Aquifer Protection Permit Application

Copper World Project

September 2022

Prepared by:

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HUDBAY

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Certification of Truth, Accuracy, and Completeness

I certify under penalty of law that this Aquifer Protection Permit (APP) application and all attachments were prepared under my direction or authorization and all information is, to the best of my knowledge, true, accurate, and complete. I also certify that the APP Regulated Facilities described in this application are or will be designed, constructed, operated, and/or closed in accordance with the terms and conditions of the Aquifer Protection Program and applicable requirements of Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2 and Arizona Administrative Code (A.A.C.) Title 18, Chapter 9. I am aware that there are significant penalties for submitting false information, including permit revocation as well as the possibility of fines and imprisonment for known violations.

Printed Name: Javier Del Rio

Title: Vice President

Company: Rosemont Copper Company

Signature: Javier Del Rio (Sep 21, 2022 15:46 MDT)

Date: 09/21/2022

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List of Acronyms and Abbreviations

ACRONYMS

A.A.C.	Arizona Administrative Code
ABA	Acid Base Accounting
ACC	Arizona Corporation Commission
ADWR	Arizona Department of Water Resources
ADEQ	Arizona Department of Environmental Quality
AEF	Annual Exceedance Frequency
AG	Acid Generating
AL	Alert Level
AMA	Active Management Area
ANF	Annual Exceedance Frequency
APP	Aquifer Protection Permit
AQL	Aquifer Quality Limit
ARD	Acid Rock Drainage
A.R.S.	Arizona Revised Statutes
ASMI	Arizona State Mine Inspector
ASTM	American Society for Testing and Materials
AWQS	Aquifer Water Quality Standard
AZPDES	Arizona Pollution Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
BATFE	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BLM	Bureau of Land Management
BMPs	Best Management Practices
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CN	Curve Number
CQA	Construction Quality Assurance
DL	Discharge Limit
DCTs	Demonstrated Control Technologies
DOT	Department of Transportation
DSHA	Deterministic Seismic Hazard Analysis
EC	Electrical Conductivity
EPCM	Engineering, Procurement and Construction Management

ERC	Emergency Response Coordinator
EW	Electrowinning
EPA	Environmental Protection Agency
EPRP	Preparedness and Respond Plan
ESA	Effective Stress Analysis
FMEA	Failure, Modes and Effect Analysis
FCC	Federal Communications Commission
FOS	Factor of Safety
GCL	Geosynthetic Clay Liner
G&H	Geological and Hydrogeological
HC	Hydrogeologic Characterization
HCT	Humidity Cell Test
HDPE	High-Density Polyethylene
HEC-HMS	Hydrologic Engineering Center's Hydraulic Modeling System
H:V	Slope Horizontal to Vertical ratio
ICMM	International Council of Metals and Mining
IFC	Issued for Construction
LCI	Lettis Consultants International, Inc.
LCRS	Leak Collection and Removal System
LLDPE	Linear Low-Density Polyethylene
LSA	Lined Surface Area
M&A	Montgomery & Associates
MCE	Maximum Credible Earthquake
MCL	Maximum Contaminant Level
MPE	Maximum Probable Earthquake
MSGP	Multi-Sector General Permit
MSHA	Mine Safety and Health Administration
MWMP	Meteoric Water Mobility Procedure
NAG	Non-acid Generating
NA	Not Analyzed
NNP	Net Neutralization Potential
NOAA	National Oceanic and Atmospheric Administration
NPR	Neutralization Potential Ratio
NRCS	National Resources Conservation Service
O&M	Operations and Maintenance
OMS	Operation, Maintenance and Surveillance
ORP	Oxidation-reduction Potential

OSP	Open Standpipe Piezometer
PAG	Potentially Acid Generating
PC	Pit Characterization
PDEQ	Pima County Department of Environmental Quality
PFS	Pre-feasibility Study
PGA	Peak Horizontal Ground Acceleration
PLR	Potential Leakage Rate
PLS	Pregnant Leach Solution
PMA	Pollutant Management Area
PMF	Probable Maximum Flood
POC	Point of Compliance
RCRA	Resource Conservation and Recovery Act
ROM	Run-of-Mine
PLS	Pregnant Leach Solution
POC	Point of Compliance
PSHA	Probabilistic Seismic Hazard Analysis
PVC	Polyvinyl Chlori0de
QA	Quality Assurance
QAE	Quality Assurance Engineer
QC	Quality Control
SA	Spectral Acceleration
SAG	Semi-Autogenous Grinding
SAP	Sampling and Analysis Plan
SCS	Soil Conservation Service
SPLP	Synthetic Precipitation Leaching Procedure
SWMP	Site Water Management Plan
SWPPP	Stormwater Pollution Prevention Plan
SVOC	Semi-volatile Organic Compounds
SX	Solvent Extraction
SX-EW	Solvent Extraction - Electrowinning
TDS	Total Dissolved Solids
TARP	Trigger Action Response Plan
TEP	Tucson Electric Power
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

VOC	Volatile Organic Compounds
VWP	Vibrating Wire Piezometer
WQL	Water Quality Limit
WRCC	Western Regional Climate Center
WRF	Waste Rock Facility

ABBREVIATIONS

ac	acre
amsl	above mean sea level
bgs	below ground surface
cf	cubic feet
cfs	cubic feet per second
cm/s	centimeters per second
ft	feet
ft^3	cubic feet
ft/sec^2	feet per second squared
°F	Degrees Fahrenheit
g	acceleration due to gravity
gpd	gallons per day
g/ton	gallons per ton
gpm	gallons per minute
in	inches
km	kilometers
lbs	pounds (avoirdupois)
lb/ft^3	pounds per cubic foot
L	liter
mg/L	milligrams per liter
Mt	million tons (short)
psi	pounds per square inch
sf	square feet
s.u.	standard units
T	tons (short)
stpd	short tons per day

GENERAL NOTES

Single-Lined:	Refers to single-lined facilities such as the Process Area Stormwater Pond, HLF Stormwater Pond(s), and Heap Leach Pad. The liner systems for these facilities will include a prepared subgrade surface, a GCL, and an HDPE or LLDPE liner.
Double-Lined:	Refers to double-lined facilities such as the Raffinate Pond, PLS Pond, Reclaim Pond, and Primary Settling Pond. The liner systems for these facilities will include a prepared subgrade surface, a GCL, an HDPE secondary (bottom) liner, an LCRS layer, and an HDPE primary (top) liner.
Inert:	Materials having a total sulfur concentration of less than 0.3% and a net neutralization potential (NNP) greater than zero (0) or a neutralization potential ratio (NPR) greater than three (3). This definition is based on the ADEQ document titled “Draft Policy for the Evaluation of Mining Rock Materials for the Determination of Inertness” (ADEQ, 1998). A.R.S. §49-201(19) defines inert as “broken concrete, asphaltic pavement, manufactured asbestos-containing products, brick, rock, gravel, sand and soil. Inert material also includes material that when subjected to a water leach test that is designed to approximate natural infiltrating waters will not leach substances in concentrations that exceed numeric aquifer water quality standards established pursuant to A.R.S. §49-223, including overburden and wall rock that is not acid generating, taking into consideration acid neutralizing potential, and that it will not be subject to mine leaching operations.”
Contact Water:	Water that has contacted process areas or active mining areas, such as areas within the pit shells.
Non-contact: Water:	Includes stormwater that is diverted around or otherwise does not contact mining operations. Excludes mine drainage or stormwater that has contacted process areas or active mining areas.
Project:	Refers to the Copper World Project.

START UP Time DESIGNATIONS

The following time frame are defined herein:

Start of Construction:	The time when site preparation begins for an Aquifer Protection Permit Regulated Facility.
Startup of Mining Operations:	The time when acid is introduced into ore on the Heap Leach Pad or when ore is introduced into the Copper-Molybdenum Grinding and Flotation Circuit.
Completion of Commissioning:	The time when construction of a facility is complete, all QC and CQA testing have been completed, construction has been approved by the Engineer of Record, and the facility has been placed into operation.

1.0 INTRODUCTION

This document presents supporting information and demonstrations that are required for an area-wide Aquifer Protection Permit (APP) application (Application, Application Document) for the Copper World Project (Project, Copper World). This Application is being submitted to the Arizona Department of Environmental Quality (ADEQ) in accordance with applicable requirements under Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2, and Arizona Administrative Code (A.A.C.) Title 18, Chapter 9. This Application provides required information for facilities that are subject to APP regulation, herein referred to as APP regulated facilities. This Application also identifies which facilities will be addressed through general permits or are exempt from regulation pursuant to Arizona Revised Statutes.

The Copper World Project is a proposed new copper production facility that has been designed to meet prescriptive Best Available Demonstrated Control Technology (BADCT) where prescriptive standards have been established. Pre-feasibility level designs have been developed for the Project. Final designs and associated design enhancements are not expected to affect the discharging status of any of the APP Regulated Facilities. As described in this Application, the Copper World Project facilities include:

- Fifty-two (52) facilities not regulated by the APP program (i.e., non-discharging, exempt, or inert, etc.);
- Six (5) facilities will have a general permit: three (3) ore stockpiles, an equipment wash facility, Type 4 sewage treatment facilities (septic systems), and large truck tire disposal areas;
- Sixteen (16) area-wide APP regulated facilities; and
- Three (3) exempt facility types that include two (2) facilities that ceased operations prior to APP regulations (Helvetia Smelter and the Copper World Reclaimed Tailings Site) and growth media (soil) stockpile(s).

1.1 GENERAL PROJECT LOCATION AND LEGAL DESCRIPTION

The Copper World Project is located approximately 28 miles southeast of Tucson Arizona in Pima County (**Figure 1**) and about 12 miles southeast of Sahuarita, Arizona. The approximate center of the main Project operations is located at latitude and longitude 31º 51'N and 110º 46'W, respectively. **Figure 2** shows the general Project facility locations that includes a Utility Corridor (UC) for power and water lines (and fiber optics) and the main operations area. **Figure 3** shows the major facilities in the main Project operations area. **Figure 4** shows a view of the Plant Site facilities.

Operations will be conducted in portions of the following sections:

- T18S R15E: Sections 10, 13, 14, 15, 22, 23, 24, 25, 27, 36
- T18S R16E: Sections 19, 30, 31

Power and water utilities are located in portions of the following sections:

- T18S R15E: 7, 17, 18, 20, 21
- T18S R14E: 1, 2, 12
- T17S, R14E: Sections 17, 18, 19, 20, 29, 32, 33, 34, 35

Rights-of-Ways have been established through State land with the Arizona State Land Department (ASLD) for these utilities. Additionally, a license agreement has been established with the Town of Sahuarita (TOS) related to the placement water utilities within the TOS limits.

The production wells are located on private Rosemont Copper Company (Rosemont) land within the flowing sections and on the following parcels:

- Sanrita South: T17S R14E, Section 29 (parcel 303-54-005B)
- Sanrita West: T17S R14E: Section 17 (parcel 303-60-1410)

Additionally, production water wells may also be constructed on the following parcel:

- Vulcan Property: T17S R13E, Section 31 (parcel 303-67-002H)

This well site is not shown on the figures since this is a contingency location and may not be needed.

The core of the Copper World Project property consists of the following:

- 132 patented lode and millsite claims that encompass nearly 2,004 acres.
- About 1,877 acres of fee land, adjacent to, and generally south and west of the patented mining claims.

Rosemont also owns additional fee lands in the area that are not part of the Copper World Project described herein (see **Figures 1 through 3**).

Patented claims are lands that were originally unpatented mining claims but by application and conveyance (i.e., the issuance of a Patent), the federal government transferred the mineral and surface estate to a private party without any kind of government reservation of property rights.

Fee Lands are also lands that have been conveyed by a Patent (in the private world these instruments are called "Deeds") to a private party but these lands were transferred based on specific federal statutes that reserved certain property rights to the federal government.

The Rosemont property is also part of an existing Rosemont Ranch, a ranching facility with over 35,000 acres of grazing lands and leases.

The following are directions to the main Copper World Project operations area from Tucson, Arizona:

- From Interstate 10 (I-10) take I-19 south approximately 16.5 miles to Sahuarita Road (exit 75) in the Town of Sahuarita. Take Sahuarita Road east to Santa Rita Road (approximately 3 miles). Turn south onto Santa Rita Road and travel south/southeast for about 11.5 miles to the site.

1.2 GENERAL PROJECT DESCRIPTION

The Copper World Project will be developed as a truck and shovel open pit mining operation. Both sulfide and oxide ore will be mined and processed. The Project will include a milling and flotation circuit (processing plant) for sulfide ore along with conventional tailings disposal. A heap leach pad (HLP) and associated solvent-extraction and electrowinning (SX-EW) are planned for the recovery of copper from oxide ore. The leaching of copper concentrate is also planned along with precious metals recovery. Additionally, the site will have an acid plant.

Six (6) open pits will be mined in a general west to east progression. From west to east these pits include Peach, Elgin, Heavy-Weight, Copper World, Broadtop Butte and Rosemont. The processing facilities will be located on the west side of the Santa Rita Mountains along with the tailings storage facilities (TSFs) and the HLP. Waste rock storage will occur on both sides of the range in a waste rock facility (WRF). Utilities (power and water) will come from the west to service the Project as shown on **Figure 2**. Fresh water for the Project will come from well fields located near the Town of Sahuarita and potentially from pit dewatering wells.

1.3 DOCUMENT ORGANIZATION

This report is organized as follows:

Section 1.0	Presents the general information regarding the Project, including Project location and legal description.
Section 2.0	Presents facility owner and operator details as well as other general information required for an area-wide APP application, including a list of APP regulated facilities described in this Application Document. This section also included a list of permits applicable to the Project.

Section 3.0	Presents information related to historic site activities, including existing site conditions such as climate, natural environment, seismicity and geologic hazards.
Section 4.0	Provides an overview of the Project's planned operations.
Section 5.0	Presents the facilities list and APP designation (such as regulated, exempt, and stormwater management).
Section 6.0	Provides a description of the surface water hydrology and stormwater management for the Project area.
Section 7.0	Presents the results of a hydrological study that includes a summary of the hydrogeologic field investigation, geology, hydrogeologic setting, aquifer hydraulic characteristic and groundwater flow modeling.
Section 8.0	Presents the results of a geochemical characterization program for the materials associated with the Project such as tailings and waste rock, including a waste rock handling plan.
Section 9.0	Provides the discharge rates and characterization rates of the APP regulated facilities.
Section 10.0	Provides a Best Available Demonstrated Control Technology (BADCT) demonstration for the area-wide APP regulated facilities included in this Application Document.
Section 11.0	Presents a site-wide water balance and management thereof.
Section 12.0	Presents the demonstration of compliance with Arizona aquifer water quality standards (AWQS), including the Pollutant Management Area (PMA), groundwater quality characterization results, proposed Points of Compliance (POCs), and predicted Discharge Impact Area (DIA).
Section 13.0	Presents a contingency plan which outlines the Project's emergency coordinators as well as defining the procedures to be completed if an unauthorized discharge occurs.
Section 14.0	Provides a proposed APP regulated facility inspection and monitoring program.
Section 15.0	Provides the description of the waste management strategy for the Project that includes non-hazardous and hazardous waste, construction debris, and large truck tire disposal.
Section 16.0	Presents the closure strategy for the Project as dictated by regulatory requirements of the APP Program and the Arizona Mined Land Reclamation Act.
Section 17.0	Presents costs estimates for APP regulated facility construction, closure, and post-closure.
Section 18.0	Provides a demonstration of technical capability.
Section 19.0	Provides a demonstration of financial capability.
Section 20.0	Presents a list of anticipated compliance schedule items for the Project following permit issuance.
Section 21.0	Lists applicable references used in the preparation of this Application Document.

Studies reports, and associated information used to inform and support this area-wide APP application are provided in **Appendix A** through **Appendix P**. Supporting information has been developed by consultants such as Wood, Piteau and Bowman, as well by Rosemont. Other consultants, such as Ausenco and Paterson & Cooke, provided as needed technical support. Previous studies associated with the Rosemont Copper Project were also referenced as needed, as were other studies and investigations performed by others in the general Copper World Project area.

Piteau provided geohydrology, geochemical and groundwater modeling support for the Project. As a subcontractor to Piteau, Bowman provided surface water hydrology support. Wood was responsible for facility designs such as for the tailings and heap leach facilities, including site water management planning and closure design. In addition to supporting this APP application, these consultants also provided support for a pre-feasibility study (PFS). With regard to the PFS, Wood developed an overall report titled:

- Rosemont Copper World Technical Report Summary on PFS for Tailings Storage Facilities, Heap Leach Facility, and Waste Rock Facility, dated June 24, 2022.

This PFS report contains appendices that are all referenced in this Application Document. For convenience, the appendices to this overall PFS report were separately referenced and provided within select appendices. The main summary document, however, is not specifically referenced. Therefore, it is provided for general reference as a completed document in **Appendix I.10**.

2.0 AQUIFER PROTECTION PERMIT INFORMATION

Rosemont Copper Company (Rosemont), a wholly owned subsidiary of Hudbay Minerals Inc., is the owner and operator of the Copper World Project (Project, Copper World). Rosemont is applying for an Aquifer Protection Permit (APP). A copy of the APP Application Form is presented in **Appendix A.1**. Additionally, an Administrative Completeness Checklist is provided in **Appendix A.2**. This checklist provides a reference between those items required by the Arizona Department of Environmental Quality (ADEQ) for an area-wide aquifer protection permit application.

General administrative information is summarized in the remainder of this section.

2.1 NAME AND ADDRESS OF THE APPLICANT, OWNER, AND OPERATOR

Owner /Operator

Rosemont Copper Company

5255 E. Williams Circle

Suite 1065

Tucson, Arizona 85711

(520) 495-3500

2.2 MAILING ADDRESS OF THE APPLICANT, OWNER, AND OPERATOR

Owner /Operator

Rosemont Copper Company

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Suite 1065

Tucson, Arizona 85711

(520) 495-3500

Facility Contact

Mr. David Krizek

Rosemont Copper Company

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Tucson, Arizona 85711

(520) 495-3527

2.3 FACILITY LOCATIONS

As noted in **Section 1.0**, the approximate center of the Copper World Project operations is located at latitude and longitude 31º 51’N and 110º 46’W, respectively. Additionally, facility operations will be conducted in portions of the following sections:

- T18S R15E: Sections 10, 13, 14, 15, 22, 23, 24, 25, 27, 36
- T18S R16E: Sections 19, 30, 31

The Project disturbance area will not encompass the entire portions of all the sections listed above. Disturbances associated with the main Project area will be confined to Rosemont's fee and patented lands of approximately 3,881 acres.

The disturbance footprint associated with the power and water utilities outside of the main Project area, which is located in the sections listed below, is approximately 73 acres. Disturbances associated with the Utility Corridor would increase if the Vulcan well site location was utilized.

- T18S R15E: 7, 17, 18, 20, 21
- T18S R14E: 1, 2, 12
- T17S, R14E: Sections 17, 18, 19, 20, 29, 32, 33, 34, 35

Section 5.0 of this Application Document, and **Appendix D**, describes each potentially APP regulated facility as well as those facilities that are exempt from APP regulation. **Table 2.01** provides a list of those facilities that are potentially regulated under ADEQ's APP Program. Facilities listed in **Table 2.01** include those that are part of this area-wide APP Application as well as facilities that may be generally permitted, such as intermediate ore stockpiles, an equipment wash, and sewage treatment facilities. These facilities will be assessed during the APP application process and a general permit will be applied for, as appropriate, or may be incorporated into the area-wide APP for the Copper World Project. Further analysis may also exempt some of these facilities from regulation.

Table 2.01 provides approximate latitude, longitude, and cadastral location of each potentially regulated APP facility. Facility locations are shown on **Figure 2** through **Figure 5**.

Table 2.01: Location of Potentially APP Regulated Facilities

Facility Name	Facility Type (A.R.S. §49-241(B))	Latitude (North)	Longitude (West)	Cadastral		
				T	R	S
General Permit Facilities (not included in Area-wide APP)						
Coarse Ore Stockpile (COS) (sulfide ore)	Intermediate Ore Stockpile	31°51'19.43" N	110°47'33.54" W	18S	15E	22
Coarse Ore Stockpile (COS) (oxide ore)	Intermediate Ore Stockpile	31°51'16.39" N	110°47'29.63" W	18S	15E	22
Temporary ROM Ore Stockpile (TRS) (combined sulfide and oxide)	Intermediate Ore Stockpile	31°51'27.11" N	110°47'5.97" W	18S	15E	23
Southwest Energy Facility	Vehicle Wash	31°51'25.19" N	110°47'16.79" W	18S	15E	23
Sewage Treatment Facilities	Septic Tanks and Leach Fields	Various	Various	18S	15E	22, 23
Tire Disposal Area (s)	Burial of Waste Tires	Various	Various	18S	15E	13, 14, 23, 24
Area-wide APP Facilities						
Tailings Storage Facility 1 (TSF-1)	Tailings	31º52’39.9” N	110º48’09.82” W	18S	15E	10, 15
Tailings Storage Facility 2 (TSF-2)	Tailings	31º50’56.24” N	110º47’ 21.93” W	18 S	15E	22, 27
Primary Settling Pond (PSB) (includes two cells)	Process Solution Pond	31°51'25.58" N	110°48'06.00" W	18S	15E	22
Heap Leach Pad (HLP)	Heap Leach Pad	31°50’55.48” N	110°47’56.01” W	18S	15E	22, 23
Pregnant Leach Solution (PLS) Pond	Process Solution Pond	31°50'58.17" N	110°48'21.93"W	18S	15E	22
HLF North Stormwater Pond	Non-Stormwater Pond	31°51'3.20" N	110°48'21.88"W	18S	15E	22
HLF South Stormwater Pond	Non-Stormwater Pond	31°50'53.59" N	110°48'21.90"W	18S	15E	22
Raffinate Pond	Process Solution Pond	31°51'17.25" N	110°48'2.09"W	18S	15E	22
Reclaim Pond	Process Solution Pond	31°51'17.27" N	110°47'58.76"W	18S	15E	22
Process Area Stormwater Pond	Non-Stormwater Pond	31°51'20.72" N	110°47'59.01"W	18S	15E	22
Waste Rock Facility	Waste Rock Facility	31°51’38.77” N	110°46’08.09” W	18S	15E	14, 13, 23, 24
Peach Pit	Open Pit	31°51’46.28” N	110°47’37.88” W	18S	15E	15
Elgin Pit	Open Pit	31°51’37.13” N	110°47’19.62” W	18S	15E	23
Heavy Weight Pit	Open Pit	31°51’42.08” N	110°46’41.07” W	18S	15E	14, 23
Copper World Pit	Open Pit	31°51’36.81” N	110°46’00.23” W	18S	15E	24
Broadtop Butte Pit	Open Pit	31°51’04.65” N	110°45’33.67” W	18S	15E	24, 25

Notes: The pits listed above have the potential to be flow-through and/or will be backfilled with waste rock. The Rosemont Pit, located on the east side of the Santa Rita Mountains, is not listed above. This pit will be a hydraulic sink and is therefore not a discharging facility. HLF = Heap Leach Facility.

2.4 EXPECTED OPERATIONAL LIFE OF THE FACILITY

The Project anticipates two (2) years of construction and pre-production stripping followed by 15 years of operations. Closure activities are anticipated to take between one (1) to two (2) years. Post-closure activities/monitoring is anticipated to occur for about 30 years.

It is estimated that construction will begin in 2025.

2.5 SUMMARY OF PERMITS FOR THE FACILITY

This is a new facility. Rosemont has already applied for, or plans to apply for, permits that include, but are not limited to, those listed in the following sections. A complete list of current permits for the Copper World Project is provided in **Appendix A.3**.

2.5.1 Federal Permits

United States Environmental Protection Agency (EPA)

- Resource Conservation and Recovery Act (RCRA) Hazardous Waste ID Number

United States Department of Transportation (DOT)

- Hazardous Materials Transportation Registration

Mine Safety and Health Administration (MSHA)

- MSHA ID Number

Bureau of Alcohol, Tobacco, Firearms and Explosives (BATFE or ATF)

- Blasting Operator Registration

Federal Communications Commission (FCC)

- Radio Licenses for Industrial/Business Pool Conventional Use

2.5.2 State Permits

Arizona Department of Environmental Quality (ADEQ)

- Area-wide Aquifer Protection Permit (APP)
- Class II Air Quality Control Permit
- Fugitive Dust Permit
- APP Type 2.02 General Permit(s) for Intermediate Stockpiles at Mining Sites
- APP Type 4 General Permit for Onsite Wastewater Treatment Facility (septic systems)
- Arizona Pollution Discharge Elimination System (AZPDES) Multi-Sector General Permit (MSGP) (stormwater permit)
- Arizona Pollution Discharge Elimination System (AZPDES) Construction General Permit (CGP) (stormwater permit)
- Solid Waste Management Inventory Number
- Hazardous Waste Management Number
- Waste Tire Cell Registration
- Water System ID for Non-transient, Non-community Water System

Arizona Department of Water Resources (ADWR)

- Groundwater Withdrawal Permit
- Dam Safety Permit
- Well Drilling Permits

Arizona Corporation Commission (ACC)

- Certificate of Environmental Compatibility (CEC) (issued to Tucson Electric Power [TEP] for 138kV power line)

Arizona State Mine Inspector (ASMI)

- Mined Land Reclamation Plan

2.5.3 Local Permits

Pima County Department of Environmental Quality (PDEQ)

- Floodplain Use Permit(s)
- Solid Waste Management Inventory Number
- Hazardous Waste Management Number

Town of Sahuarita (TOS)

- License Agreement
- ROW Use Permit

2.6 COPY OF CERTIFICATE OF DISCLOSURE REQUIRED BY A.R.S. §49-109

A.R.S. § 49-109 requires that certificate of disclosure be submitted to ADEQ if:

- A person has been convicted of a felony involving laws related to solid waste, special waste, hazardous waste, water quality or air quality in any state or federal jurisdiction of 42 United States Code section 9603 within the five (5) year period immediately preceding execution of the certificate; or
- A person has been subject in any civil proceeding (except proceedings in which ADEQ was a party) to an injunction, decree, judgment or permanent order of any state or federal court within the five (5) year period immediately preceding the execution of the certificate that involved a violation of laws of that jurisdiction relating to solid waste, special waste, hazardous waste, used oil or used oil fuel, petroleum, water quality or air quality, except for a misdemeanor violation of A.R.S. §49-550, or a violation of 42 United States Code section 9603.

Rosemont Copper is not required to file a certificate of disclosure under A.R.S § 49-109.

2.7 DEMONSTRATION OF ZONING ORDINANCES, CODES, AND REGULATIONS

Although a demonstration of compliance with local zoning ordinances is a requirement for issuance of an Aquifer Protection Permit, mining activities impacting more than five (5) acres are exempted from complying with local zoning requirements pursuant to A.R.S. § 11-812.A.2 which states:

"11-812. Restriction on regulation; exceptions; aggregate mining regulation; definitions

> *A. Nothing contained in any ordinance authorized by this chapter shall:*
>
> *2. Prevent, restrict or otherwise regulate the use or occupation of land or improvements for railroad, mining, metallurgical, grazing or general agricultural purposes, if the tract concerned is five or more contiguous commercial acres. For the purposes of this paragraph:*

(b) "Mining" has the same meaning prescribed in section 27-301."

Regardless of the exemption allowed by statute, Rosemont plans to voluntarily comply (in essence and as practicable) with many of the zoning requirements.

3.0 GENERAL PROJECT INFORMATION

3.1 GENERAL MINING/ SITE HISTORY

The first recorded mining activity in the Helvetia-Rosemont mining district occurred in 1875 and the mining district was officially established in 1878. Production from mines on both sides of the Santa Rita ridgeline supported the construction and operation of two smelters. Copper production from the district ceased in 1951 after production of about 227,300 tons of ore. **Figure 5** shows the locations of these historic mining operations.

By the late 1950s, the Banner Mining Company ("Banner") had acquired most of the claims in the area and had drilled the discovery hole into the Rosemont deposit on the east side of the ridge. In 1963, Anaconda Mining Co. acquired options to lease the Banner holdings. Over the next ten years, Anaconda carried out an extensive drilling program on both sides of the ridgeline.

In 1973, the Anaconda Mining Co. and Amax Inc. formed a 50/50 partnership to form the Anamax Mining Co. ("Anamax") and in 1985, Anamax ceased operations and liquidated their assets. ASARCO Inc. ("Asarco") purchased the patented and unpatented mining claims from Anamax's real estate interests in August 1988 and renewed exploration and engineering studies. In 1999, Grupo Mexico acquired the Helvetia-Rosemont property through a merger with Asarco and in 2004 Grupo Mexico sold the property to a Tucson real estate developer.

In April 2005, Augusta Resources purchased the property from Triangle Ventures LLC and initiated a series of extensive drill programs on the property known as the Rosemont Copper Project owned and operated by Rosemont Copper Company. Hudbay Minerals acquired Rosemont Copper Company, and its parent company August Resources, in 2014.

Evidence of past mining activities include waste rock dumps, mine workings, and building foundations. The foundation and slag pile associated with the Helvetia Smelter is still evident at the site as well as adobe walls that were part of the Helvetia Boarding House.

Underground mine workings that have the potential to affect APP regulated facilities are shown in the document titled Preliminary Geologic Hazard Assessment prepared by Wood (2022b) and provided in **Appendix B.1**. In general, only shallow or superficial mine workings are present in the tailings area. The more extensive workings are located in the proposed pit areas, which would eventually be mined out. Openings in the waste rock facility (WRF) area would be filled with non-acid generating (NAG) waste rock. **Section 8.7** and **Appendix G.3** that describes Rosemont's Waste Rock Handling Plan (Rosemont, 2022a). Additionally, a Hazard Mitigation Plan will be developed, as needed, where safety concerns exist when working around select mine openings (also see **Section 3.6**).

Old mine workings were also described in a Geologic Hazards Assessment (Tetra Tech, 2007) for facilities associated with the Rosemont Copper Project located on the east side of the Santa Rita Mountains. With regard to the Copper World Project, Tetra Tech (2007) covered the Rosemont Pit area. The Rosemont Pit, however, is not considered an APP regulated facility in this Application Document. The Rosemont Pit is anticipated to be a strong hydraulic groundwater sink and is therefore not considered an APP discharging facility.

The majority of old waste piles from these old mine working within Rosemont's private land boundaries will either be mined and processed or covered by the facilities. Materials that are not processed or covered, however, will relocated and placed in accordance with Rosemont's Waste Rock Handling Plan (Rosemont, 2022a). The Waste Rock Handling Plan provides guidelines on the testing and placement of waste rock in accordance with whether the material in non-acid generating (NAG), potentially acid-generating (PAG), or acid generating (AG). Further description of the plan is found in **Section 8.7** and **Appendix G.3**.

As a note, the old Copper World Mine mill tailings area was reclaimed in the mid-1990s by under a consent order against Asarco. ADEQ was involved in the clean-up efforts. Follow-up sampling and analysis of waste piles was also conducted in the early 2010's. ADEQ was also involved in this effort. No follow-up work was conducted by ADEQ resulting from that investigation.

With regard to historic mine workings and cultural resources in general, Rosemont conducts site surveys prior to ground disturbance on its private lands for sites that are eligible under the National Register of Historic Places (NRHP). Data recovery would occur on eligible NRHP sites. Rosemont has an internal Data Recovery Protocol that provides an overview of how and why a site would or would not be recommended eligible under the NRHP and if data recovery mitigation would be the appropriate treatment. Both historic and prehistoric sites are covered in the Data Recovery Protocol.

3.2 SITE SPECIFIC CLIMATE DATA

Climatological data, primarily from climatological stations representative of the Project area are summarized in the sections below. This information is provided in Piteau (2022a) titled Rosemont Copper World Project Rosemont Copper World Project, Hydrogeological Characterization (see **Appendix F.1**). The period of record for these monitoring stations ranges from 1894 through 2008 and includes precipitation, temperature, and pan evaporation rates. Representative data were used for calculations to size ponds, develop seepage and infiltration models, perform water balance calculations, and estimate storm events to design stormwater run-off controls.

3.2.1 Weather Stations

Meteorological data from multiple monitoring stations within a 30-mile radius of the Project, and for various time periods, include Canelo 1 NW (1910-2007), Helvetia (1916-1950), Santa Rita Experimental Range (1950-2005), Tucson International Airport (TIA) (1948-2016), Tucson University of Arizona (1894-2007), Nogales 6N (1952-2007), and Rosemont (2006-2008) (WRCC, 2021).

Data used to support technical studies for the subject APP application include precipitation and temperature data from the Helvetia monitoring station for the period between 1916-1950 and pan evaporation data from the Nogales monitoring station for the period between 1952-2007.

3.2.2 Precipitation

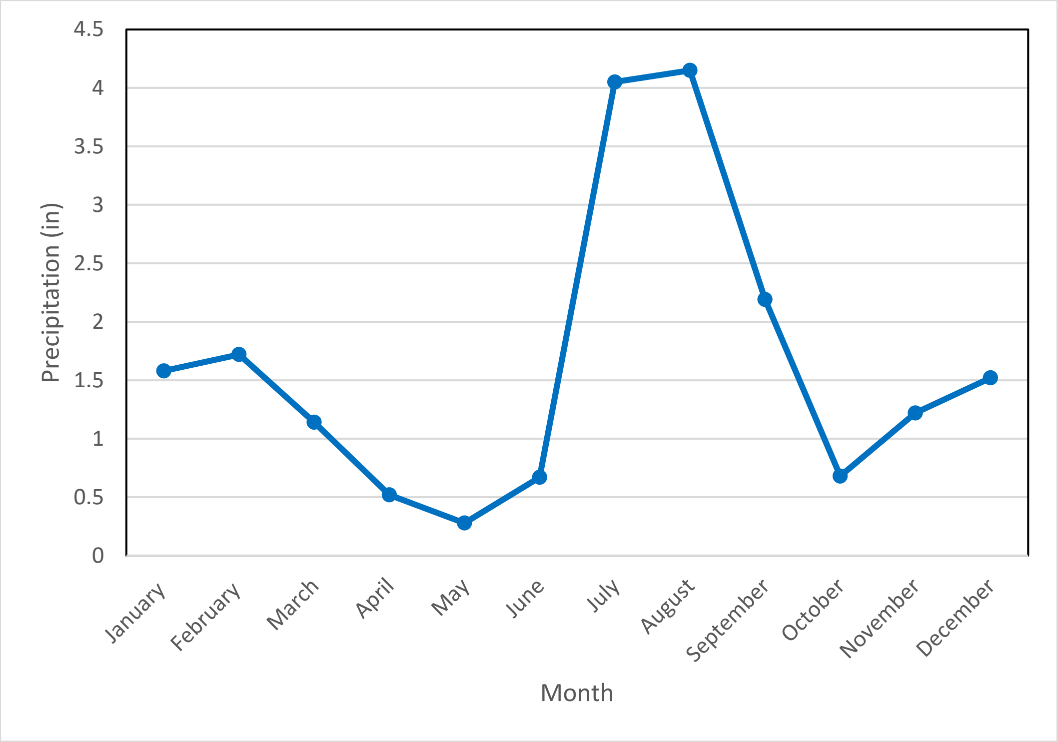
The monthly average precipitation for the Project site from the Helvetia monitoring station is summarized in **Table 3.01** and shown on **Illustration 3.01**. The minimum monthly average precipitation is 0.28 inches in May, the maximum monthly average precipitation is 4.15 inches in August, and the total annual average precipitation is 19.73 inches.

Table 3.01: Summary of Helvetia Station Monthly Average Precipitation

Month	Average Precipitation (in)
January	1.58
February	1.72
March	1.14
April	0.52
May	0.28
June	0.67
July	4.05
August	4.15
September	2.19
October	0.68
November	1.22
December	1.52
TOTAL	19.73

Notes: (in): inches

Illustration 3.01: Helvetia Station Monthly Precipitation



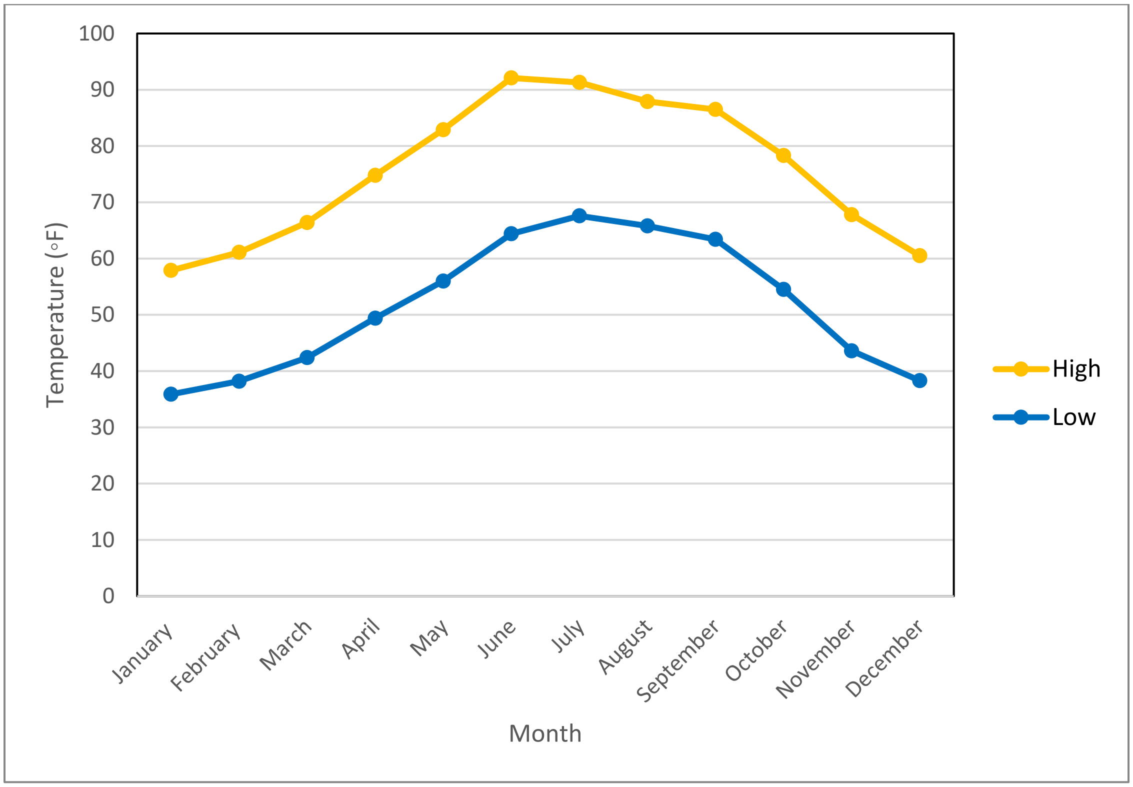
3.2.3 Temperature

The monthly average high and low temperatures for the Helvetia monitoring station are summarized in **Table 3.02** and shown on **Illustration 3.02**. The maximum average high temperature is 92.1 °F in June, and the minimum average low temperature is 35.9 °F in January.

Table 3.02: Summary of Helvetia Average Monthly Temperatures

Month	High (°F)	Low (°F)
January	57.9	35.9
February	61.1	38.2
March	66.4	42.4
April	74.8	49.4
May	82.9	56
June	92.1	64.4
July	91.3	67.6
August	87.9	65.8
September	86.5	63.4
October	78.3	54.5
November	67.8	43.6
December	60.5	38.3
Annual Average	75.6	51.6

Illustration 3.02 Helvetia Monthly Temperatures



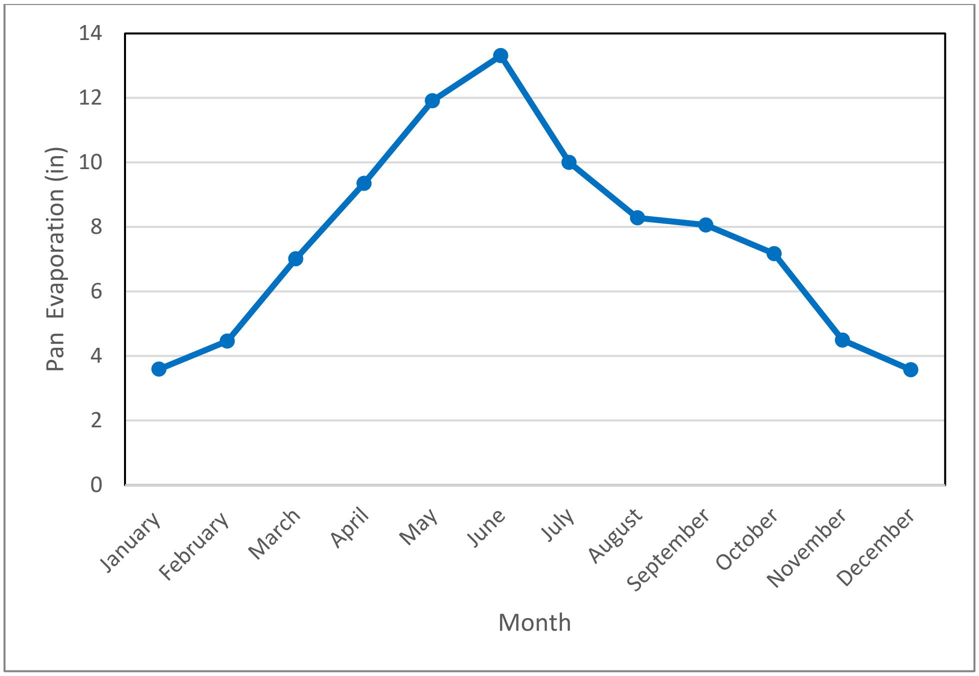
3.2.4 Pan Evaporation

The average monthly evaporation used for the Project site is from the Nogales monitoring station as summarized in **Table 3.03** and shown on **Illustration 3.03**. The minimum average pan evaporation is 3.57 inches in December, and the maximum average pan evaporation is 13.31 inches in June. Average pan evaporation significantly exceeds precipitation on both an annual basis and in each month throughout the year.

Table 3.03: Summary of Nogales Station Average Monthly Pan Evaporation

Month	Average Pan Evaporation (in)
January	3.59
February	4.46
March	7.01
April	9.35
May	11.91
June	13.31
July	10.00
August	8.28
September	8.06
October	7.17
November	4.49
December	3.57
TOTAL	91.20

Illustration 3.03: Nogales Station Monthly Pan Evaporation



3.3 NATURAL ENVIRONMENT

The Project area occupies flat to mountainous topography in the northeastern and northwestern flanks of the Santa Rita Mountains. The Project area is part of the Basin and Range physiographic province characterized by high mountain ranges adjacent to alluvial filled basins. In general, the terrain is mountainous and rugged at the higher elevations and the elevation ranges from about 3,600 to 6,300 ft amsl. Alluvial terraces and fans generally occur at elevations less than 4,250 ft in the Project area.

Project area soils range from residual soils formed on granite or limestone in higher elevation mountainous terrain to soils formed in transported alluvial sediments that occur on the piedmont slopes flanking the Santa Rita Mountains (Batchily et al, 2003). There are also areas of soils formed on basin floor, stream terraces, and floodplains.

Assignment of soils to Hydrogeologic Soil Groups (Nielsen et al, 1997) for the Project area are dominantly hydrologic Group D in the mountainous terrain at higher elevations and group A for soils formed in alluvium. Soils in hydrologic Group D have a high runoff potential and a very slow infiltration rate when thoroughly wet. A restrictive layer of nearly impervious material may be within 20 inches below the soil surface. Group A soils have low runoff potential and a high rate of infiltration when thoroughly wet. The depth to any restrictive layer is greater than 40 inches below the soil surface.

The wildlife community at the Project site consists of a variety of mammals, birds, reptiles, and amphibians. Plant and animal special status species occur within the vicinity of the Project site include Pima Pineapple Cactus (*Coryphantha scheeri var. robustispina)*, Beardless Chinchweed *(Pectis imberbis)*, Bartram's Stonecrop (*Graptopetalum bartramii*), and the Sonoran Desert Tortoise (*Gopherus morafkai*). Rosemont conducts surveys/monitoring prior to, and during ground disturbing activities and employs appropriate mitigation methods to protect these and other species.

3.3.1 East Side

Access to the east side of the Project area will be from the west along Santa Rita Road, which intersects Sahuarita Road in Sahuarita, Arizona. Santa Rita Road provides access to the Project near the base of the Santa Rita Mountains. Limited access to the east side of the Project is from State Highway 83.

3.3.1.1 Topography

The east slope of the Project area is comprised mainly of rugged mountainous terrain at elevations that range from approximately 5,000 to 6,300 ft amsl. See **Figure 6** for the existing topography in the Project area (includes contour labels).

There are three main drainage basins on the east side of the Project area, which includes Barrel, Wasp, and McCleary Canyons. A network of small arroyos from Wasp and McCleary Canyons feed the main Barrel Canyon drainage, which drains to Davidson Canyon. The basins primarily drain to the north and east.

3.3.1.2 Vegetation

Vegetation on the east slope of the Project area generally consists of Madrean evergreen woodlands with oaks and junipers interspersed with grasses, shrubs and forbes on the higher elevation portions. The semi-desert grasslands are primarily located in the lower elevations and are characterized as open grasslands with widely scattered shrubs and cactuses.

3.3.1.3 Soils

East slope soils are primarily residual soils formed on granite associated with mountainous terrain and are assigned to hydrologic group D. See **Figure 7** for soil groups in the Project area.

3.3.2 West Side

Access to the main Project area will also be from the west along Santa Rita Road, which intersects Sahuarita Road in Sahuarita, Arizona. Santa Rita Road provides access to the Project near the base of the Santa Rita Mountains.

3.3.2.1 Topography

On the west slope of the Project area, mountainous and rugged terrain occurs at elevations that range from approximately 3,600 ft to 6,300 ft amsl. Starting at approximately 4,250 ft amsl, the landscape transitions to alluvial fans and terraces on a northwest gradient down to an elevation of approximately 2,800 ft amsl near the Santa Cruz River. See **Figure 6** for the existing topography in the Project area (includes contour labels).

There are three main drainage basins on the West slope of the Project area, which includes Sycamore, Box and Sawmill Canyons. These basins generally drain to the northwest.

3.3.2.2 Vegetation

Vegetation on the west slope is also Madrean evergreen woodlands, particularly at the higher elevations with rugged mountainous terrain. The west slope has expansive semi-desert grassland associated with alluvium fans and terraces that extend west from the higher elevation mountainous terrain to the Santa Cruz River.

3.3.2.3 Soils

Soils on the west slope are formed on granite or limestone at higher elevations with mountainous terrain and are mainly assigned to hydrologic group D. The group D soils in this area are interspersed with group C soils, which have a slow rate of infiltration rate when thoroughly wet and generally have a restrictive layer that impedes the downward movement of water at a depth greater than 20 inches from the soil surface.

At an elevation of approximately 4,250 ft amsl, soils transition to alluvial fans and terraces and are assigned to hydrologic group A. Group A soils on the west slope are also interspersed with hydrologic group C soils. See **Figure 7** for soil groups in the Project area.

3.4 DESIGN STORM EVENTS

Surface water hydrology studies for the Copper World Project were performed to develop baseline conditions and to size ponds, perform water balance calculations, and estimate storm events to design stormwater control structures. Details are provided in Bowman (2022). See **Appendix B.2**.

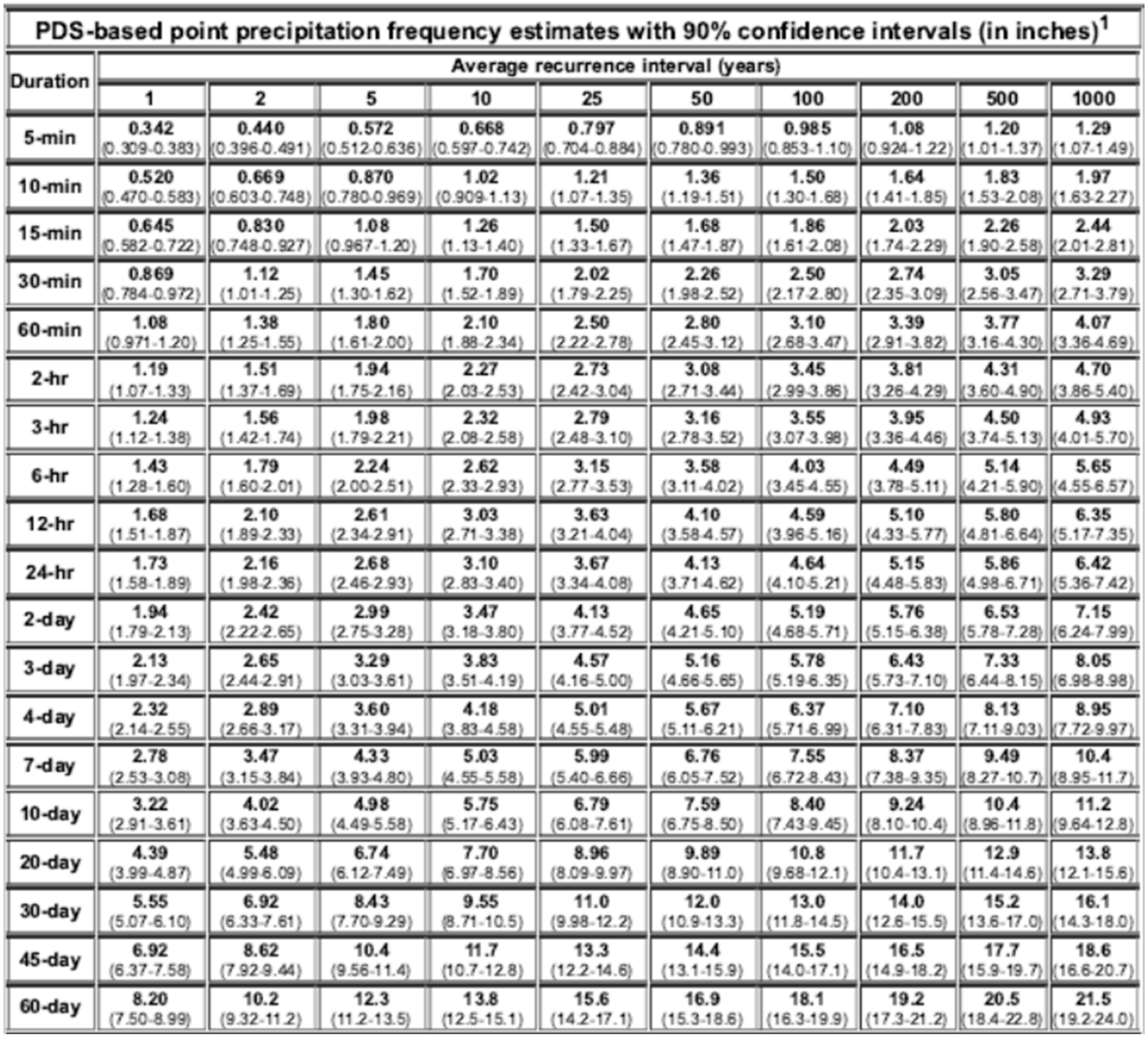
The Helvetia weather station located on the site has 25 years of continuous precipitation data. Raw data obtained from the National Oceanic and Atmospheric Administration (NOAA) was adjusted to replace 17 days of missing precipitation data from the Helvetia weather station. Statistics for the adjusted precipitation results are in **Table 3.04**.

Table 3.04: Helvetia Station Precipitation Statistics

Category	Value	Date, Time
Number of Valid Values	9617	
Number of Missing Values	0	
Last Valid Value	0.0	30 April 1950, 24:00
Minimum Value	0.0	01 January 1924, 24:00
Mean Value	0.0545378	
Maximum Value	2.89	31 August 1935, 24:00
Accumulated Amount	524.49	
Standard Deviation	0.20071046	
Skew Coefficient	5.681595	
Data Type	PER-CUM	
Units	IN	

Design storm event rainfall depths for differing return periods were obtained from NOAA Atlas 14, Volume 1, Version 5. The NOAA general frequency data for Helvetia precipitation for various design storm events are provided in **Illustration 3.04**.

Illustration 3.04: General Frequency Data for Helvetia Return Period



PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.342 (0.309-0.383)	0.440 (0.396-0.491)	0.572 (0.512-0.636)	0.668 (0.597-0.742)	0.797 (0.704-0.884)	0.891 (0.780-0.993)	0.985 (0.853-1.10)	1.08 (0.924-1.22)	1.20 (1.01-1.37)	1.29 (1.07-1.49)
10-min	0.520 (0.470-0.583)	0.669 (0.603-0.748)	0.870 (0.780-0.969)	1.02 (0.909-1.13)	1.21 (1.07-1.35)	1.36 (1.19-1.51)	1.50 (1.30-1.68)	1.64 (1.41-1.85)	1.83 (1.53-2.08)	1.97 (1.63-2.27)
15-min	0.645 (0.582-0.722)	0.830 (0.748-0.927)	1.08 (0.967-1.20)	1.26 (1.13-1.40)	1.50 (1.33-1.67)	1.68 (1.47-1.87)	1.86 (1.61-2.08)	2.03 (1.74-2.29)	2.26 (1.90-2.58)	2.44 (2.01-2.81)
30-min	0.869 (0.784-0.972)	1.12 (1.01-1.25)	1.45 (1.30-1.62)	1.70 (1.52-1.89)	2.02 (1.79-2.25)	2.26 (1.98-2.52)	2.50 (2.17-2.80)	2.74 (2.35-3.09)	3.05 (2.56-3.47)	3.29 (2.71-3.79)
60-min	1.08 (0.971-1.20)	1.38 (1.25-1.55)	1.80 (1.61-2.00)	2.10 (1.88-2.34)	2.50 (2.22-2.78)	2.80 (2.45-3.12)	3.10 (2.68-3.47)	3.39 (2.91-3.82)	3.77 (3.16-4.30)	4.07 (3.36-4.69)
2-hr	1.19 (1.07-1.33)	1.51 (1.37-1.69)	1.94 (1.75-2.16)	2.27 (2.03-2.53)	2.73 (2.42-3.04)	3.08 (2.71-3.44)	3.45 (2.99-3.86)	3.81 (3.26-4.29)	4.31 (3.60-4.90)	4.70 (3.86-5.40)
3-hr	1.24 (1.12-1.38)	1.56 (1.42-1.74)	1.98 (1.79-2.21)	2.32 (2.08-2.58)	2.79 (2.48-3.10)	3.16 (2.78-3.52)	3.55 (3.07-3.98)	3.95 (3.36-4.46)	4.50 (3.74-5.13)	4.93 (4.01-5.70)
6-hr	1.43 (1.28-1.60)	1.79 (1.60-2.01)	2.24 (2.00-2.51)	2.62 (2.33-2.93)	3.15 (2.77-3.53)	3.58 (3.11-4.02)	4.03 (3.45-4.55)	4.49 (3.78-5.11)	5.14 (4.21-5.90)	5.65 (4.55-6.57)
12-hr	1.68 (1.51-1.87)	2.10 (1.89-2.33)	2.61 (2.34-2.91)	3.03 (2.71-3.38)	3.63 (3.21-4.04)	4.10 (3.58-4.57)	4.59 (3.96-5.16)	5.10 (4.33-5.77)	5.80 (4.81-6.64)	6.35 (5.17-7.35)
24-hr	1.73 (1.58-1.89)	2.16 (1.98-2.36)	2.68 (2.46-2.93)	3.10 (2.83-3.40)	3.67 (3.34-4.08)	4.13 (3.71-4.62)	4.64 (4.10-5.21)	5.15 (4.48-5.83)	5.86 (4.98-6.71)	6.42 (5.36-7.42)
2-day	1.94 (1.79-2.13)	2.42 (2.22-2.65)	2.99 (2.75-3.28)	3.47 (3.18-3.80)	4.13 (3.77-4.52)	4.65 (4.21-5.10)	5.19 (4.68-5.71)	5.76 (5.15-6.38)	6.53 (5.78-7.28)	7.15 (6.24-7.99)
3-day	2.13 (1.97-2.34)	2.65 (2.44-2.91)	3.29 (3.03-3.61)	3.83 (3.51-4.19)	4.57 (4.16-5.00)	5.16 (4.66-5.65)	5.78 (5.19-6.35)	6.43 (5.73-7.10)	7.33 (6.44-8.15)	8.05 (6.98-8.98)
4-day	2.32 (2.14-2.55)	2.89 (2.66-3.17)	3.60 (3.31-3.94)	4.18 (3.83-4.58)	5.01 (4.55-5.48)	5.67 (5.11-6.21)	6.37 (5.71-6.99)	7.10 (6.31-7.83)	8.13 (7.11-9.03)	8.95 (7.72-9.97)
7-day	2.78 (2.53-3.08)	3.47 (3.15-3.84)	4.33 (3.93-4.80)	5.03 (4.55-5.58)	5.99 (5.40-6.66)	6.76 (6.05-7.52)	7.55 (6.72-8.43)	8.37 (7.38-9.35)	9.49 (8.27-10.7)	10.4 (8.95-11.7)
10-day	3.22 (2.91-3.61)	4.02 (3.63-4.50)	4.98 (4.49-5.58)	5.75 (5.17-6.43)	6.79 (6.08-7.61)	7.59 (6.75-8.50)	8.40 (7.43-9.45)	9.24 (8.10-10.4)	10.4 (8.96-11.8)	11.2 (9.64-12.8)
20-day	4.39 (3.99-4.87)	5.48 (4.99-6.09)	6.74 (6.12-7.49)	7.70 (6.97-8.56)	8.96 (8.09-9.97)	9.89 (8.90-11.0)	10.8 (9.68-12.1)	11.7 (10.4-13.1)	12.9 (11.4-14.6)	13.8 (12.1-15.6)
30-day	5.55 (5.07-6.10)	6.92 (6.33-7.61)	8.43 (7.70-9.29)	9.55 (8.71-10.5)	11.0 (9.98-12.2)	12.0 (10.9-13.3)	13.0 (11.8-14.5)	14.0 (12.6-15.5)	15.2 (13.6-17.0)	16.1 (14.3-18.0)
45-day	6.92 (6.37-7.58)	8.62 (7.92-9.44)	10.4 (9.56-11.4)	11.7 (10.7-12.8)	13.3 (12.2-14.6)	14.4 (13.1-15.9)	15.5 (14.0-17.1)	16.5 (14.9-18.2)	17.7 (15.9-19.7)	18.6 (16.6-20.7)
60-day	8.20 (7.50-8.99)	10.2 (9.32-11.2)	12.3 (11.2-13.5)	13.8 (12.5-15.1)	15.6 (14.2-17.1)	16.9 (15.3-18.6)	18.1 (16.3-19.9)	19.2 (17.3-21.2)	20.5 (18.4-22.8)	21.5 (19.2-24.0)

Details on the selection of hydrology modeling inputs and the resulting calculations for baseline and final facility configurations are provided in Bowman (2022) in **Appendix B.2**. Hydrology modeling calculations were performed using HEC-HMS in either the Design Storm Mode or the Continuous Mode.

