were preserved for reuse in the future in the event copper prices recovered sufficiently to make reestablishing the project economically viable.

As identified in Section 3.16.1, Affected Environment, recreational activities that may occur within the APE include driving along the area's scenic byways, OHV use, hunting, hiking, biking, bird watching, and other nature-based activities that may occur on public land. Actions associated with mine development and operation that could potentially impact these activities would include increased access road use and construction and operation of WRDFs, ore stockpiles, mill and associated processing facilities, a TSF, ancillary buildings, and a water supply network. Mine development and operation is also associated with noise from drilling, blasting, and the use of mining equipment. Haul roads are not expected to create new areas of disturbance as they would be constructed on previously disturbed land.

As discussed in greater detail in Section 3.10, Wildlife and Migratory Birds, losses of mammals, birds, or wildlife in general are expected to be significant as a result of the project. Proposed project activities may cause minor disruptions to foraging, migratory movement, or breeding behavior of some species. A few animals may be killed during these activities as a potential result of being driven out of their foraging territories and made more susceptible to predation, but these losses would not be expected to impact any species as a whole. There is currently a vast amount of undeveloped land in nearby areas where wildlife can temporarily relocate for cover and forage. Thus, impacts to hunting and other wildlife-related activities such as bird watching are anticipated to be long-term but minor.

The construction and operation of mine-related facilities and stockpiles on undisturbed public land could impact any existing recreational use of land within the project footprint, although such use is minimal. The mining area would be fully fenced to prohibit access to the site. Though there are no designated trails within the project footprint, if recreational users are accustomed to hiking, backpacking, bird watching, or riding OHVs in the outer limits of the project footprint, impacts due to restricted use could be long-term. However, due to the presence of existing mining-related structures, the open pit mine and tailings pond, and existing fencing around parts of the mine area which already restricts access for human health and safety reasons, recreational activities in this area are not prevalent. Thus, impacts to on-foot recreationists and OHV riders are anticipated to be long-term but minor. Access restrictions related to human health and safety are discussed in greater detail in Section 3.24, Human Health and Public Safety.

The quality of recreational users' experience can be dependent upon numerous factors, such as traffic (while accessing recreational sites), visual quality of the environment where recreation takes place, the level of noise present, and the ability to utilize water bodies as intended for recreational purposes. These four interrelated resources are described below.

Traffic: Access to and from the site is via 3 miles of all-weather gravel road and 10 miles of paved highway (NM-152) east to I-25, near Caballo Reservoir. As discussed previously, the Geronimo Trail Scenic Byway and the Lake Valley Backcountry Byway overlap along this portion of NM-152 (from Hillsboro east to the junction of NM-152 and Highway 85).

The impact to recreation due to increased traffic associated with mine construction and operation along this route is anticipated to be minor and long term. This minor impact would be due to the slightly decreased capacity of NM-152, which would occasionally reduce the standard pace of scenic driving along the overlap of the byways. Impacts to the local transportation network are discussed in greater detail in Section 3.20, Transportation and Traffic.

Visual quality: The visual or scenic quality of an area contributes to the recreational value. The Copper Flat mine area can be seen from both the Geronimo Trail Scenic Byway and the Lake Valley Backcountry Byway. It can also be seen from Caballo Lake State Park and Percha Dam State Park. The Copper Flat mine area is already largely developed or has been graded and cleared for mining purposes. Additional tree removal for the construction of facilities would contribute minor and long-term adverse impacts to recreation in the area based on the increased degradation of visual quality. Visual resources and potential impacts are discussed in greater detail in Section 3.14, Visual Resources.

Noise: Impacts to recreation due to increased noise caused by drilling associated with mine construction and operation throughout the APE are anticipated to be minor and long-term. Noise would be caused by drilling, blasting, and the use of other mine equipment. Noise from the mine equipment would comply with and be regulated under MSHA regulations. Mufflers and other noise abatement equipment would be installed where applicable at the mine. However, even with implementation of these measures, the level of noise within the project footprint would increase under the Proposed Action. This would impact recreationists' experience during use of the public land within and immediately adjacent to the project footprint. Impacts from noise associated with construction and operation of the mine are discussed in greater detail in Section 3.21, Noise and Vibrations.

Water use: As described in Section 3.5, Surface Water Use, predictive groundwater flow modeling was conducted to determine the extent to which groundwater pumping associated with the Proposed Action would reduce surface water quantity in the permit area. Processing ore at a nominal throughput of 17,500 tpd under the Proposed Action is predicted to slightly reduce streamflows in both Las Animas Creek and Percha Creek and reduce groundwater discharge to Caballo Reservoir and Rio Grande below Caballo Dam. This could potentially impact water-based recreation in Caballo Reservoir and the Rio Grande, if water levels became low enough to hinder recreational uses.

Total reductions in discharge to the hydrologic system from the Santa Fe Group aquifer as a result of the Copper Flat project are projected to peak at a total of about 3,100 AFY shortly after the end of mining, then diminish to near-zero over about 30 years. Flow induced from the Palomas Graben north of the study area (as delineated in JSAI 2017) is projected to reach a maximum of less than 800 AFY at the end of mining, which is estimated to result in an additional reduction of discharge to the Rio Grande by a maximum of 275 AFY. Effects on shallow groundwater (riparian) systems along Las Animas Creek and Percha Creek are projected to be minimal, with a maximum of less than 2 feet of groundwater-level change on Percha Creek and less than 1 foot of groundwater-level change on Las Animas Creek. Depletion to the Rio Grande is projected to peak around 2,080 AFY at the end of mining, then reduce to 28 AFY 100 years after mining. As required by the OSE, NMCC would mitigate the effects of pumping of the Santa Fe Group aquifer by offsetting reductions in discharge to the Rio Grande by lease or purchase of additional water rights in the amount of the reductions to flow (JSAI 2017). This would ensure that overall water-based recreational impacts to Caballo Reservoir and the Rio Grande would be minor and short- to medium-term.

3.16.2.1.2 Mine Closure/Reclamation

Reclamation and revegetation would entail the removal of aboveground structures. As vegetation becomes established, visual quality would return to what is typical for a dry, desert environment. Equipment use and vehicular traffic would essentially cease following mine closure. Once reclamation was successfully completed, all features of the recreational environment would return to existing (i.e., pre-mining operation) levels.

3.16.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Though Alternative 1 is predicted to cause greater surface water depletions than the Proposed Action due to its increased groundwater demand, the effects to recreation from mine development, operation, closure, and reclamation would be similar in nature and level as under the Proposed Action. Impacts under this alternative would be short- and medium-term, minor to moderate, of small extent, probable, and adverse. Overall, impacts to recreation under Alternative 1 would range from significant to not significant.

3.16.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

The effects to recreation from mine development, operation, closure, and reclamation under Alternative 2 would be similar in nature and level as Alternative 1 and the Proposed Action. Impacts under this alternative would be short- and medium-term, minor to moderate, of small extent, probable, and adverse. Overall, impacts to recreation under Alternative 2 would range from significant to not significant.

3.16.2.4 No Action Alternative

Under the No Action Alternative, subsurface and surface water pollution that exists at the Copper Flat site as a result of prior operations will be remediated according to a Stage 1 Abatement Plan. The area of investigation is the NMCC permit area plus a 1-mile buffer. Actions associated with cleanup activities could potentially impact any existing recreational use of land within the project footprint, although such use is minimal. Though there are no designated trails within the project footprint, if recreational users are accustomed to hiking, backpacking, bird watching, or riding OHVs in the outer limits of the project footprint, impacts due to restricted use could last for the duration of the cleanup activity and subsequent monitoring. However, due to the presence of existing mining-related structures, the open pit mine and tailings pond, and existing fencing around parts of the mine area which already restricts access for human health and safety reasons, recreational activities in this area are not prevalent. Thus, impacts to recreation under the No Action Alternative would be short- and long-term, minor, of small extent, probable, and adverse. Overall, impacts would range from significant to not significant.

3.16.3 Mitigation Measures

No mitigation measures that would be required for recreation have been identified for the Proposed Action or Alternatives 1 and 2.

3.17 SPECIAL MANAGEMENT AREAS

3.17.1 Affected Environment

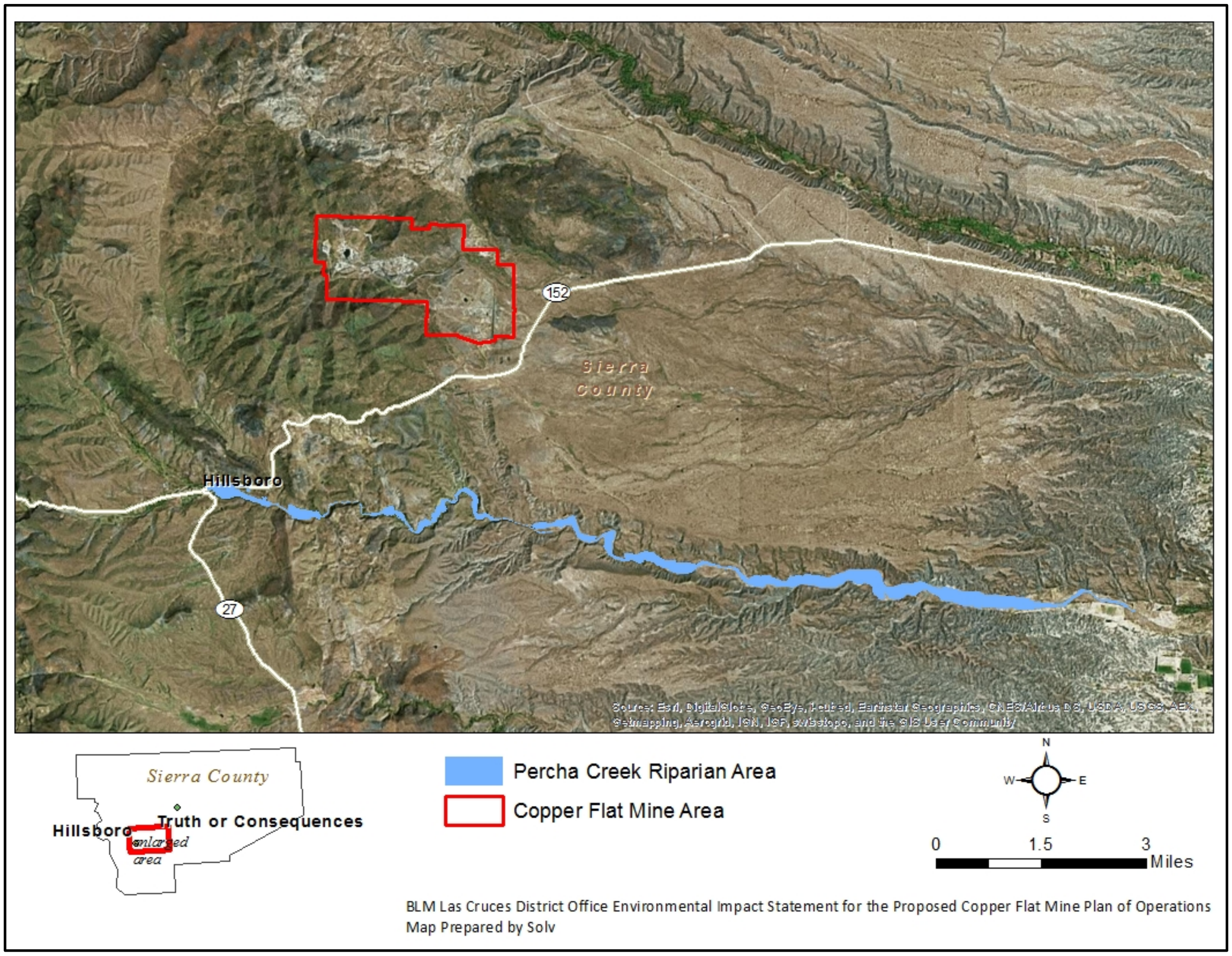
This resource section provides a discussion of areas that have been nominated for special management in Sierra County near the Copper Flat site. Special designations are ACECs (which encompass primitive recreation areas, research natural areas, outstanding natural areas, and scenic areas), Historic Trails not Congressionally designated, WSAs, lands with wilderness characteristics, National Historic Trails, and National Natural Landmarks (NNL). Backcountry Byways are discussed briefly in this section and in greater detail in Section 3.16, Recreation.

There are currently no WSAs in Sierra County. The Nutt Grasslands wilderness inventory unit was found to have wilderness characteristics in 2013 (BLM 2012a). Nutt Grasslands is located more than 10 miles from the Copper Flat site. The nearest National Historic Trail to the Copper Flat project (El Camino Real de Tierra Adentro) is over 12 miles from the easternmost boundary of the mine. There are currently no NNLs designated in Sierra County (Sierra County 2017).

3.17.1.1 Areas of Critical Environmental Concern

The BLM designates ACECs where special management attention is needed to protect human life and safety from natural hazards or to protect and prevent irreparable damage to important historical, cultural, and scenic values; fish and wildlife resources; or other natural systems or processes. There are currently no ACECs located in Sierra County (BLM 2012a). However, 870 acres of land along Percha Creek, located to the east of Hillsboro, New Mexico approximately two to three miles from the Copper Flat mine, has been proposed as an ACEC in order to preserve and protect riparian areas, special status species, and ecological resources (Sierra County 2017). It is the BLM's policy to provide temporary management to protect these significant resource values from degradation until the area is fully evaluated through the resource management planning process. The proposed ACEC is being considered in the ongoing TriCounty RMP (which will revise the White Sands RMP and amend the Mimbres RMP), in which the BLM will evaluate Percha Creek's designation as an ACEC and an alternative decision of no designation. An illustration of the proposed ACEC location within Percha Creek compared to the Copper Flat mine area is shown below (BLM 1988). (See Figure 3-42.)

Figure 3-42. Map of Proposed ACEC near Percha Creek



Source: ESRI 2010.

3.17.1.2 Backcountry and Scenic Trail Byways

The BLM Backcountry Byways program is a component of the National Scenic Byways system that focuses primarily on corridors along backcountry roads that have high scenic, historical, archaeological, or other public interest values. The Lake Valley Backcountry Byway and the Geronimo National Scenic Byway are the only listed byways found in the APE, which occurs along NM-152 where the two byways intersect (BLM 2012a). The byways are discussed in greater detail in Section 3.16.1.1, Backcountry Byways.

3.17.2 Environmental Effects

This section discusses the potential environmental effects that could occur to special management areas as a result of the Proposed Action, other action alternatives, and the No Action Alternative.

3.17.2.1 Proposed Action

Impacts under the Proposed Action would be short- and long-term, minor, of medium extent, probable, and adverse. Overall, impacts would range from significant to not significant.

3.17.2.1.1 Mine Development/Operation

Implementation of the Proposed Action is not anticipated to impact designation or management of the Percha Creek Riparian Area as an ACEC. Due to considerable distance from the mine area, mining under the Proposed Action would not change the riparian areas, special status species, and ecological resources located in this area.

The Proposed Action would result in probable, long-term, minor to moderate, and small- to medium-extent adverse impacts to the byways during the life of the project due to increased noise, traffic, and visual effects that would affect recreational activities associated with the byways. With the implementation of mitigation measures proposed in Section 3.20, Transportation and Traffic, impacts to traffic on the byways would be reduced from moderate to minor. Recreational impacts on user experience due to the construction, operation, and reclamation of the Copper Flat mine are described in Section 3.16, Recreation. Under the Proposed Action, the duration of mining would be 16 years.

3.17.2.1.2 Mine Closure/Reclamation

Impacts to most physical and biological resources would essentially cease following mine closure. Once reclamation was successfully completed, the environment surrounding backcountry byways would return to its existing (i.e., pre-mining operation) state. There would be no impacts to the proposed ACEC.

3.17.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Impacts under Alternative 1 would be short- and long-term, minor, of medium extent, probable, and adverse and would be similar to those that would occur under the Proposed Action. As under the Proposed Action, implementation of Alternative 1 is not anticipated to impact designation or management of the Percha Creek Riparian Area as an ACEC, due to distance from the mine area.

Alternative 1 would result in the same level of impact to the byways as under the Proposed Action during the life of the project due to increased noise, traffic, and visual effects that would affect recreational activities associated with the byways. Recreational impacts on user experience due to the construction, operation, and reclamation of the Copper Flat mine are described in Section 3.16, Recreation. Under the Accelerated Operations Alternative, the duration of mining at the Copper Flat site would be 11 years (5 years less than the life of the mine under the Proposed Action). Impacts to the byways would cease upon reclamation following closure of the mine. Overall, impacts would range from significant to not significant.

3.17.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Impacts under Alternative 1 would be short- and long-term, minor, of medium extent, probable, and adverse. The effects on the resources from Alternative 2 would be similar in nature as Alternative 1 and the Proposed Action. Overall, impacts would range from significant to not significant.

3.17.2.4 No Action Alternative

Under the No Action Alternative, special management areas would be maintained as they currently are. No changes or improvements would be anticipated to occur, other than those undertaken in the course of normal activities. Cleanup activities associated with the sulfate plume at the Copper Flat site are not anticipated to have any impacts on special management areas. No impacts are anticipated under this alternative to either Percha Creek Riparian Area or the byways.

3.17.3 Mitigation Measures

Potential mitigation measures include the addition of more informational signs along the byways that identify the Copper Flat mine as a resource feature that is consistent with BLM multiple-use goals. (See Figure 3-43.) Implementation of these signs at key points may inform drivers or recreational users of the history of copper mining in the area.

Figure 3-43. Informational Sign Regarding Copper Mining in the Copper Flat Area

Source: Photo by Dave Henney 2012.

3.18 LANDS AND REALTY

The BLM manages the land and mineral estates for over 13 million acres of public land and 13.7 million acres of Federally-owned mineral estate in New Mexico, Texas, Kansas, and Oklahoma. In accordance with the intent of Congress as stated in FLPMA (43 U.S.C. 1701 et seq.), land must be managed under the principles of multiple-use and sustained yield. As required by FLPMA, public land must be managed in a manner that protects the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values that, where appropriate, will preserve and protect certain public land in their natural condition; will provide food and habitat for fish and wildlife and domestic animals; and will provide for outdoor recreation and human occupancy and use by encouraging collaboration and public participation throughout the planning process. In addition, the public land must be managed in a manner that recognizes the nation's need for domestic sources of minerals, food, timber, and fiber from the public land. The BLM's Lands and Realty program processes applications for ROWs and performs land tenure adjustments, land exchanges, sales, acquisitions and disposals, leases and permits, and color-of-title. It also oversees workloads related to withdrawals (BLM 2012a).

3.18.1 Affected Environment

In addition to the mine area, the APE for land and realty includes the proposed wells, pipeline, and the NM-152 highway to the I-25 intersection. Land ownership and land use is discussed in Section 3.15, Land Ownership and Land Use. The project location information for this area is found in Figure 1-1 and Figure 1-2.

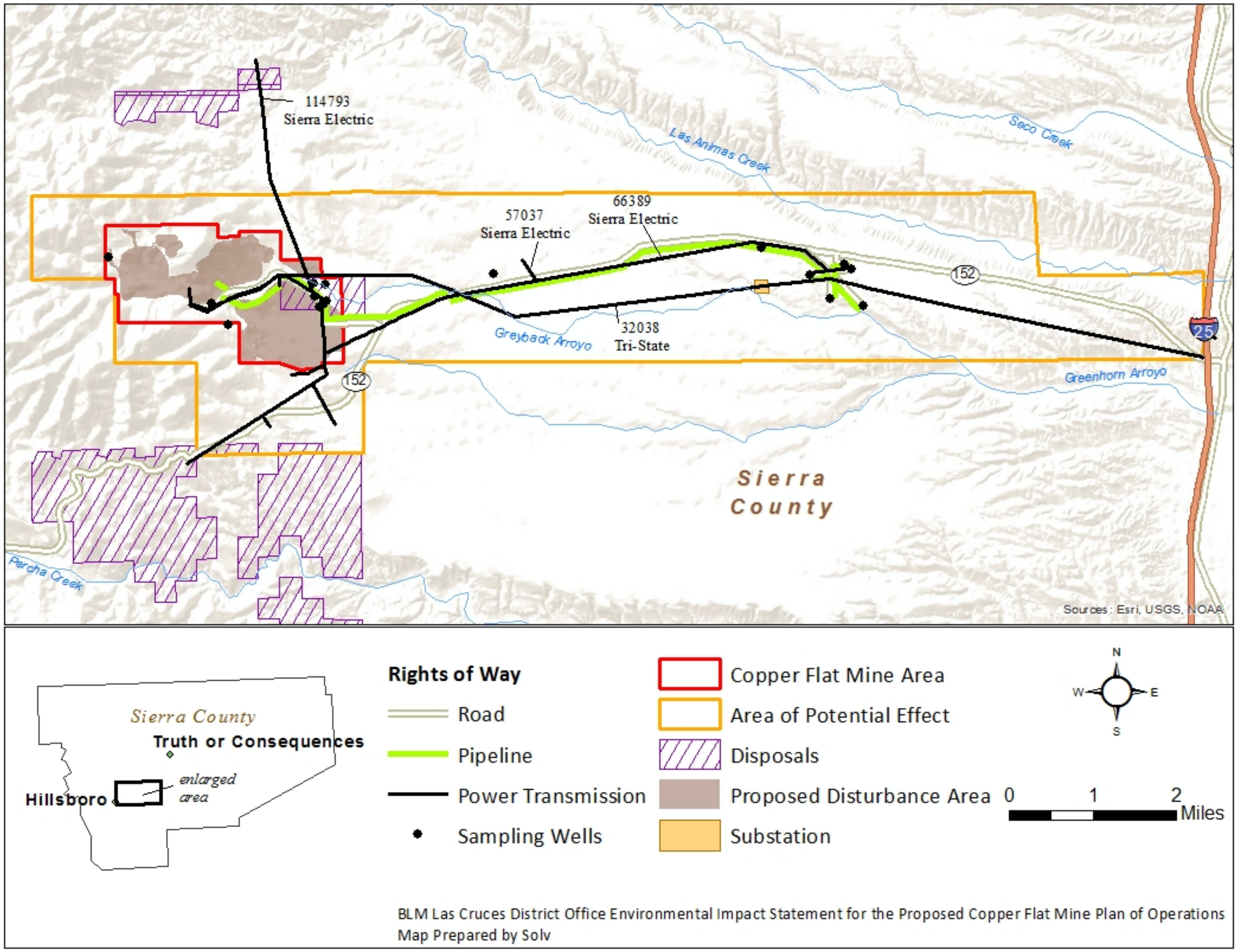
3.18.1.1 Right-of-Way Grants

A ROW grant is an agreement for the use of a specific piece of public land for a particular project, such as the development of roads, pipelines, transmission lines, and communication sites. 43 CFR 2801.5 defines a ROW grant as any authorization or instrument (e.g., easement, lease, license, or permit) that the BLM issues under Title V of FLPMA. A ROW authorizes non-exclusive use of public land, in accordance with the terms, conditions, and stipulations contained within the ROW. An important component of the BLM's ROW program is the intrastate and interstate transportation of commodities ultimately delivered as utility services (e.g., natural gas and electricity) to residential land and commercial customers. ROWs currently exist and are authorized within the APE. (See Figure 3-44.)

The BLM LCDO has granted 76,045 feet of ROW agreements related to NMCC's Copper Flat project. Descriptions of these four ROW grants are as follows (THEMAC 2011):

- ROW grants along NM-152 (See Figure 3-44.)
    - NMNM–032038 is approximately 39,795 feet in length by 50 feet in width and contains approximately 50.8 acres. The ROW is held by Tri-State G&T Associates for a transmission line project.
- NMNM–114793 is approximately 7,181 feet in length by 30 feet in width, approximately 5.0 acres, and is held by the Sierra Electric Cooperative.
- NMNM–057037 is 3,689 feet long, contains approximately 267 acres, and varies between 20 and 30 feet in width. The ROW is held by the Sierra Electric Cooperative and is for a transmission line project.

Figure 3-44. ROWs in Permit Area



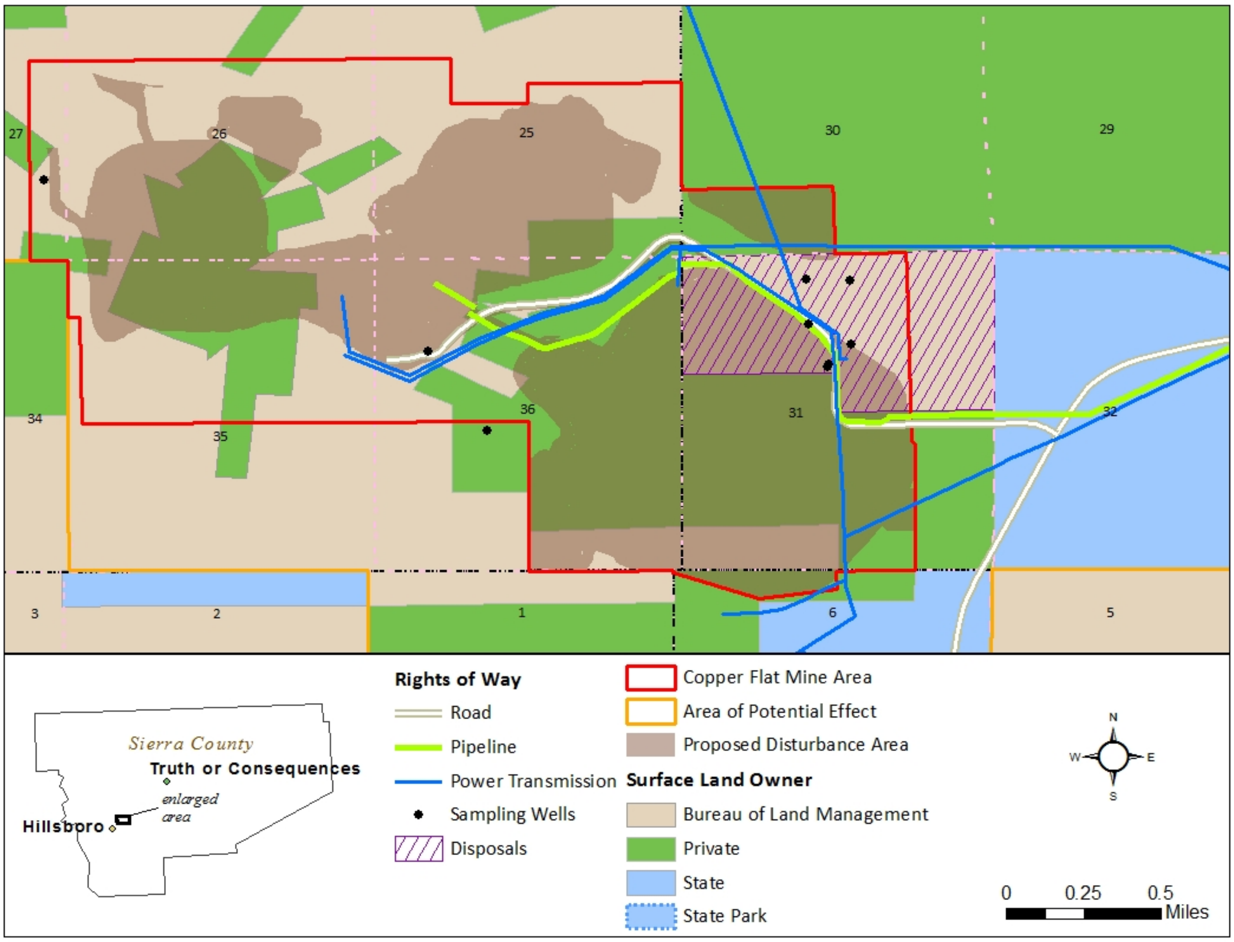
Source: BLM 2011; ESRI 2010.

Note: Substation location applies only to Alternative 2.

- NMNM–066389 is approximately 35,745 feet in length by 36 feet in width and is approximately 29.5 acres. The ROW is held by the Sierra Electric Cooperative for a transmission line project.

ROW grants in the Copper Flat mine area for purposes other than the Copper Flat mine are shown and described in Figure 3-45 and Table 3-36.

Figure 3-45. ROWs in Copper Flat Mine Area



Source: BLM 2011; ESRI 2010.

Table 3-36. ROW Grants in the Copper Flat Mine Area

Table 3-36. ROW Grants in the Copper Flat Mine Area				
ROW	**ROW Dimensions (ft)**	**Holder**	**Purpose**	**Connection to Proposed Action**
NMNM 057029	Length: 13,844 Width: 60 Acreage: 34.7	Sierra County	Road project	Crosses the proposed tailings dam and topsoil stockpile. Sierra County is responsible for grading everything up to 500 feet of the State ROW every 6 months. Copper Flat mine is responsible for maintaining the ROW beyond the 500 feet maintained by Sierra County.
NMNM 114793	Length: 1,785 Width: 30 Acreage: 5.0	Sierra Electric Corporation	Transmission line project	Runs along the access road used for the mine.
NMNM 125293	Length: 4,065 Width: 60 Acreage: 5.5	NMCC	Water pipeline project	Crosses the proposed tailings pond and is used in conjunction with the reclamation reservoir pond. This ROW was authorized for testing/feasibility purposes only.
NMNM 066389	Length: 15,394 Width: 36 Acreage: 29.5	Sierra Electric Corporation	Transmission line project	Runs along the access road used for the mine and crosses the proposed tailings pond. It is also run along the outside of the ancillary space located to the southwest of the plant area.
NMNM 032038	Length: 39,795 Width: 50 Acreage: 50.8	Tri-State G&T Associates	Transmission line project	Runs along the ancillary space located to the southwest of the plant area and into the transmission slab.
NMNM 057037	Length: 3,689 Width: Unknown Acreage: Unknown	Sierra Electric Corporation	Transmission line project	Runs along the access road used for the mine.

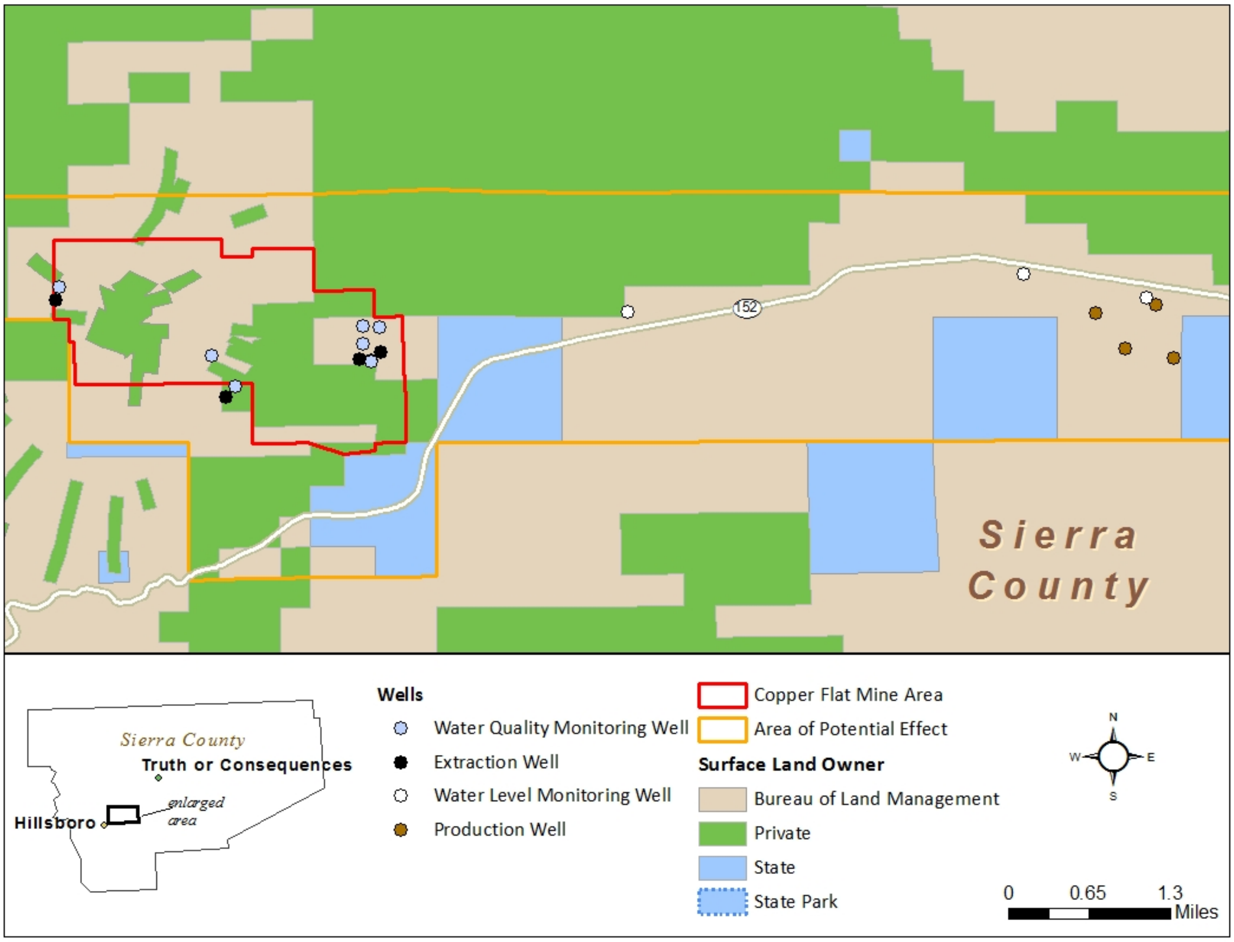
Source: THEMAC 2011.

3.18.1.2 Wells

The BLM has granted access to 18 wells on BLM land through ROWs: Eleven of these are located within the APE (orange boundary) and the remaining seven are located along NM-152. (See Figure 3-46.) Descriptions of these wells are as follows:

- Four production wells would be used to supply freshwater to the mine. These wells are authorized under ROW grant NMNM–12593. The pipeline that runs along NM-152 is ancillary to the production wells.
- Three monitoring water level testing wells (MW-5, MW-6, and MW-8) are used to monitor groundwater levels downstream of the Copper Flat project. ROWs for water facilities were previously issued by the BLM for testing/feasibility purposes. These wells are authorized under ROW grant NMNM–12593 and are located outside of the mine area along NM-152.
- Eleven extraction wells are used to monitor groundwater quality and detect seepage. These wells are authorized under ROW grant NMNM–12593 (one well: GWQ-9) and ROW grant NMNM–125870 (10 wells: GWQ-1, GWQ-5, GWQ-6, GWQ-8, GWQ-10, GWQ-22A, GWQ-22B, GWQ-94-17, IW-3, and NP-4) and are located within the Copper Flat mine area. The 10 wells authorized under NMNM–125870 would continue to be authorized under this grant after the mine closes.

Figure 3-46. Map of Wells



Source: BLM 2011; ESRI 2010.

3.18.1.3 Land Tenure Adjustments

The BLM manages 7,585 acres of public land within the APE (as described in Section 3.15, Land Ownership and Land Use). The BLM has the authority to make land tenure adjustments under Title II of FLPMA. Examples of such adjustment, which would require the appropriate identification made possible through the land management planning process, includes but is not limited to, acquisition, disposal, and withdrawal.

3.18.2 Environmental Effects

This section describes the potential environmental effects that could occur to lands and realty as a result of the Proposed Action, other action alternatives, and the No Action Alternative.

3.18.2.1 Proposed Action

There would be no impacts during mine development. Impacts would be short- and medium-term, minor, of small extent, probable, and adverse during the life of the mine and reclamation activities. Overall, impacts are not anticipated to be significant.

3.18.2.1.1 Mine Development/Operation

Potential impacts to land and realty during mining operations would be unlikely because no changes are proposed to current permitting besides the ROWs issued to NMCC as discussed above. As described in Section 1.3 of the MPO, permits were previously approved for project ROWs for testing purposes. Section 5.5 of the MPO describes the reclamation plan objectives of the proposed project. The BLM would consider these ROWs as valid existing rights when conducting any land tenure adjustments. The production well/pipeline ROW would be relinquished upon approval of the MPO. The approval of the MPO would allow NMCC to construct and maintain the road, powerline transmission, production and extraction wells, and pipeline ROWs listed above. The BLM's approval of the MPO and continued ROW grant administration would authorize NMCC to utilize the subject property for mining purposes, but this would not preclude the BLM's discretionary authority to allow non-mine uses, so long as those uses do not conflict with mining operation. The BLM would also retain discretionary authority to make adjustments to land tenure.

3.18.2.1.2 Mine Closure/Reclamation

One objective of the current reclamation plan is to work with local and regional communities to identify post-mining uses of the land and facilities to enhance opportunities to sustain the economy and culture in the post-mining phase of this project. Surface facilities, equipment, and buildings related to the mining project would be removed, foundations would be covered, and the plant site would be returned to conditions similar to those present before reestablishment of the mine. Working with local and regional communities could help to ensure that mine reclamation activities comply with all local and regional regulations.

Realty and land ownership in and around the mining area would not be changed until after reclamation and permitting requirements were complete. Under the Proposed Action, NMCC would ensure compliance with existing regulations. Any impacts to land and realty following reclamation would be congruent with existing plans or permitting.

3.18.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

There would be no impacts during mine development. Impacts would be short- and medium-term, minor, of small extent, probable, and adverse during the life of the mine and reclamation activities Effects from mine development, operation, closure, and reclamation under Alternative 1 would be similar in nature and level to the effects that would occur under the Proposed Action. As with the Proposed Action, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements. These requirements, as well as all BMPs and mitigation measures to be followed, are identical to those outlined under the Proposed Action. As with the Proposed Action, and for the same reasons, adverse impacts to land and realty during mining construction, operation, and reclamation are unlikely. Overall, impacts are not anticipated to be significant.

3.18.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

There would be no impacts during mine development. Impacts would be short- and medium-term, minor, of small extent, probable, and adverse during the life of the mine and reclamation activities. Effects from mine development, operation, closure, and reclamation would be similar in nature and level to the Proposed Action. As with the Proposed Action and Alternative 1, the mine construction, operations, and reclamation activities would be accomplished in full compliance with current New Mexico regulatory requirements. These requirements, as well as all BMPs and mitigation measures to be followed, are identical to those outlined under the Proposed Action. As with the Proposed Action, and for the same reasons, adverse impacts to land and realty during mining construction, operation, and reclamation are unlikely. Overall, impacts are not anticipated to be significant.

3.18.2.4 No Action Alternative

The No Action Alternative would avoid potential direct and indirect impacts of the Proposed Action to land and realty.

3.18.3 Mitigation Measures

No mitigation measures for land and realty beyond BMPs and regulatory requirements described in the Proposed Action have been identified for any alternative.

3.19 RANGE AND LIVESTOCK

This section discusses the affected environment and the potential impacts to range and livestock that would occur under each alternative.

3.19.1 Affected Environment

The Taylor Grazing Act, enacted by Congress in 1934, provides for the orderly use, improvement, and development of public rangelands. The Act allowed the establishment of grazing districts and the issuance of permits to graze livestock on public land. FLPMA established policy for managing BLM-administered public land under the principles of multiple-use and sustained yield. The Public Rangelands Improvement Act of 1978 further provides for the improvement of range conditions for watershed protection, livestock grazing, wildlife habitat, and other rangeland values. The rangeland program in New Mexico is managed and assessed in accordance with BLM regulations and policy (BLM 2001).

An animal unit month (AUM) is the standard measure of forage utilization. An AUM is the amount of dry forage required to sustain an animal unit, such as one cow or horse, or five sheep, for 1 month. Allowable livestock use on an allotment is based on range production balanced with management of other resources. According to 43 CFR Part 4100, Section 4110.2-2 (a), "[p]ermitted use is granted to holder of grazing preference and shall be specified in all grazing permits or leases… Permitted use shall be based upon the amount of forage available for livestock grazing as established in the land use plan, activity plan or decision of the authorized officer…" The BLM grazing permittees are allowed to take non-use in full, or in part, of the permitted numbers, per 43 CFR Part 4100, Section 4130.2 (g).

The project site (proposed mine property, pipeline/NM-152 corridor, and millsites) overlaps four grazing allotments. (See Table 3-37 and Figure 3-47.) The proposed Copper Flat mine area is primarily within the Copper Flat Ranch allotment, with small areas within the Ladder Ranch allotment and the Warm Springs Ranch allotment. The pipeline/NM-152 corridor and millsites are within the Copper Flat Ranch and South Kelly Canyon allotments. The part of the Ladder Ranch allotment that is overlapped by the mine area is in private ownership; BLM land within that allotment is located farther to the north.

Table 3-37. Grazing Allotments in Copper Flat Mine Project Site

Table 3-37. Grazing Allotments in Copper Flat Mine Project Site

Allotment Name	Allotment Number	Total Allotment/ BLM Land (Acres)	% Forage from BLM Land	Permitted Use (AUMs)[1]	Livestock Number[2]	Permit Expiration
Warm Springs Ranch	06143	151[3] / 151	100	36	3 cattle	12/31/2018
Ladder Ranch	16040	4,552 / 4,552	100	852	71 bison	02/28/2022
South Kelly Canyon	16050	13,445 / 10,775[4]	70	25	3 horses	12/09/2019
			70	958	114 cattle	
			100	132	11 cattle	
Copper Flat Ranch	16079	12,338 / 7,241	58	905	130 cattle	02/28/2025
				21	3 horses	

Source: BLM 2014.

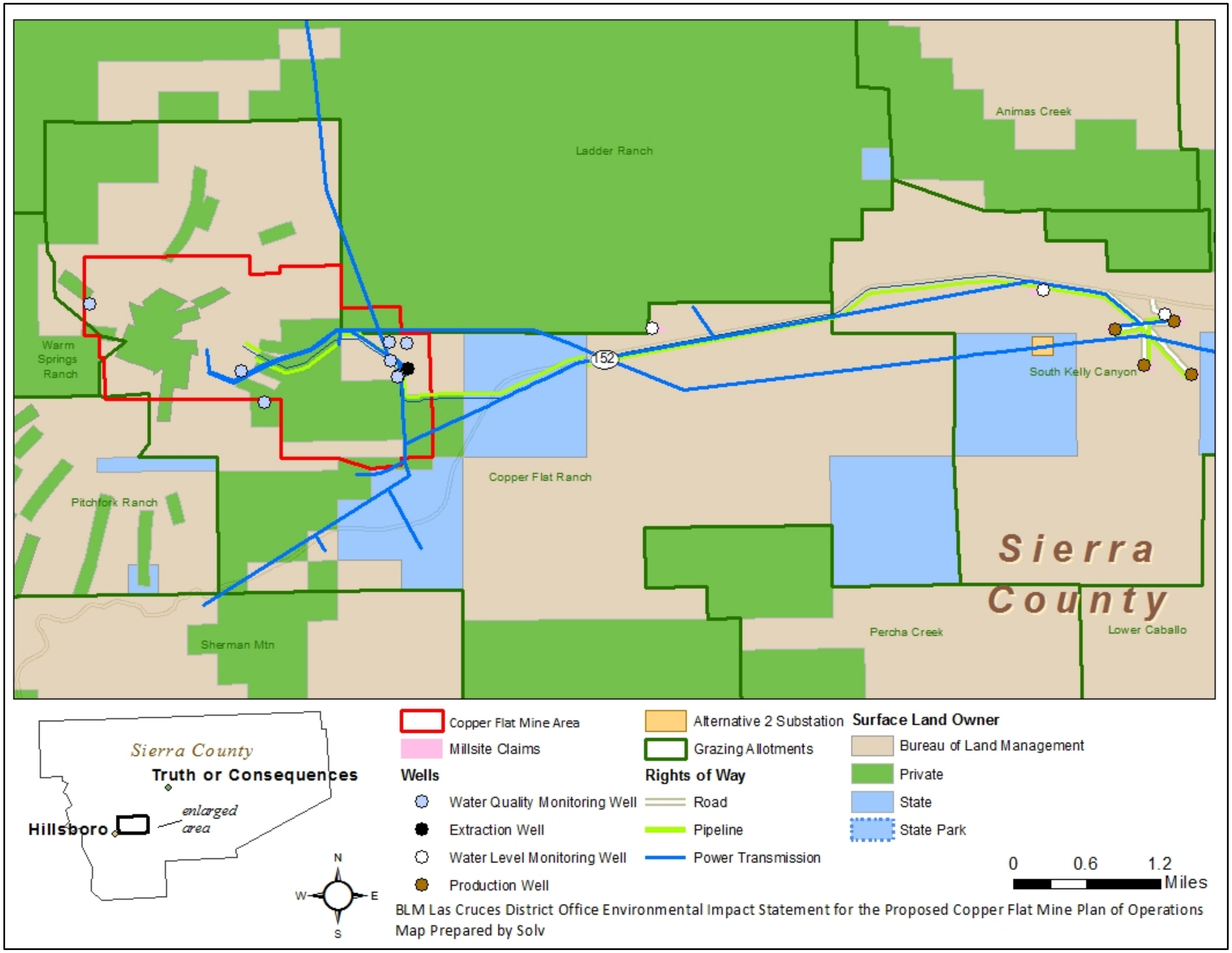
Notes: [1] For Warm Springs Ranch and Ladder Ranch: permitted use listed is for BLM land; permitted use is active; no suspended use. For South Kelly Canyon and Copper Flat Ranch, permitted use is the total number of AUMs allowed on each allotment per grazing year.

[2] Number of authorized animal units.

[3] Does not include private land; total allotment is much larger.

[4] Includes other Federal land in addition to BLM land.

Figure 3-47. Grazing Allotments that Overlap the Project Site



Source: BLM 2015.

Approximately 41.6 percent (910 acres of BLM and private land) of the proposed Copper Flat mine boundary (2,190 acres) is existing disturbed surface (Intera 2012). Relatively intact vegetation communities are present within the proposed mine area on undisturbed surfaces (as discussed in Section 3.11, Vegetation, Invasive Species, and Wetlands) and livestock grazing is an ongoing land use. The proposed pipeline corridor and millsites consist of existing roads, utilities, and groundwater well sites, but are also used for livestock grazing.

3.19.1.1 Proposed Copper Storage Shed

The proposed project would also include the construction and operation of a copper concentrate storage shed at Rincon, New Mexico. The storage shed would be constructed on a leased parcel of land approximately 45 road miles from the project site near the rail line that passes through Rincon. The land that would be used for the storage shed is previously disturbed, does not contain any grazing allotments, and is not used for livestock grazing/forage.

3.19.2 Environmental Effects

This section discusses the potential impacts to range and livestock that would occur under each alternative.

3.19.2.1 Proposed Action

The Proposed Action would have short- to long-term, minor to moderate, small extent, probable, and adverse impacts on grazing use of BLM land within the allotments in the project site. Vegetation removal would have long-term impacts for the duration of the project; the loss of forage available for grazing on BLM land would be small, but could require a reduction in permitted AUMs. Overall, impacts would be significant.

3.19.2.1.1 Mine Development and Operation

Mine development activities would impact a total of 745 acres of BLM land (see Table 2-1) within the proposed mine area – 725 acres on the Copper Flat Ranch allotment and 20 acres on the Warm Springs Ranch allotment. Of the 745 acres, 361 acres have been previously disturbed, and 384 acres would be newly disturbed (THEMAC 2011).

New surface disturbance (384 acres) would occur on the Copper Flat Ranch allotment and amount to approximately 5 percent of the total BLM land (7,241 acres) within that allotment. Approximately 58 percent of the forage within the Copper Flat Ranch allotment is derived from BLM land. (See Table 3-37.) Although there would be a small reduction of available forage, the loss of 725 surface acres of BLM land would amount to approximately 6 percent of the total surface acres for the Copper Flat Ranch allotment (12,338 acres). In May/June 2015, the BLM confirmed that the 1999 Copper Flat EIS analysis resulted in a reduction from 151 animal units to 133 animal units to account for development of the Quintana Minerals mine. Since this analysis was previously completed, and there would now be 384 acres of new disturbance on the Copper Flat Ranch allotment, the BLM has determined that this reduction in surface acres would not warrant a decrease in permitted use.

The 20 acres of the Warm Springs Ranch allotment that intersects with the western edge of the proposed mine area were previously disturbed during past mining activities. The loss of 20 acres of BLM land amounts to approximately 13 percent of the public land within the Warm Springs Ranch allotment (151 acres); however, this allotment is much larger because it consists predominantly of private land. Because of the limited amount of new surface disturbance proposed, an adjustment to permitted AUMs and authorized animal units on these allotments is not anticipated.

New Mexico follows the open range model of livestock management, so NMCC proposes to fence the mine area and install gates or cattle guards at access locations to prevent livestock from entering the property. Most of the mine area fence would be four-strand barbed wire installed following the design and construction standards of BLM Fencing Handbook H-1741-1. The boundary fence could inhibit livestock movement between the far north end of the Copper Flat Ranch allotment and the remainder of the allotment located south and east of the proposed mine property. Operation of the mine 24 hours a day would increase the volume of traffic on the mine access road and NM-152. With open range and no ROW fence along these roads, the risk of vehicle/livestock collisions could increase.

Construction of and upgrades to utility infrastructure (i.e., water supply and electrical power) in the pipeline/NM-152 corridor and construction staging on millsites outside the proposed mine area would have medium-term but minor adverse impacts over a small (limited) extent. Approximately 34.6 acres of BLM land would be disturbed for utility/road infrastructure (see Table 2-2), and 45 acres of BLM land would be disturbed for the 9 millsites at 5 acres each. Surface disturbance and loss of vegetation used as livestock forage from construction of the utilities and use of the millsites could disrupt the grazing use of the Copper Flat Ranch and South Kelly Canyon allotments until vegetation has reestablished over disturbed areas.

Approximately 15 acres of utility infrastructure and 5 acres for a millsite on BLM land would be disturbed in the Copper Flat Ranch allotment, and approximately 20 acres of utility infrastructure and 40 acres for 8 millsites on BLM land would be disturbed in the South Kelly Canyon allotment. The loss of BLM land within the Copper Flat Ranch allotment for utilities and a millsite, together with the BLM land disturbed within the mine area, would be approximately 6 percent of the total allotment of surface acres [(725 acres + 15 acres + 5 acres)/12,338 acres]. As a result of rangeland monitoring studies and a Proposed Decision issued August 23, 1982, livestock numbers permitted on Copper Flat Allotment No. 16079 were adjusted from 151 to 133 animal units. Monitoring studies continued and supported the proposed decision and a Rangeland Agreement was signed on September 10, 1987. Since the BLM had previously reduced the number of animal units to account for the development of the Quintana Minerals mine, no adjustment (reduction) to permitted AUMs because of new surface disturbance of 384 acres for the Copper Flat mine and 20 acres for utility infrastructure and a millsite within the Copper Flat allotment is proposed. Because the extent of the loss of BLM land within the South Kelly Canyon allotment would be a very small percentage of the total allotment [(20 acres + 40 acres)/13,445 acres = 0.4 percent], no adjustment to permitted AUMs for this allotment would be anticipated.

Construction activities within the proposed mine area, through the pipeline/NM-152 corridor and on millsites could have short-term indirect adverse impacts on the quality of the available forage within the allotments within the project site. As described in Section 3.11, Vegetation, Invasive Species, and Wetlands, soil compaction and erosion, fugitive dust, and the establishment or spread of invasive species can adversely affect the growth and viability of native species, which are preferred as livestock forage. BMPs to control erosion and invasive species would minimize the short-term adverse effects of construction activities.