The Design Storm Mode uses a specific storm event, such as 4.64 inches for a 100-year, 24-hour event. The Continuous Mode uses daily precipitation for about 25 years. This is done using the HEC-HMS control specification component of the model, which determines the dates for the start and end of the simulation and the calculation interval (i.e., every 25 min, every hour, etc.).

3.5 SEISMICITY

The Arizona Department of Environmental Quality (ADEQ, 2004) has published guidelines for mining project design criteria in a publication entitled "*Arizona Mining Guidance Manual, BADCT*." This manual sets forth recommendations for minimum standard design criteria with the interest of protecting the groundwater aquifers in the State of Arizona. Accordingly, the BADCT manual recommends design criteria for seismic hazards as follows:

- The minimum design earthquake is the maximum probable earthquake (MPE). The MPE is defined as the maximum earthquake that is likely to occur during a 100-year interval (80% probability of not being exceeded in 100 years) and shall not be less than the maximum historical event. This design earthquake may apply to structures with a relatively short design life (e.g., 10 years) and minimum potential threat to human life or the environment.
- Where human life is potentially threatened, the maximum credible earthquake (MCE) should be used. MCE is the maximum earthquake that appears capable of occurring under the presently known tectonic framework."

A seismic hazard assessment has been completed by Lettis Consultants International, Inc. (LCI) in order to establish the ground motions associated with the MPE and MCE. The following summarizes the results of this assessment. Additional information can be found in **Appendix B.3** (Site-Specific Seismic Hazard Analysis and Development of Ground Motions report, [LCI, 2021]).

BADCT guidance defines the MPE as the greater of the maximum historical event or one having a return period of approximately 475 years (i.e., an 80% probability of having a non-exceedance event in 100 years). Historical seismicity in the site region is sparse with only five events within 50 km of the Project site. The largest and closest event to the Project area was the November 11, 1887, Magnitude 5.7 earthquake. In 1927, a Magnitude 4.3 earthquake occurred about 40 km to the south of the Project. In 1996, the United States Geological Survey (USGS) released a "landmark" set of National Hazard Maps for earthquake ground shaking, which was a significant improvement from previous maps they had developed. These maps have since been revised and updated, and the most current version was released in 2018 (Petersen et al., 2019). For a 2,475-year return period, the 2018 USGS National Seismic Hazard Maps indicate a firm rock (or V_S30[1] of 760 m/sec) peak horizontal ground acceleration (PGA) and 1.0 sec horizontal spectral acceleration (SA) of 0.11 and 0.064g, respectively, for the Project area (where g is the acceleration due to gravity equaling 32 ft/sec^2) compared to the site-specific values of 0.088 and 0.067g for a V_S30 of 760 m/sec.

The results of the Probabilistic Seismic Hazard Analysis (PSHA) conducted by LCI are presented in terms of ground motion as a function of annual exceedance frequency (AEF) or reciprocal of the average return period. At the return periods of 475; 975; 2,475; 5,000; and 10,000 years, selected mean spectral values and their uncertainties are summarized in **Table 3.05**. The seismic hazard for the Project area can be characterized as low to moderate even at a long return period of 10,000 years.

Table 3.05: Summary of Probabilistic Ground Motions

Return Period (Years)	PGA (G'S) Mean [5th, 95th Percentile]	1.0 sec SA (G'S) Mean [5th, 95th Percentile]
475	0.024 [0.013, 0.038]	0.022 [0.010, 0.042]
975	0.039 [0.020, 0.065]	0.032 [0.014, 0.056]
2,475	0.073 [0.034, 0.122]	0.048 [0.022, 0.079]
5,000	0.115 [0.050, 0.186]	0.065 [0.030, 0.102]
10,000	0.173 [0.073, 0.267]	0.087 [0.040, 0.131]

Note:
(PGA) Peak horizontal ground acceleration; (1.0 sec SA) 1.0-second spectral response acceleration

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[1] V_s30: It is the average shear-wave velocity (m/s) over a subsurface depth of 30 m. Input for the deterministic seismic hazard analysis. (LCI, 2022)

Based on the PSHA conducted by LCI, the design seismic event with a return period of 2,475 years with a PGA of 0.073g was selected for the heap leach facility (HLF) and waste rock facility (WRF) (See the Project Design Criteria in **Section 3.7 and in Appendix B.4**). This exceeds the prescriptive BADCT requirements. The minimum earthquake that can be selected for the seismic evaluation of a tailings storage facility (TSF) is the MPE that is likely to occur during a 10,000-year interval (99% probability of not being exceeded in 100 years). This is equivalent to 0.5% probability in 50 years, which equates to an earthquake with an about 10,000-year return period. The minimum earthquake also cannot be less than the site's maximum historical event. This design earthquake is consistent with the recently published Global Industry Standard on Tailings Management (GISTM, 2020) and represents most current industrial standard to guide TSF designs and management. Moreover, the MCE has been considered in the Copper World TSF design to mitigate risks of potential impact on public safety.

3.6 GEOLOGIC HAZARDS

Geologic hazards are geologic conditions that pose a potential hazard to life and/or property. A Preliminary Geologic Hazards Assessment (Wood, 2022b) presents a summary and evaluation of geologic hazards in the vicinity of the Project based on available references. The following geologic hazards were identified as a credible risk:

- There are many areas on site with rock fall hazards. The Project property traverses the Santa Rita Mountains, and mining operations and infrastructure will be located in potential runout areas below and adjacent to steep hillslopes and rock outcrops. Areas in and around the Project property at risk for impacts from rock fall were mapped approximately as shown on **Figure 8**. Affected facilities include the WRF, the open pits, and relatively small, localized portions of the east slope of TSF-2. Additional areas of rockfall hazard not shown on **Figure 8** include steeply incised alluvial channels and valleys, in which loose cobbles or boulders can become dislodged from the channel slopes.
- Historic mine workings have been identified within the footprint of the TSF-1, WRF, and the open pits. Features included in the USGS (2021) Abandoned Mine Lands database on the Project site are shown on **Figure 8**. The majority of the features are small surface prospect workings that are no more than a few feet in diameter and depth and would likely have little impact on mining activity. However, some more extensive developments may require additional evaluation and mitigation. Mitigation of existing historic underground mine workings within the footprint of TSF-1, the WRF, and open pits may require backfilling and detailed operational procedures for work around voids, and, furthermore, if extensive underground workings are identified in the open pit areas, a Hazard Mitigation Plan for underground voids may be required that includes void identification and safe working procedures.
- The Project is located in a geographical province with relatively low rates of seismicity. However, earthquakes have occurred that would have impacted the site in the past and future seismicity is a risk. Lettis Consultants International Inc. (LCI, 2022) completed a site-specific Seismic Hazard Analysis of the Project which included a PSHA and Deterministic Seismic Hazard Analysis (DSHA). The ground motion hazard results were used in the design of the facilities at the Project. Based on the findings of the LCI (2021) study, including the lack of mapped faults with evidence of latest Quaternary displacement in the vicinity of the Project, the risk of surface fault rupture to directly impact the proposed facilities is low. LCI (2022) was described in **Section 3.5** and is provided in **Appendix B.3.**
- Flooding, existing landslides, expansive soils, and erosion are considered relatively low potential risks.

The approximate location of identified rock fall hazard areas and historic mine workings that are in the Project site area are shown on **Figure 8**.

As noted in **Section 3.1**, Tetra Tech (2007) prepared a geologic hazard assessment for the Rosemont Copper Project located on the east side of the Santa Rita Mountains.

3.7 PROJECT DESIGN CRITERIA

The Project design criteria defines the general design basis for civil and geotechnical work associated with the TSFs, heap leach pad and water management facilities at the Project. Design work has been completed in general accordance with applicable requirements of the Arizona Department of Environmental Quality Aquifer Protection Permit Program and its Arizona Mining BADCT Guidance Manual (ADEQ, 2004), which describes applicable regulations and commonly accepted industry standards and practices (Arizona Revised Statute (A.R.S. 49-243.B.1 and A.A.C. R18-9-A202(A)(5)).

The design criteria (Wood, 2022l) was prepared to guide the design of the Project facilities and is presented in **Appendix B.4**. The following key assumptions, data sources and other inputs were used to develop and/or refine the design criteria:

- Geotechnical data from current and previous studies;
- Meteorological and climatological data from local weather stations;
- Information provided by Hudbay and Hudbay's consultants;
- ADEQ's BADCT Guidance Manual; and
- Standard Engineering Practice & Regulatory Standards & Codes / International Tailings Standards.

The Project design criteria address the following topics:

- Soils, Tailings, and Slurry Properties
- Heap Leach Pad and Ponds
- General Tailings Storage Facility Information
- Waste Rock Facility
- Diversion Channels and Stormwater Management
- General Civil Design Information

4.0 OPERATIONS AND FACILITIES OVERVIEW

4.1 GENERAL OPERATIONS REVIEW

The Copper World Project will be developed as an open pit mine with a conventional copper-molybdenum concentrate processing plant for up to 60,000 tons per day (tpd) of sulfide ore for a mine life of approximately 15 years. Production will be phased according to the mine plan. Additionally, a heap leach facility (HLF), consisting of a heap leach pad (HLP) and associated ponds, will be constructed along with a solvent extraction / electro-winning (SX/EW) plant. In addition to receiving Pregnant Leach Solution (PLS) from the heap, the SX-EW plant will also receive PLS from a concentrate leach circuit. The proposed plant facilities will also include a precious metals recovery circuit and an acid plant.

The anticipated sulfide ore production rate is as follows:

- 20,000 tpd (Year 1)
- 30,000 tpd (Years 2 through 4)
- 60,000 tpd (Years 5 through 15)

The anticipated oxide ore production rate is as follows:

- 20,000 tpd (Year 1)
- 30,000 tpd (Years 2 through 4)
- 35,000 tpd (Year 5)
- 45,000 tpd (Year 6 through Year 8)
- 40,000 tpd (Year 9, partial year)

The total tonnage of sulfide ore milled will be about 277.4 Mt.

The total tonnage of oxide ore processed will be about 103.8 Mt.

The total tonnage of waste rock mined will be about 477.4 Mt. The waste rock facility (WRF), as currently designed, has the capacity of about 528 Mt.

4.1.1 Access

The access to the Project will be from the Town of Sahuarita (TOS) along Santa Rita Road (see **Figures 1 through 3**). This access road is considered the primary access to the Project.

A utility maintenance road will also be built along the Utility Corridor in the State Land right-of-way (ROW) and will be used to access the waterline and powerline for as needed maintenance. This maintenance road can generally be accessed at various points along Santa Rita Road.

Limited access will be from the east from State Route 83.

4.1.2 Electrical Power

The available electrical power supply for the Project and processing facilities will be administered by Tucson Electric Power (TEP) under a shared service agreement with Trico Electric Cooperative Inc. The electrical switchyard and substation will be located on Rosemont private land at Sanrita South as shown on **Figures 1 and 2**. The transmission line begins at Sanrita South and is located along the Utility Corridor in the State Land ROW. It will reach the switchyard near the processing plant (**Figure 4**) where it will then be distributed to the process areas.

4.1.3 Water Supply

Fresh water for the Project will be supplied from wells located on western side of the Santa Rita Mountains within the Tucson Active Management Area (AMA). Fresh water will be pumped into a holding tank located near the well sites prior to transport to a fresh/fire water tank at the Project site via an overland pipeline. Pump stations will be located at two (2) locations along the pipeline route. Water will be stored and drawn from the Fresh/Fire Water Tank located on private land near the processing plant. Pump Station No. 1 will be located at the Sanrita South Property and Pump Station No. 2 will be located at the main Project area. See **Figure 2**.

It is anticipated that some of the open pits will intercept groundwater. If necessary, the pits will be dewatered to stabilize slopes and maintain safe operations. During operations, groundwater reporting to pit sumps will be treated as mine drainage and reused within the pit shells for dust control or recycled and used as process water. Water from dewatering wells (used to minimize inflow into the pits) would be considered fresh water and would be used in the process or for general dust control.

4.2 MINING OPERATIONS

Significant near-surface mineral resources make mining the Project's deposits viable using modern open pit mining techniques. The material in the open pits will be blasted, excavated using large-scale mining equipment, loaded into mine trucks, and hauled to a predetermined location based on the material classification. Depending on the amount and type of mineral content contained in the host rock, the three (3) primary material classifications are: 1) sulfide ore, 2) oxide ore, and 3) waste rock.

Waste rock will be hauled to the Waste Rock Facility (WRF) or other areas where fill is needed, such as elevated platforms and haul roads, etc. Run-of-Mine (ROM) sulfide ore will be hauled to the Sulfide Primary Crusher for processing through the concentrator circuit. ROM oxide ore will be hauled to the Oxide Primary Crusher for processing through the crushing circuit and then placed via conveyors on the heap leach pad (HLP). As dictated by the mine plan, some ROM oxide ore will also be hauled directly to the HLP, thus by-passing the Oxide Primary Crusher circuit.

In general, the major facilities of the Project will include:

- Six (6) Open Pits (Peach, Elgin, Heavy Weight, Copper World, Broadtop Butte, Rosemont)
- Tailings Storage Facility No. 1 (TSF-1)
- Tailings Storage Facility No. 2 (TSF-2)
- Heap Leach Pad (HLP) and associated facilities
- Waste Rock Facility (WRF)
- Processing facilities
- Utilities
- Access Roads

The Peach, Elgin, Heavy Weight and Copper World pits are located on the west side of the Santa Rita Mountains. Broadtop Butte Pit straddles the ridgeline, as does the WRF. Rosemont Pit is located entirely on the east side of the ridgeline. The west side pits, including Broadtop Butte, are sometimes referred to as the "Satellite" pits and Rosemont as the main or primary pit. Mining will generally proceed from west to east.

The timeline for pre-production stripping and site preparation is approximately 2-years prior to full-scale mining operations. Prior to pre-production stripping, an additional three (3) months will be required to train work crews, construct access/haul roads, and clear and grub all areas that will be disturbed during the initial years of operation. The anticipated mine plan schedule is shown in **Table 4.01**.

Table 4.01: Copper World Mine Plan

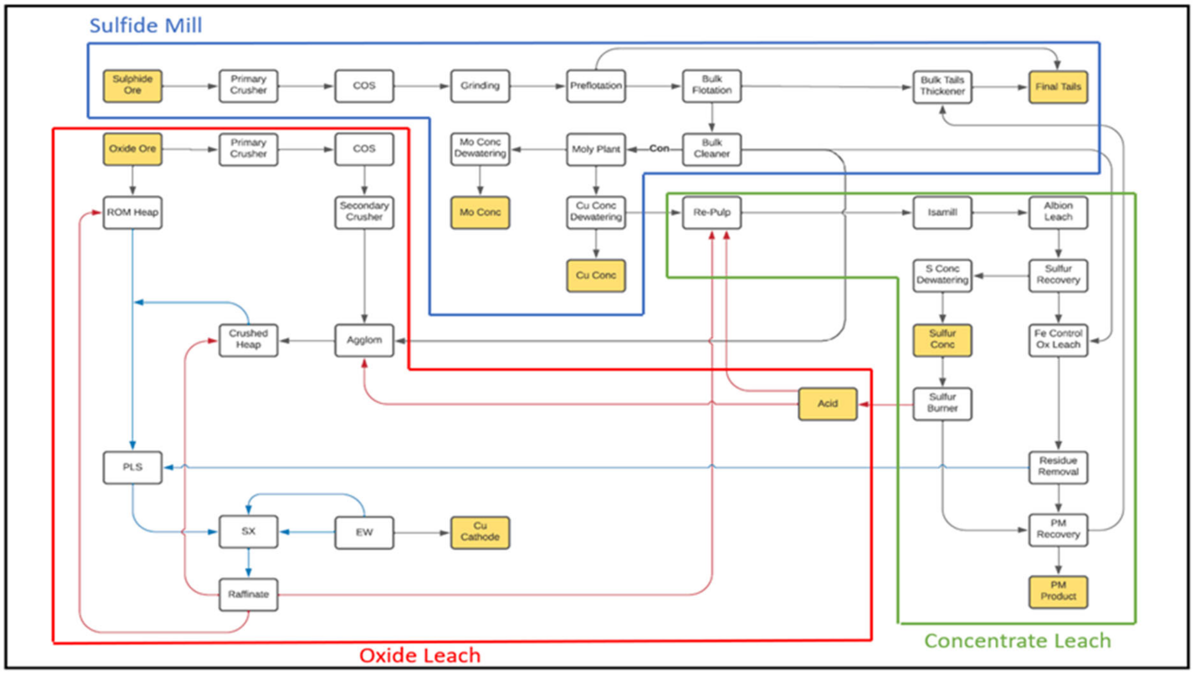
Time Period	Sulfide Ore (Ktons)	Oxide Ore (Ktons)	Waste Rock (Ktons)	Total (Ktons)
Year 1	7,300	7,300	1,400	16,000
Year 2	10,950	10,950	5,470	27,370
Year 3	10,950	10,950	7,100	29,000
Year 4	10,950	10,950	9,100	31,000
Year 5	21,900	12,775	13,424	48,099
Year 6	21,900	16,425	34,675	73,000
Year 7	21,900	16,425	34,675	73,000
Year 8	21,900	16,425	34,675	73,000
Year 9	21,900	1,164	49,457	73,000
Year 10	21,900	--	51,100	73,000
Year 11	21,900	--	46,600	68,500
Year 12	21,900	--	46,600	68,500
Year 13	21,900	--	46,600	68,500
Year 14	21,900	--	46,600	68,500
Year 15	18,280	--	49,942	68,223
TOTAL	277,430	103,842	477,420	858,692

Note: Copper World Mine Plan, November, 2021

4.3 ORE BENEFICIATION OPERATIONS

The Project plant facilities will beneficiate both sulfide and oxide copper ore and involve crushing, grinding, flotation, molybdenum (moly) separation, concentrate dewatering, concentrate leaching, and tailings dewatering. The plant facilities are separated into three (3) main circuits: Sulfide Mill, Oxide Leach, and a Concentrate Leach. See **Illustration 4.01** for a process flow diagram.

Illustration 4.01: Ore Beneficiation Flow Diagram



In the sulfide milling and flotation circuit, the ore will be beneficiated through a traditional crushing and concentrating method. The concentrate leach circuit takes the copper concentrate feed from the sulfide milling and flotation circuit for further beneficiation to produce a pregnant leach solution (PLS). This solution is sent to the SX-EW Plant for further beneficiation. Conventional copper concentrate loadout and shipping is also included in the Project along with shipping moly concentrate.

The concentrate leach facility includes a sulfur recovery circuit and a precious metals recovery circuit. An acid plant will produce sulfuric acid to be used on the heap leach pad (HLP) or in the leach circuit. The oxide ore will be beneficiated through the oxide leach circuit, where a typical heap leaching and solvent extraction - electrowinning (SX-EW) process will be used.

The following sections provide a detailed discussion of the beneficiation methods.

4.3.1 Sulfide Mill

Run-of-mine (ROM) sulfide ore will be hauled to the Primary Sulfide Crusher and dumped into the crusher dump pocket that feeds a gyratory crusher. Crushed ore will be collected in a discharge bin, withdrawn by a discharge feeder, transferred via conveyor, and deposited into the Sulfide Coarse Ore Stockpile (Sulfide COS).

The sulfide ore will be withdrawn from the Sulfide Coarse Ore Stockpile by apron feeders and conveyor belts. The conveyor belts will transport the ore to the Grinding and Classification Circuit. Primary grinding will be performed by a Semi-Autogenous Grinding (SAG) Mill operating in a closed circuit with a Pebble Crusher.

Secondary grinding will be performed with a Ball Mill which operates in a closed circuit with hydrocyclone classifiers. The Ball Mill's discharge will be combined with screen undersize material and will be pumped to the hydrocyclones. The hydrocyclone underflow will flow by gravity back to the Ball Mill where it will be milled and combined with additional undersize material and pumped back to the hydrocyclones. The hydrocyclone overflow (final grinding circuit product) will flow to the Copper/Molybdenum Bulk Flotation Circuit.

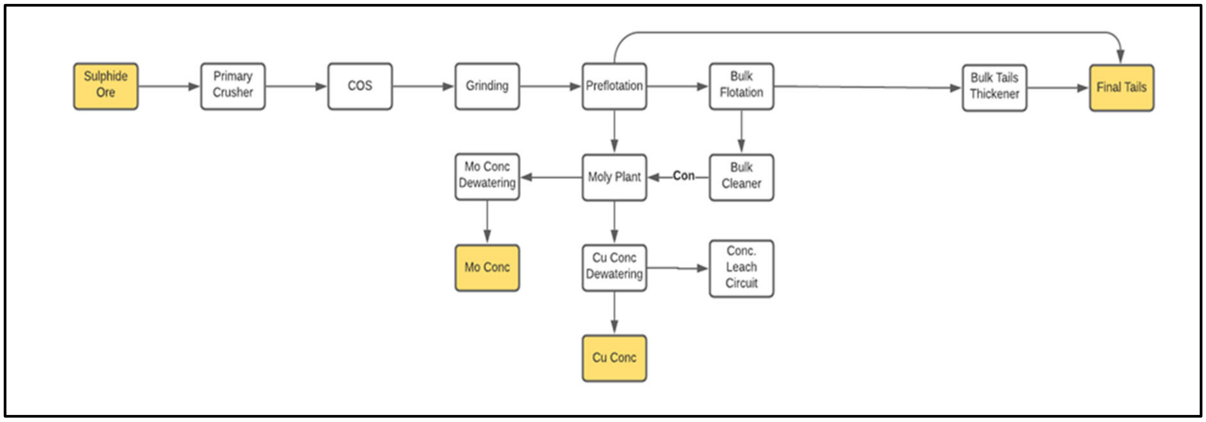
The final product of the Copper/Molybdenum Flotation Circuit will be a bulk mineral and water slurry containing copper and molybdenum minerals known as concentrate. The remaining material from the flotation circuit will be dewatered using thickeners and placed in the Tailing Storage Facilities (TSFs).

The copper/molybdenum concentrate will flow to a slurry thickener. Thickener overflow (water) will be pumped to the reclaim water system for recycling. Thickener underflow (high -density mineral slurry) will be pumped to the Molybdenum Flotation Circuit.

Molybdenum concentrate that is not recovered in the molybdenum separation flotation cells will be the final copper mineral concentrate that will flow to the copper concentrate dewatering circuit. Recovered final molybdenum mineral concentrate from flotation will flow by gravity to the molybdenum dewatering circuit where it will be filtered, dried, and bulk bagged for shipment.

From the copper concentrate dewatering circuit, the copper concentrate can either be filtered and sent as dried copper concentrate for shipment or will be repulped and sent to the Concentrate Leach Circuit. Any dried copper concentrate prepared for shipment will be loaded into concentrate trucks and sent offsite. **See Illustration 4.02** for a process flow diagram.

Illustration 4.02: Sulfide Ore Beneficiation Flow Diagram



4.3.2 Concentrate Leach

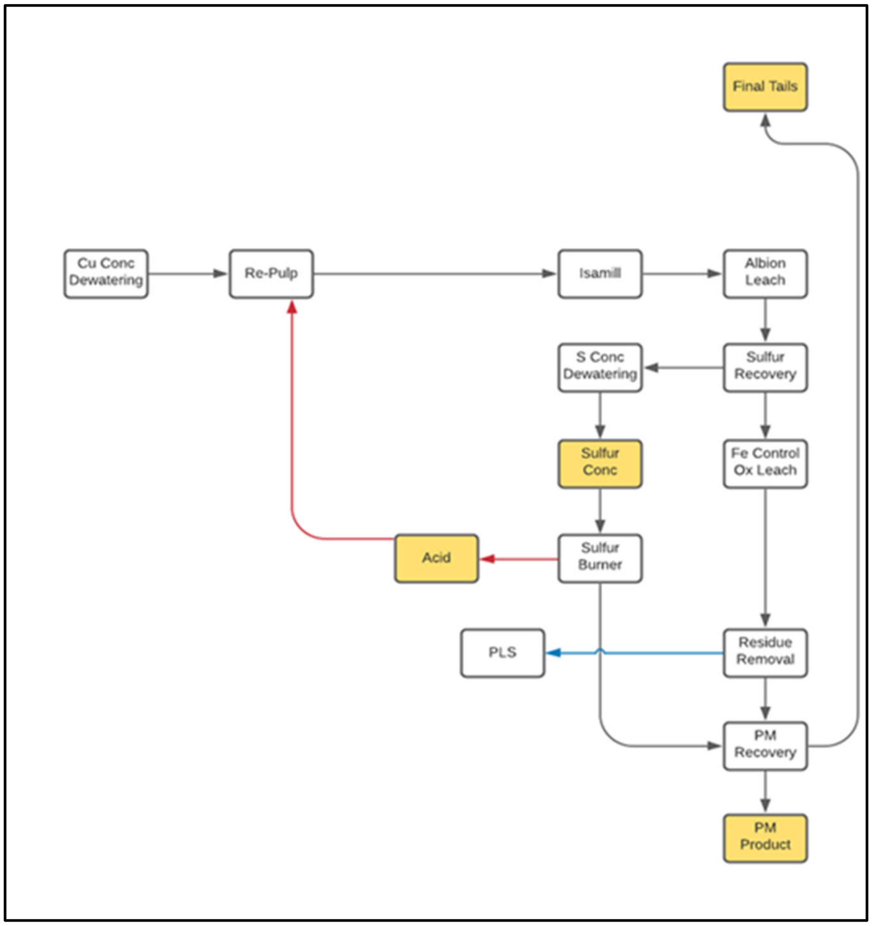
Copper concentrate that is generally sold to a third-party processor (smelter) will be treated onsite in a concentrate leach facility. The re-pulped concentrate is sent to a fine grind mill (Isamill) and milled in an acidic environment. The fine particles discharged from the mill are sent to a series of tanks for oxidation. An oxygen plant is required and will provide the necessary oxygen for the oxidation process. The product from the Concentrate Leach Circuit is directed to a sulfur flotation stage to recover sulfur concentrate, which will be directed to a sulfur burner to create sulfuric acid onsite. This acid will be sent to the heap leach or will be reused in the concentrate leach facility.

A portion of the tailings from the copper/molybdenum bulk flotation circuit is used to minimize the quantity of limestone in the Iron (Fe) control stage to precipitate any metals that were leached during the concentrate leach stage into a stable solid compound. A limestone slaking plant is required to ensure that a sufficient supply of neutralization agent is available for the process.

After the Fe control stage, the leached slurry will be dewatered in a thickener. The underflow is sent to filtration while the overflow is sent to the copper solvent extraction (SX) circuit as PLS. Once the underflow is filtered, the cake is sent to the precious metal recovery stage or to final tailings, depending on the economic value remaining in the residue. See **Illustration 4.03** for a process flow diagram.

The tailings facilities are regulated under the APP program as discussed in **Sections 5.0** and **10.0**.

Illustration 4.03: Concentrate Leach Flow Diagram



As a note, Rosemont will retain the option of filtering and shipping copper concentrate to a third-party smelter. Additionally, both processes (concentrate leach and traditional concentrate filtering and shipment) may be in concurrent operation.

4.3.3 Oxide Ore Processing

4.3.3.1 Heap Leach Process

Oxide ore will be processed using heap leaching and SX-EW processes to produce nearly pure copper cathode plates. The leaching operation will take place concurrently with milling operations. The Heap Leach Pad (HLP) will be built to accommodate the planned oxide ore tonnage of about 104 Mt. The lined HLP, collection ditch, and ponds will provide full containment of operations solution. The solution pumping system and associated pipelines will either be located within lined containment areas or will be double-lined (in the case of pipelines). Containment ponds have been sized to accommodate a 100-

year, 24-hour design storm event. Additionally, an emergency pumping system will be in place in case of power outages.

ROM oxide ore will be transported by haul trucks to the Heap Leach Pad (HLP) where it will be placed in 20 to 30-foot thick lifts prior to leaching. Some of the oxide ore will also be crushed. The split between crushed and uncrushed will depend on the economic value of the ore. In the crushing circuit, ROM oxide ore will go through both primary crushing and secondary crushing. Material crushed in the Oxide Primary Crusher then goes to the Oxide Coarse Ore Stockpile (Oxide COS). From there ore is transported via apron feeders and conveyors to a Secondary Crusher. Once crushed, this material reports to an agglomeration drum where the crushed ore will be mixed with strong acid. The agglomerated material is then conveyed to the HLP.

Copper recovery begins when a barren weak sulfuric acid solution (raffinate) is pumped from the Raffinate Pond and applied to each lift. The raffinate percolates through the ore and liberates copper ions in the ore, creating a PLS. Crawler dozers will be used to spread the oxide ore and cross rip the material to a depth of five (5) to six (6) feet to promote percolation of the raffinate solution.

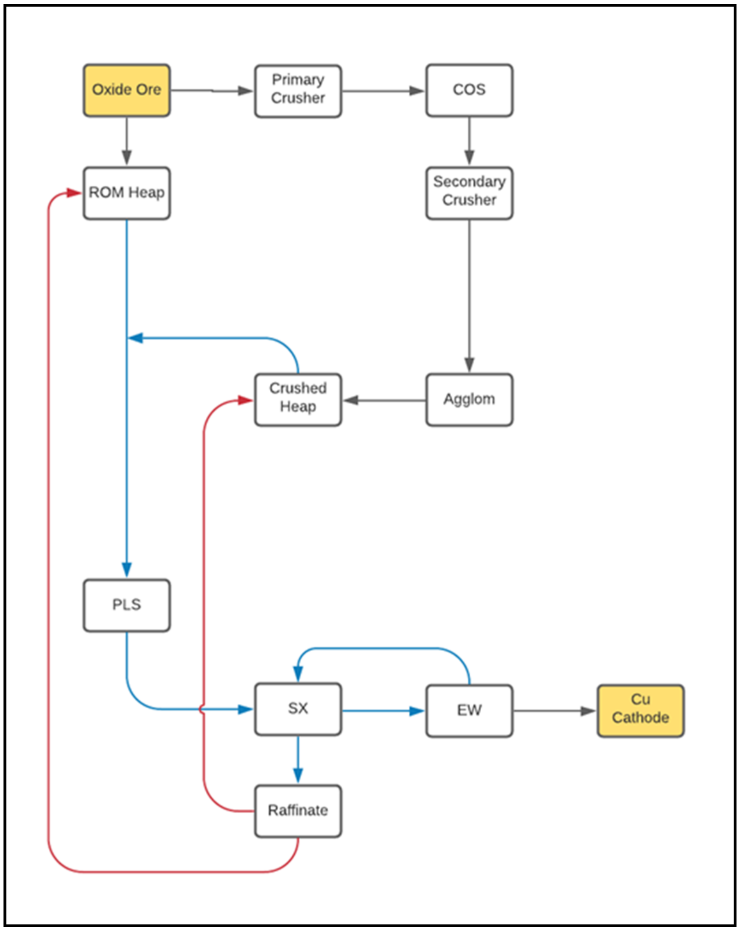
A drainage system, which consists of a drain rock layer underneath the ore and directly above the leach pad liner, will carry the PLS via gravity to the downhill perimeter berm and collection ditch pipeline system. The PLS will eventually flow into a PLS Pond located west of the HLP. The solution will be pumped from the PLS Pond to the SX-EW Process Plant where the copper will be extracted and electroplated as nearly pure copper cathode plates.

In the event of a process upset or large storm event, the PLS Pond is designed to overflow into either of two (2) stormwater ponds located adjacent to the PLS Pond The HLF North and HLF South ponds). The leach facilities are designed to meet or exceed prescriptive BADCT requirements for environmental protection. See **Illustration 4.04** for a process flow diagram.

The Heap Leach Pad (HLP) and associated ponds are regulated under the APP program as discussed in **Sections 5.0 and 10.0**.

In order to optimize leaching process depicted in **Illustration 4.04**, Rosemont may also elect to conduct small scale dump leach tests in conjunction with a pilot scale SX-EW Plant.

Illustration 4.04: Heap Leach Process Flow Diagram



4.3.3.2 *Solvent Extraction-Electrowinning Process*

After the PLS is collected in the PLS Pond, it will be pumped to the SX-EW Process Plant where it will be mixed with a petroleum-based substance known as diluent or barren organic. During this process, copper ions in the PLS will transfer to the barren organic creating loaded organic. The hydrogen molecules contained in the barren organic will transfer to the PLS creating raffinate, which will be pumped through a pipeline to the Raffinate Pond for reuse in the heap leach process.

The loaded organic will carry the copper ions to mixer-settlers, where it is mixed with an acidic aqueous solution known as lean electrolyte. During the process, copper ions contained in the loaded organic transfer to the lean electrolyte creating an enriched electrolyte solution known as rich electrolyte. Hydrogen ions transfer to the loaded organic creating barren organic. The barren organic is reused in the SX process, and the rich electrolyte is pumped to the EW tankhouse, where the rich electrolyte fills the EW cells in the tankhouse. Each EW cell contains numerous pairs of anodes and cathodes. Lead anodes transfer a direct electrical current through the rich electrolyte to stainless steel cathodes, causing a reaction whereby the copper molecules in the rich electrolyte are deposited onto the cathode. The electrons from the electric current re-acidify the electrolyte, creating lean electrolyte that is reused in the strippers. The strippers are mixers-settlers where lean electrolyte and organic are mixed to transfer copper ions from the organic to the electrolyte stripping circuit.

After a predetermined time, the copper-plated cathodes are harvested from the EW cells. The copper is removed from the stainless-steel cathode blanks using a cathode stripping machine. The stripped stainless steel cathode blanks are re-inserted into the EW cells for reuse. The copper products, in the form of plates, are weighed and bundled into two (2) to three (3) packages for shipment to customers or market warehouses via flatbed highway trucks.

4.4 SAFETY DATA SHEETS

There will be a variety of chemicals used onsite. A preliminary list of the potential chemicals and their Safety Data Sheets (SDS) are provided in **Appendix C** as part of Rosemont (2022c). The specific brands and reagents will be adjusted as necessary during construction and operations. A specific list of chemicals and their SDS information will be maintained and available for review onsite.

4.4.1 Chemical Reagents - Sulfide Ore Processing Circuit

Table 4.02 provides a list of reagents that are planned for use in the sulfide ore processing circuit.

Table 4.02: Mill Reagents

Reagents	Delivered Form	Method of Storage	Other Information
Allyl Alkyl Thionocarbamate (Aero 8944, Promoter)	Liquid in Drums	Drums on pallets in the reagent storage	Not Applicable
Alkyl Hydroxamates	Mixtures	Drums on pallets in the reagent storage	Not Applicable
Sodium Isobutyl Xanthate (SIBX, Collector)	Dry in Drums	Bags or sacks on pallets in the reagent storage	Mix tank content 10%; day tank content 10%
Dowfroth 250 (Frother)	Liquid in Drums	Drums on pallets in the reagent storage	Not Applicable
Methyl Isobutyl Carbinol (MIBC, Frother)	Liquid in Drums	Drums on pallets in the reagent storage	Mix Tank content undiluted; day tank content undiluted
Pebble Lime (CaO, pH Modifier)	Bulk by Truck	Dry in silo & as Milk of Lime (Reagent Storage)	Not Applicable
Sodium Met-Silicate (Dispersant)	Dry Powder in Bags or Super Sacks	Bags or sacks on pallets in the reagent storage	Not Applicable
No. 2 Diesel Fuel (Collector)	Liquid - Drums	Drums on pallets in the reagent storage	Not Applicable
Sodium Hydrosulfide (NaHS, Copper Depressant)	Dry Powder in Bags or Super Sacks	Bags or sacks on pallets in the reagent storage	Mix Tank content 30%; day tank content 30%
Flomin D-910 (Copper Depressant)	Liquid in Drums	Drums on pallets in the reagent storage	Not Applicable
Flocculent	Dry Powder in Bags or Super Sacks	Bags or sacks on pallets in the reagent storage	Not Applicable
Cyanide (Sodium Cyanide)*	Solid Briquettes by Tank Truck	Boxes in the reagent storage	Not Applicable

Note: (*) For precious metals recovery circuit.

4.4.2 Chemical Reagents - SX-EW Process

Table 4.03 provides a list of reagents that are planned for use in the leaching process and in the SX-EW circuit.

Table 4.03: SX-EW Reagents

Reagent	Delivered Form	Method of Storage	Other Information
Sulfuric Acid (93%)*	Liquid by Tank Truck	Storage tanks	Not Applicable
Sulphur	Liquid by Tank Truck	Storage tanks	Not Applicable
Diluent (Kerosene)	Liquid by Tank Truck	Storage tank	Not Applicable
Extractant (Acorga M5774)	Liquid by Drums	Drums on pallets in the warehouse	Circuit concentration, % of organic solution - TBD
Cobalt Sulfate	Dry Crystals in Bags or Super Sacks	Bags on pallets in the warehouse	Cobalt concentration as delivered - 21%
Guar	Dry Powder in Bags or Super Sacks	Bags on pallets in the warehouse	Not Applicable
Mist Suppressor (FC-1100)	Liquid in Drums	Drums on pallets in the warehouse	Not Applicable
Diatomaceous Earth	Dry Powder in Bags or Super Sacks	Bags on pallets in the warehouse	Not Applicable
Zinc Dust	Dry Powder in Bags or Super Sacks	Bags on pallets in the warehouse	Not Applicable
Clay	Dry Powder in Bags or Super Sacks	Bags on pallets in the warehouse	Not Applicable

Note: (*) Sulfuric acid will also be produced onsite.

4.4.3 Products Used in the General Mine Operation

Table 4.04 provides a list of products that are planned for use in the general mine operation.

Table 4.04: Products Used in the General Mine Operation

Reagents	Delivered Form	Method of Storage
Ammonium Nitrate	Bulk by Truck	Storage silos (By mine truck shop)
Blasting Powder	Dry in Boxes	Boxes in the powder magazine
Miscellaneous		
Diesel Fuel - Mine use	Liquid by Tank Truck	In tanks near mine truck shop
Diesel Fuel - Light Vehicles	Liquid by Tank Truck	In tanks by mine truck shop
Gasoline	Liquid by Tank Truck	In tanks by mine truck shop
Antifreeze – Mine Truck Shop	Liquid by Tank Truck	In tanks at the truck wash and Lube facility at mine truck shop
Engine Oils - Mine Truck Shop	Bulk by Truck	In a tank at the truck wash and Lube facility at mine truck shop
Gear Oil – Mine Truck Shop	Bulk by Truck	In a tank at the truck wash and Lube facility at mine truck shop
Automatic Transmission Fluid - Mine Truck Shop	Bulk by Truck	In a tank at the truck wash and Lube facility at mine truck shop
Hydraulic Fluid - Mine Truck Shop	Bulk by Truck	In a tank at the truck wash and Lube facility at mine truck shop
Waste Oil Storage - Mine Truck Shop	Liquid by Tank Truck	In a tank at the truck wash and Lube facility at mine truck shop
Waste Antifreeze - Mine Truck Shop	Liquid by Tank Truck	In a tank at the truck wash and Lube facility at mine truck shop
Waste Oil Storage - Light Vehicle Shop	Liquid by Tank Truck	In a tank at the mine truck shop
Waste Antifreeze – Light Vehicle Shop	Liquid by Tank Truck	In a tank at the mine truck shop

5.0 FACILITIES LIST AND APP DESIGNATIONS

This section describes the facility designations determined for the Project based on Title 49 - The Environment, Chapter 2 - Water Quality Control, Article 3 - Aquifer Protection Permits of the Arizona Revised Statutes. Based on these criteria, the facility types summarized in this section are outlined below:

- Facilities that are not regulated under the APP program because they either fall within an exemption or will not result in a discharge. See **Section 5.1**.
- Facilities authorized by the statutory general permit for stormwater management facilities. See **Section 5.2**.
- Facilities authorized by general APPs issued by rule. See **Section 5.3**.
- Area-wide APP regulated facilities. Fifteen (15) facilities were identified and included in this Application Document. See **Section 5.4**.

A brief description of each category, and the list of facilities included in each category, are provided in the sections below. Details are provided in **Appendix D** of this Application Document, in a memorandum titled Classification of Facilities under ADEQ's APP Program (Rosemont, 2022f).

As appropriate, facilities were labeled based on the above categories using the following designations:

- AR = APP Regulated Facility
- CF = Closed Facility
- EX = Exempt Facility
- GM = Growth Media
- GP = General Permit
- GS = General Site
- HL = Heap Leach
- ND = Non-Discharging
- OP = Open Pit
- OS = Off Site
- PS = Plant Site
- SW = Stormwater
- TF = Tailings Facility
- WR = Waste Rock

Figure 9 through **Figure 11** of this Application Document provided the facility locations with assigned designations.

5.1 EXEMPT OR NON-DISCHARGING FACILITIES

A.R.S. §49-250(B) identifies 26 classes or categories of facilities that are exempt from regulation under the APP program. Permit and include structures that are designed and constructed not to discharge and that are built on an impermeable barrier that can be visually inspected for leakage. Additionally, pipelines and tanks that are designed, constructed, operated, and regularly maintained so as not to discharge are also exempt.

There are 55 facilities at Copper World that are either exempt or are considered non-discharging. Details are provided in Rosemont (2022f) in **Appendix D**. The following is a list of these facility types:

ND-OS-01	Fresh Water Well Fields, Pipelines and Booster Stations
ND-OS-02	Toro Switchyard / Pump Station Electrical Substation (Sanrita South)
ND-OS-03	138 kV Powerline
ND-GS-01	Fresh / Fire Water Tank
ND-GS-02	Explosive Magazines
ND-GS-03	Mine Water Tanks and Distribution System
ND-GS-04	Field Office(s)
ND-GS-05	Tailings Slurry Pipeline(s)
ND-GS-06	Monitoring Wells
ND-OP-01	Rosemont Pit
ND-PS-01	Switchyard
ND-PS-02	Plant Substation
ND-PS-03	Mill Electric Gear
ND-PS-04	SX-EW Rectifier / Substation
ND-PS-05	Potable Water Tank and Distribution System
ND-PS-06	Gatehouse (and weigh scale)
ND-PS-07	Administration / Mine Offices
ND-PS-08	Laboratory
ND-PS-09	Mine Change House
ND-PS-10	Plant Maintenance Building
ND-PS-11	Plant Office / Change House
ND-PS-12	Main Warehouse
NP-PS-13	Truck Shop (Includes fuel station [s])
ND-PS-14	Truck Wash
ND-PS-15	Primary Crusher – Sulfide Ore
ND-PS-16	Sulfide Ore Grinding Circuit
ND-PS-17	Copper Flotation
ND-PS-18	Molybdenum (Moly) Flotation
ND-PS-19	Reagent Storage (flotation/concentrate leach)
ND-PS-20	Bulk Cu/Mo Thickener
ND-PS-21	Copper Concentrate Thickening, Filtering and Loadout
ND-PS-22	Moly Concentrate Filtration and Bagging
ND-PS-23	Tailings Thickeners
ND-PS-24	Flocculant Plant (Tailings Thickeners)
ND-PS-25	Limestone Grinding Plant / Lime Plant

ND-PS-26	Concentrate Leach Fine Grinding Plant
NP-PS-27	Concentrate Leach Circuit
ND-PS-28	Oxygen Plant(s)
ND-PS-29	Concentrate Leach Desulfurization
ND-PS-30	Concentrate Leach Iron Control
ND-PS-31	Flocculant Plant (Albion Process)
ND-PS-32	Sulfur Purification
ND-PS-33	Acid Plant
ND-PS-34	Gold/Silver Leach Circuit
ND-PS-35	Primary Crusher – Oxide Ore
ND-PS-36	Oxide Secondary Crusher
ND-PS-37	Oxide Conveyor Transfer Point / Agglomerator
ND-PS-38	Crushed Oxide Ore Conveyor System
ND-PS-39	Solvent Extraction Plant
ND-PS-40	Electrowinning Plant
ND-PS-41	Reagent Storage (SX-EW)
ND-PS-42	Ammonium Nitrate Storage
EX-GM-01	Growth Media Stockpile(s)
EX-CF-01	Helvetia Smelter Slag Pile
EX-CF-02	Copper World Reclaimed Tailings

5.2 STORMWATER MANAGEMENT FACILITIES

Stormwater from unimpacted areas (non-contact water) upgradient of the facilities will generally be routed around or through the facilities via stormwater channels or piped conveyances and released to downgradient drainages. Stormwater runoff from reclaimed facilities will also be routed offsite, as will stormwater runoff from the outer slopes of the Waste Rock Facility (WRF). The placement of materials in the WRF will follow Rosemont's Waste Rock Handling Plan (Rosemont, 2022b) with regard to the placement of non-acid generating (NAG) material on the outer slopes. Sediment basins or other controls will be placed as needed to control sediment in the runoff or dissipate flow velocities. The Waste Rock Handling Plan is summarized in **Section 8.7** and provided in **Appendix G.3**. Stormwater that has contacted process areas or active mining areas, such as areas within the pit shells, will not be released off-site.

In accordance with the statutory general permit at A.R.S. § 49-245.01, which covers facilities used solely for the management of stormwater, Rosemont will comply with the ADEQ's Industrial Multi-Sector General Permit (MSGP-2019). A Stormwater Pollution Prevention Plan (SWPPP) will be developed to address requirements of MSGP-2019.

The overall water management approach for the Copper World Project is described in the Site Water Management Plan (Wood, 2022g) provided in **Appendix E** and described in **Section 6.0.** Additionally, stormwater facilities (GP-SW-01) are shown on **Figure 13** through **Figure 18** and as described in **Section 6.0**.

Stormwater management facilities include, but are not limited to, the following:

- Permanent diversion channels;

- Temporary diversion channels;
- Drainage pipes underneath facilities; and
- Sediment basins (and other energy dissipation structures).

The different stormwater facilities (GP-SW-01) are not provided separate designations within Wood (2022g).

Any impoundments used to contain only non-contact stormwater are exempt from APP regulation pursuant to A.R.S § 49-250(B)(10).

5.3 GENERALLY PERMITTED APP REGULATED FACILITIES

The following facilities are anticipated to be permitted under general APP permits adopted by rule. Facility descriptions are provided in Rosemont (2022f) in **Appendix D**. The locations of these facilities are shown on **Figures 4 and 5**.

GP-PS-01	Sewage Treatment Facilities (Type 4 General Permit)
GP-PS-02	SW Energy Vehicle and Equipment Wash (Type 3.03 General Permit)
GP-PS-03	Coarse Ore Stockpile – Sulfide Ore (Type 2.02 General Permit)
GP-PS-04	Coarse Ore Stockpile – Oxide Ore (Type 2.02 General Permit)
GP-GS-01	Temporary ROM Stockpile (Type 2.02 General Permit)
GP-WR-01	Large Truck Tire Disposal Area(s)

5.4 AREA-WIDE APP REGULATED FACILITIES

The following facilities are included in this area-wide APP application for the Copper World Project. Facility descriptions are found in Rosemont (2022f) and in **Appendix D**. BADCT demonstration are provided **Section 10** of this Application Document. The locations of these facilities are shown on **Figures 3, 4, 10, and 11**.

AR-TF-01	Tailings Storage Facility No. 1 (TSF-1)
AR-TF-01	Tailings Storage Facility No. 2 (TSF-2)
AR-TF-03	Primary Settling Pond (PSP)
AR-WR-01	Waste Rock Facility (WRF)
AR-HL-01	Heap Leach Pad
AR-HL-02	Pregnant Leach Solution (PLS) Pond
AR-HL-03	HLF North Stormwater Pond
AR-PS-04	HLF South Stormwater Pond
AR-PS-01	Reclaim Pond
AR-PS-02	Raffinate Pond
AR-PS-03	Process Area Stormwater Pond
AR-OP-01	Peach Pit
AR-OP-02	Elgin Pit
AR-OP-03	Heavy Weight Pit
AR-OP-04	Copper World Pit
AR-OP-05	Broadtop Butte Pit

6.0 SURFACE WATER HYDROLOGY

Existing literature and data review, field studies, and extensive modeling contributed to the understanding and resulting incorporation of surface water management controls in the Project design. A supporting Site Water Management Plan (SWMP) was prepared by Wood (2022g) and provides greater detail of these studies along with proposed methods to control process solution, contact stormwater and non-contact stormwater through engineered controls and Best Management Practices (BMPs). Both findings and resulting surface water controls consider the advance of mine development over the estimated 15-year mine life and are summarized as such in the following sections. The SMWP is provided in **Appendix E**.

6.1 SURFACE WATER BODIES

Technical requirements found in A.A.C. R18-9-A202(A)(8)(b)(ii) require the applicant to include the location of any perennial, intermittent, or ephemeral surface water bodies. The Project area is characteristic of the arid Southwest with no perennial or intermittent surface water courses, but numerous ephemeral drainages are present that are charged by seasonal surface run-off during and following storm events.

The main contributing drainages in the Project area on the west side of the Santa Rita Mountains generally drain to the north and west, while the drainages on the east side of the Santa Rita Mountains flow to the north and east.

A network of small arroyos on the west side flows to the alluvial fan, with most ending in the alluvial fan or forming larger unnamed channels. Facilities on the west side are separated from east side facilities by the Santa Rita Mountain ridgeline. East side facilities, such as the Rosemont Pit, are within the Davidson Canyon watershed near the top of the Barrel Canyon Wash. The Barrel Canyon Wash confluences with the Davidson Canyon Wash which then confluences with Cienega Creek to the north and west of the Project site.

6.2 FLOW CALCULATIONS

A.A.C. R18-9-A202(A)(8)(b)(iv) requires the project applicant to provide the rate, volume, and direction of surface water flow.

The rate, volumes, and direction of surface water flow based on the 100-year, 24-hour design storm event and per the pre-development drainage basins are provided in **Table 6.01**. Pre-development basins are shown on **Figure 12**. Flow is only in response to storm events.

Table 6.01: Basin Hydrology, Pre-development, 100-Year, 24-hour Storm Event

Sub-basin	Total Area	Flow Rate	Volume	Unit Discharge	Unit Volume
	(acre)	(cfs)	(ac-ft)	(cfs/acre)	(ac-ft/acre)
01	1684.9	1874.8	335.8	1.1	0.2
02	1006.7	2783	232.6	2.8	0.2
03	597.1	1525.1	127.4	2.6	0.2
04	346.2	877.3	79.4	2.5	0.2
05	1416.8	2494.9	284.6	1.8	0.2
06	891.6	1022.1	139.7	1.1	0.2
07	675.5	1052.8	105.1	1.6	0.2
08	471.9	1366.9	85.7	2.9	0.2
09	1770.1	1132.8	250.1	0.6	0.1
10	612.9	337	75	0.5	0.1
11	421.1	1564.5	90.6	3.7	0.2
12	609.2	1717.4	100.9	2.8	0.2
13	83.0	371.7	17.9	4.5	0.2
14	66.2	334.7	14.3	5.1	0.2
15	38.5	208.7	8.3	5.4	0.2

Note: Values derived from Table 5 in Bowman (2022)

The SWMP (Wood, 2022g) provides design storm events and flows for diversion channels to convey stormwater around or under Project facilities. Additionally, the SWMP describes how storm flows would be managed during the active mine life and following closure. During operations, ponds and temporary diversions will be designed to manage flow from a 100-year, 24-hour storm event. However, for permanent diversions (including those remaining at closure), the design storm is the 1,000-year, 24-hour event. Because the diversion channels that are constructed around the facilities will remain at closure, they will be constructed to manage the 1,000-year, 24-hour storm event.

The hydrological analysis methodology employed herein utilized HEC-HMS, a product of the U.S. Corps of Engineers. The modeling software and modeling results are widely accepted by public and private sector entities.

The hydrological runoff methodology used within HEC-HMS is the one developed by the Soil Conservation Service (SCS) which assigns a curve number (CN) to different surfaces given the nature of the soil and physiographic conditions (e.g., climate, topography, soils, vegetation, etc.). This method provides the basis for determining hydrological loss and transformation processes.

The Helvetia weather station was used for precipitation inputs; the design storm event model used point precipitation frequency estimates for Helvetia obtained from NOAA Atlas 14, Volume 1, Version 5. Precipitation data from the Helvetia weather station was selected because it is most representative of the Project site. The general frequency data for Helvetia precipitation for the two design storm events, the 100-year-24 hour and the 1,000-year, 24-hour, is 4.64 inches and 6.42 inches, respectively.

Due to the absence of pan evaporation data from the Helvetia weather station, pan evaporation data from the Nogales weather station, which is at the approximate elevation as the lower portions (TSF-1) of the Copper World Project

The resultant model serves as one of the factors for facility design. Facilities for the Project are designed in a manner consistent with the rainfall-run-off estimates calculated for four scenarios based on their ultimate configuration. The four scenarios consist of separate mine development intervals including the baseline (or pre-production), Year 5, Year 10, and Year 15 when the facility reaches its ultimate footprint (Piteau, 2021). Further details are presented in **Appendix B.2** (Bowman, 2022).

Figure 13 illustrates baseline conditions on a topographic map that shows the direction of surface water flows prior to development. **Figures 14 through 18** show the development of the facilities through-out the mine life and the associated stormwater management facilities. In summary, **Figures 13 through 18** show the surface water hydrology conditions for the following years/time periods:

- Baseline or Pre-Construction Period (Year -2) (**Figure 13**)
- Operations Year 1 (**Figure 14**)
- Operations Year 5 (**Figure 15**)
- Operations Year 10 (**Figure 16**)
- Operations Year 15 (**Figure 17**)
- Closure (**Figure 18**)

6.3 100-YEAR FLOODPLAIN ASSESSMENT

A.A.C. R18-9-A202(A)(8)(b)(v) requires the project applicant to delineate the boundaries of the 100-year floodplain and provide an assessment of the 100-year flood surface flow for BADCT design to divert stormwater around APP Regulated Facilities and manage stormwater that is not diverted.

There are currently no Federal Emergency Management Agency (FEMA) or other published 100-year floodplains at or near the Project site. The closest 100-year floodplain to the west of the Project site is along the Santa Cruz River.

As noted in the section above, diversion channels will be placed upgradient to the APP regulated facilities and will be constructed to handle the 1,000-year, 24-event.

6.4 SURFACE WATER MANAGEMENT

Rosemont will manage surface water resources at the Project site in accordance with the SWMP (**Appendix E**) that ensures compliance with ADEQ requirements, assures the integrity of mine facilities by minimizing storm-generated erosional effects, and meets ADEQ requirements for off-site discharge. Outfalls would be established and monitored in accordance with ADEQ's MSGP stormwater permit program.

The following discussion outlines Rosemont's proposed approach to water management over the timeline for development, operation, and closure of the Copper World Project. Both engineered (long-term) surface water flow and sediment control structures, and construction Best Management Practices (BMPs) are discussed within the 15-year life of mine.

6.4.1 Baseline / Pre-Mining Phase

Figure 13 provides an illustration of the mine facilities and surface water controls that will be constructed during the two-year construction period (Year -2 to Year 0) prior to the start of processing operations. The following provides a summary of the water controls to be implemented for each facility.

Pits:

Stripping of overburden and mining of waste rock will occur from the Peach Pit, Elgin Pit and Heavy Weight pits during the two-year pre-mining or construction period. Overburden and waste rock from these pits will be used as construction material for roads, HLF areas and potential starter dam material for the TSF.

WRF:

No specific water management measures for the WRF are expected during the construction period, as waste rock produced during this period would be used for areas such as road building and for the base of the heap leach pad and processing area, and possibly for the TSF-1 starter dam.

Roads:

Site access and primary haul roads will be constructed using industry standard BMPs to control runoff and sediment from the roads. BMPs will be used for roads throughout the life of the Project.

Process Area:

During the two years of the pre-mining construction period, construction of the Processing Area including placement of overburden and waste rock for the Plant Site platforms, will be completed. Water management will include containment of precipitation (stormwater) that falls within the process area. Precipitation and runoff from the process area will be contained in the Process Area Stormwater Pond. Channels will be constructed within the Plant Site area to divert stormwater to this pond. Sumps may also be used in the plant area and stormwater pumped to the process area stormwater pond. As needed, diversion channels would also be constructed upgradient of the Plant Site and routed offsite (in the case of non-contact stormwater runoff from the side slopes of the WRF constructed out of NAG materials).

TSF-1:

Construction of the starter dam for Cell 1 and Cell 2 of TSF-1 will begin during the two-year construction phase of the Project. During this timeframe, stormwater management will be required prior to the start of TSF construction and throughout the life of the facility. Prior to construction of the starter dam, stormwater collection galleries and diversions will be installed around Cells 1 and 2 of TSF-1.

The stormwater diversions will convey water either to a natural drainage or to a stormwater collection gallery. The upgradient stormwater collection galleries (**Figure 13**) will be used to collect surface flow and shallow alluvial flow from upgradient of the facility. This non-contact stormwater will be conveyed under the TSF from the upstream gallery to a downgradient stormwater collection gallery (**Figure 13**). Between Year -2 and Year 0, one (1) upstream stormwater collection gallery and three (3) downstream stormwater collection galleries will be constructed.

Once the stormwater collection galleries are constructed, four (4) diversion channels (DC1, DC2 and DC3 and TDC1) will be constructed prior to the start of operations. Diversion Channel 1 (DC1) will be constructed along the east edge of Cell 1 to divert stormwater from the east and release it directly to the north into a natural drainage (**Figure 13**). Diversion Channel 2 (DC2) will be constructed along the southeast edge of TSF-1 Cell 1. This diversion channel will collect stormwater flow from southeast of the TSF-1 Cell 1 and divert it to the stormwater collection gallery in the southeast corner of TSF-1 Cell 1 (**Figure 13**). Diversion Channel 3 (DC3) will be constructed along the east edge of TSF-1, Cell 2 and convey the stormwater to a natural drainage that flows to the upstream stormwater collection gallery in the southeast corner of TSF-1 Cell 1.

HLP:

Construction of Cell 1 of the HLP facility will begin in Year -2 with the placement of waste rock as a base for the facility. Two (2) permanent diversion channels, DC6 and DC7, will be constructed south of the HLP facility. These diversions will be used to divert upstream runoff around the HLP. DC6 would divert flow to the west along the southern border of the future TSF-2, then to the south of the HLF ponds and into a natural drainage.

DC7 will be constructed on the east side of the future Cell 2 of the HLP and on the east side of the future TSF-2. This diversion will be used to capture runoff from the topographic knob south of the HLP and east of TSF-2 as shown on **Figure 13**. Water in this diversion channel will be conveyed to a natural drainage east of HLP Cell 1.

6.4.2 Operations Year 1

Figure 14 shows the surface water management structures for Year 1 of operations.

Pits:

Mining will continue in the Peach Pit, Elgin Pit and Heavy Weight Pit with as needed dewatering wells used to minimize water inflow to the pits during mining. De-watering will begin during the first year of processing (Year 1). **Figure 14** shows the water management structures for Year 1 of the operation.

Other water within the pits will include groundwater inflow collected in the pit sumps, precipitation that falls in the pits, and runoff into the pits. Water from these sources will be collected in sumps constructed at the bottom of each pit. **Table 6.03** provides the estimated volumes of water that will be collected from each pit at final configuration, which will represent the largest volume of water to be managed. The Site-Wide Water Balance prepared by Wood (20022f), which is provided as an appendix to the Site Water Management Plan (Wood, 2002g) in **Appendix E** of this Application Document or as stand-a-lone document in **Appendix J**, accounts for the increase in the contribution from precipitation from year to year as the pit sizes increase.

Table 6.03: Pit Areas and Modeled Water Input at Final Configuration

Period	Area (acres)	Average Annual Precipitation Volume (acre-feet)*	Average Groundwater Pumping Rates (gpm)
Peach Pit	68.0	111.8	1.5
Elgin Pit	43.3	71.2	2.6
Heavy Weight Pit	39.2	64.5	16.0
Copper World Pit	58.0	95.4	19.0
Broadtop Butte Pit	172.6	283.8	26.0
Rosemont Pit	466.9	767.6	296
Total	848.0	1394.3	-

Notes:
*Avg annual precipitation = 19.73 inches based on Helvetia Weather Station. Based on the groundwater modeling (Piteau, 2022b), dewatering wells for the west side pits will likely not be needed.

Water pumped from west side pit dewatering wells will either go into the water distribution system and be used in the process or will be used for general site dust suppression. Water in the pit sumps will either be pumped to the process or be used for dust suppression within the pit shells.

WRF:

As during the first two years of construction, no separate waste rock facilities will be created during the start of mining as the available waste rock from the Peach, Elgin and Heavy Weight pits will be used for construction of the leach pad base, for road construction, and possibly for TSF starter dam material.

No specific water management measures are necessary during the Year 1 of operations other than for the areas indicated.

TSF:

The seepage collection system under the TSF-1 cells, and four(4) seepage collection trenches, will be installed prior to operation of TSF-1. The seepage collection system and seepage collection trenches will ensure seepage from the tailings is contained and recycled back to the processing circuit. The seepage collection and management systems will be constructed and operational from the start of the sulfide flotation and sulfide leach circuits.

The seepage collection system is a herring-bone layout of slotted pipes that collects seepage from the tailings and conveys the seepage from the slotted pipe to a solid spine drain that conveys the solution to a seepage collection trench. From the seepage collection trench the solution is pumped to the Primary Settling Pond where it is recycled back into the process circuit.

The downstream edge and bottom of the seepage collection trenches will be lined with an 80-mil geomembrane to prevent release of seepage from the trench. A pump will be placed in a slotted HDPE pipe within the trench. The pump will be used to pump water to the Primary Settling Pond. Stormwater runoff from the TSF-1 embankment slopes would also be routed to the Primary Settling Pond via the seepage collection trenches. Water from the decant pool on top of the tailings would also be pumped to the Primary Settling Pond for reuse in the process.

At the start of operations, Cell 1 and Cell 2 of TSF-1 will be used for tailings deposition. Surface water will be managed using the existing diversion channels discussed in **Section 6.4.1.** Non-contact water that is collected in the stormwater collection gallery will be conveyed under the TSF-1 in a solid pipe to one or more of the downstream stormwater collection galleries. Water conveyed to the downstream stormwater collection galleries would either infiltrate into the alluvium or ultimately be released to a natural drainage.

HLF:

Agglomerated and/or run-of-mine oxide ore will be placed on the HLP, with leach solution conveyed to the SX-EW processing facility from the PLS Pond. Once copper has been removed from the solution, it will be piped to the Raffinate Pond, reconditioned with sulfuric acid, and reused on the HLP. Precipitation that falls directly on the HLF will be incorporated into the processing circuit. The precipitation addition to the heap leach process solution volume will increase as the HLP size increases.

The primary structure for management of stormwater flow around the HLP will be DC6 and DC7 as described in **Section 6.4.1**. Stormwater flow to the east of Cell 1 would be allowed to flow in the natural drainage until future cells are constructed.

6.4.3 Operations Year 5

Figure 15 shows the surface water management structures for Year 5 of operations.

Pits:

By Year 5, mining in the Peach and Elgin pits will have been completed. The Peach and Elgin pits will be left as open pits and will not be backfilled. Pit dewatering associated with the Peach and Elgin pits, if utilized, will cease after mining in these pits is complete. Mining will continue in the Heavy Weight Pit and will have begun in the Copper World Pit, Broadtop Butte Pit, and Rosemont Pit. **Table 6.03** provides the water input into each pit that will require management at final configuration. Management of water in the pits will be same as indicated in **Section 6.4.2** for Year 1. **Figure 15** shows the surface water management structures for Year 5 of operations.

Water management for the Rosemont Pit will be different than the west side pits due to its location outside of the Tucson Active Management Area (AMA). Water from the Rosemont Pit dewatering wells will be used for general dust suppression with excess water released to a natural drainage on the east side of the pit. Water collected in the pit sump, whether from groundwater inflow, precipitation or stormwater runoff, can be used either for dust suppression inside the pit shell or pumped to the process circuit. **Figure 15** shows the surface water management structures for Year 5 of operations.

WRF:

Waste rock would continue to be used for the HLP base, for additional roads, and possibly as material for the TSF start dams. Starting in Year 4, placement of waste rock in the WRF will begin to the west of the Heavy Weight Pit. Waste rock placement in this area will continue through Year 5 and will primarily be from the Peach Pit and from the Heavy Weight Pit. Precipitation run-off management will be accomplished with setbacks and slope angles that promote infiltration, with any excess flow to the Elgin Pit. To the extent practical, through grading of the top and benches, runoff will be conveyed to low points in the natural topography where sediment basins will be constructed to allow sediment to settle out of the stormwater prior to being released into natural drainages.

TSF-1:

By Year 5, the three (3) cells of TSF-1 will be in use. Prior to the construction of Cell 3, the diversion TDC1 will be removed and two (2) permanent diversion channels, DC4 and DC5, will be constructed. DC4 will collect stormwater flow from south of TSF-1 Cell 3 and convey the stormwater to a natural drainage on the east side of TSF-1. Diversion DC5 will be constructed to capture stormwater runoff from a small area west of Peach Pit and convey runoff to an upstream stormwater collection gallery on the east side of TSF-1 Cell 3. The non-contact water in this upstream stormwater collection gallery will be conveyed under TSF-1 to a downstream stormwater collection gallery. Stormwater would either infiltrate into the alluvium or ultimately be released to a natural drainage.

Solution management in TSF-1 will continue as described in Year 1, **Section 6.4.2**.

HLF:

By Year 5, the three (3) HLP cells will have been constructed and in operation. Solution management will be the same throughout the life of the HLF.

Surface water management for Cells 2 and 3 of the HLP will include the construction of two (2) diversion channels (DC8 and DC9). DC8 will be constructed along the south edge of Cell 3 to collect flow from two (2) drainages south of the HLP. DC8 will convey water to a stormwater collection gallery, then through a pipe under the HLP to a downstream stormwater collection gallery. From here the stormwater will be allowed to infiltrate into the alluvium or flow into a natural drainage. DC7 will be reconfigured to convey water into the same stormwater collection gallery.

The pipe under the HLP will be surrounded with clean gravel and designed to convey a 1,000-year, 24-hour storm event. The pipe will be a large diameter polyethylene (HDPE) solid pipe. Both the pipe and gravel will be used to convey the design storm event.

DC9 will be constructed to route an existing natural drainage originating to the east of HLP Cell 3, which will eventually be covered with waste rock during operations. Runoff from the waste rock will be routed to sediment basins to allow settling of sediments prior to release. DC9 conveys stormwater around the HLP to a natural drainage located north of the HLP (**Figure 15**).

6.4.4 Operations Year 10

Figure 16 shows the surface water management structures for Year 10 of operations.

Pits:

In Year 10, mining will have ceased in the Heavy Weight Pit, Copper World Pit, and Broadtop Butte Pit. The Heavy Weight Pit and Copper World Pit will have been backfilled with waste rock and the Broadtop Butte Pit will begin to be backfilled with waste rock. Because the Heavy Weight and Copper World pits will no longer exist, water previously collected in the pit sumps and pumped to the process circuit will no longer be available. **Figure 16** shows the water management structures for Year 10 of operations.

WRF:

Waste rock will be used to backfill both the Heavy Weight Pit and Copper World Pit. Mining in the Heavy Weight and Copper World pits ends in Year 7 with waste rock backfill starting immediately after cessation of mining in those pits. By Year 10 most of these two (2) pits will have been backfilled. Mining in the northern portion of the Broadtop Butte Pit will also have been completed by Year 7 and waste rock will be used to backfill this portion of the pit. Waste rock not used to backfill an existing pit will be placed in the other active waste rock placement areas.

Limited grading will occur in the WRF to promote runoff to low points in the existing topography, where runoff will pass through the sediment basins. The sediment basins will allow settling of suspended solids prior to releasing stormwater to natural drainages. Due to the evolving shape of the WRF, some sediment basins would be temporary until the final configuration of the WRF is completed. Once sections of the WRF are completed, long-term sediment basins will be constructed as needed.

TSF-1 & 2:

By Year 10, TSF-2 will have been constructed and placed in operation. TSF-2 will be constructed with two (2) cells. Collection of seepage will be the same as that used for TSF-1. Three (3) seepage collection trenches will be constructed on the west side to collect solution from the seepage collection system and seepage that bypasses the system. Solution collected will be pumped to the Primary Settling Pond for reuse in the processing circuit.

Stormwater will be diverted to the west around TSF-2 in Channel DC6. DC6 was constructed in the pre-mining period (see **Figure 16**).

HLF:

Year 9 will be the last year of oxide ore placement on the HLP. Leaching of the ore with dilute sulfuric solution will continue until it is no longer economic to recover copper from the solution. This is estimated to be from 6 to 12 months after the final ore is placed. Once leaching has ceased, the facility will go into closure, which is described in **Section 6.4.6**. No changes to the surface water management will occur during this period from that described in **Section 6.4.4**.

6.4.5 Operations Year 15

Figure 17 shows the surface water management structures for Year 15 of operations.

Pits:

No changes in water management associated with the pits from Year 10 (see **Section 6.4.4**). **Figure 17** shows the water management structures for Year 15 of operations.

WRF:

By the end of Year 15, mining will cease in the Rosemont Pit and WRF construction will be completed. The Copper World Pit will be backfilled along with the Broadtop Butte Pit. Water management associated with active portions of the WRF, including waste rock in the Copper World Pit and Broadtop Butte Pit areas, will be managed as described in Year 5 (**Section 6.4.3)** and Year 10 (**Section 6.4.4**).

Reclamation of the WRF will begin once mining in the Rosemont Pit is completed. Some concurrent reclamation may be possible on the northern portion of the WRF during operations. Reclamation will include grading the top surface, ripping to loosen the compacted surfaces, and seeding. Grading will be done to promote runoff toward the low areas of existing topography along the toe of the facility where sediment basins will be located.

TSF-1 & 2:

The systems installed through Year 10 will continue to operate through Year 15 and to the end of mining.

HLF:

The HLF will be in closure starting in Year 10. Closure is described in **Section 6.4.6**.

6.4.6 Closure

Figure 18 shows the surface water management structures at closure.

Pits:

Following cessation of mining and processing activities, the pits will be allowed to fill with water primarily from groundwater inflow. Precipitation and runoff from some surrounding upgradient areas will also add to the volume of water in the pits. Due to the high evaporation rate, the remaining pits on the west side of the Santa Rita Mountains (Peach, Elgin) will initial act as water sinks, but will potentially change over time to flow through conditions. A water sink means the rate of evaporation will exceed the groundwater inflow and precipitation inputs; thus, water will continually flow into the pit rather than through the pit. Flow through indicates that groundwater will move through the pit, which would be southeast to northwest for the Elgin and Peach pits. The Rosemont Pit will also not be backfilled. This pit, however, will be a perpetual sink.

In summary:

- Ultimately, the Peach and Elgin pits will act as flow-through pit lakes; potentially switching from a sink to flow-through conditions over time but are predicted to remain flow-through after 200 years. Sustained outflow from these pits, however, is predicted to be almost immeasurable – on the order of 1-3 gpm. See **Section 7.5.2.3**.
- Rosemont Pit is predicted to always act as a sink with evaporation exceeding inflows.
- All backfilled pits are predicted as flow-through. However, the rate of flow is very small and particle simulation shows immeasurable net discharge from pit footprints within 200 years. See **Section 7.5.2.4**.

Figure 18 shows the water management structures at closure.

WRF:

Reclamation will begin on the waste rock as soon as practicable following completion of portions of the WRF. Reclamation of the WRF and other Project areas is expected to be completed within two years of cessation of mining. Post-closure monitoring of the reclamation will be conducted for a period of 5 years after reclamation and will focus on erosion issues and vegetation success. Stormwater monitoring will be conducted per the requirements of Rosemont's stormwater permit.

TSF:

Following cessation of sulfide ore processing in Year 15, solution within the TSFs will continue to draindown with management focused on reducing the volume of entrained solution. Initial management during closure will include enhanced evaporation (estimated 30 years). Enhanced evaporation will generally consist of pumping the seepage solution from the Primary Settling Pond to the top of the tailings facility and atomizing the solution through snowmakers or similar devices.

Following consolidation and drying of the top surface, closure activities would include grading, covering with a growth media, and seeding. Once solution draindown rates decrease to a point where passive treatment can be used (estimated to be 30 years for TSF-1 and nine years for TSF-2), conversion of the seepage collection trenches to sulfate reducing treatment cells are planned. Alternatively, new treatment cell locations may also be constructed.

Data indicates sulfate and total dissolved solids in the tailings seepage will exceed the Environmental Protection Agency (EPA) Secondary Maximum Contaminant Levels (SMCLs). To address these constituents, passive sulfate reducing treatment cells would be constructed to reduce sulfate and total dissolved solids (TDS). Once treated, the solution would be allowed to infiltrate into the alluvium.

In addition to managing seepage, precipitation and runoff will be managed by grading the surface of the TSFs to promote runoff and limit infiltration. A growth media cover will be placed to hold water for vegetation use and minimize infiltration. Stormwater channels will be constructed to convey stormwater off the TSF decant pool area, through a breach in the embankment. Stormwater flow from this channel, and other channels constructed on the facility side slopes, would be routed to existing natural drainages. Sediment basins or other control structures will be used to reduce flow velocities and sediment loads prior to releasing stormwater into the natural drainages (**Figure 18**).

Closure of the TSFs is anticipated to be completed approximately 30 years after cessation of operations when pumping ceases and passive treatment of the seepage is managed in the converted sulfate reducing treatment cells.

Post-closure monitoring of the reclamation will be conducted for a period of 5 years after placement of the soil cover and will focus on erosion issues and vegetation success. Stormwater monitoring will be conducted per the requirements of Rosemont’s stormwater permit.

HLF:

Following cessation of leaching (Year 10), closure will begin with the management of draindown solutions through enhanced evaporation. Enhanced evaporation will generally consist of pumping the draindown solution to the top of the heap facility and atomizing the solution through a snowmaker or similar device. Once solution draindown rates decrease to a point where passive evaporation can be used (estimated to be 8 years after active leaching stops), the PLS Pond and HLF North Stormwater Pond will be converted to evaporation cells.

Following reduction of solution through enhanced evaporation, closure will include grading of the facility surface, covering the regraded surfaces with a growth media, and seeding. The top surface of the heap will be graded to promote runoff and limit infiltration. Grading of the inner bench slopes will also occur. The growth media cover will hold water for vegetation use and will also minimize infiltration.

As needed channels will be constructed on the side slopes to route stormwater off the reclaimed facility. Stormwater runoff from the reclaimed heap will be routed offsite to natural drainages. Sediment basins or other controls structures will be used to reduce flow velocities and sediment loads prior to releasing stormwater into the natural drainages.

Post-closure monitoring of the reclamation will be conducted for a period of 5 years after cover placement and will focus on erosion issues and vegetation success. Stormwater monitoring will be conducted per the requirements of Rosemont’s stormwater permit.

7.0 HYDROLOGIC STUDY

7.1 HYDROGEOLOGIC FIELD INVESTIGATIONS

7.1.1 Summary of Investigations

Many studies have been conducted in the vicinity of the Copper World Project to characterize geology, mineral resources and hydrogeology. Activities have included exploration drilling, field investigations and modeling studies. The key investigations are summarized below, with further details and data described in the Hydrogeological Characterization report (Piteau, 2022a) provided in **Appendix F.1** of this APP Application Document.

More than 900 boreholes have been advanced by various mining companies (Lewisohn Copper Corp., Banner, Anaconda, Asarco, Augusta and Hudbay) for mineral resource exploration in the Rosemont and Helvetia districts between 1956 and 2021. The locations of exploration boreholes are shown on **Figures 19 through 22**, and the boreholes are summarized in Appendix C of Piteau (2022a) provided in **Appendix F.1**. The data from these exploration studies have been used by Rosemont to develop the Project geological model.

Harshbarger and Associates conducted studies to inventory and monitor baseline environmental conditions in the Empire Ranch development and Rosemont district from 1975 through 1981 (Harshbarger and Associates, 1975, 1976, 1980 and 1981). The studies included:

- Summary of precipitation and temperature data; estimation of evapotranspiration, runoff and soil moisture
- Analysis of surface water drainage
- Measurement of water levels in (46) drillholes and (3) wells
- Measurement of discharge from selected springs
- Sampling of five springs and three wells for elemental chemistry
- Development of geologic and hydrologic framework models

Montgomery & Associates (M&A) conducted field investigations and studies from 2007 through 2010 to characterize Rosemont district water resources and analyze potential impacts from planned mining operations associated with the Rosemont Copper Project (M&A, 2007, 2009a, 2009b, 2009c, 2009d, 2009e, 2010a, 2010b and 2018). The studies included:

- Drilling, construction, and testing of exploration water well (E-1) to characterize water resources in the Sahuarita area
- Using the Tucson Active Management Area (TAMA) model to predict the impact of water resource development in the Sahuarita area
- Drilling and testing of four (4) wells to characterize the hydrogeology of the Rosemont Pit area for the Rosemont Copper Project
- Development of a groundwater flow model to analyze dewatering and closure of the Rosemont Pit for the Rosemont Copper Project
- Drilling and testing of (27) wells and (3) multi-level piezometers to further characterize the Rosemont Pit area hydrogeology for the Rosemont Copper Project
- Drilling and testing exploration water well (RC-2) to further characterize water resources in the Sahuarita area
- Conducting long term pumping tests to further characterize the Rosemont Pit area hydrogeology for the Rosemont Copper Project

Tetra Tech conducted studies and provided documentation from 2010 through 2017 to refine the Rosemont Pit area conceptual hydrogeology and assess potential mining environmental impacts associated with the Rosemont Copper Project (Tetra Tech, 2010, 2010e, and 2017). Studies included:

- Developing a hydrogeologic conceptual model of Davidson Canyon area to understand groundwater-surface water interactions (Tetra Tech, 2010e)
- Developing a regional groundwater flow model to predict mining impacts (Tetra Tech, 2010)
- Runoff and infiltration estimate for groundwater updates (Tetra Tech, 2017)

WestLand Resources conducted a seep and spring inventory on 104 natural and man-made features in the Rosemont and Helvetia areas and surrounding region. Their field study in 2011 and 2012 included surveys of 82 features (Westland Resources, 2012).

Hydro-Logic, LLC, performed drilling, testing and well completion activities in 2013 (Hydro-Logic, 2013a and 2013b). The studies included:

- Installation of monitoring stations in Barrel and Davidson Canyons to monitor groundwater levels, soil parameters, stormwater stages and precipitation rates
- Drilling and testing a well (HC-6) to define the nature of the Backbone Fault in the Rosemont Pit area for the Rosemont Copper Project

BasinWells Associates conducted drilling, well completion and testing activities in 2016 to assess the water production potential at a site near Sahuarita (BasinWells Associates, 2016). The study included:

- Drilling and testing water supply well (SS-1) to further characterize water resource development in the Sahuarita area

Neirbo Hydrogeology conducted a field investigation and groundwater modeling studies in 2016 and 2019 to assess the impacts of mining in the Rosemont district associated with the Rosemont Copper Project (Neirbo hydrogeology, 2016, 2019). The studies included:

- Conducting borehole flow surveys at four locations in the Rosemont Pit area
- Updating and refining the geologic model of the Rosemont Pit area
- Updating the Tetra Tech regional groundwater flow model
- Developing a prefeasibility dewatering plan using the Tetra Tech groundwater flow model

7.1.2 Recent Investigations

A study was conducted by Piteau (2022a) from March 3 through November 15, 2021, to characterize the hydrogeology of the proposed west side Satellite pits and facilities. The west side Satellite pits and facilities are shown on **Figures 3** and **4** and **Figures 10** and **11** and include:

- Peach Pit
- Elgin Pit
- Heavy Weight Pit
- Copper World Pit
- Broadtop Butte Pit
- Waste Rock Facility (WRF)
- Process Plant Area
- Heap Leach Pad (HLP)
- Tailings Storage Facilities (TSF) 1 and 2

The study consisted of (i) borehole drilling, (ii) hydraulics testing, (iii) vibrating wire piezometer (VWP) and open standpipe (OSP) completions, (iv) water level monitoring, (v) groundwater sampling, (vi) test pit infiltration testing, and (vii) and seep and spring surveys. The characterization program results are described below.

7.1.2.1 Borehole Drilling and Lithologic Logging

Thirty (30) boreholes were advanced and tested during the 2021 hydrogeological characterization program. The boreholes were advanced by National EWP using a C-14C core drill rig and HQ (3.8 in O.D.) drilling rods. Lithologic logging of the core material was conducted by Rosemont.

The locations of the 2021 hydrogeologic characterization boreholes are shown on **Figure 23**, and a summary of the borehole collars is provided in **Table 7.01**.

Table 7.01: 2021 Hydrogeologic Characterization Boreholes

Hole ID	Area	Easting (UTM-ft)	Northing (UTM-ft)	Elevation (ft amsl)	Depth (ft bgs)
RNW-HB-091	HW-CW-WRF	1709636	11563904	4562	600
RNW-HB-096	HW-CW-WRF	1711293	11566086	4731	500
RNW-HB-105	HW-CW-WRF	1711050	11565653	4695	500
RNW-HB-108	HW-CW-WRF	1710630	11565046	4640	425
RNW-HB-152	P-E	1705335	11564416	4280	278
RNW-HB-154	P-E	1705686	11564298	4275	200
RNW-HB-168	P-E	1705915	11564045	4320	600
RNW-HB-169	P-E	1707027	11564088	4391	200
GH2021-01	TSF1	1701945	11575285	3645	95
GH2021-02	TSF1	1702966	11575302	3675	308
GH2021-07	TSF1	1700833	11570771	3834	400
GH2021-09	TSF1	1701998	11568487	3953	300
GH2021-10	TSF1	1701099	11567296	4005	300
GH2021-11	TSF-2-HLP	1703104	11563658	4164	300
GH2021-13	TSF-2-HLP	1704541	11563684	4240	300
GH2021-17	TSF-2-HLP	1700850	11560476	4150	300
GH2021-22	TSF-2-HLP	1705400	11561420	4421	300
GH2021-23	TSF-2-HLP	1706988	11561998	4426	300
GH2021-24	TSF-2-HLP	1708373	11562182	4488	300
GH2021-25	TSF-2-HLP	1709783	11562290	4637	300
GH2021-26	WRF	1707277	11565636	4477	400
GH2021-28	HW	1708612	11566106	4559	410

Hole ID	Area	Easting (UTM-ft)	Northing (UTM-ft)	Elevation (ft amsl)	Depth (ft bgs)
GH2021-30	CW	1713081	11563907	5025	640
Pit2021-02	P-E	1704229	11565298	4343	486
Pit2021-03	P-E	1704885	11566233	4441	603
Pit2021-04	P-E	1704977	11565354	4389	520
Pit2021-06	HW	1709600	11565718	4755	605
Pit2021-07	CW	1712907	11565269	5103	678
Pit2021-08	BB	1715764	11562333	5604	720
Pit2021-09	BB	1714432	11560797	5656	730

Notes: HW is Heavy Weight; CW is Copper World; WRF is Waste Rock Facility; P-E is Peach-Elgin; TSF is tailings storage facility; HLP is heap leach pad; BB is Broadtop Butte; Coordinate system is Bureau of Land Management (BLM) Zone 12N (US ft), North American Datum (NAD) 83. All boreholes drilled at 0° azimuth and 90° angle.

7.1.2.2 Borehole Hydraulics Testing

Hydraulic testing was conducted within each borehole using constant head injection-recovery testing and packer testing methods. Upon completion of drilling at each borehole and/or test interval, the borehole was flushed of drilling fluids by circulating fresh water until the returns were visually clear.

Constant head injection-recovery testing was performed on select boreholes using water level monitoring equipment and water truck support. A static water level was measured using a handheld water level meter, and a VWP was installed into the open borehole below the static water level. The VWP was connected to a data logger programmed to measure water levels on 1-minute intervals. Water was injected into the borehole from the water truck under the force of gravity until a relatively steady head was developed. Flow rates were measured using a calibrated flow totalizing meter. Water was injected for up to 30 minutes, or until the water supply was extinguished. Following the injection portion of the test, the water level was allowed to recover. Water levels were measured until at least 37% of recovery to the static water level had been recorded. The injection-recovery testing data were analyzed using the Bower and Rice (1976) and Hvorslev (1951) methods.

Packer testing was performed during borehole advancement at select boreholes and intervals using an inflatable single packer assembly and water truck support. At the selected interval within a borehole, the drill rods were tripped out and the packer assembly was tripped into the borehole to the top of the selected test interval; the bottom of the borehole defined the bottom of the test interval. The packer was inflated to the pressure required to seal against the borehole. Packer testing was conducted at five pressure steps (20, 40, 80, 40 and 20 psi) for each test, or was conducted until a pressure step was unable to be completed. Fresh water was injected into the test interval at an increasing rate until the desired pressure was achieved. Total water volume was recorded once per minute for 10 minutes at each pressure step. The packer testing data were analyzed using the methods of Houlsby (1976, 1990).

7.1.2.3 Borehole Completions

The hydrogeologic characterization boreholes were competed as multi-level piezometers and open standpipes. The VWP completions were used to monitor piezometric levels to characterize lateral and vertical gradients, and the OSP completions were used to monitor piezometric levels and water quality at the water table.

VWP completions were accomplished by installing GeokonTM VWP sensors on 1-½ inch steel guide pipes at selected intervals based on the Project geological model and borehole lithologies. The guide pipes were tripped into the borehole inside the HQ drill rods. After tripping the drill rods up about 400 ft, the grout was placed initially through the guide pipe (as a tremie pipe). Additional stages of grouting were accomplished through the drill rods after tripping up further, as needed. The VWP cables were wired to GeokonTM data loggers.

OSP completions were accomplished by installing 2-inch Schedule 40 polyvinyl chloride (PVC) well casing into the borehole, typically with 60 ft sections of 0.020-inch factory slotted well screen placed at an appropriate depth to keep the water table within the screened interval.

VWP and OSP completions were finished with a 6-inch-thick concrete pad and steel monument with locking cap. VWP and OSP as-built logs are provided in Piteau (2022a).

7.1.2.4 Water Level Monitoring

Water level and piezometric pressure monitoring were conducted using a combination of water level meters and VWPs. Water levels were monitored in OSPs using a water level meter, generally on a weekly basis following OSP completions and during groundwater quality sampling as discussed below. Piezometric pressures were monitored in multi-level piezometers on a daily basis following VWP completions. Hydrographs for the 2021 hydrogeologic characterization are provided in Piteau (2022a).

7.1.2.5 Groundwater Quality Monitoring

Water quality sampling was conducted at OSP groundwater monitoring locations using dedicated QED MicropurgeTM groundwater sampling systems. Sampling was conducted in October and November 2021 at OSP locations equipped with dedicated sampling pumps. At the time of the groundwater sampling events, dedicated sampling pumps had not been installed at OSP locations G&H2021-17, Pit2021-07, Pit2021-08 and RNW-HB-168. Open standpipe G&H2021-02 is dry by design.

Prior to collection of groundwater samples, each OSP was purged at low flow rates of approximately 0.2 gpm. Purge parameters, including depth to water, pH, temperature, electrical conductivity (EC) and oxidation-reduction potential (ORP), were monitored on 5-minute intervals. Following stabilization of purge parameters, groundwater samples were collected in pre-preserved (as appropriate for each suite of analyses) laboratory-provided sample containers. The containers were labelled and placed in coolers on ice pending delivery to the analytical laboratory.

The groundwater samples were delivered to Turner Laboratories, Inc., in Tucson, Arizona, an Arizona-licensed analytical laboratory. The initial sample from each location was tested for the following suites of analytes:

- Major ions and general chemistry parameters
- Dissolved metals
- Total recoverable metals
- Radiochemicals
- Stable isotopes
- Volatile organic compounds (VOC)
- Semi-volatile organic compounds (SVOC)

The analyses were conducted using appropriate methods for each suite as noted on the laboratory analytical reports. The secondary sample from each location was tested only for major ions, and general chemistry parameters, and dissolved and recoverable metals.

7.1.2.6 Test Pit Infiltration Testing

Test pit infiltration testing was conducted at five locations in alluvium materials to characterize the hydraulic conductivity of shallow subsurface materials beneath the planned TSF-1 and the HLP. The locations were on the edge of the following drill pads at (**Figure 23**):

- G&H2021-01
- G&H2021-05
- G&H2021-10
- G&H2021-22
- G&H2021-24
- G&H2021-25

The test pits were excavated to lateral dimensions of approximately 12 ft by 6 ft, with a total depth of approximately 6 ft bgs. The approximate volume of each trench was 576 cubic feet (cu ft, 4,300 gallons equivalent). Excavated soils were stockpiled for backfilling of the trenches following completion of infiltration testing. The as-built trench dimensions were measured for infiltration testing analysis. The trench walls were logged for soil classification using the Unified Soil Classification System (USCS) (ASTM, 2017a and 2017b).

Each test pit was instrumented with a standpipe and data logging pressure transducers to monitor water levels during infiltration testing. Standpipes, consisting of nominal 2-inch diameter Schedule 40 PVC pipe with a 2 ft factory slotted (0.010 in) section of well screen, were installed to the bottom of the open trench. The standpipes were instrumented with non-vented In-Situ LevelTROLL 700TM data logging pressure transducers rated at 30 psi with an accuracy of 0.05% full scale (about 0.01 ft).

The infiltration testing was conducted in accordance with ASTM International (ASTM) standards (2016, 2020). The infiltration testing was conducted following three basic steps:

1. Pre-wet and drain trench
2. Fill trench, maintain constant-head water level and record flow rate
3. Drain trench and record falling-head water levels

The testing water was supplied to the trench using a 4,000-gallon water truck and pump system. The constant head water levels in the test pits were maintained approximately 6 inches bgs. This was done to avoid entraining fines from the upper soil layer during the infiltration tests and to avoid excessive sloughing from the sides of the test pits.

Pressure transducers were programmed to record water levels on 10 second intervals. A calibrated totalizing flow meter was used to measure discharge flow rates and volumes. The constant-head stage of the infiltration testing was initiated by opening a ball valve from the baker tank to fill the trench. Water was delivered to the trench by gravity flow. The ball valve was used to maintain the water level within the trench once the level had reached the constant-head target. Constant-head conditions were maintained for up to 30 minutes, or as long as the water supply permitted.

The falling-head stage of the infiltration testing was conducted by shutting discharge to the trench and allowing the trench to drain. The infiltration tests were completed after all charged water had drained from the trenches and water level data was downloaded from the pressure transducers for analysis. Following completion of the infiltration testing, each trench was abandoned by backfilling with the soil stockpile to the original grade.

7.1.2.7 Seep and Spring Survey

Seep and spring surveying was conducted at select monitoring locations from 2006 to 2021. Seep and spring monitoring activities included the following collected data:

- Measurement location and photo points
- Overall condition of the monitoring location
- Presence/absence of water
- Riparian vegetation; and
- Miscellaneous site information.

Each spring, seep, or constructed/enhanced water location selected for monitoring has a designated measurement location. The designated measurement locations are listed in **Table 7.02**. Spring and seep locations are shown on **Figure 24**.

Table 7.02: Spring and Seep Monitoring Locations

Spring	Easting (ft)	Northing (ft)	Elevation (ft amsl)
Barrel Spring	1739192.72	11567434.20	4278
Crucero Spring	1729520.84	11572722.92	4800
Deering Spring	1714688.34	11546182.58	5243
Escondido Spring	1750911.86	11621170.98	3363
Fig Tree Spring	1719070.52	11564979.99	5098
Helvetia Spring	1709169.98	11567832.84	4508
Locust Spring	1712138.96	11547545.81	5468
Lower Mulberry Spring	1730889.16	11570450.94	4659
MC-1 Spring	1719208.44	11559133.80	4998
MC-2 Spring	1718225.20	11560696.14	5102
McCleary Dam	1723726.87	11558602.21	4761
Mulberry Spring	1729753.75	11574730.79	4927
Papago Spring	1727460.45	11570770.82	4800
Peligro Adit	1712365.36	11560731.47	5010
Questa Spring	1737134.82	11555228.00	2605
Reach 2 Spring	1750132.69	11609680.85	3538
Rosemont Spring	1721994.79	11553010.00	4915
Ruelas Spring	1706892.90	11552693.45	5029
SC-2 Spring	1725229.48	11568352.84	4883
Scholefield Spring	1727427.65	11565570.68	4731
Shamrod Spring	1706791.21	11568270.83	4122
SS-2 Spring	1715236.09	11570062.17	4470
SW Spring	1711138.30	11549054.98	5540
Sycamore Spring	1714783.32	11572781.97	4190

Photo points (view points) were established for photographing the spring, seep, and constructed/enhanced water location. Discharge measurements were obtained at the designated discharge measurement point (as practicable and accessible). Hydrologic conditions recorded at the monitoring locations are described as (i) dry, (ii) moist soil, (iii) ponded water or (iv) flowing.

Where flow was measurable from source, a flow rate was estimated in gallons per minute (gpm) or measured using the length of time required to fill a container of a known volume or timing the travel of a lightweight tracer. In addition to ponded or flowing water, evidence of sub-surface water was also noted by evidence of damp soils or riparian vegetation.

7.1.3 Seeps and Springs

Springs occur when groundwater discharges at the ground surface. Springs that are connected to the regional groundwater system indicate that the potentiometric surface is above, or likely near, the land surface.

Springs in the general Project area have been monitored since late 2006. WestLand (2012) conducted a survey of seeps and springs and identified 104 springs and other man-made aquatic features (dams, adits, aboveground stock drinkers). This survey documented the presence (or absence) of riparian and wetland vegetation, aquatic species, flow conditions, and spring-development infrastructure. Subsequent monitoring focused on 25 sites that were near the Project area (Rosemont, 2014; Rosemont, 2021). These sites were chosen by the United States Forest Service for Mitigation Measure FS-SSR-02 based on their location relative to the Rosemont Copper Project area (Rosemont, 2018). Neirbo (2019) provided a short summary of springs in the area which included a discussion of their use in the Neirbo (2019) groundwater model. A detailed description of Project area seep and spring surveys and associated data is provided in Piteau (2022a). Spring and seep locations are shown on **Figure 24**.

There are two broad categories of springs:

- Springs that receive water from shallow, local, or perched groundwater sources. These features are not connected to the regional groundwater system, and thus would not be expected to be impacted by mine-related activities such as pit dewatering.
- Springs that receive water from bedrock sources are connected to the regional flow system. Mine-related activities could potentially impact these features if they cause the potentiometric surface to drop below the land surface.

Source areas and flow paths have not been conclusively determined for all known springs in the study area. Reasons for this include:

- Field measurements vary from year to year due to fluctuations in the water table caused by changing climate.
- Geochemical characteristics are non-unique and complicated due to complex geology along flow paths.
- Any particular spring may be sourced by a combination of recent precipitation and regional groundwater and the proportions of these sources may change as a function of changing climate.

At the time of the Westland (2012) survey, flowing, pooled water, or wet soils were observed at 41 sites. More recent monitoring data consistently show that spring discharge rates are uniformly low and that non-flowing conditions are common. The limited spring discharge is often only sufficient to create moist soil conditions. Vegetation and high temperatures lead to high evapotranspiration rates that can consume the discharging groundwater and limit the extent of surface flow.

Field observations of the 25 sites included flow conditions and water quality if sufficient flow was present (Rosemont, 2021). Only two of the 25 sites were observed to be flowing on all visits (Helvetia and Deering) and three sites have a possible perennial, but limited, groundwater source indicated by flow or wet soil. Sixteen of the 25 spring sites are likely to be related to local or perched water conditions (Neirbo, 2019). These sites have varying flow conditions, from dry to minimal flow, which indicates that water is not present or insufficient to dampen soils. These seeps may only flow in response to the infrequent precipitation events. Persistent dry conditions were observed at the remaining four sites.

7.1.4 Well Inventory

An inventory of exempt and non-exempt wells was prepared, excluding environmental wells and piezometers, within two miles of the Project area, or within the predicted 200-year 10 ft drawdown isopleth of the Project groundwater model (Piteau, 2022b) in **Appendix F.2**.

Overall, pumping wells in the Project area produce very low quantities of water, owing to the low permeability of water bearing rocks and disconnected and compartmentalized nature of the groundwater system. None of the inventoried wells are within the Discharge Impact Area (DIA) defined by the Project groundwater particle transport model (Piteau, 2022b), except those located within Rosemont private land boundaries.

Ninety-two wells were identified by registry ID in the Arizona Department of Water Resources (ADWR) Wells 55 database on November 15, 2021. Many of the registry IDs are co-located, inferring that the total number of wells by registry ID within the area of interest is less than 92.

The wells are shown on **Figure 25** (by cadastral location) and summarized in Piteau (2022a).

- Seventy-eight of the inventoried wells are classified as Exempt, indicating a capacity of less than 35 gallons per minute (gpm); only 14 of the Exempt wells have tested pumping rates.
    - Two wells indicate 1 gpm capacity
    - One well indicates 3 gpm capacity
    - Five wells indicate 5 gpm capacity
    - Five wells indicate 10 gpm capacity
    - One well indicates 25 gpm capacity
- Eight wells are classified as Non-exempt, indicating an intended capacity of more than 35 gpm.
    - Only one Non-exempt well indicates a tested capacity (64 gpm)
- Six wells are classified as Non-exempt Stock wells.
    - Four wells indicate a tested capacity of 1 or less gpm
    - One well indicates a capacity of 5 gpm
    - One well indicates a capacity of 9 gpm

Seventy-seven of the inventoried wells are within the predicted 200-yr, 10 ft drawdown isopleth (Piteau, 2022b). Fifty-seven of the inventoried wells are within the Tucson Active Management Area (TAMA).

As noted on **Figure 25**, the nearest downgradient well is approximately 2.9 miles northwest of TSF-1.

7.2 GEOLOGY

The geology of the Project and surrounding areas has been well documented in numerous public and private reports, books, maps, and papers. Key sources on the geology of the area include Schrader (1915), Darton (1925), Hays (1969), Drewes (1971, 1972a, 1972b), Anderson (1987), Ferguson et al. (2001), Ferguson et al. (2009), Johnson, et al. (2016), Cook and Ferguson (2019). Project scale geologic maps are shown on **Figures 26 through 33**. A detailed description of the geologic history, geologic units, structural geology and economic geology of the region and Project area are provided in Piteau (2022a).

7.2.1 Geologic Units

The principal geologic units in the Project area are described as follows:

- Younger Alluvium of Holocene age which occurs as permeable, unconsolidated sediments along the floodplains of the ephemeral washes that are actively being incised.
- Older Alluvium of Late Pleistocene age. Weakly consolidated gravel terraces consisting of medium- to thick-bedded, sandy, pebble-cobble gravel with rare boulders, derived from upslope or upstream units. Granitoid clasts are absent in the upper Pleistocene terrace gravels, so this is an important diagnostic characteristic of the Gila Conglomerate.
- Gila Conglomerate (Pliocene-Miocene). Light brown, medium- to thick-bedded, conglomerate, pebbly sandstone, and sandstone with a calcareous matrix. The clasts are subangular to rounded and consist of granitic rocks, quartzite, limestone, argillite, and rhyolite ash-flow tuff. The abundance of clasts varies, depending on the composition of nearby upslope areas.
- Basin-fill deposits of Quaternary and Tertiary age, which are poorly permeable near the Project site and moderately permeable toward the deeper parts of the Cienega and Upper Santa Cruz basins. The basin-fill gravel around the Santa Rita Mountains were informally divided into three units by Drewes (1972a): the piedmont facies, the river facies, and the tuff facies. The basin-fill deposits of the Upper Santa Cruz Basin are subdivided into lower and upper basin-fill units (Mason & Bota, 2006).
- Paleogene to Upper Cretaceous Intrusive and Extrusive Rocks.
    - Helvetia Granite (Paleocene) Medium-dark grey, medium- to coarse-grained quartz diorite and light-gray, medium- to coarse-grained stocks of granodiorite to quartz monzonite composition. These rocks have been dated to be around 53.5 to 55.8 mya (Drewes 1972a). Some of the material that Schrader (1915) called Mesozoic Intrusive “granite” is likely the Helvetia Granite.
    - Quartz-feldspar porphyry (Upper Cretaceous to Paleogene). Light gray to pink felsic porphyry dikes and stocks containing 8 to 15 percent phenocrysts of quartz and as much as 25 percent feldspar and 1 to 2 percent biotite.
    - Andesite Porphyry (Upper Cretaceous to Paleogene). Strongly altered, fragmental, fine-grained plagioclase porphyritic andesite or intrusive porphyry. Elliptical outcrops are located along the margin of the Mount Fagan caldera.
    - Mount Fagan Rhyolite (Upper Cretaceous, at least 5,000 feet): Rhyolite ash-flow tuff containing 20 to 35 percent phenocrysts (1 to 4 millimeters) of K-feldspar, plagioclase, quartz, and biotite. The unit is typically strongly welded but is also poorly welded in many areas, particularly in the vicinity of megabreccia blocks and megabreccia avalanche breccias contained within it. Two U-Pb zircon ages of 73 million years have been obtained recently from the rhyolite just northeast of the Project area (Ferguson, 2011). This may be the Mesozoic Intrusive “Quartz Diorite” unit of Schrader (1915).
    - Mount Fagan Rhyolite megabreccia (Upper Cretaceous): Blocks and avalanche breccia blocks contained within the Mount Fagan Rhyolite. Blocks, ranging in size from 1 to 1,000 meters, consist mostly of fractured blocks of the Bisbee Group, Fort Crittenden Formation, and andesite lava.
    - Andesite lava (Upper Cretaceous, 0–800 feet): Andesite lava containing less than 15 percent phenocrysts (<3 millimeters) of plagioclase and lesser altered mafics (probably olivine and pyroxene).
- Mesozoic (Cretaceous) sedimentary rocks. The Cretaceous sedimentary rocks unconformably overly Paleozoic rocks on “an irregularly eroded surface” (Darton, 1925).
    - Salero Canyon Formation consisting chiefly of poorly permeable, well-cemented conglomerate and mudstone.

    - Turney Ranch Formation consisting of poorly permeable quartzitic sandstone and red siltstone.
    - Shellenberger Canyon Formation. The lower part consists of poorly permeable sandstone, arkosic sandstone, limestone, and siltstone. The limestone, less than 20 feet thick, is a distinctive oyster packstone that defines the top of this unit. Sandstone is fine- to medium-grained, arkosic to lithic, and argillaceous. The sandstone is medium bedded with diffuse, low-angle cross-strata. Mudstone intervals include abundant siltstone, and pure shale or claystone is rare. The upper part consists of arkosic sandstone, mudstone, and rare pebbly sandstone. Sandstone is thin- to thick-bedded, typically massive or weakly plane-bedded or cross-stratified and argillaceous, arkosic. Sandstone also occurs in fairly thick, ripple-laminated beds. Mudstone, making up slightly more than one-half of the formation, is almost exclusively dark olive green. The unit includes a distinctive type of massive, fine- to medium-grained, spotted argillaceous sandstone. The spots, making up as much as 30 percent, are diffuse, are evenly spaced, and range in size from 0.5 to 2 millimeters. The lower part includes locally abundant, irregular carbonate nodules that weather out of mudstone units. Mudstone is mostly silty, with relatively sparse pure shale or claystone intervals.
    - Bisbee Group, Lower Cretaceous, including Apache Canyon Formation consisting of poorly permeable silty limestone, shale, siltstone, and arkosic sandstone; Willow Canyon Formation consisting chiefly of poorly permeable felspathic sandstones and arkosic conglomerate with minor mudstone, silty limestone strata, and andesite flows; A series of mafic lava flows within the Willow Canyon Formation and the Glance Conglomerate; Glance Conglomerate consisting of a pebble to boulder conglomerate, locally containing marble and quartzite.
- Paleozoic sedimentary rocks, including:
    - Naco Group, Upper Pennsylvanian to Permian; Rainvalley Formation (Permian) consisting of gray, medium- to thick bedded limestone with minor sandstone and siltstone; Concha Limestone (Permian) consisting of light- to medium-gray, medium- to thick-bedded, massive to planar-laminated, amalgamated limestone, and cherty limestone with abundant chert nodules, grading to sandy and dolomitic near the base of the formation; Sherrer Formation (Permian) consisting chiefly of light gray to pink, fine-grained, massive, silty quartzose sandstone with rare laminations; Epitaph Formation (Permian) consisting of a mixed siliciclastic-carbonate unit; Colina Limestone (Permian) consisting chiefly of dark gray to black medium- to thick bedded limestone, marble, dolomite originally consisting of micritic and skeletal wackestone; Earp Formation (Permian-Pennsylvanian), a mixed siliciclastic-carbonate unit consisting of light, reddish brown to light green, thin- to medium-bedded, planar-laminated siltstone, silty mudstone, and very fine-grained sandstone that is intercalated with light gray to pinkish gray, thick-bedded, micritic limestone and skeletal wackestone; Horquilla Limestone (Pennsylvanian) consisting of white to light-gray, thin- to thick-bedded silty limestone and dolomite with shale interbeds becomes more abundant higher in the section.
    - Escabrosa Limestone (Mississippian) consisting of white to light-gray, medium- to thick-bedded marble with dolomitic limestone present in the lower portion.
    - Martin Limestone (Devonian) consisting of light gray to light blue-gray dolomitic marble, tan sandstone, and shale.
    - Abrigo Formation (Cambrian) consisting of thin- to medium-bedded, light-tan to gray laminated limestone with siltstone interbeds. The lower part contains intercalated fine-grained, parallel-laminated to ripple laminated, fine-grained sandstone, siltstone, silty mudstone, and shale. Locally, the unit has partly been metamorphosed to light pinkish gray to greenish yellow, calc-silicate hornfels that form resistant outcrops with recessive, thin beds, lenses, and laminations. Darton (1925) describes “reticulating

brown stains of probable seaweeds” distinctive of this unit.

  - Bolsa Quartzite (Cambrian) consisting of light gray to white, medium- to fine-grained, thick- to medium-bedded quartzite or quartzose sandstone, arkosic sandstone, and quartzose conglomerate. The lower part is cross stratified, commonly coarse grained, and locally feldspathic, with composition apparently ranging from quartz arenite to subarkosic arenite. Pebbly to granular beds occur near the base of the unit, which unconformably overlies granitic basement. These rocks are not extensively exposed (Schrader, 1915). They are cut by the Mesozoic intrusive rocks and in most places rest on granite. It is inferred that beneath the overlying younger rocks the Cambrian is probably present in a considerable portion of the area (Schrader, 1915).

- Precambrian granitic intrusives including the Continental Granodiorite (local in the Project area). Extensive masses of coarse-grained and porphyritic alkali granite, quartz monzonite, or granodiorite occur in many of the ranges of southeastern Arizona in which the Pinal is exposed. Regionally, these units were emplaced in two episodes: 1650 to 1760 mya and 1430 to 1460 mya. (Drewes, 1972a). The batholiths and stocks intruded the Pinal and commonly metamorphosed the schist along their contacts. Locally, the Continental Granodiorite (1450 mya; Drewes, 1972a) is brown to light-gray coarse- to medium-grained, granodiorite to quartz monzonite and granite with 15 to 20 percent altered dark minerals. Some of the Mesozoic “granite” described by Schrader (1915) is actually Precambrian Continental Granodiorite (Darton 1925).

- Pinal Schist (Precambrian). Gneiss and migmatite dated at 1,715 +/- 10 mya (Drewes, 1972a). Present as inclusions, roof pendants, and remnants of wall rock adjacent to granitic intrusions.

7.2.2 Structural Geology

Folding and faulting occurred in several intervals of geological time, and most were often concurrent with episodes of igneous activity.

Three important periods of tectonic activity affected the modern landscape of southern Arizona, including the Project area, as follows: (1) the Laramide Orogeny (mountain-building event), approximately 80 million to 45 million years ago; (2) the initial Basin and Range event, perhaps 30 or 25 million to 16 million years ago; and (3) the later Basin and Range Orogeny, which lasted until about 5 million years ago (Armstrong and Ward, 1991).

The Laramide Orogeny was a time of regional volcanic and intrusive activity, with complex folding and thrust faulting. Large, disseminated copper deposits in central and southern Arizona were emplaced with the intrusion of granitic rocks during the Laramide Orogeny. In much of the Basin and Range, Laramide structural features were disrupted by later structural features or were covered by later Cenozoic volcanic and sedimentary deposits. In some places, particularly in the southeast part of the state, the effects of Laramide deformation are fairly well known. Laramide structural features include both northwest-trending folds and various types of faults including large thrust faults. This deformation was accompanied by widespread volcanic and intrusive igneous activity throughout much of the Basin and Range.