Drawdown of groundwater from the shallow alluvium of Las Animas Creek and Percha Creek may occur during operation of the mine and pumping of water supply wells. However, the drawdown would be negligible compared to the overall depth of the ET layer of the alluvial groundwater so that no change to riparian plant community vigor and composition is expected (as discussed further in Section 3.11, Vegetation, Invasive Species, and Wetlands). Any grazing use of areas outside the mine area but within the drawdown contours would not be affected by any change associated with mining operations on plant communities.

3.19.2.1.2 Copper Storage Shed Construction/Operation

As discussed in Section 3.19.1.1, Proposed Copper Storage Shed, the parcel of land that would be used to construct and operate the copper concentrate storage shed has been previously disturbed and is not used for livestock grazing. Therefore, the construction and operation of the storage shed would not impact range and livestock resources or forage.

3.19.2.1.3 Mine Closure/Reclamation

Reclamation of the mine area after closure would aim to restore original (pre-mining) vegetation communities in disturbed areas to provide suitable forage for livestock, and riparian areas would be replanted to replace any tree and shrub mortality that may have occurred during mine operations. Although reclamation of disturbed areas would increase available forage over the long-term, returning grazing use of the Copper Flat Ranch allotment to pre-mining conditions would depend on the health of the rangeland following New Mexico Standards and Guidelines.

3.19.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Alternative 1 would have short- to long-term, minor to moderate, small extent, probable, adverse impacts on grazing use of BLM land within the allotments in the project site. Alternative 1 would disturb 644 acres of BLM surface (including existing and new disturbance), which would be approximately 100 acres less than under the Proposed Action. Direct and indirect impacts on grazing use of the allotments would be similar to those described for the Proposed Action. Vegetation removal would have long-term impacts for the duration of the project. The loss of forage available for grazing on 644 acres of BLM land within the mine area would be small and would amount to approximately 5 percent of the total Copper Flat Ranch allotment (12,338 acres); a reduction in permitted AUMs and authorized animal units is not anticipated for the same reasons as described for the Proposed Action (see Section 3.19.2.1, Proposed Action). The impact to forage and grazing allotments for construction of the utility infrastructure and millsites would be the same as under the Proposed Action. Overall, impacts would be significant.

Drawdown of the groundwater in the deep aquifer along Las Animas Creek near the water well sites would be greater than under the Proposed Action due to a larger area where drawdown would exceed 10 feet. However, the drawdown from the shallow alluvium would be negligible compared to the overall depth of the ET layer of the alluvial groundwater so that no change to riparian plant community vigor and composition is expected, and any grazing use of areas outside the mine area but within the drawdown contours would not be affected.

Copper storage shed construction/operation impacts and mine closure and reclamation impacts to grazing use would also be similar to the Proposed Action.

3.19.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Alternative 2 would have short- to long-term, minor to moderate, small extent, probable, adverse impacts on grazing use of BLM land within the allotments in the project site. Alternative 2 would disturb 630 acres of BLM land surface (including existing and new disturbance), which would be approximately 115 acres less than under the Proposed Action. Direct and indirect impacts on grazing use of the allotments would be the same as those described for the Proposed Action. Vegetation removal would have long-term impacts for the duration of the project. The loss of forage available for grazing on 630 acres of BLM land within the mine area would be small and would amount to approximately 5 percent of the total Copper Flat Ranch allotment (12,338 acres); a reduction in permitted AUMs and authorized animal units is not anticipated for the same reasons as described for the Proposed Action (see Section 3.19.2.1, Proposed Action). The impact to forage and grazing allotments for construction of the utility infrastructure and millsites would be the same as under the Proposed Action. Overall, impacts would be significant.

The proposed electrical substation would disturb 30 acres of State Trust land within the South Kelly Canyon allotment. There are 1,920 acres of State Trust land included in the 13,445 total acres within this allotment. The loss of forage available for grazing on 30 acres would be negligible and would not likely require an adjustment of AUMs permitted for the State Trust land.

Drawdown of the groundwater in the deep aquifer along Las Animas Creek near the water well sites would be greater than under the Proposed Action due to a larger area where drawdown would exceed 10 feet. However, the drawdown from the shallow alluvium would be negligible compared to the overall depth of the ET layer of the alluvial groundwater so that no change to riparian plant community vigor and composition is expected, and any grazing use of areas outside the mine area but within the drawdown contours would not be affected.

Copper storage shed construction/operation impacts and mine closure and reclamation impacts to grazing use would also be similar to the Proposed Action.

3.19.2.4 No Action Alternative

Under the No Action Alternative, the proposed MPO would not be approved, and mining activities would not occur at the site. However, if the No Action Alternative is selected, a sulfate plume that resulted from previous Quintana mining activities would be cleaned up according to the Stage 1 Abatement Plan (JSAI 2013a). During cleanup activities, there would be no new surface disturbance within and surrounding the mine area that would result in a loss of available forage for livestock use. Existing vegetation communities would be expected to continue to survive. Any changes to permitted AUM use within the allotments would be due to rangeland conditions and livestock management. Overall, the cleanup activities that would occur under the No Action Alternative would not impact range and livestock resources or forage.

3.19.3 Mitigation Measures

The proposed mine area would be fenced to prevent injury or loss of livestock from mining operations. The location of the boundary fence would maintain connectivity for livestock movement throughout the Copper Flat Ranch allotment. Health and safety training of mine workers would include the provision of information on livestock open range and operation of vehicles to minimize the risk of collisions with livestock.

3.20 TRANSPORTATION AND TRAFFIC

3.20.1 Affected Environment

This section discusses the existing roadways and traffic volumes in and around the proposed mine location. Roadway capacity, traffic volume, and roadway condition are the factors used to define the affected environment.

3.20.1.1 Traffic Capacity

The evaluation of existing roadway conditions focuses on capacity, which reflects the ability of the network to serve the traffic demand and volume. The capacity of a roadway depends mainly on the street width, number of lanes, intersection control, and other physical factors. Traffic volumes are typically reported, depending on the project and database available, as the daily number of vehicular movements in both directions on a segment of roadway, averaged over 1 full calendar year (average annual daily traffic [AADT]), or averaged over a period of less than 1 year (average daily traffic [ADT]), and the number of vehicular movements on a road segment during the peak hour. These values are useful indicators in determining the extent to which the roadway segment is used and in assessing the potential for congestion and other problems (ITE 1999).

The performance of a roadway segment is generally expressed in terms of the level of service (LOS). The LOS scale ranges from A to F with each level defined by a range of volume to capacity ratios. LOS A, B, and C are considered good operating conditions where minor to tolerable delays are experienced by motorists. LOS D represents below average conditions. LOS E corresponds to the maximum capacity of the roadway. LOS F represents a forced or breakdown flow (i.e., traffic jam). The LOS designations and their associated volume to capacity ratios for freeways and multi-lane and two-lane arterial roadways are presented below. (See Table 3-38.)

Table 3-38. Primary Highway Level of Service Criteria

Table 3-38. Primary Highway Level of Service Criteria

LOS	Description	Criteria: Volume/Capacity (v/c)		
		Freeway	Multi-Lane Arterial	Two-Lane Arterial
A	Free flow with users unaffected by the presence of other users of the roadway.	0-0.24	0-0.33	0-0.09
B	Stable flow, but presence of the users in traffic stream becomes noticeable.	0.25-0.39	0.34-0.55	0.10-0.21
C	Stable flow, but operation of single users becomes affected by interactions with others in traffic stream.	0.40-0.59	0.56-0.75	0.22-0.36
D	High density, but stable flow; speed and freedom of movement are severely restricted; poor levels of comfort and convenience.	0.59-0.78	0.76-0.89	0.37-0.60
E	Unstable flow; operating conditions at capacity with reduced speeds, maneuvering difficulty, and extremely poor levels of comfort and convenience.	0.79-1.00	0.90-1.00	0.61-1.00
F	Forced or breakdown flow with traffic demand exceeding capacity; unstable stop and go traffic.	>1.00	>1.00	>1.00

Source: TRB 1998.

For rural, gravel roads, the LOS computations are more problematic. Terrain plays a major part in the LOS of rural roadways and is a greater factor there than for freeways and arterial roadways. The LOS used for this analysis utilizes the Highway Capacity Manual guidance of the Transportation Research Board, and standards applied for many states. (See Table 3-39.)

Table 3-39. Rural Two-Lane Uninterrupted LOS

Table 3-39. Rural Two-Lane Uninterrupted LOS					
	LOS for Level Terrain (AADT)				
Road Type	A	B	C	D	E
Secondary	316	545	869	1,398	2,208
Light duty paved	177	292	464	820	1,519
Light duty gravel	89	146	232	410	760

Source: FDOT 1998.

Finally, sight lines are included in the assessment for LOS because any material degradation of a driver's line-of-sight will significantly affect the driver's ability to see and respond to traffic issues.

New Mexico has established minimum acceptable LOS standards, which can be applied to NM-140 and NM-152. (See Table 3-40.)

Table 3-40. Minimum Acceptable Level of Service Standards

Table 3-40. Minimum Acceptable Level of Service Standards						
	LOS					
Type of Roads[1]	UPA	UMA	UCOL	RPA[2]	RMA[2]	RCOL
Two-lane highways	D	D	C	C	C	B

Source: NMDOT 2001.

Notes: [1] UPA: Urban Principal Arterial; UMA: Urban Minor Arterial; UCOL: Urban Collector Street.
RPA: Rural Principal Arterial; RMA: Rural Minor Arterial; RCOL: Rural Collector Street.
[2] Applies to NM-140 & NM-152.

3.20.1.2 Highway Condition

Roadway condition is analyzed in order to determine the potential degradation of the highway. Pavement Condition Index (PCI) is a numerical indicator that rates the surface condition of the pavement (ASTM D6433-09 Standard Practice for Roads and Parking Lots Pavement Condition Index) and was used to predict the life expectancy of roadways when data were available. The range is 0 to 100. A PCI rating of 40 or less is classified as a pavement in poor condition and a rating of 85 or more is classified as a pavement in excellent condition. Using this protocol along with bore samples of the roadways, and projecting Equivalent Single Axle Loads (ESALs) traveling the roadway, an estimate of the life expectancy of the roadway can be projected using the 1993 American Association of State Highway and Transportation Officials (AASHTO) Pavement Design Guide (AMEC 2012). ESALS is a concept developed from data collected by the AASHTO used to estimate the damage to roadways caused by vehicles. The reference axle load is 18,000-pound axle with dual tires (TxDOT 2005).

The major travel lane analyzed in this assessment starts with the access route to the entrance of the mine area, which is a 3-mile all-weather gravel road (Gold Dust Road). Gold Dust Road intersects an east-west paved highway, NM-152 east to I-25, near Caballo Reservoir. The 10 miles on NM-152 to I-25 is mainly a straight and relatively flat road that does not include any sharp turns or significantly adverse grades.

From that point, the route travels both North along I-25 to Truth or Consequences or south to Rincon, New Mexico.

The area analyzed in this section centers on the entrance to the mine and the various transportation avenues in the area. Employees are expected to primarily reside in Truth or Consequences and travel south along I-25 to NM-152 and from there to Gold Dust Road to the mine entrance. Product from the mine would be trucked east on Gold Dust Road, NM-152 to I-25, then south to a rail spur located just off of the Rincon/NM-140 (Exit #35). There are no rail, air, or public transportation venues available for transport along this route.

Peak hour traffic data, for NM-152 and NM-140, was estimated using AADT volumes from the 2013 NMDOT Transportation Information Management System (TIMS) database. It indicates a current AADT of approximately 421 vehicles near the entrance to the mine (Mile Post (MP) 55.01) on NM-152, and approximately 1,073 vehicles near the rail spur in Rincon (approximately Mile Post (MP) 2.5) on NM-140 (NMDOT 2014). There are no vehicle counts for Gold Dust Road, but the Sierra County Road Department Superintendent estimates that there are five to ten vehicle trips along the road per day (Gustin 2014).

3.20.1.3 Traffic Capacity

Operational traffic analysis, the level of performance of roadways and intersections, requires peak hour traffic volumes. The peak hour volumes were estimated from the daily traffic volumes by applying the “10 percent rule,” an assumption that peak hour volumes are 10 percent of the daily traffic volumes. This formed the initial estimate of peak hour volumes on roadways considered in this analysis.

I-25 interchange and NM-152 corridor: Due to the low daily volume, with just 421 vehicles per day (NMDOT 2014) on NM-152 within the study area, the peak hour volumes were increased above the 10 percent rule. For purposes of analysis, the NM-152 traffic volumes were doubled over the 10 percent rule to 84 vehicles, and the volume was tripled at each intersection on the I-25 on- and off-ramps to 126 vehicles. Therefore, the results reported here are conservative because the analysis considered traffic volumes well above what is likely to be present at the intersections. As shown in Table 3-41, the movements from the interchange and along the corridor operate at LOS A (HighPlan 2012). This LOS indicates an excellent operational performance and minimal congestion.

I-25 interchange to railroad spur along NM-140: During operation, material from the mine (copper concentrate) is expected to be hauled by truck to a rail spur in Rincon via I-25 and NM-140 (exit #35). Existing peak hour traffic data was estimated using 2013 NMDOT TIMS AADT volumes for NM-140. Approximately 1,073 vehicles (NMDOT 2014) utilize the entrance to the rail spur (approximately MP 2.5 on NM-140) daily. Using the 10 percent rule for peak hour traffic, as described above for the NM-152 interchange, the peak hour traffic for the NM-140 interchange was estimated to be 107 vehicles.

The entrance to the rail spur is an open driveway and there is no curb and gutter, nor a defined entrance. However, it appears there are several locations along NM-140 where trucks typically enter and exit the rail spur access area. Therefore, this analysis is just an approximation of existing traffic operations.

The analysis assumed the driveway was across from an existing intersection and was analyzed as a four-legged intersection. Estimates of side street and rail spur driveway traffic included 15 vehicles from both the street and driveway. Based on an observation of the number of homes served by the minor streets in the area, this number is considered conservative.

As shown in Table 3-41, this road operates at LOS A (HighPlan 2012). This indicates excellent operational performance and minimal congestion.

Gold Dust Road: There are no traffic count data for Gold Dust Road, but the Superintendent of the Sierra County Road Department estimates the traffic along this road at five to ten vehicles per day (Gustin 2014). This low level of traffic would suggest a LOS A rating. The traffic LOS for all three routes are all well within the New Mexico minimum standards. (See Table 3-41.)

Table 3-41. Existing Conditions Level of Service

Highway Segment	LOS
NM-152 corridor (I-25 intersection to mine entrance)	A
NM-140 corridor (I-25 intersection to railroad spur)	A
Gold Dust Road	A

Source: Computations derived from HighPlan 2012.

3.20.1.4 Sight Lines

The only area of concern with regard to sight distance is located just east of the mine entrance (MP 55.01) and involves the viewshed while traveling east on NM-152. There is some existing foliage along the inside radius that could impede the view of drivers. There are no issues with sight lines on either NM-140 or Gold Dust Road.

3.20.1.5 Highway Condition

NM-152 corridor: The PCI for NM-152 was determined to be 93, or a "pavement in excellent condition." The roadway surface is a chip seal that has minor transverse and longitudinal cracking, reveling, and bleeding. The roadway generally did not have paved shoulders. Where there were turnouts, paved shoulders were provided. In areas where there was not a paved shoulder, there was an edge drop off of 1.5 to 2.5 inches (AMEC 2012).

At MP 55 and 62, borings were made to obtain the thickness of the layers of the asphalt pavement and to obtain samples of the subgrade for subsequent testing. At MP 55 the thickness is about 4.5 inches and at MP 62 it is about 3 inches (AMEC 2012).

Using the information gathered, the PCI for NM-152 was determined to be 93, or a "pavement in excellent condition." The life expectancy of the pavement was predicted for several thicknesses. (See Table 3-42.)

Table 3-42. Theoretical Pavement Life Expectancy – NM-152

Chip Seal Thickness (Inches)	ESALs to Failure[1]	Life Expectancy (Years)
3.00	190,000	26
3.75	400,000	54
4.50	660,000	90

Source: AMEC 2012.

Note: [1] 7,300 ESALs per year. ESAL: Equivalent Single Axle Load.

NM-140 corridor: The roadway surface is asphalt concreter pavement that shows signs of age deterioration in the form of extensive transverse and longitudinal cracking. No signs of structural stress were noted (AMEC 2012). Using this information, the PCI for NM-140 was determined to be 52, or a "pavement in fair condition." Bore samplings were not taken of NM-140, so life expectancy of the highway could not be predicted as with NM-152.

Gold Dust Road: Gold Dust Road, which accesses the mine entrance directly from NM-152, is a gravel two-lane road. The Sierra County Road Department supervisor stated that the road is essentially the same road used by the Quintana Mining Company when the mine was operating in the 1980s. He indicated that the road was maintained quarterly; maintenance consisted of re-grading as necessary (Gustin 2014). The information needed to estimate the PCI for the road was not available for this analysis.

3.20.2 Environmental Effects

Transportation and traffic impacts are discussed in this section by comparing the current and anticipated future LOS for the project area, estimating the amount of highway or roadway degradation that could result from project activities, and evaluating where sight line degradation could affect LOS. Highway or roadway degradation could also substantially impact the expeditious flow of traffic, and that topic is addressed.

The potential impacts from the proposed copper mine on transportation and traffic are:

- Creation of traffic congestion;
- Change to LOS on County/State roads and highways;
- Traffic delays caused by construction activities; and
- Change in roadway maintenance due to increase highway utilization.

3.20.2.1 Proposed Action

Medium-term, major, medium extent, possible, and adverse impacts would occur under the Proposed Action. The potential impacts for mine development/operation and closure/reclamation are presented separately to provide a more detailed analysis. Overall, impacts would be significant.

3.20.2.1.1 Mine Development/Operation

The Proposed Action calls for 400-600 personnel to be hired for construction related activities, and 250 personnel for operation of the mine, including administration. Vendors, equipment, and service suppliers are anticipated to take, in total, an average of 10 to 15 trips per day by truck to the mine. Shipment of copper concentrate, in years one to five, would require 10-14 truckloads per day, 4 days per week. For years six to the end of the mining operation, there would be six to ten truckloads per day, 4 days per week. Molybdenum concentrate shipment would require two truckloads per month for the life of the mine. These trucks would go east on NM-152 to I-25, then south to a rail spur located just off of the Rincon/NM-140 intersection (at Exit #35). Shipment of concentrate would generally be via hydraulic dump trucks with 25-ton capacity towing 10-ton trailers.

Traffic capacity: For access to the mine (NM-152 and Gold Dust Road), the additional traffic would not be spaced out over the course of the normal day but would primarily be concentrated during shift changes during construction or mine operations. Therefore, it was assumed that the additional traffic would occur during the "peak hour" times. For purposes of analysis, this analysis used the following assumptions:

- Construction assumes maximum of 600 employees carpool (two per car) and one shift;
- Operations assume no carpooling and 250 employees;
- Operations have two shift changes;

- Operations day shift includes all administrative personnel;
- Operations assume maximum of 15 vendors/visitors per day (9AM – 5PM); and
- Operations assume all vendor/visitor trips are trucks.

During the construction of the mine, the additional traffic on NM-152 would decrease the LOS from LOS A to B. Construction of a copper concentrate storage shed in Rincon would impact NM-140; however, while the number of vehicles on the roadway would increase, the LOS rating of the road would remain LOS A. During operation of the mine, the LOS for NM-152 would decrease to B, and the LOS for NM-140 would remain at A.

Of greater concern would be the effect of introducing this proposed level of activity on Gold Dust Road, a gravel-surfaced rural roadway. The peak hour LOS would be C during construction of the mine and LOS B during operation. This continued level of automobile and heavy truck traffic over time along the route would cause rutting and surface degradation, causing the LOS to get progressively worse. The Sierra County Superintendent of Roads stated this level of traffic would destroy the roadway, so it is possible that the LOS rating of Gold Dust Road would decrease over the duration of the project if the road is not maintained (Gustin 2014). However, NMCC plans to maintain the roadway as necessary to ensure safe operation.

LOS A, B, or C are considered good operating conditions where minor to tolerable delays may be experienced by motorists. Thus, there would be minimal impact to highway capacity under the Proposed Action for NM-152 and NM-140. Initial results are reflected below. (See Table 3-43.)

Table 3-43. Level of Service for Proposed Action

Table 3-43. Level of Service for Proposed Action		
	LOS	
Highway Segment	Construction	Operations
NM-152 corridor (I-25 intersection to mine entrance)	B	B
NM-140 corridor (I-25 intersection to RR spur)	A	A
Gold Dust Road	C	B[1]

Source: Computations derived from HighPlan 2012.

Note: [1] During operation of the mine, the LOS rating of Gold Dust Road could decrease further due to road degradation. However, if the road is maintained throughout the operational phase of the project, impacts would remain as stated in this table.

Sight lines: The Proposed Action would not affect the sight lines of the routes in question. As stated in Section 3.20.1, Affected Environment, the only area of concern with regard to sight distance is located just east of the mine entrance (MP 55.01) and involves the viewshed while traveling east on NM-152. The existing foliage along the inside radius would need to be maintained to ensure clear visibility along this curve at all times. With proper maintenance, there would be no impact to sight lines.

Highway condition: Using the information gathered, the life expectancy of NM-152 was predicted. (See Table 3-44.)

Table 3-44. Theoretical Pavement Life Expectancy – NM-152

Table 3-44. Theoretical Pavement Life Expectancy - NM-152			
Chip Seal Thickness (Inches)	ESALs to Failure	Life Expectancy[1] (Years)	Proposed Action Life Expectancy[2] (Years)
3.00	190,000	26	12
3.75	400,000	54	26
4.50	660,000	90	42

Source: Computations derived from AMEC 2012.
Notes: [1] 7,300 ESALs per year.
[2] 15,871 ESALs per year.

Under the Proposed Action, the addition of employee vehicles and haul trucks to the traffic stream on NM-152 would reduce the structural life of the pavement by approximately 53 percent (compared to existing conditions). NMCC has executed a Memorandum of Agreement (MOA) with NMDOT to address requirements for the use of NM-152 during mine construction and operation (NMCC and NMDOT 2018). NMDOT has requested and NMCC has agreed to certain pavement improvements on that stretch of the highway prior to NMDOT's issuance of the access permit for the existing main access point to the mine. In the MOA, NMDOT and NMCC have agreed to the following:

- NMCC would fund, develop, design, engineer, and construct a one-time 2.5-inch overlay for roadway improvements based on a 20-year design life for NM-152 from I-25 to the mine access point;
- NMCC would fund, develop, design, engineer, and construct traffic turn-out and acceleration lanes at the NM-152 intersection with the mine access road;
- Proposed improvements would be for approximately 10 miles along NM-152 from I-25 to the mine access point;
- The roadway improvements would be completed by NMCC within 12 months of the onset of production at the mine and would conform to NMDOT standards; and
- All roadway improvements required subsequent to the one-time overlay would be the full responsibility of the NMDOT.

It is unknown at this time what the impact would be to NM-140, but the condition of the existing surface would indicate that the structural integrity of the road would be short-lived and the impact would be considered medium-term, adverse, major, and possible. Of greater concern is the effect of introducing this level of activity on Gold Dust Road, gravel surfaced rural roadway. The Sierra County Road Superintendent, when presented with the numbers of vehicle trips along Gold Dust Road, stated "[t]hat level of heavy traffic would destroy the roadway" (Gustin 2014). There is no data available to counter the Supervisor's assessment. However, NMCC would maintain Gold Dust Road during mining operations as necessary to ensure safe operation.

3.20.2.1.2 Mine Closure/Reclamation

Short-term adverse effects would be expected during mine closure and reclamation. The roadways would be impacted by additional vehicle trips; however, the number of trips required would be less than the Proposed Action. While there would be an increase in traffic compared to existing conditions, the increase would not change the LOS rating of any of the roads analyzed in this EIS. The increase in traffic would also reduce the structural integrity of the analyzed roadways; however, the impacts would be less than under the Proposed Action. After mine closure, it is expected that Gold Dust Road would revert back to Sierra County maintenance as it stands today, although there is no formal agreement in place between NMCC and the county.

3.20.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Medium-term, major, medium extent, possible, and adverse impacts would occur under Alternative 1. Alternative 1 calls for 400-600 personnel to be hired for construction related activities, and 265 personnel for operation of the mine, including administration. Vendors, equipment, and service suppliers are anticipated to take, in total, an average of 10 to 15 trips per day by truck to the mine. Copper concentrate shipment, in years one to five, would require 12-16 truckloads per day, 5 days per week. For years six to the end of the mining operation, there would be 8-12 truckloads per day, 5 days per week. Molybdenum concentrate shipment would require three truckloads per month for the life of the mine. As with the Proposed Action, these trucks would travel east on NM-152 to I-25, then south to a rail spur located just off of the Rincon/NM-140 intersection (Exit #35). Shipments of concentrate would generally be via hydraulic dump trucks with 25-ton capacity towing 10-ton trailers. Overall, impacts would be significant.

Traffic capacity: Normal automobile traffic associated with the mine would be the same as under the Proposed Action. The estimated impacts to LOS during construction and operations would be the same as the Proposed Action; the activities on Gold Dust Road would also be the same. As a result, there would be minimal impact to highway capacity under Alternative 1 for NM-152 and NM-140. Results are reflected below. (See Table 3-45.)

Table 3-45. Level of Service for Alternative 1

Table 3-45. Level of Service for Alternative [1]		
	LOS	
Highway Segment	Construction	Operations
NM-152 corridor (I-25 intersection to mine entrance)	B	C
NM-140 corridor (I-25 intersection to RR spur)	A	A
Gold Dust Road	C	B[1]

Source: Computations derived from HighPlan 2012.

Note: [1] During operation of the mine, the LOS rating of Gold Dust Road could decrease further due to road degradation. However, if the road is maintained throughout the operational phase of the project, impacts would remain as stated in this table.

Sight lines: Activities associated with Alternative 1 would not affect the sight lines of the routes in question. The impacts would be the same as with the Proposed Action.

Highway condition: Using the information gathered, the life expectancy of the pavement was predicted. (See Table 3-46.)

Table 3-46. Theoretical Pavement Life Expectancy – NM-152 – Alternative 1

Table 3-46. Theoretical Pavement Life Expectancy - NM-152 – Alternative 1			
Chip Seal Thickness (Inches)	ESALs to Failure	Life Expectancy[1] (Years)	Life Expectancy[2] (Years)
3.00	190,000	26	9
3.75	400,000	54	19
4.50	660,000	90	31

Source: Computations derived from AMEC 2012.
Notes: [1] 7,300 ESALs per year.
[2] 20,978 ESALs per year.

The result of the addition of the increased traffic plus the haul trucks to the traffic stream on NM-152 would reduce the structural life of the pavement by 65 percent (compared to existing conditions). It is unknown at this time what the impact to NM-140 would be, but the condition of the existing surface would indicate the structural integrity of the road would be short-lived and the impact would be considered major (similar to the Proposed Action). The impacts associated with Gold Dust Road would be the same as with the Proposed Action.

3.20.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Medium-term, major, medium extent, possible, and adverse impacts would occur under Alternative 2. Alternative 2 calls for 400-600 personnel for construction related activities, and 270 personnel for the operation of the mine, including administration. Vendors, equipment, and service suppliers are anticipated to take, in total, an average of 10 to 15 trips per day by truck to the mine. Copper concentrate shipment would require 14-19 truckloads per day and molybdenum concentrate shipment would require three truckloads per month for the life of the mine. As with the Proposed Action and Alternative 1, these trucks would travel east on NM-152 to I-25, then south to a rail spur located just off of the Rincon/NM-140 intersection (Exit #35). Shipments of concentrate would generally be via hydraulic dump trucks with 25-ton capacity towing 10-ton trailers. Overall, impacts would be significant.

Traffic capacity: Normal automobile traffic associated with the mine would be the same as with the Proposed Action and Alternative 1. The estimated impacts to LOS during construction and operations would be the same as the Proposed Action and the activities on Gold Dust Road would also be the same. As a result, there would be minimal impact to highway capacity under Alternative 2 for NM-152 and NM-140. Initial results are the same as those shown for Alternative 1. (See Table 3-45.)

Sight lines: Activities associated with Alternative 2 would not affect the sight lines of the routes in question. The impacts would be the same as with the Proposed Action and Alternative 1.

Highway condition: The life expectancy of the pavement is shown below. (See Table 3-47.)

Table 3-47. Theoretical Pavement Life Expectancy – NM-152 – Alternative 2

Table 3-47. Theoretical Pavement Life Expectancy – NM-152 – Alternative 2			
Chip Seal Thickness (Inches)	**ESALs to Failure**	**Life Expectancy[1] (Years)**	**Life Expectancy[2] (Years)**
3.00	190,000	26	7
3.75	400,000	54	16
4.50	660,000	90	26

Source: Computations derived from AMEC 2012.

Notes: [1] 7,300 ESALs per year.

[2] 25,762 ESALs per year.

The increased traffic that would occur under Alternative 2, plus the addition of haul trucks to the traffic stream on NM-152, would reduce the structural life of the pavement by approximately 70 percent (compared to existing conditions). It is unknown at this time what the impact to NM-140 would be, but the condition of the existing surface would indicate that the structural integrity of the road would be short-lived and the impact would be considered major (similar to the Proposed Action and Alternative 1). The impacts associated with Gold Dust Road would be the same as with the Proposed Action and Alternative 1.

3.20.2.4 No Action Alternative

Under the No Action Alternative, the proposed MPO would not be approved, and mining activities would not occur at the site. However, if the No Action Alternative is selected, a sulfate plume that resulted from previous Quintana mining activities would be cleaned up according to the Stage 1 Abatement Plan (JSAI 2013a). The cleanup activities would involve the use of heavy equipment and onsite personnel. However, because of the limited scale of the cleanup activities compared to the construction and operation of the mine, the overall impact to NM-152, NM-140, and Gold Dust Road would be less than the Proposed Action and, therefore, would be short-term, minor, of small extent, possible, and adverse. Overall, impacts would not be significant.

3.20.3 Mitigation Measures

No mitigation measures for transportation and traffic beyond regulatory requirements described in the Proposed Action have been identified for any alternative.

3.21 NOISE AND VIBRATIONS

3.21.1 Affected Environment

This section presents an overview of noise and how it is measured and the existing acoustic environment in and around the proposed mine location.

3.21.1.1 Noise Overview

Sound is a physical phenomenon consisting of vibrations that travel through a medium, such as air, and are sensed by the human ear. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities essential to a community's quality of life, such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz (Hz) are used to quantify sound frequency. The human ear responds differently to different frequencies. "A-weighing", measured in A-weighted decibels (dBA), approximates a frequency response expressing the perception of sound by humans. Table 3-48 presents sounds encountered in daily life and their dBA levels.

Table 3-48. Common Sounds and Their Levels

Outdoor	Sound level (dBA)	Indoor
Motorcycle	100	Subway train
Tractor	90	Garbage disposal
Noisy restaurant	85	Blender
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Source: Harris 1998.

The dBA noise metric describes steady noise levels, although very few noises are, in fact, constant. Therefore, Day-night Sound Level (DNL) has been developed. DNL is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (10 p.m. to 7 a.m.). It is a useful descriptor for noise because: 1) it averages ongoing yet intermittent noise; and 2) it measures total sound energy over a 24-hour period. In addition, Equivalent Sound Level (L_{eq}) is often used to describe the overall noise environment. L_{eq} is the average sound level in dB. Table 3-49 shows the typical DNL levels associated with various types of land use.

Table 3-49. Standard Sound Levels Associated with Various Land Uses

Land Use Category	Typical DNL (dB)	Day Level (dB)	Night Level (dB)	People per square mile
Very noisy urban residential	67	66	58	63,840
Noisy urban residential	62	61	54	20,000
Urban and noisy suburban residential	57	55	49	6,384
Quiet urban and normal suburban residential	52	50	44	2,000
Quiet suburban residential	47	45	39	638
Very quiet suburban and rural residential	42	40	34	77

Source: ANSI 2013.

3.21.1.2 Noise Guidelines

The Noise Control Act of 1972 (PL 92-574) directs Federal agencies to comply with applicable Federal, State, and local noise control regulations. In 1974, the USEPA provided information suggesting continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. In 1982, the EPA transferred the primary responsibility of regulating noise to state and local governments. However, neither the State of New Mexico nor Sierra County have noise ordinances.

3.21.1.3 Existing Noise

Proposed mine: Existing sources of noise near the proposed Copper Flat project include light traffic, high-altitude aircraft overflights, and natural noises such as wind gusts and animal and bird vocalizations. The areas surrounding the site can be categorized as rural or remote. There are no nearby noise-sensitive receptors (churches, schools, hospitals, or residences) in the immediate vicinity of the proposed Copper Flat project. As shown in Table 3-50, existing noise levels (DNL and L_{eq}) were estimated for the areas associated with the proposed Copper Flat project using the standard DNL values presented in the *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound Part 3: Short-term Measurements with an Observer Present* (ANSI 2013). Due to the remoteness of the mine area and the low population density of the surrounding area, it was assumed that the closest noise-sensitive areas were very quiet suburban and rural residential.

Table 3-50. Closest Noise-Sensitive Areas

<table>
<tr><th colspan="7">Table 3-50. Closest Noise-Sensitive Areas</th></tr>
<tr><th colspan="3"></th><th colspan="4">Estimated Existing Sound Levels (dBA)</th></tr>
<tr><th>Description</th><th>Approximate Distance from Project</th><th>Type</th><th>Land Use Category</th><th>DNL</th><th>L_{eq} (daytime)</th><th>L_{eq} (nighttime)</th></tr>
<tr><td>Hillsboro</td><td>3.5 miles</td><td rowspan="2">Residential</td><td rowspan="2">Very Quiet Suburban and Rural Residential</td><td rowspan="2">42</td><td rowspan="2">40</td><td rowspan="2">34</td></tr>
<tr><td>Residence</td><td>0.5 miles</td></tr>
</table>

Source: ANSI 2013.

Proposed copper storage shed: The project would also include the construction and operation of a copper concentrate storage shed at Rincon, New Mexico. The storage shed would be constructed on a leased parcel of land approximately 45 road miles from the project site near the rail line that passes through Rincon. Existing sources of noise near the proposed storage shed include light traffic (both personal and heavy vehicles), heavy equipment operation (i.e., equipment used to load and unload rail cars), railroad operation, high-altitude aircraft overflights, and natural noises such as wind gusts and animal and bird vocalizations. The areas surrounding the site can be categorized as a combination of rural residential and industrial. There are noise-sensitive receptors (residences) located near the proposed storage shed location.

3.21.1.4 Vibration

Proposed mine: Groundborne vibrations were evaluated using PPV and the Office of Surface Mining (OSM) vibration criteria. PPV is the maximum instantaneous [peak] level of a vibration wave, and is normally measured in inches per second. OSM thresholds vary according to the repetition pattern of vibration events, human response versus cosmetic building damage potential, and type of building for the onset of structural damage. As outlined in Section 3.13, Cultural Resources, several historic structures exist in or near the proposed mine area. Because of the remote location and lack of existing activity, there is no perceptible vibration at the site. Existing levels of vibration at the site are expected to be less than 0.04 inches per second or barely perceptible, and appreciably below levels expected under the proposed project (USDI 1989; Caltrans 2004). Neither the State of New Mexico nor Sierra County have vibration ordinances.

Proposed copper storage shed: The property where the proposed copper storage shed would be constructed and operated is adjacent to an operational railway and existing roadways. Using these conditions, it was estimated that there are perceptible vibrations at the site; however, they are below 0.04 inches per second (FTA 2006).

3.21.2 Environmental Effects

This section discusses the noise and vibration impacts that would occur under each alternative. For the Proposed Action and Alternatives 1 and 2, the noise and vibration impacts are discussed separately to provide a more detailed analysis. Section 3.10, Wildlife and Migratory Birds, discusses the noise and vibration impacts to wildlife in and around the mine site that would result from project activities.

3.21.2.1 Proposed Action

Short- and medium-term, minor, small extent, and probable adverse effects would be expected under the Proposed Action. Short-term effects would be limited to heavy equipment noise during site preparation and reclamation, while medium-term effects would be due to blasting during mineral extraction, use of rock crushers, and operation of heavy equipment during mine operations. The Proposed Action would not create noise that would be incompatible with surrounding land uses. Overall, impacts would not be significant.

3.21.2.1.1 Noise from Mine Development and Operation

Noise produced during mine development would primarily be generated during soil stripping and construction of the TSF concentrator and primary crushing facility. Operational noise would be primarily from rock crushing, diesel transport trucks, intermittent generator use, and blasting.

Heavy equipment would be used for mine development and operation and would have varying noise levels at 50 feet from the source. (See Table 3-51.) With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of heavy equipment operation and drilling sites. The zone of relatively high equipment noise typically extends to distances of 800 feet from the site of major operations.

Table 3-51. Noise Levels Associated with Heavy Equipment

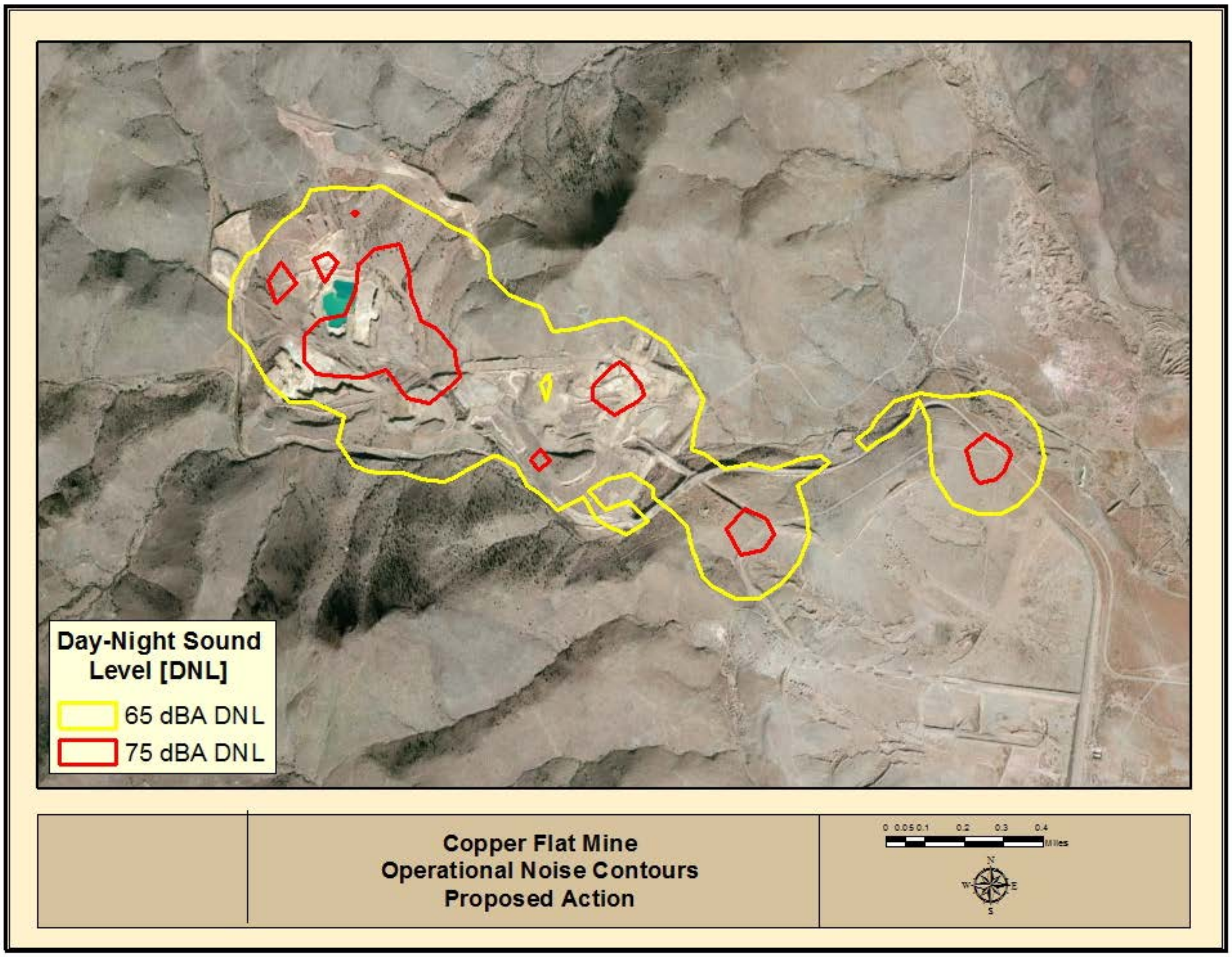
Table 3-51. Noise Levels Associated with Heavy Equipment	
Equipment	**L_{eq} (dBA) at 50 feet from Source**
Rock crusher	90[1]
Hydraulic shovels	82
Loader/dozer/grader	85
Backhoe	80
Grader	85
Crane	88
Drill rigs	98
Generator	81

Source: FHWA 2014; USDA 2004.

Note: [1] Measured at a distance of 100 feet from the source.

SoundPlan 2.0 noise model was used to estimate noise levels surrounding the proposed mining activities. SoundPlan takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, and reflections from surfaces. The International Organization for Standardization (ISO) 9613 standard *Acoustics -- Attenuation of Sound During Propagation Outdoors* was used in the assessment (ISO 1989). No credit was taken for absorptive ground cover or intervening foliage – factors that would otherwise act to reduce sound levels. Notably, the mine itself would be in a depressed topographical area and surrounded by natural berms which act as sound barriers. Areas that are likely to have a DNL above 65 dBA during operation under the Proposed Action are shown below. (See Figure 3-48.) These contours display the sound levels of heavy equipment, crusher, and trucks associated with operations. Areas with DNL above 65 dBA would occur within the proposed mine area. The area is remote and approximately 4 miles from the nearest town. Normal operation of the mine would not create noise that would be incompatible with surrounding land uses.

Figure 3-48. Estimated Noise from the Proposed Action



Source: ESRI 2010.

Noise from blasting: Blasting noise would be intermittent and greatest during initial phases; noise would decrease as mining activities progress. Although operations would take place 24 hours per day, blasting would be limited to daylight hours and would occur, on average, two to three times per week, typically during the midafternoon. Drill patterns would range from 60 to 120 blast holes, and a typical hole would contain approximately 175 pounds of ANFO (140 pounds of trinitrotoluene [TNT] equivalent). Typically, there would be 10 to 20 milliseconds of delay between each blast hole, and each blasting event would last between 1 to 2 seconds.

Noise generated from the use of explosives is a common cause of complaint among people near surface mining operations. As mentioned above, land use compatibility due to steady-state noise is typically assessed by averaging noise levels over a protracted period. However, this approach can be misleading because it does not assess community noise effects due to relatively infrequent, yet loud, impulsive noise events. For example, for a surface mining operation at which several hundred charges are detonated each year, peak pressure levels can exceed 140 dB in areas where annual DNL values indicate that noise is recommended for residential land use. The peak noise levels provide the absolute maximum sound level for an individual acoustical event, not an average over several events or over a period of time like the DNL. Although not a good descriptor of the overall noise environment like the DNL, peak levels relate well to the level of concern and possibility of complaints among people living nearby after an individual blast event. Level of concern guidelines that use peak noise levels exist for impulsive noise and the distances these effects would take place after a blasting event. (See Table 3-52.)

Table 3-52. Risk of Noise Concern and Complaints from Blasting

Table 3-52. Risk of Noise Concern and Complaints from Blasting

Risk of Noise Concern	Peak Noise Levels	Critical Distance (feet)
Low	< 115 dBP	> 2,344 feet
Medium	115–130 dBP	556 - 2,344 feet
High	130 - 140dBP	< 556 feet

Source: Siskind 1989; U.S. Army 2007; Caltrans 2004.

During each event, the 130-dBP peak noise levels would extend 556 feet from the point of detonation. This area of high concern and complaint would remain entirely within the mine area, and no nearby noise sensitive areas would be exposed to these levels of noise. The 115-dBP peak noise levels would extend 2,344 feet from the point of detonation. The level of concern and complaints associated with individual acoustical events would be moderate within this area. Although this area of moderate concern and complaint may extend beyond the mine area, there are no residences within this distance. Depending on meteorological conditions, blasting activities may be heard by residences and others as much as several miles from the site. However, these events would best be characterized as "audible but distant" and would not be appreciably intrusive. Loud acoustical events would be of limited frequency.

Noise from vehicles: Vehicular traffic would increase due to employees commuting to and from the site, haul trucks, and vendor vehicles. Additional temporary increases in vehicular traffic along NM-152 would result from the mine development workers for approximately 12-18 months prior to operations. Vehicle trips would increase at peak periods due to scheduled shift changes. Vehicles used for the Copper Flat project would be well maintained and meet the Federal, State, and local safety requirements. Trucks with properly operating mufflers would be expected to generate up to an estimated 86 dBA at 50 feet from the source. Haul road truck noise would be within the acceptable level based on existing conditions. Given the remote location, presence of topographical barriers that serve to shield distant noise sources, and distance of receptors, these effects would be minimal.

Occupational health and safety: Heavy equipment noise would dominate the soundscape for all on-site personnel. Copper Flat project personnel, particularly equipment operators, would wear adequate personal hearing protection to limit exposure and ensure compliance with Federal health and safety regulations.

3.21.2.1.2 Vibrations from Mine Development and Operation

During mining activities, vibration effects may occur from the use of heavy equipment such as general earth moving equipment, drills, and blasting. Buildings and their occupants near these types of activities would respond to vibrations with varying results, ranging from barely perceptible at low levels, distinctly perceptible at moderate levels, and possible structural damage at the highest levels. The effects of groundborne vibration include perceptible movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Building damage could occur during blasting, pile driving, and demolition activities. For locations close to these activities, plaster cracking and window breaking sometimes occurs.

Groundborne vibrations associated with heavy equipment and blasting activities were evaluated using OSM vibration criteria. PPV and critical distances at which the construction vibration would exceed human response and the threshold for structural damage were estimated. (See Table 3-53.) Groundborne vibration associated with general heavy equipment (i.e., non-impact) would be perceptible to humans and begin to cause cosmetic damage to historic structures at a distance substantially less than those of blasting. Notably, decay factors for ground borne vibrations can vary greatly based on site-specific features such as soil and rock types, and topography. The numbers provided below are estimates based on the best currently available information and were carried forward to characterize the types and overall level of effects under NEPA. If additional refinements were required, on-site monitoring during operations would be necessary to verify estimates contained herein.

Table 3-53. Critical Distance for Human Response and Structural Damage from Vibration

Table 3-53. Critical Distance for Human Response and Structural Damage from Vibration				
Human Response Thresholds				
		Critical Distance (feet)		
Human Response	**Peak Particle Velocity (inches/second)**	**General Heavy Equipment**	**Drilling**	**Blasting**
Barely perceptible	0.04	113	315	1,573
Distinctly perceptible	0.25	21	60	500
Strongly perceptible; may be annoying to some people in buildings	0.9	7	19	225
Severe; unpleasant for people in buildings; unacceptable to pedestrians on bridges	2	3	9	136
Structural Damage Thresholds				
		Critical Distance (feet)		
Structure and Condition	**Peak Particle Velocity (inches/second)**	**General Heavy Equipment**	**Drilling**	**Blasting**
Extremely fragile historic buildings, ruins, and ancient monuments	0.12	42	116	792
Fragile buildings	0.2	26	73	575
Historic and some old buildings	0.5	11	32	324
Older residential structures	0.5	11	32	324
Newer residential structures	1	6	17	210
Modern commercial/industrial buildings	2	3	9	136

Source: Siskind 1989; USDI 1989; Caltrans 2004.

Groundborne vibration associated with blasting would be distinctly perceptible at a distance of 500 feet and barely perceptible at 1,573 feet. As presented in Section 3.21.2.1.1, Noise from Mine Development and Operation, there would be, on average, two to three blasting events per week. There are several historic structures in or near the proposed mine area. Blasting activities within 792 feet, drilling activities within 116 feet, and general heavy equipment activities within 42 feet could cause minor cosmetic damage to extremely fragile historic buildings. Blasting activities within 324 feet, drilling activities within 32 feet, and general heavy equipment activities within 11 feet could cause minor cosmetic damage to older structures and historic buildings. A detailed discussion of the potential for direct effects on specific historic structures is provided in Section 3.13, Cultural Resources.

3.21.2.1.3 Noise and Vibrations from Copper Storage Shed Construction/Operation

Short-term noise impacts would occur during soil grading and construction of the shed while medium-term noise impacts would occur during operation of the storage shed. Operational noise would be primarily caused by trucks carrying copper concentrate to the shed from the mine and operation of equipment at the storage shed (a wheel loader, a loadout hopper and conveyor, and a winch system). It is assumed that the operational period of the storage shed is the same as the proposed mine.

Heavy equipment would be used for the construction and operation of the storage shed and would have varying noise levels at 50 feet from the source. (See Table 3-50.) With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of heavy equipment operation and drilling sites. The zone of relatively high equipment noise typically extends to distances of 800 feet from the site of major operations. However, these noise sources would be consistent with existing sources of noise around the proposed storage shed location.

The noise sources described above would also be new sources of ground vibrations. However, these new sources would be consistent with existing sources of ground vibrations in the vicinity of the proposed storage shed location. In addition, because there would not be any blasting at the proposed storage shed, vibrations experienced in the surrounding area are not expected to change from current conditions.

Construction impacts would be short-term and would end once the storage shed is completed while operation impacts would continue until mining operations cease. However, the noise and vibrations generated during construction and operation of the proposed storage shed would be consistent with noise and vibrations currently generated in the area. Therefore, construction and operation activities would not create noise that would be incompatible with surrounding land uses.

3.21.2.1.4 Noise and Vibrations from Mine Closure/Reclamation

Short-term adverse effects would be expected. Noise and vibrations during the mine closure and reclamation would be similar in nature to that of the use of heavy equipment during site development and operations. Effects would be due to heavy equipment use during removal of equipment and facilities, and restructuring topography and disturbed areas. Notably, no drilling or blasting would take place, and there would be no effects from these sources. Mine closure and reclamation activities would not exceed or create noise that would be incompatible with surrounding land uses.