Tertiary extension of the crust produced high-angle faulting that characterized the Basin and Range orogenic phase which began about 35 to 30 million years ago. The crustal extension was often accompanied by volcanism. The steeply dipping, mountain range bounding faults formed the valleys and mountains of the Basin and Range province seen today.

The structure of the Project area is very complex. Most of the host rocks at the Rosemont Pit deposit dip steeply (approximately 55 to 65 degrees) to the east. The principal faults in the area include the nearly horizontal Flat fault and the younger north-striking Backbone fault system. The Flat fault places mostly Mesozoic sedimentary rocks over the older Paleozoic units. The post-mineral Backbone fault system defines the western boundary of the Rosemont Pit ore deposit and separates the mineralized, Paleozoic limestone units on the east from the Proterozoic granodiorite and lower Paleozoic quartzite on the west.

The Peach-Elgin ore deposit is the most structurally complex deposit in the Project area (Anzalone, 1995). The Peach-Elgin deposit is underlain by a thrust fault that juxtaposes Paleozoic and Mesozoic sediments and late-Cretaceous-Paleocene quartz-latite porphyry over Precambrian granodiorite.

No evidence exists in the Project area of recent fault activity that cross cuts Quaternary or Holocene talus, colluvium, alluvial fan, or terrace gravels; these alluvial formations typically mask the underlying, older fault contacts where faults are present (Ferguson et al., 2009).

7.3 HYDROGEOLOGIC SETTING

Geologic formations that crop out in the Project area include Alluvial deposits, Basin-fill deposits, Cretaceous to Tertiary extrusive and sedimentary rocks, Cretaceous to Tertiary intrusive granitic rocks, Mesozoic and Paleozoic sedimentary rocks, and Precambrian granitic rocks. Each of these units are discussed below with respect to their water-bearing characteristics. In general, the igneous and sedimentary rocks yield very little water compared to basin-fill deposits. Even the alluvium, which is often the most permeable unit in the area, is not a significant source of water due to its limited areal extent and widely unsaturated conditions.

Locally, most of the significant porosity and hydraulic conductivity in formations penetrated by wells in the Project area is secondary, associated with fracture and fault zones. Cementation and alteration associated with intrusive activity have eliminated much of the primary porosity and hydraulic conductivity.

The baseline groundwater elevations and piezometric contours (including groundwater flow arrows) for the region are shown on **Figure 34**. A detailed description of the Project area hydrogeologic units is provided in Piteau (2022a).

7.3.1 Alluvium

The Younger and Older Alluvium in the Project area generally consists of unconsolidated sand and gravel deposits along the ephemeral wash channels. In general, water in the shallow alluvium along the ephemeral wash channels occurs temporarily during or following substantial and prolonged storm events.

7.3.2 Basin-Fill Deposits

Basin-fill deposits are present east and west of the Project area. Groundwater occurs in the Quaternary to Tertiary basin-fill deposits (Gila Conglomerate and Pantano Formation) in the southern part of the study area. Hargis and Harshbarger (1976) speculated that wells completed in these deposits might be capable of producing up to 100 gallons per minute (gpm). However, wells PC-4, AH-8, and PC-3 which are located in the southern part of the proposed Rosemont Pit area, and which penetrate the full thickness of the basin-fill deposits, have sustained yields of 1 to 2.5 gpm or less. These relatively low yields strongly suggest that the basin-fill deposits near the Rosemont Pit are well-cemented and poorly permeable. This is consistent with pump test results (M&A, 2007,) which indicate that aquifer transmissivity and hydraulic conductivity of these deposits are very small. Therefore, potential well production or pit inflow from this unit is expected to be very small.

7.3.3 Cretaceous-Tertiary Extrusive and Sedimentary Rocks

The Upper Cretaceous volcanic and sedimentary rocks are found in the northeast part of the Santa Rita Mountains but they are relatively uncommon in other parts of the Project area. They are well-lithified and have little or no primary porosity or permeability, except where fractured or faulted (M&A, 2009a). Well yields from wells that penetrate these rock units range from less than 1 to more than 50 gpm.

M&A (2009a) summarizes aquifer test parameters in the vicinity of the proposed Rosemont Pit. Hydrogeologic units are inferred to include Basin-fill deposits, Cretaceous to Tertiary extrusive and sedimentary rocks, Cretaceous to Tertiary intrusive granitic rocks, and Mesozoic and Paleozoic sedimentary rocks. Hydraulic conductivity ranges from 0.00077 to 517 ft/d. Reported storage coefficients range from $6.2e^{-4}$ to 0.1.

7.3.4 Cretaceous-Tertiary Intrusive Rocks

The Upper Cretaceous and Early Tertiary intrusive rocks are located in the northern Santa Rita and Empire Mountains. These units have no primary porosity or permeability. Where fractured or faulted these units will store and transmit small quantities of water (M&A, 2009a). Very few wells in the Project area are completed in these rock units and reported well yields range from near zero to a few gallons per minute. Except for a few substantial fractures and/or fault zones, these rock units are expected to act as a barrier to groundwater flow in the Project area.

Numerous northwest-striking quartz-porphyry dikes have formed in the Empire Mountains and Mount Fagan areas (Tetra Tech, 2010e). Some of these dikes appear to have been formed by intrusion into existing faults (Drewes, 1972b). These dikes are younger than the surrounding bedrock and therefore cut through the older bedrock. There is the potential that these dikes may create barriers to groundwater flow. One of the longest and most continuous of these dikes is perpendicular to Davidson Canyon. The Davidson Canyon quartz-porphyry dike is located approximately 5 miles northeast of the proposed Rosemont Pit and trends roughly perpendicular to Davidson Canyon Wash.

7.3.5 Mesozoic Sedimentary Rocks

The Bisbee Group rocks outcrop extensively along the eastern and northern slopes of the Santa Rita Mountains and cover a large area around the Empire Mountains and in the west-central part of the Whetstone Mountains. Bisbee Group rocks are known to underlie the basin-fill deposits in much of the upper Cienega Creek. Bisbee Group rocks are deformed over much of the Project area, but less than the underlying Paleozoic rocks.

Rocks of the Bisbee Group tend to have very low primary porosity and permeability. In some areas, they are locally fractured, providing secondary permeability. M&A (2009a) summarizes additional aquifer test parameters for Mesozoic sedimentary rocks as discussed in Piteau (2022b).

Groundwater in the Mesozoic sedimentary rocks occurs chiefly in joints, fractures, and faults. An exception to this is the Glance Conglomerate, which locally appears to have moderate primary permeability (M&A, 2007). Groundwater in the Mesozoic rocks probably occurs under semi-confined to confined conditions.

7.3.6 Paleozoic Sedimentary Rocks

Paleozoic rocks occur in the Project area mostly along the eastern slopes of the Santa Rita Mountains. Paleozoic rocks are also abundant in the Empire, Whetstone, and Mustang Mountains, and in the northern part of the Canelo Hills. The Paleozoic rocks include limestones, dolomites, and quartzites which were uplifted, faulted, and intruded by granitic rocks during the Laramide orogeny.

These units have little to no primary porosity and permeability; groundwater occurs chiefly in joints, fractures, and faults (M&A, 2009a).

Groundwater in the Paleozoic rocks probably occurs chiefly under confined conditions. Yields from wells that penetrate these rock units range from less than 1 to more than 50 gpm.

7.3.7 Precambrian Rocks

Granitic intrusive rocks of Precambrian age occur west of the crest of the Santa Rita Mountains and extend beneath the Paleozoic rocks to the east. The Continental Granodiorite also outcrops in the pediment area north of the Empire Mountains and in the northern part of the Whetstone Mountains. Towards the west of the Project area, the Precambrian rocks are juxtaposed against basin fill deposits by Tertiary Basin and Range faulting. The Pinal Schist is present in small areas on the west side of the Santa Rita Mountains, the Whetstone Mountains, and northern part of the Empire Mountains.

Groundwater in the Precambrian rocks occurs only in joints, fractures, and faults; there is no primary porosity or permeability (M&A, 2009a). Very few wells in the Project area are completed in these rock units and reported well yields range from near zero to a few gallons per minute.

7.3.8 Faults

Variable quantities of groundwater may be found in the secondary porosity and permeability in faults and fractures present in the various consolidated, lithified and crystalline basement rocks from the Precambrian through the Tertiary Basin-fill. Faults act as flow conduits that yield water in greater quantities than would the neighboring in-situ rocks. On the other hand, faults may also serve to compartmentalize the aquifers into isolated blocks where the faults act as flow barriers. Key faults in the Project area are described below.

Backbone Fault

A high-angle faulted zone in the Paleozoic units along the Santa Rita crestline is a structural feature which exerts a substantial degree of control over movement of groundwater in the Project area. The Backbone Fault is a complex structural assemblage of thrust faults, high angle normal faults and tear faults which forms the western edge of the east dipping block of Paleozoic sediments that include the Rosemont deposit (Anzalone, 1995). The faults dip in an easterly direction at variable angles up to 90 degrees.

The entire Backbone Fault is considered to have higher conductivity in both a north-south and vertical direction, parallel to the ridge relative to the surrounding rock formation (M&A, 2010a).

Flat Fault

A low-angle fault between the Willow Canyon Formation and the underlying Paleozoic units is a structural feature with a substantial degree of control over movement of groundwater in the Project area (M&A, 2010a). The Flat Fault originated as a large displacement normal fault. Subsequent tilting of the strata in the area rotated this fault to a low angle, giving it the appearance of a low angle thrust fault. The fault is present on the surface, at the contact between the Willow Canyon and the Paleozoic units. The fault dips in an easterly direction at variable angles up to about 20 degrees and may facilitate movement of groundwater east from the Santa Rita Mountains.

Portions of the Flat Fault are considered to have higher hydraulic conductivity relative to the surrounding rock formation, making it a conduit to flow. The Flat Fault intersects the Backbone Fault and aquifer data indicate a hydraulic connection between the faults (Montgomery & Associates, 2010a).

Davidson Canyon Fault

The Davidson Canyon fault zone extends through the Davidson Canyon area and separates the Santa Rita from the Empire Mountains (Montgomery & Associates, 2009a). The fault zone occurs northeast of the Project area, trending north along Davidson Canyon. It consists of at least two major faults in which the west side is down relative to the east side by as much as 9,800 ft near Interstate-10 (Montgomery & Associates, 2010a). The eastern fault can be traced south across the northern and western pediment of the Empire Mountains, approximately 1 mile east of Davidson Canyon. The western faults trace is concealed by alluvium. Based on interpretation of groundwater levels and geologic data, the Davidson Canyon fault is determined to represent a higher hydraulic conductivity zone relative to the surrounding rock formations (Montgomery & Associates, 2010a).

NW-Trending Faults

Davidson Canyon is separated from the Project area by a series of northwest trending faults in the Upper Cretaceous Volcanics (Tetra Tech, 2010e). The effect that these faults would have on the propagation of drawdown from dewatering the Rosemont Pit in the direction towards Davidson Canyon depends on the hydraulic properties of the faults. The occurrence of numerous springs along the northwest trending faults in the Upper Cretaceous Volcanics suggest that some faults are acting as barriers to groundwater flow (Tetra Tech, 2010e). These faults are roughly perpendicular to groundwater flow and as barriers, these faults can result in groundwater being forced to the surface.

7.4 PIT AND FACILITY HYDROGEOLOGY

The hydrogeology of the Copper World Project area is described below in order of the mine plan sequence, from west to east, followed by key facilities. A detailed description of the Project area hydrogeology is provided in Piteau (2022a) in **Appendix F.1**.The baseline groundwater elevations and piezometric contours (including groundwater flow arrows) for the Project area are shown on **Figure 35**.

7.4.1 Peach and Elgin Pits

The field investigation data, combined with geologic and structural modeling, show that there is no significant groundwater in the Peach and Elgin open pit areas. The combination of geologic complexity, poor rock mass hydraulics and lack of recharge, means there is no significant groundwater system continuity in the area. A significant proportion of planned mining is above measured piezometric levels. It is unlikely that any groundwater control measures (i.e., dewatering wells) will be needed to support proposed mining. The bedrock system contains no significant storage or conductivity. Recharge is very low. Geologic structures and the general fabric of the district will limit any groundwater movement from up-gradient areas. These characteristics are well supported by the hydraulic testing and data from the piezometers installed during 2021 (Piteau, 2022a).

Precambrian Continental Granodiorite will be exposed in the bottom portion of Peach Pit and in the southern portion of Elgin Pit. The Paleozoic sedimentary rocks that will be intercepted by the pits include Bolsa, Abrigio, Martin, Escabrosa, Horquilla, Epitaph, and Concha Formations. These will be present in the walls of both pits. The units dip eastward. The eastern part of the Elgin Pit will encounter Tertiary Quartz Monzonite Porphyry intruding the Paleozoic section. None of the geologic units are expected to produce significant groundwater during the proposed mining operations.

The proposed final floor of the Peach Pit is 3,950 ft amsl and the proposed bottom of the Elgin Pit is 4,050 ft amsl. The depth to groundwater measured at 20 monitoring locations in the Peach-Elgin area ranges from 59 feet to 236 ft bgs, and the potentiometric surface elevation ranges from 4,107 to 4,324 ft amsl. It’s evident from the piezometer data that some of these levels are locally perched, decoupled and poorly interconnected. Groundwater gradients across the two pit areas is in the west-southwest to northwest direction. Horizontal gradients vary from 0.05 to 0.11 ft/ft. Vertical gradients range from essentially zero to 0.33 ft/ft directed downward. The variable piezometric levels and gradients reflect discontinuity, perched and de-coupled groundwater, compartmentalization, and lack of active groundwater movement in the system.

7.4.2 Heavy Weight Pit

The Heavy Weight Pit geology is relatively simple, consisting of Precambrian Continental Granodiorite in the bottom and southeast half of the pit and Tertiary Quartz Monzonite Porphyry in the northwest half of the pit. The Quartz Monzonite Porphyry intrudes the other units. A thin sliver of Paleozoic (Permian) Concha Limestone sits between the Precambrian Continental Granodiorite and the Tertiary Quartz Monzonite Porphyry (Piteau, 2022a).

The geologic units occupying and surrounding the pit all have very low storage and low to very low bulk hydraulic conductivity. None are expected to produce significant groundwater during proposed mining operations. Active groundwater control measures will not be needed to support open pit mining, i.e., dewatering wells.

The proposed final floor of the Heavy Weight Pit is 4,350 ft amsl. As expected, groundwater levels vary across the site reflect the topographic grade and low bulk hydraulic conductivity of the system. Piezometer data indicate groundwater levels ranging from 4,626 ft amsl in up-gradient areas to 4,430 ft amsl in the local down-gradient areas toward the east. Horizontal gradients vary from essentially hydrostatic at the potentiometric high on the north side of Heavy Weight Pit to 0.25 ft/ft on the west side of the Copper World Pit. Vertical gradients range from 0.03 ft/ft to 0.35 ft/ft directed downward. As with other parts of the site, the variable gradients reflect discontinuity, compartmentalization, and low bulk scale conductivity.

7.4.3 Copper World Pit

The Copper World Pit footprint is in an up-gradient hydrogeologic position near the basin divide. The geologic units collectively have low bulk conductivity and extremely low storage. They are configured into a complex set of steep geometries and faulted offsets. The combination of bulk hydraulic parameters, strong discontinuity in geology, lack of up-gradient catchment or recharge, collectively combine to limit the groundwater system. There is very limited continuity or groundwater flux across this area. It's not expected that groundwater controls (dewatering wells) will be needed during mining (Piteau, 2022a).

The units exposed in the Copper World Pit include Precambrian and Paleozoic sedimentary rocks. Precambrian Continental Granodiorite will be exposed in the bottom and west wall of the Copper World Pit. This unit underlies the Paleozoic units that locally include Bolsa, Abrigo, Martin, Horquilla, Earp, Epitaph Formations. These are present in the east wall of the proposed pit.

The proposed final floor elevation of the Copper World Pit is 4,450 feet amsl to the north and 4,500 ft amsl to the south. The depth to water measured at 18 monitoring locations in and around the Copper World Pit, and the surrounding WRF area, ranges from 31 feet to 422 ft bgs. The potentiometric surface elevation ranges from 4,331 to 4,740 ft amsl. Groundwater levels show discontinuity and are influenced by topographic grades, sub-vertical geologic fabric, associated barriers, low bulk conductivity and lack of recharge. The inferred gradient across the Copper World Pit is mainly toward the northwest. Horizontal gradients range from essentially zero at the potentiometric high on the north side of Heavy Weight Pit to 0.25 ft/ft on the west side of Copper World Pit. Vertical gradients range from 0.03 ft/ft to 0.35 ft/ft directed downward, again, influenced by topography, the elevated position of the mining area and the geologic fabric.

7.4.4 Broadtop Butte Pit

The Broadtop Butte Pit area is further up the ridgeline above the Copper World Pit and to the north of Rosemont Pit. Similar to the Copper World Pit, the location contains no hydrogeologic catchment. The bulk rock properties involve low hydraulic conductivity and storage. The geologic contacts and geometries, in conjunction with faults, create significant discontinuity and compartmentalization. These factors, together with extremely low recharge conditions, create limited opportunity for groundwater occurrence or movement at the site. As such, no proactive dewatering measures will be needed during mining (Piteau, 2022a).

The Broadtop Butte Pit consists of a deeper northern pit and a north-south elongated, shallower southern extension. Precambrian Continental Granodiorite will be exposed in the bottom and west wall of the southern extension of the Broadtop Butte Pit. This unit underlies the Paleozoic units. The Paleozoic sedimentary rocks that will be exposed in the pit include Bolsa, Abrigo, Escabrosa, Epitaph, and Scherrer Formations. These are present in the east wall of the southern pit and portions of the northern pit. These units dip steeply eastward.

Tertiary-aged Quartz Monzonite Porphyry is the dominant unit in the north extension of the Broadtop Butte Pit. It intrudes all other units. It is not present in the bottom of the pit. Mesozoic sedimentary rocks including the Cretaceous Willow Formation and the Glance Conglomerate, are found in the southern and eastern portion of the northern pit. These units dip moderately steeply eastward.

The floor of the proposed Broadtop Butte Pit is 4,850 ft amsl in the north, and 5,200 ft amsl in the south. The depth to water measured at seven (7) monitoring locations in the Broadtop Butte Pit and surrounding WRF reflects the abrupt and steep topography, low bulk conductivity of the geologic units and the strong discontinuity created by the framework of contacts and faults. The range of groundwater levels illustrates the lack of connection and ability for groundwater movement or drainage in the area.

Depth to groundwater measured in the installed piezometers ranges from 61 to 513 ft bgs. The potentiometric surface elevation ranges from 5,016 to 5,409 ft amsl. The upper ranges appear perched and de-coupled, based on comparison to deeper nearby piezometers. This is expected for the location. The more elevated groundwater levels to the north also appear to reflect an isolated and de-coupled compartment.

7.4.5 Rosemont Pit

The Rosemont Pit is located immediately east of the topographic divide and Santa Rita ridgeline. Due to its up-gradient position there is very limited hydrogeologic catchment associated with the pit area. The open pit has more significant extents than the Satellite pit areas described above. It is hosted by bedrock that includes intrusive sequences and sedimentary units, which are further described below. Groundwater levels across the planned pit area are strongly variable at localized scales and reflect the topographic grade, complex geology, compartmentalization, and discontinuity within the system. Due to the proposed rate and ultimate depth of excavation, and the presence of the more porous Willow Canyon Formation in some sectors, relatively low amounts of groundwater inflow to the operations can be expected during the mine life. This may require some local pit scale dewatering and water control measures, mainly to reduce pore pressures and support highwall safety. Most groundwater inflow will be generated via storage removal from local bedrock fractures within the open pit shells and more granular Willow Canyon Formation. The geologic framework of the open pit area, and low bulk conductivity ranges, will limit any connections to the broader system. The lack of up-gradient catchment and low rates of recharge will limit groundwater flow in the area (Piteau, 2022a).

Hydraulic testing in the Rosemont Pit area (Montgomery & Associates, 2007, 2009a) indicates generally low bulk hydraulic conductivity and minimal fracturing or interconnection over a significant distance. The Willow Creek formation potentially has relatively increased storage and any local fracturing may produce low but more sustained flow as a consequence. The major bounding structures, and the complex geometry of steep dipping geologic contacts within the pit footprint, will create strong compartmentalization and domain limitations within the immediate Rosemont Pit area. The structural system and broader geologic framework will further limit interconnection to the broader system.

The Rosemont Pit is much larger in extent and depth compared to the west side mining areas. Given the proposed mining rate and depth, relatively low rates of groundwater inflow to the open pit and operating areas can be expected, mainly due to release of minor amounts of groundwater in local bedrock fractures within the pit shells as the pit floor deepens and expands. The Willow Creek formation may also produce minor amounts of groundwater as it becomes exposed in the southeast sectors.

The proposed final floor elevation for the Rosemont Pit is 3,650 ft amsl. Depth to groundwater measured at 16 monitoring locations in the proposed Rosemont Pit vicinity range from 11 to 338 ft bgs and the potentiometric surface elevation ranges from 5,017 to 5,179 ft amsl. Groundwater level variability reflects strong topographic grades, bedrock compartmentalization and low bulk hydraulic conductivity. Groundwater gradients across the site are generally toward the east and west reflecting the lack of hydrogeologic catchment associated with the site and presence of a natural divide. Horizontal gradients in the Rosemont Pit area range from 0.21 ft/ft on the southwest side and essentially zero on the north side. The horizontal gradients located away from the Rosemont Pit range from 0.07 ft/ft towards the northwest and 0.06 ft/ft towards the east. The gradients reflect significant discontinuity in the groundwater system in the Rosemont Pit area.

Confining conditions are indicated in the deeper Paleozoic rocks in and near the proposed Rosemont Pit area (Montgomery & Associates, 2007, 2009a). The elevated hydraulic heads in the Paleozoic rocks are a result of their high western elevations along the Santa Rita ridgeline and low conductivity associated with the overlying geologic sequence.

For Rosemont Pit implementation, it will potentially be necessary to operate small pit scale groundwater control measures. These measures would be needed to: i) remove small amounts of groundwater from the operating areas, and ii) to depressurize slope sectors that are very poorly conductive and have geotechnical design sensitivity to pore pressure. Due to the low bulk conductivity, limited interconnection, and strongly compartmentalized system, any pit area groundwater controls would need to be within the final pit footprint and may include low flow horizontal drains or small sector scale short term dewatering wells.

7.4.6 Waste Rock Facility (WRF)

The Waste Rock Facility will include material placed within and around the Heavy Weight, Copper World, and Broadtop Butte pits. The preceding sections discuss groundwater conditions in these areas. In addition to back filling, waste rock will also be placed on areas of native ground surrounding the pit crest areas, and other areas such as a foundation for the HLP. Bedrock includes Precambrian intrusive, Paleozoic sedimentary, Cretaceous sedimentary, and Tertiary intrusive rocks (Piteau, 2022a). Additional details are as follows:

- Precambrian Continental Granodiorite outcrops between the Heavy Weight and Copper World pits.
- Paleozoic sedimentary rocks in several areas within the WRF footprint. They are found west of Heavy Weight Pit (Concha Limestone), east and north of Copper World Pit (Bolsa Quartzite, Abrigo Formation, Martin Formation, Horquilla Limestone, Epitaph Limestone, and Scherrer Limestone), and north and east of Broadtop Butte Pit (Earp Formation, Epitaph Dolomite, Scherrer Limestone, and Concha Limestone.
- Mesozoic sedimentary rocks Willow Canyon Formation) outcrop southwest of the Heavy Weight Pit and east of Broadtop Butte Pit.
- Tertiary-aged Quartz Monzonite Porphyry is present west of Heavy Weight Pit. It intrudes all other units. This unit is not expected to yield substantial quantities of groundwater due to the generally low hydraulic conductivity of the rock matrix, and it will be expected to act as a barrier to flow.

The depth to water measured at 20 monitoring locations in the Heavy Weight Pit, Copper World Pit and WRF area ranges from 31 to 422 ft bgs. The potentiometric surface elevation ranges from 4,331 to 4,740 ft amsl from 18 locations.

The depth to water measured at four monitoring locations in the Broadtop Butte Pit and WRF area ranges from 194 to 513 ft bgs. The potentiometric surface elevation ranges from 5,143 to 5,409 ft amsl.

As previously discussed, the groundwater system in the area is compartmentalized and disrupted by complex geologic contacts and discontinuities. The system is further limited by the low bulk hydraulic conductivity of the geologic units that are present and the lack of significant recharge. Once the WRF is placed on the bedrock surface, any minor recharge will become even further reduced and limited due to the porous dump materials and propensity for precipitation to either shed or store and evaporate within the cover material (taken from Section 4.3.6 in Piteau [2022a] in **Appendix F.1**).

The geologic orientations and major structures create a fabric that will further limit any groundwater movement in east and west directions. While current groundwater levels may infer gradients in these directions, the limitations created by geologic contacts, structures and bulk conductivity will inhibit any groundwater movement. The available hydrogeologic data indicate there is only local fracture conductivity in the faults, including the Backbone fault. However, if there were minor conductivity increases along strike, gradients would be established toward the Rosemont Pit area once mining was implemented. However, this may also be limited by cross cutting east-west structures.

7.4.7 Process Plant Area

This Process Plant area, or Plant Site, is mostly underlain by a thin Piedmont Alluvium suite consisting of Holocene alluvium and Late Pleistocene alluvial fan and terrace deposits. The thickness of this section varies but is no more than 200 feet thick. Just west of this facility, the Alluvium is underlain by Basin-Fill deposits which thicken rapidly towards the Santa Cruz River (Piteau, 2022a).

The Alluvial sequence overlies Precambrian Continental Granodiorite in the western part of the Process Plant area. It has been intruded by Tertiary Helvetia Granite in the eastern part of the area. These units are also present in small outcrops within the plant footprint.

There are no faults mapped within the footprint of the Process Plant area, but the underlying intrusive rocks likely contain unmapped fractures and joints.

The Alluvium units have high hydraulic conductivity and storage characteristics. However, in their natural state, they are unsaturated. Significant groundwater is not expected to occur in the underlying Precambrian and Tertiary intrusive units due to their aquitard properties.

The depth to groundwater measured at three monitoring locations at the Process Plant area ranges from 59 to 84 ft bgs. The potentiometric surface elevation ranges from 4,061 to 4,143 ft amsl. The groundwater gradient in the locality is toward the west-northwest similar, to the topographic grade. Due to the low bulk hydraulic properties, and low recharge setting, there is not expected to be a significant bedrock groundwater flux across the area.

7.4.8 Heap Leach Pad (HLP)

This proposed HLP facility footprint is mostly underlain by a thin Piedmont Alluvium suite consisting of Holocene alluvium and Late Pleistocene alluvial fan and terrace deposits. The thickness of this section varies but is no more than 100 feet, possibly thickening towards the west. Just west of this facility, the Alluvium is underlain by Basin-Fill deposits which thicken rapidly towards the Santa Cruz Basin (Piteau, 2022a).

The Alluvial sequence overlies mostly Tertiary Helvetia Granite, but a small area of Precambrian Continental Granodiorite is present on the eastern edge and within the footprint of the facility. The Alluvium units have high hydraulic conductivity and storage characteristics. However, in their natural state, they are unsaturated. The bedrock units beneath the site have low hydraulic conductivity and storage and they are categorized as aquitards.

The depth to water measured at two (2) monitoring locations in the HLP area ranges from 59 to 141 ft bgs, as a reference. The potentiometric surface elevation ranges from 4,282 to 4,589 ft amsl. The bedrock hydraulic gradient across area is toward the northwest. However, there is not expected to be any significant bedrock flux in the area due to the low bulk conductivity ranges and lack of recharge.

7.4.9 Tailings Storage Facilities (TSFs) 1 and 2

The tailings facilities are mostly underlain by a thin Piedmont Alluvium suite consisting of Holocene alluvium and Late Pleistocene alluvial fan and terrace deposits. The thickness of this section varies but is no more than 400 feet thick. Just west of the tailings facilities the Alluvium is underlain by Basin-Fill deposits which thicken rapidly westward into the Santa Cruz basin (Piteau, 2022a).

The Alluvial sequence overlies Precambrian Continental Granodiorite, which is intruded by Tertiary Helvetia Granite. These units are also present in small outcrops within the footprints of the facilities. The Alluvium units have high hydraulic conductivity and storage characteristics. However, in their natural state, they are unsaturated. The underlying bedrock is categorized as an aquitard due to the low bulk hydraulic parameter ranges. The mapped faults may have some local scale fracturing, however, hydraulic continuity for significant strike length is not plausible given fault fill, orientations and overburden stresses.

The depth to water measured at six (6) monitoring locations in the TSF-1 area ranges from 20 to 90 ft bgs. The potentiometric surface elevation ranges from 3,582 to 3,926 ft amsl.

The depth to water measured at three monitoring locations in the TSF-2 area ranges from 48 to 272 ft bgs. The potentiometric surface elevation ranges from 3,911 to 4,275 ft amsl.

Groundwater gradients are indicated as northwest across both TSF facilities. However, bedrock flux rates will be very small given the bulk system parameters and very low recharge.

7.5 GROUNDWATER FLOW MODELING

The numerical groundwater model developed for the Copper World Project was based on 1) the results of the recent hydrogeological characterization program (Piteau, 2022a), and 2) previously developed groundwater models. A detailed description of the Project groundwater model (Piteau, 2022b) is provided in **Appendix F.2.**

The groundwater model presented in Piteau (2022b) was based on an earlier version of the Copper World Project mine plan. Adjustments to facility configurations, such as flattening the TSF embankment slopes and adjusting facility footprints, resulted in less available storage capacity. The mine plan shown in **Table 4.01** in **Section 4.2** represents less mined material than was simulated in Piteau (2022b). The major adjustment was to the Rosemont Pit. The current pit configuration has a pit bottom elevation of 3,850 ft amsl. The groundwater model assumed a pit floor elevation of 3,650 ft amsl.

Because the current mine plan calls for less mined materials that was simulated in the model, existing model results are considered conservative in terms of (i) the drawdown effects from pit dewatering (ii) the volume of seepage from the TSFs and (iii) seepage transport from the TSFs. Overall, groundwater drawdown levels from dewatering would be expected to be less than simulated and post-mining groundwater levels would be expected to recover faster than simulated, but eventually to the same equilibrium levels. Overall, the TSFs would be expected to discharge less volume than simulated and seepage would be expected to transport less distance than simulated owing to the lesser volume and correspondingly lesser mounding, i.e., a larger TSF was modeled. The concentrations of TSF seepage constituents would be less than that expected under the conditions of the previous mine plan owing to the lesser volume (and mass by inference) of seepage. The numerical groundwater flow model report developed for the Project is provided in **Appendix F.2** and is titled Rosemont Copper World Water Quantity Impacts Assessment (Piteau, 2022b).

The two previously developed groundwater models, referred herein as the West model and the East model, were used in constructing the Project model. There models included the following:

- Mason and Hipke, 2013 and Mason and Bota, 2006 (the West model). The West model is the current TAMA model update. The purpose of developing this model was to provide insights into water-supply issues in the basin-fill deposits located in the Upper Santa Cruz and Avra Valley basins. As such, this model is mainly concerned with water-supply related issues in these valleys. The southeast portion of the West model domain overlapped with portions of the East model domain developed for the East model. The West model was available as a set of MODFLOW input files.
- Tetra Tech, 2010 (the East model). The East model, which includes an update based on subsequent field investigations and analyses (Neirbo Hydrogeology, 2019), was designed for the purposes of investigating mining impacts to the local-scale hydrogeology and is largely focused on the area east of the ridgeline as part of the Rosemont Copper Project. It was distributed as a Groundwater Vistas file.

Both base models (TAMA and Tetra Tech, 2010) have had numerous internal reviews, reviews by third parties and reviews by regulators. Because of this, there was confidence that each model represented the Project conceptual model at both the regional and site-scale. Regardless, the structural components in each existing model were reviewed prior to finalizing the overall Project conceptual model and before incorporating these components into the Project groundwater model.

The modelling approach combined aspects of East and West models into a single model. Specifically, model parameter ranges, distributions and boundary conditions in the Project model were derived from the East and West models. However, important geologic and hydrogeologic details at the scale of the proposed mine plan were added where necessary and appropriate.

The Project model simulations were performed in two stages:

- A calibration model. This model is a steady-state model used to establish parameter values.
- A predictive model. This model is a transient model used to predict potential impacts that may result from the proposed actions.

7.5.1 Baseline / Pre-Mining Phase

The results of the calibration were evaluated with the following industry-standard methods:

- Analysis of weighted residual statistics
- Cross plots of simulated value against observed value
- Cross plots of residual value against observed value
- Histogram of weighted residuals
- Maps of residuals at target locations

The mass balance of the Project calibration model is 0.00%. **Table 7.03** summarizes the key calibration statistics from the final calibration model (Piteau, 2022b) provided in **Appendix F.2**.

Table 7.03: Calibration Statistics Summary

Statistic	Units	All
Count	[-]	536
Minimum observed water level	ft msl	2590.0
Maximum observed water level	ft msl	5569.9
Range in observed values	Ft	2979.9
Weighted Mean Error	Ft	21.01
Weighted Mean Absolute Error	Ft	35.7
Weighted Root Mean Squared Error	Ft	63.2
Scaled Weighted Root Mean Squared Error	[-]	2.12%

Note: Values taken from Table 3.2 in Piteau (2022b).

The weighted mean error for all targets is +21.01. This means that the residuals show a slight bias towards underprediction. The scaled weighted root mean squared error (RMSE) for all targets is 2.12%, well under the industry-standard threshold of 5% to 10%.

Overall, all of the calibration results indicate that this model is well-calibrated and is fit-for-purpose of serving as the precursor for predictive modeling.

7.5.2 Mining Phase

The final predictive model was evaluated in terms of its numerical performance. The mass balance error for each time step ranged from -0.02% to +0.04%, with only 32-time steps (out of 1,815 total time steps) having non-zero errors. No time step encountered convergence issues. Therefore, the predictive model is numerically very stable (Piteau, 2022b).

7.5.2.1 Simulated Pit Dewatering

Table 7.04 gives the average dewatering rates predicted by the model for each pit. Actual open pit dewatering methods will likely include a variety of methods such as wells, horizontal drains, and sumps and these will vary by pit. Well locations will target areas that are likely to have higher yields (i.e., fault and fractures zones with enhanced permeability) and may be located inside and outside the open pits. Horizontal drains drilled into the pit walls from pit benches may be used to keep groundwater away from the pit walls. However, it is anticipated that dewatering wells may not be needed for the Satellite pits.

Table 7.04: Average Pit Dewatering Flow Rates

Pit	Average Flow Rate (gpm)
Peach	1.5
Elgin	2.6
Heavyweight	16
Copper World North	19
Copper World South	6.0
Broadtop Butte	26
Rosemont	296

Note: It is anticipated that pit dewatering wells may not be needed for the Satellite pits.

7.5.2.2 Mounding above TSF and HLP

The two (2) tailings storage facilities (TSFs) introduce an additional water source into the system. The additional water seeping from each TSFs causes a mound of water to develop under each facility. This mound attains a maximum elevation soon after emplacement of the final material on the stack, then experiences a slow decay.

In contrast, the seepage rate beneath the HLP is so low that a mound does not develop. Instead, the water level beneath the HLP declines over time due to reduced recharge and influence of the local and regional drawdown.

7.5.2.3 Pit Lake Filling

The groundwater model (Piteau, 2022b) predicts that pit lakes will form at Peach, Elgin, and Rosemont following the cessation of pit dewatering and/or water management within the pits during operations. The lakes at Peach and Elgin are predicted to be small relative to the size of the respective pit. These two pit lakes tend to alternate between being terminal and flow-through lakes during water level recovery. In comparison, the Rosemont pit lake is large and is always a terminal lake.

Peach Pit begins filling at the beginning of mine year 7. When filling begins, water levels are at an elevation of 3,950 ft amsl at the bottom of the Peach Pit. Water levels rapidly rise to an elevation of about 4,051 ft amsl then slowly rise to an elevation of about 4,061 ft amsl before falling back to an equilibrium lake level of about 4,051 ft amsl. The maximum depth of the pit lake is about 111 ft. The water balance of the pit lake indicates that flows are very small with minor outward seepage, and likely unmeasurable in the field, i.e., the magnitude of these flows are lower than the resolution capabilities of the model. The source of this water is pit wall runoff and direct precipitation which exceeds evaporation due to the small surface area of the pit lake. Water levels and flows also reflect a complex interplay of local processes and drawdown from the Rosemont Pit.

Elgin Pit begins filling at the beginning of mine year 4. When filling begins, water levels are at an elevation of 4,050 ft amsl at the bottom of the Elgin Pit. Water levels rapidly rise to an elevation of about 4,102 ft amsl then slowly fall to an equilibrium lake level of about 4,101 ft amsl. The maximum depth of the pit lake is about 52 ft. The water balance of the pit lake indicates that flows are very small with minor outward flow, and likely unmeasurable in the field, i.e., the magnitude of these flows are lower than the resolution capabilities of the model. The source of this water is pit wall runoff and direct precipitation which exceeds evaporation due to the small surface area of the pit lake. Water levels and flows also reflect a complex interplay of local processes and drawdown from the Rosemont Pit.

Rosemont Pit begins filling at the beginning after Year 15. When filling begins, water levels are at an elevation of 3,650 ft amsl at the bottom of the Rosemont Pit. In contrast to Peach and Elgin, the filling history of Rosemont is straightforward. Water levels rapidly rise at first. The rate of rise slows down as the lake fills. By 200 years after mining stops, the lake stage is stable at about 4,253 ft amsl. The maximum depth of the pit lake is about 603 ft. The Rosemont pit lake is always terminal. Net bedrock flows are always into the lake. Compared to the surface water processes, bedrock flow is the dominate process for filling the lake. During the early stages of pit filling, the net pit lake flows are positive indicating that the sum of precipitation, pit wall runoff, and catchment runoff exceeds evaporation. This changes sign at year 67, indicating that evaporation exceeds the other surface water processes.

7.5.2.4 Behavior in the Back-filled Pits

All three of the backfilled pits experience some degree of water level rise. The amount of the rise is a function of the depth of the pit relative to the pre-mine water table, timing when recovery begins, and superimposed drawdown from ongoing dewatering in nearby pits, especially Rosemont. The assumed porosity of the backfill (30%) also plays a role in attenuating the rise. The predicted water levels in the back-filled materials will not return to pre-mine water levels due to the increased amount of storage.

All three pits also experience flows to and from the surrounding bedrock. The nature of these flows depends on the height of water in the backfilled waste rock, the hydraulic properties of the surrounding bedrock, and superimposed drawdown from ongoing dewatering in nearby pits, especially the Rosemont Pit. In all cases, the flows are very small, well within the resolution capabilities of the model and assumptions of future conditions and are likely unmeasurable in the field.

The bottom of Heavy Weight Pit is at 4,150 ft amsl. By 200 years post-mining, the water level is expected to rise to about 4,319 ft amsl, about 169 feet above the old pit floor. During the initial pit filling, net flow is from the surrounding bedrock into the backfill, and the pit does not discharge. Initial rates fall rapidly thereafter. At that point, net flows are still into the backfill, but the rate of change becomes very small. By 200 years post-mining, the net flow rate is approximately zero reflecting near equilibrium conditions. The flows are very small, well within the resolution capabilities of the model and assumptions of future conditions and are likely unmeasurable in the field.

The bottom of Copper World North Pit is at 4,450 ft amsl. By 200 years post-mining, the water level is expected to rise to about 4,544 ft amsl, about 94 feet above the old pit floor. Initially, the net flows within the bedrock are directed inwards, towards the backfill. This changes direction around model year 40 when flows are directed from the backfill into the bedrock. The magnitude of these flows are lower than the resolution capabilities of the model and are likely unmeasurable in the field.

The bottom of Copper World South Pit is at 4,500 ft amsl. By 200 years post-mining, the water level is expected to rise to about 4,627 ft amsl, some 127 feet above the old pit floor. In contrast with Copper World North, the model predicts that the net flows at Copper World South are always from the backfill into the surrounding bedrock. The net outward flow rate increases over time but the rate of change decreases. The magnitude of these flows are lower than the resolution capabilities of the model and are likely unmeasurable in the field.

The bottom of Broadtop Butte Pit is at 4,850 ft amsl. By 200-years post mining, the water level is expected to rise to about 4,974 ft amsl, some 124 feet above the pit floor. The model predicts that the net flows at Broadtop Butte are always from the backfill into the surrounding bedrock. The net outward flow rate increases over time but the rate of change decreases. However, the magnitude of these flows are lower than the resolution capabilities of the model and are likely unmeasurable in the field.

7.5.2.5 Simulated Head Differences

The Project groundwater model simulates the growth and decay of groundwater mounds relative to the pre-mining water table beneath the TSFs. There is virtually no mound developed beneath the HLP due to the low seepage rate. The mounds under the TSFs attain a maximum elevation soon after emplacement of the final material on the stack, then experience a slow decay. Drawdown related to pit dewatering accelerates the decay of the mound beneath TSF-2 and a portion of TSF-1.

A small area of the mound beneath TSF-1 may rise above the original ground surface and into the seepage capture system of TSF-1. The estimated maximum height of this mound is five feet above the top of model layer 1.

The model also shows the area affected by drawdown due to pit dewatering. The area within the 10-foot drawdown isopleth increases in size after mining stops because the water in this area is filling the Rosemont Pit and, to a lesser degree, Peach, Elgin, and the backfilled pits.

7.5.2.6 Predicted Spring Impacts

A total of twenty-one springs were used in the calibration model as head targets. Twelve of these were also uses as boundary conditions in both the calibration model and the Predictive Models. Monitoring points were placed in the predictive model at each of the springs and head hydrographs were prepared to show the head changes that each spring experienced during mining and for 200 years after mining stopped. The simulated results are similar to previously reported results (Tetra Tech, 2010; Neirbo, 2019) which show that mining only cause small flow reductions in the springs.

7.5.2.7 Predicted Stream Impacts

There are three streams represented in the model: Davidson and Cienega Creeks and the Santa Cruz River. The model simulates the amount of flow leaving the model through groundwater-surface water interactions.

The model predicts that there is no flow in the drains representing the Santa Cruz River due to irrigation and municipal pumping.

The uppermost reaches of Davidson Creek are dry in both the predictive and base case models. The lower reaches have constant flows in the base case model of about 88 and 75 gpm, respectively. In contrast, the predictive model shows that these two reaches have flows that are close to the base case flows but they change slightly from mine year 1 to 200 years post-mining. The model predicts that by 200 years after mining, these two reaches have lost about 1.8 and 0.14 gpm, respectively. These differences are very small and are within the resolution capabilities of the model. They are likely unmeasurable in the field.

All reaches of Cienega Creek are flowing except for the reach located on the northernmost area of the model. The other reaches have flows that range from 35 to 1,005 gpm. The simulated flows in the base case model are constant. Like Davidson Creek, the simulated flows in the predictive model change slightly from mine year 1 to 200 years post-mining. These changes are almost too small to see in the flow hydrographs. However, a plot of the change in flow shows that by 200 years after mining these reaches have lost up to 1.5 gpm. The losses increase from the uppermost reaches of Cienega Creek downstream, then decline in the downstream direction to losses less than 0.01 gpm. These differences are very small and are lower than the resolution capabilities of the model. They are likely unmeasurable in the field.

7.5.3 Transport

Particle tracking was done to assess the Discharge Impact Area (DIA). Particle tracking is a way of post-processing the flow model results to predict flow paths, travel times, and advective transport of solutes.

Three-hundred and thirty-one particles were tracked until 200 years after mining ceased. Particles that were released in the Rosemont, Broadtop Butte, Copper World, and Heavy Weight pits (120 particles) did not leave their respective pits within the 200-year timeframe. All but 29 of the 211 particles released from Elgin, Peach, TSF-1, TSF-2 and the HLP were transported towards the northwest along the prevailing groundwater gradients and outside of the defined Pollutant Management Area (PMA) shown on **Figure 36**. The 29 points that did not escape the PMA originated in the Peach and Elgin pits and these particles stagnated within their pit footprints as shown on **Figure 37**. Particles were released in the Rosemont Pit even though it is not considered an APP regulated facility.

An alternative model was constructed to demonstrate one potential mitigation measure to address particle excursions beyond the PMA. The alternative model considers uses a series of pump-back wells at strategic locations to capture the particles before they migrate outside of the PMA. This pump-back system was developed as an example showing the effectiveness of a pump-back system, should such as system be required.

The model assumes that these wells pump at constant rates until 200 years after mining ends. In actual practice, mitigation pumping will be optimized based on monitoring data from the Point of Compliance (POC) monitoring wells.

Particles in the mitigation demonstration were tracked until 200 years after mining ceased. As before, particles that were released in the Rosemont, Broadtop Butte, Copper World, and Heavy Weight pits did not leave their respective pits within the 200-year timeframe. All but 1 particle of the 211 particles released from Peach Pit, Elgin Pit, TSF-1, TSF-2 and the HLP were captured by the pump-back system.

8.0 GEOCHEMICAL CHARACTERIZATION

This section summarizes the geochemical characterization of the materials to be excavated and processed as part of the Copper World Project. Details of the characterization program are provided in the following documents:

- Rosemont Copper World Project Geochemical Impacts Assessment (Piteau, 2022c) in **Appendix G.1**; and
- Supplemental Geochemical Samples for Copper World Project (Piteau, 2022d) in **Appendix G.2**.

Piteau (2022c) was based on Phase I and II geochemical sampling and characterization performed from 2007 to 2017 on materials from the Rosemont Pit. This work was originally performed as part of the Rosemont Copper Project. This characterization program resulted in the collection of 358 Acid-Base Accounting (ABA) samples, 88 Synthetic Precipitation Leaching Procedure (SPLP) samples, 43 Meteoric Water Mobility Procedure (MWMP) samples, and samples for 18 Humidity Cell Tests (HCT). The main supporting data and analysis for this testing is found in the following documents:

- Baseline Geochemical Characterization. (Tetra Tech, 2007a).
- Geochemical Characterization Addendum 1 (Tetra Tech, 2007b).
- Evaluation of Rosemont Geochemical Testing Results and Local Water Quality (Tetra Tech, 2009).
- Geochemical Pit Lake Predictive Model (Tetra Tech, 2010a).
- Rosemont Geochemical Sample Selection (Tetra Tech, 2010b).
- Rosemont 2006-2008 Tailings Material Sample Sources (Tetra Tech, 2010c).
- Rosemont Preliminary Geochemistry Review and Response to Comments (Tetra Tech, 2010d).
- Infiltration, Seepage, Fate and Transport Modeling Report. Revision 2 (Tetra Tech, 2012).

Additional supporting references are provided in Piteau (2022c) in **Appendix G.1**.

Overall, the Phase I test results indicate that the materials derived from the Rosemont deposit are largely non-acid generating (NAG), with minor components of potentially acid generating (PAG) and very little acid-generating (AG) material (<1%). Only three (3) leach tests produced acidic leachate; the remaining 128 leach tests were circum-neutral. HCTs identified two (2) samples that became acid-generating. Leachates from the remaining samples were circum-neutral through 35 weeks. Both acid-generating HCT samples were from the Bolsa quartzite. About 11 percent of the Bolsa ABA test results classified the samples as PAG. The Bolsa quartzite comprised approximately 1.9 percent of the total material to be excavated from the Rosemont deposit as part of the Rosemont Copper Project.

Approximately 661.4 Mt of sulfide ore were to be mined from the Rosemont deposit as part of the Rosemont Copper Project and about 1,249.0 Mt of waste rock, or a total of about 1.9 Mt of material. In contrast, the Copper World Project will mine approximately 858.6 Mt of material from six (6) open pits, with 613.2 Mt of material being mined from the Rosemont deposit. As defined in **Section 4.2** of this Application Document, the 858.6 Mt tons of material breaks out into the following categories:

- 277.4 Mt of sulfide ore
- 103.8 Mt of oxide ore; and
- 477.4 Mt of waste rock.

Total tonnages to be mined from each of the specific pits as part of the Project are provided below:

- 31.6 Mt of material from Peach Pit;
- 16.9 Mt of material from Elgin Pit;

- 25.5 Mt of material from Heavy Weight Pit;
- 40.1 Mt of material from Copper World Pit;
- 131.3 Mt of material from Broadtop Butte Pit; and
- 613.2 Mt of material from Rosemont Pit.

As with the groundwater model presented in Piteau (2022b) and described in **Section 7.5**, the tonnages reported in Piteau (2022c) were based on an earlier version of the Copper World Project mine plan. The reported tonnages included the following:

- 65 Mt of material from Peach Pit-Elgin;
- 25 Mt of material from Heavy Weight Pit;
- 42 Mt of material from Copper World Pit;
- 205 Mt of material from Broadtop Butte Pit; and
- 1,017 Mt of material from Rosemont Pit.

The overall tonnage in this earlier version of the mine plan totaled about 1,354 Mt. The main difference is the tonnage associated with the Rosemont Pit, which is approximately 613.2 Mt for the current mine plan (see **Table 4.01** in **Section 4.2**) versus 1,017 Mt assumed in Piteau (2022c). The difference, 403.8 Mt, is mainly due to adjusting the bottom elevation of the Rosemont Pit shell. The pit floor was assumed to have an elevation of 3,650 feet amsl in the earlier version as opposed to an elevation of 3,850 ft amsl in the mine plan version presented in this Application Document. As noted in **Section 7.5**, the main diver for adjusting the final Rosemont Pit shell was based on adjustments to the final facility configurations. For example, facility adjustments incorporated flatter tailings embankment slopes. These adjustments affected the ultimate capacity of the tailings facilities and thus reduced the amount of material to be mined.

The geochemical analysis presented in Piteau (2022c) used the available geochemical data derived from the Rosemont deposit (proxies) to represent similar rock types to be mined in the Satellite pits. Although the geochemical analysis and results presented in Piteau (2022c) were based on the higher tonnages (1,017 Mt from the Rosemont Pit and 337 Mt from the Satellite pits), applying the overall conclusions to the current mine plan (613.2 MT from the Rosemont Pit and 245.4 Mt from the Satellite pits) are valid. Results are summarized in the following sections.

8.1 ORE CHARACTERIZATION

The Copper World Project includes a milling and processing plant for approximately 277 Mt of sulfide ore, and heap leaching of approximately 104 Mt of oxide ore. In general, ore materials are defined as having a copper grade greater than 0.1%. Ore grade materials with soluble copper content of >50% will report to the heap leach pad (HLP) for leaching with a mild sulfuric acid solution, whereas the remaining ore will be routed to the mill. Tailings from the milling process will be stored in the TSFs.

Most geologic units present in Satellite pits are found in the Rosemont Pit and the style of mineralization is also broadly the same. Given the predominantly limestone / skarn nature of the deposits, and the continuity of rock materials between open pits, the overarching geochemical nature of Rosemont and Satellite pits is similar and pose low risk of production of acid rock drainage (ARD).

Ore rock and overburden is predominantly comprised of limestone / skarn materials, which is acid-neutralizing. Based on the larger overall tonnage of 1,354 Mt, over 90% of all mined material possess a Neutralizing Potential Ratio (NPR) >3.0, which is classified as non-acid generating (NAG) material per the ADEQ's BADCT guidance document (ADEQ, 2004). Low concentrations of leached metals are anticipated due to the neutralizing capacity of the rock.

The mined materials generally contain a low sulfur content, averaging ~0.39% for ore material and ~0.24% for waste, which meets ADEQ's sulfur cut-off of 0.3% for "inert" materials. The sulfur content of high-grade ore is still relatively low, ranging from 2% to 3% within a small amount of rock materials. While the potential may exist for localized ARD generation, this will be mitigated by the abundance of neutralizing materials in the larger rock mass. Again, these percentages were based on the larger overall tonnage of 1,354 Mt.

8.2 TAILINGS CHARACTERIZATION

Tailings will be disposed of via cyclones in two (2) TSFs located on the western piedmont of the Santa Rita Mountains. TSF-1 facility footprint will span an area of approximately 946 acres, and the TSF-2 footprint will occupy and area of 307 acres. Approximately 277 Mt of tailings will be deposited between the two (2) TSFs (TSF-1 has capacity of about 231 Mt and TSF-2 about 47 Mt). The majority of mined and milled material will be derived from limestone/skarn rock, which constitute about 67% of materials mined based on the larger tonnage of 1,354 Mt.

Although initially based on the earlier mine plan representing 445 Mt of tailings, the Copper World Project TSFs will accommodate a total of approximately 277 Mt of material and is anticipated to be comprised from similar rock types and the percentages as those stated in **Table 8.01**. A breakdown of geologic units comprising the TSFs is provided in **Table 8.01**.

Table 8.01: Geologic composition of TSFs

Geologic Unit	Tons (mT)	% Composition
ABRIGO	13.60	3.1%
ANDESITE	9.71	2.2%
ARKOSE	7.11	1.6%
BOLSA	18.40	4.1%
CONCHA	0.53	0.1%
EARP	46.40	10.4%
EPITAPH	50.10	11.3%
ESCABROSA	13.40	3.0%
GILA	0.38	0.1%
GLANCE	30.90	6.9%
GRANODIORITE	13.80	3.1%
HORQUILLA	140.00	31.4%
MARTIN	6.76	1.5%
QMP	48.80	11.0%
SCHERRER	41.60	9.4%
UNKNOWN	3.65	0.8%
Total	445	100.0%

8.3 HEAP LEACH PROCESS CHARACTERIZATION

The composition of the oxide ore materials sent to the HLP is roughly that presented in Table **8.02**. Although initially based on the earlier mine plan representing 215 Mt of oxide ore, the Copper World Project HLP will accommodate 103.8 Mt of material and is anticipated to be comprised of similar rock types and the percentages as those stated in **Table 8.02**. Both ROM and crushed/agglomerated oxide ore will be placed on the lined HLP.

Ore materials with a soluble copper content of >50% are preferentially routed to the HLP. The composite acid-base accounting (ABA) characteristics of ore rock routed to the HLP are projected to be neutralizing. Major rock units comprising the HLP raw materials will be the Abrigo, Andesite, Bolsa, Horquilla, and Qmp (**Appendix G.1**).