3.21.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

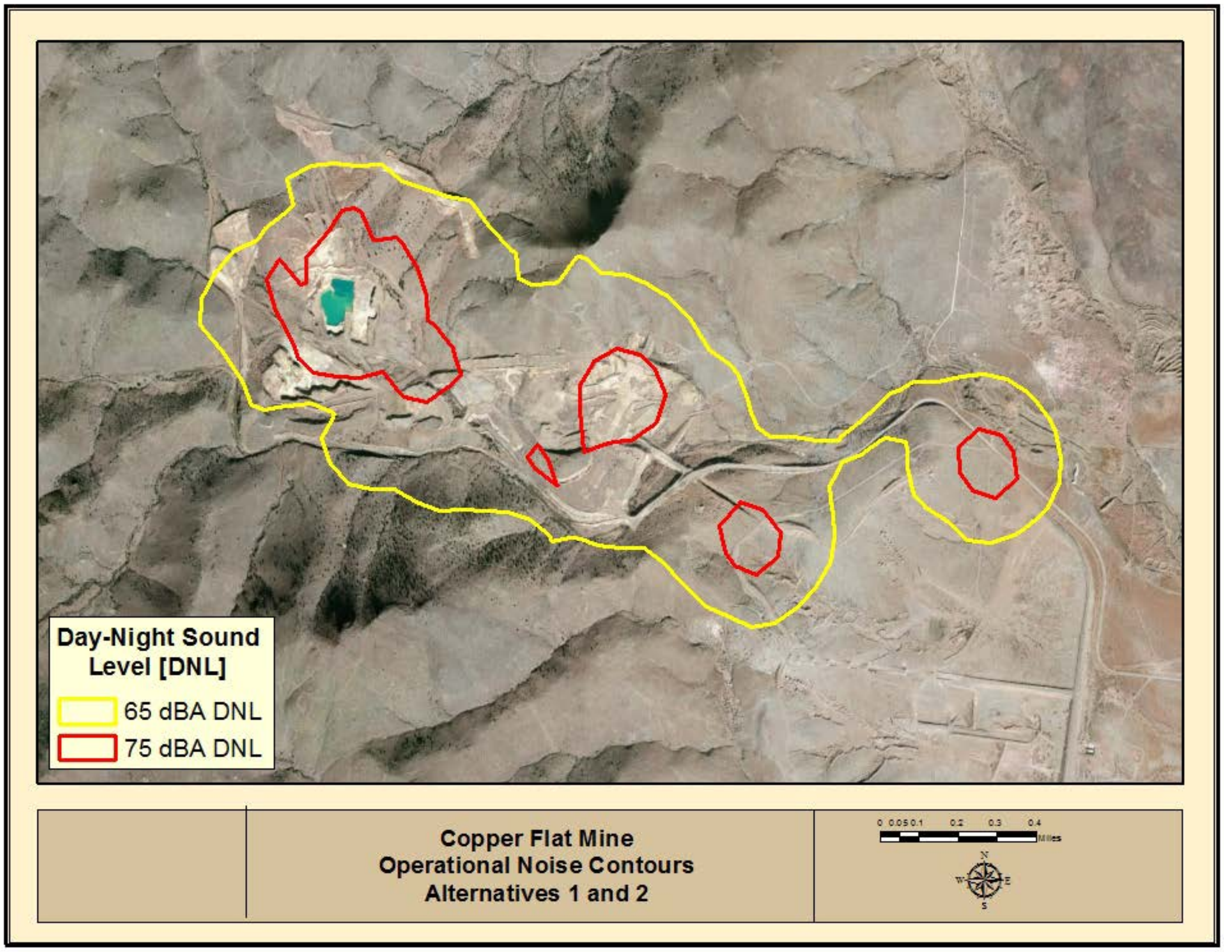
Short- and medium-term, minor, small extent, and probable adverse effects would be expected from Alternative 1. The effects from mine development, closure, and reclamation would be the same as those outlined under the Proposed Action; however, the effects from mine operation would be slightly greater in level and frequency because of the increased number of blasting events and daily truck trips that would occur under this alternative. Short-term effects would be limited to heavy equipment noise during site preparation and reclamation, while medium-term effects would be due to blasting during mineral extraction, use of rock crushers, and heavy equipment during mine operations. Alternative 1 would not create noise that would be incompatible with surrounding land uses. Overall, impacts would not be significant.

3.21.2.2.1 Noise from Mine Development and Operation

Areas that are likely to have a DNL above 65 dBA under Alternative 1 are shown in Figure 3-49. These contours display the sound levels of heavy equipment, crusher, and trucks associated with accelerated operations. As with the Proposed Action, areas with DNL above 65 dBA would be within the proposed mine area. The area is remote and operation of the mine would not create noise that was incompatible with surrounding land uses.

Noise impacts from construction and operation of the copper storage shed would be similar to the impacts described under the Proposed Action.

Figure 3-49. Estimated Noise from Alternatives 1 and 2



Source: ESRI 2010.

Noise from blasting: Peak sound levels under Alternative 1 would be identical to those outlined under the Proposed Action, although the frequency of blasting events would increase from the two to three per week that would occur under the Proposed Action. Level of concern guidelines that use peak noise levels exist for impulsive noise after a blasting event. (See Table 3-52.) There would be a moderate level of concern and complaints within 2,344 feet of blasting activity, which includes areas beyond the mine area; however, there are no residences within this area. Blasting activities may be heard as much as several miles from the site; however, these events would be distant and not appreciably intrusive. Although there would be an increased frequency of blasting events, the site is remote.

3.21.2.2.2 Vibrations from Mine Development and Operation

The effects from vibration during mine development and operation would be similar in nature and in level as those outlined under the Proposed Action; however, vibrations associated with earth moving equipment, drills, and blasting would be more frequent. Critical distances at which the construction and blasting vibration would exceed human response and the threshold for structural damage would remain unchanged when compared to the Proposed Action. (See Table 3-53.) A detailed discussion of general effects to humans and structures is outlined under the Proposed Action. A detailed discussion of the potential for direct effects on historic structures is outlined in Section 3.13, Cultural Resources. Although there would be an increased frequency of events, the site is remote.

Vibration impacts from construction and operation of the copper storage shed would be similar to the impacts described under the Proposed Action.

3.21.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Short- and medium-term, minor, small extent, and probableadverse effects would be expected from Alternative 2. The effects from mine development, operation, closure, and reclamation would be similar in nature and overall level as those outlined under Alternative 1. It normally takes a doubling in activities to have a barely perceptible change in the overall noise environment. Therefore, although there would be a 20 percent increase in production, the overall amount of heavy equipment and mining activity would be comparable to Alternative 1. Alternative 2 would not create noise that would be incompatible with surrounding land uses. Overall, impacts would not be significant.

3.21.2.3.1 Noise from Mine Development and Operation

Figure 3-47 outlines the areas that are likely to have a DNL above 65 dBA under Alternative 2. As with the Proposed Action and Alternative 1, areas with DNLs above 65 dBA would be within the proposed mine area. The area is remote, and operation of the mine would not create noise that was incompatible with surrounding land uses. These effects would be similar to Alternative 1.

Noise impacts from construction and operation of the copper storage shed would be similar to the impacts described under the Proposed Action.

Noise from blasting: The effects from blasting would be similar in nature and overall level as those outlined under Alternative 1. These effects would be similar to Alternative 1.

3.21.2.3.2 Vibrations from Mine Development and Operation

The effects from vibration during mine development and operation would be similar in nature and in level as those outlined under Alternative 1. Critical distances at which the construction and blasting vibration would exceed human response and the threshold for structural damage would remain unchanged. These effects would be similar to Alternative 1.

Vibration impacts from construction and operation of the copper storage shed would be similar to the impacts described under the Proposed Action.

3.21.2.4 No Action

Under the No Action Alternative, the proposed MPO would not be approved, and mining activities would not occur at the site. However, if the No Action Alternative is selected, a sulfate plume that resulted from previous Quintana mining activities would be cleaned up according to the Stage 1 Abatement Plan (JSAI 2013a). The cleanup activities would involve the use of heavy equipment and onsite generators, similar to the Proposed Action. However, because of the limited scale of the cleanup activities compared to the construction and operation of the mine, the overall noise and vibration impacts would be less than the Proposed Action and, therefore, would be short- to medium-term, minor, of small extent, probable, and adverse. Overall, impacts would not be significant.

3.21.3 Mitigation Measures

Due to the remote location and the overall minor impacts under each alternative, no mitigation would be required. Although the overall effects would be less than significant, the following BMPs are proposed to minimize the potential for blasting noise and vibration impacts:

- Coordinate with local authorities regarding the movement of oversized loads or heavy equipment;
- Ensure proper hearing protection would be worn at all times;
- Below-grade level rock crushing equipment and production facilities; and
- Notification to nearby townships and residents who may experience blast noise.

3.22 SOCIOECONOMICS

The analysis of socioeconomic resources identifies aspects of the social and economic environment that are sensitive to changes and that may be affected by the proposal to conduct mining operations for a period of approximately 11 to 16 years. The Proposed Action and alternatives would consist of construction and operation activities associated with a poly-metallic mine and processing facility at the Copper Flat site. The analysis specifically considers how the Proposed Action and alternatives might affect the individuals, communities, and the larger social and economic systems of Sierra County, the surrounding region; and the State of New Mexico.

3.22.1 Affected Environment

Appendix D of Social Science Considerations in Land Use Planning Decisions of BLM's Land Use Planning Handbook H-1601-1 provides guidance on how social and economic issues and concerns may be incorporated into the planning process. This section evaluates socioeconomic characteristics, including population, employment, housing, community services, and economic systems. Social impacts resulting from the proposed project would be felt most by individuals, communities, residents, and workers in Sierra County. Businesses, community services, and economic systems in Sierra County would likely change the most in response to the implementation of the Proposed Action and alternatives. Since potential impacts with the greatest magnitude, duration, extent, and likelihood would occur in Sierra County, it is therefore defined as the Region of Influence (ROI) for the analysis of socioeconomic impacts. Impacts that extend outside of the ROI are discussed where applicable throughout the section.

The data supporting this analysis are collected from standard sources, including the U.S. Census Bureau (Census or USCB), Bureau of Labor Statistics (BLS), other Federal, State, and local agencies, or other research institutes. Demographic and economic data is presented for Sierra County and compared to demographic and economic data for the State of New Mexico. Demographic data from the Census is also presented for the Hillsboro Census Designated Place (CDP) and the City of Truth or Consequences as applicable, and housing data is presented by Census Tracts (CTs) and Block Groups (BGs) in Sierra County. The inclusion of demographic data for the Hillsboro CDP and Truth or Consequences does not change the ROI since these are located within Sierra County.

3.22.1.1 Population and Housing

Section 3.22.1.1.1 describes population changes for the ROI and the state of New Mexico overall. Past and current population data are from the 2000 and 2010 Census, and the components of population are 2010-2013 American Community Survey estimates. Section 3.22.1.1.2 describes housing characteristics for Sierra County and the State of New Mexico overall and property values by CTs and BGs in Sierra County. Current housing characteristics and property values are 2006-2010 or 2010-2014 American Community Survey estimates. Historical housing characteristics and property values for Sierra County and New Mexico are from the 1970, 1980, and 1990 Census.

3.22.1.1.1 Population

The 2010 estimated population of Truth or Consequences is 6,475, a net decrease of 814 or 11.2 percent from the 2000 estimated population. The State population grew by 13.2 percent from 2000-2010. (See Table 3-54.) Sierra County and Truth or Consequences grew negatively by 0.1 percent and 11.2, respectively.

Table 3-54. Population Change, 2000-2010

Location	2000	2010	Numeric Change 2000-2010	Percent Change 2000-2010
Hillsboro CDP	n/a[a]	124	n/a	n/a
Truth or Consequences	7,289	6,475	-814	-11.2
Sierra County	13,270	11,988	-1,282	-0.1
New Mexico	1,819,046	2,059,179	240,133	13.2

Source: USCB 2000, 2010.

Note: Census Year 2000 population statistics are not available (n/a) for the Hillsboro CDP.

In general, the population of Sierra County is older than that of the State as a whole. The percentage of children in Sierra County (the ROI), including those under 5 years and between 5 and 18 years, is lower than percentages for those same age groups in the State of New Mexico. Population estimates and the percent of children by age group in the Hillsboro CDP, Truth or Consequences, Sierra County, and New Mexico are shown below. (See Table 3-55.)

Table 3-55. Summary of Children by Age Group

Location	Total Population	Children Under 5 Years		Children 5 to 18 Years		All Children Under 18 Years	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
Hillsboro CDP	124	0.0	0.0	4	3.2	4	3.2
Truth or Consequences	6,475	368	5.7	736	11.4	1,104	17.1
Sierra County	11,988	568	4.7	1,360	11.3	1,928	16.1
New Mexico	2,059,179	144,981	7.0	373,691	18.1	518,672	25.2

Source: USCB 2010.

The distribution of population by age in Sierra County, including the Hillsboro CDP and Truth or Consequences, and New Mexico is summarized below. (See Table 3-56.) The percent of the population between the ages of 19 and 44 is lower in Sierra County than in the State as a whole. The percent of persons 65 and older in Sierra County is about double the percent in the State overall.

Table 3-56. Distribution of Population by Age, 2010

Location	Percent Under 18 Years	Percent 19-44 Years	Percent 45-64 Years	Percent 65 and Older
Hillsboro CDP	3.2	6.4	45.2	45.2
Truth or Consequences	17.1	37.3	30.7	14.9
Sierra County	16.0	21.0	32.4	30.6
New Mexico	25.1	64.8	26.5	13.2

Source: USCB 2010.

The large proportion of the population over the age of 65 can be explained by the fact that Sierra County has historically been a retirement area. Some important characteristics of a retirement community include recreational and library facilities, low cost of living, adequate medical facilities, and education and shopping opportunities (Sierra County 2017). Health services are described in Section 3.22.1.5.2 (Health Services); continuing education is described in Section 3.22.1.5.3 (Education); recreation and quality of life are described in Section 3.22.1.6 (Community Cohesion and Quality of Life).

Further, the fact that a smaller proportion of the population in Sierra County is between the ages of 19 and 44 (21 percent) compared to the State of New Mexico (64.8 percent) can likely be explained in part by the fact that Sierra County does not have a 4-year university. [The Census enumerates people based on their usual address, or where they live or stay most of the time (USCB 2010)]. As described in Section 3.22.1.5.3 (Education), Western New Mexico University's branch community college in Sierra County offers a number of adult education classes, including certification programs aimed at students interested in immediate employment in certain target job markets. The school is also an excellent local resource for those who wish to expand their professional skills or take prerequisite courses that can lead to transferring to a 4-year college or university (Sierra County 2006). Except for those living in Sierra County and attending Western New Mexico University's branch community college, individuals living and attending a 4-year university in another county would not be counted in the Census as residents of Sierra County.

The components of population change between 2010 and 2013 are summarized below. (See Table 3-57.) Births and deaths are estimated using reports from the National Center for Health Statistics and the Federal-State Cooperative for Population Estimates. Between 2010 and 2013, the Sierra County population decreased by 416 people (USCB 2013). Deaths exceeded births each year and overall (USCB 2013). Given the age distribution of the population, decreases in population due to "natural events" can be expected to continue. Generally speaking, the birth and death estimates are the most reliable parts of the population estimates program, as all states require birth and death certificates.

Domestic in- and out-migration includes all changes of residence including moving into, out of, or within a given area (i.e., Sierra County) in the United States. International migration refers to movement of people across the borders of the United States. Domestic migration estimates are based on Internal Revenue Service tax exemptions, change in Medicare enrollment, and change in the group quarters population and are therefore less reliable than birth and death estimates. The total population change includes a residual, or the change in population that cannot be attributed to any specific demographic component (USCB 2015).

Table 3-57. Components of Population Change in Sierra County, 2010-2013

Table 3-57. Components of Population Change in Sierra County, 2010-2013				
	Time Period			
Component	2010-2011	2011-2012	2012-2013	Total Change 2010-2013
Births	99	100	92	299
Deaths	245	238	227	705
Domestic migration	76	22	-163	13
International migration	-4	-1	-4	-13
Total population change	**-74**	**-119**	**-328**	**-416**

Source: USCB 2013.

Note: The total population change includes a residual, or the change in population that cannot be attributed to any specific demographic component.

3.22.1.1.2 Housing

A housing unit refers to a house, an apartment, a mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters, or if vacant, intended for occupancy as separate living quarters. An owner-occupied housing unit indicates that the owner or co-owner lives in the unit even if mortgaged or not fully paid for. A household includes all the people who occupy a housing unit as their usual place of residence. The homeownership rate is calculated by dividing the owner-occupied units by the total number of occupied units.

Housing characteristics and median property values are presented in Tables 3-58 and 3-59 for the Hillsboro CDP; Truth or Consequences; Sierra County; the State of New Mexico; and by CTs and Block Groups BGs in Sierra County. CTs are small, relatively permanent statistical subdivisions of a county or equivalent entity, generally with a population size between 1,200 and 8,000 people. A CT usually covers a contiguous area, and its boundaries usually follow visible and identifiable features. They were designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions. A BG is a statistical subdivision of a CT, generally defined to contain between 600 and 3,000 people and 240 and 1,200 housing units. It is the smallest geographic unit for which the USCB tabulates sample data, i.e., data that are collected from a fraction of households. BGs are statistical areas bounded by visible features such as roads, streams, and railroad tracks, and by nonvisible boundaries such as property lines, city, township, school district, county limits, and short line-of-sight extensions of roads (USCB 2013). As shown in Figure 3-50, Sierra County consists of four CTs and eight BGs, and the proposed mine area is located in CT 2694.02, BG 2.

Table 3-58. Housing Characteristics, 2010 Estimates

Table 3-58. Housing Characteristics, 2010 Estimates [a, b]			
Location	**Total Housing Units**	**Occupied Housing Units (%)**	**Homeownership Rate (%)**
CT 9622, BG 1	1,167	62.6	71.0
CT 9622, BG 2	1,177	69.4	63.3
CT 9623, BG 1	1,137	63.5	78.7
CT 9623, BG 2	1,036	74.8	68.1
CT 9624.01, BG 1	912	32.2	63.3
CT 9624.01, BG 2	1,274	38.1	87.4
CT 9624.02, BG 1	868	50.8	95.5
CT 9624.02, BG 2[b]	750	56.0	93.6
Hillsboro CDP	123	30.9	100
Truth or Consequences	3,910	67.7	64.7
Sierra County	8,464	56.1	78.3
New Mexico	887,890	85.2	69.6

Source: USCB 2010-2014.

Notes: Proposed Action and alternatives located in CT 9624.02, BG 2.

[a] Data for CTs and BGs in Sierra County are 2010-2014 estimates.

[b] Data for the Hillsboro CDP, Truth or Consequences, Sierra County, and New Mexico are 2006-2010 estimates.

Table 3-59. Value of Owner-Occupied Housing Units, 2010 Estimates

Table 3-59. Value of Owner-Occupied Housing Units, 2010 Estimates[a]						
Location	**Less than $49,999**	**$50,000-$99,999**	**$100,000-$249,999**	**$250,000-$499,999**	**More than $500,000**	**Median Value**
CT 9622, BG 1	39.9%	39.3%	21.7%	0.0%	0.0%	$64,000
CT 9622, BG 2	26.4%	28.7%	41.2%	1.7%	1.7%	$82,100
CT 9623, BG 1	32.7%	42.4%	24.8%	0.0%	0.0%	$70,000
CT 9623, BG 2	14.3%	30.1%	47.1%	4.9%	3.4%	$110,800
CT 9624.01, BG 1	12.3%	23.6%	28.0%	11.3%	24.7%	$221,700
CT 9624.01, BG 2	6.1%	3.2%	51.9%	9.6%	0.1%	$135,100
CT 9624.02, BG 1	17.8%	16.2%	59.4%	6.7%	0.0%	$135,400
CT 9624.02, BG 2 [b]	32.6%	13.5%	35.4%	7.6%	10.9%	$113,400
Hillsboro CDP	47.2%	0.0%	19.5%	18.1%	0.0%	$59,500[c]
Truth or Consequences	27.6%	35.2%	49.2%	1.8%	1.4%	$80,300[c]
Sierra County	24.0%	29.6%	38.8%	4.4%	3.3%	$92,800[c]
New Mexico	13.3%	15.1%	47.1%	19.1%	5.4%	$158,400[c]

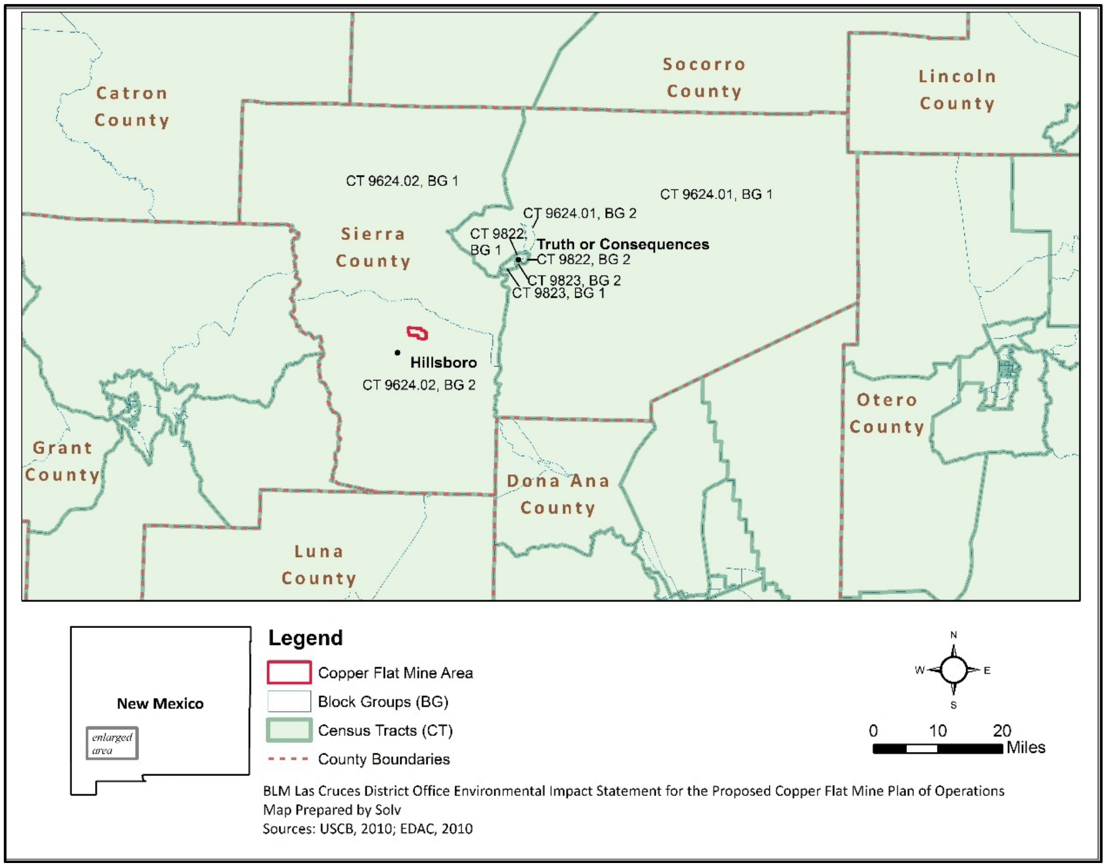
Source: USCB 2010-2014; USCB 2006-2010.

Notes: [a] 2010-2014 estimates.

[b] Proposed Action and alternatives located in CT 9624.02, BG 2.

[c] 2006-2010 estimates.

Figure 3-50. Census Tracts and Block Groups in Sierra County



Source: USCB 2010-2014a; USCB 2010-2014e.

As shown in Table 3-58, Sierra County has 8,464 total housing units, 56.1 percent of which are occupied. The homeownership rate is in Sierra County is 78.3 percent; said otherwise, 78.3 percent of occupied housing units are occupied by their owners. There are more renters in Truth or Consequences than in Sierra County overall. While the vacancy rate in Hillsboro County (69.1 percent) is higher compared to Sierra County (43.1), all of the occupied housing units in the Hillsboro CDP are occupied by their owners (i.e., the homeownership rate in Hillsboro is 100 percent).

The percentage of occupied housing units by CT and BG range from 32.2 percent in CT 9624.01, BG 1 to 74.8 percent in CT 9623, BG 2. The homeownership rates range from 63.3 percent in CT 9622, BG 2 and CT 9624.01, BG 1 to 95.5 percent in CT 9624.02, BG 2. In CT 9624.02, BG 2, where the Proposed Action and alternatives is located, 56 percent of housing units are occupied – about the same as in Sierra County overall. However, the homeownership rate in CT 9624.02, BG 2 is 93.6 percent, about 15 percent higher than in Sierra County overall.

As shown in Table 3-59, the majority of owner-occupied housing units in Sierra County are valued at $250,000 or less. However, in CT 9624.01, BG 1 and CT 9624.02, BG 2 (where the proposed project site is located), homes valued at $250,000 or more represent a larger portion than in other CTs and BGs; or 36 percent and 18.5 percent, respectively.

The median values of housing units reflect housing units (house and lot, mobile home and lot, or condominium unit) with and without a mortgage, and are based on respondents' estimates of how much the property would sell for if it were for sale (USCB 2013). The median values of housing units in CT

9622, BGs 1 and 2 and CT 9623, BG 1 are lower than in Sierra County overall; but the median values of housing units in CT 9623, BG 2; CT 9624.01, BGs 1 and 2; and CT 9624.02, BGs 1 and 2 are higher than in Sierra County overall. Notably, the median value of housing units in CT 9624.01, BG 1 is higher than in any other CT/BG; is about twice as high as in Sierra County; and about 40 percent higher than in New Mexico. The median value of housing units in CT 9624.02, BG 2, where the proposed mine area is located, is about 20 percent higher than in Sierra County overall; but about 40 percent lower than in the State of New Mexico.

As detailed in Chapter 2, Quintana Mineral Corporation (Quintana Minerals) began development of the Copper Flat mine in the 1970s. In 1982, Quintana Minerals brought the property into production as an open pit mine with a mill and concentrator. Following startup of mineral processing, the mine was in commercial production for 3.5 months until all operations were halted due to a significant decline in copper prices (NMCC 2014a). In 1986, all on-site surface facilities were removed and a BLM-approved program of non-destructive reclamation was carried out (THEMAC 2011).

In an attempt to discern whether Quintana Minerals' Copper Flat mine affected housing in Sierra County, the number of housing units, percent of occupied housing units, the homeownership rate, and the median value of owner-occupied housing units in Sierra County and the State of New Mexico for 1970, 1980, and 1990 are presented in Tables 3-60 and 3-61. These data are not readily available on the CT or BG level for 1970, 1980, and 1990, and as such are not included in Tables 3-60 and 3-61. The historical median values are adjusted for inflation in order to accurately compare the median value of housing units over time. The 1970, 1980, and 1990 median housing unit values were adjusted to 2010 dollars using the appropriate BLS Consumer Price Index Research Series (CPI-U-RS) adjustment factor (USCB 2017).

As shown in Tables 3-60 and 3-61, the percentage of occupied housing units in Sierra County and New Mexico decreased about seven and two percent (respectively) from 1970 to 1980. And while the percent of occupied housing units in Sierra County increased by about four percent between 1980 and 1990, it decreased in the State of New Mexico by about one percent during this period. The homeownership rate in Sierra County increased at about three and two percent from 1970 to 1980 and from 1980 to 1990, respectively. In comparison, the homeownership rate in New Mexico increased about two percent from 1970 to 1980, while it decreased almost one percent from 1980 to 1990.

The number of housing units and the median value of owner-occupied housing units increased at a substantial rate in both Sierra County and the State of New Mexico between 1970 and 1980. The number of housing units increased by almost 45 percent in Sierra County from 1970 to 1980, and by almost 56 percent in New Mexico during the same period. Similarly, the median value of housing units in Sierra County and New Mexico increased by more than 60 percent and 70 percent from 1970 to 1980, respectively.

The number of housing units in both Sierra County and New Mexico continued to increase by about 20 and 25 percent (respectively) between 1980 and 1990. But while the median value of owner-occupied housing units in New Mexico actually decreased by about one percent from 1980 to 1990, the median value of housing units continued to increase in Sierra County during this same period, despite the fact that Quintana Minerals' Copper Flat mine closed in 1986 after only a few months of operation.

Table 3-60. Historical Housing Characteristics in Sierra County, 1970-1990

Component	1970	1980	1990	% Change, 1970-1980	% Change, 1980-1990
Housing units	3,743	5,392	6,457	44.1%	19.8%
Occupied housing units (%)	76.4%	69.5%	73.3%	-6.9%	3.8%
Homeownership rate (%)	67.7%	71.1%	73.3%	3.4%	2.2%
Median value of owner-occupied housing units	$39,097[a]	$63,253[a]	$80,115[a]	61.7%	26.6%

Source: USCB 1970; USCB 1980; USCB 1990.

Note: [a] In 2010 dollars.

Table 3-61. Historical Housing Characteristics in New Mexico, 1970-1990

Component	1970	1980	1990	% Change, 1970-1980	% Change, 1980-1990
Housing units	325,715	507,513	632,058	55.8%	24.5%
Occupied housing units (%)	88.8%	87.0%	85.9%	-1.8%	-1.1%
Homeownership rate (%)	66.4%	68.1%	67.4%	1.7%	-0.7%
Median value of owner-occupied housing units	$65,664[a]	$114,158[a]	$113,133[a]	73.9%	-0.9%

Source: USCB 1970; USCB 1980; USCB 1990.

Note: [a] In 2010 dollars.

Based on Table 3-60, it is possible that Quintana Minerals' Copper Flat mine contributed to the rate at which housing was developed in Sierra County from 1970 to 1980. Similarly, the mine's closure and reclamation in 1986 could have slowed the rate of construction from 1980 to 1990. The construction and operation of the mine in the 1970s and 1980s could have caused properties in Sierra County to appreciate as demand and spending increased, but the extent of its effects was likely limited due to its short-lived operation. Because median property values continued to increase from 1980 to 1990 – albeit at a third of the rate from 1980 to 1990 – the mine's closure does not appear to have caused property values to depreciate. Further, any effects on housing development and property values were more likely caused by the Community Pit No. 1, a limestone and siltstone quarry located west of Las Cruces that operated sporadically for 40 years starting in 1969. Community Pit No. 1 is discussed in Chapter 4 (Cumulative Effects).

Overall, it is impossible to know at what rate housing units would have been constructed from 1970 to 1990 had the mine never existed. And because hundreds of mines in the State of New Mexico were constructed and operated during this same approximate time frame, the state does not provide a baseline against which to compare Sierra County housing characteristics. Said otherwise, comparing Sierra County's housing characteristics against those of the state can at best establish a correlative relationship between the existence of a mine and its impact on housing development and property values. Overall, changes in Sierra County housing characteristics are roughly in line with those in the State of New Mexico.

Lastly, it is difficult to say exactly how property values in Sierra County were affected by the Quintana Minerals' Copper Flat mine, because several factors can affect real estate values, including:

- Proximity to an operation with negative externalities (noise, light, air pollution) (this can negatively impact property values);
- Proximity to local employment opportunities;
- Quality of public education (i.e., school district);
- Access to public transit; social, shopping, or recreational opportunities;
- The age and condition of the home itself; and
- History of other negative events (e.g., fire, flooding, site of a violent crime).

3.22.1.2 Labor

Because NMCC anticipates hiring locally, labor force and employment figures for Sierra County are presented as they would likely be directly affected by the Proposed Action and alternatives. Civilian labor force and employment data are from the BLS, and data regarding the number of establishments and employees in Sierra County are from the USCB.

3.22.1.2.1 Civilian Labor Force

The size of a county's civilian labor force is measured as the sum of those currently employed and unemployed. From 2000 to 2010, Sierra County's labor force grew 2.3 percent faster than the State's (BLS 2000; BLS 2010). (See Table 3-62.)

Table 3-62. Civilian Labor Force, 2000-2010

Table 3-62. Civilian Labor Force, 2000-2010				
Location	2000	2010	Numeric Change 2000-2010	Percent Change 2000-2010
Sierra County	5,295	5,923	628	11.9
New Mexico	852,296	934,377	82,081	9.6

Source: Bureau of Labor Statistics 2000, 2010.

3.22.1.2.2 Employment

Annual employment levels in Sierra County for the years 2000 and 2010 are exhibited below. (See Table 3-63.) The BLS does not provide employment figures for the City of Truth or Consequences or the Hillsboro CDP. From 2000 to 2010, employment in Sierra County increased 9.8 percent. The number employed in New Mexico increased by 50,175 persons, or 6.2 percent, over the same 10-year period.

Table 3-63. Annual Employment

Table 3-63. Annual Employment				
	Number in Employment			
Location	2000	2010	Numeric Change	Percent Change 2000-2010
Sierra County	5,060	5,555	495	9.8
New Mexico	810,027	860,202	50,175	6.2

Source: Bureau of Labor Statistics 2000, 2010.

Health Care and Social Assistance is the industry with the most employment statewide and in 12 of New Mexico’s counties, including Sierra County. The three largest employers in Sierra County – Sierra Home Health and Hospice, Sierra Vista Hospital, and New Mexico State Veterans Home – each employ between 100 and 249 persons. The seven next largest businesses, each employing between 50 and 99 persons, include:

1. Ambercare Hospice – hospices;
2. Smithco Construction – utility contractors;
3. M A & Sons – dried/dehydrated fruits and vegetables;
4. Walmart Supercenter – department stores;
5. Percha Creek Traders – art galleries and dealers;
6. Truth or Consequences Elementary – schools; and
7. Denny’s – full-service restaurant (NMWFS 2014).

The construction, retail trade, and accommodation of food services sectors have the largest number of establishments in Sierra County. The number of establishments in each sector, the number or range of employees at each establishment, and the most frequent establishment size in the sector based on the number or range of employees is shown below. (See Table 3-64.) Of 496 businesses county-wide, 369 have between 1 and 4 employees; 111 employers have between 5 and 9 employees; 30 have between 20 and 49 employees; and 7 have between 50 and 249 employees; 3 have between 100 and 249 employees (USCB 2007).

Table 3-64. Establishments and Employees in Sierra County, 2007

Sector	# of Establishments	# of Employees (Value or Range)	Most Frequent Establishment Size by # of Employees (Mode)
Mining	3	20-99	1-4
Utilities	2	20-99	5-19
Construction	35	263	1-4
Manufacturing	5	85	5-49
Retail trade	53	389	1-4
Transportation and warehousing	7	6	1-4
Information	4	20-99	1-4
Finance and insurance	16	79	1-4
Real estate and rental and leasing	11	20-99	1-4
Professional, scientific, and technical services	15	53	1-4
Management of companies and enterprises	1	0-19	10-19
Administrative and support and waste management and remediation services	6	0-19	1-4
Educational services	1	0-19	1-4
Health care and social assistance	21	541	1-4
Arts, entertainment, and recreation	5	35	1-19
Accommodation and food services	38	414	1-4
Other services (except public administration)	25	141	1-4
Total for all sectors	**248**	**2140**	**1-4**

Source: USCB 2007.

3.22.1.2.3 Unemployment Rates

The unemployment rate is defined as the number of unemployed persons divided by the labor force, where the labor force is the number of unemployed persons plus the number of employed persons. Sierra County's 2010 unemployment rate is 6.8 percent, the highest it has been since 2000, but still lower than the State's 7.9 percent. Both the county and State unemployment rates rose and fell with national trends. County and State unemployment rates decreased at roughly the same rate between 2004 and 2006; then experienced a sharp increase in 2008. The latter can be attributed to the 2008 economic crisis, which was part of the global financial downturn.

3.22.1.3 Earnings

Several measures are used to discuss earnings, including per capita personal income (PCPI), total industry income, and compensation by industry. Personal income data are measured and reported for the county of the place of residence. PCPI, then, is the personal income for county residents divided by the total county's population. Compensation data, however, are measured and reported for the county of work location and are typically reported on a per job basis. Compensation data indicate the wages and salaries for work done in a particular place (e.g., a county), but if the worker does not live in the county where the work occurred then a sizeable portion would be spent elsewhere. These expenditures will not remain in or flow back into that county's economy. Total compensation includes wages and salaries as well as employer contribution for employee retirement funds, social security, health insurance, and life insurance.

3.22.1.3.1 Per Capita Personal Income

Personal income is the income received by all persons from all sources, or the sum of net earnings by a place of residence, property income, and personal current transfer receipts (USDOC 2012). This includes earnings from work received during the period. It also includes interest and dividends received, as well as government transfer payments, such as social security checks. It is measured before the deduction of personal income taxes and other personal taxes and is reported in current dollars.

Annual PCPI for 2000, 2005, and 2010 for Sierra County and the State of New Mexico are shown below. (See Table 3-65.) All dollar estimates are in current dollars (not adjusted for inflation).

Table 3-65. Per Capita Personal Income

Table 3-65. Per Capita Personal Income				
	Income			
Location	2001	2005	2010	Percent Change 2000-2010
Sierra County	$19,691	$23,242	$32,139	63.2
New Mexico	$24,751	$28,641	$33,342	34.7

Source: USDOC 2010.

In 2010, the PCPI in Sierra County was $32,139, representing a 63.2 percent increase since 2001. While the State PCPI was higher than Sierra County's during this 9-year interval, the annual per capita income in Sierra County grew almost 30 percent faster than in the State overall. The differential between the two steadily decreased over the 2001-2010; in 2010 the Sierra County's PCPI was only about $1,000 less than the State average. The interrelated increases in labor force, employment, and PCPI can be attributed in part to the aging and shrinking resident population; new developments such as Spaceport America; as well as the ongoing revival of downtown Truth or Consequences.

3.22.1.3.2 Industry Compensation

What is often termed in economic data "total industry compensation" is somewhat of a misnomer, in that a portion of the "industry earnings" stems from government related activity. This is made clear when the composition of industry compensation is presented. Nevertheless, total industry compensation provides a good picture of the relative sizes of market related economic activity, or business activity, performed in a county. (See Table 3-66.)

Income is generated by economic activity in Sierra County through a variety of sectors, including various types of business as well as government. This income is not always received by a person living in the county; for example, a person from neighboring counties may cross county lines to go to work. The employee compensation by industry, however, is a measure of economic activity generated in the county, regardless of where the employee resides.

Sierra County's main economic drivers are agriculture, healthcare, and tourism. The agriculture industry consists primarily of cattle ranching (NMWC 2013). Government and government enterprises accounted for a total of $49,705,000 (about 50 percent) of the annual compensation of employees in 2010. Sierra County, the City of Truth or Consequences, and the Truth or Consequences Public Schools are some of the largest employers in Sierra County. (See Table 3-66.)

Table 3-66. Compensation of Employees by Industry in Sierra County

Table 3-66. Compensation of Employees by Industry in Sierra County			
Sector	**2001 ($100)**	**2005 ($100)**	**2010 ($100)**
Farm (crops, livestock, and dairy)	2,993	3,717	4,248
Forestry, fishing, related activities	(D)	(D)	(D)
Mining	(D)	(D)	(D)
Oil and gas extraction	0	0	0
Mining (except oil and gas)	(D)	0	0
Support activities for mining	0	(D)	448
Utilities	(D)	(D)	(D)
Construction	(D)	5141	9,394
Manufacturing	(D)	4013	5,503
Wholesale trade	(D)	(D)	(D)
Retail trade	7,476	6,740	10,797
Transportation and warehousing	(D)	714	214
Information	967	335	660
Finance and insurance	1,551	2,291	2,751
Real estate	(D)	444	498
Rental and leasing services	(D)	194	145
Professional, scientific, and technical services	1,254	5,747	3,408
Management of companies and enterprises	0	0	0
Administrative and waste management services	1,945	739	1,520
Educational services	(D)	(D)	(D)
Health care and social assistance	(D)	(D)	(D)
Arts, entertainment, recreation	664	701	975
Accommodation and food services	5,876	5,261	6,749
Other services except public administration	2,742	3,123	3,852
Government and government enterprises	34,946	41,036	49,705
Total	**60,414**	**80,196**	**100,867**

Source: USDOC 2001; USDOC 2010.

Note: (D) Not shown to avoid disclosure of individual confidential information.

Spaceport America, the commercial aerospace facility just west of the White Sands Missile Range, opened in 2011. The final EIS for the Spaceport America Commercial Launch Site estimated that the project would create up to 725 jobs during construction and about 225 during launch operations (FAA 2008). Since 2010, more than $3.6 million had been paid to New Mexico suppliers, and SpaceX had expended more than $2 million on construction of the facility, which includes a landing pad, propellant tanks and a mission control center (TSR 2014; Spaceport America 2014). By the end of 2014, Virgin Galactic had paid more than $2.6 million in rent and fees to the New Mexico Spaceport Authority.

According to Spaceport America, over 1,400 New Mexico residents were employed during the development and construction phase – about 10 percent were residents of Sierra County. In the current operational phase, about 100 people are employed – approximately 15 percent of which are residents of Sierra County. The Chief Executive Officer projects a total of 200 FTE jobs and 150 PTE jobs – about 20 percent of which would be Sierra County residents (Spaceport America 2015).

3.22.1.4 Public Finance

The State of New Mexico levies direct taxes on extractive industries operating in the State: the severance and processors taxes are State taxes and revenues go directly to the State. Tax rates for each mineral are imposed on the value of production less specified exemptions and deductions. The taxable value for both the severance and processors tax are based on production value, but production value is defined differently for each tax. Extractive industries are also subject to property taxes for non-operating mines and the copper ad valorem tax for operating mines. The copper ad valorem tax is dependent upon: 1) the value of the mine and all real and personal property; and 2) the value of salable minerals (NMTRD 2012).

3.22.1.4.1 Processors Tax

The Resources Excise Tax Act (Section 7-25-4 NMSA 1978) consists of three taxes (resources, processors, and services) on activities related to natural resources in New Mexico. NMCC would be subject to the processors tax because it is the owner of the land and would be processing the hard minerals. While the mineral ore would be processed outside of New Mexico, NMCC would not be subject to the resources or services tax because it would be both severing and processing the natural resources. If the metal ores owned by one are severed by another person and not processed in the state, the owner would be subject to the resources tax and the person severing the metal ores would be subject to the service tax (NM State Statutes 7-25-7).

The tax liability for the processors tax is determined by applying specific tax rates to the taxable value. (See Table 3-67.) The taxable value for the processors tax is specified in NM State Statutes 7-25-3. In essence, it is the value of the resource minus transportation costs and royalty payments.

3.22.1.4.2 Severance Tax

New Mexico imposes a severance tax on the privilege of severing natural resources. No severance taxes are levied in Sierra County because no mining operations currently exist. Calculation of the taxable value for the purposes of the severance tax includes determining the gross value and then deducting royalty payments. The severance tax rates for copper, silver, gold, and molybdenum are listed below. (See Table 3-67.)

Table 3-67. Severance and Processors Statutory Tax Rates

Table 3-67. Severance and Processors Statutory Tax Rates		
	Statutory Tax Rates (% of Taxable Value)	
Mineral	Severance Tax	Processors Tax
Copper	0.50	0.75
Molybdenum	0.13	0.13
Gold	0.20	0.75
Silver	0.20	0.75

Source: NMSA 2011.

3.22.1.4.3 Royalties

The land (2,189 acres) designated as the mine area consists of both patented and unpatented mining claims and fee land. The NMCC now owns a 100 percent interest in the mineral and surface estates in the patented mining claims, other patented land, and unpatented mining claims and millsites included in the mine area (NMCC 2013). There is no royalty for hardrock mining on Federal land, and royalties would not be paid to the New Mexico State Land Office since mineral production would not be derived from State Trust land (GAO 2009).

Advance royalty and net smelter return royalty rates, permissible deductions, and payment schedules are negotiated agreements between NMCC and Hydro Resources, Copper Flat LLC, and GCM (previous mineral rights holders). The amended *Option and Purchase Agreement with Hydro Resources, Cu Flat LLC, and GCM* stipulates that advance royalty payments would occur every 3 months after obtaining all State and Federal permits required for the commercial operation of the mine. The amount of the advance royalty payment would depend on the price of copper during the 3 calendar months preceding the month in which the payment is due. If the price of copper during the 3-month period is below $2.00/lb., the advance royalty payment would be $50,000. If the price of copper is above $2.00/lb., the advance royalty payment would be $112,500 (NMCC 2013).

NMCC may be required to pay 3.25 percent in NSR royalties "for any quarter in which there is 'gross revenue." NMCC's obligation to pay NSR royalty starts after 1) mineral products are sold; and 2) the aggregate amount of NSR royalty payments otherwise due exceeds the aggregate amount of advance royalty payments made to date. The NSR royalty would be charged as 3.25 percentage of the mineral's gross value, dependent upon the volume and grade of mineral processed each year; metal recovery rates; metal prices; and the terms of the assumed smelter contract. Permissible deductions would include costs associated with transportation, storage, smelting, and refining as well as resource excise and severance taxes; but not mineral extraction costs (NMCC 2013; NMCC 2015b).

NMCC's obligation for advance royalty payments (but not NSR royalty payments) would end when the aggregate amount of all payments of NSR royalty and advance royalty exceed $10,000,000 or when NMCC has relinquished and terminated any and all rights to conduct commercial production (NMCC 2013; NMCC 2015b). Advance royalty payments made to Hydro Resources, Cu Flat LLC, and GMC – after NMCC has received the State and Federal permits required for commercial operation of the mine but before mineral products are sold – can be credited against NSR Royalties payments (NMCC 2015b).

3.22.1.4.4 Property Taxes and Copper Ad Valorem Tax

New Mexico levies property taxes on the owner of each copper mineral property under Property Tax Code (Section 7-39-8 NMSA 1978). As mentioned previously, the NMCC now owns a 100 percent interest in the mineral and surface estates in the patented mining claims, other patented land, and unpatented mining claims and millsites included in the mine area. NMCC will pay property taxes to Sierra County on private property and improvements to patented mining claims, or land to which NMCC has title. NMCC also holds rights to unpatented mining claims and millsites located on public land administered by the BLM, or land to which the Federal government has title. NMCC currently pays and will continue to pay an annual fee to the BLM to maintain rights to the unpatented claims and millsites. Sierra County does not assess property tax for unpatented claims on Federal land.

For non-operating mines (i.e., currently, the Copper Flat mine), the property is taxed at the normal, non-residential county rate. Sierra County will continue to collect property taxes on NMCC-owned property to which it has patented mining claims until the mine becomes active and starts selling a mineral product. At that time, the current property tax assessment would be replaced with an ad valorem tax based on the gross value of production.

The copper ad valorem tax is imposed on active copper production in lieu of the property tax and is levied on the value of the mine and all real and personal property held or used for the purpose of mining (i.e., equipment for processing in a concentrator, SX-EW plant, precipitation plant, or a smelter). For operating mines where the ore is mined for processing in a concentrator (i.e., the Proposed Action and alternatives), the valuation for property tax purposes is equal to 30 percent of the value of salable copper and other minerals contained in the concentrate. The tax rate is to be determined through an agreement by the county assessor and the owners of the mine. This rate is generally fairly close to the regular residential county rate. The taxable event occurs when the severer sells copper in New Mexico or when the severer ships, transmits, or transports copper out of New Mexico without first making sale of the resource. Like property taxes, copper ad valorem tax revenue is added to the Copper Production Tax Fund, which is distributed by State and county treasurers to taxing authorities.

Sierra County currently does not produce copper, and as such no taxes are levied on ad valorem production or equipment. In 2009, the net taxable value for property tax purposes in Sierra County was $265,596,091 – the residential taxable value was $152,899,365 (about 58 percent) and the non-residential taxable value was $112,696,726 (about 42 percent). Sierra County's property tax obligation was $5,952,423 – $3,330,896 (about 56 percent) of which was residential and $2,621,526 (about 44 percent) was nonresidential (NMTRD 2010).

The tax per person is the total tax obligations associated with properties in a given area (sum of residential, nonresidential, and ad valorem production and equipment), divided by the population of permanent residents in the area. For Sierra County in 2009, the property tax obligation per person was $479, based on a total of 12,437 residents. Property tax obligations per person average about $765 statewide. High per capita figures for a particular jurisdiction typically reflect high rates or high taxable values of properties to which the rates are applied, although exceptions occur. High figures can reflect an extremely small population coupled with relatively high ad valorem tax collections, or when much of the property in a particular area is owned by individuals who do not live in the area (NMTRD 2010).

Figures from Grant County are used to provide an example of property tax obligations for a county that is subject to the copper ad valorem tax (and Grant County was the only county in New Mexico to produce copper in 2009). In 2009, the net taxable value of copper production or the net taxable value for ad valorem production was $172,480,724 – about 24 percent of Grant County's total net taxable value for property tax purposes. About 50 percent of the net taxable value for property tax purposes was residential, and about 26 percent was nonresidential. Grant County's total property tax obligation in 2009 was $13,431,451 – $5,406,102 (about 40 percent) of which was residential; $3,994,120 (about 30 percent) of which was nonresidential; and $4,031,228 (about 30 percent) of which was ad valorem production. Based on 29,844 residents, the property tax obligation per person in Grant County in 2009 was $450 (NMTRD 2010).

3.22.1.4.5 Indirect Taxes

The State of New Mexico imposes a Gross Receipts Tax (GRT) on sales and services provided in the State, including selling property in New Mexico and leasing (or licensing) property employed in New Mexico. The tax rate varies by location; the prevailing GRT at the project site is 6.3125 percent. For goods and services purchased outside of the State, a compensating tax is levied at a rate of 5.125 percent in order to protect New Mexico businesses from unfair competition from out-of-State businesses not subject to GRT. The State collects the tax and distributes the appropriate amounts to local government units.

The primary source of municipal and county revenues in Sierra County is gross receipts from spending at local businesses. GRT in Sierra County increased 71 percent between 2005 and 2010, while receipts in New Mexico increased 8.9 percent in the State of New Mexico (NMTRD 2010). In the March 2008 special election, Sierra County's residents voted to increase the GRT rate by 0.25 percent to provide Spaceport America the funding and taxation district needed to build the publicly financed facility. The GRT increase means residents pay an additional 25 cents for every $100 on purchases (Las Cruces Sun-News 2008). (See Table 3-68.)

Table 3-68. Gross Receipts Tax, 2005-2010

Table 3-68. Gross Receipts Tax, 2005-2010			
	Receipts		Percent Change
Location	2005	2010	2005-2010
Sierra County	$38,871,515	$66,474,914	71.0
New Mexico	$13,275,583,875	$14,450,723,812	8.9

Source: New Mexico Taxation and Revenue Department 2005-2010.

3.22.1.4.6 Payment in Lieu of Taxes

Under federal law, local governments (usually counties) are compensated through various programs for reductions to their property tax bases due to the presence of most Federally-owned land. This land cannot be taxed but may create a demand for services such as fire protection, police cooperation, or longer roads to skirt the Federal property. Some compensation programs are run by specific agencies and apply only to that agency's land. The most widely applicable program, administered by the Department of the Interior, is called "Payments in Lieu of Taxes" (31 U.S.C. §6901-6907).

In Sierra County, three categories of Federal land are eligible for PILT payments:

1. Land dedicated to the use of Federal water resources development projects (under jurisdiction of the Bureau of Reclamation);
2. Land in the National Forest System; and
3. Land administered by the BLM (CRS 2014).

From 2000-2010, the BLM accounted for almost 65 percent of all PILT-eligible acreage in Sierra County. During this 10-year period, BLM acreage decreased by 56 acres overall and the total USFS acreage increased by 398 acres. Total Bureau of Reclamation (BOR) acreage decreased by 37,458.

In Sierra County, approximately $30,000 each year goes to the county road department and the balance goes to the county general fund. PILT monies from the BLM, USFS, and BOR contribute roughly half of the county's budget (SCBC 2006). (See Table 3-69.)

Table 3-69. Acres and PILT payments in Sierra County, 2005-2010

Table 3-69. Acres and PILT Payment in Sierra County, 2005-2010					
Year	BLM (acres)	USFS (acres)	BOR (acres)	Total Acres	Payment
2005	854,140	386,854	95,945	1,336,939	$762,903
2006	854,122	386,851	58,574	1,299,547	$762,903
2007	854,087	386,851	58,574	1,299,512	$773,198
2008	854,087	386,851	58,574	1,299,512	$1,225,105
2009	854,087	386,851	58,574	1,299,512	$1,210,735
2010	854,087	386,851	58,574	1,299,512	$896,178

Source: U.S. Department of the Interior 2000-2010.

The authorized level of PILT payments is calculated under a complex formula. No precise dollar figure can be given in advance for each year's PILT authorized level. Payments to individual counties may vary from the prior year because of changes in acreage data, which is updated yearly by the federal agency administering the land; population data, which is updated based on USCB data; and the prior year revenue payment, which is reported by states. The per acre and population variables used to compute payments are also adjusted for inflation, using the Consumer Price Index and Census data, as required by 1994 amendments to the Payments in Lieu of Taxes Act (CRS 2014).