Table 8.02: Geochemical Composition of HLP

Geochemical Unit	Tons (mT)	% Composition	Average AP (TCaCO^3/ kt)	Average NP (TCaCO^3/ kt)	Average Cu%
ABRIGO:<1.2	0.07	0.0%	86.6	80.6	0.9
ABRIGO:>3	26.00	12.1%	2.8	378.2	0.3
ABRIGO:1.2-3	0.16	0.1%	82.0	170.2	0.7
ANDESITE:<1.2	0.02	0.0%	29.8	25.1	0.2
ANDESITE:>3	32.20	15.0%	2.7	95.7	0.2
ANDESITE:1.2-3	0.22	0.1%	22.9	53.3	0.2
ARKOSE:<1.2	0.00	0.0%			0.4
ARKOSE:>3	2.61	1.2%	9.5	141.4	0.3
ARKOSE:1.2-3	0.00	0.0%			
BOLSA:<1.2	0.18	0.1%	17.6	16.6	0.4
BOLSA:>3	25.70	12.0%	5.5	159.1	0.3
BOLSA:1.2-3	0.90	0.4%	24.5	51.6	0.3
CONCHA:>3	0.14	0.1%	7.9	121.8	0.6
EARP:>3	4.36	2.0%	1.9	437.3	0.3
EPITAPH:<1.2	0.00	0.0%			
EPITAPH:>3	11.10	5.2%	4.8	355.0	0.3
EPITAPH:1.2-3	0.00	0.0%			
ESCABROSA:>3	10.00	4.7%	3.6	508.0	0.2
GILA:>3	0.37	0.2%	2.6	306.6	0.1
GLANCE:<1.2	0.00	0.0%			
GLANCE:>3	5.67	2.6%	7.6	423.5	0.2
GLANCE:1.2-3	0.00	0.0%			
GRANODIORITE:<1.2	0.33	0.2%	33.7	21.3	0.3
GRANODIORITE:>3	14.50	6.7%	2.1	55.6	0.3
GRANODIORITE:1.2-3	4.71	2.2%	4.0	9.0	0.4
HORQUILLA:>3	24.70	11.5%	3.1	469.1	0.3
MARTIN:>3	6.02	2.8%	3.7	423.3	0.3
QMP:<1.2	0.46	0.2%	11.5	9.1	0.3
QMP:>3	26.20	12.2%	4.1	60.4	0.2
QMP:1.2-3	8.28	3.9%	8.2	17.4	0.2
SCHERRER:>3	2.35	1.1%	3.5	396.3	0.3

Geochemical Unit	Tons (mT)	% Composition	Average AP (TCaCO^3/ kt)	Average NP (TCaCO^3/ kt)	Average Cu%
SCHERRER:1.2-3	0.00	0.0%			
UNKNOWN:<1.2	0.00	0.0%			
UNKNOWN:>3	7.21	3.4%	2.4	34.5	0.2
UNKNOWN:1.2-3	0.07	0.0%	86.6	80.6	
Total	215	100%	4.1[1]	227.8[1]	0.26[1]
Weighted NPR			55.3		-
Calculated Element Percentages			Ca	S	Cu
			9.1%[2]	0.131%[3]	0.26%

[1] Weighted average

[2] Conversion using 25 for NP to Calcium. See Piteau (2022c) for details.

[3] Conversion using 31.25 for AP to Sulfur. See Piteau (2022c) for details.

8.4 WASTE ROCK CHARACTERIZATION

The composition of the materials in the Waste Rock Facility (WRF) is roughly that presented in **Table 8.03**. Although initially based on the earlier mine plan representing 695 Mt, waste rock generated by the Copper World Project will be about 477.4 Mt and is anticipated to be comprised of similar rock types and the percentages as those stated in **Table 8.03**.

The bulk AP and NP composition characterize the WRF as non-acid generating (NAG), with a composite NPR of ~31. Taken on the whole, the WRF will not develop ARD and will have capacity to neutralize any small pockets of acid generating (AG) materials, which only comprise about ~0.5% of the facility. Material abundance and weighted average of AP and NP of Geochemical Units comprising the WRF materials are summarized in **Table 8.03**.

A Waste Rock Handling Plan has been developed and is summarized in **Section 8.7** and presented in **Appendix G.3**. The plan outlines how the waste rock will be characterized into the following categories: NAG, PAG, and AG. The plan also provides guidance on the placement of materials within the WRF

Table 8.03: Geochemical Composition of WRF

Geochemical Unit	Tons (mT)	% Composition	Average AP (TCaCO^3/ kt)	Average NP (TCaCO^3/ kt)
ABRIGO:<1.2	0.02	0.0%	24.1	24.9
ABRIGO:>3	38.70	5.6%	5.7	423.7
ABRIGO:1.2-3	0.02	0.0%	12.1	28.6
ANDESITE:<1.2	1.15	0.2%	47.2	43.3
ANDESITE:>3	222.00	31.9%	6.2	73.3
ANDESITE:1.2-3	10.70	1.5%	27.4	60.9
ARKOSE:<1.2	0.08	0.0%	6.6	7.0
ARKOSE:>3	49.10	7.1%	2.5	66.4
ARKOSE:1.2-3	1.04	0.1%	4.7	9.6
BOLSA:<1.2	0.63	0.1%	8.4	4.3
BOLSA:>3	31.10	4.5%	3.6	139.9
BOLSA:1.2-3	4.39	0.6%	6.1	13.9
CONCHA:>3	0.92	0.1%	3.3	215.3

Geochemical Unit	Tons (mT)	% Composition	Average AP (TCaCO^3/ kt)	Average NP (TCaCO^3/ kt)
EARP:>3	17.40	2.5%	4.7	454.3
EPITAPH:>3	11.70	1.7%	6.4	327.0
ESCABROSA:>3	15.70	2.3%	2.1	695.1
GILA:>3	16.60	2.4%	3.0	227.5
GLANCE:>3	61.60	8.9%	4.1	565.7
GLANCE:1.2-3	0.02	0.0%	24.8	54.5
GRANODIORITE:<1.2	0.26	0.0%	15.7	9.7
GRANODIORITE:>3	40.80	5.9%	4.7	90.1
GRANODIORITE:1.2-3	5.67	0.8%	3.4	7.6
HORQUILLA:>3	25.10	3.6%	3.0	594.3
MARTIN:>3	43.10	6.2%	7.5	511.1
QMP:<1.2	0.02	0.0%	7.7	8.8
QMP:>3	60.50	8.7%	17.0	141.0
QMP:1.2-3	11.30	1.6%	41.9	105.9
SCHERRER:>3	19.10	2.7%	13.9	412.2
UNKNOWN:<1.2	0.09	0.0%	6.2	5.3
UNKNOWN:>3	5.60	0.8%	2.7	53.3
UNKNOWN:1.2-3	0.46	0.1%	4.8	10.5
Total	695	100%	7.4[1]	231.9[1]
Weighted NPR			31.3	

[1] Weighted value

8.5 SUPPLEMENTAL GEOCHEMICAL SAMPLING

The results of the material characterization presented in Piteau (2022c) and summarized above were all based on testing of the various rock types derived from the Rosemont deposit. The chemical behavior of the materials representing the rock types found in the Satellite pits were based on an equivalent lithology, AP and NP character, and ore body samples collected from the Rosemont deposit. Additional sampling of materials in the Satellite pits was conducted to provide guidance on how the updated test results may modify the source terms / chemical release functions (CRFs) used in the geochemical models presented in Piteau (2022c). The sampling and analysis of these additional Satellite pit samples are presented in the memorandum titled Supplemental Geochemical Samples for Copper World Project (Piteau, 2022d). HCTs are still in progress. As previously noted, this memorandum is provided in **Appendix G.2**.

The main focus of the supplemental geochemical characterization program was to collect samples for underrepresented rock units found in the Satellite pits and characterize their leachate chemistry and potential to generate ARD. A total of 32 samples were selected from split cores taken from exploration boreholes drilled in the Satellite pits. Samples were submitted for the following tests:

- Modified Sobek Acid-base Accounting (ABA)
- Non-acid Generating testing
- Whole Rock assay
- Meteoric Water Mobility Procedure (MWMP)
- Humidity Cell Test (on select samples)

The other emphasis of Piteau (2022d) was testing to determine the potential to leach pollutants from surface soils or vadose zone. The results of this testing are summarized in **Section 8.6**.

As noted, geochemical modeling (Piteau, 2022c) utilized chemical release functions (CRFs) to simulate the release of constituents from rock materials. Some geochemical units lacked samples to develop CRFs. Where this occurred, a proxy sample was selected from a geochemically similar unit or a conservative sample was used.

Although testing is not complete, results to date suggest that the mass loading rates for the Satellite pit samples will be lower than the proxy CRFs used for the majority of geochemical units in the Satellite pits as represented in Piteau (2022c). In summary, given the predominantly limestone / skarn nature of the deposits, and the continuity of rock materials between the open pits, the overarching geochemical nature of the Rosemont and Satellite pits pose a low risk of production of ARD.

8.6 POTENTIAL TO LEACH POLLUTANTS

The potential to leach pollutants from surface soils or the vadose zone as a result of seepage beneath Project facilities is estimated to be low. The results of laboratory MWMP analyses, conducted on composite soil samples from test pits at eight (8) locations in the TSF-1, TSF-2 and HLP areas, indicate mobilization of only a few dissolved metals above MCLs, and only for a subset of the samples. These results are present in the memorandum titled Supplemental Geochemical Samples for Copper World Project (Piteau, 2022c). This memorandum is provided in **Appendix G.2**.

Concentrations of aluminum (up to 12 mg/L), arsenic (up to 0.016 mg/L) and iron (up to 5.8 mg/L) were mobilized. The MWMP leachate samples also resulted in pH as low as 6.41 s.u. While these results do not exceed numeric AWQS, they do exceed primary MCLs (in the case of arsenic) or secondary MCLs (in the case of aluminum, iron and pH). However, the results represent a conservative analysis endpoint owing to the nature of the MWMP method and its application. The analytical method is conservative for two reasons:

- The method uses a full pore volume of lixiviant with 24 hours of agitation – conditions that will not be encountered during Project operations.
- The method generally represents higher mobilization of constituents associated with a first flush, and mobilization following the first flush is generally much lower.

8.7 WASTE ROCK HANDLING PLAN

A Waste Rock Handling Plan (Rosemont, 2022b) has been developed for the Copper World Project and is provided in **Appendix G.3**. This plan provides a general handling approach for waste rock materials characterized as non-acid generating (NAG), potentially acid generating (PAG), and acid-generating (AG). The Waste Rock Handling Plan also introduces the approach Rosemont intends to utilize during operations to categorize the waste rock materials. This approach utilizes calcium (Ca) and magnesium (Mg) to calculate the acid neutralizing potential (ANP) of the waste rock and sulfur to calculate the acid generating potential (AGP). Support documents have been prepared and are provided in **Appendix G.3** comparing this approach to using traditional ABA data. These supporting documents include:

- Evaluation of Whole Rock Correlation with ABA (Geochemical Solutions, 2017)
- Update: Evaluation of Whole Rock Correlation with ABA (Geochemical Solutions, 2022)

8.8 PRECIOUS METALS PROCESSING CIRCUIT

As described in **Section 4.0**, the Copper World Project processing facilities will include a concentrate leach circuit. Part of that circuit includes the recovery of precious metals. The precious metals recovery circuit will utilize weak acid dissociable (WAD) cyanide in the process. Following a cyanide destruction phase, the process results in a residue that will be mixed with the tailings stream from the sulfide ore milling process and sent to the TSFs. Based on the anticipated concentration of cyanide in the liquid portion of the residue, and the volume of the tailings stream, the concentration of cyanide in the tailings reporting to the TSFs will be less than 0.2 ppm, which is the AWQS for cyanide. Additional cyanide destruction will naturally occur at the TSFs based on exposure to ultraviolet (UV) rays from the sun. Monitoring of the process will occur to ensure cyanide concentrations reporting to the TSFs will not cause AWQS violations.

9.0 DISCHARGE CHARACTERIZATION

Under A.A.C. R18-9-A202(A)(4), the characterization of discharge is required and includes the discharge rate, volume, frequency, and location, as well as the chemical, biological, and physical characteristics of the discharge. The estimated discharge rates for the Copper World Project APP regulated facilities were also used, as appropriate, for the Best Available Demonstrated Control Technology (BADCT) demonstrations presented in **Section 10.0**.

This is a new facility that has not yet been constructed; therefore, no discharges have occurred and/or are documented. **Section 9.1** coves the potential rate of discharge estimated for the area-wide APP regulated facilities while **Section 9.2** covers the anticipated chemistry of the discharge.

9.1 DISCHARGE RATES

Depending on the facility type, discharge rates were calculated based on different DCTs associated with the facility type, such as liner systems. As appropriate, these analyses were used in **Section 10.0** as part of selecting the facility BADCT design. Selected designs were compared to prescriptive BADCT, were available. In other cases, such as for the open pits, the anticipated discharge from the facility was presented without comparison to other options.

9.1.1 Tailings Storage Facility

Three (3) alternative TSF configurations assessed for BADCT (**Section 10.0**) are summarized below. Details and illustrations of the alternatives are provided in the document titled APP Facilities Discharge Calculations and BADCT Evaluation (Wood, 2022j) in **Appendix H.1**. Alternative 2 is the selected approach.

Tailings slurry will be pumped to the top of the TSFs for deposition. Water in the slurry will either evaporate, be entrained in the tailings and seep to the bottom of the impoundment or be pumped back to the process circuit from the decant pool on the surface of the impoundment. The construction of the impoundment allows for seepage to be picked up in a seepage collection system and recycled back into the process circuit. A small portion is expected to bypass the system and infiltrate into the underlying soil or rock. Water that infiltrates into the underlying soil or rock has the potential to affect groundwater. The rate at which water percolates into the ground from a tailings facility depends on both the configuration of the facility and the hydrogeologic characteristics of the site.

Alternative 1 – Unlined

In Alternative 1, tailings are in direct contact with native material (soil and rock) below the footprint of the TSF. Soil is present across most of the footprint of both TSFs, which will be roller compacted after removal of vegetation during construction. Some rock would be exposed in incised drainage channels where the soil cover was naturally removed by erosion. In the exposed rock areas, vegetation is removed but no further improvements are anticipated during construction. Seepage from the tailings facility into the underlying materials is controlled by the hydraulic characteristics of the soil and rock immediately below the facility.

Alternative 2 – Unlined with Seepage Collection System

Alternative 2 assumes an unlined facility with a seepage collection system that collects water that reaches the bottom of the tailings facility. The seepage collection system consists of a network of perforated pipes placed directly on exposed soil and rock and a number of seepage collection trenches constructed along the downgradient side of the TSFs. With a finger drain configuration, the drainage pipes and associated gravel envelopes only cover a portion of the facility bottom. Native, compacted ground is present in the remainder of the area

For seepage calculation purposes, it was assumed the spacing and configuration of the seepage collection system will be at least 80 percent effective at collecting seepage. Seepage water is pumped from the seepage collection trenches to the Primary Setting Pond where it is recycled back into the process.

Alternative 3 – Geosynthetic Lined with Overliner Collection System

Alternative 3 would include a geomembrane placed on a prepared, compacted soil surface with an overliner drainage collection system. The liner is a low hydraulic conductivity element that restricts downward movement of water, hence reducing the amount of seepage out of the bottom of the facility. The drainage collection system located above the geomembrane removes tailings porewater and reduces the hydraulic head acting on the membrane.

9.1.1.1 TSF Water Budget

The amount of water that discharges from the bottom of a TSF is limited by the availability of water in the TSF and the hydrogeologic characteristics of the TSF (i.e., drainage and liner systems) and the soil and rock below it. This section addresses water availability. **Section 9.1.1.2** addresses hydrogeologic controls.

Water budget calculations for the entire Project, including the TSFs, are shown in the Site-Wide Water Balance Memorandum (Wood, 2022f) provided in **Appendix J**. The discharge calculations presented in Wood (2022j) were performed to support the water balance presented in Wood (2022f). However, the site-wide water balance assumed that the seepage collection system, including the seepage collection trenches, would remove approximately 98 percent of the seepage water reaching the bottom of a TSF. The 98 percent efficiency was based on preliminary modeling presented in the memorandum titled Rosemont Copper World Project – TSF 1 and 2 Seepage Analysis Memorandum (Wood, 2022h) presented in **Appendix H.2**. Final design of the seepage collection system will target 98 percent control. For comparative purposes, Wood (2022h) only assumed that the seepage collection system would be 80 percent effective. The 80 percent efficiency number was originally selected as a reasonable control target.

The amount of tailings pumped to the TSFs will vary throughout the operating life of the Project; therefore, the amount of water that could potentially discharge from the TSFs and affect the environment also varies over time. The potential discharge is highest in operating years 11 through 15 at TSF-1, and in year 15 at TSF-2. **Table 9.01** summarizes the maximum amount of water that could potentially discharge from TSFs 1 and 2 for Alternatives 1, 2 and 3. The potential discharge is less in Alternatives 2 and 3 than in Alternative 1 because the seepage collection and/or liner/overliner systems in Alternatives 2 and 3, respectively, remove water at the bottom of the facility before it can reach groundwater.

9.1.1.2 Discharge Calculation Approach

The discharge from the bottom of each alternative tailings facility configuration was calculated using a two-step process. First, the discharge controlled either by flow into soil and rock below the TSF (Alternatives 1 and 2), or by leakage through a geomembrane liner (Alternative 3), was calculated for each TSF. Second, that discharge was compared to the net inflow. See Wood (2022j) in **Appendix H.**1 for details.

Alternatives 1 (Unlined) and 2 (Unlined with Underdrain System)

The discharge from the bottom of an unlined TSF is controlled by the rate of flow through the soil and rock units that underlie the facilities, and the availability of water. Potential flow from the bottom of a facility controlled by the hydraulic properties of soil and rock beneath the facility was calculated using the Darcy Equation (Darcy):

$$Q = KiA$$

Where:

Q = discharge (with units of volume per unit time)

K = hydraulic conductivity (with units of length per unit time)

i = the vertical hydraulic gradient (unitless), which is dh/dz, where h is hydraulic head (length), z is elevation (length), and d/d is the differential operator

A = cross-sectional area through which flow occurs (with units of area).

The values for parameters are as follows.

Hydraulic conductivity (K)

In Alternative 1, soil and rock units with different values of hydraulic conductivity outcrop in the footprint of the TSFs. The Darcy flow is calculated for each soil or rock unit using the hydraulic conductivity and the plan view area of that unit. The Darcy flow for the entire TSF is the sum of the calculated flows for each soil or rock unit. Table A2-1 in Attachment 2 of Wood (2022h) provides the hydraulic conductivity and areal extent of each soil and rock unit exposed at the bottom of TSFs 1 and 2, respectively. Representative hydraulic conductivity values for the unconsolidated Basin Fill and Recent Alluvium were selected based on experience with similar materials at other sites.

In Alternative 2, the underdrain system that covers part of the TSF footprint has much higher conductivity than the underlying soil and rock units and hence does not impede downward movement of water. The Darcy flow from the bottom of the TSFs is controlled by the hydraulic conductivity of the native soil and rock units, and thus the Darcy flow in Alternative 2 is the same as in Alternative 1.

Hydraulic Gradient. (i)

In Alternatives 1 and 2, the vertical hydraulic gradient is assumed to be 1. This is appropriate for downward flow in partially saturated material below a TSF in which the water content profile is at a steady-state condition. This condition is expected to exist in the vadose zone between the bottom of a TSF and the water table of the underlying aquifer.

Area (A)

The area of each soil or rock unit present below TSFs 1 and 2 is used to calculate the Darcy discharge through each unit. The sum of the discharge through each unit below TSF-1 or 2 is the Darcy discharge for the entire TSF. The TSF area used in this evaluation is the footprint bounded by the toe of the upstream (interior) perimeter embankment slope.

Alternative 3 (Underdrain and Geomembrane Liner on Prepared Compacted Soil Base)

The discharge from the bottom of a TSF with a geomembrane liner above the underlying soil and rock is controlled by the rate at which water leaks through the geomembrane into the underlying material. The leakage rate depends on the size and frequency of defects in the geomembrane, the thickness and hydraulic conductivity of the material immediately below the geomembrane, how well the geomembrane contacts the underlying material, and the hydraulic head above the membrane. In accordance with guidance provided in U.S. Environmental Protection Act (US EPA) (1989) and U.S. EPA (1992), a 1 cm^2 defect per 4,000 m^2 of geomembrane area is assumed.

The soil and rock units below the TSFs are much thicker (tens of feet) than the expected hydraulic head (feet) above the geomembrane. Therefore, empirical equations for a geomembrane overlying a thick low-conductivity soil underliner were used. The hydraulic conductivity and area of each of the soil and rock units present below the TSFs (**Appendix H.1**) were used to calculate leakage through defects in the membrane above each unit.

Good contact between the geomembrane and underlying material is assumed. The hydraulic head above the membrane is assumed to be one (1) foot. Low hydraulic conductivity tailings slimes retard movement of water downward to the bottom of a TSF, and concurrently result in loss of hydraulic head, justifying the assumption of relatively low head above the geomembrane.

Based on the assumed conditions, Equation 7 from Giroud et al. (1994) can be used to estimate leakage through a geomembrane at the bottom of the TSFs. This equation is summarized as:

$$Q = c\ a^{0.1}\ h^{0.9}\ K^{0.74}$$

Where:

Q = the leakage rate (m^3/s) per 4,000 m^2 (based on the assumption of one defect per 4,000 m^2 per U.S. EPA guidance)

c = a coefficient that accounts for ‘good’ (0.21) or ‘poor’ (1.15) contact between the geomembrane and the underlying material (unitless). Good contact is assumed. C=0.21

a = the size of the assumed defect (m^2). A 1 cm2 = $1x10^{-4}$ m^2 defect is assumed.

h = hydraulic head above the membrane (m). The head above the membrane is assumed to be 0.3 m, equal to approximately one (1) foot.

K = the hydraulic conductivity of the material immediately below the geomembrane (m/s). See Table A2-1 in Attachment 2 of Wood (2022j) in **Appendix H.1**.

The leakage rate was calculated for each geologic unit, and its hydraulic conductivity value, that outcrops in the TSF footprint. The leakage through the entire outcrop area for a unit was calculated by multiplying the leakage rate per 4,000 m^2 by (outcrop area / 4,000 m^2). The leakage rate for the entire TSF footprint is the sum of the leakage for each unit that outcrops in the footprint. As in the Darcy flux approach used in Alternatives 1 and 2, the TSF area used in this evaluation is the footprint bounded by the toe of the upstream (interior) perimeter embankment slope.

9.1.1.3 TSF Discharge Results

The Darcy discharge and membrane leakage rate calculations described herein assume that water is readily available, i.e., that the flow through the TSF footprint is not limited by the net inflow into the TSF. As discussed in **Section 9.1.1.1**, the water available in a TSF is limited. The maximum discharge from a TSF is the smaller of the net inflow (**Table 9.01**) and the calculated Darcy discharge (Alternatives 1 and 2), or the smaller of the net inflow and leakage (Alternative 3). These values are compared in **Table 9.01** and in **Appendix H.1**. Limited water availability controls discharge from the TSFs in Alternatives 1 and 2, but not in Alternative 3.

The finger underdrain in Alternative 2, and the overliner drainage system in Alternative 3, are both assumed here to remove 80 percent of the available seepage at the bottom of the TSF. The liner in Alternative 3 further restricts discharge from the TSFs and the actual discharge differs between Alternative 2 and 3.

Table 9.01: Discharge from TSF-1 and TSF-2 Constrained by Water Availability

Facility	Alternative	Maximum Potential Discharge[2] (gal/min)	Darcy Discharge with Unlimited Water Availability[3] (gal/min)	Membrane Leakage with Unlimited Water Availability[4] (gal/min)	Discharge from Facility[5] (gal/min)	Discharge from Facility[5] (gal/day)
TSF-1	1 – Unlined, no underdrain	759	3,914,009	—	759	1,092,672
	2 - Unlined, finger underdrain	152	3,914,009	—	152	218,534
	3- Geomembrane liner on compacted subgrade and overliner drain	152	—	0.32	0.32	465
TSF-2	1 – Unlined, no underdrain	377	1,406,837	—	377	542,880
	2 - Unlined, finger underdrain	75	1,406,837	—	75	108,576
	3- Geomembrane on compacted subgrade and overliner drain	75	—	0.11	0.11	154

Notes
1. Discharge refers to draindown water that percolates into materials below a TSF and has the potential to leach into groundwater.
2. See Table 3-1 in Wood (2022j), **Appendix H.1**.
3. Alternatives 1 and 2. Tables A2-1 and A2-2 in **Appendix H.1**.
4. Alternative 3. Table A2-3 and A2-4 in **Appendix H.1**.
5. The smaller of maximum potential discharge and discharge or leakage with unlimited water availability.

The calculated discharge rates in **Table 9.01** are likely larger than what the actual discharge rates will be for the following reasons:

- The net discharge to the TSFs will be smaller than the amount assumed. Some water will be decanted and returned to the process water circuit, as opposed to the assumption that no water will be decanted.
- Tailings slimes will be deposited at the bottom of the TSFs and create a layer that has much lower hydraulic conductivity than the alluvium and basin fill materials that outcrop in the TSF footprints. Reducing the hydraulic conductivity of the material at the bottom of the TSFs will reduce the Darcy discharge proportionally.
- The tailings facilities will be constructed in stages. Water can discharge into the subsurface only below the portion of a TSF that has been constructed and is in service. The values shown in **Table 9.01** assume the entire footprint of a TSF is in service and therefore overestimates the actual discharge.

9.1.1.4 Comparison to Seepage Modeling Results

A separate evaluation of the discharge rate from TSFs 1 and 2 is presented in Rosemont Copper World Project – TSF 1 and 2 Seepage Analysis Memorandum (Wood, 2022h) and provided in **Appendix H.2**. The evaluations presented in **Section 9.1.1.2** and in Wood (2022j) are not directly comparable for the following reasons.

1. The evaluations had different objectives. The objective of the BADCT evaluation presented in Wood (2022j) and in **Section 9.1.1.2** above was to determine the effect of the various TSF bottom configurations (e.g., underdrain, liner) on discharge from the TSF into the underlying material. The objective of the tailings seepage analysis (Wood, 2022h) was to quantify the discharge from a single TSF configuration having a seepage collection system and associated trenches.

2. The evaluations focused on different parts of the flow system. The evaluation summarized in **Section 9.1.1.3** and presented in **Appendix H.1** focused on quantifying the flowrate from a TSF with multiple bottom configurations but did not consider movement of water after it discharged out of a TSF.

   The tailings seepage analysis (Wood, 2022h) evaluated a single TSF configuration and considered flow in the soil and rock units below the TSF. The focus of the analysis was on 1) quantifying the flowrate of water removed by the seepage collection system and associated trenches that intercept water in alluvial soil below the TSFs and 2) quantifying the flowrate of the remaining water into rock units below the alluvial soil. The water that flows into the rock units may potentially affect groundwater.

3. Different calculation approaches were used between Wood (2022h) and Wood (2022j). The evaluation in Wood (2022j) calculated flowrates using empirical solutions appropriate for a given TSF bottom configuration. The seepage analysis (Wood, 2022h) used a two-dimensional computer model to simulate flow and quantify flowrates at various locations in the materials in and below the TSF.

The Seepage Analysis Memorandum (Wood, 2022h) reflects a 98% capture of the seepage from the tailings facility via the seepage collection system and associated seepage collection trenches located at the outer perimeter of the tailings facilities. The 98% capture was used in the BADCT analysis in **Section 10.0** and in the site-wide water balance in **Section 11.0**. This reflects the selected alternative, Alternative 2.

9.1.2 Heap Leach Pad (HLP)

Run-of-mine (ROM) and crushed / agglomerated oxide ore will be placed on the HLP. A mild sulfuric acid leaching solution will be distributed over the ore to leach copper. The solution percolates through the ore, reacts with the ore, and generates a copper-bearing PLS. The PLS accumulates at the base of the lined leach pad where it flows laterally to a central collection system that reports to the PLS Pond. Copper is extracted from the PLS solution in a SX-EW process, leaving a barren raffinate solution which is stored in the Raffinate Pond. The raffinate solution is amended with acid and fresh make-up water and then reused in the leaching process on the HLP.

Although the HLP is a lined facility, liners have the potential to leak due to defects, etc., and therefore have the potential to affect groundwater. The rate at which liquid discharges from the bottom of the HLP and the ability to reach groundwater depends on both the configuration of the facility and the hydrogeologic characteristics of the site. The Potential Leakage Rate (PLR), or potential discharge from the bottom of the HLP, was estimated for two (2) alternative liner configurations. The two (2) HLP liner configurations. The results were used in the BADCT analysis in **Section 10.0**.

Alternative 1 - Geomembrane Lined with Low Permeability Soil

Alternative 1 consists of an 60-mil HDPE liner installed above a prepared and compacted one (1) foot thick low permeability soil base. An overliner solution drainage collection system is constructed above the geomembrane to collect and pipe the PLS to the PLS Pond. The drainage system reduces the hydraulic head on the HLP liner. The liner system is a low hydraulic conductivity element that restricts downward movement of the PLS; hence, reducing the potential for solution discharge from the bottom of the facility.

Alternative 2 – Geomembrane Lined with GCL

Alternative 2 assumed a 80-mil double-side textured LLDPE liner installed over a geosynthetic clay liner (GCL). The GCL is installed on a prepared subgrade. The overliner drainage system would be the same for Alternative 1.

9.1.2.1 Heap Leach Facility Water Budget

The HLP is expected to be used during operating years 1 through 9, and then closed. During the operating period, acidic leaching solution is applied at a rate of 3,000 gallons per minute. The evaporative loss is 45 gpm. The remaining 2,955 gpm of PLS is recovered at the bottom of the heap leach ore pile in the overliner drainage system and piped to the PLS Pond.

9.1.2.2 Heap Leach Facility Discharge Calculation Approach

The discharge from the HLP was estimated using a membrane leakage approach, i.e., Equation 9 of Giroud et al. (1994) for both Alternatives 1 and 2. The estimated discharge values were compared to the HLP net inflow. The discharge from the bottom of the HLP was assumed to be the smaller of the two numbers.

As described in **Section 9.1.1.2**, the rate at which water leaks through a geomembrane liner is controlled largely by the size and frequency of defects such as failed seams, tears, or holes, the hydraulic conductivity of the material immediately below the membrane, how well the membrane contacts the underlying material, and the hydraulic head above the membrane. The approach for calculating the leakage rate through defects in the geomembrane was described previously.

The prescriptive BADCT specifies that the maximum and average hydraulic head over the liner of the Heap Leach Pad (HLP) to be less than 5 and 2 feet, respectively (ADEQ, 2004). Therefore, the HLP calculations used a hydraulic head of 2 feet. The total lined surface area (LSA) of the HLP was estimated to be approximately 336 acres.

The following assumptions were utilized for calculating the discharge from the HLP.

- Alternatives have a one-foot prepared and compacted soil base. In Alternative 1, the subgrade is compacted to achieve hydraulic conductivity of 10^{-6} cm/s or less as required by BADCT (low permeability soil). In Alternative 2, the soil is compacted sufficiently to provide a suitable base for a geomembrane and GCL, but not to meet a hydraulic conductivity criterion.
- Constant head of two (2) feet over the geomembrane due to leaching solution application and accumulation of PLS at the base of the stacked ore, and removal of PLS by an overliner drainage system, as prescribed in the BADCT Guidance Manual (ADEQ, 2004).
- The geomembrane liner has a one (1) square centimeter (cm^2) defect per 4,000 square meters (m^2) of lined area per EPA guidance (U.S. EPA, 1989: 1992).
- Contact between geomembrane liner or GCL and the soil base is ‘good’. Good contact assumes that there are minimal wrinkles in the geomembrane while being installed and/or the liner is placed on compacted and stable soil base that has been well compacted and appears smooth.

Alternative 1 – Geomembrane Lined with Low Permeability Soil

The discharge from the bottom of an HLP with a geomembrane liner above the underlying soil and rock is controlled by the rate at which water leaks thorough the geomembrane into the underlying material.

The leakage through the geomembrane liner was calculated using Equation 9 of Giroud et al. (1994). The hydraulic conductivity of the material below the geomembrane is assumed to be 10^{-6} cm/s, consistent with BADCT requirements for a low-permeability, compacted subgrade. A two (2) foot hydraulic head above the geomembrane was used in calculations, in accordance with BADCT guidance for the average depth of ponded water at the bottom of a HLP.

Alternative 2 - Geomembrane Lined with GCL

As in Alternative 1, discharge from the bottom of an HLP with a geomembrane – GCL composite liner is controlled by the rate at which water leaks thorough the geomembrane into the underlying GCL. The approach described for HLP Alternative 1 was modified slightly to account for the difference in the material immediately below the geomembrane: a thick soil underliner in Alternative 1 versus a thin GCL in Alternative 2. A GCL is thin – typically ¼ inch – relative to the depth of ponded water above the liner – typically feet. For this situation, Equation 9 from Giroud et al. (1994) was also used to estimate leakage through a composite geomembrane-GCL liner:

$$Q = c\ i_{avg}\ a^{0.1}\ h^{0.9}\ K^{0.74}$$

where i_{avg} is a dimensionless coefficient, whose value depends on the ratio of head (h) above the geomembrane to the thickness (D) of the low hydraulic conductivity element below the membrane. The relationship between i_{avg} and h/D is provided in Figure 1 of Giroud et al. (1994). For this case, h=0.6 m (2 feet), D=0.006 m (¼ inch), and $h/D = 10^2$. The corresponding value of i_{avg} is 8. The other terms were defined previously in **Section 9.1**.

9.1.2.3 HLP Discharge Results

Detailed calculations of the rate of leakage through the HLP membrane liner (Alternatives 1 and 2) are provided in Tables A3-1 and A3-2 found in Wood (2022j) and provided in **Appendix H.1**.

The membrane leakage rates calculated in Wood (2022j) Tables A2-6 and A2-7 assume that water is readily available, i.e., that the flow through the bottom of the HLP footprint is not limited by the net inflow into the heap. However, the net inflow into the heap is greater than the membrane leakage rates. Therefore, discharge from the heap is controlled by the membrane leakage rates in Alternatives 1 and 2. The net inflow and calculated discharge or leakage rates for the HLP are summarized in **Table 9.02**. The leakage rate for the BADCT design (Alternative 1) is greater that for the design with a GCL (Alternative 2). Using a GCL instead of a compacted low permeability subgrade reduces the leakage rate by approximately 84 percent.

Table 9.02: Potential Leakage from the HLP for Two Alternative Liner Configurations

Facility	Alternative	Maximum Potential Discharge (gal/min)	Membrane Leakage with Unlimited Water Availability (gal/min)	Discharge from Facility (gal/min)	Discharge from Facility (gal/day)
HLP	1- Geomembrane liner on thick low permeability soil	2,956	0.34	0.34	492
	2 - Geomembrane liner on thin GCL underliner on prepared subgrade	2,956	0.05	0.05	78

The calculated discharge values in **Table 9.02** are likely greater than what the actual discharge rates will be. This is primarily because the HLP will be constructed in stages. PLS could discharge into the subsurface only below the portion of the HLP that is in service. The values in **Table 9.02** assume the entire footprint of the HLP is in service and therefore overestimate the actual discharge.

9.1.3 Lined Ponds

This section provides the potential leakage rate (PLR) from the double-lined process solution ponds and from single-lined non-stormwater ponds

9.1.3.1 Process Solution Ponds

The process solution ponds for the Copper World Project include the following:

- Primary Settling Pond
- Pregnant Leach Solution Pond
- Raffinate Pond
- Reclaim Pond

9.1.3.1.1 Design Description

The prescriptive BADCT design for process ponds incorporates a geomembrane double-liner and a leak collection and removal system (LCRS). The composite liner has a primary (upper) and secondary (lower) geomembrane. A geonet between the two membranes is part of the LCRS that allows liquid between the liners to flow to a collection sump. Liquid in the collection sump can then be removed. This design minimizes the head on the secondary liner by maintaining a freely drained condition between the primary and secondary liner, with a hydraulic head of ¼-inch (the thickness of the geonet) over the pond area. The primary liner is underlain by the geonet which is part of the LCRS system. The secondary liner is under the geonet. The secondary liner is underlain by a GCL placed on a prepared soil subgrade. Components of the composite liner system are assumed in good contact with each other and the underlying material.

Two alternative configurations were evaluated.

Alternative 1 is the prescriptive BADCT design. The liner system for all process solution ponds incorporates dual-liners with a leak collection and removal system (LCRS). The composite liner has a primary (upper) and secondary (lower) geomembrane. Both membranes are ultraviolet (UV) light resistant, 60-mil HDPE material. Solution that leaks through the primary liner is drained to an LCRS collection sump via the geonet. This design minimizes the head on the secondary liner by maintaining a freely drained condition between the primary and secondary liner. The 60-mil secondary geomembrane is underlain by a compacted, low permeability subgrade. All components of the composite liner system are assumed in good contact with each other and the underlying material.

Alternative 2 increases the thickness of the primary and secondary HDPE geomembranes to 80 mils. The compacted low permeability subgrade below the secondary geomembrane used in Alternative 1 is replaced with a GCL over a prepared subgrade. All components of the composite liner system are in good contact with each other and the underlying material

9.1.3.1.2 Discharge Calculation Approach

Discharge from a pond with a membrane liner system is equal to the rate of leakage through the liner, which is controlled by the hydraulic head above the liner, the size and frequency of defects (e.g., holes, imperfect seams, tears) in the liner, the hydraulic conductivity of the material immediately below the membrane, and the quality of the contact between the membrane and the underlying material. In a dual-membrane liner system, with a LCRS between the primary and secondary membranes, only leakage through the secondary (lower) membrane reports to the environment. Leakage through the primary (upper) membrane is removed by the LCRS.

The membrane leakage approach described by Giroud et al. (1994) is used here to estimate leakage through a membrane liner. The applicable equation (Equation 9) is:

$$Q = c i_{avg}\ a^{0.1}\ h^{0.9}\ K^{0.74}$$

Where:

Q = discharge through liner (m3/s) per 4000 m2 of membrane

c = contact constant (1.15 for “poor” and 0.21 for “good” conditions)

i_{avg} = a dimensionless coefficient determined from Figure 1 in Giroud et al. (1994)

a = area of defect (m2)

h = head on liner (m)

K = hydraulic conductivity of underliner (m/s)

The rate at which water leaks through defects in the primary geomembrane does not control the discharge rate from the bottom of a pond into the environment. Only leakage through defects in the secondary geomembrane results in discharge from the pond bottom. Hence, the size and frequency of defects in the secondary geomembrane, the hydraulic head above the secondary geomembrane, the hydraulic conductivity of the material below the secondary geomembrane, and the contact condition between the geomembrane and the underlying material, control the rate of leakage through the composite liner system and out the pond bottom. The geonet drains freely and maintains hydraulic head above the secondary geomembrane equal to the thickness of the geonet, ¼ inch = 0.006 m.

EPA guidance suggests assuming one, one (1) cm^2 membrane defect per 4,000 m^2, which is approximately one (1) defect per acre (1 acre = 4,047 m^2). The leakage rate for an entire facility is proportional to the facility area divided by 4,000 m^2.

9.1.3.1.3 Discharge Calculation Results

Calculations of potential leakage from process solution ponds with Alternative 1 and 2 liner configurations, with a 1 cm^2 defect per 4,000 m^2, are provided in **Table 9.03**. For all process solution ponds associated with the Project, the leakage rate for the BADCT design (Alternative 1) is greater than for the design with a GCL (Alternative 2). Using a GCL instead of a compacted subgrade reduces the leakage rate by approximately 98 percent. These results were used in the BADCT analysis in **Section 10.0** for process solution ponds.

Table 9.03: Discharge from Bottom of the Process Solution Ponds with Two Alternative Liner Configurations

Pond	Alternative[1,2]	Area[3]		Hydraulic Conductivity of Underliner[4] K	Leakage per 4,000 m^2 Q_{4000}	Leakage Through Pond Area Q_{pond}		
		acres	m^2	m/s	m^3/s	m^3/s	gal/ day	gal/ year
Primary Settling Pond	1	5.1	20,450	1.0E-8	1.0E-9	5.1E-09	0.12	43
	2			5.0 E-11	2.0 E-11	1.0 E-10	0.0023	0.85
Pregnant Leach Solution Pond	1	3.2	12,960	1.0E-8	3.3E-09	3.3E-09	0.074	27
	2			5.0 E-11	2.0 E-11	6.5E-11	0.0015	0.54
Raffinate Pond	1	1.5	6,079	1.0E-8	1.0E-09	1.5E-09	0.035	13
	2			5.0 E-11	2.0 E-11	3.0E-11	0.0007	0.25
Reclaim Pond	1	1.5	5,992	1.0E-8	1.5E-09	1.5E-09	0.034	13
	2			5.0 E-11	2.0 E-11	3.0E-11	0.0007	0.25

Notes
1. Alternative 1: dual geomembrane and geonet LCRS liner system on compacted, low permeability subgrade.
2. Alternative 2: dual geomembrane and geonet LCRS liner system on GCL and prepared subgrade
3. Area within the crest of the interior slope of perimeter embankment
4. Alternative 1: Low permeability subgrade. Alternative 2: GCL

9.1.3.2 Non-Stormwater Water Ponds

The non-stormwater ponds planned for the Copper World Project include the following:

- Process Area Stormwater Pond
- HLP North Stormwater Pond
- HLP South Stormwater Pond

9.1.3.2.1 Design Descriptions

The non-stormwater ponds are used to manage contact stormwater runoff from the process area and heap leach facility. The water in these ponds is expected to have much lower solute concentrations than the liquids managed in process solution ponds. Additionally, the ponds are expected to contain water only occasionally and for short durations. These differences are the basis for using a different liner system for the stormwater ponds.

Two alternative liner designs were evaluated.

- Alternative 1 is the prescriptive BADCT design liner system for non-stormwater ponds. It consists of a single 60-mil HDPE geomembrane liner in direct contact with a compacted subgrade.

- Alternative 2 consists of a single 80-mil HDPE geomembrane, a GCL underliner, and a prepared subgrade.

9.1.3.2.2 Discharge Calculation Approach

The discharge from the bottom of non-stormwater ponds was calculated using a membrane leakage approach using Equation 9 of Giroud et al. (1994). Each stormwater pond is constructed with a single geomembrane on a prepared, prepared soil base or GCL. Leakage through the liner system is controlled by the rate at which water leaks through the geomembrane system into the underlying soil.

The material immediately underlying the geomembrane restricts flow resulting from defects in the membrane. The hydraulic head acting on the geomembrane of the stormwater pond liner was assumed to be the maximum pond depth, which is much larger than that acting on the secondary liner of the process water pond.

As with the process water ponds, the applicable equation is shown below with parameters previously identified in **Section 9.4.1.2**.

$$Q=ci_{avg}\ a^{0.1}\ h^{0.9}\ K^{0.74}$$

EPA guidance suggests assuming one, 1 cm^2 membrane defect per 4,000 $m^{2,}$ which is approximately one defect per acre (1 acre = 4,047 m^2). The leakage rate for an entire facility is proportional to the facility area divided by 4,000 m^2.

9.1.3.2.3 Discharge Calculation Results

Calculations of the potential leakage from the stormwater ponds with Alternative 1 and 2 liner configurations and a 1 cm^2 defect per 4,000 m^2 are summarized in **Table 9.04**. For the stormwater ponds, the leakage rate for the BADCT design (Alternative 1) is greater than for the design with a GCL (Alternative 2). Using a GCL instead of a prepared subgrade reduces the leakage rate by approximately 75 percent.

9.04: Discharge from Bottom of Stormwater Ponds with Two Alternative Liner Systems

Pond	Alternative [1,2]	Area[3]		Hydraulic Conductivity of Underliner[4] K	Leakage per 4,000 m^2 Q_{4000}	Leakage Through Pond Area Q_{pond}		
		acres	m^2	m/s	m^3/s	m^3/s	gal/day	gal/year
Process Area Stormwater Pond	1	1.5	6,044	1.0 E-8	2.2E-06	3.4E-06	77	28,100
	2			5.0E-11	5.5E-07	8.3E-07	19	7,000
HLF North Stormwater Pond	1	3.0	12,319	1.0 E-8	2.2E-06	6.9E-06	157	57,200
	2			5.0E-11	5.5E-07	1.7E-06	39	14,200
HLF South Stormwater Pond	1	3.0	12,319	1.0 E-8	2.2E-06	6.9E-06	157	57,200
	2			5.0E-11	5.5E-07	1.7E-06	39	14,200

Notes
1. Alternative 1: single geomembrane liner on prepared, compacted subgrade.
2. Alternative 2: single geomembrane liner on GCL and prepared subgrade.
3. Area within the crest of the interior slope of perimeter embankment.
4. Alternative 1: Prepared, compacted subgrade. Alternative 2: GCL.

9.1.4 Waste Rock Facility

Seepage from the WRF is anticipated to be limited due to the physical characteristics of the materials placed within the facility, the unsaturated nature of the materials, and the high evaporation rate of the area. Stormwater will also be routed off the facility into natural drainages downgradient of the facility, thus limiting the source of infiltration. See **Section 7.4.6** of this Application Document and Section 4.3.6 in Piteau (2022a) in **Appendix F.1**.

9.1.5 Open Pits

9.1.5.1 Peach Pit

As discussed in **Section 7.5.2.3**, the groundwater model predicts the Peach Pit has the potential for very minor outward flow which is likely unmeasurable in the field, i.e., the magnitude of these flows are lower than the resolution capabilities of the model. The source of this water is pit wall runoff and direct precipitation which exceeds evaporation due to the small surface area of the pit lake. Water levels and flows also reflect a complex interplay of local processes and drawdown from the Rosemont Pit.

9.1.5.2 Elgin Pit

As discussed in **Section 7.5.2.3**, the groundwater model predicts the Elgin Pit has the potential for very minor outward flow which is likely unmeasurable in the field, i.e., the magnitude of these flows are lower than the resolution capabilities of the model. The source of this water is pit wall runoff and direct precipitation which exceeds evaporation due to the small surface area of the pit lake. Water levels and flows also reflect a complex interplay of local processes and drawdown from the Rosemont Pit.

9.1.5.3 Heavy Weight Pit.

As discussed in **Section 7.5.2.4**, during the initial Heavy Weight Pit filling the net flow is from the surrounding bedrock into the backfill, and the pit does not discharge. By 200 years post-mining, the net outflow is approximately zero, reflecting near equilibrium conditions. The flows are very small, well within the resolution capabilities of the model and are likely unmeasurable in the field.

9.1.5.4 Copper World Pit

As discussed in **Section 7.5.2.4**, initially, the net flows within the bedrock of the north lobe of the Copper World Pit are directed inwards towards the backfill, and the pit lobe does not discharge. Around model year 40, the flows are directed from the backfill into the bedrock. The magnitude of these flows are lower than the resolution capabilities of the model and are likely unmeasurable in the field.

In contrast with the north lobe of Copper World Pit, the net flows at the south lobe are always discharging from the backfill into the surrounding bedrock. The discharge rate increases over time but the rate of discharge decreases but the rate of change decreases. The magnitude of these flows are lower than the resolution capabilities of the model and are likely unmeasurable in the field.

9.1.5.5 Broadtop Butte Pit

As discussed in **Section 7.5.2.4**, the net flows at the Broadtop Butte Pit are always discharging from the backfill into the surrounding bedrock. The net outward flow rate increases over time but the rate of change decreases. The magnitude of these flows are lower than the resolution capabilities of the model and are likely unmeasurable in the field.

9.1.5.6 Rosemont Pit

As discussed in **Section 7.5.2.3**, the Rosemont Pit is always a terminal lake and does not discharge. Net bedrock flows are always into the lake. Compared to the surface water processes, bedrock flow is the dominate process for filling the lake.

9.1.6 Other APP Regulated Facility Discharge Rates

9.1.6.1 Temporary ROM Stockpile (TRS)

The Temporary ROM Stockpile (TRS) is not anticipated to generate substantial discharge or discharge chemistry impacts. As discussed in **Section 8.0,** ore and waste rock materials are largely neutralizing. Due to the temporary nature of the facilities, unsaturated conditions of the materials, and relatively slow geochemical kinetics, significant metals are not anticipated to be generated or mobilized. Management of stormwater includes directing stormwater to local sumps and then pumping to the process circuit or routing stormwater via diversion channels to the Process Plant Stormwater Pond.

9.1.6.2 Coarse Ore Stockpile (COS)

The Coarse Ore Stockpiles are not anticipated to generate substantial discharge or discharge chemistry impacts. As discussed in **Section 8.0** ore and waste rock materials are largely neutralizing. Due to the temporary nature of the facilities, unsaturated conditions of the materials, and relatively slow geochemical kinetics, significant metals are not anticipated to be generated or mobilized. Management of stormwater around the COS includes directing stormwater to local sumps and then pumping to the process circuit or routing stormwater via diversion channels to the Process Plant Stormwater Pond. Additionally, sumps are located in the reclaim tunnels beneath the stockpiles. Stormwater that infiltrates through the stockpile and reaches the sumps will be pumped into the process circuit.

9.1.6.3 SW Energy Vehicle and Equipment Wash (SWE-V&E-W) Pond

The SW Energy Facility is not anticipated to generate substantial discharge or discharge chemistry impacts. The facility will have a small evaporation pond associated with the wash pad for the Prill Trucks, etc. Based on a previous design for the Rosemont Copper Project, the evaporation pond was six (6) feet deep with two (2) feet of freeboard. At a four (4) foot depth of water in the pond, the LSA was about 0.059 acres. Assuming this depth was maintained in the pond, the PLR would be less than one (1) gallon per day. The solution chemistry is anticipated to reflect that of the tailings seepage water.

The pond liner consisted of the following, the equivalent of which is anticipated for this same facility type for the Copper World Project:

- 60-mil HDPE liner;
- GCL; and
- Prepared subgrade (a minimum of 6-inches).

9.1.6.4 Sewage Treatment Systems

The size of the sewage treatment facilities (septic leach fields) described in has not been designed. However, the sewage treatment system for the Rosemont Copper Project was estimated to be 4,850 gpd for eight (8) leach fields, with individual systems ranging from 125 gpd to 1,500 gpd. None of the individual systems would be more that 3,000 gpd.

9.1.6.5 Large Truck Tire Disposal Areas

The placement of large mining truck tires in cells within WRF is not anticipated to generate additional discharge.

9.1.7 Conclusions

The alternatives evaluated for the TSFs included:

- Alternative 1 – no liner or seepage collection system
- Alternative 2 – seepage collection system (with seepage collection trenches)
- Alternative 3 – geomembrane liner system

Alternative 2 was assumed to be designed to achieve at least an 80% reduction in seepage from the unlined scenario. The lined scenario, Alternative 3, reduced the discharge by over 99% from the base case with no collection system or liner. As presented in Wood (2022h), additional analysis was performed for Scenario 2 using a two-dimensional computer model. Modeling results showed up to 98 percent capture of the seepage.

For the HLP, using a geomembrane and GCL over a prepared subgrade reduces the leakage rate by approximately 84 percent relative to the BADCT design with a geomembrane over a low permeability, compacted subgrade.

For the process solution ponds, using a dual geomembrane liner with a geonet LCRS and a GCL above a prepared subgrade reduces the leakage rate by approximately 98 percent relative to the BADCT design with a geomembrane and LCRS system above a low permeability, compacted subgrade.

For the stormwater ponds, using a single geomembrane liner and a GCL above a prepared subgrade reduces the leakage rate by approximately 75 percent relative to the BADCT design with a geomembrane liner above a prepared, compacted subgrade.

Three (3) of the six (6) open pits will be backfilled: Heavy Weight, Copper World, and Broadtop Butte. Upon recovery of the water table, the potential exists for the backfilled pits to discharge. However, the magnitude of these flows are lower than the resolution capabilities of the model and are likely unmeasurable in the field.

Two (2) of the pits located on the west side of the Santa Rita Mountains, Peach and Elgin, will not be backfilled. Upon recovery of the water table, the potential exists for outward flow from the pits. However, the flows are very small and likely unmeasurable in the field, i.e., the magnitude of these flows are lower than the resolution capabilities of the model.

Although included in the discussion, the Rosemont Pit is always a strong terminal sink and therefore does not discharge.

9.2 DISCHARGE CHEMISTRY

The following sections provide the anticipated chemistry of the solutions associated with the respective facilities.

9.2.1 Tailings Facilities

A composite chemical release function (CRF) was developed for the TSFs by multiplying the Week 0 (first flush) leachates of each Geochemical Unit by its relative abundance (**Table 9.05**). The composite leachate was then geochemically equilibrated with the atmosphere and mineral phases. No scaling factor was applied to TSF leachate because the samples represented milled materials. Final seepage chemistry is provided in **Table 9.05**. Details are provided in **Appendix G.1** (Piteau, 2022c).

Table 9.05: TSF Composite Seepage Chemistry

Parameter	Units	EPA MCL	AWQS	Composite Seepage Chemistry	Final Tailings Seepage Chemistry
pH	s.u.	6.5-8.5	-----	6.99	7.06
Alkalinity, Total	mg/L	-----	-----	47	47
Aluminum	mg/L	0.2	-----	0.01	0.00
Antimony	mg/L	0.006	0.006	0.002	0.002
Arsenic	mg/L	0.01	0.05	0.004	0.003
Barium	mg/L	2.0	2.0	0.02	0.02
Beryllium	mg/l	0.004	0.004	0.000	0.000
Boron	mg/l	-----	-----	0.000	0.000
Cadmium	mg/L	0.005	0.005	0.000	0.000
Calcium	mg/L	-	-----	281	281
Chloride	mg/L	250	-----	6	6
Chromium	mg/L	0.10	0.10	0.00	0.00
Copper	mg/L	1.00	-----	0.007	0.006
Fluoride	mg/L	4.00	4.00	1.20	1.20
Iron	mg/L	0.3	-----	0.03	0.00
Lead	mg/L	0.015	0.05	0.001	0.000
Magnesium	mg/L	-----	-----	28	28
Manganese	mg/L	0.05	-----	0.03	0.00
Mercury	mg/L	0.002	0.002	0.000	0.0000
Molybdenum	mg/L	-----	-----	0.06	0.06
Nickel	mg/L	-----	0.1	0.00	0.00
Nitrogen, Total as N	mg/L	10.0	10.0	0.00	0.00
Potassium	mg/L	-----	-----	13.6	13.6
Selenium	mg/L	0.05	0.05	0.026	0.026
Silver	mg/L	0.10	-----	0.000	0.000
Sodium	mg/L	-----		27	27
Sulfate	mg/L	250	-----	808	808
Thallium	mg/L	0.002	0.002	0.0000	0.0000
TDS	mg/L	500	-----	1,213	1,212
Uranium	mg/L	0.03	-----	0.000	0.000
Zinc	mg/L	5.00	-----	0.00	0.00

Indicates values above AWQS

Key results from the TSF geochemical modeling are as follows:

- The TSF leachate is anticipated to be circum-neutral and of a calcium sulfate (Ca-SO_4) type chemistry. This is aligned with the bulk composition of ore rocks routed to the TSFs being

~66.7% limestone / skarns. See clarification in **Section 8.0**.

- No constituents are predicted to exceed AWQS, although predicted sulfate concentrations are elevated.
- The composite leachate solution is super-saturated with respect to ferrihydrite, gibbsite, barite, and pyrolusite under atmospheric conditions. Trace amounts of these minerals precipitate owing to the already low concentrations of metals in tailings leachate.

9.2.2 Heap Leach Facilities

Resultant HLP seepage chemistry is provided in **Table 9.06** which includes input geochemical profiles prior to mixing and mineral dissolution. Details are provided in Piteau (2022c) in **Appendix G.1.**

Key results from the HLP geochemical modeling are as follows:

- HLP chemistry is strongly acidic, as anticipated, and possesses elevated metal concentrations.
- Concentrations of copper, iron, and sulfate are within anticipated levels for acid leach solutions. Mineralogical controls providing the source for copper, iron, and sulfate are reasonable. Concentrations of other metal elements such as aluminum, manganese, and zinc are likely under predicted given the amount of mineral dissolution associated with heap leaching.
- Concentrations of minor metals and ions (beryllium, cadmium, fluoride, selenium) are at reasonable concentrations given the geochemical conditions.
- Gypsum and barite are the only two mineral phases predicted to precipitate.