From 1994 to 2008, payments have not matched the full entitlement level because funding levels were subject to appropriation. Payments to local jurisdictions funded from 41 to 77 percent of the entitlement levels. However, the Emergency Economic Stabilization Act of 2008 made the PILT program mandatory, so beginning with the fiscal year (FY) 2008 payment and continuing through FY2012, payments equaled the full entitlement levels for each county that receives PILT payments. Indeed, the 2007 payment increased from $773,198 in 2007 to $1,225,105 in 2008.

3.22.1.5 Community Services

The ability for police, fire, and health services to respond to community needs may be affected by an increase in population as a result of the Proposed Action and alternatives. Existing community services are described in the following sections.

3.22.1.5.1 Police and Fire Services

There are a total of 14 full-time law enforcement employees and 179 volunteer firefighters in Sierra County (FBI 2010; USFA 2012; TCVFD 2014). A county's fire and police district, with the approval of the Board of County Commissioners, may service another district in an adjacent county pursuant to a mutual aid agreement. Most firefighting and law enforcement units in Sierra County share mutual aid agreements with surrounding counties that allow cross-coverage for emergencies (NMAC 2012).

Law enforcement: The Sierra County Sheriff's Department has a total of 14 law enforcement employees, including 12 officers and two civilians (FBI 2010). Both the Sierra County's Sheriff's Department and the City of Truth or Consequences Police Department are located in the City of Truth or Consequences. In 2008, New Mexico State Police employed 528 full-time sworn personnel, or 27 law enforcement officers per 100,000 residents; decreasing 11.2 percent since 2004 (USDOJ 2008).

The 911 program in Sierra County was launched in response to national security concerns following the destruction of the World Trade Center towers. The purpose is to create a single map system with an address for all residences; reduce redundancy in road names; and foster the adequate marking of addresses for emergency services. The program's project manager stated that this program is 90 percent complete, but the map is not yet ready for public distribution. While all addresses have been entered into the system, the database has inconsistencies that need to be rectified (SCBC 2006).

The Law Enforcement Protection Fund Act (§29-13-1 through 9 NMSA) provides limited funds to municipal and county police and sheriff departments for maintenance and improvement of those departments. The act outlines a distribution formula that provides annual payments of $20,000 for counties with populations less than 20,000 persons (i.e., Sierra County).

Fire resources – volunteer fire departments: The impetus to create volunteer fire departments (VFDs) in the last few years has come from the Department of Homeland Security, which has funded training and equipment to increase disaster preparedness. The National Fire Plan, administered through the U.S. Forest Service, has channeled funding and training to the VFDs in Sierra County in recent years. VFDs have been conducting patrols and prevention work.

All fire departments in Sierra County are VFDs: Truth or Consequences, Elephant Butte, Las Palomas, Poverty Creek, Winston Chloride, Lakeshore, Arrey/Derry, Caballo, Monticello, and Hillsboro. There are a total of 10 VFDs, 13 stations, and 179 volunteer firefighters in Sierra County. (See Table 3-70.)

Table 3-70. Volunteer Fire Departments in Sierra County

Fire Department	Number of Stations	Volunteer Firefighters
Arrey-Derry Fire Department	2	16
Caballo Fire & Rescue	1	20
Hillsboro Fire/Rescue Department	2	19
Lakeshore Fire Department	1	12
Las Palomas Volunteer Fire Department	1	15
Monticello-Placita Volunteer Fire Department	1	15
Truth or Consequences Volunteer Fire Department	2	25
Winston Chloride Volunteer Fire Department	1	10
Elephant Butte Fire Department	1	24
Poverty Creek Volunteer Fire Department	1	23
Total	**13**	**179**

Source: U.S. Fire Administration 2012; TCVFD 2014.

The Truth or Consequences Volunteer Fire District services the proposed mine area, and all calls are dispatched through the Truth or Consequences VFD. Established in 1923, it carries an Insurance Services Organization rating of Class 5. The station includes a roster of 25 volunteer firefighters; two fire stations; four fire engines; and one ladder truck.

The BLM also makes contributions related to fire protection. Because they are first responders, rural volunteer fire departments are invited to submit lists of equipment needs of which the BLM funds a portion through its Rural Fire Assistance program. The BLM uses “fuel hazard” monies to treat brush, create fire lines, and protect infrastructure on public land. For example, the BLM funded work to reduce the fire hazard near a telecommunications tower near Winston (Sierra County 2006).

The Community Wildfire Protection Plan (2012) deals exclusively with wildfires – the most frequent hazard faced by Sierra County. The Community Wildfire Protection Plan identifies the risks and hazards associated with wildfires and provides an assessment of fire behavior potential (i.e., flame length potential, rate of fire spread). Its plan of action includes fire prevention efforts to reduce building/structure ignitability and an assessment of local preparedness and firefighting capabilities, firefighter training, and water supply (Sierra County 2017).

Emergency management: The County has an Emergency Management Office whose purpose is to be the liaison resource for all agencies with regard to fire, police, and other emergency medical needs for both volunteer and paid positions. It is funded through the State Office of Emergency Management.

The Sierra County Community Emergency Response Team (CERT) was established in 1997 under the administration of the Federal Emergency Management Agency. The CERT Program educates people about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Using the training provided in the classroom and during exercises, CERT members can assist others in their neighborhood or workplace following an event when professional responders are not immediately available to help (FEMA 2014). Sierra County CERT has 40-45 active members and nine CERT trainers. All members and trainers are volunteers and all have been trained as first responders in emergencies and disasters (Sierra County 2006). Since its establishment in 1997, the Sierra County CERT has responded to 10 flood and winter storm emergencies, conducting activities such as general evacuation, sandbagging, and staffing shelters. The Sierra County CERT has also performed other non-emergency functions including emergency preparedness, home safety, and prevention assistance such as winterizing homes, fire safety actions, and crime prevention steps (FEMA 2012).

The Sierra County Disaster Mitigation Plan (2012) covers emergency situations such as severe weather, wildfires, flash floods, drought and high wind. It sets out a protocol to be followed in emergencies and sets out responsible parties (Sierra County 2017).

3.22.1.5.2 Health Services

Sierra Vista Hospital is a rural, community-owned and community-operated 25-bed critical access hospital healthcare facility located in the City of Truth or Consequences. A member of the New Mexico Hospitals and Health Systems Association, the hospital serves the 13,000 residents as well as the 900,000 annual visitors. Patients have access to services provided by Sierra Vista Hospital's laboratory, radiology department, respiratory care, physical therapy, ambulance, emergency department, specialty clinics, and many other services (SVH 2012). Sierra County is listed as a health professional shortage area, or as having limited capacity to handle healthcare emergencies or increases in service demand.

Other healthcare facilities in Sierra County and the services they provide include:

- Ben Archer Health Center – Health clinic, behavioral health, primary care, X-rays, dental care, counseling, immunizations, transportation;
- Milagro Health Center – Health clinic/services;
- New Mexico Department of Health, Sierra County Public Health – Advocacy, family planning, health clinic, immigrant, immunizations, infectious diseases, prenatal care;
- New Mexico State Veterans Home – Advocacy, health services, housing, transportation;
- Sierra Health Care Center – Skilled nursing, therapy, rehab, Alzheimer's unit, advocacy, home visitation;
- Sierra Outpatient Rehabilitation & Therapy – Advocacy, support, senior services/care, recovery, disabilities, health information/services; and
- Sierra Home Health, Hospice, and Homemaking Services/PCO – Advocacy, support, senior services, home visitation, counseling, disabilities, education, health information/services, prescriptions (SHC 2014).

As mentioned earlier, three of the four major employers in Sierra County provide healthcare services. New Mexico State Veterans Home, Sierra Vista Hospital, and Sierra Home Health, Hospice, and Homemaking Services each employed between 100-249 persons in 2010 (NMWFS 2014).

Every county is responsible for ambulance transportation and hospital care of indigent patients under the provisions of the Indigent Hospital and County Health Care Act (§27-5-2 NMSA). Ambulance service may be furnished to points outside the county provided no local established ambulance service in the area is available, or if one exists, such service has inadequate capacity or is insufficient for the service requested. The county may use funds from the Indigent Care Funds Act to pay for ambulance service for indigent persons (§27-5-2 NMSA).

3.22.1.5.3 Education

Total enrollment, functional capacity, number of classrooms, and student-to-teacher ratio at schools may be affected by mine workers and their families relocating to Sierra County and are therefore described in the following section. Continuing education at Western New Mexico University's branch community college is described in Continuing Education.

Schools: Students residing in Sierra County attend schools in the Truth or Consequences Municipal School District. Total enrollment, functional capacity, number of classrooms, and student-to-teacher ratio for the five schools in the Truth or Consequences School District are presented below. (See Table 3-71.) Figures for the functional capacity, utilization capacity, and the number of classrooms in each school assume the use of portable classrooms.

Table 3-71. Truth or Consequences School District, 2010-2011

Table 3-71. Truth or Consequences School District, 2010-2011					
School	**Enrollment**	**Functional Capacity***	**Utilization Capacity***	**# of Classrooms***	**Student to Teacher Ratio**
Arrey Elementary School (Pre-K-5)	133	263	50.6	17	15:1
Truth or Consequences Elementary School (Pre-K-3)	357	396	95.1	31	17:1
Sierra Elementary Complex (4-5)	161	196	88.3	13	12:1
Truth or Consequences Middle School (6-8)	318	448	71.0	26	15:1
Hot Springs High School (9-12)	407	604	68.9	35	13:1

Source: New Mexico Public Education Department 2011; NCES 2011.

Note: *With portable classrooms.

The Truth or Consequences Municipal School District maintains approximately 238,700 square feet of school and support facilities for almost 1,400 students. The 2011 Truth or Consequences Municipal School District Facilities Master Plan (FMP) determined that schools currently have adequate classrooms to accommodate current student enrollment. However, the Truth or Consequences Elementary School and Sierra Elementary rely on portable classroom units to maintain adequacy, and both are projected to soon be over capacity (ARC 2011).

The "high range" scenario in the 2011 FMP assumed development of the Spaceport and the Copper Flat mine (beginning in 2015) would increase population growth and birth rates. Under this scenario, ARC projects that enrollment will increase at 2.4 percent per year on average beginning in 2016-2017. Under this scenario, the Truth or Consequences Elementary School would not have sufficient classroom space; Arrey Elementary would have substantial capacity; Sierra Elementary is projected to have increasing capacity; and the Truth or Consequences Middle School and Hot Springs High School would have a classroom surplus (ARC 2011).

Advanced education: An overview of educational attainment for the population aged 25 and older in Truth or Consequences, Sierra County and New Mexico is presented below. Based on feedback from the public, data on educational attainment for the Hillsboro CDP has proven to be inaccurate. More accurate information is not available; therefore, educational attainment for the Hillsboro CDP is not included in Table 3-72.

Table 3-72. Highest Level of Educational Attainment, 2010

Location	Population 25 years and over	High school Graduate (%)*	Some college, no degree (%)	Bachelor's Degree or higher (%)
Truth or Consequences	4,231	38.6	25.2	16.8
Sierra County	8,488	37.3	24.5	16.8
New Mexico	1,296,627	27.0	23.1	25.5

Source: USCB 2006-2010.

Note: *Includes equivalency.

Continuing education: Western New Mexico University's branch community college in Sierra County offers a number of adult education classes, including certification programs aimed at students interested in immediate employment in certain target job markets. The school is also an excellent local resource for those who wish to expand their professional skills or take prerequisite courses that can lead to transferring to a 4-year college or university. The Workforce Investment Act, a State initiative with Federal funding, provides funds to Sierra County youths aged 14-21 with work experiences through business partnerships (Sierra County 2006).

3.22.1.6 Community Cohesion and Quality of Life

Quality of life can be characterized as a person's well-being and happiness. For this analysis, quality of life considerations focus on those elements that the public generally associates with a high quality of life: education, safety, recreation opportunities, access to transportation facilities, sense of community, and a positive general living environment. Other factors, such as air quality and noise, could also contribute to a person's sense of quality of life. Demographic and economic indicators used to describe the level of community cohesion in Sierra County in Section 3.22.1.6.1 are from the 2010 Census and 2006-2010 American Community Survey estimates.

3.22.1.6.1 Community Cohesion

Community cohesion is the degree to which residents have a sense of belonging to their neighborhood or community, including commitment to the community or a strong attachment to neighbors, institutions, or particular groups. Determining the level of community cohesion is by nature subjective and requires professional judgment.

Several economic, social, and cultural factors shape and influence a community's level of cohesion or the level of cohesion between communities. Given the complexity of relationships within and between communities, a defined set of indicators to determine the level of community cohesion (expressed as high, medium, or low) does not exist. Cohesive communities are generally associated with certain characteristics that revolve around age, income, race, and residential status. Individual indicators considered may change based on the location; project size and type; scope of an analysis; and available data. Studies show that indicators of higher community cohesion can include the following:

- Residential stability (e.g., households of two or more people, homeownership);
- Residential longevity;
- Working class families;
- Ethnic homogeneity;
- Parks and other community facilities; and
- Higher proportions of senior citizens (Caltrans 1997; FDOT 2000; Caltrans and FHWA 2015).

Information from public scoping comments; newspaper publications; public documents (e.g., past EISs, development projects); academic publications on the topic; recent social and economic (including mining) history of the area; and project information were also reviewed to identify a reasonable and relevant set of indicators to consider in determining the level of community cohesion in Sierra County. Table 3-73 includes figures for community cohesion indicators selected for the purpose of this analysis. Sierra County is considered to have a medium level of community cohesion.

Table 3-73. Community Cohesion Indicators in Sierra County

Table 3-73. Community Cohesion Indicators in Sierra County					
Location	Householder Moved to Unit after 2000 (%)	Median Household Income*	Ethnic Homogeneity	Homeowner-ship Rate (%)	Persons 65 Years and Older (%)
Hillsboro CDP*	0	$24,875*	89.5	60.46	45.2
Truth or Consequences	57.4	$21,862*	85.7	63.5	14.9
Sierra County	43.7	$25,583*	85.6	78.3	30.6
New Mexico	64.6	$42,090*	68.4	69.6	13.2

Source: USCB 2010; USCB 2006-2010.

Note: *In 2010 inflation-adjusted dollars.

Approximately 43.7 percent of householders moved into their Sierra County unit after 2000. Sierra County has a 78 percent homeownership rate and 72.4 percent are owner-occupied; roughly 2,400 units are available for rent. Additionally, 53 percent of the all households are family households.

Of the 1,950 children under the age of 17 in Sierra County, 986 live with two parents. Approximately 200 (or 11 percent) of those children have one parent in the labor force, or (presumably) one parent at home. Additionally, 30.6 percent of Sierra County's population is over the age of 65, an above-average concentration.

Since social classes lack clear boundaries and overlap, there are no definite income thresholds as for what is considered working class. Sociologist Leonard Beeghley identifies a combined household income of $66,000 as a typical working-class family (Beeghley 2004). Sociologists William Thompson and Joseph Hickey estimate an income range of roughly $16,000 to $30,000 for the working class (Thompson and Hickey 2005). The "working class" is typically associated with manual labor and high school education. The 2010 median household income in Sierra County was $25,583; 73.5 percent are high school graduates; 11.2 percent have some college or an associate's degree; and 0 percent have a bachelor's degree or higher (USCB 2010c). Sierra County qualifies as a working-class community.

Ethnic homogeneity is a term used to describe an area whose population has a similar ethnic background. In Sierra County, 85.6 percent of the population is identified as having "one race"; in this case, white. Based on previous research, and comparison to income levels in other parts of New Mexico, Sierra County can be considered an area of lower median family income levels and a high level of ethnic similarity.

3.22.1.6.2 Recreation and Tourism

Local tourist and recreational attractions include Elephant Butte Lake and State Park, the Gila National Wilderness, Caballo Lake State Park, Percha Dam State Park, several museums and ghost towns, and the mineral baths located in Truth or Consequences. A more detailed discussion of backcountry byways, hunting, hiking, and sightseeing are discussed in Section 3.16, Recreation.

A total of 69 percent of the budget for State parks is supported by self-generated revenue and 31 percent is from the State general fund. The self-generated revenue is closely correlated with visitation and boating activity, and those numbers are dramatically affected by lake levels. The recent drought years have reduced revenue from park fees, boat registrations, and boat excise taxes – creating real budget strain. Some years, State parks enacted aggressive vacancy savings (delays in filling positions), spending restrictions and other efficiency steps in order to offset a total budget shortfall. Drought, wildfires, and seasonal park closures and the accompanying impacts on visitation have negatively impacted many New Mexico communities intertwined with the State parks. Other sources of self-generated receipts are received through day use, overnight camping and other services such as the use of the group shelters, group reservation areas, special use permits, and from fees generated by the sailboat "mast up" storage facility (NMEMNRD 2005; NMEMNRD 2012).

Elephant Butte Lake State Park is New Mexico's main watersports destination and attracts over 1 million visitors per year, creating about $900,000 in annual revenue (NMEMNRD 2015). There are over 100,000 visitors during Memorial Day weekend, marking the beginning of the summer season. Boating and fishing during the summer months are the most popular and lucrative recreational activities. The park also has numerous camping and picnicking areas, with more than 200 developed campsites and 100 electrical hook-ups for RVs and trailers.

Elephant Butte Lake State Park is a designated warm water fishery with largemouth bass, catfish, walleye, flathead and channel catfish, crappie, black, smallmouth, white and striped bass and bluegill (NMEMNRD 2015). New Mexico Boating Training employs between 20 and 49 persons per year, and offers boat rentals, boating safety courses, excursions, etc. (NMWC 2013). A 10 percent Federal excise tax on the purchase of fishing equipment and motor boat fuel helps states individually promote sport fisheries. This includes acquiring easements or leases for public fishing, funding hatchery and stocking programs, supporting aquatic education programs, and improving boating facilities for anglers (NMDGF 2015).

Caballo Lake State Park is located 16 miles (26 km) south of Truth or Consequences on the Rio Grande. Water-based recreational activities include boating, kayaking, canoeing, sailing, swimming, and fishing. Caballo Lake supports largemouth bass, walleye, white bass, catfish, crappie, bluegill, northern pike, sunfish, and the occasional rainbow trout. It has 170 campsites and utility hookups for RVs; hiking, horseback riding, picnicking, and birding are also popular activities. Percha Dam State Park also offers fishing, camping, picnicking, wildlife viewing, and birding opportunities. Both parks draw hundreds of species of birds due to their location along the Rio Grande flyway, especially migratory bird species in the spring and fall. Beginning in late October, golden eagles nest in the nearby Caballo foothills, while bald eagles nest in large areas around and within Caballo Lake State Park (NMEMNRD 2000).

A portion of the Cibola National Forest Magdalena Ranger District, mostly in Socorro County, extends into the northern portion of Sierra County. The San Mateo Mountains offer camping, hiking, and picnicking opportunities. Luna Park – located within the Apache Kid Wilderness – and Springtime are the two developed recreation sites closest to Sierra County.

The Gila National Forest Black Range and Wilderness Ranger Districts (RDs) represent 365,618 acres in Sierra County, or 13.5 percent of the county's total acreage. The Gila Cliff Dwellings National Monument, which is jointly managed by the National Park Service and the Forest Service under a MOU, lies within the Wilderness RD. A large portion of the Aldo Leopold Wilderness lies within the Black Range RD, as does a small portion of the Gila Wilderness. The most popular recreational activities in the Black Range RD include camping and hiking. Wilderness permits for the Gila and Aldo Leopold Wilderness are not required, nor are camping or hiking permits. While the Gila NF has some "fee areas", most areas are not, so visitors can access many sites without charge. NM-152 bisects the Black Range RD in the south, taking travelers through the historic town of Hillsboro (32 miles southwest of Truth or Consequences). State Highway 52 provides a tour of historic towns established by ranchers, farmers, or miners throughout the 1800s and into the early 1900s. The Continental Divide National Scenic Trail and a large portion of the Geronimo Trail Scenic Byway cross the Black Range RD (USFS 2007).

Annual visitation and revenue at State parks and national forests in Sierra County are presented below. (See Table 3-74.)

Table 3-74. Annual Visitation and Revenue at State Parks or National Forests in Sierra County

Table 3-74. Annual Visitation and Revenue at State Parks or National Forests in Sierra County		
State Park or National Forest	**Annual Visitation**	**Annual Revenue**
Elephant Butte State Lake Park (2010)	1,191,283	$902,856
Caballo Lake State Park (2010)	262,281	$235,994
Percha Dam State Park (2010)	55,137	$33,214
Gila National Forest (2006)	452,000	n/a
Cibola National Forest (2006)	1,056,428	n/a

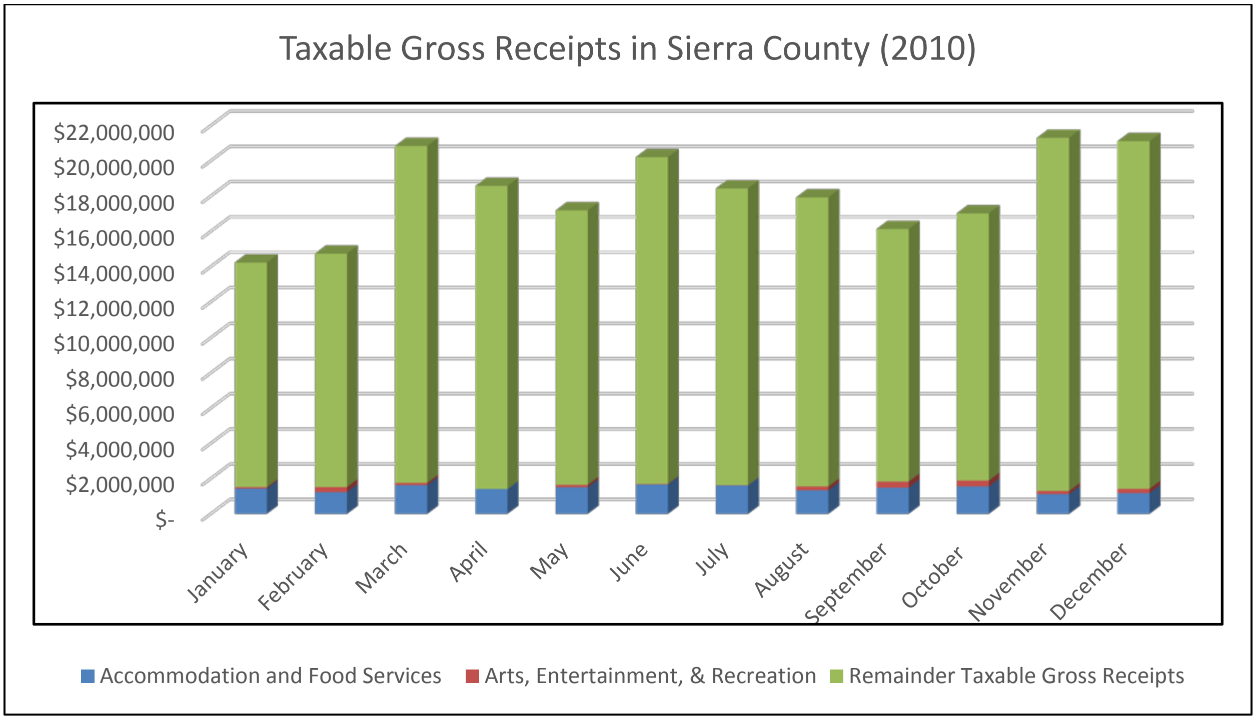
Source: NMEMNRD 2015; USFS National Visitor Use Monitoring 2006.

Note: Annual Visitation and Revenue figures are most recent figures available.

The designation of the Hot Springs Bathhouse and Commercial Historic District on the NRHP in Downtown Truth or Consequences in 2005 provided an impetus to interpret and preserve the city's mid-century architecture. The revitalization efforts of Truth or Consequences Main Street and the newly established Healing Waters Trail, a 2.3-mile urban trek, have proven successful elements of renewal (Tor C 2006).

New Mexico Taxation and Revenue posts monthly data on gross taxable receipts by NAICS code, including accommodation and food services. While not all tax receipts from accommodation and food services can be attributed to recreation and tourism, this provides one measure showing the importance of this sector in Sierra County over a period of 12 months. Each bar in Figure 3-51 is the accrual month; the business activity occurs the previous month and collection occurs the pursuant month. Figure 3-51 shows the gross taxable receipts for the accommodation and food; and arts, entertainment, and recreation sectors; as well as the remaining sectors in Sierra County for 2010. Overall, the accommodation and food services and arts, entertainment, and recreation sectors accounted for 10.3 percent of all gross taxable receipts in 2010 (NMTRD 2010b).

Figure 3-51. Taxable Gross Receipts in Sierra County, 2010



Source: NMTR 2010b.

3.22.1.6.3 Quality of Life and Recreational Values

Over the past few decades, the social environment of the surrounding communities has been in transition from traditional extractive associations with natural resources (i.e., grazing, ranching, agriculture, logging, and mining) to more recreation- and tourism-based economies and lifestyles. Much of the logging industry in this part of New Mexico has disappeared; with the largest sawmill closing in 1993. Ranching continues to be a major activity in the area, but the economic viability of ranching is threatened by prolonged drought conditions and market forces. On the other hand, local tourism industries have expanded and there has been considerable amenity migration (the movement of people based on the draw of natural or cultural amenities) into the area by retirees and others, along with major investments in vacation homes (USFS 2007).

Values and beliefs associated with recreation link residents to public land and resources. These same natural amenities attract retirees and others to the area. Environmental amenities associated with the Elephant Butte Lake State Park, parts of the Gila and Cibola National Forests, the Black Range Mountains, Turtleback Mountain, and the banks of the Rio Grande contribute to the region's identity, as well as area quality of life. Proximity to this land can influence where people choose to live (i.e., migration) and how much people are willing to pay for housing (i.e., property values).

Research by Hand et al. indicates that people make regional housing and labor market decisions based in part on the availability of and proximity to public land, like forests, lakes, mountains, etc. Living proximate to public land provides amenities such as convenient access to recreation and wildlife viewing, as well as disamenities such as crowds, litter, and noise. That is, population movement and migration into environmentally desirable areas, like Sierra County and surrounding counties, can be explained by the presence of, and density of, natural resources and associated environmental amenities. Additionally, housing prices in the Southwest are higher based on overall proximity and access to public land (Hand et al. 2008).

Although economic conditions are changing in the local community, outdoor recreational resources continue to be perceived as linked to local economic well-being. The scenic resources (including NM-152); arid, moderate climate; dark skies; and outdoor opportunities in the area often attract retirees and those looking for second homes. Activities drawing people to the area include boating; fishing; dispersed camping; use of RV parks; golfing; hunting; OHV use; picnicking; sightseeing; driving along scenic backcountry byways; and hiking. Landscape appearance and scenery can be important public land amenities, not just as recreation opportunity settings, but also as elements of the region's identity. Factors such as clean air and water quality, scenery and natural landscape, open space, dark skies, and the number of recreation opportunities can be economic assets themselves for local economies.

3.22.2 Environmental Effects

The analysis for socioeconomics evaluates the social and economic effects, both adverse and beneficial, of the permitting, construction, operation, and reclamation phases of the Proposed Action and alternatives.

As noted earlier, the ROI for the socioeconomic analysis is defined as Sierra County, or the area most likely to be affected by the Proposed Action and alternatives. The community could experience direct, indirect, or induced economic impacts from employment, wages and taxes, etc., as a result of construction and operation associated with the Proposed Action and alternatives, either as a result of permitting, construction, operation, or reclamation. Additionally, the impacts could consist of changes in the quality of life for area residents and visitors due to increased tax revenue.

The temporal bounds for analyzing socioeconomics will be guided in part by available data, an assessment of current conditions (without the Proposed Action and alternatives), and the phases of activity associated with the Proposed Action and alternatives (permitting, construction, operation, and reclamation).

3.22.2.1 Proposed Action

Long-term, major, medium to large extent, probable, beneficial and adverse impacts would occur under the Proposed Action. Overall, impacts would be significant. Operation of the mine would occur over a 16-year period, and while the phases are sequential, there would be some overlap as the activities of an earlier phase continue during the implementation of subsequent phases. The duration and estimated project costs by phase are shown below (NMCC 2014a). (See Table 3-75.)

Table 3-75. NMCC Estimated Project Costs – Proposed Action

Description	Duration (years)	Cost (USD)
Pre-construction/permitting	2	$18,408,000
Construction/site preparation	2	$363,535,000
Mining operations	17	$1,408,196,000
Closure/reclamation	3	$45,398,000
Total	**24**	**$1,835,537,000**

Source: NMCC 2014.

Note: All estimates include resource taxes and exclude income taxes.

A "multiplier" is a number used by economists to determine the impact of a project on the economy. It is the ratio of total change in output or employment to initial change (or direct change). Multipliers are a numeric method of describing the secondary impacts stemming from a change. For example, an employment multiplier of 1.8 would suggest that for every 10 employees hired in a given industry, 8 additional jobs would be created in other industries, such that 18 total jobs would be added to the given

The economic impacts of the development, operation, and reclamation phases of the Proposed Action and alternatives are estimated using the Impact Analysis for Planning (IMPLAN) input-output economic modeling system, originally developed by the Minnesota IMPLAN Group. (See Appendix M.) This type of regional economic modeling is a standard approach to measuring the production and consumption linkages in an economy between households, industries, and institutions (such as government), thus providing an estimate of the "ripple" effects in an economy associated with a direct stimulus or investment.

The multipliers of IMPLAN measure these downstream or ripple effects. The IMPLAN database includes multipliers for 440 industries (including mining). The multipliers in IMPLAN are defined as the sum of the direct, indirect, and induced effects divided by the direct impact. (See Table 3-76.) In the IMPLAN model, businesses produce goods to sell to other businesses, consumers, governments, and purchasers outside the region. The output is produced using labor, capital, fuel, and intermediate inputs. The demand for labor, capital, and fuel per unit of output depends on their relative costs.

The IMPLAN model estimates the direct effects of spending for development activities and consumption spending of new residents and construction workers; the indirect effects of local vendors providing goods and services to the primary firms; and the induced impacts of employees of these firms spending a portion of their earnings in the local economy. Economic activity is measured in terms of income and employment generated (or lost) due to the Proposed Action. With increased spending, many different sectors of the economy benefit, not only the directly impacted sector but also many sectors indirectly. All sides of the cost-benefit analysis are analyzed, including costs to the local community and surrounding area as well as benefits the mine would bring.

Table 3-76. IMPLAN Definitions

Table 3-76. IMPLAN Definitions	
Impact Type	**Definition**
Direct	The set of expenditures applied to the predictive model (i.e., I/O multipliers) for impact analysis (i.e., a $10 million-dollar order is a $10 million-dollar direct effect).
Indirect	Expenditures within the study region on supplies, services, labor, and taxes.
Induced	Money that is re-spent in the ROI as a result of spending from the indirect effect.

Source: MIG 2012.

Each of these steps (direct, indirect, and induced) recognizes an important "leakage" from the economic study region spent on purchases outside of the defined area. "Leakage" is the non-consumptive use of income, including savings, taxes, and imports that "leak" out of the main flow between output, factor payments, national income, and consumption. Eventually these leakages would stop the cycle (MIG 2012). While direct impacts refer to the dollar value of economic activity that circulates through the economy; State and county taxes, inventory, and other similar payments do not circulate through the economy in the same manner.

Equipment and materials would be procured locally to the extent possible, but specialized equipment and materials required for copper mining are not available locally. Such items would be shipped from other areas. The economic analysis completed by NMCC and tax consultants for the feasibility study indicates that approximately 15 percent of construction phase costs, or approximately $55 million, would be spent in Sierra County (NMCC 2014b). The IMPLAN model is adjusted to capture costs that would be spent in Sierra County during the construction phase.

NMCC anticipates hiring over 70 percent of the workforce from local communities, or from Sierra County as well as surrounding counties. The portion of labor hired locally would be highly dependent on the skill levels of the local labor force at the time of hiring for the construction phase and the applicability of these skills moving into the operations phase. NMCC is working with the local community to identify skills anticipated for operations to allow interested individuals to prepare for enhancing their skill set (NMCC 2014a). Preparation for potential mine workers is discussed below in the "Education" section. The IMPLAN model is adjusted to capture employee compensation that would occur in Sierra County. It should be noted that the mining industry, like many industries, is affected by market forces such as supply, demand, and the rising and falling prices of mineral commodities. This analysis does not capture potential mining operational changes in response to market forces.

Projected population increases as they relate to schools, quality of life, and housing are based on the number of direct jobs anticipated during the construction and operation phases. A quantitative economic evaluation of revenues, expenditures, taxes, and income and costs of utilities and infrastructure is included in Section 3.25, Utilities and Infrastructure.

Implementation of the action alternatives and development of the proposed Copper Flat mine could have direct and indirect impacts to the local (Sierra County) and State economies in terms of employment, government revenues, personal income, business sales, and quality of life. Results are expressed in terms of employment (annual average full- and part-time jobs); wages and salaries or labor income (total payroll costs, including benefits); total economic activity (total value of production); and direct taxes. All results are expressed in 2014 dollars and are not adjusted for inflation.

3.22.2.1.1 Mine Development/Operations

Pre-construction/permitting: The period from 2014 to 2016 is assumed for the permitting phase, and costs are estimated at $18.4 million (NMCC 2014a). Approximately $15.9 million of the pre-construction/permitting costs occurred in 2014; approximately $1.67 million occurred in 2015; and an estimated $838,000 will occur in 2016. The pre-construction/permitting phase would generate over $15 million in total economic activity and support almost 250 direct, indirect, and induced jobs from 2014 to 2016 – translating to over $13 million in labor income.

The permitting phase would support 175 full- and part-time direct jobs and $11.4 million in labor income from 2014 to 2016. Of the 175 direct jobs supported during this 3-year period, 152 of those occurred in 2014. The 175 full and part-time jobs would be generated mostly in the environmental and other technical consulting services sector. Note that a direct employment effect does not necessarily represent direct employment by NMCC during this phase. Activities performed in this sector could include legal advice and representation; accounting, bookkeeping, and payroll services; architectural, engineering, and specialized design services; surveying and mapping services; consulting services; research services; and other professional, scientific, and technical services.

About 21 jobs (indirect) would be generated through purchases from local businesses. Another 53 jobs (induced) would be generated through the purchases of those receiving income and consequently spending that income locally. Overall economic impacts of the permitting phase by employment, salaries and wages, and economic activity are presented below. (See Table 3-77.)

Table 3-77. Economic Impacts of Permitting Phase in Sierra County – Proposed Action

Table 3-77. Economic Impacts of Permitting Phase in Sierra County – Proposed Action			
Impact Type	**Employment**	**Labor Income**	**Value Added**
Direct effect	175	$11,408,052	$11,456,789
Indirect effect	21	$613,451	$982,044
Induced effect	53.2	$1,398,719	$2,987,959
Total effect	**249**	**$13,420,222**	**$15,417,792**

Source: Calculations using IMPLAN PRO Version 3.

Construction/site preparation: Impacts associated with the construction of the mine facilities would be a one-time event. Construction of the project is planned to occur from 2016-2018, though most construction activity would occur in 2017. The impact scenario was constructed based on the peak number of construction jobs and annual construction costs. Total construction costs are estimated to be $363.5 million, of which approximately $55 million would be spent in Sierra County (NMCC 2014b). Most of the initial investment of $101.5 million for mobile and fixed plant equipment would occur outside of Sierra County (some within the State, some not), so these expenditures are not considered in the impact analysis. Dollar impacts are presented in 2014 (constant) dollars and are not adjusted for inflation. (See Table 3-78.)

Table 3-78. Economic Impacts of Construction Phase in Sierra County – Proposed Action

Table 3-78. Economic Impacts of Construction Phase in Sierra County – Proposed Action			
Impact Type	**Employment**	**Labor Income**	**Value Added**
Direct effect	221	$10,523,194	$20,170,889
Indirect effect	25	$885,317	$1,396,175
Induced effect	50	$1,306,941	$2,753,525
Total effect	**296**	**$12,715,452**	**$24,320,590**

Source: Calculations using IMPLAN PRO Version 3.

The construction phase includes wholesale purchases of mining equipment, payments to construction firms, payments for outside services, and purchases of fuels, electricity and supplies. Despite the $363.5 million that would be spent during the construction phase, the number of jobs directly supported and the associated labor income is relatively low. The reason for the disparity between expenditure figures and the economic impacts is that the expenditure categories registering the largest gains (e.g., wholesale purchases of mining equipment and fuels and petroleum products) have small local economic impacts per $1 million of spending compared to service sectors. Mining equipment may be purchased from wholesalers in New Mexico but is produced entirely out of State.

Indirect impacts result from directly impacted industries purchasing supplies and materials from other industries. Indirect jobs include local vendors from whom NMCC would make purchases and local retail stores and establishments where Copper Flat employees would shop. Induced impacts occur when employees of the directly and indirectly affected industries spend the wages they receive. The indirect and induced jobs created during construction and operation phases are often relatively low-wage jobs such as restaurant workers or convenience store clerks.

Mining operations: The IMPLAN model was customized to incorporate a sector for copper mining that does not currently exist in Sierra County. No mining has taken place in Sierra County since the early

1980s. The introduced mining sector used multipliers based on national per-worker values for the copper mining industry and is adjusted for project specifics. The IMPLAN impact scenario was constructed based on knowing the annual operating costs and workforce. While expenditures in Sierra County have some effect on the rest of the State and expenditures in the rest of the State have some effect on Sierra County, this analysis does not estimate these interactions.

The operations phase would create over $1.1 billion in total economic activity; support over 3,300 direct, indirect, and induced jobs over a period of 16 years; and provide over $262 million in labor income. (See Table 3-79.) Labor income captures all forms of employment income, including wages and benefits. The increase in economic activity in the local economy, or the value added to the local economy, represents the wealth created by the industry activity (i.e., mining).

Table 3-79. Economic Impacts of Operation Phase in Sierra County – Proposed Action

Table 3-79. Economic Impacts of Operation Phase in Sierra County – Proposed Action			
Impact Type	**Employment**	**Labor Income***	**Value Added**
Direct effect	2,165	$229,506,397	$1,070,179,831
Indirect effect	192	$6,739,617	$12,666,235
Induced effect	985	$26,010,211	$54,778,017
Total effect	**3,341**	**$262,256,225**	**$1,137,624,082**

Source: Calculations using IMPLAN PRO Version 3.

Note: *Includes wages and benefits.

The Copper Flat mine would directly generate over 2,100 full and part-time jobs during the 16-year operations phase, including mine workers, administration, and maintenance personnel. (See Table 3-79.) Average direct employment in Sierra County by the mine would be about 127 employees per year. Workers in Sierra County would experience a roughly $230 million increase in labor income (including benefits), or an average of $13.5 million per year. Peak yearly impacts would occur in years 3, 4, and 5 of the operation phase; and coincide with the highest annual operating cost(s). Direct employment in peak years would vary between 248 and 285; and compensation would vary between $24.4 and $27 million during these 3 years.

Overall, the average annual payroll of Copper Flat employees would contribute significantly to the total wages and salaries in Sierra County. When using an average of $13.5 million in annual payroll, approximately 80 percent is actually “take home” pay, and the other 20 percent goes toward workers’ compensation, health insurance, unemployment, and Social Security. Thus, approximately $10.8 million would flow into local economies where employees reside. If 70 percent of the Copper Flat employees live in Sierra County, the total wages and salaries would represent a maximum of 7.5 percent of total employee compensation in Sierra County based on 2010 employee compensation. (See Table 3-62.)

These workers would represent new purchasing power that would support additional jobs and payroll at local retail and service establishments in Sierra County. Unlike basic industries that export most products, local retailers and service establishments recycle money within the local economy. NMCC would make purchases from local vendors and NMCC employees would shop at local establishments. These local vendors and their employees in turn would make additional local purchases. The total impacts include both the direct and secondary impacts created by other local businesses and their employees. Purchases by both NMCC and its employees outside of Sierra County are not represented here. As discussed above, the IMPLAN database includes multipliers for 440 industries (including mining) to measure these downstream or ripple effects. A multiplier is the ratio of total change in output or employment to initial change (or direct change). There is a larger multiplier effect associated with the consumer spending of workers directly supported by mining operations. Through this spending, the Copper Flat mine would indirectly support almost 1,200 indirect and induced jobs.

IMPLAN does not estimate tax impacts using rates or levies, but rather uses the actual tax collected by the government for the year of the data set. These indirect business taxes, or the taxes on production and imports, are then distributed among the various tax types (e.g., property, severance) based on the State's distributions as defined by the Annual Census of Government Finances. Since sectors for copper mine development and operations did not previously exist, IMPLAN estimates proprietor income, other property type income, and tax on production and imports using national averages. Due to the specificity of the severance and property tax code(s) as it relates to a copper mine in New Mexico, impacts from IMPLAN are not reported here.

Further, while the model estimates other property income (OPI) – corporate profits, capital consumption allowance, payments for rent, dividends, royalties and interest income – these are not considered direct impacts. IMPLAN treats OPI as a leakage (i.e., OPI is not spent in Sierra County and thus does not generate any additional impacts), since it is impossible to model where or how much shareholders would spend or reinvest. Advance royalty and Net Smelter Royalty payments would be made to Hydro Resources, Cu Flat LLC, and GMC after NMCC has received the State and Federal permits required for commercial operation of the mine but before mineral products are sold. Since royalty payments would not be made to any State or Federal entity, impacts to the local economy and residents of Sierra County would be negligible. As such, royalties are not discussed further. Tax impacts are calculated separately and discussed below under “Direct Taxes.”

3.22.2.1.2 Mine Closure/Reclamation

The 3-year reclamation phase would begin during the last year of operation – theoretically, in 2033. However, IMPLAN data are not available past 2030. As such, the estimated impacts from this phase may be overstated. The impact scenario was constructed based on knowing the annual operating costs for this phase. Hazardous and chemicals materials and reagent management; removing surface facilities; plugging drill holes and water wells; recontouring the disturbance area; and reestablishing vegetation for grazing would directly support 162 direct jobs. Unlike the development and operation phases, due to the nonspecialized workers needed for reclamation, the majority of jobs could be filled by the local labor force. More than $25 million in economic activity would result from this phase. (See Table 3-80.)

Table 3-80. Economic Impacts of Reclamation Phase in Sierra County – Proposed Action

Table 3-80. Economic Impacts of Reclamation Phase in Sierra County – Proposed Action			
Impact Type	**Employment**	**Labor Income***	**Value Added**
Direct effect	162	$11,413,646	$21,281,855
Indirect effect	31	$1,034,475	$1,666,336
Induced effect	51	$1,358,069	$2,848,471
Total effect	**244**	**$13,806,190**	**$25,796,661**

Source: Calculations using IMPLAN PRO Version 3.

Note: *Includes wages and benefits.

In contrast to the operation phase, the reclamation phase would directly support the waste management and remediation services sector (as opposed to the copper mining sector), which would enjoy the majority of the increased labor income. (See Table 3-80.) However, the reclamation phase would also create additional labor income in the food service and healthcare sectors.

A reclamation bond is required by the BLM and State of New Mexico to guarantee the completion of project reclamation. Following regulatory review of the proposed plan of operations and reclamation techniques presented herein, NMCC will prepare, at a time specified by the BLM [43 CFR 3809.401(d)], a detailed estimate of the cost to fully reclaim the operations as required by 43 CFR 3809.552. This reclamation plan would be administered by the NMEMNRD MMD and the NMED -- Mining Environmental Compliance Section. Financing will include a mix of equity and debt, but the ratio will depend on market conditions, interest rates, and other factors that will continue to vary over the course of project development. In negotiating specific arrangements for the Proposed Action, factors such as the operator's financial condition, track record, and management systems will likely affect the terms of financial assurance the government will require to give it a feeling of reasonable certainty (ICMM 2005). While dependent on the resulting amount and terms of financial assurance, mitigation measures are proposed to ensure funding would be available to completely cover reclamation costs.

3.22.2.1.3 Public Finance

Direct taxes: NMCC provided estimates of direct tax liabilities under the Proposed Action; direct tax costs by year are summarized below. (See Table 3-81.) The copper ad valorem, severance, and processors taxes paid directly to the State would be over $18 million during the construction, operation, and reclamation phases (NMCC 2014a).

Tax estimates provided in Table 3-81 assume metal prices of $3.00/lb for copper; $9.50/lb for molybdenum; $1,350/oz. for gold; and $22/oz. for silver. Ultimately, State and local tax revenue would be proportional to copper, molybdenum, gold, and silver prices for that year. Additionally, because of the shared distribution of severance taxes throughout the State (80 percent to the State general fund and 20 percent to counties and municipalities), the portion of severance taxes paid to Sierra County and municipalities would only equate to a portion of the total severance taxes generated as a result of the mine.

The increased rate of roadway deterioration is described in Section 3.20, Traffic and Transportation for the Proposed Action and the alternatives. NMCC has consulted with NMDOT to discuss the project and NM 152. NMCC would pay for a one-time overlay for roadway improvements based on a 20-year design life for NM 152 with the projected traffic from the mine. Turn lanes and acceleration lanes would be added to facilitate traffic flow and provide enhanced safety for the traffic around the heavy trucks. The overlay, turn lanes and acceleration lanes would be completed within 12 months of the onset of mine production. After these enhancements are completed, the State would resume normal maintenance of NM-152. A formal agreement has been made between NMDOT and NMCC that documents these proposed improvements.

The tax revenue from the Proposed Action would allow for any increased maintenance costs associated with road repair and infrastructure following the initial enhancements to be addressed. Given the formal agreement between NMCC and NMDOT as well as the additional tax revenue from the project, potential impacts from increased road maintenance costs would be negligible.

Table 3-81. Direct Taxes by Year – Proposed Action

Year	Copper Ad Valorem Tax ($000)	Severance Tax ($000)	Processors Tax ($000)	Transportation Cost ($000)
Construction/Site Preparation				
2016	-	-	-	-
2017	-	-	-	-
Operation/Minerals Beneficiation				
2018	765	139	545	13,631
2019	813	148	591	14,323
2020	796	145	581	13,917
2021	723	131	508	13,150
2022	699	127	495	12,552
2023	625	114	457	11,034
2024	610	111	448	10,678
2025	566	103	419	9,789
2026	500	90	353	8,899
2027	477	86	341	8,366
2028	472	85	333	8,366
2029	519	93	356	9,255
2030	559	101	383	10,073
Closure/Reclamation				
2031	560	101	383	-
2032	594	108	431	-
2033	433	78	316	-
Total	**$9,711**	**$1,759**	**$6,940**	**$143,988**

Source: NMCC 2014.

Indirect taxes: A buyer's GRT liability may be reduced through the use of Industrial Revenue Bonds (IRB), an economic development tool that assigns the county's tax exemption status to the issuer. The IRB would be issued by Sierra County to offset the New Mexico GRT obligations towards certain tangible personal equipment which includes eligible equipment and machinery to be installed and operated at the mine. Under the authority of the County Industrial Revenue Bond Act (Ch. 4, Art. 59, New Mexico Statues Annotated), Sierra County would be the legal purchaser and owner of the IRB property; in turn leasing the property back to the issuer. In this case, NMCC would essentially acquire the tax status of the county, becoming exempt from compensating tax and GRT on purchases of eligible mining and processing equipment.

NMCC has identified IRB-qualifying equipment proposed for the operation and analyzed the proposed capital expenditure list in order to develop an appropriate GRT rate to apply to the economic model. Following this review, an effective GRT rate of 4.30 percent was applied to project capital as an overall average to include the use of IRBs and applicable GRT and compensating tax rates. NMCC is continuing efforts with the external consultants to finalize issuance of the IRB. This effort will also require participation and agreement of Sierra County officials. GRT and compensating taxes are not direct tax revenues to Sierra County, and as such any exemption would have indirect impacts to Sierra County (NMCC 2013).

Mining companies generate a large amount of tax revenue, due partly to the high business taxes they pay and partly because their employees, being highly compensated, also pay high taxes. Provision of government services is a relatively labor-intensive activity. A given quantity of dollars spent on government services supports a relatively large number of jobs. Industries with per employee tax contributions that exceed the statewide average are likely to be making a net fiscal contribution to the State. The companies and their employees pay in taxes an amount that exceeds the value of the services they receive, with the difference serving to subsidize the provision of public services to other residents of the State (AMA 2012).

3.22.2.1.4 Population and Housing

NMCC anticipates hiring over 70 percent of the workforce from communities within a 75-mile radius of the mine. With a total population of 11,988, a labor force of 5,923, and an unemployment rate of 6.2 percent in 2010, Sierra County would only fill a portion of mining jobs needed for all phases of the Proposed Action. Some employees would commute from counties adjacent to Sierra County. Others would be hired from Truth or Consequences and from the rest of Sierra County, but this analysis assumes that a portion of workers would “cross over” to work at the Copper Flat mine (i.e., leave their current job to work at the Copper Flat mine). Relatively few employees from the Hillsboro CDP would be hired, as this community consists largely of retirees.

Current plans do not exist to develop nearby temporary housing. NMCC plans to keep the public and relevant parties informed about timing related to project milestones, and to rely on the market to fill the need (NMCC 2012a). Construction workers are expected to commute to the mine area from their residences rather than relocate, and typically commute up to 2 hours one way for a job, or an average of 73 miles and maximum of 115 miles one way (Gilmore et al. 1982). Assuming that any construction workers relocating to the area would relocate to Sierra County, and based on New Mexico’s average family size of 3.13 individuals, the population is expected to grow at least temporarily by approximately 100 individuals over the duration of the construction phase. The housing vacancy rate in Sierra County was more than 40 percent in 2010, with over 3,700 housing units unoccupied (USCB 2006-2010). Given the number of unoccupied housing units in Sierra County, and that the income per worker in the mining industry is higher than the average income per worker across all industries, workers would not be precluded from renting in Sierra County.

The minimal, increased demand on the local housing market during this time is not likely to cause rental rates to increase. Any increase in rental rates would be nominal and should not affect the ability of individuals living on a fixed income to pay rent. Because property taxes apply to owners (and not renters), the tax base would not be impacted. Any increase in housing demand would therefore not affect Sierra County’s ability to provide funding for social services, health services, or schools. In contrast, the increased tax revenue from the Proposed Action would generate tax revenue that could help fund community services, like facilitating the hiring of new staff at publicly funded medical facilities.

During the operation phase, direct impacts to population in the analysis area would result from approximately 30 percent of employees relocating to the region either temporarily or permanently, including staying in hotels/motels, apartments, or purchasing a home. Assuming that operation workers relocating to the area would relocate to Sierra County, the population is expected to grow permanently by approximately 120-270 individuals (including families) over the duration of the operation phase. Again, considering the significant number of vacant housing units, little or no transient housing would be required in the mine area or in the communities closest to the mine area. Those who relocate would have ample housing options in Sierra County, and in-migration would help offset local housing vacancies.

Section 3.22.1.1.2, Housing, attempts to discern whether Quintana Minerals' Copper Flat mine affected housing in Sierra County. The number of housing units, percent of occupied housing units, the homeownership rate, and the median value of owner-occupied housing units in Sierra County and the State of New Mexico for 1970, 1980, and 1990 are presented in Tables 3-60 and 3-61. The data do not indicate that Quintana Minerals' Copper Flat mine caused property values in Sierra County to decrease. However, any impact on property values would not likely have been realized given that the mine closed after only a few months of operation. And because historical CT and BG data for Sierra County is not readily available, the impact on homes in close proximity to the Copper Flat mine could not be evaluated. A negative impact on property values would have most likely occurred to homes in close proximity to the Copper Flat mine.

Properties in CT 9624.02, BG 2[b] would likely devalue given their proximity to the negative externalities (noise, light, air pollution) associated with the Proposed Action and alternatives. As described in a report entitled "A Framework for Assessing the Economic Benefits of Mine Reclamation: A Case Study Addressing Reclamation of the Molycorp Mine, Questa, New Mexico," there is well-established empirical literature linking various disamenities, contamination and health hazards (e.g., air and water pollution and proximity to hazardous waste sites) to reductions in property values, and losses can often be substantial (although estimates vary widely). There is also evidence for a gradient effect, where more proximal properties receive the highest losses in value (Ecology and Law Institute and Amigos Bravos, 2001). A 2012 article published in the Australian Journal of Agricultural and Resource Economics, "The impact of mining and smelting activities on property values: a study of Mount Isa city, Queensland, Australia," uses the hedonic pricing method to examine the impact of lead and copper mining- and smelting-related pollution on nearby property prices. (The hedonic pricing method is most often used to value environmental amenities that affect the price of residential properties. It can be used to estimate economic benefits or costs associated with environmental quality, including air pollution, water pollution, or noise and environmental amenities, such as aesthetic views or proximity to recreational sites. The basic premise is that the price of a marketed good is related to its characteristics, or the services it provides.) The results of the study show that the marginal willingness to pay (or the amount an individual would be willing to pay for a change in that environmental good or service) to be farther from the pollution source is AUS $13,947 (USD $11,290) per kilometer within the 4-kilometer radius selected (Neelawala et al., 2012).

Unlike the Molycorp Mine near Questa, New Mexico, Quintana Minerals' Copper Flat mine was reclaimed. And while the proposed mine area is located in the United States and not Australia, and does not include on-site smelting activities, the Australian study discusses the impacts of lead and copper mining on property values. But both studies draw similar and applicable conclusions. The Proposed Action and alternatives would likely have a negative effect on property values in Sierra County overall, and the effect would likely be greatest on properties in CT 9624.02, BG 2[b], or those closest to the mine area. However, it is difficult to quantify how much property values would be impacted.

"A Framework for Assessing the Economic Benefits of Mine Reclamation: A Case Study Addressing Reclamation of the Molycorp Mine, Questa, New Mexico" also explains that impacts on property values can vary across neighborhood types, geographical and environmental settings. For example, pollution in otherwise pristine or beautiful settings may generate larger losses than elsewhere (Ecology and Law Institute and Amigos Bravos, 2001). While the Proposed Action is not predicted to have effects on water supplies that would have direct, adverse economic or real estate impacts, Sierra County may generate greater losses given that its natural setting is what draws retirees to the area.

The report uses the Molycorp Mine near Questa, Taos County, New Mexico as a case study, and describes how Questa's economy has long been plagued by the instability of the molybdenum market. Surrounding communities such as Taos, Angel Fire and Red River have been growing as quality of life and physical attractiveness are becoming the most important factors in business location decisions and as a result of increased tourism. Questa has been less able to capitalize on these opportunities due to ecological damage caused by the both the mine and real and perceived threats from the mine to human health and the environment as well as the loss of scenic and aesthetic values. Denuded mining sites deflate property values by causing both an out-migration of residents concerned about the health impacts of nearby mining and by reducing housing demand. The report concludes that as environmental quality improves with reclamation, property values increase, recreation and tourism recover, and communities are better able to market themselves as attractive places to live and work (Ecology and Law Institute and Amigos Bravos, 2001). As such, Sierra County may be less able to capitalize on growth opportunities and experience an out-migration of residents due to real and perceived threats from the Proposed Action and alternatives on human health and the environment.

Other factors that would affect individual property values include the age and condition of the home itself and the history of other negative events (e.g., fire, flooding, or site of a violent crime). Still other factors would depend on individual preferences and needs, such as the proximity to local employment and shopping opportunities, the quality of public education, and the accessibility to public transit. The proximity to local employment opportunities would likely be less of a factor for properties the Hillsboro CDP, given the substantial retirement community. The proximity to local employment opportunities could be considered beneficial to employees relocating to work at the Copper Flat mine. The quality of public education is described in Section 3.22.1.5.3, Education, though again, this factor would likely be less relevant to homes in the Hillsboro CDP given the substantial retirement community. The proximity of homes near the mine area to recreational opportunities is discussed in Section 3.22.2.1.6, Community Cohesion and Quality of Life, and in the following Section 3.22.2.1.5, Community Services. Properties in the mine area are not accessible via public transit. Hillsboro is the closest town to the mine area, and includes a general store and post office, but otherwise the closest shopping opportunities are in Truth or Consequences.

3.22.2.1.5 Community Services

Law enforcement: The number of law enforcement officers (14) and firefighters (179) currently serving Sierra County are presented in Table 3-70. Assuming an increase of about 200 individuals (including families), project-related increases in population would raise the ratio of residents to law enforcement officers and residents to firefighters by less than 1 percent. Since most firefighting and law enforcement units in Sierra County share mutual aid agreements with surrounding counties that allow cross-coverage for emergencies, it is unlikely that the overall increase in population would cause law enforcement and firefighting to become overwhelmed. Should additional law enforcement officers be needed, at least a portion of the funding would be compensated for by the anticipated increased tax revenues arising from the Proposed Action. Unincorporated Sierra County has a volunteer firefighting staff, but municipalities in the county have professional fire departments. Should paid firefighter staff be needed in municipalities or unincorporated Sierra County, the anticipated increase in tax revenue arising from the Proposed Action could mitigate the small impact by facilitating the hiring of firefighters.

Health services: Existing medical services are characterized as one staffed hospital bed per 480 residents of Sierra County. The combined increase in population in Sierra County would increase the staffed bed to person ratio to 1:488. An additional 748 staffed hospital beds in surrounding counties are available to Sierra County residents, but residents would visit Sierra Vista Hospital in an emergency situation.

The Proposed Action would create significant indirect and induced jobs and associated salaries in the healthcare sectors, including private hospitals; offices of physicians, dentists, and other health practitioners; nursing and residential care facilities. Given that Sierra County is a health professional shortage area, any increase in population would further strain the existing medical services. Increased tax revenues could facilitate retaining existing staff and hiring new staff at publicly-funded medical facilities.

Schools: Based on the number of children under the age of 5 years, and a projected increase in enrollment at a rate of 2.4 percent per year on average, Truth or Consequences Elementary School is expected to be over-capacity starting in the 6th year of operation of the Proposed Action. While some students could attend Arrey Elementary School, which could accommodate at least 130 additional students pre-K-5, or Sierra Elementary Complex, which could accommodate at least 35 students in grades 4-5; Truth or Consequences Elementary School is the main facility available for students in grades pre-K-3. If needed, increased local and county revenue from property, copper ad valorem, severance, and GRT taxes could contribute to capital improvements to expand capacity at the Truth or Consequences Elementary School or to hire additional staff.

3.22.2.1.6 Community Cohesion and Quality of Life

Community cohesion: Many of the potential social impacts associated with the Proposed Action are closely tied to boom and bust mining economies. The introduction of a transient workforce population into an established community often changes the social functioning of that community, resulting in increases in the consumption of alcohol, illegal drugs, and misuse of prescription drugs. Subsequently, there may be increases in violence, crime, injury, chronic disease, and mental well-being associated with alcohol and substance misuse. The increases in alcohol and drug use arise from a combination of factors that include increased disposable income, changing family roles, and increased stress among local residents (Mucha 1978). If jobs and income increase social or economic disparity in a region, this could have adverse health impacts across the entire population.

The Proposed Action could adversely impact the social fabric of the local community. In the past, communities that have become specialized in mining go through cycles of economic expansion followed by economic collapse. These cycles can stress families and tend to tear the social fabric of communities as workers have to commute out of the area to work or they and their families have to relocate (Power 2008).

Recreation and tourism: In general, the negative perception of impacts to natural amenities from mining – especially to water quantity and water quality, wildlife, and air quality – that attract recreationists to an area in the first place could be a deterrent in both the short- and long-term. Additional tree removal for additional haul roads and the construction of facilities could contribute to impacts to recreation in the area based on the increased degradation of visual quality. Self-generated receipts at state parks are closely linked to outdoor water-based activities, and the existence of an open-pit copper mine could impact revenue and visitation. However, given that the closest state park, Caballo State Lake Park, is located about 15 miles east of the Copper Flat mine area, any direct impacts on visitation and revenue would likely be negligible.

As noted in Section 3.16, Recreation, the Geronimo Trail Scenic Byway offers scenic views of the Black Range Mountains, Caballo Mountains, Caballo Lake, and Gila National Forest. The extent to which an active mine would deter tourists or recreationists from travelling this byway is difficult to quantify. However, it is likely that during the 1- to 2-year construction period, some may avoid the portion of NM-152 (from Hillsboro east to the junction of NM-152 and Highway 85), where the Geronimo Trail Scenic Byway and the Lake Valley Backcountry Byway overlap, due to the perception of increased traffic and air emissions hindering their experience. Visitation at the Gila National Forest in the western edge of Sierra County may decrease during this time since the Black Range RDs (including the Gila Wilderness) is most easily accessed via NM-152. NM-152 is one of three routes providing access to the Wilderness Ranger District; and one of six to the Silver City Ranger District. Economic benefits derived from direct spending on food, gas, lodging, etc., as well as GRTs generated from visitor spending, would also be affected.

Additionally, the portion of the Geronimo Trail Scenic Byway that follows NM-152 is located in a former mining area, which promotes tourism through sightseeing tours of abandoned mines and ghost towns. While some tourists may be deterred due to the perception of increased traffic and air quality or the degradation of visual quality, some may instead be drawn to the area. The Copper Flat mine project could create or renew interest in nearby ghost mining towns, the mining process, and the evolution of mining in the area; and benefit tourism.

Quality of life and recreational values: Assuming that people value proximity to Elephant Butte Lake State Park, parts of the Gila and Cibola National Forests, the Black Range Mountains, Turtleback Mountain, and the banks of the Rio Grande and its resources; the existence of an open-pit copper mine would negatively impact the value of neighboring properties. National forests that continue to be accessible without fees or undue restrictions are valued as contributing to recreation opportunities and enhancing the overall quality of life in the region. The impacts to (or the perception of impacts to) natural amenities that attract retirees and others to relocate to the area could be a deterrent in the long-term.

As stated earlier, the relationship between mining projects and recreation is unclear. Based on the potential impacts (or perception of impacts) on air quality, water resources, recreation, wildlife, transportation, and noise, the Proposed Action could deter retirees, tourists, and recreationists looking to enjoy Sierra County's natural amenities. That said, the Proposed Action would diversify the industry base as well as provide other employment opportunities.

3.22.2.1.7 Conclusion

The Copper Flat mine would potentially create significant beneficial impacts of major magnitude due to the creation of jobs, labor income, and tax revenues. Overall, the Proposed Action would support over $1.2 billion in economic activity, about 4,100 jobs with salaries worth over a total of $300 million and generate $18.4 million in local and State revenue during the life of the project. The extent of impacts would be medium (localized) to large, since most of the jobs would be filled by area residents but a portion would travel from outside of the economic region. These impacts are probable, since the relationship between an infusion of capital and direct, indirect, and induced impacts is well-established. Due to the lack of operational copper mines in the area with which to compare or base projected impacts, there is moderate confidence in the accuracy of the predictions as to the types, extent, and likelihood of impacts. However, impacts to tax revenue, for example, are dependent on the global price of copper. The precedence and uniqueness of the impact would be minor due to historical copper mining at the same location as well as active copper mines in the nearby Grant and Catron counties.

Although the Proposed Action would yield tangible, major economic benefits for Sierra County in the long term, the socioeconomic impact of this mine remains controversial due to the historical boom and bust cycles that have occurred in the region and elsewhere. Many historical and current mining areas are synonymous with lagging economies, due to the instability or volatility of mining jobs and earnings (which is tied to the global price of copper). High wages and regular layoffs contribute to unemployment, with workers remaining in the local area hoping to be rehired. Recreational amenities from public land are economic assets that can help attract and retain people and their business. A more diverse economy and ready access to larger population centers via road and air travel also play key roles in enabling areas to maximize the benefits of public land; the relationship between the mining and tourism sectors is unclear. Sierra County's ability to promote amenities as well as retain migrants and businesses from the Proposed Action would ultimately determine the long-term size, health, and diversity of the economy.

3.22.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Long-term, major, medium to large extent, probable, beneficial and adverse impacts would occur under Alternative 1. Overall, impacts would be significant. The Accelerated Operations Alternative proposes to increase material processing at the mine from 17,500 tpd to 25,000 tpd or 9,125 kilotons per year (ktons/yr). Economic impacts discussed under Alternative 1 are compared to those discussed under the Proposed Action. Potential impacts to population and housing; community services (including law enforcement, health services, schools); and community cohesion and quality of life would be similar to those discussed under the Proposed Action and are therefore not discussed further.

Project costs under Alternative 1 would be equal to those under the Proposed Action for the permitting, construction, and reclamation phases. Operation of the mine would occur over an 11-year period as opposed to a 16-year period under the Proposed Action. The cost of operations would be lower than under the Proposed Action and the duration would be 6 years shorter. The IMPLAN impact scenario for the operation phase under Alternative 1 was adjusted to reflect the aforementioned information as compared to the Proposed Action. Estimated project costs are shown below. (See Table 3-82.)

Table 3-82. NMCC Estimated Project Costs – Alternative 1

Table 3-82. NMCC Estimated Project Costs – Alternative 1		
Description	**Duration (years)**	**Cost (USD)**
Pre-construction/permitting	2.0	$18,408,000
Construction/site preparation	1.5	$363,535,000
Mining operations	11.0	$1,305,412,000
Closure/reclamation	3.0	$45,398,000
Total	**17.5**	**$1,732,753**

Source: NMCC 2014.

Note: All estimates include resource taxes and exclude income taxes.

3.22.2.2.1 Pre-Construction/Permitting

The overall cost, cost per year, and calendar year of the permitting phase are the same for the Proposed Action and Alternative 1. As such, impacts do not differ from those discussed under the Proposed Action.

3.22.2.2.2 Construction/Site Preparation

The overall cost, cost per year, and calendar year of the construction phase are the same for the Proposed Action and Alternative 1. As such, impacts do not differ from those discussed under the Proposed Action.

3.22.2.2.3 Mining Operations

Under Alternative 1, the operations phase would create over $1 billion in total economic activity and support 3,100 direct, indirect, and induced jobs over a period of 11 years. (See Table 3-83.) Overall, Alternative 1 would create about 175 fewer direct, indirect, and induced jobs than the Proposed Action.

Table 3-83. Economic Impacts of Operation Phase in Sierra County – Alternative 1

Impact Type	Employment	Labor Income	Value Added
Direct effect	2,078	$220,306,831	$1,027,282,854
Indirect effect	168	$5,891,152	$11,329,585
Induced effect	916	$24,206,710	$50,977,531
Total effect	**3,162**	**$250,404,692**	**$1,089,589,970**

Source: Calculations using IMPLAN PRO Version 3.

Under Alternative 1, the Copper Flat mine would directly generate over 2,000 full and part-time jobs during the operations phase. Average direct employment would be about 189 employees per year compared to 127 per year under the Proposed Action (due to the shorter duration of the operations phase). While the overall increase in direct labor income (including benefits) would be about $10 million higher under the Proposed Action, under Alternative 1 the average labor income per year is about $6.5 million higher. The magnitude, duration, and timeframe of peak yearly impacts to employment and labor income would be similar for the Proposed Action and Alternative 1; peak annual operating costs would also occur in years 3, 4, and 5 of the operation phase. Peak yearly impacts and peak annual employment would occur in years 3, 4, and 5 of the operation phase and coincide with the highest annual operating cost(s). Peak employment under Alternative 1 would vary between 315 and 357 in years 3, 4, and 5 of the operation phase, and correspond to compensation between $31 and $33.7 million for these 3 years.

3.22.2.2.4 Closure/Reclamation

While the total and annual cost of the reclamation phase would be the same for the Proposed Action and Alternative 1, the activities would occur in different calendar year(s). However, since IMPLAN data are not available past 2030, the estimated impacts to employment, labor income, and value added do not differ substantially.

3.22.2.2.5 Direct Taxes

NMCC provided estimates of direct tax liabilities under the Proposed Action, and Table 3-84 summarizes the direct tax costs by year. The copper ad valorem, severance, and processors taxes paid directly to the State under the Proposed Action and Alternative 1 would be very similar; and equal about 18.5 million under Alternative 1 or about $80,000 higher (NMCC 2014a). Transportation costs are about 15 percent higher under Alternative 1, but since the processors and severance taxes are calculated net of deductions the overall taxes are not much affected.

Table 3-84. Summary of Tax Revenue – Alternative 1

Tax	Amount ($)
Copper ad valorem tax	$9,756,000
Severance tax	$1,768,000
Processors tax*	$6,969,000
Total	**$18,493,000**

Source: NMCC 2014.

Note: *Net of Transportation Costs and Royalties.

As described under the Proposed Action, NMCC would pay for a one-time overlay for roadway improvements based on a 20-year design life for NM 152 with the projected traffic from the mine. Turn lanes and acceleration lanes would be added to facilitate traffic flow and provide enhanced safety for the traffic around the heavy trucks. These traffic improvements would be completed within 12 months of the onset of mine production. After these enhancements are completed, the state would resume normal maintenance of NM-152. As with the Proposed Action, the tax revenue from Alternative 1 would allow for any increased maintenance costs associated with road repair and infrastructure following the initial enhancements to be addressed. Given the formal agreement between NMCC and NMDOT as well as the additional tax revenue from the project, potential impacts from increased road maintenance costs would be negligible.

3.22.2.2.6 Conclusion

Overall impacts would be similar to those discussed under the Proposed Action. The annual increases in labor income would be higher under Alternative 1, because employment would be concentrated over a shorter period. However, this alternative would create the fewest number of direct, indirect, and induced jobs due to the comparatively short duration of the operations phase; though the associated labor incomes and value added to the economy would be similar to those under the Proposed Action.

3.22.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Long-term, major, medium to large extent, probable, beneficial and adverse impacts would occur under Alternative 2. Overall, impacts would be significant. As with Alternative 1, potential impacts to population and housing; community services (including law enforcement, health services, schools); and community cohesion and quality of life would be similar to those discussed under the Proposed Action and are therefore not discussed further.

Project costs under Alternative 2 are the same for the permitting, construction, and reclamation phases under the Proposed Action and Alternative 1. The cost of the operations phase would be higher than under the Proposed Action, but the duration (and therefore the timing) of the phases would be different. The IMPLAN impact scenario for the operation phase under Alternative 2 was adjusted to reflect the aforementioned differences to the Proposed Action. Similar to Alternative 1, the estimated operational life of the mine is shorter (11 years instead of 16). (See Table 3-85.)

Table 3-85. NMCC Estimated Project Costs – Alternative 2

Description	Duration (years)	Cost (USD)
Pre-construction/permitting	4-5	$18,408,000
Construction/site preparation	1-2	$363,535,000
Mining operations	11	$1,525,285,000
Closure/reclamation	3	$45,398,000
Total	**19-21**	**$1,952,626,000**

Source: NMCC 2014.

Note: All estimates include resource taxes and exclude income taxes.

3.22.2.3.1 Pre-Construction/Permitting

The overall cost, cost per year, and calendar year of the permitting phase are the same for the Proposed Action and Alternative 1. As such, impacts do not differ from those discussed under the Proposed Action.

3.22.2.3.2 Construction/Site Preparation

The overall cost, cost per year, and calendar year of the construction phase are the same for the Proposed Action and Alternative 2. As such, impacts do not differ from those discussed under the Proposed Action.

3.22.2.3.3 Mining Operations

Under Alternative 2, the operations phase would create approximately $1.8 billion in total economic activity and support more than 5,200 direct, indirect, and induced jobs over a period of 11 years; compared to $1.1 billion in total economic activity and over 3,300 direct, indirect, and induced jobs under the Proposed Action. (See Table 3-86.)

Table 3-86. Economic Impacts of Operation Phase in Sierra County – Alternative 2

Table 3-86. Economic Impacts of Operation Phase in Sierra County – Alternative 2			
Impact Type	**Employment**	**Labor Income**	**Economic Activity**
Direct effect	3,440	$364,651,777	$1,700,357,634
Indirect effect	273	$9,568,219	$18,473,030
Induced effect	1,506	$39,762,642	$83,736,506
Total effect	**5,218**	**$413,982,638**	**$1,802,567,171**

Source: Calculations by Author using IMPLAN PRO Version 3.

Alternative 2 would create almost 1,300 more direct jobs than would the Proposed Action; and almost 1,900 more direct, indirect, and induced jobs overall. Average annual direct employment by the mine for Alternative 2 would also be higher than the Proposed Action over the operations phase – about 287 employees per year compared to 127 per year under the Proposed Action. Mine workers in Sierra County would experience a roughly $365 million increase in labor income (including benefits) during the operations phase, or an average of about $30.4 million per year – about $16.9 million more per year than the Proposed Action. Peak yearly impacts would occur in years 3, 4, and 7 of the operation phase, in line with the highest annual operating costs for this alternative. Direct employment in peak years (years 3, 4, and 7 of the operation phase) would vary between 335 and 387 and compensation in these peak years would vary between $34.3 and $36.6 million.

Under Alternative 2, the mining operations phase would last 11 years, would cost $1,525,285,000, and would create 3,440 direct jobs and 273 indirect jobs. Under Alternative 1, the mining operations phase would last 11 years, cost $1,305,412,000, and create 2,078 direct jobs and 168 indirect jobs. Alternative 2 would create more direct and indirect jobs because the cost for this phase is $219,873,000 higher. Given that this alternative is the most expensive and has the highest rate of production (30,000 tpd), more money would be allocated for more workers to be able to meet the production schedule.

3.22.2.3.4 Closure/Reclamation

The overall cost, cost per year, and calendar year of the reclamation phase are modeled the same for the Proposed Action and Alternative 2. Because IMPLAN cannot incorporate activities planned past 2030, impacts do not differ from those discussed under the Proposed Action.

3.22.2.3.5 Direct Taxes

NMCC provided estimates of direct tax liabilities under the Proposed Action, and Table 3-87 summarizes the different direct taxes that would be levied on NMCC. Compared to the Proposed Action, the copper ad valorem, severance, and processors taxes paid directly to the State would be higher under Alternative 2. Transportation costs are about 40 percent higher under Alternative 2 – over $200 million.

Table 3-87. Summary of Tax Revenue – Alternative 2

Table 3-87. Summary of Tax Revenue – Alternative 2	
Tax	**Amount ($)**
Copper ad valorem tax	$11,588,000
Severance tax	$2,099,000
Processors tax*	$8,325,000
Total	**$22,012,000**

Source: NMCC 2014.

Note: *Net of Transportation Costs and Royalties.

As described under the Proposed Action, NMCC would pay for a one-time overlay for roadway improvements based on a 20-year design life for NM 152 with the projected traffic from the mine. Turn lanes and acceleration lanes would be added to facilitate traffic flow and provide enhanced safety for the traffic around the heavy trucks. These traffic improvements would be completed within 12 months of the onset of mine production. After these enhancements are completed, the State would resume normal maintenance of NM-152. A formal agreement has been made between NMDOT and NMCC that documents NMCC's commitment to provide the traffic improvements. Similar to the Proposed Action and Alternative 1, the tax revenue from Alternative 2 would allow for any increased maintenance costs associated with road repair and infrastructure following the initial enhancements to be addressed. Given the formal agreement between NMCC and NMDOT as well as the additional tax revenue from the project, potential impacts from increased road maintenance costs would be negligible.

3.22.2.3.6 Conclusion

In summary, impacts would be similar to those discussed under the Proposed Action. However, the magnitude of both beneficial and adverse impacts would be greatest under this alternative due to the number of direct, indirect, and induced jobs and labor income as well as the associated economic activity in Sierra County. Overall, Alternative 2 would support an additional $700 million in total economic activity and 2,000 jobs compared to the Proposed Action. Given that this alternative has the highest rate of production and therefore gross revenue, the State would collect an additional $3.6 million in direct taxes. That said, economic impacts are still tied to the global price of copper and the potential interruption or termination of copper mining still exists; the magnitude of any potential collapse would therefore also be more severe.

3.22.2.4 No Action Alternative

Under the No Action Alternative, the proposed MPO would not be approved, and mining activities would not occur at the site. If the No Action Alternative is selected, a sulfate plume that resulted from previous Quintana mining activities would be cleaned up according to the Stage 1 Abatement Plan (JSAI 2013a).

Potential impacts on population, housing, employment, income characteristics, economic activity, taxes and revenues, or quality of life conditions would not be significant. The overall impact under the No Action Alternative would be medium-term, minor, of small extent, and possible. Overall, impacts would not be significant.

The cost and duration of the Stage 1 Abatement activities are not known at this time but would likely be substantially lower and shorter (respectively) than the Proposed Action and alternatives. For purposes of this analysis, it is assumed that the cleanup activities would create the need for both specialized and nonspecialized workers, and that at least some of the jobs could be filled by the local labor force. This alternative would create the fewest number of direct, indirect, and induced jobs given the limited scale of the cleanup activities compared to the Proposed Action and alternatives. A small increase in labor income and value added to the economy would still occur. Given the small scope of the cleanup activities, the boom and bust cycle associated with mining activities would not occur under this alternative. It is also assumed that no new materials would be purchased in Sierra County. Sierra County would continue to collect property taxes on NMCC-owned property to which it has patented mining claims so long as the mine is not active and does not sell a mineral product. Because the mine would not be operational, NMCC would not be subject to the copper ad valorem, severance, or processors taxes. Benefits from increased spending and tax revenue under the action alternatives would therefore not occur under this alternative.

The Stage 1 Abatement activities could cause property values to increase, especially in CT 9624.02, BG 2[b], and could also cause an in-migration to Sierra County. Any residual ecological damage caused by the historical mine and real or perceived threats from the mine to human health and the environment that could have still been acting as a deterrent to in-migration would be removed under this alternative. As discussed in Section 3.2, Air Quality, the overall impact on air quality would be less than the Proposed Action given the limited scale of the cleanup activities. In the short-term, cleanup activities involving the use of heavy equipment and machinery, like those generated from drilling activities, would create fugitive dust emissions. In the long-term, the recreational value of the area and quality of life would increase with the completion of Stage I Abatement activities. If the in-migration is substantial, similar impacts to schools and community services described under the action alternatives would also occur under the No Action Alternative.

3.22.3 Mitigation Measures

Mitigation activities could enhance the positive effects and minimize negative effects from "boom and bust" mining activity and ensure that Sierra County receives the maximum benefit from the infusion to its local economy. Potential mitigation could include the following:

- Provide job training programs aimed at developing the skills of the local population to enable employment in the mining industry. While NMCC anticipates hiring over 70 percent of the workforce from local communities, the portion of labor hired locally will be dependent on the skill levels of the local labor force at the time of hiring for the construction phase and the applicability of these skills moving into the operations phase. Such job training program(s) would increase the percentage of local residents filling jobs created by the mine by enabling the local community to identify skills anticipated for operations and allow interested individuals to enhance their skill set.
- Provide benefits package to employees that encourages saving and installation of 401K programs in an effort to reduce the severity of effects from "boom and bust." While the effectiveness of financial education and literacy programs is difficult to measure, most studies find some positive correlation between financial education and financial well-being (Walstad et al. 2010). Financial education has been shown to reduce debt, home foreclosures, bankruptcies (especially medical bankruptcies), and unemployment (Long 2011). The provision of health care and 401K programs could reduce the severity of effects from the "bust."
- Develop community outreach programs that would help communities adjust to changes triggered by mining, such as establishing vocational training programs for the local workforce to promote development of skills required by the mining industry; supporting community health screenings, especially those addressing potential health impacts related to the mining industry; and providing financial support to local libraries for development of information repositories on copper mining, including materials on the hazards and benefits of commercial development. Storing and making this information available electronically could also be of great value (TEEIC 2013b).
- Develop community monitoring programs that would be sufficient to identify and evaluate socioeconomic impacts resulting from mining. Monitoring programs should collect data reflecting

economic, fiscal, and social impacts of the development at both the tribal, State, and local level. Parameters to be evaluated could include impacts on local labor and housing markets, local consumer product prices and availability, local public services (e.g., police, fire, and public health), and educational services. Programs could also monitor indicators of social disruption (e.g., crime, alcoholism, drug use, and mental health) and the effectiveness of community welfare programs in addressing these problems (TEEIC 2013b).

3.23 ENVIRONMENTAL JUSTICE

EO 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations”, requires that Federal agencies consider as a part of their action any disproportionately high and adverse human health or environmental effects to minority and low-income populations. Agencies are required to ensure that these potential effects are identified and addressed.

The USEPA defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” The goal of “fair treatment” is not to shift risks among populations, but to identify potential disproportionately high adverse impacts on minority and low-income communities and identify alternatives to mitigate any adverse impacts.

3.23.1 Affected Environment

For purposes of assessing environmental justice under NEPA, the CEQ defines a minority population as one in which the percentage of minorities exceeds 50 percent or is substantially higher than the percentage of minorities in the general population or other appropriate unit of geographic analysis (CEQ 1997). As with the socioeconomic impacts analysis, since potential impacts with the greatest magnitude, duration, extent, and likelihood would occur in Sierra County, Sierra County is defined as the ROI for any direct and indirect impacts that may be associated with the implementation of the Proposed Action and alternatives. For purposes of comparison, the State of New Mexico is defined as the region of comparison (ROC), or the “general population” as it corresponds to the CEQ definition.

In this section, demographic and income data for Sierra County (the ROI) are compared to demographic and income data for the State of New Mexico (the ROC). Due to the site-specific nature of the Proposed Action and alternatives, census tract (CT) data are then used to identify high concentration “pockets” of environmental justice populations within Sierra County and near the mine area. The distribution of minorities and low-income populations in the vicinity of the mine area are described below.

3.23.1.1 Minority Populations

The CEQ defines “minority” as including the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic Origin; or Hispanic (CEQ 1997). All figures and calculations are based on demographic profile data from the 2010 Census. (See Table 3-88.)

The CEQ defines a minority population in the following ways:

- “…If the percentage of minorities exceeds 50 percent... (CEQ 1997).” As this definition applies to the Proposed Action and alternatives, if more than 50 percent of the Sierra County population consists of minorities, this would qualify the county as constituting an environmental justice population.
- “… [If the percentage of minorities] is substantially higher than the percentage of minorities in the general population or other appropriate unit of geographic analysis (CEQ 1997).” For purposes of this analysis, a discrepancy of 10 percent or more between minorities (the sum of all minority groups) in Sierra County and the State of New Mexico would be considered “substantially” higher, and would categorize Sierra County as constituting an environmental justice population.

Table 3-88. Summary of Minorities and Minority Population Groups in the ROI and ROC

Location	Total Population	Minority (%)	American Indian & Alaska Native (%)	Black or African American (%)	Asian (%)	Native Hawaiian & Other Pacific Islander (%)	Hispanic or Latino (%)
Sierra County[a]	11,988	30.5	1.7	0.4	0.4	0.0	28.0
New Mexico[b]	2,059,179	59.2	9.4	2.1	1.4	0.1	46.3

Source: USCB 2010.

Notes: ROI = Region of Influence; ROC = Region of Comparison

[a] ROI; [b] ROC

As Table 3-88 indicates, Sierra County does not meet the regulatory definition of consisting a minority population or minority group(s). Minorities in Sierra County represent less than 50 percent of their total respective populations, while minorities represent 59 percent of the total state population. The percentage of minorities in Sierra County is lower than the percentage of minorities in the State of New Mexico. By both CEQ definitions of a minority population, the ROI does not constitute an environmental justice population.

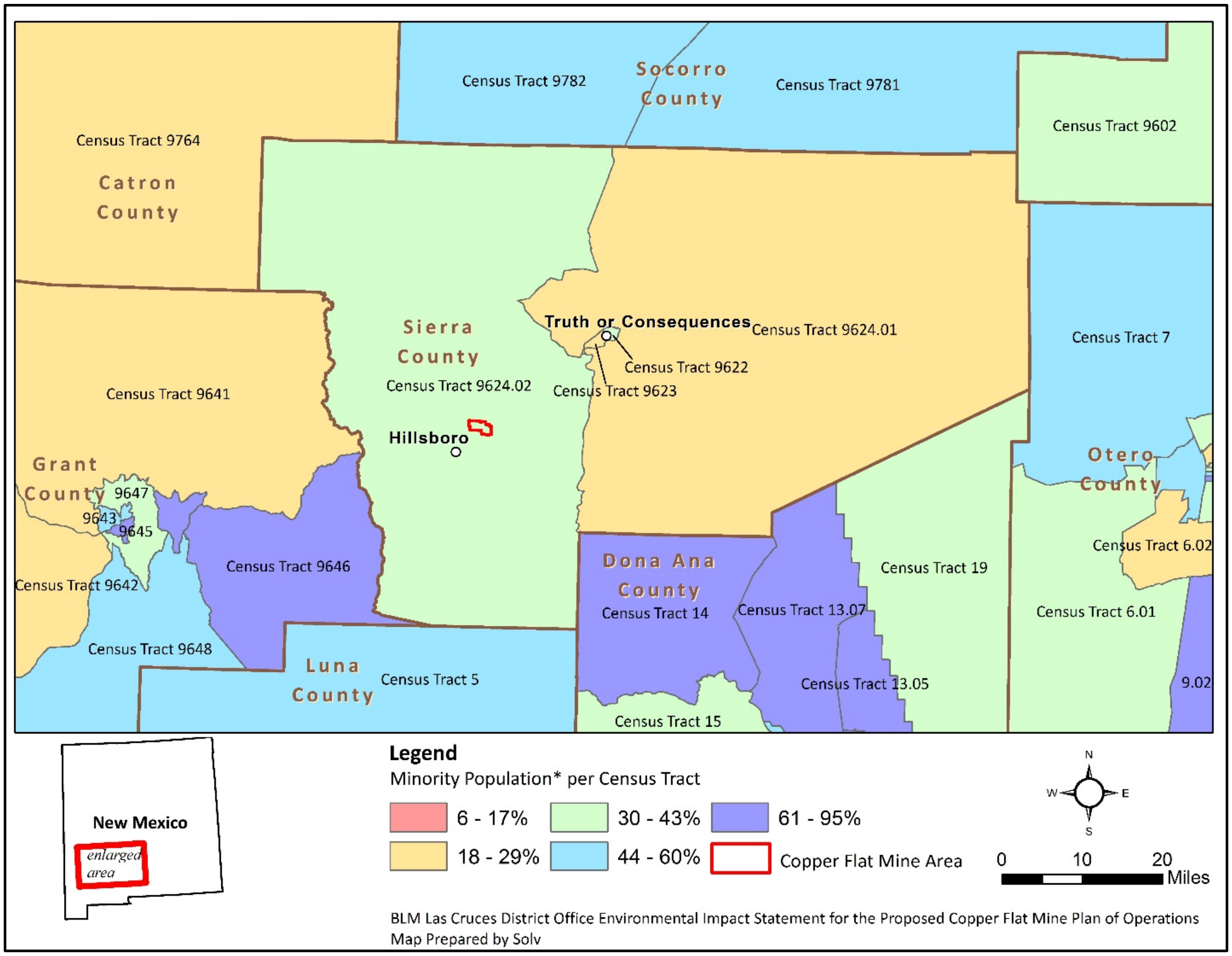
Minority populations by CTs: Due to the site-specific nature of the Proposed Action and alternatives, in addition to describing minority populations on the county level, CT data are used to identify any high concentration "pockets" of minority populations and describe the distribution of minorities in the vicinity of the mine area (CEQ 1998). It should be noted that although Figure 3-52 and Table 3-89 present census data for a geographic area within the ROI, the ROI does not change and is still defined as Sierra County. CTs are small, relatively permanent statistical subdivisions of a county or equivalent entity, generally with a population size between 1,200 and 8,000 people. A CT usually covers a contiguous area, and its boundaries usually follow visible and identifiable features (USCB 2014). They were designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions (USCB 2013).

Potential impacts from traffic delays would be felt most by populations in CTs located near the mine area. The Proposed Action and alternatives are located in CT 9624.02; the percentage of minorities in CT 9624.02 is compared to the percentage(s) of minorities in the nine surrounding CTs to determine whether CT 9624.02 constitutes an environmental justice population. Applying the CEQ definition(s) from above, CT 9624.02 would be identified as an environmental justice population if:

- More than 50 percent of CT 9624.02 consists of minorities; or
- The percentage of minorities in CT 9624.02 is substantially higher than the percentage of minorities in the nine surrounding CTs. For purposes of this analysis, a discrepancy of 10 percent or more between minorities (the sum of all minority groups) in CT 9624.02 and the nine surrounding CTs would be considered "substantially" higher, and would categorize CT 9624.02 as an environmental justice population.

Figure 3-52 shows the distribution of minorities in these CTs, with the proportion of minorities shown using color-coded ranges. These ranges were developed based on commonalities or themes revealed by the CT data. For example, CTs shown in light blue indicate that between 44 and 60 percent of their population is represented by minorities. Each CT is outlined black and labeled with a number (per USCB numbering), and the mine area is shown in red. (See Figure 3-52.)

Figure 3-52. Distribution of Minorities by Census Tract near the Mine Area



Source: BLM 2011; ESRI 2010; USCB 2010.

In CT 9624.02, minorities represent 38.4 percent of the total population. The percentage of minorities in CT 9624.02 does not exceed 50 percent of the population; therefore, it does not constitute an environmental justice population on this basis. (See Table 3-89.)

To determine the percentage of minorities in the nine surrounding CTs, the aggregate estimate of minorities for the nine CTs was divided by the total population for the nine CTs. (See Table 3-89.) In the nine CTs directly surrounding CT 9624.02, minorities represent 48.6 percent of the population. The percentage of minorities in CT 9624.02 is lower than the percentage in the nine surrounding CTs. As such, CT 9624.02 does not constitute an environmental justice population on this basis.

Table 3-89. Minorities and Minority Population Groups near the Mine Area by Census Tract

Census Tract (CT)	Total Population	Minorities (%)	American Indian & Alaska Native (%)	Black or African American (%)	Asian (%)	Native Hawaiian & Other Pacific Islander (%)	Hispanic or Latino (%)
9624.02*	2,589	38.4	1.5	0.1	0.3	0.0	36.5
9623	3,460	29.0	1.7	0.6	0.6	0.0	26.1
9622	3,456	33.1	2.1	0.5	0.3	0.1	30.0
9624.01	2,483	20.7	1.2	0.2	0.4	0.0	18.8
14	5,719	87.4	1.4	0.4	0.4	0.1	85.2
5	4,338	57.0	1.9	0.1	0.2	0.1	53.7
9646	3,060	80.0	2.1	0.4	0.1	0.0	77.4
9641	2,515	24.7	1.7	0.3	0.4	0.0	22.2
9764	3,725	22.3	2.7	0.4	0.2	0.0	19.0
9782	1,851	46.0	8.4	0.7	0.4	0.1	36.5
Aggregate of surrounding CTs	30,607	48.6	2.2	0.5	0.3	0.0	45.5

Source: USCB 2010.

Note: *Proposed Action and alternatives located in CT 9624.02.

3.23.1.2 Low-Income Populations

Low-income populations are defined as households with incomes below the Federal poverty level. There are two slightly different versions of the Federal poverty measure: poverty thresholds defined by the USCB and poverty guidelines defined by the U.S. Department of Health and Human Services (DHHS).

The poverty thresholds are the original version of the Federal poverty measure, and are updated each year by the USCB. The USCB uses a set of income thresholds that vary by family size and composition (number of children and elderly) to determine who is in poverty. If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty. The same applies for a single individual. The official poverty thresholds do not vary geographically, but are updated for inflation. The official poverty definition considers pre-tax income and does not include capital gains or non-cash benefits such as public housing, Medicaid, and food stamps (CEQ 1998). Poverty thresholds are primarily used for statistical purposes, such as calculating poverty population figures or estimating the number of Americans in poverty each year. Poverty threshold figures are reported in the annual poverty report, and provide a yardstick for progress or regress in antipoverty efforts. *Environmental Justice Guidance Under NEPA* recommends that USCB poverty thresholds be used to identify low-income populations (CEQ 1997).

The DHHS poverty guidelines are simplifications of the USCB's detailed matrix of poverty thresholds and are used mostly for administrative purposes, such as determining financial eligibility for certain federal programs. The DHHS guidelines are also used as the basis for many state and regional guidelines, including Head Start, the Food Stamp Program, the National School Lunch Program, the Low-Income Home Energy Assistant Program, and the Children's Health Insurance Program. Similar to the USCB's poverty thresholds, the DHHS poverty guidelines are updated annually and vary based on family size (but not the number of children and elderly). The poverty guidelines do not vary geographically for the 48 contiguous states. The DHHS 2014 poverty guidelines define low-income populations as those whose median household income is at or below the maximum annual income of $19,790 for a family of three (USDHHS 2014).

Because CEQ guidance does not specify a threshold for identifying low-income populations, the same approach used to identify environmental justice minority populations is applied to low-income populations. Sierra County would be defined as a low-income population or environmental justice population if:

- More than 50 percent of Sierra County consists of families or persons below the poverty threshold; or
- The percentage of low-income families or persons in Sierra County is substantially higher than the percentage in New Mexico. A discrepancy of 10 percent or more between Sierra County and the State of New Mexico would be considered “substantially” higher, and would categorize Sierra County as constituting a low-income population.

The CEQ does not use median household income to directly define low-income populations. However, DHHS uses median household figures to define poverty guidelines which are relevant to and have several Federal, State, and regional applications. Median household income figures are also used to identify low-income populations. A discrepancy of 10 percent or more between the median household income(s) in Sierra County and New Mexico would categorize Sierra County as constituting a low-income population.

Poverty and economic figures are based on the USCB American Community Survey (ACS) Selected Economic Characteristics data set from 2006-2010. (See Table 3-90.) Table 3-90 uses these data and provides statistics relevant to assessing the presence of low-income populations in the areas that would be affected by the Proposed Action and alternatives. As displayed below, the percentage of all people below the poverty threshold in Sierra County is 2.1 percent higher than in New Mexico. The percentage of families in Sierra County living below the poverty threshold is 0.1 percent lower than in the State. However, the median household income in the State of New Mexico is $16,507 higher than in Sierra County, or about 39.2 percent higher. The median household income in Sierra County is therefore substantially lower than in the State of New Mexico. Sierra County therefore qualifies as an environmental justice population on this basis.

Table 3-90. Summary of Income and Poverty Statistics in the ROI and ROC

Table 3-90. Summary of Income and Poverty Statistics in the ROI and ROC

Location	Total Population	Percentage of All People Below the Poverty Threshold	Percentage of Families Below the Poverty Threshold	Median Household Income*	Average Family Size
Sierra County[a]	11,988	22.5	15.6	$25,583*	2.64
New Mexico[b]	2,059,179	20.4	15.7	$42,090*	3.13

Source: USCB 2010; USCB 2006-2010.

Notes: *In 2010 inflation-adjusted dollars.

ROI = Region of Influence; ROC = Region of Comparison

[a] ROI; [b] ROC

Low-income populations by CT: As with minority populations, due to the site-specific nature of the Proposed Action and alternatives, CT data are used to identify high concentration “pockets” of low-income populations and describe the distribution of low-income populations in the vicinity of the mine area (CEQ 1998). It should be noted that although Table 3-91 and Figure 3-53 present census data for a geographic area within the ROI, the ROI does not change and is still defined as Sierra County. The potential to experience delays from traffic, suffer a loss of (or gain from) employment or income, or experience adverse effects to general mental and physical health and well-being would be felt most by low-income populations close to the mine area. The Proposed Action and alternatives are located in CT 9624.02, therefore poverty statistics in CT 9624.02 are compared to poverty statistics in the nine surrounding CTs.

Table 3-91. Population Below Poverty Threshold near the Mine Area by Census Tract

Census Tract (CT)	Total Population	Below Poverty Estimate	Below Poverty Percent
9624.02*	2,589	318	12.3
9623	3,460	886	25.6
9622	3,456	978	28.3
9624.01	2,483	544	21.9
14	5,719	2,208	38.6
5	4,338	1,280	29.5
9646	3,060	581	19.0
9641	2,515	274	10.9
9764	3,725	570	15.3
9782	1,851	250	13.5
Aggregate of surrounding CTs	30,607	7,571	24.7

Source: USCB 2006-2010.

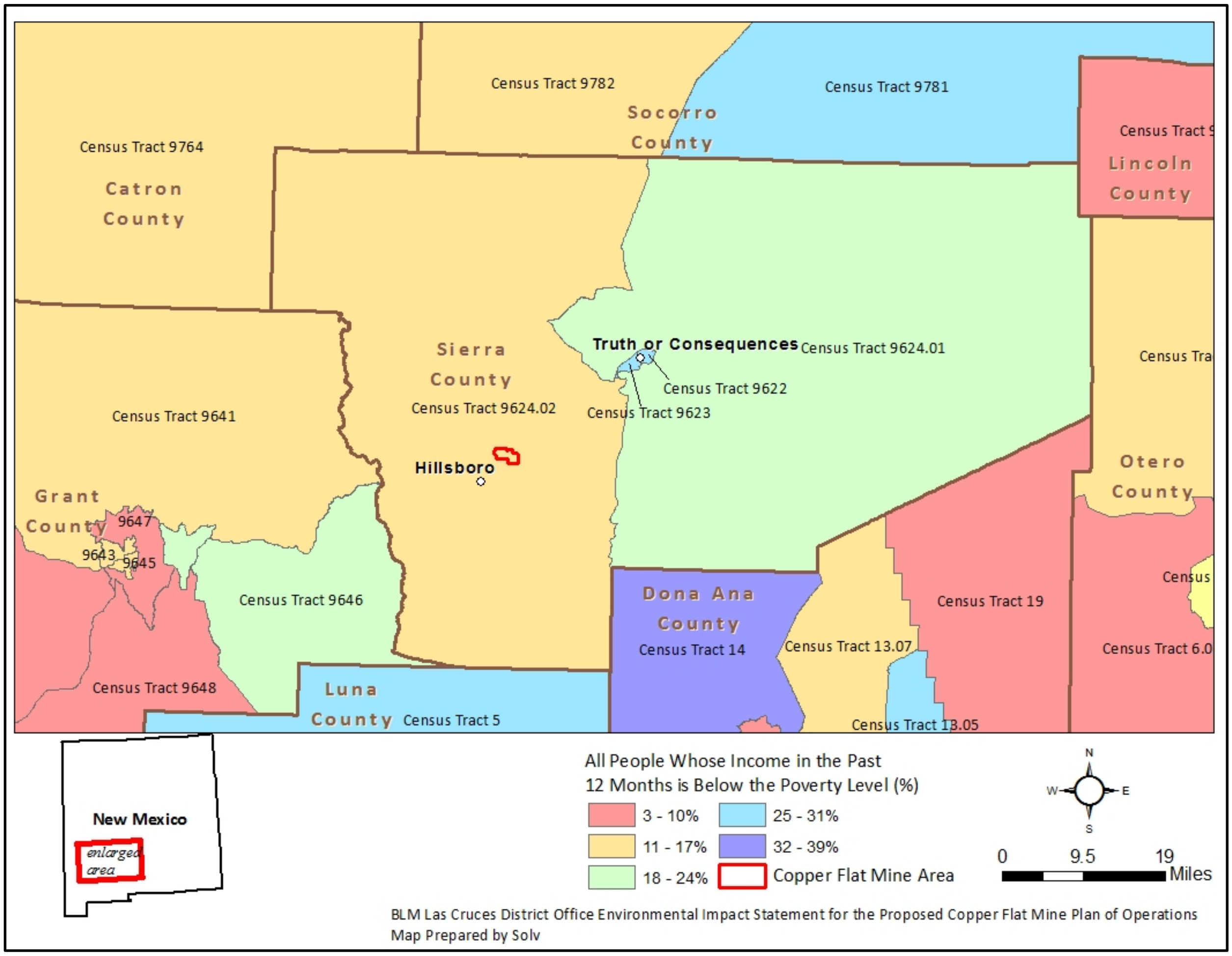
Note: *Proposed Action and alternatives located in CT 9624.02.

Applying the CEQ definition(s) from above, CT 9624.02 would be identified as having a low-income population if:

- More than 50 percent of CT 9624.02 consists of families or persons below the poverty threshold; or
- The percentage of low-income families or persons in CT 9624.02 is substantially higher than the percentage in the nine surrounding CTs. For purposes of this analysis, a discrepancy of ten percent or more between low-income populations in CT 9624.02 and the nine surrounding CTs would be considered “substantially” higher, and would categorize CT 9624.02 as constituting a low-income population.

The distribution of low-income populations by CT is shown below, with the proportion of low-income populations shown using color-coded ranges. (See Figure 3-53.) These ranges were developed based on commonalities or themes revealed by the CT data. For example, CTs shown in light green indicate that between 18 and 24 percent of the population is living below the poverty threshold. Each CT is outlined black and labeled with a number (per USCB numbering); counties are outlined brown; and the mine area is shown in red.

Figure 3-53. Distribution of Low-Income Populations by Census Tract near the Mine Area



Source: BLM 2011; ESRI 2010; USCB 2010f.

In CT 9624.02, low-income populations represent 21.9 percent of the total population. (See Table 3-91.) The percentage of low-income populations in the immediate vicinity does not exceed 50 percent of the population; therefore, it does not constitute an environmental justice population on this basis.

To determine the percentage of low-income populations in the nine surrounding CTs, the aggregate estimate of all persons living below the poverty threshold is divided by the total population for the nine CTs. In the nine CTs directly surrounding CT 9624.02, low-income populations represent 24.7 percent of the population. The percentage of people living below poverty in CT 9624.02 is lower than the nine surrounding CTs; therefore CT 9624.02 does not constitute an environmental justice population on this basis.

In summary, Sierra County overall is not a minority population by either CEQ definition. Sierra County is considered a low-income population due to the substantially lower median household income compared to the State of New Mexico. CT data did not identify high concentration "pockets" of environmental justice populations near the mine area.

3.23.2 Environmental Effects

Consideration of the potential consequences for environmental justice requires three main components:

1. A demographic assessment of the affected community to identify the presence of minority or low-income populations that may be potentially affected.
2. An assessment of all potential impacts identified to determine if any result in significant adverse impact to the affected environment.
3. An integrated assessment to determine whether any disproportionately high and adverse impacts exist for minority or low-income groups present in the study area.

Where minority or low-income populations are found to represent a high percentage of the total affected population, the potential for these populations to be displaced, suffer a loss of employment or income, or otherwise experience adverse effects to general mental and physical health and well-being is assessed in order to determine whether any disproportionately high and adverse impacts would occur as a result of the Proposed Action and alternatives.

3.23.2.1 Proposed Action

Disproportionately high and adverse effects to low-income populations are anticipated. Impacts to low-income populations would be medium- to long-term, minor, of medium extent, and probable. There are no drinking water sources near the mine, and no impacts to community water supplies have been identified in the surface and groundwater analyses. The proposed mining activities would not require lane closures and, therefore, would not restrict access to hospitals and public health facilities or institutional places of worship, but could increase traffic and cause time delays. There would be medium-term effects on low-income miners in close proximity to fugitive dust and heavy vehicle emissions, as well as long-term effects due to historical economic impacts associated with the boom and bust of mining projects. Overall, impacts would be significant.