Table 9.06: HLP Composite Seepage Chemistry

Parameter	Units	AWQS	Andesite Leach Col.	Qmp Leach Col.	Composite Leachate[1]	Final HLP Seepage Chemistry[2]
pH	s.u.	-----	3.34	3.65	3.50	0.73
Alkalinity, Total	mg/L	-----	-	-	-	<0
Aluminum	mg/L	-----	71.4	14	31.6	31.73
Antimony	mg/L	0.006	<0.02	<0.02	0.003	0.003
Arsenic	mg/L	0.05	0.0039	<0.003	0.0024	0.002
Barium	mg/L	2.0	0.027	0.042	0.034	0.01
Beryllium	mg/l	0.004	**0.0291**	**0.0075**	**0.015**	**0.015**
Boron	mg/l	-----	0.000	0.000	0.000	0.000
Cadmium	mg/L	0.005	**0.377**	**0.085**	**0.179**	**0.180**
Calcium	mg/L	-----	526	172	301	526
Chloride	mg/L	-----	6.97	2.8	4.4	4
Chromium	mg/L	0.10	0.04	0.014	0.023	0.02
Copper	mg/L	-----	53.1	90.1	69.2	2,703.7
Fluoride	mg/L	4.00	**6.38**	1.57	3.18	3.18
Iron	mg/L	-----	1.09	0.46	0.71	757.65
Lead	mg/L	0.05	0.034	0.045	0.039	0.039
Magnesium	mg/L	-----	187	32	77.4	78

Parameter	Units	AWQS	Andesite Leach Col.	Qmp Leach Col.	Composite Leachate[1]	Final HLP Seepage Chemistry[2]
Manganese	mg/L	-----	31.1	6.78	14.6	14.6
Mercury	mg/L	0.002	<0.002	0.0004	0.0002	0.0002
Molybdenum	mg/L	-----	0.009	<0.008	0.002	0.00
Nickel	mg/L	0.1	0.73	0.14	0.32	0.32
Nitrogen, Total as N	mg/L	10.0	0.12	0.06	0.05	0.05
Potassium	mg/L	-----	9.81	3.07	5.48	5.5
Selenium	mg/L	0.05	**0.13**	<0.04	**0.051**	**0.051**
Silver	mg/L	-----	0.017	0.007	0.011	0.011
Sodium	mg/L		10.3	6.2	8.0	51
Sulfate	mg/L	-----	2500	772	1389	32,551
Thallium	mg/L	0.002	<0.015	<0.015	0.0010	0.0010
TDS	mg/L	-----	3890	1250	2205	36,738
Uranium	mg/L	-----	n/a	n/a	0.000	0.000
Zinc	mg/L	-----	**21.5**	4.95	**10.35**	**10.35**

Indicates values above AWQS

[1] Composite for tested HLP samples

[2] Fully reacted HLP facility leachate

9.2.3 Waste Rock Facility

A composite CRF was developed for the WRF by multiplying the Week 0 (first flush) leachates of each Geochemical Unit by its relative abundance. No scaling factor was applied to the composite CRF. The composite CRF was geochemically equilibrated with atmospheric conditions and mineral phases to precipitate a likely assemblage of minerals. Final seepage chemistry from the WRF is provided in **Table 9.07**. Details are provided in Piteau (2022c) in **Appendix G.2**.

Table 9.07: WRF Composite Seepage Chemistry

Parameter	Units	AWQS	Composite Seepage Chemistry	Final WRF Seepage Chemistry (Unscaled)
pH	s.u.	-----	8.05	7.43
Alkalinity, Total	mg/L	-----	100	98
Aluminum	mg/L	-----	0.18	0.00
Antimony	mg/L	0.006	0.000	0.000
Arsenic	mg/L	0.05	0.009	0.005
Barium	mg/L	2.0	0.01	0.01
Beryllium	mg/l	0.004	0.000	0.000
Boron	mg/l	-----	0.000	0.000
Cadmium	mg/L	0.005	0.000	0.000

Parameter	Units	AWQS	Composite Seepage Chemistry	Final WRF Seepage Chemistry (Unscaled)
Calcium	mg/L	-----	21	21
Chloride	mg/L	-----	3	3
Chromium	mg/L	0.10	0.00	0.00
Copper	mg/L	-----	0.025	0.017
Fluoride	mg/L	4.00	0.99	0.99
Iron	mg/L	-----	0.09	0.00
Lead	mg/L	0.05	0.004	0.002
Magnesium	mg/L	-----	3.2	3.2
Manganese	mg/L	-----	0.0	0.000
Mercury	mg/L	0.002	0.0001	0.0001
Molybdenum	mg/L	-----	0.01	0.01
Nickel	mg/L	0.1	0.00	0.00
Nitrogen, Total as N	mg/L	10.0	0.05	0.05
Potassium	mg/L	-----	6.3	6.3
Selenium	mg/L	0.05	0.010	0.010
Silver	mg/L	-----	0.000	0.000
Sodium	mg/L		20	20
Sulfate	mg/L	-----	29	29
Thallium	mg/L	0.002	0.0000	0.0000
TDS	mg/L	-----	184	182
Uranium	mg/L	-----	0.000	0.000
Zinc	mg/L	-----	0.01	0.01

Indicates values above AWQS

Key results from the WRF geochemical modeling are as follows:

- WRF seepage chemistry is circum-neutral and possesses a calcium bicarbonate (Ca-HCO_3) type chemistry. Alkalinity is predicted to be the highest ion in the solution with low concentrations of metals and trace ions.
- Seepage is anticipated to meet AWQS and is within the range of observed values in background groundwater (TDS, SO_4, F, Fe, Mn, etc.).
- The unequilibrated composite solution is super-saturated with regard to ferrihydrite, gibbsite, malachite, and pyrolusite under atmospheric conditions. These saturated mineral phases further reduce aluminum, arsenic, iron and manganese concentrations after mineral equilibration. Thus any WRF seepage is geochemically controlled and anticipated to be of good quality.
- Minor attendant metal ions can be removed via the mechanism of adsorption onto the substrates of colloids. The simulated removal of mass through adsorption excludes the potential sorption pathway of ions onto the substrates of WRF materials itself or onto other metal oxides which precipitate from solution (i.e., aluminum and manganese oxides). Predicted seepage chemistry is therefore considered to overpredict the concentrations of attendant metal ions.

9.2.4 Open Pits

9.2.4.1 Peach Pit

Simulated pit lake chemistry for the Peach Pit during filling is provided in Piteau (2022c). Key results from the geochemical model are:

- Predicted lake water is characterized as circum-neutral with ample alkalinity. Major ions are projected to evapoconcentrate through time because the evaporation of surface waters is greater than groundwater discharge.
- Pit lake water is anticipated to meet most AWQS concentrations. Fluoride concentrations are predicted to be above AWQS. Elevated fluoride concentrations are attributed to moderate concentrations in background groundwater and contributions from exposed Granodiorite which evapoconcentrate through time.
- The abundance of alkalinity from wall rock and groundwater provides neutralization that are conducive to attenuating most metals and will serve as a geochemical control on trace attendant metals. This occurs for iron, copper, and aluminum elements. These conditions are anticipated to continue in perpetuity.
- Groundwater outflow chemistry will reflect the bulk pit lake chemistry concentrations through time. The presence of compartmentalizing structures in the Peach-Elgin pit area, such as the western ridge of Bolsa quartzite, may turn the Peach pit lake into a hydraulic sink.
- Several minerals are predicted to precipitate and control lake chemistry including barite, calcite, ferrihydrite, fluorite, gibbsite, malachite, and rhodochrosite.

9.2.4.2 Elgin Pit

Simulated pit lake chemistry for the Elgin Pit during filling is provided in Piteau (2022c). Key results from the geochemical model are:

- Predicted lake water is characterized as circum-neutral with ample alkalinity. Major ions are projected to evapoconcentrate through time because the evaporation of surface waters is several times greater than groundwater discharge.
- Pit lake water is anticipated to have fluoride concentrations elevated above AWQS limits. Elevated fluoride concentrations are related to the moderate concentrations found in groundwater and wall rock flushing of NAG Epitaph material. Fluoride is predicted to evapoconcentration through time.
- The abundance of alkalinity from wall rock and groundwater creates conditions that are conducive to geochemically attenuating most metals, which will serve as a geochemical control on trace attendant metals. This occurs for iron, copper, and aluminum elements, and are anticipated to continue in perpetuity.
- Groundwater outflow chemistry will reflect the bulk pit lake chemistry concentrations through time. The magnitude of outflow is small, controlled by low permeability crystalline bedrock materials that are characteristic for this area. Many ore deposits contain local geologic structure and alterations that compartmentalize groundwater conditions at the pit scale. The presence of compartmentalizing structures in the Peach-Elgin pit area would likely transform the Elgin pit lake into a hydraulic sink.
- Several minerals are predicted to precipitate and control lake chemistry including barite, calcite, ferrihydrite, fluorite, gibbsite, and malachite.

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9.2.4.3 Heavy Weight Pit

Simulated pore water chemistry for the Heavy Weight Pit backfill is provided in Piteau (2022c). Key results from the geochemical model are:

- Predicted pore water is characterized as circum-neutral with low metal concentrations and elevated TDS.
- Fluoride is temporarily elevated above AWQS and is expected to meet standards 10-years after closure. Fluoride concentrations are attributed to mass loading from NAG Granodiorite materials along the pit floor.
- The release of fluoride is related to the flushing of Granodiorite wall rock materials and moderately high concentrations in groundwater.
- Predicted pore water chemistry resembles background groundwater chemistry. Major ions such as sulfate, calcium, sodium, and magnesium are consistent with the range of background groundwater chemistry.
- Several minerals are predicted to precipitate, and control backfill chemistry, including barite, calcite, ferrihydrite, fluorite, gibbsite, malachite, and rhodochrosite.

9.2.4.4 Copper World Pit

Simulated pore water chemistry for the Copper World North Pit backfill is provided in Piteau (2022c). Key results from the geochemical model are:

- Predicted pore water is characterized as circum-neutral with low metal and major ion concentrations.
- Pore waters are predicted to temporarily elevated above AWQS for fluoride during the first 5-years post closure, but in the long term meet AWQS requirements. Fluoride concentrations are attributed to mass loading from NAG Granodiorite materials along the pit floor and moderate concentrations in groundwater.
- Elevated TDS is related to alkalinity released from saturated backfill. In reality, backfill alkalinity may be equilibrated with calcite and other carbonate mineral species, thus leading to lower release rates that those calculated from the geochemical model.
- Predicted pore water chemistry resembles a mixture of background groundwater chemistry and infiltration. Major ions such as alkalinity, sulfate, calcium, sodium, and magnesium are consistent with the range of background groundwater chemistry. These ion concentrations decline with time as groundwater outflow removes mass from the system.
- Predicted chemistry results are consistent with the low inflow geochemical system, where the principal contact rock materials are NAG waste rock, Granodiorite and Bolsa.
- Only ferrihydrite was predicted to precipitate.

Simulated pore water chemistry for the Copper World south pit backfill is provided in Piteau (2022c). Key results from the geochemical model are:

- Predicted pore water is characterized as circum-neutral with low metal and major ion concentrations.
- Pore waters are predicted to be elevated above AWQS for fluoride during the first 10-years of closure, but meets standards long-term. Fluoride concentrations are attributed to mass loading from NAG Granodiorite materials along the pit floor.
- Elevated TDS is related to alkalinity released from saturated backfill. In reality, backfill alkalinity maybe equilibrated with calcite and other carbonate mineral species than those calculated from the geochemical model that would lead to lower release rates.

- Pore water concentrations decline with time as groundwater outflow removes mass from the system. Backfill infiltration becomes an increasingly dominant component of pore water throughout recovery.
- Barite, calcite, ferrihydrite, fluorite, gibbsite, and malachite were predicted to precipitate.

9.2.4.5 Broadtop Butte Pit

Simulated pore water chemistry for the Broadtop Butte Pit backfill is provided in Piteau (2022c). Key results from the geochemical model are:

- Predicted pore water is characterized as circum-neutral with low metal concentrations.
- Predicted TDS concentrations are within the range of observed values in background groundwater concentrations, and therefore would not degrade groundwater conditions.
- In general, pore water concentrations are predicted to decrease after 20 years post-closure as groundwater outflow flushes backfill material and removes mass from the system. Infiltration becomes the primary long-term geochemical control on pore water chemistry.
- Predicted pore water chemistry resembles background groundwater chemistry. Major ions such as alkalinity, sulfate, calcium, sodium, and magnesium are consistent with the range of background groundwater chemistry.
- Several minerals are predicted to precipitate and modify backfill chemistry including barite, calcite, ferrihydrite, fluorite, gibbsite, and malachite.

9.2.4.6 Rosemont Pit

Although not considered an APP regulated facility, simulated pit water chemistry for the Rosemont Pit is provided in Piteau (2022c). Key results from the geochemical model are:

- Predicted lake water is characterized as circum-neutral with ample alkalinity and low metal concentrations. Lake water is not anticipated to exceed AWQS.
- Sulfate concentrations are anticipated to evapoconcentrate until equilibrium with gypsum is reached. Gypsum, and other sulfate evaporites, are undersaturated in the current geochemical simulation. Major conservative ions such as sulfate, chloride, sodium, and magnesium are anticipated to evapoconcentrate through time until reaching mineral saturation. However, based on the mass loading rates geochemical equilibration will not occur for many hundreds of years.
- The abundance of alkalinity from wall rock and groundwater creates conditions that are conducive to attenuating most metals, which will serve as a geochemical control on attendant metals. These conditions are anticipated to continue in perpetuity.
- Several minerals are predicted to precipitate and control lake chemistry including barite, calcite, ferrihydrite, fluorite, gibbsite, and malachite.

9.2.5 Other APP Regulated Facilities

Solutions with the lined process and stormwater ponds are anticipated to contain the following solution types:

- PLS Pond: Solution chemistry as described in **Section 9.2.2**.
- North HLF Stormwater Pond: Solution chemistry as described in **Section 9.2.2**.
- South HLF Stormwater Pond Solution chemistry as described in **Section 9.2.2**.
- Raffinate Pond: Solution chemistry as described in **Section 9.2.2**.

- Reclaim Pond: Solution chemistry as described in **Section 9.2.1**.
- Process Plant Stormwater Pond: Solution chemistry as described in **Section 9.2.1**.
- Primary Settling Pond: Solution chemistry as described in **Section 9.2.1**.

9.2.6 General APP Regulated Facilities

9.2.6.1 Temporary ROM Stockpile (TRS)

The Temporary ROM Stockpiles (TRS) are not anticipated to generate substantial discharge or discharge chemistry impacts. As discussed in **Section 8.0,** ore and waste rock materials are largely neutralizing. Due to the temporary nature of the facilities, unsaturated conditions of the materials, and relatively slow geochemical kinetics, significant metals are not anticipated to be generated or mobilized.

9.2.6.2 Coarse Ore Stockpile (COS)

The Coarse Ore Stockpiles (COS) are not anticipated to generate substantial discharge or discharge chemistry impacts. As discussed in **Section 8.0,** ore and waste rock materials are largely neutralizing. Due to the temporary nature of the facilities, unsaturated conditions of the materials, and relatively slow geochemical kinetics, significant metals are not anticipated to be generated or mobilized.

9.2.6.3 SW Energy Facility

The SW Energy Facility (or SWE-V&E-W Facility) is not anticipated to generate substantial discharge or discharge chemistry impacts. The facility will have a small evaporation pond associated with the wash pad for the Prill Truck, etc. Based on previous design for the Rosemont Copper Project, the evaporation pond was six (6) feet deep with two (2) feet of freeboard. At a four (4) foot depth of water in the pond, the LSA was about 0.059 acres. Assuming this depth was maintained in the pond, the liner leakage rate would be less than one (1) gallon per day. The solution chemistry is assumed to reflect that of the tailings seepage water as described in **Section 9.2.1**.

The pond liner is anticipated to consist of the following, which is equivalent to the previous design.

- 60-mil HDPE liner;
- GCL; and
- Prepared subgrade (a minimum of 6-inches).

9.2.6.4 Sewage Treatment Facility

The sewage treatment facilities (septic fields) for the Copper World Project have not been designed. Therefore, the discharge rates associated with these facilities have not been determined. Additionally, no hazardous chemicals will be put into these systems, only effluent from sinks, showers, and restroom facilities.

Additionally, no sanitary waste will go to any of the discharging facilities. All will either go to an onsite septic system or to holding tanks for offsite disposal by a licensed contractor.

9.2.6.5 Large Truck Tire Disposal Areas

The placement of large mining truck tires in cells within WRF is not anticipated to generate additional discharge.

9.2.6.6 Stormwater Control Structures

The stormwater control structures associated with the Project will be constructed to accomplish the following:

- Route non-impacted water generated from upgradient areas around or through the facilities;
- Route stormwater runoff from impacted areas with the facility boundaries to containment structures for reuse in the process circuits;
- Route stormwater off the reclaimed facilities and into downgradient natural drainages; and
- Route stormwater off the WRF slide slopes during operations and post-operations.

As noted in **Section 9.2.3**, seepage that may develop in the WRF is expected to meet AWQS. Additionally, material placement in the WRF will be in accordance with the Waste Rock Handling Plan described in **Section 8.7**. Non-acid generating (NAG) materials will preferentially be placed on the outer slopes of the WRF. Therefore, stormwater routed through the sediment basins located around the WRF and into the downgradient natural drainages is expected to be of good quality.

10.0 DEMONSTRATION OF BADCT FOR AREA-WIDE APP REGULATED FACILITIES

APP statutes require that an individual APP facility "will be so designed, constructed and operated as to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology, processes, operating methods or other alternatives..." (or BADCT) (Arizona Revised Statues (A.R.S.) § 49-243.B.1). A demonstration of BADCT is a method of evaluating technologies, processes, and operating methods to determine if the facility reduces, to the extent practical, the loading of pollutants to the aquifer and therefore meets the requirements set forth in the statute.

Arizona Administrative Code (A.C.C.) R18-9A202(A)(5) requires the applicant to submit a description of the design, processes, operating methods, or other alternatives proposed to meet the requirements of A.R.S. § 49-243.B.1. The BADCT demonstrations have been develop in accordance with the applicable provisions of A.A.C. R18-9A202(A)(5) and the Arizona Mining BADCT Guidance Manual (ADEQ, 2004).

The BADCT demonstration process may involve the use of a "Prescriptive" approach or an "Individual" approach. In order to use Prescriptive BADCT, the applicant must utilize control technologies, processes, and operating methods developed by ADEQ to achieve BADCT. If a facility utilizes prescriptive BADCT criteria or equivalents, it will satisfy the requirements of A.R.S. § 49-243.B.1. ADEQ (2004) prescriptive BADCT criteria have been established only for certain types of mining facilities.

As an alternative to the use of prescriptive BADCT, or for facility types where prescriptive BADCT criteria have not been developed, an applicant may provide an individual BADCT analysis. As part of an Individual BADCT evaluation, the applicant must describe the alternative discharge control measures considered, the technical and economic advantages and disadvantages of each alternative, and the justification for selection or rejection of each alternative. The BADCT demonstrations provided in this section follow the outline for the individual and prescriptive criteria as provided in the Arizona Mining BADCT Guidance Manual.

Common aspects of the Project that are applicable to each of the area-wide APP regulated facilities are listed below in **Section 10.1**. Additionally, the following categories are discussed for each of the facilities addressed in **Section 10.2**, **Section 10.3** and **Section 10.4**:

- Facility description (includes capacity);
- Solution characterization;
- Siting considerations (includes discission on geotechnical investigation, groundwater levels, seismic analysis and geologic hazards);
- Design, construction, and operations criteria (includes BADCT containment evaluation, construction details, and operational monitoring);
- Stability analysis;
- Surface water control; and
- Closure (includes discussion of PMA and DIA).

During operations, ponds and temporary diversions will be designed to manage flow from a 100-year, 24-hour storm event. However, for permanent channels constructed during operations or at closure, the design storm is the 1000-year, 24-hour event. Because the diversion channels constructed around the facilities will remain at closure, they will be constructed to manage the 1,000-year, 24-hour event.

10.1 COMMON BADCT ELEMENTS

The APP regulated facilities share several elements that are common to the entire site. These include but are not limit to:

- Climate discussed in **Section 3.2**;
- Pollutant Management Area (PMA) boundary discussed in **Section 12.1**;
- Site diversions and non-contact stormwater controls discussed in **Section 6.4**;
- Area-wide geologic Hazards discussed in **Section 3.6**; and
- Area-wide groundwater monitoring program discussed in **Section 12.3**.

10.2 FACILITIES DESIGNED USING ESTABLISHED PRESCRIPTIVE CRITERIA

Prescriptive BADCT demonstrations have been prepared for the following APP regulated facilities:

- Heap Leach Pad (HLP)
- Pregnant Leach Solution (PLS) Pond
- Heap Leach Facility (HLF) Stormwater Ponds
- Raffinate Pond
- Reclaim Pond
- Process Area Stormwater Pond
- Primary Settling Pond

Design drawings for these facilities are provided in **Appendix I.10**. **Figures 3 and 10** show final facility contours.

10.2.1 Heap Leach Pad (HLP)

During the life of the Copper World Project, approximately 104 million tons of oxide ore will be placed on the HLP. This includes about 73.2 million tons of crushed and agglomerated ore and 30.6 million tons of run-of-mine (ROM) ore. The Copper World Project HLP has been designed to contain the total amount of oxide ore. The crushed ore will be placed on the pad using conveyors while the ROM ore will be placed by haul trucks. The oxide ore will have leach / raffinate solution (low concentration sulfuric acid solution) pumped to the top and side slopes of the heap which will percolate through the stacked material, dissolving copper and generating Pregnant Leach Solution (PLS). The PLS will be collected by a series of solution collection pipes and a liner system which will direct the solution to the PLS Pond.

10.2.1.1 Solution Characterization

Both the raffinate solution and PLS solution are low pH sulfuric acid solutions. The raffinate solution is applied to the oxide ore on the HLP to dissolve the copper in the ore. Once the raffinate solution is applied to the ore and contains copper, it becomes PLS and is sent the SX/EW plant for processing. After the copper is removed from solution, the barren solution is sent to the Raffinate Pond where it is reconditioned with sulfuric acid to reduce the pH. Once reconditioned, the raffinate solution is reapplied to the material on the HLP. **Section 9.2.2** provides the anticipated chemistry of the leach solution.

10.2.1.2 Siting Considerations

Site characteristics were assessed during the geotechnical investigation by collecting geotechnical, geological, and hydrogeological data as outlined in the Geotechnical Site Investigation Memorandum

(**Appendix I.6**). The geotechnical investigation included advancing borings and test pit excavations, field mapping, and sampling of potential borrow sources to support engineering analysis and provide foundation design recommendations.

As stated in the geotechnical memorandum, the subgrade foundation materials throughout the site generally consist of competent rock overlain (in some areas) by weathered and altered rock, which is covered by varying thicknesses of colluvium soils. Colluvium soils generally consist of sands and gravels with small varying amounts of silt or clay, varying amounts of cobbles, boulders, highly to completely weathered rock, and moderate to slightly weathered rock. Considering the dense nature of the foundation materials, results of direct shear tests on remolded soil samples were used to represent both the foundation soil and embankment/structural fill.

Groundwater was recorded in several of the borings across the site and ranged in depths from 59 to 141 feet below ground surface (ft bgs).

The HLP is located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 2,475 years was selected for the HLP, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. With regard to the HLP, no specific hazards were noted.

10.2.1.3 Design, Construction and Operations Criteria

HLP Alternatives Considered for Discharge Control

Two alternative designs were considered as part of the BADCT analysis in addressing potential discharge from the HLP facility. Each of the two alternatives, and the associated discharge, are described below. However, Alternative 2 is the selected design.

Alternative 1 - Geomembrane Liner on Native, Low Permeability Soil Underliner, with Overliner Drainage System

The discharge from the bottom of a HLP with a geomembrane liner above an underlying soil is controlled by the rate at which water leaks thorough the geomembrane into the underlying material.

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.2** and presented in **Appendix H.1** (Wood, 2022j). Alternative 1 assumed a prescriptive BADCT liner system consisting of a 60-mil HDPE geomembrane on 12-inches of compacted, low permeability soil. A 2-foot depth of PLS above the geomembrane was used in the calculations in accordance with BADCT guidance for the average depth of ponded water at the bottom of a HLP.

The potential leakage rate (PLR) of solution through the liner for this alternative was calculated at 0.34 gpm or 492 gallons per day.

Alternative 2 - Geomembrane Liner on GCL Underliner, with Overliner Drainage System

Discharge from the bottom of a HLP with a geomembrane liner above a GCL is controlled by the rate at which water leaks thorough the geomembrane into the underlying GCL

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.2** and presented in **Appendix H.1**. Alternative 2 assumed a liner system consisting of an 80-mil LLDPE geomembrane underlain with a GCL. A 6-inch prepared subgrade was also assumed under the GCL. As with Alternative 1, a 2-foot depth of PLS above the geomembrane was used in the calculations in accordance with BADCT guidance for the average depth of ponded water at the bottom of a HLP.

The PLR of solution through the liner for this alternative was calculated at 0.05 gpm or 78 gallons per day.

Selected Alternative - Geomembrane Liner on GCL Underliner, with Overliner Drainage System

Alternative 2 is the selected design. Per R18-9-A202(A)(5)(a)(ii), a cost analysis of the alternatives was prepared, See Rosemont (2022g) in **Appendix I.11**.

Construction activities will conform to applicable permits, design drawings, specifications and other environmental and engineering related documents developed for the Project. Site preparation of the facility will include clearing and grubbing, removing unsuitable soils, placing and compacting waste rock as the foundation of the HLP, and if necessary, placing structural fill material to provide foundations for HLP infrastructure. Subgrades will consist of, at minimum, six inches of native or engineered fill materials compacted to 95% maximum dry density (standard Proctor; ASTM D-698) which is required to provide a firm base for the overlying materials.

The liner system will be installed within the footprint of the HLP and consist of the following components from bottom to top:

- Subgrade foundation materials consisting of competent rock overlain by weathered and altered rock which is covered by varying thicknesses of colluvium and soils, along with compacted waste rock placed as the foundation for the HLP.
- Underliner consisting of a geosynthetic clay liner (GCL) to achieve a hydraulic conductivity of less than 10E^{-6} cm/sec.
- The underliner is overlain by a geomembrane consisting of 80-mil, double-sided textured linear low-density polyethylene (LLDPE).
- The overliner will consist of a three-foot thick layer of a well-draining material installed over the geomembrane. The overliner material will be obtained from ore consisting of 1.5-inch minus rock with a hydraulic conductivity of $1x10^{-1}$ cm/sec or higher. There will also be a series of perforated solution collection pipes directly above the geomembrane which will be sized and spaced to allow an average and maximum hydraulic head over the liner of less than 2 feet and 5 feet, respectively. As noted, a 2-foot hydraulic head on the liner was used in the discharge calculations.

In addition to the overliner drainage system, an underdrain will also be installed under the heap liner. Solution captured by the underdrain would report to the PLS Pond or HLF stormwater pond.

The lining system will be secured in an engineered anchor trench around the perimeter of the heap.

Liner puncture testing was performed for the HLP and included as an attachment in Wood (2021c) in **Appendix I.**6.

The minimum slope of the liner is three (3) percent.

The LSA of the HLP is about 336 acres.

Th capacity of the heap is 104 million tons.

The overall side slope angle is 2.3:1.

The maximum slope height will be 430 feet with a top elevation of 4,830 ft amsl. Note: Liner puncture testing was performed. Results are provided in Wood (2021c) in **Appendix I.6**.

Design drawings for the HLP are provided in **Appendix I.10**. Additionally, the following design documents were prepared for the HLP and are provided in **Appendix I**:

- Heap Leach Pad (HLP) Pipe Settlement Analysis (Wood, 2022c) in **Appendix I.8**
- Stability Analysis Memorandum – Heap Leach Facility (HLF) (Wood, 2022e) in **Appendix I.2**
- Heap Leach Liner Chemical Compatibility (Wood, 2022d) in **Appendix I.7**
- Piping Sizing Analysis Memorandum – Heap Leach Facility (Wood, 2021a) in **Appendix I.9**

10.2.1.4 Stability

The Heap Leach Facility Stability Analysis Memorandum (**Appendix I.2**) shows the HLP meets the minimum static and pseudo-static factor of safety (FOS) of 1.3 and 1.0, respectively. The summary and conclusion from the stability analysis are as follows:

- The critical failure surfaces and corresponding factors of safety for all cases associated with the HLP cross-sections are presented on Figures 4-4 through 4-11 in **Appendix I.2**. The factors of safety are summarized in table below. The **Table 10.01** also provides the design criteria for comparison. All factors of safety exceed the minimum design criteria for static and pseudo-static conditions.

Table 10.01: Summary of Limit Equilibrium Stability Results – HLP

Cross-section	Direction	Static Analyses		Min. BADCT Requirement, Static Analyses	Pseudo-static Analyses	Min. BADCT Requirement, Pseudo-static Analyses
		Circular Slip Surfaces	Linear Slip Surfaces			
HLF01	Downgradient	1.77	1.34	1.3	1.19	1.0
HLF02	Downgradient	1.91	1.56		1.39	

Notes: NA = not applicable. HLF01 and HLF02 are sections through the heap.

10.2.1.5 Facility Inspection Criteria

As indicated in **Section 20**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14**, preliminary inspection and monitoring forms were prepared for the APP regulated facilities and are presented in **Section K**. These forms will be updated upon issuance of the APP for the Copper World Project.

Inspection of the HLP will be conducted on the schedule as required by the APP. Inspections will include a visual observation of the heap and checking for sloughing or other instability. Inspections will be recorded. If any action conditions are exceeded, the ADEQ will be notified in accordance with the permit conditions. Inspection forms will be maintained on site and available for agency review.

10.2.1.6 Surface Water Control

Stormwater diversion channels will be constructed to handle non-contact stormwater runoff from a 1,000-year, 24-hour storm event during operations and after closure. The diversion channels will release non-contact stormwater downgradient of the facilities into existing drainages. One existing drainage flows through the proposed Cell 3 of the HLP. Due to land restrictions, flow in this drainage cannot be diverted around the HLP. For this drainage, an upstream stormwater collection gallery will be located upgradient of the HLP (south side of Cell 3). This gallery will collect the flow in the drainage and convey the flow under the HLP to a downstream stormwater collection gallery. From there the stormwater will seep into the alluvium and or overflow the downstream gallery into the existing drainage. Details on the stormwater collection gallery system is provided in the Site Water Management Plan (**Appendix E**) and summarized in **Section 6.4**.

10.2.1.7 Closure/Post-Closure

A conceptual closure plan has been developed for the Copper World Project. This plan will be further defined as the Project is developed and operated. The current Conceptual Closure Plan is provided in **Appendix M** and summarized in **Section 16**.

The HLP will be closed using prescriptive BADCT guidance to the extent practical. One prescriptive closure guidance method that will not be used is the rinsing of the spent ore on the heap leach pad. This closure method would not be used due to the extensive amount of water needed to rinse the ore and the challenge of managing (disposing) of that water after rinsing.

The following provides the general steps for closure of the HLP:

- HLP slopes constructed to final overall slope configuration
- Manage draindown solution through active evaporation
- Long-term management of draindown through evaporation cells converted from existing PLS Pond and one HLF stormwater pond
- Grade the top surface to promote runoff and minimize infiltration
- Regrade the inner bench slopes to promote runoff and minimize infiltration
- Place and grade cover material – 18 inches on top and slopes of the HLP spent leach material
- Construct horizontal and vertical stormwater channels on the reclaimed slopes to collection runoff and convey the stormwater to a diversion channel and into a natural drainage
- Revegetation
- Post-closure monitoring of cover (erosion and revegetation)
- Post-closure monitoring at POC wells

Management of draindown solution from the HLP is the most critical aspect of closure. After active leaching has ceased, the goal will be to reduce the volume of solution within the HLP as quickly as possible to allow full closure and reclamation of the facility. Active evaporation will be used to reduce the solution volume. Snow makers or similar devices will be used to increase the efficiency of evaporation. Solution will continue to circulate from the HLP to the PLS Pond during the active evaporation phase. Once the volume of solution is low enough to be passively evaporated, final closure methods will be implemented which include the following:

- The surface of the spent leach material will be graded to promote runoff from the top and side slopes.
- Eighteen inches of growth media will be placed over the top and slopes of the spent leach material to provide a base for vegetation growth and to store water (evapotranspiration) water for vegetation uptake and evaporation. The regraded surface will be revegetated with native species
- Runoff from the surface of the reclaimed heap will be routed to diversion channels that will convey stormwater runoff to existing drainages.
- Convert the PLS Pond and HLF North Stormwater Pond to evaporation cells to allow for long-term passive evaporation of draindown from the reclaimed heap.

Based on results from the Heap Leach Draindown Estimator (HLDE) model, passive evaporation would begin eight (8) years after the start of active evaporation. With active leaching likely ending in Year 9 or Year 10 of the operations, closure of the HLP would be completed three (3) years after mining ceases. See the Conceptual Closure Plan in **Appendix M** for additional detail.

The Pollutant Management Area (PMA) and Discharge Impact Area (DIA) for the Copper World Project are presented in **Section 12** and detailed in **Appendix F.2** (Piteau, 2022b). Also see **Figures 36 and 37** for the PMA and DIA, respectively.

10.2.2 Pregnant Leach Solution (PLS) Pond

Pregnant Leach Solution (PLS) is collected by a drainage system from the HLP and conveyed to the PLS Pond. From the PLS Pond, the solution is then piped to the SX/EW plant for copper recovery. The PLS Pond will be constructed to have a capacity below freeboard of about 1,903,797 ft^3 (14.24 million gallons or 43.7 acre-feet) with a maximum depth to the pond crest of 24 feet. The pond is designed to contain 1) 24-hours of draindown from the HLP in the event of pump failure, 2) 8-hours of operational flow, and 3) precipitation from a 100-year, 24-hour storm event.

A spillway will be constructed to two (2) HLF stormwater ponds located both the north and south of the PLS Pond. Overflow from the PLS Pond into the HLF stormwater ponds will be for emergency, short-term storage only. Outer embankments will be constructed to be no steeper than 2:1.

10.2.2.1 Solution Characterization

Both the raffinate solution and PLS solution are low pH sulfuric acid solutions. The raffinate solution is applied to the oxide ore on the HLP to dissolve the copper in the ore. Once the raffinate solution is applied to the ore and contains copper, it becomes PLS and is sent the SX/EW plant for processing. After the copper is removed from solution, the barren solution is sent to the Raffinate Pond where it is reconditioned with sulfuric acid to reduce the pH. Once reconditioned, the raffinate solution is reapplied to the material on the HLP. **Section 9.2.2** provides the anticipated chemistry of the leach solution.

10.2.2.2 Siting Considerations

Site characteristics were assessed during the geotechnical investigation by collecting geotechnical, geological, and hydrogeological data as outlined in the Geotechnical Site Investigation Memorandum (**Appendix I.6**). The geotechnical investigation included advancing borings and test pit excavations, field mapping, and sampling of potential borrow sources to support engineering analysis and provide foundation design recommendations.

As stated in the geotechnical memorandum, the subgrade foundation materials throughout the site generally consist of competent rock overlain (in some areas) by weathered and altered rock, which is covered by varying thicknesses of colluvium soils. Colluvium soils generally consisted of sands and gravels with small varying amounts of silt or clay, varying amounts of cobbles, boulders, highly to completely weathered rock, and moderate to slightly weathered rock. Considering the dense nature of the foundation materials, results of direct shear tests on remolded soil samples were used to represent both the foundation soil and embankment/structural fill.

Groundwater was recorded in several of the borings across the site ranging in depths from 59 to 141 ft bgs.

The PLS Pond is located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 2,475 years was selected for the HLF ponds, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. With regard to the PLS Pond, no specific hazards were noted.

10.2.2.3 Design, Construction and Operations Considerations

PLS Pond Alternatives Considered for Discharge Control

Two alternative designs were considered as part of the BADCT analysis in addressing potential discharge from the PLS Pond facility. Each of the two alternatives, and the associated discharge, are described below. However, Alternative 2 is the selected design.

Alternative 1 - Geomembrane Liner on Native, Low Permeability Soil Underliner

The discharge from the bottom of a pond with a geomembrane liner above an underlying soil is controlled by the rate at which water leaks thorough the geomembrane into the underlying material.

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 1 assumed a prescriptive BADCT liner system consisting of a 60-mil HDPE geomembrane top liner, LCRS, 60-mil bottom liner, and 6-inches of compacted, low permeability soil.

The potential leakage rate (PLR) of solution through the bottom liner for this alternative was calculated at 27 gallons per year.

Alternative 2 - Geomembrane Liner on GCL Underliner

Discharge from the bottom of a pond with a geomembrane liner above a GCL is controlled by the rate at which water leaks thorough the geomembrane into the underlying GCL

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 2 assumed a liner system consisting of an 80-mil HDPE geomembrane top liner, LCRS, 80-mil HDPE bottom liner, a GCL, and 6-inches of prepared subgrade.

The PLR of solution through the bottom liner for this alternative was calculated at 0.54 gallons per year.

Selected Alternative - Geomembrane Liner on GCL Underliner

Alternative 2 is the selected design. Per R18-9-A202(A)(5)(a)(ii), a cost analysis of the alternatives was prepared. See Rosemont (2022g) in **Appendix I.11**.

Construction activities will conform to the permit, design drawings, specifications and other environmental and engineering related documents developed for the Project. Site preparation of the facility will include clearing and grubbing, removing unsuitable soils, compacting the foundation, and if necessary, placing structural fill to provide foundations for Project infrastructure. Subgrades will consist of, at minimum, six inches of native or natural materials compacted to 95% maximum dry density (standard Proctor; ASTM D-698) which is required to provide a firm base for the overlying materials.

The PLS Pond will be a double-lined facility with a Leak Collection and Recovery System (LCRS). The pond liner system will consist of the following:

- A prepared subgrade
- A GCL on the prepared subgrade
- An 80-mil HDPE secondary liner (bottom liner)
- A geogrid as part of the LCRS
- An 80-mil HDPE primary liner (top liner)

The bottom of the pond will be sloped at a 3% grade so leakage through the primary liner, which contacts the geogrid, preferentially flows to the LCRS sump where the solution can be detected and removed.

In addition to the LCRS, an underdrain will be installed under the pond liner system. Solution captured by the underdrain would report to the PLS Pond.

The lining system will be secured in an engineered anchor trench around the perimeter of the pond.

The top LSA of the PLS Pond is 3.2 acres.

The inner lined slopes are 2.5:1. Outer embankment slopes would be no steeper than 2:1.

Freeboard is 2-feet. Depth of the pond is 24 feet to the crest.

The pond volume below freeboard is 43.7 acre-feet.

Alert Level 1 (AL1) for the PLS Pond was calculated to be 1.11 gal/min or 1,600 gal/day. AL2 was calculated to be 35 gal/min or 50,900 gal/day (see Wood [2022j] in **Appendix H.1**.

Design drawings for the PLS Pond are provided in **Appendix I.10**. Additionally, the following design documents were prepared for the PLS Pond and are provided in **Appendix I**:

- Stability Analysis Memorandum – Heap Leach Facility (HLF) (Wood, 2022e) in **Appendix I.2**

10.2.2.4 Stability

The Heap Leach Facility Stability Analysis Memorandum (**Appendix I.2**) shows the PLS Pond meets the minimum static and pseudo-static FOS of 1.3 and 1.0, respectively. The summary and conclusion from the stability analysis are as follows:

- The critical failure surfaces and corresponding factors of safety for all cases associated with the PLS Pond cross-section are presented on Figures 4-12 through 4-15 in **Appendix I.2**. The factors of safety are summarized in table below. The **Table 10.02** also provides the design criteria for comparison.

Table 10.02: Summary of Limit Equilibrium Stability Results – PLS Pond

Cross-section	Direction	Static Analyses		Min. BADCT Requirement, Static Analyses	Pseudo-static Analyses	Min. BADCT Requirement, Pseudo-static Analyses
		Circular Slip Surfaces	Linear Slip Surfaces			
POND02	Downstream	1.54	NA	1.3	1.40	1.0
	Upstream	1.89	NA		1.69	

Notes: NA = not applicable. POND02 is a section through the PLS Pond.

10.2.2.5 Facility Inspection Criteria

As indicated in **Section 20**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14**, preliminary inspection and monitoring forms were prepared for the APP regulated facilities and are presented in **Section K**. These forms will be updated upon issuance of the APP for the Copper World Project.

Inspection of the PLS Pond will be conducted on the schedule as required by the APP. Inspections will include a visual observation of the ponds and checking the LCRS for the presence of fluid. Inspections will be recorded. The presence or absence of fluid in the LCRS will also be recorded and the volume of fluid removed. If fluid amounts exceed the action level, the ADEQ will be notified in accordance with the permit conditions. Inspection forms will be maintained on site and available for agency review.

Alert levels were calculated for leakage through the top liner reporting to the LCRS sump. Details on these alert levels are provided in **Appendix H.1** (Wood, 2022j). Alert Level 1 (AL1) for the PLS Pond was calculated to be 1.11 gal/min or 1,600 gal/day. AL2 was calculated to be 35 gal/min or 50,900 gal/day.

10.2.2.6 Surface Water Control

The PLS Pond is located immediately west and downgradient of the HLP and TSF-1, therefore eliminating the need for additional upgradient stormwater diversion. Diversion and containment systems for the Project are generally designed for the 1,000-year, 24-hour and 100-year, 24-hour events, respectively.

10.2.2.7 Closure/Post-Closure

A conceptual closure plan has been developed for the Copper World Project. This plan will be further defined as the Project is developed and operated. The current Conceptual Closure Plan is provided in **Appendix M** and summarized in **Section 16**.

The PLS Pond, along with the HLF North Stormwater Pond, will be converted to evaporation cells for long-term passive management of draindown from the HLP. Based on results from the Heap Leach Draindown Estimator (HLDE) model, passive evaporation would begin eight years after the start of active evaporation. A description of a typical evaporation cell is provided in the Conceptual Closure Plan (**Appendix M**).

The Pollutant Management Area (PMA) and Discharge Impact Area (DIA) for the Copper World Project are presented in **Section 12** and detailed in Piteau (2022b) provided in **Appendix F.2**. Also see **Figures 36 and 37** for the PMA and DIA, respectively.

10.2.3 HLF Stormwater Ponds

Overflow from the PLS Pond during storm or upset events is collected into the two HLF stormwater ponds known as the HLF North Stormwater Pond (North Pond) and HLF South Stormwater Pond (South Pond). These ponds are primarily stormwater ponds, but may contain process solutions for brief periods of time; as such, they are considered non-stormwater ponds for purposes of the BADCT Guidance Manual. Each of the HLF stormwater ponds will be constructed to have a storage capacity below freeboard of 1,917,270 ft^3 (14.34 million gallons or 44 acre-feet) with a maximum depth to the pond crest of 24 feet. The ponds are designed to contain runoff and precipitation from a 100-year, 24-hour storm event.

A spillway will be constructed from two (2) HLF stormwater ponds to the PLS Pond. Overflow from the PLS Pond into the HLF stormwater ponds will be for emergency, short-term storage only. Outer embankments will be constructed to be no steeper than 2:1.

10.2.3.1 Solution Characterization

The poorest quality water that would be present in the HLF stormwater ponds would be overflow from the PLS Pond. Both the raffinate solution and PLS solution are low pH sulfuric acid solutions. The raffinate solution is applied to the oxide ore on the HLP to dissolve the copper in the ore. Once the raffinate solution is applied to the ore and contains copper, it becomes PLS and is sent the SX/EW plant for processing. After the copper is removed from solution, the barren solution is sent to the Raffinate Pond where it is reconditioned with sulfuric acid to reduce the pH. Once reconditioned, the raffinate solution is reapplied to the material on the HLP. **Section 9.9.2** provides the anticipated chemistry of the leach solution. The solution chemistry in the HLF stormwater ponds is anticipated to be similar, but likely more dilute because of the potential presence of stormwater in the ponds as well.

10.2.3.2 Siting Considerations

Site characteristics were assessed during the geotechnical investigation by collecting geotechnical, geological, and hydrogeological data as outlined in the Geotechnical Site Investigation Memorandum (**Appendix I.6**). The geotechnical investigation included advancing borings and test pit excavations, field mapping, and sampling of potential borrow sources to support engineering analysis and provide foundation design recommendations.

The memorandum indicates that subgrade foundation materials throughout the site generally consist of competent rock overlain (in some areas) by weathered and altered rock which is covered by varying thicknesses of colluvium soils. Colluvium soils generally consisted of sands and gravels with small varying amounts of silt or clay, varying amounts of cobbles, boulders, highly to completely weathered rock, and moderate to slightly weathered rock. Considering the dense nature of the foundation materials, results of direct shear tests on remolded soil samples were used to represent both the foundation soil and embankment/structural fill.

Groundwater was recorded in several of the borings across the site ranging in depths from 59 to 141 ft bgs.

Both of the HLF stormwater ponds are located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 2,475 years was selected for the HLF ponds, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. With regard to the HLF stormwater ponds, no specific hazards were noted.

10.2.3.3 Design, Construction and Operations Considerations

HLF Stormwater Pond Alternatives Considered for Discharge Control

Two alternative designs were considered as part of the BADCT analysis in addressing potential discharge from the HLF Stormwater Pond facilities. Each of the two alternatives, and the associated discharge, are described below. However, Alternative 2 is the selected design.

Alternative 1 - Geomembrane Liner on Native, Prepared Subgrade

The discharge from the bottom of a pond with a geomembrane liner above an underlying soil is controlled by the rate at which water leaks thorough the geomembrane into the underlying material.

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3.** and presented in **Appendix H.1**. Alternative 1 assumed a prescriptive BADCT liner system consisting of a 60-mil HDPE geomembrane top liner and 6-inches of a compacted, prepared subgrade.

The potential leakage rate (PLR) of solution through the liner for this alternative was calculated at 157 gallons per day or 57,200 gallons per year. Note that the pond was considered full in the calculations. This is a conservative assumption, as the pond will only contain water for short periods of time during rain events or upset conditions. The PLR is therefore likely overstated as a result.

Alternative 2 - Geomembrane Liner on GCL Underliner

Discharge from the bottom of a pond with a geomembrane liner above a GCL is controlled by the rate at which water leaks thorough the geomembrane into the underlying GCL

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3.** and presented in **Appendix H.1**. Alternative 2 assumed a liner system consisting of an 80-mil HDPE geomembrane, a GCL, and 6-inches of prepared subgrade.

The PLR of solution through the liner for this alternative was calculated at 39 gallons per day or 14,200 gallons per year. Note that the pond was considered full in the calculations. This is a conservative assumption, as the pond will only contain water for short periods of time during rain events or upset conditions. The PLR is therefore likely overstated as a result.

Selected Alternative - Geomembrane Liner on GCL Underliner

Alternative 2 is the selected design. Per R18-9-A202(A)(5)(a)(ii), a cost analysis of the alternatives was prepared. See Rosemont (2022g) in **Appendix I.11**.

Construction activities will conform to the permit, design drawings, specifications and other environmental and engineering related documents developed for the Project. Site preparation of the facility will include clearing and grubbing, removing unsuitable soils, compacting the foundation, and if necessary, placing structural fill to provide foundations for Project infrastructure. Subgrades will consist of, at minimum, six inches of native or natural materials compacted to 95% maximum dry density (standard Proctor; ASTM D-698) which is required to provide a firm base for the overlying materials.

The HLF ponds will be single-lined facilities. The pond liner system will consist of the following:

- A prepared subgrade
- A GCL on the prepared subgrade
- An 80-mil HDPE liner

The bottom of each HLF stormwater pond would be sloped at a 1% grade to one side in order to facilitate evacuation of the pond.

An underdrain will be installed under the pond liner system. Solution captured by the underdrain would report to the PLS Pond.

The lining system will be secured in an engineered anchor trench around the perimeter of the pond.

The top LSA of each HLF Stormwater Pond is 3.0 acres.

The inner lined slopes are 2.5:1. Outer embankment slopes are no steeper that 2:1.

Freeboard is 2-feet. The depth of each HLF Stormwater Pond is 24 feet to the crest.

The volume of each HLF Stormwater Pond below freeboard is 44 acre-feet.

Design drawings for the HLF stormwater ponds are provided in **Section I.10**. Additionally, the following design documents were prepared for the HLF stormwater ponds are provided in **Appendix I**:

- Stability Analysis Memorandum Heap Leach Facility (HLF) (Wood, 2022e) in **Appendix I.2**.

10.2.3.4 Stability

The Stability Analysis Memorandum Heap Leach Facility (**Appendix I.2**) provides stability analyses for the heap leach and the PLS Pond. Although an analysis was not specifically done for the HLF stormwater ponds, their configuration is the same as the PLS Pond; therefore, the results from the PLS Pond analysis can be applied to the HLF stormwater ponds. Based on the results of the PLS Pond, the HLF stormwater ponds meet the minimum static and pseudo-static FOS of 1.3 and 1.0, respectively. The summary and conclusion from the stability analysis are as follows:

- The critical failure surfaces and corresponding factors of safety for all cases associated with the HLF stormwater pond cross-section are presented on Figures 4-12 through 4-15 in **Appendix I.2**. The factors of safety are summarized in table below. The **Table 10.03** also provides the design criteria for comparison.

Table 10.03: Summary of Limit Equilibrium Stability Results – HLF Stormwater Ponds

Cross-section	Direction	Static Analyses		Min. BADCT Requirement, Static Analyses	Pseudo-static Analyses	Min. BADCT Requirement, Pseudo-static Analyses
		Circular Slip Surfaces	Linear Slip Surfaces			
POND02	Downstream	1.54	NA	1.3	1.40	1.0
	Upstream	1.89	NA		1.69	

Notes: NA = not applicable. POND02 is a section through the PLS Pond. POND02 is the same effective cross-section through each HLF stormwater pond.

10.2.3.5 Facility Inspection Criteria

As indicated in **Section 20**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14**, preliminary inspection and monitoring forms were prepared for the APP regulated facilities and are presented in **Section K**. These forms will be updated upon issuance of the APP for the Copper World Project.

Inspection of the HLF stormwater ponds will be conducted on the schedule as required by the APP. Inspections will include a visual observation of the ponds and liner integrity. Since the HLF stormwater ponds are single lined and do not have a LCRS, inspections will focus on signs of liner damage, or leaks when fluid is present. Inspection forms will be maintained on site and available for agency review.

10.2.3.6 Surface Water Control

The HLF stormwater ponds are located immediately west and downgradient of the HLP and TSF-2, therefore eliminating the need for additional upgradient stormwater diversion. Diversion and containment systems for the Project are generally designed for the 1,000-year, 24-hour and 100-year, 24-hour events, respectively.

10.2.3.7 Closure/Post-Closure

A conceptual closure plan has been developed for the Copper World Project. This plan will be further defined as the Project is developed and operated. The current Conceptual Closure Plan is provided in **Appendix M** and summarized in **Section 16**.

The HLF South Stormwater Pond will be closed and reclaimed using BADCT prescriptive closure methods as identified in the Arizona Mining Guidance Manual BADCT and in the Conceptual Closure Plan (**Appendix N**).

The HLF North Stormwater Pond, along with the PLS Pond, will be converted to evaporation cells for long-term passive management of draindown from the HLP. Based on results from the Heap Leach Draindown Estimator (HLDE) model, passive evaporation would begin eight years after the start of active evaporation. A description of a typical evaporation cell is provided in the Conceptual Closure Plan (**Appendix M**).

The Pollutant Management Area (PMA) and Discharge Impact Area (DIA) for the Copper World Project are presented in **Section 12** and detailed in **Appendix F.2** (Piteau, 2022b). Also see **Figures 36 and 37** for the PMA and DIA, respectively.

10.2.4 Raffinate Pond

The Raffinate Pond will contain solution recovered from the SX/EW process. This solution will be reconditioned by lowering the pH with the addition of sulfuric acid and then recycled to the heap leach. Makeup water to this circuit will come from the fresh water sources. The Raffinate Pond will be constructed to have a storage capacity below freeboard of 794,496 ft^3 (5.94 million gallons or 18.2 acre-feet) with a maximum depth to the pond crest of 24 feet. The pond is designed to contain 1) 24-hours flow from the plant, 2) 8-hours of operational flow, and 3) precipitation from a 100-year, 24-hour event.

A spillway will be constructed to the Reclaim Pond and to the Process Plant Stormwater Pond in case of upset conditions. The pond is constructed on an elevated platform in the Plant Site area. Outer embankments will be constructed to be no steeper that 2:1.

10.2.4.1 Solution Characterization

Both the raffinate solution and PLS solution are low pH sulfuric acid solutions. The raffinate solution is applied to the oxide ore on the HLP to dissolve the copper in the ore. Once the raffinate solution is applied to the ore and contains copper, it becomes PLS and is sent the SX/EW plant for processing. After the copper is removed from solution, the barren solution is sent to the Raffinate Pond where it is reconditioned with sulfuric acid to reduce the pH. Once reconditioned, the raffinate solution is reapplied to the material on the HLP. **Section 9.2.2** provides the anticipated chemistry of the leach solution.

10.2.4.2 Siting Considerations

Site characteristics were assessed during the geotechnical investigation by collecting geotechnical, geological, and hydrogeological data as outlined in the Geotechnical Site Investigation Memorandum (**Appendix I.6**). The geotechnical investigation included advancing borings and test pit excavations, field mapping, and sampling of potential borrow sources to support engineering analysis and provide foundation design recommendations.

The memorandum indicates that subgrade foundation materials throughout the site generally consist of competent rock overlain (in some areas) by weathered and altered rock which is covered by varying thicknesses of colluvium soils. Colluvium soils generally consisted of sands and gravels with small varying amounts of silt or clay, varying amounts of cobbles, boulders, highly to completely weathered rock, and moderate to slightly weathered rock. Considering the dense nature of the foundation materials, results of direct shear tests on remolded soil samples were used to represent both the foundation soil and embankment/structural fill.

Groundwater was recorded in several of the borings across the site ranging in depths from 59 to 84 ft bgs.

The Raffinate Pond is located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 2,475 years was selected for the Plant Site area ponds, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. With regard to the Raffinate Pond, no specific hazards were noted.

10.2.4.3 Design, Construction and Operations Considerations

Raffinate Pond Alternatives Considered for Discharge Control

Two alternative designs were considered as part of the BADCT analysis in addressing potential discharge from the Raffinate Pond facility. Each of the two alternatives, and the associated discharge, are described below. However, Alternative 2 is the selected design.

Alternative 1 - Geomembrane Liner on Native, Low Permeability Soil Underliner

The discharge from the bottom of a pond with a geomembrane liner above an underlying soil is controlled by the rate at which water leaks thorough the geomembrane into the underlying material.

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 1 assumed a prescriptive BADCT liner system consisting of a 60-mil HDPE geomembrane top liner, LCRS, 60-mil bottom liner, and 6-inches of compacted, low permeability soil.

The potential leakage rate (PLR) of solution through the bottom liner for this alternative was calculated at 13 gallons per year.

Alternative 2 - Geomembrane Liner on GCL Underliner

Discharge from the bottom of a pond with a geomembrane liner above a GCL is controlled by the rate at which water leaks thorough the geomembrane into the underlying GCL

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 2 assumed a liner system consisting of an 80-mil HDPE geomembrane top liner, LCRS, 80-mil HDPE bottom liner, a GCL, and 6-inches of prepared subgrade.

The PLR of solution through the bottom liner for this alternative was calculated at 0.25 gallons per year.

Selected Alternative - Geomembrane Liner on GCL Underliner

Alternative 2 is the selected design. Per R18-9-A202(A)(5)(a)(ii), a cost analysis of the alternatives was prepared. See Rosemont (2022g) in **Appendix I.11**.

Construction activities will conform to the permit, design drawings, specifications and other environmental and engineering related documents developed for the Project. Site preparation of the facility will include clearing and grubbing, removing unsuitable soils, compacting the foundation, and if necessary, placing structural fill to provide foundations for Project infrastructure. Subgrades will consist of, at minimum, six inches of native or natural materials compacted to 95% maximum dry density (standard Proctor; ASTM D-698) which is required to provide a firm base for the overlying materials.

The Raffinate Pond will be a double-lined facility with a Leak Collection and Recovery System (LCRS). The pond liner system will consist of the following:

- A prepared subgrade
- A GCL on the prepared subgrade
- An 80-mil HDPE secondary liner (bottom liner)
- A geogrid as part of the LCRS
- An 80-mil HDPE primary liner (top liner)

The bottom of the pond will be sloped at a 3% grade so leakage through the primary liner, which contacts the geogrid, preferentially flows to the LCRS sump where the solution can be detected and removed.

The bottom of the pond will be sloped at a 3% grade so leakage through the primary liner, which contacts the geogrid, preferentially flows to the LCRS sump where the solution can be detected and removed.

The lining system will be secured in an engineered anchor trench around the perimeter of the pond.

The top LSA of the raffinate Pond is 1.5 acres.

The inner lined slopes are 2.5:1. Outer embankment slopes would be no steeper than 2:1.

Freeboard is 2-feet. Depth of the pond is 24 feet to the crest.

The pond volume below freeboard is 18.2 acre-feet.

Alert Level 1 (AL1) for the Raffinate Pond was calculated to be 0.52 gal/min or 750 gal/day. AL2 was calculated to be 17 gal/min or 23,800 gal/day (see Wood [2022j in **Appendix H.1**).

Design drawings for the Raffinate Pond are provided in **Appendix I.10**. Additionally, the following design documents were prepared for the Raffinate Pond and are provided in **Appendix I**:

- Copper World Project – Stability Analyses on Primary Settling, Process Area Stormwater, Reclaim, and Raffinate Ponds Memorandum (Wood, 2022m) in **Appendix I.4.**

10.2.4.4 Stability

The Stability Analyses on Primary Settling, process Area Stormwater, Reclaim, and Raffinate Ponds Memorandum (**Appendix I.4**) provides stability analyses for the Plant Site area ponds. Based on the results of the analysis, the Plant Site area ponds meet the minimum static and pseudo-static FOS of 1.3 and 1.0, respectively. The summary and conclusion from the stability analysis are as follows:

- The critical failure surfaces and corresponding factors of safety for all cases associated with the Raffinate Pond cross-section are presented on **Figures B9 through B12** in **Appendix I.4**. The factors of safety are summarized in table below. The **Table 10.04** also provides the design criteria for comparison.

Table 10.04: Summary of Limit Equilibrium Stability Results – Raffinate Pond

Cross-section	Cross Section	Static Analyses		Min. BADCT Requirement, Static Analyses	Pseudo-static Analyses		Min. BADCT Requirement, Pseudo-static Analyses
		Failure Direction			Failure Direction		
		West-East	East-West		West-East	East-West	
Raffinate Pond	S2	1.9	1.8	1.3	1.7	1.6	1.0

10.2.4.5 Facility Inspection Criteria

As indicated in **Section 20**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14**, preliminary inspection and monitoring forms were prepared for the APP regulated facilities and are presented in **Appendix K**. These forms will be updated upon issuance of the APP for the Copper World Project.

Inspection of the Raffinate Pond will be conducted on the schedule as required by the APP. Inspections will include a visual observation of the ponds and checking the LCRS for the presence of fluid. Inspections will be recorded. The presence or absence of fluid in the LCRS will also be recorded and the volume of fluid removed. If fluid amounts exceed the action level, the ADEQ will be notified in accordance with the permit conditions. Inspection forms will be maintained on site and available for agency review.

Alert levels were calculated for leakage through the top liner reporting to the LCRS sump. Details on these alert levels are provided in **Appendix H.1** (Wood, 2022j). Alert Level 1 (AL1) for the Raffinate Pond was calculated to be 0.52 gal/min or 750 gal/day. AL2 was calculated to be 17 gal/min or 23,800 gal/day.

10.2.4.6 Surface Water Control

The Raffinate Pond is located on an elevated platform on the west side of the Plant Site area. Diversion channels will be constructed to direct stormwater runoff from within the plant area to the Process Area Stormwater Pond. Channels within the plant area will be designed for the 100-year, 24-hour event. Sumps may also be constructed in the plant area. Stormwater reporting to these sumps would be pumped to the Process Area Stormwater Pond

10.2.4.7 Closure/Post-Closure

The Raffinate Pond will be closed and reclaimed using BADCT prescriptive closure methods for Process Ponds as identified in the Arizona Mining Guidance Manual BADCT and in the Conceptual Closure Plan (**Appendix M**).

The Pollutant Management Area (PMA) and Discharge Impact Area (DIA) for the Copper World Project are presented in **Section 12.1** and detailed in **Appendix F.2** (Piteau, 2022b). Also see **Figures 36 and 37** for the PMA and DIA, respectively.

10.2.5 Reclaim Pond

The Reclaim Pond will be used to contain water reclaimed from the sulfide ore processing circuit. Water contained in the Reclaim Pond will be reused in the process circuit. The Reclaim Pond will be constructed to have a storage capacity below freeboard of 795,183 ft^3 (5.95 million gallons or 18.2 acre-feet) with a maximum depth to the pond crest of 24 feet. The pond is designed to contain 1) 24-hours of flow from the plant, 2) 8-hours of operational flow, and 3) precipitation from a 100-year, 24-hour event.

A spillway will be constructed to the Raffinate Pond and to the Process Plant Stormwater Pond in case of upset conditions. The pond is constructed on an elevated platform in the Plant Site area. Outer embankments will be constructed to be no steeper that 2:1.

10.2.5.1 Solution Characterization

The solution within the Reclaim Pond is anticipated to reflect that of tailings seepage. **Section 9.2.1** provides the anticipated chemistry of the tailings seepage solution.

10.2.5.2 Siting Considerations

Site characteristics were assessed during the geotechnical investigation by collecting geotechnical, geological, and hydrogeological data as outlined in the Geotechnical Site Investigation Memorandum (**Appendix I.6**). The geotechnical investigation included advancing borings and test pit excavations, field mapping, and sampling of potential borrow sources to support engineering analysis and provide foundation design recommendations.

The memorandum indicates that subgrade foundation materials throughout the site generally consist of competent rock overlain (in some areas) by weathered and altered rock which is covered by varying thicknesses of colluvium soils. Colluvium soils generally consisted of sands and gravels with small varying amounts of silt or clay, varying amounts of cobbles, boulders, highly to completely weathered rock, and moderate to slightly weathered rock. Considering the dense nature of the foundation materials, results of direct shear tests on remolded soil samples were used to represent both the foundation soil and embankment/structural fill.

Groundwater was recorded in several of the borings across the site ranging in depths from 59 to 84 ft bgs.

The Reclaim Pond is located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 2,475 years was selected for the Reclaim Pond, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. With regard to the Reclaim Pond, no specific hazards were noted.

10.2.5.3 Design, Construction and Operations Criteria

Reclaim Pond Alternatives Considered for Discharge Control

Two alternative designs were considered as part of the BADCT analysis in addressing potential discharge from the Reclaim Pond facility. Each of the two alternatives, and the associated discharge, are described below. However, Alternative 2 is the selected design.

Alternative 1 - Geomembrane Liner on Native, Low Permeability Soil Underliner

The discharge from the bottom of a pond with a geomembrane liner above an underlying soil is controlled by the rate at which water leaks thorough the geomembrane into the underlying material.

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 1 assumed a prescriptive BADCT liner system consisting of a 60-mil HDPE geomembrane top liner, LCRS, 60-mil bottom liner, and 6-inches of compacted, low permeability soil.

The potential leakage rate (PLR) of solution through the bottom liner for this alternative was calculated at 13 gallons per year.

Alternative 2 - Geomembrane Liner on GCL Underliner

Discharge from the bottom of a pond with a geomembrane liner above a GCL is controlled by the rate at which water leaks thorough the geomembrane into the underlying GCL

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3.** and presented in **Appendix H.1**. Alternative 2 assumed a liner system consisting of an 80-mil HDPE geomembrane top liner, LCRS, 80-mil HDPE bottom liner, a GCL, and 6-inches of prepared subgrade.

The PLR of solution through the bottom liner for this alternative was calculated at 0.25 gallons per year.

Selected Alternative - Geomembrane Liner on GCL Underliner

Alternative 2 is the selected design. Per R18-9-A202(A)(5)(a)(ii), a cost analysis of the alternatives was prepared. See Rosemont (2022g) in **Appendix I.11**.

Construction activities will conform to the permit, design drawings, specifications and other environmental and engineering related documents developed for the Project. Site preparation of the facility will include clearing and grubbing, removing unsuitable soils, compacting the foundation, and if necessary, placing structural fill to provide foundations for Project infrastructure. Subgrades will consist of, at minimum, six (6) inches of native or natural materials compacted to 95% maximum dry density (standard Proctor; ASTM D-698) which is required to provide a firm base for the overlying materials.

The Reclaim Pond will be a double-lined facility with a Leak Collection and Recovery System (LCRS). The pond liner system will consist of the following:

- A prepared subgrade
- A GCL on the prepared subgrade
- An 80-mil HDPE secondary liner (bottom liner)

- A geogrid as part of the LCRS
- An 80-mil HDPE primary liner (top liner)

The bottom of the pond will be sloped at a 3% grade so leakage through the primary liner, which contacts the geogrid, preferentially flows to the LCRS sump where the solution can be detected and removed.

The lining system will be secured in an engineered anchor trench around the perimeter of the pond.

The top LSA of the Reclaim Pond is 1.5 acres.

The inner lines slopes are 2.5:1. Outer embankment slopes would be 2:1.

Freeboard is 2-feet. Depth of pond is 24 feet to the crest.

The pond volume below freeboard is 18.2 acres-feet.

Alert Level 1 (AL1) for the Reclaim Pond was calculated to be 0.51 gal/min or 740 gal/day. AL2 was calculated to be 16 gal/min or 23,500 gal/day (see Wood [2022j] in **Appendix H.1**).

Design drawings for the Reclaim Pond are provided in **Appendix I.10**. Additionally, the following design documents were prepared for the Raffinate Pond and are provided in **Appendix I**:

- Copper World Project – Stability Analyses on Primary Settling, Process Area Stormwater, Reclaim, and Raffinate Ponds Memorandum (Wood, 2022m) in **Appendix I.4.**

10.2.5.4 Stability

The Stability Analysis on Primary Settling, Process Area Stormwater, Reclaim, and Raffinate Ponds Memorandum (**Appendix I.4**) provides stability analyses for the Plant Site area ponds. Based on the results of the analysis, the Plant Site area ponds meet the minimum static and pseudo-static FOS of 1.3 and 1.0, respectively. The summary and conclusion from the stability analysis are as follows:

- The critical failure surfaces and corresponding factors of safety for all cases associated with the Reclaim Pond cross-section are presented on **Figures B5 through B8** in **Appendix I.4**. The factors of safety are summarized in table below. The **Table 10.05** also provides the design criteria for comparison.

Table 10.05: Summary of Limit Equilibrium Stability Results – Reclaim Pond

Cross-section	Cross Section	Static Analyses		Min. BADCT Requirement, Static Analyses	Pseudo-static Analyses		Min. BADCT Requirement, Pseudo-static Analyses
		Failure Direction			Failure Direction		
		West-East	East-West		West-East	East-West	
Reclaim Pond	S2	1.8	1.8	1.3	1.6	1.6	1.0

10.2.5.5 Facility Inspection Criteria

As indicated in **Section 20**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14**, preliminary inspection and monitoring forms were prepared for the APP regulated facilities and are presented in **Appendix K**. These forms will be updated upon issuance of the APP for the Copper World Project.

Inspection of the Reclaim Pond will be conducted on the schedule as required by the APP. Inspections will include a visual observation of the ponds and checking the LCRS for the presence of fluid. Inspections will be recorded. The presence or absence of fluid in the LCRS will also be recorded and the volume of fluid removed. If fluid amounts exceed the action level, the ADEQ will be notified in accordance with the permit conditions. Inspection forms will be maintained on site and available for agency review.

Alert levels were calculated for leakage through the top liner reporting to the LCRS sump. Details on these alert levels are provided in **Appendix H.1** (Wood, 2022j). Alert Level 1 (AL1) for the Reclaim Pond was calculated to be 0.51 gal/min or 740 gal/day. AL2 was calculated to be 16 gal/min or 23,500 gal/day.

10.2.5.6 Surface Water Control

The Reclaim Pond is located on an elevated platform on the west side of the Plant Site area. Diversion channels will be constructed to direct stormwater runoff from within the plant area to the Process Area Stormwater Pond. Channels within the plant area will be designed for the 100-year, 24-hour event. Sumps may also be constructed in the plant area. Stormwater reporting to these sumps would be pumped to the Process Area Stormwater Pond.

10.2.5.7 Closure/Post-Closure

The Reclaim Pond will be closed and reclaimed using BADCT prescriptive closure methods for Process Ponds as identified in the Arizona Mining Guidance Manual BADCT and in the Conceptual Closure Plan (**Appendix M**) and summarized in **Section 16**.

The Pollutant Management Area (PMA) and Discharge Impact Area (DIA) for the Copper World Project are presented in **Section 12** and detailed in **Appendix F.2** in Piteau (2022b). Also see **Figures 36 and 37** for the PMA and DIA, respectively.

10.2.6 Process Area Stormwater Pond

The Process Area Stormwater Pond will be used to contain stormwater runoff that falls within the Plant Site area. This water will be considered contact water and will be used to provide make-up water for either the sulfide ore processing circuit (flotation) or oxide ore processing circuit (HLP and SX/EW) throughout the life of the mine. The Process Area Stormwater Pond will be constructed to have a storage capacity below freeboard of 819,881 ft^3 (6.13 million gallons or 18.8 acre-feet) with a maximum depth to the pond crest of 24 feet. The pond is designed to contain runoff within the Plant Site area from a 100-year, 24-hour storm event.

A spillway will be constructed to the Reclaim Pond and to the Raffinate Pond in case of upset conditions. The pond is constructed on an elevated platform in the Plant Site area. Outer embankments will be constructed to be no steeper that 2:1.

10.2.6.1 Solution Characterization

In general, the solution within the Process Area Stormwater Pond is anticipated to reflect that of tailings seepage. **Section 9.2.1** provides the anticipated chemistry of the tailings seepage solution. As noted above, raffinate solution could also be sent to the pond under upset conditions. **Section 9.2.2** provides the anticipated chemistry of the raffinate/leach solution.

10.2.6.2 Siting Considerations

Site characteristics were assessed during the geotechnical investigation by collecting geotechnical, geological, and hydrogeological data as outlined in the Geotechnical Site Investigation Memorandum (**Appendix I.6**. The geotechnical investigation included advancing borings and test pit excavations, field mapping, and sampling of potential borrow sources to support engineering analysis and provide foundation design recommendations.

The memorandum indicates that subgrade foundation materials throughout the site generally consist of competent rock overlain (in some areas) by weathered and altered rock which is covered by varying thicknesses of colluvium soils. Colluvium soils generally consisted of sands and gravels with small varying amounts of silt or clay, varying amounts of cobbles, boulders, highly to completely weathered rock, and moderate to slightly weathered rock. Considering the dense nature of the foundation materials, results of direct shear tests on remolded soil samples were used to represent both the foundation soil and embankment/structural fill.

Groundwater was recorded in several of the borings across the site ranging in depths from 59 to 84 ft bgs.

The Process Area Stormwater Pond is also located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 2,475 years was selected for the Plant Site area ponds, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. With regard to the Process Area Stormwater Pond, no specific hazards were noted.

10.2.6.3 Design, Construction and Operations Considerations

Process Area Stormwater Pond Alternatives Considered for Discharge Control

Two alternative designs were considered as part of the BADCT analysis in addressing potential discharge from the Process Area Stormwater Pond facility. Each of the two alternatives, and the associated discharge, are described below. However, Alternative 2 is the selected design.

Alternative 1 - Geomembrane Liner on Native, Prepared Subgrade

The discharge from the bottom of a pond with a geomembrane liner above an underlying soil is controlled by the rate at which water leaks thorough the geomembrane into the underlying material.

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 1 assumed a prescriptive BADCT liner system consisting of a 60-mil HDPE geomembrane top liner and six (6) inches of a prepared subgrade.

The potential leakage rate (PLR) of solution through the liner for this alternative was calculated at 177 gallons per day or 28,100 gallons per year. Note that the pond was considered full in the calculations. This is a conservative assumption, as the pond will only contain water for short periods of time during rain events or upset conditions. The PLR is therefore likely overstated as a result.

Alternative 2 - Geomembrane Liner on GCL Underliner

Discharge from the bottom of a pond with a geomembrane liner above a GCL is controlled by the rate at which water leaks thorough the geomembrane into the underlying GCL

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 2 assumed a liner system consisting of an 80-mil HDPE geomembrane, a GCL, and six (6) inches of prepared subgrade.

The PLR of solution through the liner for this alternative was calculated at 19 gallons per day or 7,000 gallons per year. Note that the pond was considered full in the calculations. This is a conservative assumption, as the pond will only contain water for short periods of time during rain events or upset conditions. The PLR is therefore likely overstated as a result.

Selected Alternative - Geomembrane Liner on GCL Underliner

Alternative 2 is the selected design. Per R18-9-A202(A)(5)(a)(ii), a cost analysis of the alternatives was prepared. See Rosemont (2022g) in **Appendix I.11**.

Construction activities will conform to the permit, design drawings, specifications and other environmental and engineering related documents developed for the Project. Site preparation of the facility will include clearing and grubbing, removing unsuitable soils, compacting the foundation, and if necessary, placing structural fill to provide foundations for Project infrastructure. Subgrades will consist of, at minimum, six (6) inches of native or natural materials compacted to 95% maximum dry density (standard Proctor; ASTM D-698) which is required to provide a firm base for the overlying materials.

The Process Area Stormwater Pond will single-lined. The pond liner system will consist of the following:

- A prepared subgrade
- A GCL on the prepared subgrade
- An 80-mil HDPE liner

The bottom of the pond would be sloped at 1% grade to one side in order to facilitate evacuation of the pond.

The lining system will be secured in an engineered anchor trench around the perimeter of the pond.

The top LSA of the Process Area Stormwater Pond is 1.5 acres.

The inner lines slopes are 2.5:1. Outer embankment slopes would be no steeper than 2:1.

Freeboard is 2-feet. Depth of the pond is 24 feet to the crest.

The pond volume below freeboard is 18.8 acre-feet.

Design drawings for the Process Area Stormwater Pond is provided in **Appendix I.10**. Additionally, the following design documents were prepared for the Process Area Stormwater Pond and are provided in **Appendix I**:

- Copper World Project – Stability Analyses on Primary Settling, Process Area Stormwater, Reclaim, and Raffinate Ponds Memorandum (Wood, 2022m) in **Appendix I.4.**

10.2.6.4 Stability

The Stability Analyses on Primary Settling, Process Area Stormwater, Reclaim, and Raffinate Ponds Memorandum (**Appendix I.4**) provides stability analyses for the Plant Site area ponds. Based on the results of the analysis, the Plant Site area ponds meet the minimum static and pseudo-static FOS of 1.3 and 1.0, respectively. The summary and conclusion from the stability analysis are as follows:

- The critical failure surfaces and corresponding factors of safety for all cases associated with the Process Area Stormwater Pond cross-section are presented on **Figures B1 through B4** in **Appendix I.4**. The factors of safety are summarized in table below. **Table 10.06** also provides the design criteria for comparison.

Table 10.06: Summary of Limit Equilibrium Stability Results – Process Area Stormwater Pond

Cross-section	Cross Section	Static Analyses		Min. BADCT Requirement, Static Analyses	Pseudo-static Analyses		Min. BADCT Requirement, Pseudo-static Analyses
		Failure Direction			Failure Direction		
		West-East	East-West		West-East	East-West	
Process Area Stormwater Pond	S1	1.9	1.8	1.3	1.7	1.6	1.0

10.2.6.5 Facility Inspection Criteria

As indicated in **Section 20**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14**, preliminary inspection and monitoring forms were prepared for the APP regulated facilities and are presented in **Section K**. These forms will be updated upon issuance of the APP for the Copper World Project.

Inspection of the Process Area Stormwater Pond will be conducted on the schedule as required by the APP. Inspections will include a visual observation of the ponds and liner integrity. Since the Process Area Stormwater Pond is single lined and does not have a LCRS, inspections will focus on signs of liner damage, or leaks when fluid is present. Inspection forms will be maintained on site and available for agency review.

10.2.6.6 Surface Water Control

The Process Area Stormwater Pond is located on an elevated platform on the west side of the Plant Site area. Diversion channels will be constructed to direct stormwater runoff from within the plant area to the Process Area Stormwater Pond. Channels within the plant area will be designed for the 100-year, 24-hour event. Sumps may also be constructed in the plant area. Stormwater reporting to these sumps would be pumped to the Process Area Stormwater Pond.

10.2.6.7 Closure/Post-Closure

The Process Area Stormwater Pond will be closed and reclaimed using BADCT prescriptive closure methods for Process Ponds as identified in the Arizona Mining Guidance Manual BADCT and in the Conceptual Closure Plan (**Appendix M**) and summarized in **Section 16.0**.

The Pollutant Management Area (PMA) and Discharge Impact Area (DIA) for the Copper World Project are presented in **Section 12** and detailed in **Appendix F.2** in Piteau (2022b). Also see **Figures 36 and 37** for the PMA and DIA, respectively.

10.2.7 Primary Settling Pond

The Primary Settling Pond will be used for storage of water reclaimed from both Tailing Storage Facilities (TSFs) and will also have a separate cell to contain the volume of the tailings thickener in the event of an upset condition.

The Primary Settling Pond and the thickener cell will be constructed to have a storage capacity below freeboard of approximately 1,877,283 ft^3 (14.04 million gallons or 43 acre-feet) and 333,018 ft^3 (2.49 million gallons or 7.6 acre-feet), respectively. The main section of the Primary Settling Pond will have a maximum depth to the pond crest of 20 feet while the thickener cell will have a maximum depth to the pond crest of 12 feet.

The main Primary Settling Pond section is sized to contain 24-hours of solution draindown from the TSFs and the precipitation from a 100-year, 24-hour storm event. The separate cell will be used to contain the contents of the tailings thickener in the event of upset conditions that require the thickener to be emptied. If the thickener contents are emptied into the cell, a clean-out ramp is designed to allow equipment access to remove the solids. The cell for the thickener material will have a 3-foot protective layer over the primary liner to allow rubber-tired equipment to access the pond without damaging the liner.

A spillway between the cells will be constructed to allow greater storage capacity, if needed, during upset conditions. Both ponds will have outer embankments constructed no steeper than 2:1.

10.2.7.1 Solution Characterization

The solution within the Primary Settling Pond is anticipated to reflect that of tailings seepage. **Section 9.2.1** provides the anticipated chemistry of the tailings seepage solution.

10.2.7.2 Siting Considerations

Site characteristics were assessed during the geotechnical investigation by collecting geotechnical, geological, and hydrogeological data as outlined in the Geotechnical Site Investigation Memorandum (**Appendix I.6**). The geotechnical investigation included advancing borings and test pit excavations, field mapping, and sampling of potential borrow sources to support engineering analysis and provide foundation design recommendations.

The memorandum indicates that subgrade foundation materials throughout the site generally consist of competent rock overlain (in some areas) by weathered and altered rock which is covered by varying thicknesses of colluvium soils. Colluvium soils generally consisted of sands and gravels with small varying amounts of silt or clay, varying amounts of cobbles, boulders, highly to completely weathered rock, and moderate to slightly weathered rock. Considering the dense nature of the foundation materials, results of direct shear tests on remolded soil samples were used to represent both the foundation soil and embankment/structural fill.

Groundwater was recorded in several of the borings across the site ranging in depths from 59 to 84 ft bgs.

The Primary Settling Pond is located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 2,475 years was selected for the Plant Site area ponds, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. With regard to the Primary Settling Pond, no specific hazards were noted.

10.2.7.3 Design, Construction and Operations Considerations

Primary Settling Pond Alternatives Considered for Discharge Control

Two alternative designs were considered as part of the BADCT analysis in addressing potential discharge from the Primary Settling Pond facility. Each of the two alternatives, and the associated discharge, are described below. However, Alternative 2 is the selected design.

Alternative 1 - Geomembrane Liner on Native, Low Permeability Soil Underliner

The discharge from the bottom of a pond with a geomembrane liner above an underlying soil is controlled by the rate at which water leaks thorough the geomembrane into the underlying material.

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 1 assumed a prescriptive BADCT liner system consisting of a 60-mil HDPE geomembrane top liner, LCRS, 60-mil bottom liner, and 6-inches of compacted, low permeability soil.

The potential leakage rate (PLR) of solution through the bottom liner for this alternative was calculated at 43 gallons per year.

Alternative 2 - Geomembrane Liner on GCL Underliner

Discharge from the bottom of a pond with a geomembrane liner above a GCL is controlled by the rate at which water leaks thorough the geomembrane into the underlying GCL

The leakage through the geomembrane liner was calculated using the approach described in **Section 9.1.3** and presented in **Appendix H.1**. Alternative 2 assumed a liner system consisting of an 80-mil HDPE geomembrane top liner, LCRS, 80-mil HDPE bottom liner, a GCL, and 6-inches of prepared subgrade.

The PLR of solution through the bottom liner for this alternative was calculated at 0.85 gallons per year.

Selected Alternative - Geomembrane Liner on GCL Underliner

Alternative 2 is the selected design. Per R18-9-A202(A)(5)(a)(ii), a cost analysis of the alternatives was prepared. See Rosemont (2022g) in **Appendix I.11**.

Construction activities will conform to the permit, design drawings, specifications and other environmental and engineering related documents developed for the Project. Site preparation of the facility will include clearing and grubbing, removing unsuitable soils, compacting the foundation, and if necessary, placing structural fill to provide foundations for Project infrastructure. Subgrades will consist of, at minimum, six inches of native or natural materials compacted to 95% maximum dry density (standard Proctor; ASTM D-698) which is required to provide a firm base for the overlying materials.

The Primary Settling Pond will be a double-lined facility with a Leak Collection and Recovery System (LCRS). The pond liner system will consist of the following:

- A prepared subgrade
- A GCL on the prepared subgrade
- An 80-mil HDPE secondary liner (bottom liner)
- A geogrid as part of the LCRS
- An 80-mil HDPE primary liner (top liner)

In addition to the above, the thickener cell with include following;

- A 3-foot protective layer over the primary (top) liner to allow rubber-tired equipment to access the pond without damaging the liner.

The bottom of each pond will be sloped at a 3% grade so leakage through the primary liner, which contacts the geogrid, preferentially flows to the LCRS sump where the solution can be detected and removed.

In addition to the LCRS, an underdrain will be installed under the pond liner system. Solution captured by the underdrain would report to the main Primary Settling Pond cell.

The lining system will be secured in an engineered anchor trench around the perimeter of the pond.

Inner lined slopes are 2.5:1. Outer embankment slopes are no steeper than 2:1.

The top LSA of the main Primary Setting Pond cell is 3.74 acres.

Freeboard is 2-feet. The depth of the main cell is 20 feet to the pond crest.

The volume of the main cell is below freeboard is 43 acre-feet.

The top LSA of the Thickener cell is 1.4 acres.

Freeboard is 2-feet. The depth of the Thickener cell is 12 feet to the pond crest.

The volume of the Thickener cell is below freeboard is 7.6 acre-feet

Alert Level 1 (AL1) for the main cell of the Primary Settling Pond was calculated to be 1.15 gal/min or 1,660 gal/day. AL2 was calculated to be 37 gal/min or 52,800 al/day. For the Thickener cell, AL1 was calculated to be 0.32 gal/min or 460 gal/day. AL2 was calculated to be 10 gal/min or 14,800 gal/day (see Wood [2022j] in **Appendix H.1**).

Design drawings for the Primary Settling Pond are provided in **Appendix I.10**. Additionally, the following design documents were prepared for the Primary Settling Pond and provided in **Appendix I**:

- Copper World Project – Stability Analyses on Primary Settling, Process Area Stormwater, Reclaim, and Raffinate Ponds Memorandum (Wood, 2022m) in **Appendix I.4.**

10.2.7.4 Stability

The Stability Analyses on Primary Settling, Process Area Stormwater, Reclaim, and Raffinate Ponds Memorandum (**Appendix I.4**) provides stability analyses for the Plant Site area ponds. Based on the results of the analysis, the Plant Site area ponds meet the minimum static and pseudo-static FOS of 1.3 and 1.0, respectively. The summary and conclusion from the stability analysis are as follows:

- The critical failure surfaces and corresponding factors of safety for all cases associated with the Primary Settling Pond cross-section are presented on **Figures B13 through B16** in **Appendix I.4.** The factors of safety are summarized in table below. The **Table 10.07** also provides the design criteria for comparison.

Table 10.07: Summary of Limit Equilibrium Stability Results – Primary Settling Pond

Cross-section	Cross Section	Static Analyses		Min. BADCT Requirement, Static Analyses	Pseudo-static Analyses		Min. BADCT Requirement, Pseudo-static Analyses
		Failure Direction			Failure Direction		
		West-East	East-West		West-East	East-West	
Primary Settling Pond	S1	2.2	2.2	1.3	1.9	1.9	1.0

10.2.7.5 Facility Inspection Criteria

As indicated in **Section 20**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14**, preliminary inspection and monitoring forms were prepared for the APP regulated facilities and are presented in **Section K**. These forms will be updated upon issuance of the APP for the Copper World Project.

Inspection of the Primary Settling Pond will be conducted on the schedule as required by the APP. Inspections will include a visual observation of the ponds and checking the LCRS for the presence of fluid. Inspections will be recorded. The presence or absence of fluid in the LCRS will also be recorded and the volume of fluid removed. If fluid amounts exceed the action level, the ADEQ will be notified in accordance with the permit conditions. Inspection forms will be maintained on site and available for agency review.

Alert levels were calculated for leakage through the top liner reporting to the LCRS sump. Details on these alert levels are provided in **Appendix H.1** (Wood, 2022j). Alert Level 1 (AL1) for the main cell of the Primary Settling Pond was calculated to be 1.15 gal/min or 1,660 gal/day. AL2 was calculated to be 37 gal/min or 52,800 al/day. For the Thickener Cell, AL1 was calculated to be 0.32 gal/min or 460 gal/day. AL2 was calculated to be 10 gal/min or 14,800 gal/day.

10.2.7.6 Surface Water Control

Upgradient stormwater diversion channels will be constructed as needed. Additionally, the HLF and TSF-2 are located upgradient of the pond; thus minimizing the potential for stormwater run-on.

10.2.7.7 Closure/Post-Closure

The Primary Settling Pond will be used during the active evaporation phase of closure of TSF-1 and TSF-2. During closure of the TSFs, draindown from the two TSFs will be pumped to the Primary Settling Pond and then pumped to snow makers or other devices on the top of the TSFs to enhance evaporation of solution. Once the draindown of solution is low enough to be managed through passive treatment cells, the Primary Settling Pond will be closed and reclaimed. Closure of the pond will be completed using the BADCT prescriptive methods identified in the Arizona Mining Guidance Manual BADCT for process ponds and in the Conceptual Closure Plan (**Appendix M**) and summarized in **Section 16**.

The Pollutant Management Area (PMA) and Discharge Impact Area (DIA) for the Copper World Project are presented in **Section 12.1** and detailed in **Appendix F.2** in Piteau (2022b). Also see **Figures 36 and 37** for the PMA and DIA, respectively.

10.3 FACILITIES WITHOUT ESTABLISHED PRESCRIPTIVE BADCT

ADEQ has not developed prescriptive BADCT for the following Copper World Project facilities:

- Waste Rock
- Open Pits

10.3.1 Waste Rock

Rock excavated from pits that has concentrations of metals that are too low to be economically processed as ore will be managed as waste rock. Some waste rock will be used as fill material for constructing mine facilities, such as a base for the HLP processing facilities, and mine roads, during the pre-mining phase and first 6 years of the 15-year operating period. Waste rock will be placed in the main Waste Rock Facility (WRF) beginning in operating Year 4.

Waste rock will be used to backfill in three (3) of the five (5) Satellite pits: Heavy Weight, Copper World, and Broadtop Butte. Mining will generally progress from west to east, beginning with the Peach and Elgin pits and ending with the Rosemont Pit. Similarly, backfilling mined-out pits with waste rock will also progress generally from west to east, from the Heavy Weight Pit to the Broadtop Butte Pit. The Peach and Elgin pits – the westernmost of the Satellite pits – will not be backfilled with waste rock.

Waste rock in excess of the volume needed to backfill the three (3) pits will be managed by placing waste rock in the WRF laterally beyond the footprint of the pits and vertically above the pit rim elevations. **Figure 3** shows the WRF and other planned mine features.

A total of about 477.4 million tons of waste rock will be excavated and placed within the main WRF or other areas where fill is required. Approximately 85 percent is from the Rosemont Pit, 9 percent from the Broadtop Butte Pit, and the remainder from the Copper World, Heavy Weight, Elgin, and Peach pits. Hence the characteristics of rock from the Rosemont Pit will dominate the characteristics of the WRF. The waste rock tonnages from each pit are summarized below:

- Peach-Elgin pits: 4.4 Mt
- Heavy Weight Pit: 6.1 Mt
- Copper World Pit: 13.3 Mt

- Broadtop Butte Pit: 43.1 Mt
- Rosemont Pit: 410.5 Mt

10.3.1.1 Waste Rock Characterization

Samples of waste rock from the Rosemont Pit and the Satellite pits were characterized to evaluate their potential to generate or neutralize acid, and to leach metals. An extensive characterization of waste rock from the Rosemont Pit was completed as part of the Rosemont Copper Project. The rock types that will be mined from the Satellite pits will also be mined from the Rosemont Pit, and therefore the waste rock characterization results for the Rosemont Pit were extrapolated to the Satellite pits.

Characterization of the waste rock was summarized in **Section 8.4**. Details are provided in the report titled the Copper World Project Geochemical Impacts Assessment (Piteau, 2022c) provided in **Appendix G.1**. Additional characterization of materials to be mined from the Satellite pits is provided in the memorandum titled Supplemental Geochemical Samples for Copper World Project (Piteau, 2022d) in **Appendix G.2**. In summary, based on characterization of Rosemont Pit and Satellite pit rocks, little of the waste rock is expected to generate acid. Carbonate rocks that have substantial acid neutralizing capacity comprise a substantial fraction of the waste rock. Seepage, if it does develop, is not expected to exceed AWQS. **Section 7.5** described the pore water chemistry that is likely to developed within the backfilled pits. Although some constituents may become elevated above AWQS in the backfill, modeling has indicated that these constituents are unlikely to migrate outside of the PMA within the 200-year model duration (see **Section 7.5** and **Appendix F.2**). In summary, WRF is unlikely to generate ARD.

The Waste Rock Handling Plan, provided in **Appendix G.3**, and described in **Section 8.7**, provides additional details on the placement of waste rock within the WRF with regard to materials classified as non-acid generating (NAG), potentially acid-generating (PAG) and acid-generating (AG). In general, NAG materials will be places on the outer slopes of the WRF while Pag Materials will be placed to the interior. AG materials will be encapsulated with NAG materials.

10.3.1.2 Siting Considerations

The location of the WRF is based on the proximity of the six (6) open pits and the operational considerations of handling the material. Operational considerations include available locations to place materials, the distance from the source (pits), and any other management criteria such as placement restrictions based on the waste rock classification and Waste Rock Handling Plan.

Mining will progress generally west to east and thus waste rock management areas will also be developed generally west to east. The WRF will be generally as follows. Operating Years 1-3: none (waste rock used as construction material)

- Operating Years 1-3: none (waste rock used as construction material)
- Operating Years 4-7: waste rock placement adjacent to Elgin, Heavy Weight, Copper World, and Rosemont pits
- Operating Years 7-14: placement in Heavy Weight Pit and adjacent area
- Operating Years 8-15: placement in Copper World Pit and adjacent area
- Operating Years 10-15: placement in Broadtop Butte Pit and adjacent area

The depth to water measured at 20 monitoring locations in the Heavy Weight Pit, Copper World Pit and WRF area ranged from 31 to 422 ft bgs.

The depth to water measured at four (4) monitoring locations in the Broadtop Butte Pit and WRF area ranged from 194 to 513 ft bgs.

The WRF is located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 2,475 years was selected for the WRF, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. Rockfall hazards were identified in portions of the pit downslope of areas where rock is exposed on relatively steep slopes above a pit. These hazards would also apply to the WRF that incorporates these pits. remnants of previous mining activities present a hazard across much of the Project area, including the WRF. These remnants include prospect pits, open mine pits, shafts, adits, underground workings extending from shafts and adits, and waste rock piles. Although limestone is present in the Project area, the risk for karst features to affect Project activities is low.

Seismic hazards are discussed in **Section 3.5** and in greater detail in **Appendix B.3**. The Project site is in a geographical province characterized by relatively few late Quaternary surface fault traces and low rates of seismicity. The risk of surface fault rupture to directly impact the facilities is considered low. Ground motion hazard results have been used in the design of the facilities at the Project, including pit and waste rock slopes. Flooding, existing landslides, expansive soils, and erosion are considered relatively low potential risks.

The Waste Rock Handling Plan provided in **Appendix G.3** provides details on waste rock management.

10.3.1.3 Design, Construction and Operations Considerations

Site Preparation

Site preparation WRF will occur in conjunction with development of the open pit areas. Site preparation for the WRF facility areas outside the pit limits will depend on site specific circumstances. Site preparation of areas interior to the facility may be limited whereas outer embankment areas would be cleared of vegetation and other deleterious materials. Site preparation in those areas may also consist of roller-compacting the foundation soils.

Waste rock will be placed by off-highway haul trucks. Material will be end-dumped and graded (pushed) with dozers or other conventional earthmoving equipment to facilitate subsequent access by the haul trucks. Pits will be backfilled by end-dumping waste rock at the bottom of pits, which will be accessed using the pit haul roads constructed during the mining phase, and/or dumping rock near the pit rim and pushing it into the pit using dozers.

Pit dewatering and/or stormwater management from pit sumps will cease at or soon after the end of mining at a given pit. After dewatering ends, the groundwater level will recover and rise above the elevation of the bottom of the pit. The duration of dewatering, or other water management requirements, will depend on operational needs to facilitate placement of waste rock within the pit bottoms.

The main WRF covers about 725 acres in two distinct areas (west portion and an east portion).

Approximately 477 million tons will be mine from all six (6) pits. However, the main WRF has been designed to accommodate up to 528 million tons of material.

The top elevation of the west portion ranges from 5,300 ft amsl to 5,400 ft amsl with an overall maximum slope height of about 900 feet. The top elevation of the east portion ranges from 5,600 ft amsl to 5,700 ft amsl with an overall maximum slope height of 400 feet.

The overall slope angle will be 2.2:1.

Waste rock will be placed with the WRF in accordance with the Waste Rock Handling Plan (Rosemont, 2022a).

Design drawings for the WRF are provided in **Appendix I.10**. Additionally, the following design documents were prepared for the WRF are provided in **Appendix I**:

- Stability Analysis Memorandum – Waste Rock Facility (Wood, 2021b) in **Appendix I.3**

10.3.1.4 Stability

The Waste Rock Facility Stability Analysis Memorandum (**Appendix I.3**) shows that the WRF meets the minimum static and pseudo-static FOS of 1.3 and 1.0, respectively. The summary and conclusion from the stability analysis are as follows:

- The critical failure surfaces and corresponding factors of safety for static stability for all WRF cross-sections are presented on Figure 3 through Figure 8 in **Appendix I.3**. The factors of safety are summarized in **Table 10.08** below. **Table 10.08** also provides the design criteria for comparison. All factors of safety exceed the minimum design criteria for static and pseudo-static conditions.

Table 10.08: Summary of Limit Equilibrium Stability Results – WRF

Cross-section	Direction	Static Analyses	Min. BADCT Requirement, Static Analyses	Pseudo-static Analyses	Min. BADCT Requirement, Pseudo-static Analyses
		Circular Slip Surfaces			
WRF01	Downgradient	1.44	1.3	1.31	1.0
WRF02	Downgradient	1.36		1.24	
WRF03	Downgradient	1.59		1.44	

10.3.1.5 Facility Inspection Criteria

As indicated in **Section 20.0**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14.0**, preliminary inspection and monitoring forms were prepared for the APP regulated facilities and are presented in **Section K**. These forms will be updated upon issuance of the APP for the Copper World Project.

Inspection of the WRF will be conducted on the schedule as required by the APP. Inspections will include a visual observation of the WRF and checking for sloughing or other instability. Inspections will be recorded. If any action conditions are exceeded, the ADEQ will be notified in accordance with the permit conditions. Inspection forms will be maintained on site and available for agency review.

10.3.1.6 Surface Water Control

Stormwater runoff from the WRF will be routed off the facility and into natural drainages. Stormwater will be routed through sediment basins where sediments will drop out. Although the waste rock will be placed at final grades, as needed grading will be performed in order to route stormwater to the basins. **Section 6.4** and the Site Water Management Plan (Wood, 2022g) describes the management of stormwater during operations and at closure. The Site Water Management Plan is presented in **Appendix E**.

10.3.1.7 Closure/Post-Closure

Closure of the WRF will consist of grading to promote stormwater runoff from of the slopes and benches and managing sediment in the runoff through the use of sediment basins. The sediment basins constructed during operations will continue to serve the same purpose in closure.

Testing of the waste rock has shown that the majority of waste rock is acid neutralizing, thus the generation low pH water with elevated metals is not anticipated. The waste rock will be revegetated directly without the placement of a soil cover.

Post-closure monitoring will consist of a minimum of five years of vegetation and erosion control monitoring of the WRF. In addition to reclamation monitoring, stormwater monitoring will be conducted per the Project's stormwater permit. POC well monitoring will also be conducted.

The Pollutant Management Area (PMA) and Discharge Impact Area (DIA) for the Copper World Project are presented in **Section 12** and detailed in **Appendix F.2**. Also see **Figures 36 and 37** for the PMA and DIA, respectively.

10.3.2 Open Pits

Oxide ore and sulfide ore will be mined using open-pit methods. Six (6) pits will be operated during the life of the Project. The Rosemont Pit is the largest and deepest pit of the six (6) pits and is located on the east side of the Santa Rita Mountain Range. The remaining pits, referred to as the Satellite pits, are the Broadtop Butte Pit, Copper World Pit, Heavy Weight Pit, Elgin Pit, and the Peach Pit, which are primarily located on the west side of the Santa Rita Mountain Range. The locations of the pits and other mine facilities are shown on **Figure 3**.

10.3.2.1 Siting Considerations

The location of the pits is dictated by the location of ore bodies, property boundaries, and geotechnical stability of pit slopes. A geologic model was developed for the Project based on geologic mapping and subsurface characterization. The geologic model is the basis for the selected open pit locations.

The Rosemont Pit is located on the eastern flanks of the Santa Rita Mountain Range. Its footprint is approximately 467 acres, and the maximum depth from the highest point on the rim to the final pit bottom is 1,850 feet. The Broadtop Butte Pit is north of and adjacent to the Rosemont Pit and straddles the ridgeline of the Santa Rita Mountains. The footprint is approximately 165 acres, and the maximum depth is 1,150 feet. The Copper World Pit is northwest of the Broadtop Butte Pit, generally on the southern slope of unnamed peaks. It has an area of 57 acres and a total depth of 750 feet. The Heavy Weight Pit is west of the Copper World Pit and is also on the southern slope of unnamed peaks. It has an area of 38 acres and a total depth of 750 feet. The Elgin Pit is southwest of the Heavy Weight pit on the southern slopes of unnamed pits. It has an area of 41 acres and a maximum depth of 400 feet. The Peach Pit is located on Peach Knob. It has an area of 64 acres and a maximum depth of 700 feet.

The pits are located generally on relatively high terrain, and none intersect perennial surface water bodies. At most locations, the terrain slopes away from the rim of each pit, such that surface runoff naturally flows away from most of the perimeter of each pit. Runoff diversion in areas where the terrain slopes toward a pit is discussed below.

Runoff from the eastern portion of the Project area, including the Rosemont Pit and the eastern portion of the Broadtop Butte Pit, will flow to the Wasp Canyon and Barrel Canyon drainages, which are ephemeral drainages. Runoff from the area west of the ridgeline of the Santa Rita Mountains, including the area from the west side of the Broadtop Butte Pit to the Peach Pit, will flow to unnamed ephemeral drainages that drain west. Additional information regarding site surface water hydrology is provided in **Appendix B.2** – Surface Water Management Plan and in Rosemont Copper World Project Baseline and Final Configuration Hydrology (Bowman, 2022).

Geologic hazards in the Project area are discussed in detail in the Preliminary Geologic Hazard Assessment (Wood, 2022b) provided in **Appendix B.1**. Rockfall hazards were identified in portions of the pit downslope areas where rock is exposed on relatively steep slopes above a pit. Remnants of previous mining activities present a hazard across much of the Project area, including the open pits. These remnants include prospect pits, open mine pits, shafts, adits, underground workings extending from shafts and adits, and waste rock. Although limestone is present in the Project area, the risk for karst features to affect Project activities is low. Seismic hazards are discussed in greater detail in the Site-Specific Seismic Hazard Analysis (LCI, 2022), provided in **Appendix B.3**.

The Project site is in a geographical province characterized by relatively few late Quaternary surface fault traces and low rates of seismicity. The risk of surface fault rupture to directly impact the facilities is considered low. Ground motion hazard results have been used in the design of the facilities at the Project, including pit slopes. Flooding, existing landslides, expansive soils, and erosion are considered relatively low potential risks.

10.3.2.2 Design, Construction and Operations Considerations

The Rosemont Pit and Satellite pits are designed to maximize the extraction of oxide and sulfide ores subject to constraints of property boundaries, mining economics, and engineering considerations. The construction schedule for the Project includes two (2) years of pre-mining site preparation and facility construction followed by a 15-year operational mine life, and two (2) years of site closure. Tonnages mined from each of the open pits were summarized in **Section 8.0**. Both oxide and sulfide ore will be mined and processed. A total of approximately 104 million tons of oxide ore, 277 million tons of sulfide ore, and 477 million tons of waste rock will be mined. Waste rock mined in the first six (6) years will generally be used as construction fill material such as for haul roads and a base for the HLP. Waste rock will be placed in the main WRF beginning in operations year 4.

During the pre-mining phase, site preparation will include as needed clearing and grubbing and soil stockpiling. As much as practicable, diversion channels will be constructed to divert stormwater away from pit areas. Site water management details are summarized in **Section 6.4** and provided in **Appendix E**.

Captured runoff, precipitation that falls directly in a pit, and groundwater seeping into the pit can be used for dust control within the pit shells or pumped to the process water circuit.

Pit dewatering wells will be installed as needed to provide dry working conditions and reduce pore pressures in order to increase the FOS of a slope against failure. Groundwater pumped from the wells on the west side of the Santa Rita Mountains can be used for general dust control or pumped to the process circuit. Dewatering water from the Rosemont Pit can be used for general dust control, with the excess released into natural drainages downgradient of the Rosemont Pit. Pit dewatering rates were assumed in the groundwater model developed for the Project (**Appendix F.2**). However, pit dewatering wells are only anticipated for the Rosemont Pit.

The slope design for the previous Rosemont Pit configuration associated with the Rosemont Copper Project was reviewed and updated to consider the revised pit configuration. The slopes for the Satellite pits were designed based on the recent geologic and geotechnical characterization program. The Pit Slope Design Study in **Appendix I.5** provides a detailed description of the geotechnical data and the pit slope design. The pit slopes are designed with 50- and 100-foot-high benches to accommodate mining ore in 50-foot increments. The Rosemont Pit slope designs achieved a FOS ranging from 1.23 (for a slope in relatively weak Gila Conglomerate and arkose) to 1.70. These factors exceed the required value of 1.2 specified in Project Design Criteria (**Appendix B.4**). For the Satellite pits, the FOS for different slopes range from 1.46 to 4.19, again exceeding the required value. Recommended slope geometry values (inter-ramp slope angle, overall slope angle, bench height) for the Rosemont and Satellite pits are provided in **Appendix I.5**. The recommended overall slope angles in various portions of the Rosemont Pit range from 33 to 44 degrees and from 40 to 45 degrees for the Satellite pits. FOS vales are summarized in **Section 10.3.2.3** below.

During the operational phase, waste rock, oxide ore, and sulfide ore will be blasted, excavated in 50-foot benches using hydraulic shovels, and transported using 240-ton off-highway haul trucks. Haul roads in each pit, and haul roads connecting the pits to other site areas, will be constructed as needed. A portion of the mined waste rock will be used as construction fill material and the remainder will placed in the main WRF. The Waste Rock Handling Plan in **Appendix G.3** provides information on the placement criteria regarding different classifications of waste rock.

Both oxide and sulfide ore will be mined. Some of the oxide ore will be placed on the HLP as run-of-mine (ROM) material. A portion of the oxide ore will be hauled to the oxide primary crusher for size reduction. The crushed and agglomerated oxide ore will be conveyed to the HLP. Both the ROM and crushed ore will be leached using a dilute sulfuric acid solution.

Sulfide ore will be hauled to the primary crusher for size reduction. Crushed ore will be conveyed to the process area for grinding, followed by separation of target minerals using a flotation process. Concentrate from the flotation process may be shipped off-site for additional processing or treated on-site in a concentrate leach circuit. Tailings from the flotation process will be pumped as a slurry to the TSFs.

10.3.2.3 Stability

The Pre-Feasibility Level Pit Slope Design Study (**Appendix I.5**) indicates that limit equilibrium slope stability analyses were performed to calculate the FOS for overall slope stability. As a part of the design acceptance criteria (DAC), CNI (2016) used a minimum acceptable FOS of 1.2 for the Rosemont Pit. Since the stripping ratios of the Satellites pits are low, and mining will occur simultaneously in multiples pits, the economic consequences of slope instability or step-outs in the planned multi-pit Satellite pit operations are relatively low. Additionally, since critical facilities are not expected to be located within the pits or close to the pit crests, a design FOS of 1.2 is considered appropriate against large-scale instability. The summary and conclusion from the stability analysis are as follows:

- The cross-sections selected at locations representative of the overall slope height and lithology of the Rosemont Pit are presented on Figure 2 in **Appendix I.5**. **Table 10.09** provides a summary of the slope stability analyses for the Rosemont Pit.

Table 10.09: Summary of Slope Stability Analyses – Rosemont Pit

Cross-section	Analysis	Factor of Safety	Slope Height (feet)	Inter-ramp slope Angle (degree)*	Overall Slope Angle (degree)
R1	Overall	1.41	1,840	43/46	41
R2	Overall	1.70	1,050	44	42
R3	Weak Arkose	1.35	735	39	39
	Overall	1.65	1,145	44/39	33
R4	Gila/Arkose	1.23	525	39	36
	Overall	1.26	1,485	47	40
R5	Overall	1.38	1,815	47	44
R6A	Backbone Fault	1.31	1,720	46	43
	Precambrian Unconformity	1.40	1,720	46	43

Note:

(*) Upper and lower inter-ramp lope angle shown where a haul road or step out decouple the slope

- Seven (7) cross-sections were selected at locations representative of overall slope height and lithology for the Satellite pits. Rock mass stability analyses in the Satellite pits indicate high factors of safety for deep-seated shear through rock mass; therefore, rock mass strength is not indicated to be a control of overall stability. Where slope designs are not limited by large-scale stability, they will be limited by a bench configuration that can be reliably and safely achieved. The cross-sections selected at locations representative of overall slope height and lithology of the Satellite pits are presented on **Figure 3 through Figure 5** in **Appendix I.5**. **Table 10.10** provides a summary of the results of the Satellite pit slope stability analyses.

Table 10.10: Summary of Slope Stability Analyses – Satellite Pits

Cross-section	Analysis	Factor of Safety	Slope Height (feet)	Inter-ramp slope Angle (degree)	Overall Slope Angle (degree)
PE1	Overall	2.92	680	45	45
HW1	Overall	3.10	725	45	45
	Helvetia Thrust (fault strength)	1.46	725	45	45
CW1E	Overall	2.80	525	45	45
CW1W	Leader Fault	1.71	475	45	45
CW2	Overall	3.20	575	45	40
BTB1A	Overall	3.91	625	45	40
BTB2A	Overall	4.19	490	45	41
BTB3A	Overall	1.74	800	45	45

10.3.2.4 Facility Inspection Criteria

As indicated in **Section 20.0**, an Operations, Monitoring, and Maintenance Manual (O&M Manual) will be prepared for APP regulated facilities prior to operations. Additionally, and per **Section 14.0**, preliminary inspection and monitoring forms were prepared for most the APP regulated facilities and are presented in **Section K**. Development of pit monitoring requirements will be based on requirements of the APP issued for the Copper World Project.

Inspection of the pits will be conducted on the schedule as required by the APP. Inspections are anticipated to include a visual observation of the pit slopes and checking for instability. Inspections will be recorded. If any action conditions are exceeded, the ADEQ will be notified in accordance with the permit. Inspection forms will be maintained on site and available for agency review.

10.3.2.5 Surface Water Control

Stormwater runoff from areas upgradient of the open pits will be routed away from the pits to the extent practicable. Groundwater inflow and stormwater within the pit shells will be managed as process water and pumped from pit sumps to the process circuit. Water management details are provided in the Site Water Management Plan is presented in **Appendix E** and summarized in **Section 6.0**.

10.3.2.6 Closure/Post-Closure

The Rosemont, Peach, and Elgin pits will remain as open pits following mine closure. The remaining pits (Broadtop Butte, Copper World, and Heavy Weight pits) will be backfilled with waste rock and incorporated in the WRF. The disturbed areas adjacent to the Rosemont, Peach, and Elgin pits will be ripped to loosen the compacted material and seeded with native species. Stormwater channels will be constructed, as practicable, to divert remaining stormwater runoff away from the pits. In addition to the perimeter boundary fencing, the interior perimeter of the remaining open pits will be fenced, and warning signs posted.

At closure, dewatering and other pit sump water management will cease. Water levels will recover, and pit lakes will form in all three (3) of the pits that remain open. Backfill in the remaining pits will become saturated.

The Rosemont Pit will have the largest and deepest pit lake. The water level in the lake will be controlled by the rate of groundwater inflow, direct precipitation in the pit, and water loss by evaporation from the pit lake surface. The predicted pit lake elevation 200-years post-closure is about 4,253 ft amsl. Based on the expected groundwater inflows and the high evaporation rate, the Rosemont pit lake is predicted to be a strong groundwater sink. As such, the Rosemont Pit is not considered an APP regulated facility. Details of the groundwater flow model for the Copper World Project is provided in **Section 7.5** and in **Appendix F.2** (Piteau, 2022b).

The anticipated chemistry of the pit lake water or pore water in the backfilled pits is summarized in **Section 9.2** and provided in detail in **Appendix G.1**. As noted in **Section 7.4** and in Piteau (2022b), model results generally indicate that flows are very small with regard to the Backfilled pits with minor outward seepage, and likely unmeasurable in the field, i.e., the magnitude of these flows are lower than the resolution capabilities of the model.

Post-closure monitoring will include water levels in the pit lakes and at POC wells or at other monitoring locations to provide a basis for evaluating the status of the pit lakes as flow-through or terminal pit lakes. Water quality in the pit lakes will be periodically monitored. See **Section 14.0**.

With regard to the placement of waste rock within the Heavy Weight, Copper World and Broadtop Butte pits, NAG materials will preferentially be placed below the water recovery level.

10.4 FACILITIES DESIGNED USING INDIVIDUAL BADCT

Individual BADCT demonstrations have been prepared for the following APP facilities associated with the Copper World Project:

- Tailings Storage Facilities

10.4.1 Tailings Storage Facilities

This section presents the BADCT evaluation for the proposed tailings facilities, TSF-1 and TSF-2. The individual BADCT approach is used for the two (2) Copper World Project TSFs. The individual BADCT approach for base metal tailings impoundments is described in the ADEQ Mining BADCT Guidance Manual (ADEQ, 2004). The individual BADCT process is performance based, with no pre-approved prescribed design.

For this process, a reference design was established that incorporated a combination of demonstrated control technologies (DCTs) appropriate for the site. The aquifer loading potential for the reference design was then evaluated against alternative designs. The design resulting in the greatest practical reduction of pollutant loading to the aquifer, as compared to the reference design, was selected as the BADCT design. The development of individual BADCT components may be based on considerations such as waste characteristics, site-specific characteristics (hydrology, hydrogeology, etc.), design measures, operational features, and closure methodology.