Sierra County does not constitute an environmental justice population since the percentage of minorities neither exceeds 50 percent nor is substantially higher than the percentage of minorities in the State. Disproportionate impacts to minorities in Sierra County are therefore negligible and are not discussed further.

As described above, Sierra County represents the primary focus and ROI for any direct and indirect impacts that may be associated with the implementation of the Proposed Action and alternatives. For purposes of comparison, the state of New Mexico was defined as the geographic unit of comparison and the "general" population (the ROC).

3.23.2.1.1 Mine Development/Operation

As previously established, Sierra County constitutes an environmental justice population due to low median household income levels. (See Table 3-90, Table 3-91, and Figure 3-53).

In general, the types of potential impacts from the Proposed Action and alternatives would determine the level of potential impacts to low-income populations, and could include:

- **Employment opportunities** – Impacts to mine workers through economic pathways, including from "boom and bust";
- **Impacts to air quality** – Mine workers are inherently exposed to increased fugitive dust and exhaust emissions from heavy machinery;
- **Impacts to water quality** – Health risks from decreased drinking water quality; and

- **Impacts to transportation and traffic** – Increased service demand from workforce migration could increase travel time or miles traveled or restrict or delay access to hospital or healthcare facilities, recreation areas, and institutional places of worship.

Employment opportunities: The Proposed Action would produce over 2,700 direct jobs during the life of the project (24 years), which would be filled by the local labor force to the extent possible. NMCC is working with the local community to identify the skills needed for operations to allow interested individuals to prepare for or enhance their relevant skills (THEMAC 2011). Beneficial impacts would be felt most by those in search of a job, but the Proposed Action would also create a number of indirect or induced jobs from project-related spending and the spending decisions of workers (see Section 3.22, Socioeconomics, for a detailed discussion of jobs and economic activity).

Potential health impacts associated with increased employment overall could disproportionately benefit low-income individuals hired by NMCC. Jobs and income are strongly associated with a number of beneficial health outcomes such as an increase in life expectancy, improved child health status, improved mental health, and reduced rates of chronic and acute disease morbidity and mortality (HDA 2004; Cox et al. 2004).

However, boom periods can also bring about negative health impacts including increases in alcohol and drug use, domestic violence, and unintentional injuries. These types of health impacts have commonly been experienced in other resource extraction communities across North America, and have also been observed in New Mexico during previous mining boom periods (Goldenberg et al. 2010; Seydlitz and Laska 1994; Bush and Medd 2005; Milkman et al. 1980; Brodeur 2003).

Impacts to air quality: As described in Section 3.2, Air Quality, during development, operation, and reclamation of the mine, fugitive dust emissions associated with surface disturbance (drilling, blasting, site development, and other earth-moving activities) would be generated. Fugitive dust and exhaust emissions would occur due to heavy vehicles and equipment traveling over paved and unpaved (gravel) surfaces during the mine's lifetime. The majority of the NO_x, SO_2, and CO emissions would be associated with the vehicle/equipment exhaust. Most of the particulate matter emissions would result from surface disturbances associated with the haul trucks and other vehicles and equipment traveling over paved and unpaved surfaces. Since these emissions would occur at ground level and would likely cause temporary increases in air pollutant emissions in the immediate vicinity of the mine area, it is unlikely that these emissions would be transported more than a few miles, except on windy days and during extreme wind events. Development and operation of the copper concentrate storage shed in Rincon, about 45 miles from the project site, would also generate air emissions. Emissions from the use of heavy equipment at the copper concentrate storage shed would be much less compared to those generated by mine development and operation. BMPs such as road watering and other dust control measures would help reduce the amount of emissions.

As noted in Section 3.2, Air Quality, the magnitude of adverse impacts on air quality from the Proposed Action during the main phases would be minor overall, and the extent would be limited to mine workers – at least some of whom would be low-income. It is unknown at this time what proportion of mine workers hired by NMCC would be low-income, and therefore it is difficult to categorize the magnitude of potential impacts to low-income mine workers due to air quality. However, based on the skills required for workers at copper mines, it is likely that a disproportionate impact to low-income workers would occur.

The USEPA Region 9 and the NMED regulate air quality in New Mexico. The Proposed Action would not exceed major source thresholds outlined in the PSD regulations, generate emissions that would exceed the NAAQS (40 CFR Part 50) or NMAAQS at any nearby location, or contribute to a violation of any

State, Federal, or local air regulation. Each state has the authority to adopt standards stricter than those established under the Federal program. In general, New Mexico accepts the Federal standards; however, the State does have slightly stricter standards for some pollutants such as SO_2, CO, and NO_2, as well as a standard for TSP (NMED 2002).

Impacts to water quality: Contamination of groundwater and surface water could result in adverse health effects to low-income populations if drinking water quality is affected.

As discussed in Section 3.4, Water Quality, adverse impacts to water quality are anticipated to be generally minor, short-term, small extent, unlikely, and adverse. As discussed in Section 3.6, Groundwater Resources, adverse effects to groundwater quality in close proximity to the pit would be major, long-term, small extent, and probable; resulting in an overall finding of significant impact. While the groundwater quality next to the pit lake does not meet State standards, this is only relevant to human health or public safety if groundwater at the pit lake is used as a source of drinking water, which is not the case. Public access to the pit lake affected by an inflow of mining-influenced groundwater would be restricted.

Non-point source pollution could be caused by stormwater runoff from disturbed areas of the mine such as haul roads, parking areas, equipment storage areas, or other ancillary facilities. The required multi-sector general permit for stormwater discharges associated with industrial activity will require preparation of a SWPPP; additional recommendations include the installation and use of BMPs for prevention of non-point source pollution from mine facilities and routine inspection, maintenance, and recordkeeping for all stormwater pollution control facilities. Because non-point source pollution is regulated by existing laws and regulations and the proponent must comply with those laws, potential effects to water quality from non-point source pollution are not considered to be significant. There would be zero stormwater discharge from the from the waste rock piles during operations because it would be captured and reused in the mining process.

Spills or other unanticipated releases of petroleum products, explosives, and other potentially hazardous substances could potentially impact water quality. Because storage, use, management, and spill response for petroleum products, explosives, and other potentially hazardous substances is already addressed by existing laws and regulations (i.e., SCP, a SPCC Plan, and additional requirements set forth by MSHA), and the operator must comply with those laws, potential adverse effects to water quality associated with spills or other anticipated releases of hazardous substances to the environment are not considered to be significant.

There are no drinking water sources near the mine, and no impacts to community water supplies from the use of the freshwater production wells have been identified in the surface and groundwater analyses.

Impacts to transportation and traffic: Access to and from the site would occur via three miles of all-weather gravel road and 10 miles of paved highway (NM-152) east to I-25 and Gold Dust Road. As discussed in Section 3.20, Transportation and Traffic, there would be minimal impact to highway capacity for NM-152 and NM-140 under the Proposed Action. Additional traffic on NM-152 and Gold Dust Road would not be spaced out over the course of the normal day but would primarily be concentrated during shift changes during construction or mine operations. Motorists may experience minor to tolerable delays during these “peak hour” times.

Sierra Vista Hospital is a rural, community-owned and community-operated 25-bed critical access hospital located in Truth or Consequences, about 18.8 miles northeast from the mine area. Payments via Medicaid, State-financed insurance, Medicare, private insurance, and military insurance are accepted. Payment assistance is offered by way of sliding fee scale and on a case-by-case basis (SVH 2014). While some time delays and traffic are anticipated, access would not be restricted in the case of a serious accident. However, Sierra County is listed as a health professional shortage area, or as having limited capacity to handle healthcare emergencies or increases in service demand (HRSA 2014). Impacts to community services, including hospitals, are discussed further in Section 3.22, Socioeconomics.

Approximately 40 percent of the population is affiliated with an institutionalized religion in Sierra County (Admaveg, Inc. 2014). There are nine institutional places of worship located within 20 miles of the proposed mine area (ESRI 2014). The closest, Union Community Church, is located 4.1 miles southwest of the proposed mine area. The Proposed Action is expected to cause medium-term impacts to traffic and produce some time delays in accessing these institutional places of worship, specifically in close proximity to the mine area. (The mine would operate 7 days a week, including on Sundays, 365 days per year.) However, since the majority of institutional places of worship are located in Truth or Consequences, impacts to religious activities at the nine aforementioned places of worship are expected to be minimal.

3.23.2.1.2 Mine Closure/Reclamation

Employment opportunities: As discussed in 3.22, Socioeconomics, the 3-year reclamation phase would support 162 direct jobs. Unlike the development and operation phases, due to the non-specialized workers needed for reclamation, the majority of jobs could be filled by the local labor force.

The social and economic benefits of job creation discussed under Section 3.23.2.1.1, Mine Development/Operation, would not be permanent; they would largely be reversed in the long-term after the mine closes and well-paying mining jobs cease to exist. The impact of mining on local economies around the world has often been described as “boom and bust.” Moreover, the boom and bust cycle can more heavily impact environmental justice populations. Low-income populations have potential vulnerabilities and a tendency to live paycheck-to-paycheck. The newly-earned income tends not to be saved and cash is spent immediately on food and other commodities. Once environmental justice communities and populations become dependent on the mining boom economy, it is often difficult to maintain the same standard of living and quality of life after the boom ends.

Impacts to air quality: Reclamation and revegetation would stabilize exposed soil and control fugitive dust emissions. Once mining ceases and vegetation is re-established, particulate emission levels would return to what is typical for a dry, desert environment. Equipment use, vehicular traffic, and associated emissions would essentially cease following mine closure. Once reclamation is complete, ambient pollutant concentrations would return to existing (i.e., pre-mining operation) levels.

Impacts to water quality: There are no drinking water sources near the mine, and no impacts to community water supplies from the use of the freshwater production wells have been identified in the surface and groundwater analyses. It is unlikely that new impacts to low-income populations as they relate to water quality would occur during mine closure/reclamation if they did not occur during mine development/operation.

Impacts to transportation and traffic: Vehicular traffic would return to pre-mining levels following mine closure.

3.23.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Impacts to low-income populations would be medium- to long-term, minor, of medium extent, probable, and adverse. The effects from mine development, operation, closure, and reclamation would be similar in nature and level as under the Proposed Action. Overall, impacts would be significant.

3.23.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Impacts to low-income populations would be medium- to long-term, minor, of medium extent, probable, and adverse. The effects from mine development, operation, closure, and reclamation would be similar in nature and level as Alternative 1 and the Proposed Action. Overall, impacts would be significant.

3.23.2.4 No Action Alternative

Disproportionately high and adverse effects to low-income populations are not anticipated. Impacts to low-income populations would be short- to long-term, minor, of small extent, and possible. Any adverse impacts associated with traffic and transportation and water quality would be minimal and would not disproportionately impact low-income populations. Short- to medium-term, limited effects could possibly affect low-income, non-specialized workers in close proximity to fugitive dust and heavy vehicle emissions, though all on-site personnel would be affected and therefore the impacts would not necessarily be disproportionate. Social and economic benefits associated with job creation would occur, last the duration of the cleanup activities, and be largely reversed after the jobs cease to exist. Given the small scope of the cleanup activities, the boom and bust cycle associated with mining activities would not occur under this alternative; thus, it would not disproportionately affect low-income populations. Overall, impacts would not be significant.

Under the No Action Alternative, the proposed MPO would not be approved, and mining activities would not occur at the site. However, if the No Action Alternative is selected, a sulfate plume that resulted from previous Quintana mining activities would be cleaned up according to the Stage 1 Abatement Plan (JSAI 2013a).

Employment opportunities: It is assumed that the cleanup activities would create the need for both specialized and non-specialized workers, and that at least some of the nonspecialized jobs could be filled by the local labor force and include low-income populations.

Generally, the same types of social and economic benefits described under Section 2.23.2.1.1, Mine Development/Operation associated with job creation would also occur and last the duration of the cleanup activities. These benefits would not be permanent and would largely be reversed in the long-term after the cleanup activities are completed and these jobs cease to exist. While environmental justice populations can be more heavily impacted by the creation and cessation of jobs, given the scope and duration of the cleanup activities, the boom and bust cycle associated with mining activities would not occur under this alternative.

Air quality: As discussed in Section 3.2, Air Quality, the overall impact on air quality would be less than the Proposed Action given the limited scale of the cleanup activities. On-site personnel would be exposed to fugitive dust emissions from cleanup activities involving the use of heavy equipment and machinery, like those generated from drilling activities. It is assumed that both specialized and non-specialized onsite personnel would be exposed to such fugitive dust emissions. Therefore, potential impacts to air quality would not disproportionately affect low-income workers.

Traffic and transportation: Given the limited scale of the cleanup activities compared to the Proposed Action, any additional vehicles accessing the site via NM-152 and Gold Dust Road would cause minimal impacts to traffic and transportation. These additional vehicles would not cause delays or hinder access to Sierra Vista Hospital or any places of worship in the area.

Water quality: The Stage 1 Abatement Plan would address current water contamination at the existing tailings pond and therefore improve water quality. Abatement actions to remediate a plume underlying the former TSF would likely involve some form of runoff control to minimize dispersion of the plume, and may have an effect on surface water patterns in this vicinity. However, there are no drinking water sources near the mine, and no impacts to community water supplies from the use of the freshwater production wells have been identified in the surface and groundwater analyses. Any effect on water quality would not affect low-income populations – disproportionately or otherwise.

3.23.3 Mitigation Measures

Mitigation activities could enhance the positive effects and minimize negative effects from “boom and bust” mining activity on low-income populations, which are historically more prone to the effects of “boom and bust.” The following suggested mitigations were developed by the BLM as examples of steps that might be taken to reduce potentially significant impacts to environmental justice populations, though the effect of any environmental justice mitigation would be difficult to measure. These examples would be used as a starting point in discussions with adversely and disproportionately impacted populations. Such discussions would be designed to develop mitigation measures that would be acceptable to all parties. Potential mitigations could include:

- Provide job training programs aimed at developing the skills of the local population to enable employment in the mining industry. While NMCC anticipates hiring over 70 percent of the workforce from local communities, the portion of labor hired locally will be dependent on the skill levels of the local labor force at the time of hiring for the construction phase and the applicability of these skills moving into the operations phase. Such job training program(s) would increase the percentage of local residents filling jobs created by the mine by enabling the local community to identify skills anticipated for operations and allow interested individuals to enhance their skill set.
- Provide benefits package to employees that encourages saving and installation of 401K programs in an effort to reduce the severity of effects to environmental justice populations from boom and bust (TEEIC 2013a). While the effectiveness of financial education and literacy programs is difficult to measure, most studies find some positive correlation between financial education and financial well-being (Walstad et al. 2010). Financial education has been shown to reduce debt, home foreclosures, bankruptcies (especially medical bankruptcies), and unemployment (Long 2011). The provision of health care and 401K programs could reduce the severity of effects from the “bust.”

3.24 HUMAN HEALTH AND PUBLIC SAFETY

Hazardous materials and solid waste/solid waste disposal information is described for both the existing condition and the predicted effects from the Proposed Action and alternatives in the following sections: 3.9.1, Affected Environment; 3.9.2, Environmental Consequences; and 3.9.3, Mitigation Measures.

3.24.1 Affected Environment

Mining and related activities may pose risks to human health and public safety (HHPS) without protective measures that minimize these risks. This section describes the HHPS setting elements within which potential effects may occur or are managed to avoid adverse effects. The topics covered in this resource section include:

- Mine Safety Training;
- Pollution;
- Chemicals and Metals;
- Worker Injuries and Fatalities;
- Employment and Health;
- Location-Specific Risks; and
- The Regulatory Environment.

3.24.1.1 Mine Safety Training

Due to the high number of injuries and fatalities caused by special circumstances surrounding mining at the time, the Federal Mine Safety and Health Act of 1977 created the MSHA, which oversees the safety of mine workers (MSHA no date[a]). Any mine worker may file a complaint with MSHA if a safety concern is not resolved with a supervisor (Bokich 2012).

In 30 CFR 48, MSHA requires safety training for all miners, which includes at least 8 hours of refresher training every year and at least 24 hours of training for new miners. A surface metal mine must have a training plan approved by the MSHA District Manager of the area in which the mine is located. The training plan lists the teaching methods and course materials. Required safety topics for the annual refresher course for surface metal miners are:

- Instruction and demonstration of use, care, and maintenance of applicable self-rescue and respiratory devices;
- Instruction on transportation controls, such as controls for transportation of miners and materials, and communication systems, such as use of mine communication systems, warning signals, and directional signs;
- Review of the escape system, escape and emergency evacuation plans in effect at the mine, and instruction in the fire warning signals and firefighting procedures;
- When applicable, introduction to and instruction on the mine's highwall and ground control plans, procedures for working safely in areas of highwalls, water hazards, pits, and spoil banks, and safe work procedures during hours of darkness;
- Instruction on the purpose of taking dust measurements (if applicable), noise, and other health measurements, explanation of any health control plan in effect at the mine, and explanation of the health provisions of the Federal Mine Safety and Health Act and warning labels;
- Recognition and avoidance of electrical hazards;
- Instruction in first aid methods acceptable to MSHA;

- With mines storing or using explosives, review and instruction on explosive related hazards;
- Health and safety aspects of the tasks to which the miner will be assigned; and
- Review of accidents and causes of accidents as well as instruction in accident prevention in work environment.

New miners receive training in the same topics covered in the refresher courses, excluding the review of accidents, as well as training on the following subjects:

- Instruction in the statutory rights of miners and their representatives under the Federal Mine Safety and Health Act and authority and responsibility of the supervisors, which includes procedures for reporting hazards;
- Tour of mine or representative portion of the mine with observation and explanation of method of mining or operation; and
- Recognition and avoidance of present mine hazards.

Additional training subjects for both new and experienced miners may be required by the MSHA District Manager based on the mine's conditions and circumstances. Miners also receive safety training prior to new work for which they have not demonstrated safe operating procedures within the previous 12 months and either received training or performed the task within the previous 12 months. All training must be performed by MSHA-approved instructors, except for new task training of miners and hazard training. A representative for the miners must receive a copy of the training plan or a copy of the training plan must be posted 2 weeks prior to submission to the MSHA District Manager. Any miner comments would be submitted to MSHA with the training plan, or miners can submit directly to MSHA's District Manager concerns regarding the training plan (30 CFR 48).

At least once annually, all surface delivery, office, or scientific worker, students, or occasional, short-term maintenance or service worker would receive hazard training. In addition to any training deemed necessary by the MSHA District Manager, this training includes the following subjects (30 CFR 48):

- Hazard recognition and avoidance;
- Emergency and evacuation procedures;
- Health and safety standards, safety rules, and safe working procedures; and
- Self-rescue and respiratory devices.

3.24.1.2 Pollution

Mining involves activities that could potentially introduce pollution into the environment without protective measures. Workers and the public could be exposed to this contamination, which could cause a wide range of health issues depending on the contaminant type, concentration, and exposure length, as well as individual characteristics, such as age.

Without protective measures, HHPS can be negatively impacted by unmanaged air pollution. Section 3.2, Air Quality, discusses in greater detail the setting for air resources affected by the proposed project. Air pollution can cause breathing problems; throat and eye irritation; cancer; birth defects; and damage to immune, neurological, reproductive, and respiratory systems (USEPA 2012a). Some types of air pollution can lead to global warming (See Section 3.3, Climate, Climate Change and Sustainability). Potential human health and safety impacts can be caused by global climate change effects associated with rising sea level, increased rate of respiratory disease, and increased exposure to extreme heat (Miller 2003). National and State ambient air quality standards provide for the maximum allowable atmospheric concentrations of pollutants that may occur while protecting public health and welfare with a reasonable margin of safety.

Chemical and other material spills from construction and mine operations, typically associated with improper waste management, are also sources of possible impacts to HHPS. Spills can introduce soil and water contamination and create exposure pathways to workers and the public. The severity of risks and effects from a spill are determined by its composition and quantity. For example, a common material used in construction and mine operations that could be spilled at the proposed mine area is diesel, which is an irritant of the lungs and skin. High levels of diesel exposure can cause nervous system damage or death (ATSDR 2011). Section 3.9, Hazardous Materials and Solid Waste/Waste Disposal, discusses in greater detail the affected environment for wastes and materials present from the implementation of the Proposed Action or the alternatives.

The transport of hazardous materials and hazardous wastes on public roadways is controlled by DOT regulations. Any transport of such materials to or from the mine site must be done in compliance with these regulations to protect public safety. All hazardous materials and waste would be transported by commercial carriers contracted by the NMCC in accordance with the hazardous substances shipping requirements of CFR Title 49 and in compliance with the Federal Motor Carrier Safety Regulations of the DOT, parts 383, 390, 397, and 399. In the event of a release, the transportation company would be responsible for response and cleanup. NMCC would specify that the contract carriers be licensed and inspected as required by the New Mexico Department of Public Safety/Motor Transportation Division and the DOT. The permits, licenses, and certificates are the responsibility of the carrier. CFR Title 49 requires that all shipments of hazardous substances be properly identified and placarded. Shipping documents must be accessible and include safety data sheets that contain information describing the hazardous substance, immediate health hazards, fire and explosion risks, immediate precautions, firefighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers. Hazardous wastes would also be transported from the project site to be properly disposed of in accordance with RCRA regulations. Transportation of these waste streams would adhere to all applicable State and Federal regulations including requirements for hazardous waste manifests with shipments, labeling or using placards, and emergency information requirements.

3.24.1.3 Chemicals and Metals

Without protective measures, HHPS could be negatively impacted by uncontrolled exposure to metals and chemicals used in mining. In their undisturbed state, the metals stored in rock are mostly stable within the environment. During mining, there is some potential that these metals may be reintroduced into water, soil, and air, potentially exposing humans and animals (such as livestock). Unmanaged exposure to these metals could cause adverse health effects. Mining processes by their nature concentrate these extracted metals and, without proper management, potentially expose individuals to higher concentrations and increasing associated health risks. The mining process also uses various chemicals that could pose additional health and safety risks, such as those that cause explosions or contain toxic materials. The severity of these risks depend on the type of metal or chemical involved and its quantity, method of exposure (ingestion, inhalation, etc.), and other chemicals in the surroundings that could react producing fumes, fires, and other hazards.

Copper is a naturally occurring metal that, in low quantities, is essential for health. However, toxic health effects occur at high levels of copper exposure. Copper released to the soil from weathering of rocks or discharge from human activities generally bonds to soil’s topic layers. Similarly, copper released into water forms copper compounds or binds to suspended particles in water. Exposure to high levels of copper can irritate the nose, mouth, and eyes. Long-term exposure to particulates containing copper can cause headaches, dizziness, nausea, and diarrhea. The consumption of large amounts of copper in drinking water can also cause nausea, stomach cramps, and diarrhea. Animals that consume sufficient quantities of copper exhibit decreased fetal growth (ATSDR 2004).

Though inadequate human and animals studies prevent the USEPA from determining if copper is a carcinogen (ATSDR 2004), the agency has set a not-to-exceed limit of 1.3 mg of copper per liter in drinking water due to the other negative health effects of copper exposure and consumption (USEPA 2012b). During an 8-hour work shift and 40-hour work week, the Occupational Safety and Health Administration's (OSHA) copper exposure limit is 0.1 mg per cubic meter (mg/m^3) for copper fumes (vapors from heating copper) and 1.0 mg/m^3 for copper dusts and mists (ATSDR 2004).

Molybdenum is another metal that would be mined during this project. It can cause irritation of the eyes, nose, and throat as well as liver and kidney damage (NIOSH 2011). Molybdenum creates fires when in contact with some chemicals, including strong acids used in mining, and must be stored at an appropriate distance from these chemicals. Finely dispersed particles of molybdenum can cause explosions. To prevent explosions and to avoid the health issues found in studies of animals exposed to molybdenum, dust suppression and breathing protection is critical. The National Institute for Occupational Safety and Health has determined that further study is required to determine the health and environmental effects of molybdenum. Molybdenum's threshold limit value is 10 mg/m^3 for the inhalable fraction and 3 mg/m^3 for the respirable fraction based on an 8-hour work day in a 40-hour work week due to adverse health effects seen in animal studies (NIOSH 2006).

Silver is another metal proposed for mining at the Copper Flat site. Silver is naturally released from rocks during weathering. Long-term human exposure to high levels of silver causes arygria, or blue-gray discoloration of body tissues including skin. Respiration of high levels of silver can cause stomach pains, breathing problems, and lung and throat irritation. The Agency for Toxic Substances and Disease Registry (ATSDR) has determined that the reproductive and developmental impacts of silver are unknown due to lack of studies. Similarly, according to USEPA, the human carcinogenicity of silver is not classifiable, mainly due to lack of studies (ATSDR 1999). However, due to suspected health impacts, the USEPA has set a not-to-exceed amount of 0.1 mg per liter of silver in drinking water (USEPA 2012c). Any releases or spills of greater than or equal to 1,000 pounds of silver must be reported to USEPA. The OSHA 8-hour work day, 40-hour work week exposure limit to silver is 0.01 mg/m^3 (ATSDR 1999).

Gold would also be mined at Copper Flat. However, gold presents no health and safety risks that require implementation of protective measures beyond the use of standard dust and safety equipment. Some compounds of gold require additional safety measures (Williams Advanced Materials no date).

As listed in Section 3.9, Hazardous Materials and Solid Waste/Waste Disposal, other chemicals would be used in the proposed project. By volume, the major compounds that would be utilized are lime, ammonium sulfide, and sodium hydrosulfide. Other chemicals would be used at an order of magnitude less (over 1 million pounds per year versus around 100,000 pounds or less per year). Further discussion of chemicals is included in Section 3.9, Hazardous Materials and Solid Waste/Waste Disposal.

Lime or calcium hydroxide can cause sore throat and coughing if inhaled, burning of the eyes, and abdominal pains and cramps if swallowed. Lime violently reacts with acids to form heat and possibly fire, which poses additional safety hazards in industrial scenarios, such as mining, where many different chemicals are used. OSHA has set the time-weighted average permissible exposure limit for lime for 8-hours at 15 mg/m^3 for total dust and 5 mg/m^3 for respirable fraction (NIOSH 1997).

Ammonium sulfide is corrosive and is a fire hazard. It causes irritation, headache, dizziness, and passing out. Symptoms begin at exposure to around 500 ppm. When mixed with water, ammonium sulfide creates the toxic, flammable hydrogen sulfide (NJDHSS 2011). OSHA has not set any exposure limits for this substance (NOAA 1999).

Sodium hydrosulfide is corrosive, toxic with contact to skin, and causes severe eye damage. Inhalation of sodium hydrosulfide causes sore throat and burning sensations. Skin and eye exposure can cause redness, pain, and burns. Ingestion can cause burns, abdominal pain, vomiting, and shock. Sodium hydrosulfide creates dangerous hydrogen sulfide when mixed with moisture. OSHA has not set exposure limits to this substance, but it is considered a poison (NIOSH 2008).

3.24.1.4 Work Injuries and Fatalities

Both construction and mining work would occur during the development phases of the mining project. Both of these types of occupations may be hazardous due to the tasks involved, especially the use of heavy machinery. The 2016 fatal work injury rate per 100,000 FTE workers in the construction industry was 10.1 for construction workers compared to 3.6 for all workers (BLS 2017).

Fatal injuries in private mines, quarrying, and oil and gas extraction sites decreased 11.4 percent in 2016 from 2015 (BLS 2017). Of the 89 fatalities in 2016 for mining, quarrying, and oil and gas extraction, the mining industry alone accounted for 22 of the fatalities within this group, which is 0.4 percent of the 5,190 fatalities reported for all industries. The 2015 all-injury rate of 2.01 per 200,000 hours worked for metal/non-metal mines was a 10.4 percent decrease since 2009 (MSHA 2018a). The 2014 fatality rate of .01042 per 200,000 hours worked for metal/non-metal mines was a 30 percent increase since 2008 (MSHA 2018b).

3.24.1.5 Employment and Health

An issue raised in the public scoping period for this project was the effect of employment on health. A comment was made that there was a lack of local opportunities for youth with and without college educations. Copper Flat would provide training and jobs for those with little or no experience and provide MSHA training and certification. This subsection addresses the relationship of employment status on mental and physical health of workers and their families.

Employment and income have a strong influence on a person’s health. A review of 46 original studies and 23 additional articles on the effect of unemployment on health showed a strong, positive association between unemployment and several poor health outcomes, such as physical or mental illness (Jin et al. 1995). Thirty-three different studies covering over 150,000 participants from 24 different countries also showed that employment is related to health (Hartman no date). This relationship is found in men and women as well as younger and older individuals (Hartman no date). Causality is complicated by confounding factors such as financial hardships (Jin et al. 1995; Bartley 1994).

Employment offers more than financial security; it provides structure, mental and physical activity, and opportunities for social interaction. One study concluded that a reduced psychological and physical state can occur even when unemployment benefits meant no change to income. However, other studies have shown that after 12 to 18 months, the deterioration of health effects from continuous unemployment plateau, which may be due to adaptive responses like lowered personal expectations (Bartley 1994). Further, unfulfilling jobs can be as detrimental to psychological health as unemployment (Bartley 1994; Brousseau and Yen 2000). Spouses and families also receive the benefits of employment and consequences of unemployment (Jin et al. 1995; Brousseau and Yen 2000). One study found unemployment stress to be equal to or exceeding that of a divorce (Jin et al. 1995).

3.24.1.6 Location-specific Risks

In addition to the typical risks associated with mining, the location of the proposed project introduces additional risk factors to human health and safety. This subsection discusses the location-specific risks.

Risks from working outdoors in rural New Mexico include bites or other dangerous exposure to snakes, disease-carrying rodents, and other wildlife such as scorpions and spiders, as well as sun and heat exposure. Twisted ankles or other injuries from working on uneven or unstable ground can also occur. Risks common to use of heavy machinery include injury from entanglement of clothing and other items, such as jewelry. Workers in the project area can fall and injure themselves or others. Risks are also posed by objects falling from areas such as the walls of the mine, TSF, and in other storage and work areas. Working in a remote setting such as Copper Flat mine also complicates injury or safety incidents as emergency medical staff and facilities are 74 miles away.

Large equipment would also be moving into, out of, and around the facility. As with most mining projects, large equipment carrying hazardous materials presents many safety concerns, particularly when related to traffic accidents (see Section 3.20, Transportation and Traffic). NMCC has met with NMDOT several times and has prepared a traffic and pavement study for NMDOT. There is currently a formal agreement between NMDOT and NMCC that would require a 2.5-inch overlay on the highway to be completed 12 months after the onset of mine production that would have the strength to safely sustain expected truck traffic. NMDOT has not expressed a need for paved shoulders, and discussions have not identified a lower level of safety due to existing shoulders.

Radioactive exposure from rocks commonly found in copper mining areas is another potential safety issue. This is discussed in Sections 3.4, Water Quality, and 3.7, Mineral and Geologic Resources.

3.24.1.7 Regulatory Environment

Several laws and regulations that protect worker and public safety would apply to this project. This section briefly notes some of the most relevant examples. MSHA directly regulates mining practices that promote HHPS. Federal agencies such as the USEPA and agencies within the State of New Mexico regulate the quality of the environment, which in turn protects HHPS. Further descriptions of these regulations are in the sections for each applicable resource area, such as air or water.

The Clean Water Act and Federal Water Pollution Control Act Amendments regulate discharge to surface waters from point sources (BLM 2012b). Pursuant to the Clean Water Act, the USEPA reviews the adequacy of NEPA documents (USFS and MDEQ 2011). The New Mexico Water Quality Act, New Mexico Statutes Annotated 1978 §74-6-1 et seq., protects groundwater from pollution and reduces groundwater pollution from mines (BLM 2012b).

RCRA regulates hazardous waste storage, treatment, and disposal (BLM 2012b). By the Emergency Planning and Community Right-to-Know Act of 1986 (42 USC 11001–11050), the private sector must inventory chemicals and chemical products, report those in excess of threshold planning quantities, inventory emergency response equipment, provide annual reports and support to local and State emergency response organizations, and maintain a liaison with the local and State emergency response organizations and the public. The Pollution Prevention Act of 1990 (42 USC 13101–13109) encourages and requires prevention and reduction of waste streams and other pollution through minimization, process change, and recycling. It encourages and requires development of new technology and markets to meet the objectives (USFS 2011).

30 CFR 62 Section 100 sets forth health standards for mines subject to the Federal Mine Safety and Health Act of 1977. Also, 30 CFR 56 provides specific safety and health standards to surface metal and nonmetal mine operations (USFS 2011). New Mexico Statute 69-27-1 requires that mine employers must provide a reasonably safe working environment and utilize all safety procedures and equipment for the workers' protection. Similarly, by New Mexico Statues 69-27-6, all workers must not lessen the safety of

others by failing to obey orders or degrade or remove the equipment (New Mexico Compilation Commission no date).

3.24.2 Environmental Effects

The environmental effects of the proposed expansion of the Copper Flat mine are presented below in 3.4.2.1, Proposed Action; 3.4.2.2, Alternative 1: Accelerated Operations – 25,000 Tons per Day; and 3.4.2.3, Alternative 2: Accelerated Operations – 30,000 Tons per Day.

3.24.2.1 Proposed Action

Short- and medium-term, minor, small extent, possible or unlikely, and adverse effects would be expected under the Proposed Action. Short-term effects may be characterized by such pollutants as fugitive dust and heavy vehicle emissions during site preparation, while medium-term effects would be due to fugitive dust and heavy vehicle emissions during mine operation and reclamation. Effects would be of a small extent, typically confined to the site or facilities within the site. The likelihood of occurrence would be under conditions of a malfunction or upset of routine working conditions. There would also be medium- to long-term, minor, medium extent, probable, and beneficial effects on employment status and health and on actions that are compliant with current laws and regulations. Overall, adverse impacts would not be significant, and beneficial impacts would be significant.

Without protective measures, the mining activities described throughout Chapter 2, Proposed Action and Alternatives, have the potential to pose a risk to HHPS, including blasting, using heavy machinery and chemicals, and risks presented by outdoor activities. There are three important baseline requirements that serve as the foundation for managing HHPS at the mine area. The mine employer provides MSHA-compliant training for mine workers according to an approved plan that raises the level of awareness for all workers and supervisory personnel at the mine area. Second, the mine is inspected at least twice annually by MSHA to help ensure the mine's compliance with established MSHA regulations from development through reclamation. Third, fencing and exclusionary devices such as gates are used to exclude the public, in particular, from areas of the mine that could present unnecessary hazards. Mine workers are trained to recognize and manage hazards, but the public has no training and so is excluded from areas that would pose hazards to untrained individuals.

3.24.2.1.1 Mine Development and Operation

Effects of air pollution are determined by Section 3.2, Air Quality, to be short- and medium-term, minor, of small extent, probable, and adverse. Short-term effects would be due to fugitive dust and heavy vehicle emissions during site preparation, while medium-term effects would be due to fugitive dust and heavy vehicle emissions during mine operation.

Effects of water quality on HHPS are anticipated to be generally long-term, minor, of small extent, unlikely, and adverse (Section 3.4, Water Quality). The exception to these general findings is that groundwater quality effects in close proximity to the pit are determined to be long-term, major, of large extent, probable and adverse. This is because the quality of the existing groundwater next to the pit does not meet State standards set for groundwater quality. Water quality as measured by these standards is only relevant to HHPS if the water were used as a drinking water source, which is unlikely. Public access to the pit lake affected by an inflow of mining-influenced groundwater would be restricted and there are no operational or reclamation purposes served by worker contact with this water. The small extent of the lower quality groundwater near the pit indicates that there would be no HHPS issues associated with water supply withdrawal for uses that could lead to human exposure.

Effects of contamination resulting from waste disposal or handling of hazardous materials are determined by Section 3.9, Hazardous Materials and Solid Waste/Waste Disposal, to be short-term, minor, of small extent, possible, and adverse under the Proposed Action. The use and management of hazardous materials required for operation of the Copper Flat project are intended to occur in accordance with safe handling and disposal procedures established by applicable laws and regulations. The environmental effects would be limited to an accidental release during standard facility operations. No long-term adverse effects would be anticipated due to the required response actions that would be taken in the event of an accidental release.

As discussed in Section 3.9, Hazardous Materials and Solid Waste/Solid Waste Disposal, exposure of humans to extracted metals and chemicals that are classified as hazardous materials and are used in the mining process could produce short-term minor, small extent, possible, and adverse effects under the Proposed Action. In addition, the mandatory mine safety training for workers and suitable access to MSDSs raises the awareness of workers to these possible exposures and trains them in the proper handling, storage, and exposure reduction practices associated with these substances. Regular inspections by MSHA provide an independent regulatory assurance that exposures of this type are minimized or eliminated at the mine area.

The effects from work injuries and fatalities would be short-term and possible. Mining activities are potentially hazardous, so they are regulated by MSHA, inspected regularly for compliance with established health and safety requirements, and subject to mandatory health and safety training for workers to increase awareness and compliant work behaviors. Despite these provisions, work injuries and fatalities in mine construction and mine operation do occur (though rarely), as noted in Section 3.24.1, Affected Environment. The applicable consideration that addresses the rare occurrences of major worker injuries or fatalities is whether they are reasonably foreseeable. With the implementation of the above-mentioned programmatic safeguards, it is reasonable to conclude that worker injuries would be minor in magnitude for expected construction and mine operation activities. NEPA analyses are no longer required to evaluate or base decisions upon worst-case scenarios, which in this case would be major injuries or fatalities that arise despite the implementation of commonplace and mandated safeguards.

Project-specific risks that arise from performing mining work outdoors in rural New Mexico would be short-termand possible with examples involving animal bites, uneven terrain, use of explosives, the movement of large vehicles, operation of crushing and grinding equipment, and high work platforms. These project-specific risks associated with mining or outdoor work are addressed in the mandatory mine worker safety training. Along with important standard mine safety information, which is also project-specific for surface mining issues, the training creates awareness of local topics such as snake-bite avoidance and treatment, other local wildlife that may be hazardous, hazards that may arise from inclement weather, and health and safety responses that may be necessary due to the rural remote location of the mine.

Laws and regulations noted in Section 3.24.1, Affected Environment, require construction companies and mine operators to perform activities in a manner that protects mine workers and the public. In the absence of these laws and regulations, it is possible that these same activities would present greater hazards, perhaps similar to hazardous conditions that were present at mines before laws were enacted and regulations were put in place. Since the effect is beneficial, no mitigation to reduce the significance of the effect is warranted.

3.24.2.1.2 Mine Closure/Reclamation

Under conditions of mine closure and reclamation, the character of work performed at the site would be different from that of mine development and operation. Generally, many of the same hazards remain, although they are somewhat diminished in the scope of potential harm to HHPS with the shutdown of ore processing activities. Fewer personnel would be present and fewer movements of heavy equipment are likely in that hauling of extracted ore, waste rock, and processed ore would have ceased. This would be balanced to an extent by the movement of heavy equipment involved with demolition and recontouring slopes that are being reclaimed.

The effects of potential pollution would be diminished from the mine development and operation stage by the decrease in the level of activity, and would be short-term and unlikely. The potential for air pollution remains due to fugitive dust and heavy equipment emissions, such that CAA compliance responses described in Section 3.2, Air Quality, would remain in effect. Water quality effects described in Section 3.4, Water Quality, would remain as described. Pollution from waste disposal or handling of hazardous materials would be diminished as the potential resulting from the use of chemicals in ore processing would have ceased, even though substances such as diesel fuel would remain on-site.

Effects resulting from exposures to extracted metals and chemicals should be substantially reduced but not eliminated for this stage of the project because metals would no longer be extracted and chemicals used in processing would no longer be used. Adverse effects would be short-term but unlikely. As removal of ore processing equipment occurs, protection from metals exposure resulting from residual concentrations associated with the equipment would be necessary as provided in safety training and standard operating procedures.

The effects from worker injuries and fatalities during the mine closure and reclamation stage would continue to be short-term and possible as the effects and the environment during mine closure and reclamation would be similar to that of mine development and operation. There are fewer concerns with injuries and fatalities associated with ore extraction and processing, but there continues to be a need for safeguards related to use of heavy equipment and demolition activities.

Because of the shorter duration of the mine closure and reclamation period, expected effects due to employment status and health would be medium-term and beneficial. However, since the overall effect would be beneficial, no mitigation to reduce the significance of the effect would be warranted.

Project-specific risks would be the same as for mine development and operations, except that risks for use of explosives and operation of crushing and grinding equipment would be eliminated. The effects of these risks are determined to be short-term and possible.

Actions taken in the mine closure and reclamation stage that are compliant with current laws and regulations would be beneficial, and no mitigation to reduce the significance of the effect would be warranted.

3.24.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Short- and medium-term, minor, small extent, possible or unlikely, and adverse effects would be expected under Alternative 1. The overall effects of this alternative, as well as the individual effects resulting from the implementation of Alternative 1, would be the same as the Proposed Action. The primary differences between Alternative 1 and the Proposed Action that would affect HHPS are as follows:

- Process rate increased to nominal 25,000 tpd;
- Mine life shortened to 11 years due to higher process rate;
- Total disturbance footprint reduced;
- Number and disturbance footprint of rock storage piles reduced;
- Power requirements increased due to increased process rate; and

- Concentrate loads trucked increased due to higher process rate.

The increased ore production rate would result in the employment of more mine personnel on a daily basis, more trucks and heavy equipment utilized on a daily basis, and a shorter mine life. This means that more chemicals would be used, more pollution would be generated, more personnel would be exposed to heavy equipment operation, and the pool of potentially injured workers would be greater for any given day of mine development, mine operation, mine closure, or mine reclamation. Worker training and regulatory applicability would remain at a constant level of protection, however, irrespective of these other increased levels. The shorter mine life means that the total number of days of HHPS exposure over the life of the mine would be reduced by 30 percent. Higher numbers of personnel employed over a shorter mine life tend to balance each other out in the effects of employment. The duration of this effect for mine development and operation is of medium duration rather than long-term; however, the overall effect of employment remains beneficial. Overall, impacts would not be significant.

3.24.2.3 Alternative 2: Accelerated Operations – 30,000 Tons per Day

Short- and medium-term, minor, small extent, possible or unlikely, and adverse effects would be expected under Alternative 2. The overall effect of this alternative and the individual effects resulting from the implementation of Alternative 2 would be the same as the Proposed Action. The primary differences between Alternative 2 and the Proposed Action in terms of how they would affect HHPS are as follows:

- Process rate increased to nominal 30,000 tpd;
- Total tons processed increased 25 million tons over life of mine
- Mine life shortened to 11 years due to higher process rate;
- Total disturbance footprint reduced;
- Number and disturbance footprint of rock storage piles reduced;
- Power requirements increased due to increased process rate; and
- Concentrate loads trucked increased due to higher process rate.

The increased ore production rate would have the same individual effects as described for Alternative 1, except that Alternative 2 would also process 25 million more tons over the life of the mine. This increased production would have no additional effect on the overall or individual effects that were described for Alternative 1. Overall, impacts would not be significant.

3.24.2.4 No Action Alternative

The No Action Alternative would avoid potential impacts of the Proposed Action and alternatives to HHPS. Actions subsequent to the Stage 1 abatement plan may involvement handling and exposure to hazardous wastes. Specific remedies or treatment processes are unknown at this time, but health and safety plans would be reviewed and approved as part of the remediation process. Therefore, expected impacts would be medium-term, minor, of small extent, unlikely, and adverse. Overall, impacts would not be significant.

3.24.3 Mitigation Measures

No specific mitigation measures for HHPS have been identified for any alternative. The implementation of a health and safety training program and actions that are compliant with laws and regulations intended to protect HHPS represent a mitigation measure for mining actions that would otherwise be hazardous, but these safeguards are included with the Proposed Action and two alternative actions with no option for removal.

3.25 UTILITIES AND INFRASTRUCTURE

Utilities and infrastructure that are potentially impacted by the proposed expansion of the Copper Flat mine are described in both their existing condition and the predicted effects from the Proposed Action and alternatives in the following sections: 3.13.1, Affected Environment; 3,13.2, Environmental Consequences; and 3.13.3 Mitigation Measures.

3.25.1 Affected Environment

Utilities that serve the surrounding communities of Hillsboro and Truth or Consequences include power, water, wastewater collections and treatment, and solid waste removal. The communities and households that are served by these utilities are described in Section 3.22, Socioeconomics. The utilities are described below. Mine facilities, buildings, and roads are also discussed.

3.25.1.1 Power

Power to the area is supplied by Tri-State Generation and Transmission Association and distributed by the Sierra Electric Cooperative. A 115-kilovolt (kV) power line was installed for the mine in 1982 because of the limited capacity of existing power lines that supplied the community of Hillsboro and surrounding rural areas (M3 2012). This power line, which comes from a substation 13 miles to the east at Caballo Reservoir, is currently not in service (THEMAC 2013a). The mine's substation, installed in 1982, has since been removed and would need to be reconstructed for the project (M3 2012). In addition to the Tri-State transmission lines, a 345-kV power line owned by El Paso Electric (another regional electric utility) crosses the inactive 115-kV line approximately 7 miles east of the mine.

An existing 25-kV distribution line that originally provided power to the production water wells located east of the mine, the booster stations on the fresh water pipeline, and the reclaim water pump stations at the tailings dam is no longer serviceable for these purposes and would need to be replaced (M3 2012).

3.25.1.2 Water Supply Network

Four high-capacity production water wells are located about 8 miles east of the plant site on BLM-administered public land. These wells were drilled to depths of between 957 feet and 1,005 feet. All are 26 inches in diameter and cased with 16-inch casing. Most of the original roads that serve the production wells, as well as pump foundations, are intact. An existing 20-inch welded steel pipeline transports water to the project site. The pipeline is buried a minimum of 2 feet deep from the well field to the point of entry into the mine area (THEMAC 2011). Inspections of the pipeline conducted in 2011 indicated that it was in serviceable condition pending refurbishment work and repairs (THEMAC 2012). Water supplies for the communities surrounding the project site are provided by local utilities and water districts, including the city of Truth or Consequences and the Hillsboro Mutual Domestic Water Consumers Association (BLM 1999).

3.25.1.3 Sewage Treatment System

Wastewater in the communities surrounding the project site is managed through public utilities and private septic systems. Septic systems were used for domestic waste for previous mining operations, and are no longer in service.

3.25.1.3 Solid Waste Disposal

The Sierra County Landfill north of Truth or Consequences closed at the end of 2010; however, it is still used as a solid waste transfer station where county residents drop off residential refuse for transport to a landfill (Sierra County 2014). Transfer stations also exist at Arrey and Hillsboro. Solid waste in the project area, including waste at these transfer stations, is currently managed at the Truth or Consequences Waste Collection and Recycling Center.

3.25.1.4 Mine Facilities and Buildings

Most mine and mill area buildings from the Quintana mine were removed in 1986, but concrete foundations remain and were backfilled to preserve them for future use. A State and Federally approved water diversion channel also still exists, which redirects off-site drainage flows (stormwater) around the mine area (See Section 3.5, Surface Water Use, for more information about on-site stormwater management). Additional structures and facilities still present on site from the Quintana operation include the primary crusher structure, the reclaim tunnel, concentrator building foundation, truck shop, administration building slab, and the access cut from the millsite to the tailings area (THEMAC 2012).

3.25.1.5 Mine Haul and Access Roads

Transportation and access to the mine is addressed in Section 3.20, Transportation and Traffic. Most original haul and access roads are intact. These roads are unpaved. Existing haul and access roads occupy approximately 23 acres on public and private lands (THEMAC 2011). A number of pre-1981 primitive roads also currently exist within the proposed mine area.

3.25.2 Environmental Effects

This section presents the analysis of environmental effects of the Proposed Action – 17,500 Tons per Day; Alternative 1: Accelerated Operations – 25,000 Tons per Day; Alternative 2: Accelerated Operations – 30,000 Tons per Day; and the No Action Alternative.

3.25.2.1 Proposed Action – 17,500 Tons per Day

Impacts from the Proposed Action would be short-term, minor, of small extent, probable, and adverse. The Proposed Action is not expected to result in the addition of a significant number of households to the surrounding community. This is discussed further in Section 3.22, Socioeconomics. Therefore, an increase in demand for utility services in the communities surrounding the project site as a result of the Proposed Action is not anticipated. The only increase in demand for utility services anticipated would be created by the mining operation. Overall, impacts would not be significant.

3.25.2.1.1 Mine Development/Operation

Power: A 115-kV power line owned by Tri-State Generation that supplied previous mining operations would be reconnected under the Proposed Action. This line does not currently serve any other users and no effects are anticipated from the use of this line. Under the Proposed Action, electrical demand is estimated at 22.4 kWh/ton of produced ore. At the proposed ore production rate of 17,500 tpd, this would result in a daily electrical demand of 391.8 megawatt hours (MWh). Tri-State Generation, the power supplier, has stated that sufficient power generating capacity exists to meet mine needs without impacting other users (Capps 2014). The on-site substation would be reconstructed in the same location as in 1982 and would be fenced and constructed in accordance with BLM stipulations.

The power demands of the mine are not anticipated to approach the capacity of power suppliers under operational conditions studied.

Water supply system: The water demand for the project would be approximately 8,283 gpm with the majority of the water used in the ore processing operation. Of this demand, approximately 5,928 gpm, or 72 percent, would be obtained from reclaimed process water, pit water pumping (dewatering), and other recycling and water conservation measures described in the Proposed Action (Section 2.1.7, Water Supply).

Approximately 2,356 gpm, or 28 percent, would be fresh water make-up (THEMAC 2014). Fresh water would be conveyed from the production wells in an existing 20-inch welded steel pipeline. A pipeline of this size and material type may be expected to carry up to 6,500 gpm (M3 2012). Average annual fresh water use would be approximately 3,802 AF, with a total life of mine water use of approximately 212,000 AF.

Fresh water would be supplied by the existing production wells and would not place a draw on domestic water sources in the surrounding area. There are no drinking water sources near the mine (Section 3.4, Water Quality), and no impacts to community water supplies from the use of the fresh water production wells that have been identified in the surface and groundwater analyses (Sections 3.5, Surface Water Use, and 3.6, Groundwater Resources). The extent to which drawdowns from pumping may impair existing private wells would be finally determined by the New Mexico OSE.

Sewage treatment: Sanitary wastewater would be handled and disposed of through two existing septic tanks/leach fields permitted by the NMED. An estimated daily workforce of 250 persons (Section 2.1.5, Project Workforce and Schedule) using an estimated allowance of 50 gallons per person per day for sanitary purposes (THEMAC 2013b) would result in approximately 12,500 gallons of wastewater per day entering the septic system. The septic systems would be slightly modified, including enlargement of the leach fields and placement of larger septic tanks.

As no demand is anticipated to be placed on domestic or municipal sewage systems in the region, there are no impacts to these systems.

Solid waste disposal: Non-hazardous solid waste generated by the mine would be disposed of in the permitted on-site Class III sanitary landfill on private land, placing no demand on the solid waste disposal system in the surrounding areas. At closure, the landfill would be closed according to NMED requirements (THEMAC 2011). Hazardous waste is addressed in Section 3.9, Hazardous Materials and Solid Waste/Solid Waste Disposal; very small amounts of hazardous waste are expected to be generated and would be removed by a licensed operator for proper disposal at an off-site permitted landfill.

As no demand is anticipated to be placed on county or municipal solid waste disposal systems, no impacts to these systems are expected.

Mine facilities and buildings: Mine facilities would be constructed at the site of the original Quintana plant site and, to the extent practicable, would use the original concrete foundations, thereby minimizing disturbances to new areas. Re-using or upgrading existing infrastructure would limit impacts to areas other than those affected by the original mining operation. Where practicable and economically feasible, NMCC would consider alternative construction materials and techniques to improve the overall energy efficiency of the project. This may include renewable energy generation (solar, wind, etc.) for certain buildings (THEMAC 2011).

Roads: Existing haul and access roads would be utilized to the extent possible. Under the Proposed Action, haul and access road coverage would be increased over the existing area by 35 acres, for a total of 58 acres. Haul roads are not expected to create new areas of disturbance as they would be constructed on previously disturbed land (THEMAC 2011). Exploration roads and pads would be sited as much as possible to avoid any identified cultural resources (THEMAC 2011).

A fugitive dust control program would provide for water application on haul roads and other disturbed areas; chemical dust suppressant application (such as magnesium chloride) may be used where appropriate (THEMAC 2011). Fugitive dust is addressed in detail in Section 3.2, Air Quality.

Roads on the project site would be constructed to meet the demands of the mine, be limited to the mine area, and remain throughout the life of the mine and part of the reclamation period.

3.25.2.1.2 Mine Closure/Reclamation

At closure, all facilities, equipment, and buildings would be removed and areas would be reclaimed according to applicable standards and revegetation plans (THEMAC 2011). Production wells would be abandoned in accordance with applicable rules and regulations (THEMAC 2011).

3.25.2.2 Alternative 1: Accelerated Operations – 25,000 Tons per Day

Impacts from Alternative 1 would be short-term, minor, of small extent, probable, and adverse. As under the Proposed Action, the action proposed under Alternative 1 is not expected to result in the addition of a significant number of households to the surrounding community (Section 3.22, Socioeconomics). Therefore, an increase in demand for utility services in the surrounding community as a result of Alternative 1 is not anticipated. The only increase in demand for utility services anticipated would be created by the mining operation. Overall, impacts would not be significant.

Power: Since the 115-kV power line that would be reconnected under Alternative 1 does not currently serve any other users, no effects are anticipated by the use of this line. Under Alternative 1, electrical demand is estimated at 22.37 kWh/ton. At the proposed ore production rate of 25,000 tpd, this would result in a daily demand of 559.25 MWh. Tri-State Generation, the power supplier, has stated that sufficient power generating capacity exists to meet mine needs without impacting other users (Capps 2014). As in the Proposed Action, the substation would be reconstructed in the same on-site location as in 1982 and would be fenced and constructed in accordance with BLM stipulations.

The power demands of the mine are not anticipated to approach the capacity of power suppliers under any operating condition

Water supply system: The water demand for the project under Alternative 1 would be approximately 11,569 gpm with the majority of the water used in the ore processing operation. Of this demand, approximately 8,292 gpm, or 72 percent, would be obtained from reclaimed process water, pit water pumping (dewatering), and other recycling and water conservation measures described for Alternative 1 in Section 2.2.7, Water Supply. Approximately 3,271 gpm, or 28 percent, would be fresh water make-up. As under the Proposed Action, fresh water would be conveyed from the production wells in an existing 20-inch welded steel pipeline. A pipeline of this size and material type may be expected to carry up to 6,500 gpm (M3 2013). Average annual fresh water use would be approximately 5,280 AF, with a total life of mine water use of approximately 214,000 AF.

Fresh water would be supplied by the existing wells and would not place a draw on domestic water sources (THEMAC 2011). There are no drinking water sources near the mine (Section 3.4, Water Quality), and no impacts to community water supplies from the use of the fresh water production wells have been identified in the surface and groundwater analyses (Sections 3.5, Surface Water Use, and 3.6, Groundwater Resources). At closure, the BLM would decide if production wells and pipelines would be left in place (THEMAC 2012).

Similar to the Proposed Action, the extent to which drawdowns from pumping may impair existing private wells would be finally determined by the New Mexico OSE.

Sewage treatment: Sanitary wastewater would be handled and disposed of through two existing septic tanks/leach fields permitted by the NMED. An estimated daily workforce of 265 people (Section 2.2.5, Project Workforce and Schedule) using an estimated allowance of 50 gallons per person per day for sanitary purposes (THEMAC 2013b) would result in approximately 13,250 gallons of wastewater per day entering the package plant. Fifty gallons per person per day is considered a conservative estimate. The septic systems would be slightly modified, including enlargement of the leach fields and placement of larger septic tanks.

Similar to the Proposed Action, no demand is anticipated to be placed on domestic or municipal sewage systems in the region.

Solid waste disposal: Solid waste disposal would be the same under Alternative 1 as under the Proposed Action. Non-hazardous solid waste generated by the mine would be disposed of in the permitted on-site Class III sanitary landfill on private land, placing no demand on the solid waste disposal system in the surrounding areas.

Mine facilities and buildings: As under the Proposed Action, mine facilities and buildings under Alternative 1 would utilize the original plant site and minimize impacts to new areas. Renewable energy generation and alternative building materials would be considered where practicable.

Roads: Existing haul roads would be utilized under Alternative 1 to the extent possible with some minor realignment. Under Alternative 1, haul road coverage on the project site would be approximately 25 acres, 33 acres less than the Proposed Action. A fugitive dust control program would utilize water, and chemical dust suppressant application (such as magnesium chloride) may be used where appropriate (THEMAC 2012). Fugitive dust is addressed in detail in Section 3.2, Air Quality.

Roads within the project site would be constructed to meet the demands of the mine, would be limited to the mine area, and would remain throughout the life of the mine and part of the reclamation period.

3.25.2.3 Alternative 2: Accelerated Operations– 30,000 Tons per Day

Impacts from Alternative 2 would be short-term, minor, of small extent, probable, and adverse. Similar to the Proposed Action, the action proposed under Alternative 2 is not expected to result in the addition of a significant number of households to the surrounding community (Section 3.22, Socioeconomics). Therefore, an increase in demand for utility services in the surrounding community as a result of Alternative 2 is not anticipated. The only increase in demand for utility services anticipated would be created by the mining operation. Overall, impacts would not be significant.

Power: Under Alternative 2, electrical demand is estimated at 22.36-kWh/ton. At the proposed rate of 30,000 tpd, this would result in a daily demand of 670.8 MWh. Tri-State Generation, the power supplier, has stated that sufficient power generating capacity exists to meet mine needs without impacting other users (Capps 2014). A new substation is planned under Alternative 2 only as a 345-kV, three-breaker ring bus substation, expandable to a future breaker-and-a-half configuration, with a 345/115-kV, 100 mega volt amp transformer bank and single breaker on the 115-kV low-side. This new primary substation would be located on State Trust land south of NM-152 and east of the production wells. The on-site substation would be reconstructed in the same location as in 1982 and would be fenced and constructed in accordance with BLM stipulations.

The power demands of the mine are not anticipated to approach the capacity of power suppliers under any operating condition.

Water supply system: The total water demand for the project under Alternative 2 would be approximately 13,761 gpm with the majority of the water used in the ore processing operation. Of this demand, approximately 9,978 gpm, or 72 percent, would be obtained from reclaimed process water, pit water pumping (dewatering), and other recycling and water conservation measures described for Alternative 2 in Section 2.3.7, Water Supply. Approximately 3,782 gpm, or 28 percent, would be fresh water make-up. As under the Proposed Action, fresh water would be conveyed from the production wells in an existing 20-inch welded steel pipeline. A pipeline of this size and material type may be expected to carry up to 6,500 gpm (M3 2013). Average annual fresh water use would be approximately 6,105 AF, with a total life of mine water use of approximately 257,000 AF.

Fresh water would be supplied by the existing wells and would not place a draw on domestic water sources (THEMAC 2011). There are no drinking water sources near the mine (Section 3.4, Water Quality), and no impacts to community water supplies from the use of the fresh water production wells have been identified in the surface and groundwater analyses (Sections 3.5, Surface Water Use, and 3.6, Groundwater Resources).

Similar to the Proposed Action, the extent to which drawdowns from pumping may impair existing private wells would be finally determined by the New Mexico OSE.

Sewage treatment: All sanitary wastewater would be treated by the planned package water treatment plant and recycled back into the process water stream, placing no demand on the capacities for sewage treatment in the surrounding communities. An estimated daily workforce of 270 people per day using an estimated allowance of 50 gallons per person per day for sanitary purposes (THEMAC 2013b) would result in approximately 13,500 gallons of liquid waste per day entering the package plant (THEMAC 2013a). Fifty gallons per person per day is considered a conservative estimate.

Similar to the Proposed Action, no demand is anticipated to be placed on domestic or municipal sewage systems in the region; therefore, no impacts to these systems are expected.

Solid waste disposal: Solid waste disposal would be the same under Alternative 2 as under the Proposed Action ad Alternative 1. Non-hazardous solid waste generated by the mine would be disposed of in the permitted on-site Class III sanitary landfill on private land, placing no demand on the solid waste disposal system in the surrounding areas. No impacts to these systems are expected.

Mine facilities and buildings: Construction and operation of mine facilities and buildings would be the same under Alternative 2 as for the Proposed Action, utilizing the original plant site and minimizing impacts to new areas. Renewable energy generation and alternative building materials would be considered where practicable (THEMAC 2013a).

Roads: As under the Proposed Action and Alternative 1, existing haul roads would be utilized under Alternative 2 to the extent possible with some minor realignment. Under Alternative 2, haul and access road coverage would be increased over the area required for Alternative 1 by 11 acres, for a total of 36 acres. Exploration roads and pads would be sited as much as possible to avoid any identified cultural resources (THEMAC 2013a).

A fugitive dust control program would provide for water application on haul roads and other disturbed areas; chemical dust suppressant application (such as magnesium chloride) may be used where appropriate (THEMAC 2013a). Fugitive dust is addressed in detail in Section 3.2, Air Quality.

Roads within the project site would be constructed to meet the demands of the mine, would be limited to the mine area, and would remain throughout the life of the mine and part of the reclamation period.

3.25.2.4 No Action Alternative

The No Action Alternative would avoid potential direct and indirect impacts of the Proposed Action or alternatives. No utility or infrastructure upgrades would occur. There will be small utility and infrastructure impacts associated with actions for the Stage 1 abatement process. Those actions are not specifically known yet but are likely to be small in scope as compared with the Proposed Action and alternatives, and so are also likely to be short-term, minor, of small extent, probable, and adverse.

Under the No Action Alternative, no utility or infrastructure upgrades would occur so there would be no direct or indirect environmental impacts.

3.25.3 Mitigation Measures

Mitigation measures identified for the Proposed Action and Alternatives 1 and 2 include implementing alternative power generation where practical; recycling of gray water and process water to reduce overall fresh water use in mining operations; implementing fugitive dust control on roads; and reusing existing haul and access roads, structures, foundations, facilities, and disturbance footprints to the extent practical.

3.26 PALEONTOLOGY

Paleontological resources, or fossils, include the bodily remains, traces, or imprints of plants and animals preserved in the earth. Paleontological resources also include related geological information, such as rock types and ages. Most fossils occur in sedimentary rock formations. The geological and physical characteristics of paleontological resources in a known fossil location, either on or outside of BLM-managed public land, may often indicate the potential presence of other paleontological resources in similar rock formations and outcrops on BLM-managed public land. Unlike cultural resources, which may exist largely at or near the land surface, paleontological resources are found both at the surface and throughout the subsurface environment. The primary source for information in this section, unless otherwise noted, is the TriCounty Draft RMP/EIS (BLM 2013).

3.26.1 Affected Environment

Sierra County has many geologic formations. The rocks of the Precambrian era include a complex of gneiss with metasedimentary and metavolcanic rocks intruded by granites that are not fossil bearing. The rock formations of the Early Paleozoic era (limestones, sandstones, shales, and conglomerates) are widespread in southern New Mexico and include nearly 320 million years of deposition of marine sediments with invertebrate fossils.

In Sierra County, the greatest potential for fossils occurs in the alluvial and terrace deposits (including the Santa Fe Group) along the Rio Grande; in portions of the Caballo, Fra Cristobal, San Andres, and Mimbres mountains; and in the Jornada del Muerto area near Elephant Butte Reservoir. Most of these locations are a considerable distance from the proposed Copper Flat mine. Fossils found in Sierra County are listed below. (See Table 3-92.)

Table 3-92. Fossils Found in Sierra County

Table 3-92. Fossils Found in Sierra County		
Geologic Period	**Formation**	**Fossils**
Quaternary-Tertiary (Neogene)	Otero	Mammals (horse, camel, mammoths), reptiles
Tertiary (Neogene)	Palomas (Santa Fe Group)	Charaphyta, gar fish, crustaceans, mammals (dogs, horses, camels, gomphotheres, coryphodons, leopards), reptiles
Tertiary (Paleogene)	Jordan Canyon	Mammals (merycoidodontidae)
Tertiary (Paleogene)	Love Ranch	Reptiles
Tertiary (Paleogene)	Rubio Peak Formation	Brontothere
Tertiary (Paleogene)	Palm Park	Mammals (horses, brontotheres, hyracodotidae, hyaenodontidae), reptiles, plants
Permian	Abo	Arthropods and other insects, amphibians, reptiles, miscellaneous other vertebrates and invertebrates, conifers and other plants
Permian	Bursum	Vertebrates

Source: BLM 2013.

No paleontological resources of critical or educational value have been identified within the proposed mine area. The western half of the mine area lies predominantly in Cretaceous-age andesite formations, which are not conducive to fossil formation because of their origin in a molten, volcanic environment. The eastern half of the mine area is within the Palomas Formation of the Santa Fe Group.

The Santa Fe Group is Miocene to Pliocene in age, the same age as the Ogallala Formation in eastern New Mexico, which has produced a variety of mammalian fauna. It is designated as a Potential Fossil Yield Classification (PFYC) 3 area (BLM 2013). The PFYC system used by the BLM provides an estimate of the potential that significant paleontological resources will be found in a mapped geological unit and is used to assess possible resource impacts and mitigation needs for federal actions that involve surface disturbance, land use planning, or land tenure adjustment).

The Palomas Formation represents two depositional environments forming interpenetrating wedges: alluvial fan deposits from the surrounding uplifts and axial river deposits from the ancestral Rio Grande. Vertebrate fossil localities have been found in the Palomas Formation in the Palomas Basin area. Almost all of them occur in the axial river deposits (Ziegler 2015).

The mine area also includes some local incisions such as Greyback Arroyo that expose medial and distal alluvial fan deposits of the Palomas Formation. These consist primarily of poorly sorted pebble to cobble gravels or poorly lithified conglomerates with clast composition including basalt, andesite, rhyolite, tuff, chert, and chalcedony (Ziegler 2015).

Some of the fossil material found nearest to Copper Flat includes the Kelly Canyon local fauna (found just north of Caballo), the Caballo local fauna (found along the western shore of Caballo Lake), and the Palomas Creek local fauna (discovered 8 km southwest of Truth or Consequences). The Kelly Canyon local fauna includes fish, frogs, salamanders, snakes, birds, woodrat, and muskrat fossil material. The Caballo local fauna is dominated by much larger animals, including large land tortoises, glyptodonts, horses, camels, deer, and gomphotheres (elephant-like mammals). The Palomas Creek fauna is similar to the Caballo fauna and fossil material pertaining to rodents, horses, peccary, camels, mastodons, tortoises, and ground sloths have been recovered from this locality (Ziegler 2015). The nearest known significant fossil assemblage to Copper Flat is located at Percha Box approximately 2.5 miles south of the project area (BLM 1999).

3.26.2 Environmental Effects

This section discusses impacts on paleontological resources that could occur as a result of proposed mining activities. Surface-disturbing activities involving excavation can “discover,” and at the same time inadvertently damage or destroy, sub-surface paleontological resources. When discovery occurs, resources can be curated for scientific, educational, or recreational values. Conversely, these activities can cause the the fossil resource to be damaged, destroyed, or lost. Restriction of public access during mining operations could reduce the potential for public discovery and diminish the chance of vandalism or theft. Removal of vegetation and soil from the surface may expose fossils. The largest potential impacts on paleontological resources would occur where surface disturbances take place in formations with high potential for paleontological resources.

Activities associated with project activities that could result in erosion would not necessarily damage paleontological resources; however, excessive erosion resulting from surface disturbance could damage fossils present at the surface.

3.26.2.1 Proposed Action

There would be no impacts on paleontological resources under the Proposed Action. No paleontological resources of critical or educational value have been identified within the proposed mine area (BLM 1999).

Paleontological surveys were performed outside the mine area at millsite staging areas that discovered no additional paleontological resources (Ziegler 2015).

3.26.2.1.1 Mine Development/Operation

Under the Proposed Action, no impacts on paleontological resources are anticipated as a result of implementing actions associated with mine construction or mining operations, such as development related to power, water supply, sewage treatment, solid waste disposal, mine facilities and buildings, or roads.

3.26.2.1.2 Mine Closure/Reclamation

At closure, all facilities, equipment, and buildings would be removed and areas would be reclaimed according to applicable standards and revegetation plans (THEMAC 2011). Production wells would be abandoned in accordance with applicable rules and regulations (THEMAC 2011). Under the Proposed Action, impacts on paleontological resources are not anticipated as a result of implementing these actions associated with mine closure and reclamation.

3.26.2.2 Alternative 1

There would be no impacts on paleontological resources under Alternative 1. The environmental effects on paleontological resources under Alternative 1 would be the same as those that would occur under the Proposed Action.

3.26.2.3 Alternative 2

There would be no impacts on paleontological resources under Alternative 2. The environmental effects on paleontological resources that would occur under Alternative 2 would be the same as those that would occur under the Proposed Action. Paleontological surveys were also performed outside the mine area at the site of a proposed electrical substation (only proposed under Alternative 2) that discovered no additional paleontological resources (Ziegler 2015).

3.26.2.4 No Action Alternative

The No Action Alternative would avoid potential direct and indirect impacts of the Proposed Action or alternatives. No impacts to paleontological resources would occur. Actions associated with the Stage 1 sulfate plume abatement process would have a small potential to encounter paleontological resources. Environmental protection measures would be implemented as described in Section 2.1.16, Environmental Protection Measures, in the unlikely event that paleontological resources are discovered as a result of the abatement process.

3.26.3 Mitigation Measures

No paleontological resources have been discovered in the mine area and other surveyed areas. Therefore mitigation measures are not necessary. However, environmental protection measures would be implemented as described in Section 2.1.16, Environmental Protection Measures, in the unlikely event that paleontological resources are discovered as a result of mine development, operations, closure, or reclamation.

3.27 SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

In describing the appropriate content of an EIS, NEPA Section 102(C)(iv) requires that an EIS consider "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity". In its declaration of national environmental policy found within NEPA Section 101, Congress establishes the goal of creating and maintaining conditions for productive harmony between man and nature, charging the Federal government with responsibility for using all practicable means and measures to achieve this harmony.

The primary existing productivity of the Copper Flat mine area features vegetation growth suitable for grazing by livestock (cattle) and other ruminants, as well as other general wildlife habitat. Previous mining activity at the site in the 1980s, with the reclamation and restoration standards required at that time, may have rendered the site less productive than existing conditions prior to mining operations. The site is not used for timber growth or harvest, farming, or any aquatic productivity practices as the existing pit lake is not usable and there is little or no other usable water on the site.

As described in more detail in Section 3.28, Irreversible and Irretrievable Commitment of Resources, there would be a steep, narrow drawdown cone in the immediate vicinity of the open pit that would be permanent. The drawdown potentially may affect the productivity of a nearby well, but there is not sufficient information available to confirm this. If OSE determines that the well would be impaired due to mining operations, the well would be deepened or replaced by NMCC to return its productivity.

For the proposed project, the Copper Flat mine area would be mined for copper and other locatable minerals such as gold, silver, and molybdenum. Through proposed contemporaneous reclamation efforts to be performed during mining operations and final activities performed at closure of the mining phase, the project site would be reclaimed and restored in accordance with a reclamation plan required and approved by the BLM and the MMD.

Once reclaimed, site productivity would return to the same uses of the mine area that occur at present, with the exception that the expansion of the pit lake area would leave slightly less available productive area. These uses would include open range cattle grazing, low-density recreational activities such as hunting, and wildlife habitat. Modern reclamation and restoration standards, including increased soil cover requirements introduced by the recent adoption of the Copper Rule in New Mexico, would likely result in an overall productivity increase in affected land that could meet or exceed levels of productivity present at the site prior to mining activities performed in the 1980s.

Therefore, development of this site for a mine would not eliminate the potential for long-term overall productivity of this land. No significant impacts to long-term productivity are expected to occur from the proposed project.

3.28 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An EIS is required by NEPA Section 102(C)(v) to discuss whether implementing the Proposed Action would, for any reason, irreversibly and irretrievably commit resources, making them unavailable for other purposes. An example of this would be a decision to consume a resource, such as fuel, that is then no longer available for other purposes and cannot be recycled or reused. Such a commitment must be described and evaluated along with benefits of the project.

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mineral ore. Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line ROW or road.

Some resources committed for this project involve requisite amounts of steel, iron, concrete, and fuel required to construct a mine to extract mineral ore. Project equipment and construction commuters would use fossil fuels (diesel and gasoline derived from non-renewable oil) during the construction phase of the mine. Effects from the commitment of construction resources for such a mine (e.g., gravel, cement, iron, etc.) would be expected to be minor and not significant. No significant impact on, or demand for, construction material resources is anticipated.

During operation of the mine, fuel resources would be consumed by trucks hauling ore. Considering the number of trucks per day involved in this transport, no significant impacts to gasoline or diesel fuel resources would occur in the State or the region. Some materials such as steel and concrete may be reclaimed or recycled when the project is completed and the site reclaimed. Fuel used during construction and operation would be irretrievable.

Water used for processing and smaller mining-related uses, although extensively recycled, is not renewable and represents an irreversible use of resources. Groundwater recovery in the bedrock near the mine pit would be limited. Recovery in the Santa Fe Group would eventually (over decades) be essentially complete.

Copper and other locatable minerals would be mined and processed into a more concentrated form. Once mined and processed into refined products, these metals are potentially and very often recycled and reused. Therefore, only a small amount of the refined product would be irreversibly and irretrievably lost as a mineral resource.

A small amount of terrestrial wildlife habitat would be lost long-term due to the expansion of the pit area. Waterfowl would use the expanded pit lake area, but a small amount of terrestrial habitat at the rim of the current pit area would be excavated with the pit expansion.

The site currently presents itself visually as a former mine in the area within and surrounding the mine area because of previous mine activities from the 1980s. At mine closure and the completion of reclamation and restoration activities, the mine would still be visible, perhaps with a visibly larger mine footprint, although modern reclamation and restoration requirements would minimize the long-term visual impacts.

As stated in Section 3.6.2.1.1, Mine Development and Operation, a deep but narrow drawdown cone at the mine pit would be permanent and would continue to slowly expand over time, even after mining has ceased. The BLM has evaluated available information for a private well close to the mine site and within the permanent drawdown cone. Analysis of this information reveals that water would be drawn down in the well approximately 70 feet within the 150-foot-deep well because of pit dewatering. So, a water column would remain at the well, but from this finding alone, the BLM cannot assume there would be no impact to well yield. It remains possible that the small amount of bedrock aquifer thickness available after dewatering would not supply enough water to keep the stock tank full. Without more information, the BLM cannot conclude whether there would be adverse impacts to the long-term productivity of the well.

The Legislature has passed a law (NMSA 1978, §§ 72-12A-1, et seq) allowing a mine to dewater an aquifer (i.e. open pit) that affects existing wells without causing "impairment". In this situation, the mining company may proceed with dewatering. If the well is determined to be impaired by the OSE, the mining company must comply with the law and provide the affected owner with a replacement well or replacement water supply. In this case, the mining company would pay for deepening the well or for drilling a new well if the well's function is diminished by mining operations.

The BLM recognizes and accepts the validity of this approach based upon this law recognizing that the performance of any wells within the permanent drawdown cone is not known to an extent that will allow an accurate determination of impact. If hydrological impacts to these wells from pit dewatering are demonstrated and documented against an accepted baseline as mine operations proceed, then NMCC would be obligated to replace the well or water supply in accordance with this law.

Overall, development and operation of this site for a mine would not eliminate the potential for the irreversible and irretrievable commitment of resources for this land.

CHAPTER 4

CUMULATIVE IMPACTS

CHAPTER 4. CUMULATIVE IMPACTS

The Council on Environmental Quality's (CEQ) Regulations (40 Code of Federal Regulations [CFR] 1500-1508) implementing the procedural provisions of NEPA, as amended (42 United States Code [USC] 4321), define cumulative impacts as:

> *"…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action (40 CFR 1508.7)"*

Incorporating the principles of cumulative impacts analysis into the environmental impact assessment of an action should include the following:

- Past, present, and reasonably foreseeable future actions;
- All Federal, non-Federal, and private actions;
- Impacts on each affected resource, ecosystem, and human community; and
- Truly meaningful effects.

When describing the affected environment of cumulative impacts, natural boundaries should be used. When determining the environmental consequences of cumulative impacts, additive, opposing, and synergistic effects should be addressed. The sustainability of resources, ecosystems, and human communities should also be considered. The analysis should look beyond the life of the Proposed Action and alternatives.

The actions qualifying for inclusion in the cumulative impacts analysis are those that affect a resource or resources potentially affected by the proposed project during all or part of the timespan of the potential impacts from the proposed project. Section 4.1 presents the past, present, and reasonably foreseeable future actions associated with the proposed project area. Section 4.2 provides the cumulative environmental consequences by resource topic, beginning with air quality and following the same order in which resource topics were presented in Chapter 3.

4.1 ACTIONS CONSIDERED IN CUMULATIVE IMPACTS ANALYSIS

The types of projects, actions, and activities considered in the cumulative impacts analysis include highway development; natural resource extraction; water management and development; climatic events; urban and commercial development; and rural development and land management. All past, present, and reasonably foreseeable future projects, actions, and activities considered in this chapter are presented chronologically and are summarized in Table 4-1 below. (See Table 4-1.)

The actions described in this section were identified through personal communication with the BLM and other Federal agency staff and personal communication with commercial and local representatives of the Chambers of Commerce and local economic development entities in the area. Actions that could be considered speculative, such as stating that more development would occur in an area because existing recreational facilities would attract new businesses and residents, are not included in Table 4-1. These are actions that would not meet the criteria which potential future actions must meet to be considered reasonably foreseeable, such as: 1) legislation drafted to implement the action; 2) the existence of a completed approved plan; 3) an awarded contract for work on action; or 4) any work on an action that is currently being prepared.

Table 4-1. Past, Present, and Reasonably Foreseeable Future Actions

Table 4-1. Past, Present, and Reasonably Foreseeable Future Actions	
Project/Action	**Description of the Action**
Past Actions (Settlement to 1950)	
Community settlement	Truth or Consequences, originally known as Hot Springs, grew up around the construction of Elephant Butte Dam in 1912, although the area had long been inhabited by Apache and Spanish settlers.
Livestock grazing and rangeland improvements	Ranching and livestock grazing has been a predominant use of the land since the 1880s, when railroads arrived in the territory. Historically, grazing on public land has been authorized and numerous rangeland improvements such as fencing and watering sources have been developed.
Taylor Grazing Act of 1934	The Taylor Grazing Act of 1934 (Title 43 USC Section 315), signed by President Roosevelt, was intended to "*stop injury to the public grazing lands by preventing overgrazing and soil deterioration; to provide for their orderly use, improvement, and development; to stabilize the livestock industry dependent upon the public range*." The BLM is now required to allot grazing permits to ranchers and monitor and enforce grazing allowances. Additionally, a portion of the fees collected for grazing livestock on public land is returned to the appropriate grazing district to be used for range improvements.
Water development, Elephant Butte and Caballo Reservoir	The Territorial Legislature of New Mexico passed a law providing for the creation of a water users' association that met the Federal requirements to establish these associations on U.S. reclamation projects. A convention was held on May 21, 1906 between the U.S. and Mexico determining that 60,000 acre-feet of water would be sent annually to Juárez, Mexico, from the reservoir at Elephant Butte.
Rio Grande Canalization Project	The Rio Grande Canalization Project was constructed between 1938 and 1943 in southern New Mexico, continuing east to Texas. The project provides protection against a 100-year flood and assures releases of waters to Mexico in accordance with the 1906 convention. It extends 106 miles along the Rio Grande from the Percha Division Dam below Caballo Dam in New Mexico southward into Texas below El Paso.
Climatic events	Severe droughts occurred in the project region in 1916-18, 1921-26, 1934, 1951-57, and 2007-2012. The 1951-57 drought and the latest drought are believed to have been the most severe in the past 350 years. Floods occurred on the Rio Grande in 1904, 1905, 1929, 1935, and 1941 (NOAA 2012).
Military bases: Fort Bliss; Holloman Air Force Base; White Sand Proving Grounds, New Mexico	Established in 1848, Fort Bliss is located on 1.12 million acres of land extending across Texas and New Mexico. With the U.S. entry into World War I, Fort Bliss was garrisoned by a Provisional Cavalry division. Holloman Air Force Base was established in 1942 as Alamogordo Air Field, 6 miles west of Alamogordo. Located east of Las Cruces and later renamed White Sands Missile Range, the White Sands Proving Grounds was established in 1945. The 3,200-square mile range is where the first atomic bomb was tested in 1945.
Elephant Butte State Park	Located on BOR land, Elephant Butte State Park holds the largest and most visited lake in the State of New Mexico. Elephant Butte Dam was completed in 1916 and was the largest dam in the world at the time. It was listed on the National Register of Historic Places in 1979. At full capacity, the lake is 31,000 surface acres of water and the State park includes another 30,000 land acres. It has seven campgrounds, nine comfort stations, a day use area, four boat ramps, five boat docks, and four trails.

Table 4-1. Past, Present, and Reasonably Foreseeable Future Actions (Continued)	
Project/Action	**Description of the Action**
Present Actions (1950 to 2018)	
Elephant Butte State Park	Located on BOR land, Elephant Butte State Park holds the largest and most visited lake in the State of New Mexico. Elephant Butte Dam was completed in 1916 and was the largest dam in the world at the time. It was listed on the National Register of Historic Places in 1979. At full capacity, the lake is 31,000 surface acres of water and the State park includes another 30,000 land acres. It has seven campgrounds, nine comfort stations, a day use area, four boat ramps, five boat docks, and four trails.
Copper Flat mine	Copper mining has been pursued in the Copper Flat area northwest of Hillsboro since the mid-1950s. Exploration continued into the 1970s when sufficient reserves were identified. In 1982, an open pit copper mine was developed and operated for just 3 months. This is the Quintana mine that the Proposed Action would reactivate and expand.
Current ranching activities	Ranching continues to take place on public land in and near the mine area. The Federal Rangeland Improvement Act of 1978 improved grazing allotment management for the BLM. Most of the public land in and surrounding the mine area is grazed by livestock. Livestock production has declined in recent years due to the low market value and the current drought. Currently in New Mexico, livestock grazing on public land is guided by the *New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management* (BLM 2000a).
Wilderness Act of 1964	Congress passed the Wilderness Act of 1964, which directed the Secretary of Agriculture to establish guidelines for wilderness.
Restoration along the Rio Grande to improve riparian habitat, water quality, and water quantity	Restoration improvements along the Rio Grande include reducing the consumptive water use of floodplain vegetation by improving riparian habitat. Current activities include removing salt cedar and planting native vegetation that will enhance riparian habitat and require less water. Other current and ongoing restoration activities include grade control and sediment capture structures, relocating diversions, and reconnecting channels and floodplains.
Desalination plants	A new water desalination plant was constructed on Fort Bliss, east of El Paso International Airport. The facility has been part of the water-supply system for the City of El Paso. Two other plants are in development in Alamogordo: the Tularosa Basin National Desalination Research Facility and the Alamogordo Municipal Desalination Plant. The Alamogordo Municipal Desalination Plant would process water from a well field on public land about 10 miles north of Tularosa.
Nonnative Phreatophyte/ Watershed Management Plan	The *Nonnative Phreatophyte/Watershed Management Plan* focuses on the prevention and control of tamarisk and associated nonnative invasive plants with the ultimate goal of restoring healthy, productive ecosystems. The plan will facilitate management and implementation of future control practices and rehabilitation efforts in New Mexico's watersheds and riparian areas.
New Mexico Environment Department (NMED) Watershed Restoration Action Strategy	The Watershed Restoration Action Strategy grant for the Lower Rio Grande watershed, enabled under the Clean Water Act, Section 319(h), provides an opportunity for the New Mexico Department of Agriculture to list specific water quality problems in the Lower Rio Grande, and it identifies the contaminants that are causing these problems and their sources. Strategies have been developed to improve watershed conditions through best management practices (BMPs).

Table 4-1. Past, Present, and Reasonably Foreseeable Future Actions (Continued)	
Project/Action	**Description of the Action**
New Mexico Department of Game and Fish Comprehensive Wildlife Conservation Strategy	The New Mexico Comprehensive Wildlife Conservation Strategy identifies species and habitats of greatest conservation concern in the State. Its focus is on Species of Greatest Conservation Need (SGCN), key wildlife habitats, and the conservation of both. The desire is that New Mexico's key habitats persist in the condition, connectivity, and quantity to sustain viable populations of SGCN.
Water supply projects	*Elephant Butte Irrigation District:* In 1979, the Elephant Butte Irrigation District assumed control over the operation and maintenance of ditches and canals within its district. However, the BOR remained in charge of the reservoir, dam, and diversion dams.
Bureau of Reclamation (BOR) water management projects	The BOR manages an estimated 70,000 acres in Sierra County, about 4 percent of the County's land base. Its mission is the development of water resources primarily for agriculture and flood control. Although recreation was a peripheral benefit during much of the BOR's history, in recent years the growth of recreation has become a major management activity in many BOR project areas. The BOR has primary responsibility for water storage and delivery for irrigation and municipal use along the Rio Grande River in New Mexico. Currently, the BOR manages two water control projects in the Sierra County portion of the Rio Grande. It monitors arroyos and maintains channels feeding into the river. The BOR also leases land surrounding reservoirs to State Parks for four State parks in the area. The BOR works with the Sierra Soil and Water Conservation District to remove invasive species like salt cedar. It also works with National Resource Conservation Service on stream banks for fish enhancement.
BLM's Resource Management Plan (RMP) covering Sierra County	The BLM manages 822,000 acres in Sierra County, nearly 45 percent of its land base. A land use plan for the BLM is called a Resource Management Plan (RMP). The White Sands RMP covers Sierra and Otero counties, and was last updated in 1986. The Mimbres RMP covers Doña Ana, Luna, Hidalgo, and Grant counties and was last updated in 1993. The Draft TriCounty RMP was published in 2013 and covers Sierra, Otero, and Doña Ana counties.
State of New Mexico ex. rel. Office of the State Engineer v. Elephant Butte Irrigation District, CV-96-888	On December 28, 2017, the New Mexico Third District Court rendered its decision in respect of the water rights associated with the Copper Flat Project. The Court determined that: 1) the Mendenhall Doctrine did not apply to the water rights claimed by NMCC because there was no continuous reasonable diligence to place the water rights to use at the mine; 2) NMCC has the option to purchase vested water rights from two water rights holders of 861.84 acre-feet per year (AFY); 3) NMCC's assertion of ownership of an additional 696 AFY acquired as part of the purchase of the Copper Flat Project from Hydro Resources were found to be extinguished as a result of abandonment, other than a stock right in one well and a water element of the 34 AFYassociated with the open pit; and 4) the inchoate Mendenhall water rights claimed by NMCC have also been extinguished because of a lack of due diligence by the predecessors in placing the water to beneficial use.

Table 4-1. Past, Present, and Reasonably Foreseeable Future Actions (Continued)	
Project/Action	**Description of the Action**
Texas v. New Mexico and Colorado, U.S. Supreme Court	In 2013, Texas sued New Mexico and Colorado, alleging that by allowing farmers in southern New Mexico to pump from groundwater wells near the Rio Grande, New Mexico has failed to send its legal share of water downstream. The U.S. government argued that New Mexico was also harming its ability to deliver water under the Compact, as well as under its international treaty with Mexico. On March 5, 2018, a unanimous U.S. Supreme Court opinion determined: 1) the Compact is inextricably intertwined with the Rio Grande Project and the Downstream Contracts; 2) New Mexico has conceded in pleadings and at oral argument that the United States plays an integral role in the Compact's operation; 3) a breach of the Compact could jeopardize the Federal government's ability to satisfy its treaty obligations to Mexico; and 4) the United States has asserted its Compact claims in an existing action brought by Texas, seeking substantially the same relief and without that State's objection. Otherwise, the outcome of this case still remains uncertain.
Projected population growth	The populations of Sierra, Otero, and Doña Ana counties are anticipated to increase through the life of the TriCounty RMP. Below are population projections for the *TriCounty RMP/EIS Planning Area*. (see population projections table below) Source: BBER 2017.
Spaceport America	Spaceport America is the first purpose-built commercial spaceport in the world. It is located a short distance from Truth or Consequences in southern Sierra County. Virgin Galactic is the spaceport's anchor tenant. Spaceport America has been providing commercial launch services since 2006. Phase One construction is now complete. Phase Two of the construction and pre-operations activities has begun and includes improvements to the vertical launch complex, the paving of the southern road to the spaceport, and the development of a world-class visitor center for students, tourists, and space launch customers.
SunZia transmission lines	SunZia Transmission, LLC, plans to construct and operate two 500-kilovolt (kV) transmission lines originating at a new substation in Lincoln County in the vicinity of Corona, New Mexico, and terminating at the Pinal Central Substation in Pinal County near Coolidge, Arizona. The proposed transmission lines would cross just to the east of the proposed mine area.
Union Pacific Intermodal Transfer Station	A Union Pacific rail facility in Santa Teresa, New Mexico was constructed and completed in 2014. The locomotive fueling station and intermodal freight yard occupies 2,200 acres, and includes fueling facilities, crew change buildings, and an intermodal yard and ramp to load and unload up to 250,000 containers annually that for seamless transfer among ships, trucks, and trains.
TriCounty Resource Management Plan (RMP) decisions as it relates to the Lake Valley Back Country Byway	This Byway is nestled between the Mimbres and Caballo Mountains and the Cooke's Range in southwestern New Mexico. It traverses NM Highways 152 and 27 between Las Cruces and Truth or Consequences, near a string of lakes and reservoirs in Sierra County. TriCounty RMP decisions are forthcoming from BLM for the Byway.

County	**Population Projections by Year**		
	2020	**2030**	**2040**
Sierra	12,048	12,218	12,737
Otero	66,367	67,047	66,841
Doña Ana	243,164	273,513	299,088

Source: BBER 2017.

Table 4-1. Past, Present, and Reasonably Foreseeable Future Actions (Concluded)	
Project/Action	**Description of the Action**
Reasonably Foreseeable Future Actions (2018 to 2042)	
TriCounty Resource Management Plan (RMP) decisions as it relates to the Lake Valley Back Country Byway	This Byway is nestled between the Mimbres and Caballo Mountains and the Cooke's Range in southwestern New Mexico. It traverses NM Highways 152 and 27 between Las Cruces and Truth or Consequences, near a string of lakes and reservoirs in Sierra County. TriCounty RMP decisions are forthcoming from BLM for the Byway.
Mine Plan of Operations at Continental Pit and Hanover Mountain Mine in Cobre, Grants County	Freeport McMoRan is planning future mining operations at its Cobre Mining Company Continental Pit and Hanover Mountain Mine in Cobre, Grants County. It involves mining and hauling copper ore from the Continental Pit and Hanover Mountain Mine in Cobre to Chino's existing facility. The proposed mine plan includes constructing a haul road to transport copper ore from Cobre to Chino's existing facility for processing. Once the haul road is constructed, mining activities will commence and the total mine production from the Continental and Hanover Mountain pits at Cobre will range from about 20,000 to 125,000 tpd. These activities are expected to occur over a 10-year period.
Continued grazing permit authorizations	The BLM continually reviews and re-authorizes permits for grazing on BLM-administered land in New Mexico.
Source: BLM 2012c; NMPR 2018; THEMAC 2018.	

The timeframe for the analysis includes activities or actions that occurred in the past (settlement to 1950), or present (1950 to 2018), or are reasonably foreseeable for the duration of the project (2018 to 2042). For the purposes of this analysis, the duration of the project, including mine construction, operations, closure, and reclamation, would be 16 years and is assumed to occur approximately between the years 2018 and 2042. Construction activities would start at the beginning of this timeframe.

4.2 CUMULATIVE IMPACTS BY RESOURCE AREA

This section analyzes the potential for cumulative impacts from the Proposed Action, Alternative 1, Alternative 2, and the No Action Alternative when added to the past, present, and reasonably foreseeable future actions within the area of cumulative effect. The area of cumulative effect varies by resource. Cumulative impacts and a description of the area of cumulative effect are presented by resource topic below.

4.2.1 Proposed Action, Alternative 1, and Alternative 2

This section discusses the potential for cumulative impacts from the Proposed Action and alternatives when added to the past, present, and reasonably foreseeable future actions within the area of cumulative effect. The cumulative impacts associated with the mining development of Copper Flat for Alternatives 1 and 2 would be virtually the same as for the Proposed Action.

Air quality: Short- and medium-term, minor, small extent, and probable adverse cumulative effects would be expected under the Proposed Action and alternatives. Short-term effects would be limited to fugitive dust and heavy vehicle emissions during site preparation, while medium-term effects would be due to fugitive dust and heavy vehicle emissions during mine operation and reclamation. Other regional and national sources that have notable contributions to air quality impacts include vehicle travel, non-road mobile equipment, electrical generating units, fossil fuel production, and other transportation. By directly inventorying all emissions in nonattainment regions and monitoring concentrations of criteria pollutants in attainment regions, the State of New Mexico considers the effects of all past and present emissions in the state. This is done by putting a regulatory structure in place designed to prevent air quality deterioration for areas that are in attainment with the National Ambient Air Quality Standards (NAAQS) and to reduce common or criteria pollutants emitted in nonattainment areas to levels that would achieve compliance with the NAAQS (USEPA 2014d). This structure of rules and regulations is contained in the State Implementation Plan (SIP). SIPs include:

- State regulations that the U.S. Environmental Protection Agency (USEPA) has approved;
- State-issued, USEPA-approved orders requiring pollution control at individual companies; and
- Planning documents, such as area-specific compilations of emissions estimates and computer simulations (modeling analyses) demonstrating that the regulatory limits assure that the air quality would meet Federal and State standards (USEPA 2012d).

The SIP process applies either specifically or indirectly to all activities in the region. Regional growth and contemporaneous actions would continue, including electrical generating activities, fossil fuel production, and changes in transportation infrastructure. Neither these nor any other large-scale projects or proposals have been identified that, when combined with the Proposed Action and alternatives, would threaten the attainment status of the region, or would lead to a violation of any Federal, State, or local air regulation.

Climate, climate change, and sustainability: Short- and medium-term, minor, small extent, probable, adverse cumulative effects to climate change and sustainability would be expected under the Proposed Action and alternatives. Short-term effects would be due to heavy vehicle emissions and the construction of facilities during site preparation, while medium-term effects would be due to heavy vehicle emissions and operation of facilities during mine operation and reclamation. The Proposed Action and alternatives would not contribute to a violation of any Federal, State, or local regulation associated with emissions, climate, or sustainability. Other regional and national sources that have notable contributions via the emission of greenhouse gases (GHGs) include vehicle travel, non-road mobile equipment, electrical generating units, fossil fuel production, and transportation. By directly inventorying all emissions in nonattainment regions and monitoring concentrations of criteria pollutants in attainment regions, the State of New Mexico considers the effects of all past and present emissions in the State. Regional growth and contemporaneous actions would continue, including electrical generating activities, fossil fuel production, and changes in transportation infrastructure. Neither these nor any other large-scale projects or proposals have been identified that when combined with the Proposed Action and alternatives, would threaten the attainment status of the region, would have substantial emissions, or would lead to a violation of any Federal, State, or local air regulation.

When compared to the likely adverse effect of the past, present, and future projects that contribute to climate change, the current project would make a small contribution to the overall cumulative effect to climate change.

In January 2004, Active Water Resource Management (AWRM) was created to provide tools for the New Mexico Office of the State Engineer (OSE) to actively manage limited water resources during drought periods, to include the effects of climate change. In New Mexico, the State constitution makes priority of right the basis for water administration, but recent drought years have compelled the OSE to develop tools for AWRM that enable them to responsibly manage limited water resources. The Copper Flat project would be subject to AWRM, as determined necessary by the OSE. However, AWRM does not diminish NMCC's commitment to fully offset surface water depletions to the Rio Grande system due to water pumped for mining purposes.

Water quality: As noted in Chapter 3, Affected Environment and Environmental Consequences, there is some evidence that impacts to surface waters have occurred due to past mining and processing activities to a limited extent in the Greyback Arroyo. Similarly, groundwater monitoring down-gradient of the mining and mineral processing area (MMPA) indicates that there may have been groundwater impacts due to past mining and processing activities as well.

Groundwater flows near the MMPA run roughly from west to east, toward the Rio Grande Valley. Past activities that may have caused additive impacts at the MMPA include grazing and other mining activity. Grazing activity in the area would potentially increase the generation of suspended sediments and would likely have little to no impact on groundwater. Past mining activities are noted directly north of the tailings storage facility (TSF) (and denoted as "Strip Mines" on geologic maps). These past mining activities could have contributed to the impacts on groundwater observed in the down-gradient monitoring wells in the Greyback Arroyo. Other than past mining-related activities, there appear to be no other past activities up-gradient of the MMPA that could have contributed or that may likely currently contribute to additive impacts to groundwater resources.

As for reasonably foreseeable future actions that may create additive impacts, most notable are the Proposed Action and alternatives. The expansion of the pit and associated waste areas (i.e., TSF) could contribute additional impacts to the currently impacted groundwater. However, because the pit has been demonstrated to be a hydrologic sink (pending a determination by the State via permit issuance), impacts from the exposure of previously undisturbed material in the pit to pit lake water (i.e., groundwater inflow) would likely be minor. Additional waste added to the existing waste rock area would also potentially increase impacts to some extent. However, given the mitigation activities identified in Chapter 3, Affected Environment and Environmental Consequences, for the Proposed Action and alternatives coupled with the pit hydrologic sink (pending a determination by the State via permit issuance) and the low leaching potential of the waste and low-grade ore, any additional impacts to groundwater quality are likely long-term, minor, small extent, unlikely, and adverse.

The proposed expansion of the TSF would also pose the potential for additional impacts to groundwater quality as the TSF is operated and ultimately dewatered. However, the additional development of the TSF would include the placement of an impermeable barrier on the older material prior to adding new material. This barrier would minimize the potential for leachate from the bottom of the new tailings to impact groundwater but would also minimize the contact of the leachate with underlying material that would potentially add more contaminants. Accordingly, the potential for additive impacts associated with the TSF is long-term, minor, small extent, unlikely, and adverse.

Other future activities down-gradient of the MMPA and within the potential affected area include grazing and transportation (i.e., roads and highways). These activities would likely contribute sediments and potentially various petroleum-derived contaminants. However, as previously discussed, these activities are not likely to impact groundwater and are not likely to contribute to the spectrum of groundwater contamination.

As with groundwater, the area of potential impact to surface water quality from past, current, and reasonably anticipated future actions is fairly limited around the footprint of the MMPA. Surface water run-on would be diverted around the existing mining operations and runoff generated from disturbed areas would largely be contained to minimize contact and downstream impacts. Any remaining runoff coming from the MMPA will discharge to an ephemeral drainage that runs only as a result of precipitation events. Samples from the Greyback Arroyo downstream of the MMPA show limited and probably transient impacts from past and present mining and processing activities.

The Proposed Action and alternatives has the potential to contribute to surface water impacts in an additive fashion to current impacts. While the pit expansion would likely have little such impact, continued development of waste and low-grade ore storage areas and the TSF have the potential to impact surface water quality in the future. The marginal impacts from these expansions would cause a potential increase in suspended sediments, total dissolved solids (TDS), and metals in surface water. However, measures in place within the Proposed Action and alternatives to control discharges from the MMPA to surface water such as sedimentation structures and berms would minimize these impacts.

There is potential for grazing activities to have contributed or to contribute to suspended particulate loading to surface water in an additive manner upstream and downstream of the MMPA. Given recent extended drought conditions for the area, however, contributions from grazing activities may be somewhat overshadowed by impacts from reduction of stem density and cover. Related impacts would likely not contribute additional contamination normally expected for mining activities, such as TDS or dissolved or suspended metals.

Transportation-related activities (i.e., roads and highways) also have the potential to add to impacts to surface water quality from past, current, and future mining and processing activities. As with impacts to groundwater quality, however, most of the impacts would be due to releases of suspended particulate matter and petroleum derivatives that are not necessarily expected from mining and processing activities.

Surface water use: The Proposed Action and alternatives would have long-term, minor to moderate, large extent, probable, and adverse effects. The Proposed Action and alternatives would reduce groundwater discharge to Caballo Reservoir and the Rio Grande, decreasing surface water quantities there. As mitigation for these effects, NMCC has committed to providing wet offsets that would compensate for all projected depletions to Caballo Reservoir and the Rio Grande system, for as long as these depletions may occur. The BLM may authorize this mine project; any operations are premised on the acquisition of necessary water rights under the authority of the OSE for the life of the mine plan.

The existing and projected demands include existing diversions such as the 60,000 AFY of water delivered to Juárez, Mexico from Elephant Butte and Elephant Butte Irrigation District operations and water-supply projects. In addition, the populations of Sierra, Otero, and Doña Ana Counties are anticipated to increase through the life of the Proposed Action and alternatives, potentially placing additional demand on surface water resources of the Rio Grande. The cumulative effects of the Proposed Action and alternatives would be mitigated through provision of wet offsets as described above.

Severe droughts have occurred in the area of the Proposed Action and alternatives, most recently between 2007 and 2012. Droughts would also constitute a cumulative impact. Stormwater flows in tributary drainages to the Rio Grande would be reduced, as would direct rainfall on the Elephant Butte and Caballo Reservoirs.

Impacts from the Proposed Action and alternatives may be offset to a degree by watershed management practices and riparian habitat improvements. The Nonnative Phreatophyte/Watershed Management Plan and other restoration projects along the Rio Grande reduce the consumptive water use of floodplain vegetation by removing invasive species such as salt cedar and replacing them with native vegetation that requires less water.

Groundwater use: Impacts to the regional water budget, including flows of the Rio Grande, would be long-term, major, of large extent, probable, and adverse. Water budget impacts would begin to reduce once mining ends. Impacts to water levels caused by the supply well field would be long-term, moderate, of medium extent, probable, and adverse. Regional drawdown impacts would begin to reduce once mining stops. Impacts to water levels caused by the pit would be long-term, major, of small extent, probable, and adverse. Overall, impacts on groundwater resources would be significant.

Impacts to groundwater levels close to the mine pit would be permanent and thus cumulative to any future pumping that may occur in this area. There are currently no reasonably foreseeable future actions in this location identified in Section 4.1, Actions Considered in Cumulative Impacts Analysis, that would require pumping of this nature. There is currently a lowered groundwater level that is a residual permanent effect for groundwater levels in the area of the existing pit resulting from previous mining activities at Copper Flat in 1982. The previous duration of mining operations was relatively short and the difference between current groundwater levels and historic levels is likely to be very small, except in close proximity to the pit. The cumulative impact from the Copper Flat mine would incorporate the prior effect, and since the groundwater impact would be a significant impact in the area of the mine pit, the cumulative impact would also be significant.

The New Mexico Third District Court decision that determined NMCC has water rights amounting to 861.84 AFY would leave the mine well short of projected operational water demands. As stated in Section 1.6.3, NMCC intends to lease or purchase and transfer groundwater rights from a well located elsewhere in the basin to the NMCC production wells. The amount purchased would be the amount necessary to ensure all water uses are accounted for, including any impacts to the Rio Grande. NMCC has committed to providing wet offsets that would compensate for all projected depletions to Caballo Reservoir and the Rio Grande system, for as long as these depletions may occur. This mitigation would eliminate the cumulative effect on Caballo Reservoir and the Rio Grande system due to mine groundwater pumping. The BLM may authorize this mine project; any operations are premised on the acquisition of necessary water rights under the authority of the OSE for the life of the mine plan.

The U.S. Supreme Court case considering Texas v. New Mexico and Colorado is still in progress and its outcome is uncertain. It is difficult and unnecessary to speculate on the outcome of this case for purposes of assessing the cumulative impact of this case on the proposed Copper Flat mine expansion. The NMCC commitment to offset depletions to the Rio Grande system and retire water rights once they are no longer needed by the mine indicate a neutral to beneficial effect regardless of the outcome of the Supreme Court case. The OSE will consider these factors in evaluation of the project during the permitting process.

Mineral and geological resources: Long-term, major, large extent, probable, and adverse cumulative effects would be expected under the Proposed Action and alternatives, which would remove a large quantity of existing geologic materials; up to 152 million tons of ore and other material would be extracted during the life of the mine. But, due to the geographically limited nature of the Proposed Action and alternatives, there would be no impacts associated with the Copper Flat mine that would affect any other assets in the region nor would any other activity affect mineral and geological resources within the mine area.

Soils: Long-term, moderate, of medium extent, and probable adverse cumulative effects to soils would be expected under the Proposed Action and alternatives. Soils in the Copper Flat project area near Hillsboro, New Mexico have been, and continue to be, destroyed or disturbed for such purposes as mining, community settlement, livestock grazing and ranching activities, construction of roads, operation and maintenance of ditches and canals, and urban development. Adverse impacts from these activities include soil compaction, channelization of runoff from impervious surfaces, erosion of soils and mass movement, loss of ecological function where soils are under water or impervious surfaces, and land subsidence. Drought could result in vegetation mortality leading to loss of cover and increased erosion, as well as drying of soils.

Adverse soils impacts associated with the Proposed Action and alternatives would be small as compared to cumulative past, present, and foreseeable future effects. As indicated above, because soil impacts would be mitigated through BMPs and implementation of the reclamation plan, cumulative impacts to soils in the immediate mine area would be small.

Hazardous materials and solid waste: Short-term, minor, small extent, possible to unlikely, and adverse cumulative effects would be expected under the Proposed Action and alternatives. Due to the geographically limited nature of the Proposed Action and alternatives, there would be no impacts associated with hazardous materials required by the Copper Flat mine that would affect any other assets in the region nor would any other activity affect the use or safety of hazardous materials within the mine site.

Wildlife and migratory birds: Cumulative impacts under the Proposed Action and alternatives are expected to be long-term, minor, of medium extent, probable, and adverse as well as some long-term, minor, medium extent, probable, and beneficial effects from long-term improvements to habitats. Surface disturbance associated with mineral development and forage use by livestock would result in cumulative effects over a larger area than is analyzed in this document. The combined surface disturbance of past, present, and future development would be detrimental to wildlife species due to fragmentation and destruction of habitat.

Detrimental impacts include loss and degradation of habitat due to mineral development, disruption of daily and seasonal animal movement and habitat use due to increased human presence, increased traffic volume and speeds, and noise and light pollution. Each disturbed area increases habitat fragmentation, reduces the connectivity and integrity of habitats, and displaces wildlife and special status species over the short- and long-term. The reasonably foreseeable development in the county from expansion of existing city areas and the development of large projects such as Spaceport America would impact wildlife species by degrading or removing habitat and disrupting normal behavior. Although mitigation and reclamation could reduce the adverse impacts in the long term (perhaps resulting in improved habitat for the population), the Proposed Action and alternatives could result in the displacement of the population in the short-term or the loss of the local population in the long-term.

Beneficial impacts would occur after mine restoration of the project site and from the Rio Grande improvements, Nonnative Phreatophyte/Watershed Management Plan, the NMED Watershed Restoration Action Strategy, and any nearby mine reclamation, in addition to activities based on wildlife and land management planning efforts that are currently underway.

Vegetation and non-native invasive species: Medium- and long-term, minor to moderate, of medium extent, and probable adverse cumulative effects would be expected under the Proposed Action, primarily to upland vegetation. Vegetation in the Copper Flat project area has been, and continues to be, cleared or disturbed for such purposes as mining, community settlement, livestock grazing and ranching activities, construction of roads, operation and maintenance of ditches and canals, and urban development. These activities involve removal, trampling, or destruction of vegetation; disturbance of ground cover; and introduction of invasive species. Many of these actions also contribute to soil compaction and erosion, making it more difficult for native plant species to re-inhabit an area after disturbance. Additionally, pressure from increasing human presence includes trampling of vegetation due to pedestrian traffic, and concentrated areas of foot traffic which removes vegetation and fragments habitat and vegetative populations. Climate change could lead to increased drought and floods, further removing native vegetation as both drought and flooding could result in vegetation mortality and an increase in invasive species.

Beneficial effects of past, present, and foreseeable future actions also exist. Restoration improvements along the Rio Grande, including reducing the consumptive water use of floodplain vegetation by improving riparian habitat (i.e., removing salt cedar and planting native vegetation) would enhance native riparian communities and require less water. The Nonnative Phreatophyte/Watershed Management Plan focuses on the prevention and control of salt cedar and associated nonnative invasive plants with the ultimate goal of restoring healthy, productive ecosystems. The plan will facilitate management and implementation of future control practices and rehabilitation efforts in New Mexico's watersheds and riparian areas. Adverse vegetation impacts associated with the Proposed Action and alternatives would be small compared to cumulative past, present, and foreseeable future effects.

Threatened and endangered species and special status species: Mining development and operation activities would add a minor increment to an array of other factors to slightly increase overall adverse cumulative effects. Mitigation measures and proper reclamation would reduce or offset and may improve overall cumulative effects, particularly after mining ceases. Because the Mexican spotted owl, western yellow-billed cuckoo, and Chiricahua leopard frog have been observed or recorded near the mine area, cumulative impacts may affect these species. The likelihood and severity of possible effects are being evaluated, and proposed measures to mitigate adverse effects are being determined in consultation with the USFWS in compliance with Section 7 requirements of the ESA. Cumulative impacts are expected to be long-term, minor, small extent, probable, and adverse under the Proposed Action on special status species that are not Federally-listed and that have been observed in the project site, or that could occur because potential habitat exists in the project site. This EIS has identified mitigation measures to reduce these impacts. Overall, these impacts would be significant.

Agriculture, grazing, development, groundwater use, and channelization of creeks for agriculture and development contribute to the loss and fragmentation of habitat available for special status species. Surface water management of the perennial rivers and reservoirs by Federal and State agencies also contribute to the loss and creation of riparian habitat suitable for the yellow-billed cuckoo and Chiricahua leopard frog. Climate change could lead to increased drought and floods, further removing depleting native upland vegetation and riparian communities, as both drought and flooding could result in plant mortality and an increase in non-native species.

Beneficial effects of past, present, and foreseeable future actions also exist or would exist. The Non-native Phreatophyte/Watershed Management Plan (NMDA 2005) focuses on the management and implementation of future control practices and rehabilitation efforts in New Mexico's watersheds and riparian areas that provide habitat for special status species. Such restoration improvements along the Rio Grande, including reducing the consumptive water use of floodplain vegetation by improving riparian habitat (i.e., removing salt cedar and planting native vegetation) would enhance native riparian communities, require less water, and improve habitat suitable for special status species.

Land use and land ownership: The cumulative impacts would be short- and medium- term, minor, of small extent, probable and adverse during the life of the mine and reclamation activities. Impacts from reclamation activities may be beneficial due to enhancement of the area, though these impacts would comply with existing land use plans and would therefore be minor. Land tenure at the mine would not change during the life of the mine based on any known past, present, or reasonably foreseeable projects. The land status and prior rights currently held by parties would remain unchanged. However, the overall land use at the mine would be restricted to mining operations. The mine operator would lease private and use Federal surface estates and Federal mineral estates from the BLM for the life of the mine and until the mine area has been reclaimed and released from bond. Land uses in and around the mining area would not be changed until after reclamation and the final land use would be congruent with previous land use.

Land use of the area may change as development spreads from existing communities or areas are developed for oil, gas, or other mining activities. Although the land use would change from inactive to active mining, the land use category would not change. In addition, permitting requirements would assure compliance with existing land use regulations for areas of the proposed project.

Other activities may impact land use and land ownership in the areas around the proposed project as land is developed, but these projects would also be subject to permitting based on land management. After reclamation is complete, impacts may be beneficial due to enhancement of the area, though these impacts would not be incongruent with existing plans or permitting, and therefore cumulative impacts would be expected to be minor.

Recreation: Cumulative recreational impacts under the Proposed Action and alternatives would be short- to long-term, minor, of small to medium extent, probable, and adverse. The population growth projected in the TriCounty RMP/EIS planning area would contribute to an increased demand for recreational amenities in the region surrounding the Copper Flat mine. This growth is anticipated to lead to a simultaneous increase in regional traffic, which would be additive to the increase in traffic that would result from the use of the access road to the Copper Flat site. Some of this traffic may be mitigated by the transportation projects planned by the New Mexico Department of Transportation - Region 1, but some would cause increased traffic on the Lake Valley Backcountry Byway and the Geronimo Trail Scenic Byway. As described in Table 4-1, resource management decisions are forthcoming for the three counties affected by the Lake Valley Backcountry Byway. Cumulative impacts to the pace of scenic driving on the byways are anticipated to be adverse, minor, and medium- to long-term. Transportation impacts are described further in Section 3.20, Transportation and Traffic.

No recreation projects are proposed in the immediate vicinity of the Copper Flat site. Thus, cumulative visual impacts, as they pertain to recreational viewers' perception of a site, would be nonexistent. It is unlikely that recreational activities at Spaceport America would be impacted by the development and operation of the Copper Flat mine.

When compared to the likely adverse effect of the past, present, and future recreation projects in the area, the current project would make a small contribution to the overall cumulative effect to recreation.

BLM Special Management Areas: Cumulative impacts under the Proposed Action and alternatives would be short- and long-term, minor, of medium extent, probable, and adverse for Special Management Areas (consisting only of the Byways located in the project region). These impacts may be exacerbated by future development projects within the vicinity of the project area. The population growth projected in the TriCounty RMP/EIS planning area would contribute to an increased demand for infrastructural and recreational amenities in the region surrounding the Copper Flat mine. This growth is anticipated to lead to a simultaneous increase in regional traffic, which would be additive to the increase in traffic that would result from the use of the access road to the Copper Flat site. However, construction and operation proposed under the Copper Flat mine project would likely not preclude the designation of any future areas as Special Management Areas.

Range and livestock: The Proposed Action and alternatives would have short- to long-term, minor to moderate, small extent, probable, and adverse cumulative impacts on grazing use of BLM land within the allotments in the area surrounding the mine. Vegetation removal would have long-term impacts for the duration of the project; the loss of forage available for grazing on BLM land would be small but could require a reduction in permitted AUMs. Range conditions and available forage in the area surrounding the Copper Flat mine and near Hillsboro, New Mexico have been and continue to be changed for mining, livestock grazing and ranching activities, road construction, and rural development. These activities involve disturbance of vegetation and potential for introduction of invasive species, which could impact availability and quality of forage for livestock. Rangeland conditions are assessed periodically against the New Mexico Standards and Guidelines and permitted use of BLM land for grazing is adjusted accordingly. These assessments and adjustments facilitate long-term maintenance of the range resources for multi-use management.

Transportation and traffic: Medium-term, major, medium extent, possible, and adverse cumulative impacts would occur under the Proposed Action and alternatives. The proposed Copper Flat mine would introduce increased traffic and roadway deterioration in localized areas. There are no known past, present, or future actions that would significantly affect the level of service or roadway degradation above that which would be experienced by the proposed construction, mining operation, or closure and reclamation of the Copper Flat mine.

Noise and vibration: Short- and medium-term, minor, small extent, and probable adverse cumulative effects would be expected under the Proposed Action and alternatives. Short-term effects would be limited to heavy equipment noise during site preparation and reclamation, while medium-term effects would be due to blasting during mineral extraction, use of rock crushers, and operation of heavy equipment during mine operations. The Proposed Action and alternatives would not create noise that would be incompatible with surrounding land uses. No other projects have been identified that, when combined with the Proposed Action and alternatives, would have significant effects.

Socioeconomics: In conjunction with other developments in and around Sierra County, the proposed project would result in major, probable, large, long-term, adverse and beneficial cumulative impacts. It would create additive, synergistic, cumulative impacts to the local economy, affecting population growth, employment rates, earnings per capita, total compensation of employees, and recreation and tourism revenues. These projects would support several billion dollars in economic activity and represent significantly beneficial cumulative impacts to Sierra County over the coming decades – though they would not represent a source of permanent prosperity.

The socioeconomic impact of the proposed mine is a matter of interest due to historical boom and bust cycles that have occurred with some mines in the region and elsewhere. Some other mining projects have been risky investments – as exemplified by Quintana Minerals Corporation's short-lived mining operations in 1982, when after 3 months the price of copper decreased and the mine closed. The synergistic effect or spin-off activities associated with both the proposed project and other development projects listed in Table 4-1 (especially mine operations at the Continental Pit and Hanover Mountain Mine in Cobre, Grants County) could be strongly linked to or reliant on the mining sector. Spin-off development and businesses growing or shrinking in tandem with the mining sector would therefore contribute to a "boom" and have an additive, synergistic effect on beneficial impacts; but could also contribute to a bigger "bust" and have an additive, synergistic effect on adverse impacts.

Environmental justice: Mine operations at Cobre Mine in Grant County, when added to the proposed project, would create both adverse and beneficial cumulative impacts to low-income populations that would be minor, probable, large, and long-term. Though the two mines would not occur in the same county and many of the jobs created would likely be filled by respective county residents, a portion could travel from outside the respective economic regions for work at either mine; it is also assumed that not all jobs at either mine would be filled by low-income populations. For example, a Sierra County resident could travel to the adjacent Grant County for a job at the Cobre mine; and a Grant County resident could travel to Sierra County for a job at the Copper Flat mine. Others could cross counties for jobs created by the spin-off or related development that would likely follow construction activities at both mines (e.g., restaurants, hotels). If both mines re-open and operate, potential economic cumulative effects on low-income populations would likely be minor and beneficial as it relates to environmental justice.

A boom and bust socioeconomic cycle can more heavily impact environmental justice populations. Once environmental justice communities and populations become dependent on the mining boom economy, it is often difficult to maintain the same standard of living and quality of life after the boom ends. Positive and negative health impacts associated with a well-paying job at a mine could disproportionately impact low-income workers hired by either mine during the "boom," and adverse impacts associated with ensuing unemployment or the "bust" could also disproportionately impact low-income workers. Cumulative impacts associated with boom and bust cycles on low-impact populations would likely be additive and synergistic and both adverse and beneficial impacts could be significant.

Cultural resources: Long-term, minor to major, small to medium extent, and possible to probable adverse cumulative effects would be expected under the Proposed Action and alternatives. Past actions in the region such as livestock grazing, mining, development of military installations, water management and irrigation, and activities associated with expanding communities (namely economic development and infrastructure improvements) likely resulted in the destruction of historic properties (i.e., significant cultural resources). Those impacts that occurred in the 1970s and later that involved Federal agency oversight would have included mitigation of effects to historic properties. As populations expand, and the need for development continues, historic properties in the region will continue to be adversely affected by present and future land-disturbing developments, with those affects occurring on Federal land being mitigated.

For historic properties, the destruction of and damage to properties over time occurs on a property-by-property basis. Cumulative effects, if they exist, are most likely to occur at a regional level rather than to a single property. It is expected that the Proposed Action and alternatives would result in adverse effects to multiple historic properties. These effects would be additive to those that have occurred or will occur throughout the region as a result of past, present, and reasonably foreseeable actions. When compared to the likely adverse effect of the past, present, and future actions on historic properties, the current project will make a small contribution to the overall cumulative effect to historic properties in the region.

Visual resources: Construction and operations under the Proposed Action and alternatives would last 16 years. Long-term effects are those that last more than 10 years. Therefore, cumulative visual impacts associated with the Proposed Action and alternatives would be short- to long-term, minor to moderate, large, probable, and adverse during the construction and operations phase due to the contrast of the proposed mine in the Class IV visual resource management (VRM) area as well as long-term, minor to moderate, large extent, probable, and beneficial during the reclamation phase.

The area of potential effect for the Proposed Action and alternatives is in the Basin and Range province, which has a landscape character typical to the province of broad, open basins bounded by prominent mountain ranges and covered by pinon-juniper vegetation (USFS 2009). The area is located within the foothills of the Black Range, which is a major north-south mountain chain in south-central New Mexico. Past and present actions have contributed to modifications to the characteristic landscape in the area of analysis including mechanical vegetation treatments, transmission lines and other linear rights-of-way. Future actions that would contribute to cumulative impacts to visual resources of the landscape consist of other mining activities, additional vegetation treatments and restoration activities, oil and gas exploration and production, and development of pipelines and power lines. (See Table 4-1.)

Over the next 20 years, reasonably foreseeable future development would change the character of the existing landscape. Reasonably foreseeable actions would potentially remove vegetation by grazing and land treatment methods, change the landform by surface disturbance during mining and road building, and introduce linear structures to the landscape including power lines and pipelines. These developments would introduce moderate changes to visual resources. Mitigation measures would be implemented to return the tract to a more natural landscape as pit activities are completed. The analysis assumes that mitigation measures for visual resources would be implemented with reasonably foreseeable future projects to reduce contrasts. Cumulatively, contrasts would remain consistent with the BLM visual resource management Class III objectives in the area of analysis.

Human health and public safety: Short- and medium-term, minor, small extent, possible or unlikely, and adverse effects would be expected under the Proposed Action and alternatives. Short-term effects may be characterized by such pollutants as fugitive dust and heavy vehicle emissions during site preparation, while medium-term effects would be due to fugitive dust and heavy vehicle emissions during mine operation and reclamation. Effects would be of a small extent, typically confined to the site or facilities within the site. The likelihood of occurrence would be under conditions of a malfunction or upset of routine working conditions. There would also be medium- to long-term, minor, medium extent, probable, and beneficial effects on employment status and health and on actions that are compliant with current laws and regulations.

One exception to this is the previous mining activity that occurred at the Copper Flat mine area. Past expectations of safety at the time of previous mine reclamation were not as comprehensive as they are today. The result is that existing conditions at the mine area are likely more hazardous than they would be under natural conditions.

With closure of the mining operations and the ensuing land reclamation, it is reasonable to expect that conditions at the mine area would be restored to a more natural condition that would be an improvement over conditions present at the start of mining operations. This would create a net beneficial effect for human health and public safety over the long-term. Areas such as the remaining open pit and lake that may pose a safety hazard would have access restricted to the general public.

The mine safety training provided to workers at the mine area would raise the collective awareness of general safety and health issues in the local communities where many of the workers reside, resulting in a slightly beneficial cumulative effect in these communities and for other present and future activities identified in this chapter.

Utilities and infrastructure: Cumulative impacts from the Proposed Action and alternatives would be short-term, minor, of small extent, probable, and adverse. The Proposed Action and alternatives is not expected to result in the addition of a significant number of households to the surrounding community. Therefore, an increase in demand for utility services in the communities surrounding the project site as a result of the Proposed Action and alternatives is not anticipated. The only increase in demand for utility services anticipated would be created by the mining operation.

Due to the geographically limited nature of the Proposed Action and alternatives and the lack of reliance on public utilities and infrastructure, there would be no impacts associated with the Copper Flat mine that would affect any other utilities and infrastructure in the region, nor would any other activity associated with public utilities and infrastructure affect the mine area.

Paleontological resources: There would be no cumulative impacts on paleontological resources under the Proposed Action and alternatives. No paleontological resources of critical or educational value have been identified within the proposed mine area (BLM 1999). Paleontological surveys were performed outside the mine area at millsite staging areas that discovered no additional paleontological resources Section 3.26 concludes that conditions within the mine area are not conducive to fossil discovery or impacts as a result of mine development, operations, closure, or reclamation. Despite these findings, an environmental protection measure for paleontological resources would be employed as discussed in Section 2.1.16, Environmental Protection Measures, to protect paleontological discoveries.

4.2.2 No Action Alternative

Under the No Action Alternative, there would be no mining activities at Copper Flat. As a result, there would be no mining impacts associated with the various resource areas previously discussed.

Under the No Action Alternative, the Stage 1 Abatement Plan would continue to be implemented to define site conditions, investigate known areas of groundwater and surface water contamination at the site, and define the extent and magnitude of groundwater contamination. Stage 2 of the abatement plan, also to be implemented under the No Action Alternative, would address selection and design of an effective treatment option to abate groundwater contamination. Stage 2 would include a feasibility study to analyze abatement alternatives. Implementation of remedies selected in Stage 2 would have a direct and beneficial impact on groundwater resources, since the groundwater targeted by the abatement would have contamination removed or rendered immobile.

There would also be no other mining restoration or reclamation of the Copper Flat properties beyond those from previously authorized activities such as mineral exploration; they would remain in the state they are today. Since there would be no other impacts associated with the mining, restoration, or reclamation of the property, there would be no cumulative impacts associated with these other activities at Copper Flat.

Depending upon the abatement remedy selected, the cumulative impacts would likely be moderate in magnitude, long-term duration, small extent, probable likelihood, and therefore significant.

CHAPTER 5

CONSULTATION AND COORDINATION

CHAPTER 5. CONSULTATION AND COORDINATION

An Environmental Impact Statement (EIS) must be prepared when a Federal agency considers approving an action within its jurisdiction that may impact the human environment. An EIS aids Federal officials in making decisions by presenting information on the physical, biological, and social environment of a proposed project and its alternatives. The first step in preparing an EIS is to determine the scope of the project, the range of action alternatives to be included in the document, and the impacts to be analyzed.

This EIS has been prepared with input from and coordination with interested tribal governments, agencies, organizations, and individuals. The Council on Environmental Quality (CEQ) regulations [40 Code of Federal Regulations (CFR) 1500–1508] require an early scoping process to determine the issues related to the Proposed Action and alternatives that the EIS should address. The purpose of the scoping process is to identify important issues, concerns, and potential impacts that require analysis in the EIS and to eliminate insignificant issues and alternatives from detailed analysis. Public involvement is a vital component of NEPA for vesting the public in the decision making process and allowing for full environmental disclosure.

5.1 PUBLIC INVOLVEMENT

The purpose of scoping is to provide an opportunity for members of the public to learn about the proposed mine reopening and to share any concerns or comments they may have. Input received during the public scoping process is used to help the BLM identify issues and concerns to be considered in the EIS, as well as to identify potential alternatives. In addition, the scoping process helps to identify any issues that are not considered relevant and that can therefore be eliminated from detailed analysis in the EIS. The list of stakeholders and other interested parties is also updated and generally expanded during the scoping process.

On January 9, 2012, the BLM Las Cruces District Office (LCDO) published a Notice of Intent (NOI) in the Federal Register (FR) (vol. 77, no. 5, p. 1080-1081, Doc 2012-125) to prepare an EIS for this project. The NOI noted that public scoping meetings would be held with 15 days prior notification in local media. These notices were posted in the *Albuquerque Journal*, *The Herald*, and the *Las Cruces Sun News* on February 7, 2012. Additionally, the BLM ran notices in the *Las Cruces Bulletin* and the *Sierra County Sentinel* on February 10, 2012. Solv created a project website to inform the public of the NEPA process, and it included notice of these public scoping meetings. Solv sent a news release to local television stations and radio stations: KFOX – Las Cruces Bureau, KDBC 4 CBS, KVIA Channel 7, NewsChannel 9 (KTSM), KRWG-TV/FM MSC TV 22-NMSU, KINT TV Univision 26, Telemundo 48, KOB Channel 4, KOAT Channel 7, KVLC 101.1FM, KGRT, and KRWG.

The BLM hosted two scoping meetings in Hillsboro and Truth or Consequences, New Mexico, on February 22 and 23, 2012, respectively, to provide the public with an opportunity to learn about the project and provide comments. The meeting in Hillsboro was held at the Hillsboro Community Center, and the meeting in Truth or Consequences was held at the Truth or Consequences Civic Center. Public participants at the meetings numbered 59 in Hillsboro and 72 in Truth or Consequences.

There was an open house portion of the meeting to encourage discussion and information sharing and to ensure that the public had opportunities to speak with representatives of the BLM LCDO, the State of New Mexico, and New Mexico Copper Corporation (NMCC). Several display stations with exhibits, maps, and other informational materials were staffed by representatives of the BLM LCDO, the State of New Mexico Minerals and Mining Division, the New Mexico Environment Department, NMCC, and Solv. Meeting attendees were requested to sign in upon entering, at which time they were provided with handouts and informed about the meeting format and how to comment at the meeting. The handouts and displays provided information about the NEPA process, project background, cooperating agencies, a fact sheet about the BLM LCDO, and how to provide comments. The open house session was followed by a presentation and public comment session. The BLM, Solv, and NMCC all spoke during the presentation.

A 30-day scoping comment period (January 9, 2012 through March 9, 2012) was provided in order for the public to submit comments related to potential issues via email, mail, fax, project website, or project phone answering system. A total of 94 individuals submitted comments.

On December 4, 2015, the BLM LCDO published a Notice of Availability (NOA) in the FR (vol. 80, no. 233, p. 75862, Doc 2015-338) for the Draft EIS for this project. The initial 60-day public comment period was eventually extended through April 4, 2016. During the comment period, two public meetings were conducted in Hillsboro, New Mexico on December 16, 2015 and in Truth or Consequences, New Mexico on December 17, 2015. The public meetings offered interested parties the opportunity to express concerns and support for the project. There were 54 attendees at the Hillsboro public meeting and 51 attendees at the Truth or Consequences public meeting.

During the comment period, 103 comments were received from 11 separate commenters from public agencies, 318 comments were received from seven separate commenters from non-governmental organizations, and 776 comments were received from 159 separate commenters from the public. These comments and their responses are included in Appendix N as two documents:

- **Comments, Categories, and Responses (CCR):** A summary document that groups similar individual comments, such that one or more comments may be addressed by a single comment response; and
- **Comment Response Matrix (CRM):** Individual comments with their responses and source information for the comment appear on their own line of a summary matrix. Each submitted comment has an individual response.

5.1.1 Mailing List

A mailing list identifying individuals (as points of contact) in organizations, agencies, and interest groups was used to provide information about the public meetings, scoping period deadlines, and other key milestones. The BLM mailing list was used as the foundation but was periodically revised, updated, and expanded throughout the scoping period and was further updated throughout the entire NEPA process. Individuals who signed in at either of the public meetings or submitted comments during the scoping period were automatically added to the mailing list unless they stated that they did not want to be added or did not want to receive additional information as the project progressed.

The first direct mailing related to the EIS process occurred on February 6, 2012 and included 206 recipients, distributed by either regular mail or electronic mail. The mailing provided information about the Proposed Action, announced scoping meetings and locations, and provided information about how to submit comments. A second mailing was sent in December 2015 when the draft EIS was released that include a summary of the draft EIS and the alternatives that were analyzed, along with information about the comment period, how to review and comment on the EIS, and the dates, times, and locations of all public review meetings. A third mailing will announce availability of the Final EIS, and a fourth mailing will announce availability of the Record of Decision (ROD).

The following agencies, organizations, and individuals were notified that the Draft EIS would be available in paper copy, on compact disc (CD), and on the BLM's website. Two hundred printed copies and 200 CDs were prepared for mailing because some mailing list recipients requested and received a paper copy or CD of the Draft EIS for review and comment. The BLM has sent copies of the Final EIS to the same entities listed below and to those who requested a copy.

FEDERAL AGENCIES

U.S. Department of the Interior
- Bureau of Land Management
  - Washington Office, D.C.
- New Mexico State Office
- Las Cruces District Resource Advisory Council

Bureau of Indian Affairs

National Park Service

Office of Environmental Policy and Compliance
- Regional Office, Albuquerque

Department of State
- International Boundary and Water Commission Upper Rio Grande Project

U.S. Fish and Wildlife Service
- Las Cruces, New Mexico
- Albuquerque, New Mexico

U.S. Army Corps of Engineers
- Albuquerque District

U.S. Department of Agriculture
- Forest Service, Regional Office

U.S. Environmental Protection Agency
- Region 6

U. S. Geological Survey

Office of Surface Mining

U.S. Department of Transportation

STATE AGENCIES AND ORGANIZATIONS

Governor, State of New Mexico

New Mexico Department of Agriculture

New Mexico Department of Game and Fish

New Mexico Environment Department

New Mexico Energy, Minerals, and Natural Resources Department
- Mining and Minerals Division
- State Forestry Division

New Mexico Office of the State Engineer

New Mexico State Historic Preservation Office

New Mexico State Land Office

New Mexico Department of Transportation

New Mexico Indian Affairs Department

New Mexico Bureau of Mine Safety

LOCAL GOVERNMENTS

City of Truth or Consequences, New Mexico
City Manager
Chamber of Commerce
Public Library

City of Elephant Butte

Community of Hillsboro
Hillsboro Community Library

Sierra County, New Mexico

TRIBAL GOVERNMENTS

Comanche Indian Tribe

Kiowa Tribe of Oklahoma

Mescalero Apache Tribe

Fort Sill Apache Indian Tribe

White Mountain Apache Indian Tribe

Hopi Tribal Council

Isleta Pueblo

Navajo Nation

Ysleta del Sur Pueblo

Zuni Pueblo

CONGRESSIONAL/LEGISLATORS

Senator Tom Udall, State of New Mexico

Senator Jeff Bingaman, State of New Mexico

Representative Steve Pearce, 2nd Congressional District of New Mexico

John Arthur Smith, 35th Congressional District of New Mexico

OTHER INTERESTED ORGANIZATIONS

New Mexico Wilderness Alliance

Sierra Club, New Mexico Chapter

The Wilderness Society

New Mexico Wildlife Federation

Ladder Ranch

Tetra Tech

Copper Flat Ranch allotment permittee

Chino Mines Company

New Mexico Environmental Law Center

Elephant Butte Irrigation District

Gila Resources Information Project

5.2 CONSULTATION WITH TRIBAL GOVERNMENTS

Federal agencies are required to consult with American Indian tribes (Tribes) as part of the Advisory Council on Historic Preservation Regulations, Protection of Historic Properties [36 CFR 800], implementing Section 106 of the National Historic Preservation Act (NHPA). Accordingly, NHPA outlines when Federal agencies must consult with Tribes and the issues and other factors this consultation must address. In addition, pursuant to Executive Order (EO) 13175, executive departments and agencies are charged with engaging in regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications and are responsible for strengthening the government-to-government relationship between the United States and Indian tribes.

As a Federal agency, the BLM has a trust responsibility to Tribes to protect tribal cultural resources and to consult with Tribes regarding those resources. Certain laws, regulations, and EOs guide consultation with American Indians to identify cultural resources important to Tribes and to address tribal concerns about potential impacts to these resources. Section 101(d)(6) of the NHPA mandates that Federal agencies consult with Tribes and other Native American groups who either historically occupied the project area or may attach religious or cultural significance to cultural resources in the region. NEPA implementing regulations link to the NHPA, as well as the American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Religious Freedom Restoration Act, EO 13007, EO 13175 Consultation and Coordination with Indian Tribal Governments (65 FR 67249), and the Executive Memorandum on Government-to-Government Relations with Native American Tribal Governments (59 FR 22951). This body of legislation calls on agencies to consult with American Indian tribal leaders and others knowledgeable about cultural resources important to them. BLM Manual 8120 and BLM Handbook H-8120-1 address tribal consultation specifically; the subject is addressed in terms of Section 106 of the NHPA in the nationwide Programmatic Agreement (PA) and New Mexico Protocol. The BLM consulted with Tribes during development of this Draft EIS, and this consultation will continue through development of the Final EIS.

Consultation with Tribes is required under multiple Federal and State statutes. The purposes of consultation are to elicit from tribal representatives concerns for potential impacts from the proposed project on the Tribe or resources that are significant to the Tribe, and to identify possible mitigation measures to resolve or minimize potential impacts. Formal consultation under NEPA and Section 106 was initiated with a scoping letter sent to the public, including Tribes, on February 3, 2012. No responses to these letters were received from Tribes or tribal members, and no tribal representatives attended the public scoping meetings held on February 22, 2012 in Hillsboro, New Mexico and February 23, 2012 in Truth or Consequences, New Mexico.

Tribal consultation letters were sent on November 7, 2012, to the Comanche Indian Tribe, Fort Sill Apache Tribe, Hopi Tribe, Isleta Pueblo, Kiowa Tribe, Mescalero Apache Tribe, Navajo Nation, White Mountain Apache Tribe, Ysleta del Sur Pueblo, and Zuni Pueblo. The letters described the proposed Copper Flat mine project and requested information from the Tribes on any concerns they had for potential impacts to tribally-significant resources.

Two Tribes provided responses:

1. The Hopi Tribe sent a letter stating their desire to continue consultation because they believe that archaeological sites with which they are affiliated would potentially be impacted by the proposed project. They asked to receive copies of the final archaeological survey reports and the Draft EIS.
2. The White Mountain Apache Tribe stated that unless human remains or materials related directly to them were discovered, they were not interested in further consultation.

During the time between the availability of this Draft EIS and the issuance of the Final EIS and the BLM's ROD, consultation with the Tribes by the BLM and State agencies will continue to ensure that Tribal concerns are understood and presented in the documentation, to identify appropriate mitigation measures, and to fulfill the requirements of relevant Federal and State statutes. In compliance with

Section 106 requirements, a PA documenting the tribal consultation efforts was signed in November 2016. Consultation with the Tribes regarding the proposed project may also continue beyond the ROD, in a manner determined during development of mitigation measures.

5.3 CONSULTATION WITH U.S. FISH AND WILDLIFE SERVICE

A Biological Assessment (BA) is required by law (Endangered Species Act [ESA] of 1973, 16 USC 1531 et seq.) for projects on Tribal or Federally managed lands. A BA is the means to review, analyze, and document the direct, indirect, interrelated, interdependent, and cumulative effects on U.S. Fish and Wildlife Service (USFWS) Federally-listed endangered, threatened, proposed, or candidate species as well as proposed or designated critical habitats thereof, as a result of actions undertaken on Federally managed land.

Following USFWS review of the draft BA for the Copper Flat mine expansion, the BLM met with the USFWS twice, on November 9, 2016 and December 19, 2016, to gather information needed to progress with the development of the BA. Discussion has focused on potential impacts on the Chiricahua leopard frog, the yellow-billed cuckoo, the southwestern willow flycatcher, the Rio Grande chub, the Rio Grande sucker, and the Rio Grande Cutthroat trout. Late in 2017, after the receipt of relevant public comments, the USFWS advised the BLM to also consider protected species that are part of species recovery programs at the Ladder Ranch, which is adjacent to the mine area. The protected species are the Chiricahua leopard frog, the Mexican gray wolf, the Bolson tortoise, the southwestern willow flycatcher, and the yellow-billed cuckoo. This information has been incorporated in the BA. The BA is included as Appendix J.

5.4 LIST OF PREPARERS

This EIS was prepared and reviewed by a team from the BLM. A team associated with Solv assisted the BLM in conducting research, gathering data, and preparing the EIS and supporting documents. Table 5-1 identifies team members and their roles.

Table 5-1. List of Preparers

Table 5-1. List of Preparers		
Organization	**Name**	**Project Role**
BLM	Anthony Hom	Realty
BLM	Corey Durr	Water; Soil; Air Quality; Climate Change and Sustainability
BLM	Dave Legare	Cultural Resources
BLM	Deborah Stevens	Public Outreach
BLM	Douglas Haywood	Lead Agency Project Manager
BLM	Ikumi Doucette	NEPA
BLM	Jack Barnitz	Wildlife
BLM	James Renn	Paleontological Resources
BLM	Jennifer Montoya	NEPA Manager; Socioeconomics; Environmental Justice; Land Use
BLM	Jim Salas	Website
BLM	Joe Sanchez	Recreation
BLM	Leighandra Keeven	Geology, Project Lead
BLM	Margie Guzman	Wildlife
BLM	Mike Williams	Transportation and Traffic; Utilities and Infrastructure
BLM	Ray Hewitt	Geographic Information Systems
BLM	Rena Gutierrez	Public Involvement
BLM	Russell Stovall	Hazardous Materials; Human Health and Public Safety

Table 5-1. List of Preparers (Continued)		
Organization	**Name**	**Project Role**
BLM	Shannon Gentry	Range and Livestock; Vegetation
BLM	Tim Frey	Wildlife – Fish
BLM	Tom Phillips	BLM Special Management Areas; Visual Resources; Wilderness
BLM	Vanessa Duncan	Noise and Vibration
Solv	Chelsie Romulo	Website; Comments; Visual Resources; Land Use and Land Ownership; Lands and Realty; Wildlife and Migratory Birds
Solv	Dave Henney	Contract Project Manager
Solv	Zoie Diana	GIS Support
Solv	Phil Sczerzenie	Wildlife and Migratory Birds; Vegetation and Non-native Invasive Species; Threatened and Endangered Species and Special Status Species, Biological Assessment
Solv	Eveline Martin	Soils; Vegetation and Non-native Invasive Species, Wildlife, Threatened and Endangered Species and Special Status Species, QC Review
Solv	Wendy Grome	QC Review, Deputy Project Manager
Solv	Brian Minichino	Air Quality; Noise and Vibration; Range and Livestock; Transportation & Traffic
Solv	Marissa Staples	BLM Special Management Areas; Climate Change and Sustainability; Recreation; Document Management, Visual Resources; Land Use and Land Ownership; Lands and Realty, Cultural Resources
Solv	Pam Sarlouis	Document Formatting and Preparation
Solv	Mary Peters	Threatened and Endangered Species and Special Status Species; Range and Livestock
Solv	Nathalie Jacque	Socioeconomics and Economic Development; Environmental Justice; Cumulative Impacts, Deputy Project Manager
Solv	Steve Shiell	Deputy Project Manager; Chapter 2 (Proposed Action & Alternatives); Transportation & Traffic; Cumulative Impacts
Solv	Tim Lavallee	Air Quality; Noise and Vibration
CDM Smith	Todd Bragdon, Brian Munson, Rochelle Larson	Water Quality
Daniel B. Stephens and Associates	Paula Schuh, John Ayarbe	Surface Water Use
Daniel B. Stephens and Associates	Julie Kutz	Hazardous Materials and Solid Waste/Waste Disposal
Lee Wilson and Associates	Lee Wilson	Groundwater Use; Mineral and Geologic Resources
Southwest Planning	Chris Cordova	Utilities and Infrastructure
Van Citters Historic Preservation	Katherine Roxlau	Cultural Resources Lead

Source: Summarized from internal FEIS data.

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GLOSSARY

GLOSSARY

Air-Quality Control Region: A contiguous area where air quality is relatively uniform. AQCRs may consist of two or more cities, counties or other governmental entities, and each region is required to adopt consistent pollution control measures across the political jurisdictions involved.

Alkali sinks: A sunken area of land where the soil is strongly impregnated with alkalis, which are destructive to vegetation.

Allotment (range): A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under management of an authorized agency. An allotment generally consists of Federal rangeland, but may include intermingled parcels of private, State, or Federal land. BLM stipulates the number of livestock and season of use for each allotment.

Alluvial valley: Valley filled with stream deposit.

Ambient: The natural surroundings of a location.

Amenity migration: The movement of people based on the draw of natural or cultural amenities.

Animal unit: A unit of measure for rangeland livestock equivalent to one mature cow or five sheep or five goats, all over 6 months of age. An animal unit is based on an average daily forage consumption of 26 pounds of dry matter per day.

Animal unit month (AUM): A standardized unit of measurement of the amount of forage necessary for the complete sustenance of one animal unit for a period of one month; also, a unit of measurement of grazing privileges that represents the privilege of grazing one animal unit for a period of one month.

Area of potential effect: The area of potential effect (APE) is the geographic area within which an undertaking (i.e., project) may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.

Attainment area: A region within which the level of a pollutant is considered to meet the National Ambient Air Quality Standards.

A-weighted decibel: Decibel measurement on the “A-weighting” scale. A decibel adjusted (weighted) to reflect the relative loudness of sounds most sensitive to human ears.

Best Management Practice (BMP): Method that has been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources, including construction sites. They also help prevent or mitigate other safety and environmental issues.

Breccia pipe: A chimney-like structure filled with angular rock fragments.

Cash and cash equivalents: The most liquid assets found within the asset portion of a company's balance sheet. Cash equivalents are assets that are readily convertible into cash, such as money market holdings, short-term government bonds or Treasury bills, marketable securities, and commercial paper.

Cash trust fund: A fund set up by a company in an amount that is determined to be sufficient to cover specific reclamation costs which are contained in the decommissioning plan. The fund amount will be a function of the expected annual reclamation costs, investment policy, and expected real rates of return.

Change house: Building where mine workers change into work clothes, also known as "the dry."

Civilian labor force: The sum total of those currently employed and unemployed.

Codominant: Being one of two or more of the most common or important species in an ecological community.

Colluvium: A thin layer of soil and debris.

Contamination: The introduction into water, air, and soil of microorganisms, chemicals, toxic substances, wastes, or wastewater in a concentration that makes the medium unfit for its next intended use.

Copper ad valorem: Extractive industries are subject to the copper ad valorem tax for operating mines. The copper ad valorem tax is dependent upon: 1) the value of the mine and all real and personal property and; 2) the value of salable minerals.

Criteria pollutants: Six primary air pollutants found throughout the United States as defined by USEPA pursuant to the Clean Air Act. They are particulates, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead.

Cultural resources: Cultural resources are physical manifestations of culture, specifically archaeological sites, architectural properties, ethnographic resources, and other historical resources relating to human activities, society, and cultural institutions that define communities and link them to their surroundings.

Day-Night Average Sound Level: The A-weighted equivalent sound level for a 24-hour period with an additional 10 dB imposed on the equivalent sound levels for night time hours of 10 p.m. to 7 am.

Decibel: A unit used to express the intensity of a sound wave, equal to 20 times the common logarithm of the ratio of the pressure produced by the sound wave to a reference pressure, usually 0.0002 microbar.

Discountable Effects: Effects that are extremely unlikely to occur. This term was developed by USFWS for analyzing effects to biological resources.

Equivalent sound level: Quantifies the noise environment as a single value of sound level for any desired duration.

Forb: An herbaceous flowering plant other than grasses.

Full-time equivalent (FTE): One person working full-time for 1 year or 2,080 hours.

General Head Boundary: Model boundary across which flow can occur based on the difference in head between the model cell next to the boundary and reference level at the boundary.

Graben: A depressed block of land bordered by parallel faults.

Grama: Any of several pasture grasses (genus *Bouteloua*) of the western United States.

Graminoids: Grasses, herbaceous plants with narrow leaves growing from the base.

Grazing: Consumption of native forage on rangeland or pastures by livestock or wildlife.

Grazing allotment: An area where one or more livestock operators graze their livestock. An allotment generally consists of Federal land but may include parcels of private or State-owned land.

Grazing permit: An authorization that allows grazing on public land. Permits specify class of livestock on a designated area during specified seasons each year. Permits are of two types: preference (10 years) and temporary nonrenewable (1 year).

Greenhouse gas: Any gas, such as carbon dioxide or chlorofluorocarbons (CFCs), that contributes to the greenhouse effect when released into the atmosphere.

Hazards training: Per 30 CFR 48.31, instruction on hazard recognition and avoidance; emergency and evacuation procedures; health and safety standards, safety rules, and safe working procedures; self-rescue and respiratory devices; and such other instruction as may be required by the Mine Safety and Health Administration District Manager based on circumstances and conditions at the mine.

Hedonic Pricing Method: The hedonic pricing method is most often used to value environmental amenities that affect the price of residential properties. It can be used to estimate economic benefits or costs associated with environmental quality, including air pollution, water pollution, or noise and environmental amenities, such as aesthetic views or proximity to recreational sites. The basic premise is that the price of a marketed good is related to its characteristics, or the services it provides. For example, the price of a car reflects the characteristics of that car—transportation, comfort, style, luxury, fuel economy, etc. Therefore, the individual characteristics of a car or other good can be valued by looking at how the price people are willing to pay for it changes when the characteristics change.

Hertz: A unit of frequency equal to 1 cycle per second.

Historic properties: Historic properties are cultural resources that meet the criteria for listing on the NRHP.

Inhalable fraction: Portion of dust cloud capable of being breathed in via nose and mouth.

Invasive species: Non-native species that tend to spread prolifically and undesirably or harmfully.

Letter of credit: An agreement between a banking institution and a company whereby the bank will provide cash funds to a third party (the beneficiary, which in this case would be the government), under specific terms contained in the letter of credit.

Lineament: A distinctive line or contour.

Make-up water: Water supplied to compensate for loss by evaporation and leakage.

Material Safety Data Sheet (MSDS): Sheets that contain safety information about a chemical or material including necessary protective equipment and safety precautions, such as reactivity.

Mesa: An isolated flat-topped hill with steep sides, found in landscapes with horizontal strata.

Meters: The international standard unit of length, approximately equivalent to 39.37 inches.

Mine Area: Area within the mine project boundary.

National Ambient Air Quality Standards: Standards established by the USEPA that apply to outdoor air throughout the country. Primary standards are designed to protect human health, with an adequate margin of safety, including sensitive populations such as children, the elderly, and individuals suffering from respiratory disease.

National Register of Historic Places: The National Register of Historic Places (NRHP) is a listing maintained by the Federal government of prehistoric, historic, and ethnographic buildings, structures, sites, districts, and objects that are considered significant at a Federal, State, or local level. Listed resources can have significance in the areas of history, archaeology, architecture, engineering, or culture. Resources that are listed on the NRHP, or have been determined eligible for listing, have been documented and evaluated according to uniform standards, and have been found to meet criteria of significance and integrity.

Net smelter returns royalty: Charged as a percentage of the mineral's gross value, or the production volume multiplied by the price per pound. The State does permit mining companies to deduct costs associated with transportation and processing costs from royalty payments, but not mineral extraction costs. The Commissioner decides the royalty rates on a case by case basis; however, the rate cannot be less than 2 percent.

Nonattainment areas: A region where air pollution levels persistently exceed National Ambient Air Quality Standards.

Noxious weeds: Invasive plant species that has been designated by county, State, or Federal government.

Order of magnitude: A fixed ratio between sets of numbers or amounts. The common order of magnitude is 10, meaning an order of magnitude is 10 times something else and something that is two orders of magnitude is 100 times another item.

Other property income: Represents property income minus proprietor income. It includes corporate profits, capital consumption allowance, payments for rent, dividends, royalties, and interest income. It may also be referred to as "other property type income".

Payment in lieu of taxes: A program whereby the local government or municipality is compensated foregone property tax revenue due to the nature of ownership or use of a particular piece of real property (e.g. land, right-of-way).

Per capita personal income: This measure of income is calculated as the total personal income of the residents of an area divided by the population of the area. Per capita personal income is often used as an indicator of the quality of consumer markets and of the economic well-being of the residents of an area.

Performance bond: A bond issued to one party of a contract as a guarantee against the failure of the other party to meet obligations specified in the contract. Under the performance bond agreement, the insurer agrees to act as surety for the company and makes a commitment to be financially responsible for all claims and expenses arising out of the (in this case) decommissioning plan up to a certain limit.

Permissible exposure limit: The legal limit of employee exposure to a chemical or physical agent established by Occupational Safety and Health Administration.

Permit Area: Area within the mine project boundary, the pipeline corridor, the production wells, and the ancillary sites including millsite and substation areas.

Permitted livestock use: The forage allocated by, or under the guidance of, an applicable land use plan for livestock grazing in an allotment under a permit or lease and expressed in AUMs.

Playas: An area of flat, dried up land, esp. a desert basin from which water evaporates quickly.

Perennial plants: A plant that that lives for more than 2 years.

Personal current transfer receipts: Payments consisting of transfer payments by persons to government and to the rest of the world. Payments to government include donations, fees, and fines paid to Federal, State, and local governments, formerly classified as "personal nontax payments."

PM_{10}: Particulate matter less than 10 microns in diameter.

$PM_{2.5}$: Particulate matter less than 2.5 microns in diameter.

Programmatic Agreement: A Programmatic Agreement is a document developed to memorialize the measures that would be implemented to avoid, minimize, or mitigate adverse effects that would occur to historic properties as the result of an undertaking. Such measures are normally developed by the lead Federal agency in consultation with the SHPO, ACHP, the project proponent, interested Tribes, and the interested public.

Raised fault block: Very large blocks of rock, sometimes hundreds of kilometers in extent, created by tectonic and localized stresses in the Earth’s crust.

Reagent management: The management of a substance or compound that is added to a system in order to bring about a chemical reaction, or added to see if a reaction occurs.

Resources Excise Tax Act: Consists of three taxes (resources, processors, and services) on activities related to natural resources in New Mexico. The first tax, the “resources tax” is imposed if the entity is the owner of the land where the extracting is taking place. The second, the “processors tax” applies if the entity owns the land and is processing hard minerals. The third, the “services tax” applies to the entity severing or processing natural resources if it is not the owner of the natural resources. The service charge is the total amount of money or the reasonable value of other consideration received for severing or processing any natural resource.

Respirable fraction: Dust that can penetrate into the gas-exchange region of the lungs.

Right-of-Way: The legal right, established by usage or grant, to pass along a specific route through grounds or property belonging to another. The public land the BLM authorizes a holder to use or occupy under a grant.

Runoff: The non-infiltrating water entering a stream or other conveyance channel shortly after a rainfall.

Sediment: Particles derived from rock or biological sources that have been transported by water.

Severance tax: A tax imposed on the privilege of removing of nonrenewable natural resources. Severance tax is charged to producers, or anyone with a working or royalty interest, for operations in the imposing States.

Short ton: A unit of mass equal to 2,000 pounds.

Solvency: The ability of a company to meet its long-term financial obligations. Solvency is essential to staying in business, but a company also needs liquidity to thrive.

State Implementation Plan: The State plan for complying with the Federal Clean Air Act. A SIP consists of narrative, rules, technical documentation, and agreements that an individual State will use to clean up areas not meeting the National Ambient Air Quality Standards.

Surety bond or Surety: A promise to pay one party (the obligee) a certain amount if a second party (the principal) fails to meet some obligation, such as fulfilling the terms of a contract. The surety bond protects the obligee against losses resulting from the principal's failure to meet the obligation.

Tangible asset: Assets that have a physical form. Tangible assets include both fixed assets, such as machinery, buildings and land, and current assets, such as inventory.

Threshold limit value: The level below which it is believed that a worker's exposure daily over a career would have no adverse health effects based on available research.

Time-weighted average: Average exposure over a unit of time (often 8 hours), meaning periods of exposure may exceed this amount if average is at or below the specified level.

Unemployment rate: The number of unemployed persons divided by the labor force, where the labor force is the number of unemployed persons plus the number of employed persons.

Volcanic basalts: A common extrusive igneous rock formed from the rapid cooling of basaltic lava exposed at or very near the surface.

Warm season grasses: Grasses that go dormant in the winter in mild climate areas. They normally will not grow in cold winter areas.

Willingness to Pay: The amount an individual would be willing to pay for a change in that environmental good or service.

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