The DCT process and operational methods considered in the BADCT evaluation for the tailings facilities included the following:

- Surface water control (upgradient diversion stormwater channels and collection galleries, run-on redirection and run-off control measures).
- Slime sealing of the facility base resulting from the tailings process and placement method.
- Modeled and designed seepage collection systems.
- Minimization of reclaim “decant” pond area(s).
- Localized engineered containment.

10.4.1.1 Solution and Waste Characterization

During the life of the Copper World Project, approximately 277 million tons of sulfide ore will be processed, which will create approximately 277 million tons of tailings. The Copper World TSFs have been designed to contain the total predicted tailings volume. TSF-1 is designed with a capacity of approximately 231 million tons and TSF-2 has a design capacity of about 47 million tons.

Tailings consist of finely ground spent ore from the sulfide flotation circuits. Typically, the tailings particle size ranges from sand to silt. Following ore processing, the tailings are sent to cyclones to separate the sand fraction from the smaller particle sizes (slimes). The sand fraction is then used in construction of the TSF embankments. The remaining tailings fractions are deposited within the interior of the TSFs.

The solution portion of the tailings is approximately 31% by weight. During cycloning, approximately 12 percent of the solution is lost to the environment (evaporation or seepage) or is entrained within the sand fraction. The remaining solution (88 percent) is either 1) contained with the slimes that is deposited within the TSFs, 2) lost to evaporation while on the surface of the tailings and in the decant pool, 3) reclaimed from the decant pool and pumped to the Primary Settling Pond for reuse in the process, or 4) infiltrates into the tailings material and results in seepage at the bottom of the TSFs. The majority of seepage will be collected in the seepage collection system and seepage collection trenches and pumped to the Primary Settling Pond for reuse in the process circuit. The small fraction of solution that bypasses the seepage collection system would discharge to the alluvium and into the bedrock system.

Solution that bypasses the seepage collection system is expected to have elevated levels of sulfate and TDS that exceed EPA non-enforceable secondary MCLs, but not exceed any numeric AWQS (Piteau, 2022c). **Section 9.2.1** provides the anticipated chemistry of the tailings seepage solution.

10.4.1.2 Siting Considerations

The site-specific characteristics considered in the BADCT evaluation include the following:

- Foundation bedrock coverage with low hydraulic conductivity underneath relatively shallow veneer alluvial/colluvial materials, also referred to as a “geologic liner”;
- Relatively shallow pronounced alluvium drainages; and
- Relatively low amounts of precipitation and large net evaporation rates.

Site characteristics were assessed during a geotechnical investigation program comprised of test pits and drill holes, and laboratory and in-situ testing completed by Wood as outlined in the Geotechnical Site Investigation Memorandum (Wood, 2021c) provided in **Appendix I.6**. The geotechnical investigation memorandum indicates that the material under the TSFs consist of alluvial deposits (alluvium and colluvium [including poorly sorted gravels and sands], clayey gravels, and well-sorted sands), highly to completely weathered rock, and moderate to slightly weathered rock. To simplify the stability analysis model assumptions and material properties, the foundation materials were conservatively considered to be an alluvial / colluvial soil for the entire foundation depth evaluated, consistent with the past design assumptions for the Rosemont Copper Project. The foundation soils within the TSF footprints were generally logged as dense materials. The prepared soil foundation for the TSFs will consist of compacted native or natural materials.

The depth to water measured at six (6) monitoring locations in the TSF-1 area ranged from 20 to 90 ft bgs.

The depth to water measured at three (3) monitoring locations in the TSF-2 area ranged from 48 to 272 ft bgs.

The TSFs are located outside of the 100-year floodplain estimated by FEMA (2007). The 100-year floodplain was obtained from the FEMA (2007) Flood Insurance Rate Map for Pima County, Arizona and incorporated areas.

A site-specific seismic hazard study was completed by LCI (**Appendix B.3**). The design seismic event with a return period of 10,000 years was selected for the TSFs, which is more rigorous than the Maximum Probable Earthquake (MPE) which corresponds to a return period of about 475 years.

In addition to the site-specific seismic hazard analysis, a Geologic Hazards Assessment (Wood, 2022b) was prepared for the Project. This assessment was summarized in **Section 3.6** and is presented in **Appendix B.1**. With regard to the TSFs, minor historic mine workings are present in the TSF-1 footprint. These are shallow workings that do not intersect groundwater and will be filled with local borrow materials. Rockfall hazards may be present in the TSF-2 area.

10.4.1.3 Design, Construction and Operations Considerations

Three alternative designs were considered as part of the BADCT analysis to address potential facility discharges. The alternatives consisted of the following:

- Alternative 1 – TSFs with No Underdrains (Reference Design)
- Alternative 2 – TSFs with Underdrains
- Alternative 3 – TSFs with Geomembrane Underliner

The first alternative is the reference design. Potential discharges from Alternatives 2 and 3 were compared to the reference design. This analysis was used to support selection of the selected BADCT design. Alternative 2 is the selected design.

All alternatives incorporated the following discharge control technologies:

- Minimize reclaim pond area;
- Surface water control (run-on redirection and run-off control);
- Slime sealing resulting from the tailings placement method; and
- Localized engineered containment.

Darcy's equation was used as a conservative method to evaluate and compare the volume of seepage at the base of the tailings for each alternative. The use of Darcy's equation assumes full saturation of the material and generally overestimates the actual conditions. The use of Darcy's equation for evaluating seepage was only completed to facilitate a comparison between the reference design and the two alternatives. The assumption for the Darcy's equation comparison was that the seepage collection system was 80 percent effective at capturing seepage. Again, this effectiveness assumption was only used for comparison purposes, as the effectiveness of the actual seepage collection system will be designed to have a higher effectiveness. Results of the discharge calculations based on Darcy equation are provided in **Appendix H.1** and summarized in **Section 9.1**.

For the Alternative 2, a seepage model was also completed using Slide2 from Rocscience to more accurately evaluate the seepage volume at the base of the tailings and the volume that is likely to bypass the seepage collection system. Results of the seepage modeling are provided in **Appendix H.2**.

Alternative 1 – TSFs with No Underdrains (Reference Design)

The TSF design for Alternative 1 consists of a tailings impoundment with small perimeter reclaim ponds, underflow sand embankment as part of the dam structures, and outer perimeter side slope toe seepage collection channels. For this alternative, underdrains are not utilized beneath the underflow sand embankment. This alternative requires spreading and compaction of the underflow tailings in the lower half of the underflow sand embankment in thin, compacted lifts. Compaction of underflow tailings in the lower half of the embankment is required to meet minimum design stability factors of safety. The compacted underflow tailings result in an increased phreatic surface and wetting of the foundation beneath the full underflow sand embankment footprint.

Under the Reference Design scenario (unlined), the volume of water discharging from TSF-1 and TSF-2 based on the Darcy equation would be 759 gpm and 377 gpm, respectively. See **Section 9.1.1** and **Appendix H.1**.

Alternative 2 – TSFs with Underdrains

The TSF design for Alternative 2 consists of a tailings impoundment with decant ponds in each cell, underflow sand embankment, seepage collection system and seepage collection trenches. Underdrains will be constructed at the base of the downstream portion of the underflow sand embankment. The TSF design will incorporate a granular underdrain system beneath the underflow sand embankment to increase vertical drainage, maintain a low phreatic surface in the dam embankment, and removes water from cyclone underflow sand deposition.

The seepage collection system will consist of perforated pipes with a gravel envelope to collect seepage from the tailings. The gravel envelope will be covered with filter sand or a geofabric that provides filter compatibility to prevent tailings from entering the seepage collection system. A protective cover will be placed on top of the filter sand to reduce the potential for erosion and contamination of the system during precipitation events prior to being covered by tailings.

The seepage collection system is constructed of perforated pipes placed within a variable thickness of 3-inch minus drain gravel, and a minimum 1-foot-thick layer of filter sand (or geofabric) underneath the gravels and 2-foot-thick filter sand layer (or geofabric) above the drain gravel to provide filter compatibility with the foundation soils and underflow sand. At full buildout, the anticipated volume of solution collected in the seepage collection system and seepage collection trenches is 745 gpm for TSF-1 and 369 gpm for TSF-2 (Wood, 2022h).

Under the Alternative 2 scenario (unlined with underdrain), the volume of water bypassing the collection system for TSF-1 and TSF-2 based on the Darcy equation would be 152 gpm and 75 gpm, respectively.

As indicated previously, a 2-D seepage model (**Appendix H.2**) was used to more accurately predict the seepage bypassing the collection system of the selected alternative. Based on the modeling using Slide2, the volume of water bypassing the collection system would be 11.0 gpm for TSF-1 and 6.4 gpm for TSF-2. Seepage captured in the underdrain system and in the seepage collection trenches would be 683 gpm and 372 gpm, respectively, for TSF-1 and TSF-2. This equates to an approximate 98 percent effectiveness of the seepage collection system and seepage collection trenches as modeled with Slide2.

Alternative 3 – TSFs with Geomembrane Liner

The TSF design for Alternative 3 consists of the tailings impoundment with a geosynthetic liner over a compacted sub-base with an overliner drainage system. The overliner drainage system would reduce hydraulic head on the liner and would convey seepage to a seepage collection pond where the water would be pumped to the Primary Settling Pond for reuse in the flotation circuit. The drains would be constructed in a similar manner as in Alternative 2, but above a synthetic liner.

Flow to the groundwater from Alternative 3 (lined) would be based on calculated leakage through defects in the liner as discussed in the Discharge Memorandum (**Appendix H.1**) as summarized in

Section 9.1. Under Alternative 3 scenario, the volume of water discharging from TSF-1 and TSF-2, based on the Darcy equation, would be 0.32 gpm and 0.11 gpm, respectively.

Selected Alternative – TSFs with Underdrains

Alternative 2 is the selected design. Per R18-9-A202(A)(5)(a)(ii), a cost analysis of the alternatives was prepared. See Rosemont (2022g) in **Appendix I.11**. Alternative 2 was selected based on the anticipated efficiency of the seepage collection system and the cost/benefit analysis.

The physical characteristics of TSF-1 are as follows:

- The footprint of TSF-1 is 946 acres
- The capacity of TSF -1 is 231 million tons.
- The overall side slopes angle is 3:1.
- The maximum slope height will be 267 feet with a top elevation of 4,197 ft amsl.

The physical characteristics of TSF-2 are as follows:

- The footprint of TSF-1 is 307 acres
- The capacity of TSF -1 is 47 million tons.
- The overall side slopes angle is 3:1.
- The maximum slope height will be 255 feet with a top elevation of 4,600 ft amsl.

Details are summarized in **Section 10.4.1.4** below.

10.4.1.4 Facility Designs

The TSF sites were selected based on a combination of environmental, engineering, land ownership and economic factors. The PFS level design drawings for the TSFs have been developed using the criteria described below. A general layout is shown on **Figure 3**. The TSF design drawings are provided in **Appendix I.10**.

Both of TSF-1 and TSF-2 consist of multiple cells. For each cell, a TSF starter dam (start phase) will first be constructed using locally borrowed soil and/or waste rock; the main starter dam along the downgradient edge of each cell will then be raised by centerline construction methods, and in some areas, followed by the upstream construction method until the final dam configuration is achieved. For the remainder of each cell, where there is sufficient cyclone sand to reach ultimate dam configuration, the starter dam will be raised via the centerline construction method. **Table 10.11** provides a summary of dam configurations and raise construction methods for the critical sections of TSF-1 and TSF-2 with the interim configurations (i.e., Starter Dam and Centerline Raise) and final configuration with the upstream raise configuration.

Table 10.11: Summary of Dam Configurations and Raising Method

TSF Section	Lowest Foundation Elevation	Starter Dam Crest Elevation	Centerline Raise Crest Elevation	Upstream Raise or Final Crest Elevation
TSF01A	3,620	3,690	3,850	3,915
TSF02A	4,335	4,450	4,595	4,665

The main starter dam of each individual cell will be sequentially raised using the coarse fraction of tailing sands (cyclone underflow) in a centerline manner (centerline phase). The tailings will be separated, using hydro-cyclones, into the coarse sand fraction and fine “slimes” fraction. The coarse sand fraction will be placed downstream of the starter dam and the fine fraction will be deposited upstream. The coarse sand provides a more permeable zone for control of the phreatic level in the TSF embankment. One of the design criteria for the operation of the TSF is to maintain a minimum length of 400 feet of tailings beach between the supernatant decant pool and the upstream crest of the embankment.

As part of the starter dam construction, a chimney drain consisting of coarse rock will be constructed on the upstream face of the starter dam, overlain by a layer of cyclone sand to further promote vertical drainage toward a seepage collection system. The proposed chimney drain, seepage collection system, and cyclone sands in the embankments are anticipated to improve recovery of tailings water and keep the majority of structural zones of the embankment (i.e. downstream shell zone of cyclone sand and starter dam material) from saturation.

During the final raises of the TSF embankments, when there is insufficient cyclone sand available for centerline raises, upstream construction methods will be used for TSF-1 and TSF-2. For TSF-1, the final five (5) raises of the embankment will be constructed using upstream methods. For TSF-2, upstream construction methods will be used for the final seven (7) raises on Cell 1 and final six (6) raises on Cell 2. Upstream construction method involves constructing embankments in discrete lifts using compacted tailings or engineered fill, and spigotting whole tailings from the crest of the embankment. Each upstream embankment raise will be approximately ten (10) feet in height using a compacted berm fill material. Upon completion of each lift, the next lift will be stepped inboard to create an overall slope ratio of three horizontal to one vertical (3H:1V). Compacted berm fill can be either a locally borrowed soil, select waste rock, or tailings from the impoundment if the materials meet the specification for gradation and compaction specifications.

Engineering analyses were performed to evaluate the tailings disposal operations during the starter phase (starter dam), interim phase (centerline raise), and final phase of each TSF cell. Evaluations of the impoundment stability, storage capacity and stormwater containment were performed.

Due to these configurations, structural components, drainage elements, and operating procedures required to confirm slope stability for static and earthquake conditions constitute important parts of the discharge control system. The Stability Analysis Memorandum, Tailings Storage Facilities, Rosemont Copper World Project is provided in **Appendix I.1**.

Additional examples of control technologies, processes, or operating methods and site characteristics that shall be combined to form discharge control satisfying BADCT, are summarized below.

Site Preparation and Excavation

Construction activities will conform to permit conditions, design drawings, specifications and other environmental and engineering related documents developed for the Project. The two impoundment areas will then be prepared for construction by clearing existing vegetation, debris, and other deleterious materials in addition to large rocks and boulders, and leveling. where necessary. Areas designated to receive embankment or berm fill will be further prepared by the removal of any loose alluvial or colluvial soils or other deleterious materials.

Stormwater Diversion and Collection System Design

Stormwater management around the TSF will be controlled using diversion channels and stormwater collection galleries. Stormwater diversion channels will be constructed prior to TSF construction to capture and convey stormwater from upgradient of the TSFs, around the TSFs, and released downgradient of the TSFs. Several upgradient drainages associated with TSF-1 cannot be diverted around the facility due to topography and Project boundary limitations. Stormwater runoff in these drainages will be collected in upstream stormwater collection galleries and conveyed under the TSF via solid piping. The stormwater conveyed under the TSF will flow into a downstream stormwater collection gallery and allowed to infiltrate into the alluvium or overflow into an existing drainage downgradient of the TSF. The location of the stormwater collection galleries associated with the TSFs is shown on **Figures 13 through 18**. Cross-sections of the stormwater collection galleries are shown in the Site Water Management Plan (**Appendix E**).

Precipitation that falls within the TSF will either be collected in the decant pond and pumped to the Primary Settling Pond for reuse in the flotation process circuit or will infiltrate into the tailings material.

Most of the precipitation that infiltrates into the tailings will eventually be collected in the tailings seepage collection system, conveyed to the seepage collection trenches, and be pumped to the Primary Settling Pond for reuse in the sulfide ore processing circuit.

Shallow Decant Pond

Each cell of both TSFs is designed to maintain a decant pond containing water from the deposited tailings and precipitation. A minimum of five (5) feet of water within the decant pond will be maintained, to the extent possible, to allow a floating barge with a pump. Water in the decant pond will be pumped to the Primary Settling Pond for reuse in the processing circuit. Locations of the decant ponds for each cell will vary during operations and can be controlled through managed deposition of tailings within each cell. The goal will be to maintain the decant pond a minimum of 400 feet from the TSF cell embankment.

Tailings Side-Slope Stormwater Collection Channels

Stormwater collection channels will be placed along the toe to the TSF will be used to collect runoff from the TSF embankment. These channels will be lined with a geomembrane and will convey the runoff to the seepage collection trenches.

Tailings Seepage Collection System

The TSFs will incorporate a seepage collection system to manage seepage water associated with tailings deposition. The seepage collection system consists of seepage collection piping and seepage collection trenches. The seepage collection piping includes a network of herring-bone pattern perforated drainage pipes connected to a centralized solid pipe (spine) buried in an envelope of gravel to increase vertical drainage within the embankment, maintain a minimal phreatic surface, and remove construction water from cyclone underflow sand deposition. The seepage water intercepted by the seepage collection system will be conveyed by gravity to several seepage collection trenches placed along the side slope toes of the TSFs. The seepage collection system will be designed for a mill maximum throughput of 60,000 short tons per day (stpd).

The seepage collection trenches are located downstream of the TSF embankments for both TSF-1 and TSF-2 (**Figures 14 through 17**). The seepage collection trenches will collect seepage water from the seepage collection piping and seepage that bypasses the piping and flows through the alluvium. The HDPE lined collection trenches have been designed to collect seepage water from the seepage collection piping, perimeter toe channel, seepage water from the adjacent embankment, and seepage in the alluvium that bypasses the piping.

The design storage volume of each seepage collection trench is sufficient to retain 12-hours of draindown from the TSF in the event of upset conditions (power outage, pump failure, etc.). The estimated seepage rates for the 30,000 stpd scenario is proportional to the tailing deposition rate for the 60,000 stpd scenario. The volume of water reporting to the tailings at peak production (60,000 stpd) is approximately 4,098 gpm (Wood, 2022) at peak production. Some of this water is lost to evaporation, is recovered in the decant pool, or entrained in the tailings material. The anticipated volume that will be collected in the seepage collection system and seepage collection trenches is 683 gpm for TSF-1 and 372 gpm for TSF-2 (**Appendix I.1**).

The TSFs have been designed based on the following site characteristics and operational practices to establish the reference design:

- Bedrock, present at shallow depths over the majority of the TSF basin footprints, functioning as a natural geologic liner.
- Construction of alluvial cutoffs and seepage collection systems along the main drainages beneath both TSFs.
- Construction of an impoundment seepage collection system within the TSF impoundment basins to promote reclaim water recovery and reduce pore pressure within the TSF embankments.
- The use of cycloned tailings construction techniques and installation of a chimney drain to

obtain an embankment structural zone resistant to liquefaction.

- Diversion of non-contact upgradient stormwater runoff around the TSFs.
- Channels and berms for the collection of contact stormwater runoff from the downstream slopes of the tailings embankments.

The details of these discharge control elements are shown on the PFS level design drawings in **Appendix I.10**.

10.4.1.5 Stability

Slope stability analyses were performed for two (2) analysis sections using the base case phreatic surfaces from the steady-state, active deposition seepage models. The selected sections are shown on Figure 3.1 in **Appendix I.1**. **Table 10.12** summarizes the construction stages analyzed for the sections. Section TSF-1A is along the maximum height of the facility and Section TSF-1B is adjacent to the relocated access road. Sections TSF-2A1, TSF-2A2, and TSF-2B are also along maximum sections.

Stability analyses using a phreatic surface from probable maximum flood (PMF) conditions were not analyzed as the phreatic surface for this condition was lower than that of active deposition conditions. Each analysis was conservatively modeled with fully hydrostatic conditions. Slope stability analyses for normal operating conditions were analyzed for drained, undrained, pseudostatic and post-earthquake loading conditions. The PMF condition was only analyzed for undrained conditions. In accordance with the BADCT Guidance Manual, minimum factors of safety requirements with material testing are 1.3 for static loading conditions and 1.0 for pseudostatic loading conditions. **Appendix I.1** provides the TSF stability analysis memorandum (Wood, 2022d). A summary of the stability analysis is provided below.

- The results of the static stability analysis and the FOS for the critical failure surfaces for each cross-section are provided in **Table 10.12**. The minimum FOS obtained for each of the critical cross-sections is higher than the required minimum FOS prescribed by BADCT. The stability analyses show that the FOS is higher than both the required FOS of 1.5 for the end of construction condition and FOS of 1.3 for the interim construction condition.

Table 10.12: Summary of Stability Analyses Results – TSFs (Static)

Section	Case	Calculated FOS – Static	
		Undrained/TSA (Min. FOS > 1.3)	Drained/ESA (Min. FOS > 1.5)
TSF-1A	Starter Dam	1.90	1.90
	Centerline Raise	2.03	2.03
	Final Configuration	2.00	2.03
TSF-1B	Starter Dam	2.05	2.05
	Centerline Raise	2.04	2.04
	Final Configuration	2.00	2.03
TSF-2A1	Starter Dam	1.89	1.89
	Centerline Raise	2.03	2.03
	Final Configuration	1.78	2.02
TSF-2A2	Starter Dam	1.85	1.85
	Centerline Raise	2.06	2.06
	Final Configuration	1.93	2.05
TSF-2B	Starter Dam	1.87	1.87
	Centerline Raise	2.03	2.03
	Final Configuration	1.78	2.02

Notes:
ESA: effective stress analyses
FOS: factor of safety
TSA: total stress analyses

Pseudo-static-based analyses are commonly used to apply equivalent seismic loading on earthfill structures. In an actual seismic event, the peak acceleration would be sustained for only a fraction of a second. Actual seismic time histories are characterized by multiple-frequency attenuating motions. The accelerations produced by seismic events rapidly reverse motion and generally tend to build to a peak acceleration that quickly decays to lesser accelerations. Consequently, the duration that a mass is actually subjected to a unidirectional, peak seismic acceleration is finite, rather than infinite.

The results of the pseudo-static stability and post-earthquake analyses, and the factors of safety for the critical failure surfaces for each cross-section, are summarized in **Table 10.13**. The minimum factor of safety obtained for the critical cross-sections is higher than the required minimum factor of safety prescribed by BADCT.

Table 10.13: Summary of Stability Analyses Results – TSFs (Pseudo-Static and Post-Earthquake)

Section	Case	Calculated FOS – Seismic	
		Pseudo-Static (Min. FOS > 1.1)	Post-Earthquake (Min. FOS > 1.1)
TSF-1A	Starter Dam	1.50	NA
	Centerline Raise	1.55	NA
	Final Configuration	1.24	1.13
TSF-1B	Starter Dam	1.64	NA
	Centerline Raise	1.56	NA
	Final Configuration	1.17	1.12
TSF-2A1	Starter Dam	1.47	NA
	Centerline Raise	1.55	NA
	Final Configuration	1.18	1.14
TSF-2A2	Starter Dam	1.45	NA
	Centerline Raise	1.57	NA
	Final Configuration	1.23	1.18
TSF-2B	Starter Dam	1.47	NA
	Centerline Raise	1.55	NA
	Final Configuration	1.18	1.13

10.4.1.6 Hydrology and Hydraulics

An initial hydrology and hydraulics analysis was performed as part of the Copper World Project Prefeasibility Study to support the TSF design. This design includes the seepage collection system alternative. The hydrology and hydraulics analyses presented in this section further support the BADCT analysis for the selected design.

TSFs Drainage Conditions

The Copper World TSF drainage basins are largely undeveloped. The region is semi-arid but susceptible to severe rainfall events. Vegetation is typical of the Upper Sonoran Desert zone, consisting mainly of desert shrubs and native grasses. According to Table 9-2 of the *National Engineering Handbook* (NRCS, 2004), the Copper World TSF drainage basins fall under the “desert shrub” category of semi-arid rangelands. The ground cover was observed to be approximately 50 percent, which corresponds to the “Fair” condition. For the proposed Copper World TSF conditions, the TSFs are designed to store the design runoff volume from the main TSF sub-basins. The 100-year, 24-hour storm event was used to size containment structures during operations. The 1,000-year, 24-hour storm event was used to size permanent diversion channels, whether constructed during operations or post-closure. Temporary channels were sized for the 100-year, 24-hour event.

Table 10.14 provides the 100-year, 24-hour flow volumes and rates for the predevelopment subbasins. Subbasins are shown on **Figure 12** of this main Application Document and on Figure 1 in **Appendix B.2**.

Table 10.14: Sub-basin Hydrology, Pre-development, 1:100 Storm

Sub-basin	Total Area	1:100 Flow Rate	1:100 Volume	1:100 Unit Discharge	1:100 Unit Volume
	(acre)	(cfs)	(ac-ft)	(cfs/acre)	(ac-ft/acre)
01	1684.9	1206.92	15,189.6	0.716	9.015
02	1006.7	2022.7	10,146.7	2.009	10.079
03	597.1	1077.4	5,831.4	1.804	9.766
04	346.2	616.6	3,489.4	1.781	10.079
05	1416.8	1661.1	14,675.6	1.172	10.358
06	891.6	544.6	8,601.1	0.611	9.647
07	675.5	543.7	6,204.8	0.805	9.185
08	471.9	817.2	4,535.5	1.732	9.611
09	1770.1	507.4	15,544.9	0.287	8.782
10	612.9	110.8	5,376.9	0.181	8.773
11	421.1	1230.4	4,219.7	2.922	10.021
12	609.2	928.1	5,923.6	1.523	9.724

Hydrologic Analyses Results

The results of the hydrologic evaluations are used to establish flood storage requirements for the TSFs and sizing of appurtenant structures and discharge capacities for the proposed stormwater bypass channels. The TSF stormwater controls were generally designed for the 1,000-year, 24-hour storm event. The results of the hydrology, including the unit discharge and unit volumes for the sub-basins affecting the TSFs, are provided in **Appendix B.2** (Bowman, 2022).

The flow rates for the divided sub-basins were estimated based on the unit discharge and unit volumes. The volumes summarized in **Table 10.15** are based on the 1,000-year, 24-hour storm event. The basin delineation associated with **Table 10.15** is provided on Figure 11 in **Appendix B.2**.

Table 10.15: Sub-basin Hydrology, 1:1,000 Storm Event

Sub-basin	Total Area	1:1,000 Flow Rate	1:1,000 Volume	1:1,000 Unit Discharge	1:1,000 Unit Volume
	(acre)	(cfs)	(ac-ft)	(cfs/acre)	(ac-ft/acre)
01A	999.6	2752.9	8558.9	2.754	8.562
01B-1	959.1	1967.7	23692.5	2.052	24.703
02A	674.3	2174.9	6059.3	3.225	8.986
02B	368.0	1685.4	3354.2	4.580	9.115
02B-1	128.6	851.7	3374.5	6.623	26.240
03A	518.4	1715.9	4531.9	3.310	8.742

Sub-basin	Total Area	1:1,000 Flow Rate	1:1,000 Volume	1:1,000 Unit Discharge	1:1,000 Unit Volume
	(acre)	(cfs)	(ac-ft)	(cfs/acre)	(ac-ft/acre)
03A-1	89.8	580.6	2376.2	6.465	26.461
04A	36.3	247.8	324	6.826	8.926
04A-1	72.8	447	1997.9	6.140	27.444
04B-1	88.4	531.5	2340.7	6.012	26.479
05A	82.9	388.2	717.8	4.683	8.659
05B	33.2	228	294.7	6.867	8.877
05B-1	179.8	1197.7	4757.6	6.661	26.461
05C	248.3	1581	2250.3	6.367	9.063
05D	433.7	2113.6	3804.6	4.873	8.772
05E	6.7	54.3	62.4	8.104	9.313
05F	22.3	178.1	196.8	7.987	8.825
05F-1	58.3	386	1556.8	6.621	26.703
05G	30.0	234.5	271.2	7.817	9.040
05G-1	37.6	261.5	985.5	6.955	26.210
06A	118.1	482.8	985.5	4.088	8.345
06B-1	97.5	278.6	2409.4	2.857	24.712
06C-1	353.1	851.4	9181.3	2.411	26.002
07A	157.7	772.1	1316.1	4.896	8.346
07B	259.1	971.4	2273.1	3.749	8.773
07C	434.7	1926.4	3914	4.432	9.004
07D-1	356.0	1218	8942.5	3.421	25.119
08A	534.7	2378.1	4608.3	4.448	8.618
09A	1333.4	1938.1	11740.6	1.454	8.805
09C	67.4	348.9	615.6	5.177	9.134
09D-1	63.7	496.4	1899.1	7.793	29.813
10A	527.8	513.8	4680.5	0.973	8.868
10B	66.0	230.5	585.7	3.492	8.874
11A	239.4	1134	2007.5	4.737	8.386
11A-1	141.1	920	3734.6	6.520	26.468
11A-2	53.7	370	1473	6.890	27.430
11A-3	22.5	182.3	596.2	8.102	26.498
12A	119.9	956.9	1138.6	7.981	9.496

Sub-basin	Total Area	1:1,000 Flow Rate	1:1,000 Volume	1:1,000 Unit Discharge	1:1,000 Unit Volume
	(acre)	(cfs)	(ac-ft)	(cfs/acre)	(ac-ft/acre)
12A-1	466.8	2636.9	13921.9	5.649	29.824
12B	25.5	185.9	88.3	7.290	3.463
13A	25.6	189.2	221	7.391	8.633

Diversion Channel Hydraulics

The stormwater diversion system will consist of a series of channels to divert stormwater around and underneath the TSFs. Several drainages east of TSF-1 cannot be diverted around the TSF due to topography and land restrictions. For these drainages, diversion channels will convey stormwater to several stormwater galleries with pipes that will convey the stormwater under TSF-1 to a downstream stormwater collection gallery. From there, stormwater will infiltrate into the alluvium or overflow into an existing drainage downgradient of the TSF. This system is not designed to retain water upgradient of the TSFs but to collect and uniformly convey water beneath the TSFs.

Diversion channels were calculated as trapezoidal shapes with varying bottom widths. The channels are assumed to be cut in the upper alluvial/colluvial materials with side slopes of 2H:1V. Rock cuts are assumed to have a Manning's n-value of 0.35.

Many structures will need to turn flows about 90 degrees which will cause run up on the embankments. Three (3) feet of freeboard will be added to the final diversion channel design to account for this run up and to prevent overtopping during the design storm event. **Table 10.16** provides a summary of the diversion channel flow capacity requirements. Channel locations are shown on **Figures 13 through 18** and in **Appendix E**.

Table 10.16: Summary of Diversion Channels

Diversion	Location/Description	1000-Year Event Flow (cfs)[1]
DC1	East side of Cell 1, TSF-1	1,101
DC2	South side of Cell 1, TSF-1	2,174
DC3	East side of Cell 2, TSF-1	1,685
DC4	West side of Cell 3, TSF-1	115
DC5	East side of Cell 3, TSF-1	464
DC6	South and west side of TSF-2	2,897
DC7	East side of Cell 2, TSF-2 and east side of Cell 2, HLF	2,197
DC8	Southeast side of HLF	1,635
DC9	North side of Cell 3 of HLF	228
TDC1[2]	South side of Cell 2, TSF-1	176[2]

[1] 1000-year event flow data based on Bowman (2022). Table reproduced from Table 4 in Wood (2022g).

[2] TDC1 is a temporary diversion channel which would be removed prior to construction of Cell 3 of TSF-2. This diversion channel would be designed to manage a 100-year, 24-year storm event.

The stormwater diversion channels were designed to pass the 1,000-yr event. Channel bottoms and sides will be lined with as needed erosion protection to minimize erosion in areas with unconsolidated alluvium material. Channels are shown on **Figures 13 through 18**.

A 24-foot-wide access road was designed around the perimeter of TSF-1. A 32-foot-wide county road was assumed the rerouted county road as shown on **Figures 13 through 18**.

10.4.1.7 Closure/Post-Closure

Closure and reclamation of the TSFs will focus on managing both draindown from the tailings and long-term stormwater management. Closure methods will be in accordance with ADEQ BADCT Prescriptive requirements for TSFs, to the extent practical. **Appendix M** provides the Conceptual Closure Plan developed for the Project. The following sections provide a summary of that plan. As needed, the Conceptual Closure Plan will be updated and modified throughout the life of the Project.

Draindown Management

Managing draindown of solution from the TSFs will dictate the schedule for closure of the TSFs. The solution entrained within the TSFs at closure, and precipitation that infiltrates into the tailings after closure, will be managed as draindown (contact water). The draindown solution collected in the seepage collection system and seepage collection trenches will be pumped to the Primary Settling Pond. The goal for closure the TSFs will be to reduce the volume of solution within the tailings as much as possible. This will be accomplished through enhanced evaporation techniques. Enhanced evaporation may include using devices such as snowmakers on the TSFs to enhance solution evaporation. Active management of solution will continue until the volume of draindown can be managed passively. Passive management may be through the use of sulfate reducing treatment cells converted from the existing seepage collection trenches or in newly constructed cells.

Geochemical analysis of the tailings seepage (Piteau, 2022c) indicates sulfate and TDS will exceed EPA non-enforceable secondary MCLs, but no numeric AWQS will be exceeded. To allow for passive treatment and infiltration, the seepage collection trenches will be converted to sulfate reducing treatment cells or new cells will be constructed that would treat the minimal flow from each TSF cell. Estimates of draindown indicate that active or enhanced evaporation would be required for approximately 30 years for TSF-1 and seven years for TSF-2.

Passive treatment for the reduction of sulfate has been used primarily for treating acid mine drainage that has low pH and high metal contents. The seepage from the TSFs is expected to have elevated sulfate, but heavy metals are anticipated to be below AWQS. Rosemont would conduct bench-scale and pilot-scale testing during operations to 1) design this long-term seepage management approach and 2) to determine alternatives to this approach.

A typical passive treatment cell for sulfate reduction creates an anaerobic environment where sulfate reducing bacteria convert sulfate to sulfide ions and bicarbonate. The dissolved sulfide ion precipitates metals as sulfides. Creating the necessary anaerobic conditions involves limiting oxygen into the treatment cell, a sulfate source (draindown from TSF), maintaining a 5.0 pH (maintained by bicarbonate reaction and limestone source), and providing organic matter.

Reclamation Procedures

The following provides a list of the reclamation procedures for closure of the TSFs.

- TSF embankment slopes constructed to final slope configuration
- Allow draindown to occur and drying of top surface
- Manage draindown solution through active evaporation
- Long-term management of draindown within sulfate reducing treatment cells converted from existing seepage collection trenches
- Once the top surface is stable enough for equipment, grade the surface to promote runoff and minimize infiltration

- Place and grade cover material – 24 inches on embankment slopes and 18 inches on top of the tailings
- Construct downchutes from the decant pool through a breach in the embankment, down the embankment slope and to a diversion channel or natural drainage, including construction of runoff control channels on the embankment slopes
- Revegetation
- Post-closure monitoring of soil cover (erosion) and revegetation
- Post-closure monitoring at POC wells

Stormwater Management

One of the closure strategy objectives is to manage stormwater run-on and runoff to reduce net infiltration into the tailings and minimize erosion. Diversion channels will be constructed during operations to divert water around the TSFs and prevent erosion of the TSF embankments. Details of the stormwater management system are presented in Site Water Management Plan for the Project (Wood, 2022g) and provided in **Appendix E.**

The closure design concept for the tailings impoundment is to place a growth media cover on the tailings top and embankment areas and route stormwater runoff off the reclaimed tailings and into natural drainages downgradient of the facility.

Infiltration and Erosion Control

As the tailings surface begins to dry and consolidate sufficiently for equipment to safety operate on the surface, the final growth media cover will be placed. Approximately 18-inches of growth media will be placed on the top tailings surface and 24-inches on the tailings embankments. This depth of growth media will provide storage capacity for precipitation, thus providing moisture for vegetation growth and minimizing infiltration. Riprap lined channels will be placed on TSF embankment slopes to convey the runoff to the embankment toe and into a perimeter diversion channel and eventually to a natural drainage. These channels will minimize erosion of the cover material on the embankment slopes.

The objective of TSF cover design is to provide a durable and functional cover that limits erosion while limiting, to the greatest extent practicable, net percolation into the underlying tailings while re-establishing a functional ecosystem. This closure strategy utilizes a vegetated cover with a site-specific native seed mix that represents native vegetation.

Once soil cover has been placed on the tailings, downchute channels will also be constructed from the decant pool of each cell to convey stormwater runoff from the TSF surface. Stormwater will be routed down the slope of the TSF embankment to a diversion channel that will convey the runoff to a natural drainage. The downchutes have been designed to manage the runoff from a 1,000-year, 24-hour storm event. **Table 10.17** provides the channel size and riprap size for TSF-1 and TSF-2 downchute channels and **Figure 18** shows the approximate location of the downchutes.

Table 10.17: Downchute Design Parameters

	Bottom Width (ft)	Side Slope (H:V)	Flow Depth Top (ft)	Riprap size Top (in)	Flow Depth Chute (ft)	Riprap Size Chute (in) – 2 layers
TSF1-Cell 1	7	3:1	0.93	2.3	0.56	37.1
TSF1-Cell 2	7	3:1	0.84	2.1	0.5	32.7
TSF1-Cell 3	7	3:1	0.7	1.7	0.41	26.4
TSF2-Cell 1	7	3:1	0.6	1.5	0.37	22.1
TSF2-Cell 2	7	3:1	0.7	1.7	0.43	26.0

Table reproduced from Table 1 in Wood (2022k).

11.0 SITE-WIDE WATER BALANCE

This section provides a summary of the site-wide water balance (SWWB) developed for the Copper World Project. Details are provided in **Appendix J** in a document titled Site-Wide Water Balance Memorandum (Wood, 2022f). This memorandum is also an appendix to the Site Water Management Plan (Wood, 2022g) provided in **Appendix E**.

11.1 INTRODUCTION AND BACKGROUND

The SWWB considers water consumption, water loss through evaporation and material entrainment, water reclaimed from processing, seepage collection for TSFs, non-contact stormwater, and contact water from mine pits and WRFs. With these considerations, the SWWB is used to predict the volume of water loss and estimates the amount of make-up/fresh water needed for operations. Rosemont currently holds an annual water right for up to 6,000 acre-feet of groundwater (see **Appendix A.3**). This water right will be the primary water source for start-up of the operation and make-up (fresh) water during the life of the mine.

11.2 CLIMATE MODULE

The climate data, such as annual precipitation and annual pan evaporation, came from Piteau (2022a) in **Appendix F.1**. The annual precipitation and annual pan evaporation are 19.7 inches and 91.2 inches, respectively.

11.3 LIMITATIONS AND ASSUMPTIONS

The SWWB considers water consumption, water loss through evaporation and material entrainment, water reclaimed from processing, stormwater and seepage collection from the TSFs, solution management associated with the HLF, the diversion of non-contact stormwater and stormwater runoff from the outer slopes of the WRF, and the capture of contact stormwater from process areas such as the Plant Site and pit areas. With these considerations, the SWWB is used to predict the volume of water loss to the environment (either via evaporation or seepage) and estimates the amount of make-up/fresh water needed for operations. Discussion of individual processes (i.e., sulfide and oxide ore types) and facility water demands are provided in the following sections and in **Appendix J**.

Sulfide Ore Processing and Tailings

During sulfide ore beneficiation, water flow across various facilities including the crusher, flotation, concentrate leaching, thickener and the tailings storage facilities. The following are the basic components of the sulfide circuit where water is either added or lost.

- Crushing Circuit – fresh water added.
- Mill – fresh water added.
- Flotation Plant – Water lost in concentrate and water added from Reclaim Pond and Primary Settling Pond.
- Sulfide Concentrate Leach – water added from Primary Settling Pond
- Thickener – Water lost to environment, water lost in tailings and water reclaimed to Reclaim Pond.
- Tailings – water loss through evaporation and entrainment in tailings. Water reclaimed from the decant pond and seepage collection system.

The greatest loss of water is the system is associated with the two (2) TSFs. The thickened tailings are pumped from the Plant Site to the TSFs. Cyclones remove the sand fraction for use in embankment construction while the fine tailings are deposited to the inside the TSF to form a beach. The deposition process creates a pool on top of the TSF where water will collect (decant pool). Water from the decant pool will either be lost to evaporation, reclaimed and pumped to the Primary Settling Basin for reuse in the process water circuit, or infiltrate into the tailings. **Table 11.01** provides the primary data and assumptions used in the SWWB associated with the sulfide ore processing.

Table 11.01: Primary Data for Sulfide Ore Processing and Tailings

Description	Data
Ore water content (% by weight)	3.5
Ore water content after crushing (% by weight)	5
Loss to environment at crushing (% by weight)	7
Fraction of process water supply to crusher (% of total)	85
Fraction of fresh water supply to crusher (% of total)	15
Total water requirement at flotation plant (g/ton ore)	175
Mill/flotation plant fresh water supply (fraction of total water supply, as %)	35
Thickened tailings water content (% by weight)	31.8
Sand separated by cycloning (% by weight)	30
Loss of water during cycloning (fraction of thickened. tailings water content, as %)	12
Settled dry density of fine tailings (lb/ft^3)	90
Specific gravity of fine tailings (dimensionless)	2.65
Average saturation (dimensionless)	1
Bulk density of fine tailings (lb/ft^3)	118
Interstitial water content (% by weight)	31.6
Berms area (fraction of footprint, % of total)	20
Decant pond area (% of tailings area)	15
Tailings wet beach area (% of tailings area)	25
Tailings dry beach area (% of tailings area)	30
Tailings drying beach area (% of tailings area)	30
Evaporation factor for pond	0.75
Evaporation factor for wet beach area	0.7
Evaporation factor for dry beach area	0.05
Evaporation factor for drying beach area	0.5
Plant site catchment area (ac)	45
Avg. surface area: PLS Pond, Reclaim Pond, Raffinate Pond (ac)	4
Avg. surface area: storm ponds (ac)	2.5
Plant site runoff rate (gpm/ac)	0.179
Undisturbed TSF area runoff rate (gpm/ac)	0.179

Notes:
ac – acres
g/ton – gallons per ton
gpm/ac – gallons per minute per acre
gpm/sf – gallons per minute per square foot
lb/ft3 – pound per cubic foot

PLS – Pregnant Leach Solution

Oxide Ore Processing and Heap Leaching

Oxide ore processing involves leaching of crushed and agglomerated ore and run-of-mine (ROM) ore using a mild sulfuric acid solution on a lined heap leach pad (HLP). The following provides the basic steps of the heap leach process, including a description of water losses in the system:

- ROM ore is hauled and placed directly on the lined leach pad – no water used in this process.
- Crushed and agglomerated ore conveyed to the lined leach pad – fresh water used for crushing and agglomerating and water loss through evaporation.
- Leaching the ore with a mild sulfuric acid solution – recycled raffinate solution and fresh make-up water. Water loss through evaporation via the drip irrigation system on the leach pad. Water loss to interstitial spaces in ore.
- Solution recovery in a drainage system located above the containment liner. Solution conveyed to the Pregnant Leach Solution (PLS) Pond – water loss through evaporation in PLS Pond.
- Solution processing using solvent extraction/electrowinning (SX/EW) process with reclaimed solution routed from the SX/EW Plant to the Raffinate Pond.
- Reconditioning of raffinate solution with fresh water and sulfuric acid – reclaimed water from SX/EW process with addition of fresh water and sulfuric acid. Water loss through evaporation in the Raffinate Pond.

The primary data and assumptions used in the SWWB associated with oxide ore processing are provided in **Table 11.02**.

Table 11.02: Primary Data for Oxide Ore Processing and Heap Leaching

Description	Data
Ore water content (% by weight)	3.5
Ore water content after crushing (% by weight)	5
Loss to environment at crushing (% by weight)	7
Fraction of process water supply to crusher (as %)	80
Fraction of fresh water supply to crusher (as %)	20
Water content at agglomeration (% by weight)	15
Fraction of process water supply to agglomerator (as %)	80
Fraction of fresh water supply to agglomerator (as %)	20
Undisturbed HLF area runoff rate (gpm/ac)	0.179
Leaching solution application rate (gpm/sf)	0.004
Leaching solution application total (gpm)	3000
Loss of barren solution at SX/EW plant (% by weight)	5
Loss of barren solution at Con Leach (% by weight)	2

Notes:
gpm/ac – gallons per minute per acre
gpm/sf – gallons per minute per square foot
SX/EW – Solvent Extraction – Electrowinning

11.4 PITS

Each of the six (6) pits receives direct precipitation, stormwater runoff from the local catchment area (which includes the pit itself) and groundwater pumping. The estimated groundwater yield assumed from dewatering wells for Peach Pit, Elgin Pit, Heavy Weight Pit, Copper World Pit and Broadtop Butte Pit is estimated to be less that 100 gpm. The yield from the Rosemont Pit is estimated to be about 300 gpm.

Groundwater from pit dewatering wells associated with the Satellite pits could be used for fresh make-up water or for general dust control. Groundwater from pit dewatering of the Rosemont Pit could be used for general dust control with excess water released into natural drainages downgradient from the Rosemont Pit. These dewatering wells would be located outside the Tucson Active Management Area (AMA); as such, groundwater cannot be pumped into the AMA from outside the AMA.

Water collected in the pit sumps is considered contact water and can be pumped to the process water circuit (regardless of pit source) or can be used as dust control within the pit shell. Water collected in the sumps may come from direct precipitation, stormwater runoff, or groundwater inflow. The SWWB also takes into account evaporative losses within the pits.

11.5 SURFACE WATER MANAGEMENT

Surface water management is discussed in more detail in the Site Water Management Plan (**Appendix E**). The primary objective of surface water management is to divert non-contact stormwater runoff as much as practicable. This will be accomplished through a series of diversion channels and stormwater collection galleries to route stormwater around or through the facilities, with diverted water directed into existing off-site natural drainages. Contact water, which includes all stormwater that contacts process facilities, will be retained onsite and used in the process.

11.6 GROUNDWATER MANAGEMENT

Rosemont currently holds a groundwater right to 6,000 acre-feet that is anticipated as the primary fresh water source for the start-up of mine operations and will be the source of make-up/fresh water during operations. The wellfield is located northwest of the Project area. Pit dewatering wells on the west side of the Santa Rita Mountains may also be used for fresh make-up water.

11.7 CLOSURE

Management of water during closure and post-closure includes maintaining the long-term water management facilities constructed during operations as well as additional controls constructed during the closure-period.

Long-term, post-closure diversion channels will be designed and constructed to pass the 1,000-year, 24-hour storm event. Precipitation that falls on the reclaimed TSFs, heap leach, and process area will be routed to natural drainages located downgradient of the facilities. Precipitation that falls on the waste rock facility will also be routed to off-site natural drainages. Precipitation that falls within the three open pits (Peach, Elgin and Rosemont) will contribute to the pit lakes and be retained.

11.8 SUMMARY

The SWWB was developed to aid in the design of the processing facilities and development of the Site Water Management Plan (Wood, 2022g). The primary goal is to determine when and if additional water sources are needed to meet the demands of the Project. Rosemont's decision in handling non-contact water or stormwater runoff, is to divert, capture and release as much non-contact stormwater runoff as possible.

A water balance summary table was developed for the water balance memo provided in **Appendix J**. This summary table, Table 6 in Wood (2022f), is not reproduced herein. As indicated in Table 6 (Wood, 2022f), the Rosemont Copper Project operates with a surplus of water during the first four years of operations. Once production in Year 5 increases to 60,000 tons per day of sulfide ore, a water deficit will occur, with the peak water deficit of 1,000 gpm occurring in Year 6. Based on the SWWB model, the water deficit will occur during Years 5 through 8. A surplus of water will then be realized from Year 9 through the end of mining (Year 15), i.e., not all of the current 6,000 acre-foot annual allocation would be needed.

12.0 COMPLIANCE WITH AQUIFER WATER QUALITY STANDARDS

12.1 POLLUTANT MANAGEMENT AREA

The Pollutant Management Areas (PMAs) for the Project are defined by the contiguous footprints of the Project private land boundaries within which each of the planned pits and facilities are located (**Figure 36**). There are two contiguous private land boundaries defining two separate PMAs. TSF-1 is located within one PMA, and the remaining pits and facilities are located within the second PMA.

12.2 GROUNDWATER QUALITY CHARACTERIZATION

Groundwater in the Project area ranges between Ca-SO_4 and Ca-HCO_3 type. Dominant cations are mainly calcium and magnesium, which is aligned with the limestone / skarn bedrock aquifers found throughout the Project area. Anions are mainly composed of sulfate and bicarbonate which span a wide range of rock compositions. Very little sodic groundwater is found in the Project area. A detailed description of groundwater quality characterization in the Project area is provided in Piteau (2022a) in **Appendix F.1.**

Groundwater sampling results indicate generally good quality and meet all Arizona Aquifer Water Quality Standards (AWQS). pH is circum-neutral, with values ranging between 7.1 s.u. - 8.3 s.u.

Wells located in the Santa Rita range generally have higher TDS and major ion concentrations. Deeper screened wells, in settings where two wells have been twinned, generally possess higher TDS; this suggests longer flow paths from recharge sources.

12.3 PROPOSED POINTS OF COMPLIANCE

Point of Compliance (POC) wells are required to monitor for potential Project site discharges. Ten (10) POC groundwater monitoring wells are recommended for the Project based on the hydrogeologic conceptual model (Piteau, 2022a), the results of predictive particle transport modeling (Piteau, 2022b), and the locations of proposed Project pits and facilities.

The criteria for selecting the proposed POC locations included:

- Downgradient of Project pits and facilities
- Within 750 ft of Pollutant Management Area (PMA)
- Within the general area of surface drainage channels
- Site access for drilling, well construction and monitoring activities.

The proposed locations of POC wells are shown on **Figure 36**.

- Four (4) POC wells (POC-1 through POC-04) are located on the north and west property boundaries of TSF-1 in the Santa Cruz basin. Surface management directly down-gradient of each of these wells is in the jurisdiction of the State of Arizona.
- POC-05 is located northwest of a portion of TSF-2. Surface management directly down-gradient of this well is in jurisdiction of the State of Arizona.
- POC-06 is located to the northwest of a portion of the Plant Site area and HLP. Surface management directly down-gradient of this well is in jurisdiction of the Bureau of Land Management (BLM).
- Two (2) POC wells (POC-07 and POC-08) are located to the southwest and northwest of portions of the WRF area. Surface management directly down-gradient of POC-07 is in jurisdiction of the State of Arizona; surface management directly down-gradient of POC-08 is in jurisdiction of the U.S. Forest Service (USFS).

- Two (2) POC wells (POC-09 and POC-10) are located to the east of portions of the WRF area. Surface management directly down-gradient of these wells is in the jurisdiction of the U.S. Forest Service (USFS).

No POC wells are needed at the Rosemont Pit area due to the predicted groundwater capture zone associated with operational pit dewatering and the characterization of a terminal pit lake (sink) during closure.

12.4 PREDICTED DISCHARGE IMPACT AREAS

The Discharge Impact Area (DIA) is predicted by the Project groundwater flow model (Piteau, 2022b) and shown in **Figure 37**. The Project groundwater flow model uses particle tracking to predict the advective transport of pit and facility discharges.

As described in **Section 7.5.3**, three-hundred and thirty-one particles were tracked until 200 years after mining ceased. Particles that were released in the Rosemont, Broadtop Butte, Copper World, and Heavy Weight pits (120 particles) did not leave their respective pits within the 200-year timeframe. All but 29 of the 211 particles released from Elgin, Peach, TSF-1, TSF-2 and the HLP were transported up to about 2 miles towards the northwest along the prevailing groundwater gradients. The 29 points that did not escape the PMA originated in the Peach and Elgin pits and these particles stagnated within their pit footprints as shown on **Figure 37**. Although not considered an APP regulated facility, particles were also placed within the Rosemont Pit for completeness.

12.5 SUMMARY OF PROPOSED DISCHARGE CONTROLS

Discharge controls were evaluated using the Project groundwater flow model (Piteau, 2022b). As described in **Section 7.5.3**, an alternative particle tracking model was constructed to demonstrate one potential mitigation measure to address particle excursions beyond the PMA. The alternative model simulates a series of pump-back wells at strategic locations to capture the particles before they migrate outside of the PMA.

Particles in the mitigation demonstration were tracked until 200 years after mining ceased. As before, particles that were released in the Rosemont, Broadtop Butte, Copper World, and Heavy Weight pits did not leave their respective pits within the 200-year timeframe. All but 1 particle of the 211 particles released from Peach Pit, Elgin Pit, TSF-1, TSF-2 and the HLP were captured by the pump-back system as shown on **Figure 37**.

The model assumes that these wells pump at constant rates until 200 years after mining ends. In actual practice, mitigation pumping will be optimized based on monitoring data from performance and POC monitoring wells.

As noted in **Section 9.2.**4, there is the potential for fluoride to be elevated above AWQS in several of the pits, such as Peach, Elgin, Copper World, and Heavy Weight. As a mitigation measure, adding additional sources of calcium to the Peach and Elgin pit lakes, and to the bottoms of Copper World and Heavy Weight as part of backfilling, would support the precipitation of fluorite and help attenuate fluoride concentrations. Intermediate alert (non-POC) wells could also be installed to monitor fluoride concentrations downgradient of the pits to inform any required mitigation steps.

13.0 CONTINGENCY PLAN

This Contingency Plan addresses the requirements of Arizona Administration Code (A.A.C.) R18-9-A204 and presents the Emergency Response Coordinator (ERC) associated with the Copper World Project, including available mitigation/response equipment and also the actions to be taken if a discharge results in any of the following conditions per A.A.C. R18-9-A204(A):

- A violation of an Aquifer Water Quality Standard (AWQS) or an Aquifer Quality Limit (AQL);
- A violation of a discharge limitation (DL);
- A violation of any other permit condition;
- An Alert Level (AL) is exceeded; or
- An imminent and substantial endangerment to the public health or the environment.

The Contingency Plan stated herein will also part of a larger, standalone Contingency / Emergency Response Plan that will cover other programs such as Risk Management Plan (ICMM Good Practice Guide), Failure Modes and Effect Analysis (FMEA), Trigger Action Response Plan (TARP), Emergency Preparedness and Response Plan (EPRP), Operations, Maintenance, and Surveillance (OMS), and Title 40 of the Code of Federal Regulations (40 CFR), Part 112, Oil Pollution Prevention and Title 11, Article 22 of the Arizona Administrative Code dealing with the use of cyanide in the precious metals recovery circuit.

During construction and operations, Rosemont will maintain a copy of the Contingency / Emergency Response Plan at the Project site, where day-by-day decisions are made regarding facility operations. The Contingency / Emergency Response Plan will set out an organized and coordinated course of action to be followed to minimize hazards to human health or the environment.

As needed, the Contingency / Emergency Response Plan will be modified during the life of the Project to reflect updated contact information, operational stage, and emergency response procedures, etc.

The Contingency / Emergency Response Plan will also include agency contact information as well as contact information for emergency personnel.

The remainder of this section covers the requirements of A.A.C. R18-9-A204. This Contingency Plan will be updated to include requirements in the final aquifer protection permit issued for the Project and will be incorporated into the Contingency /Emergency Response Plan.

13.1 EMERGENCY RESPONSE COORDINATOR

Table 13.01 identifies the current Rosemont personnel who would participate and/or coordinate an emergency response involving a potential discharge to groundwater and the order by which they should be contacted. This list will be modified and updated as additional personnel are added to the Project. This information is required per A.A.C. R18-9-A204(D)(2).

Table 13.01: Rosemont Emergency Response Coordinator (ERC)

Person/Title	Responsibility	Contact Information
Primary Contact/ERC: David Krizek Title: Environmental Manager	Coordinate response and notifications	Office Phone: (520) 495-3527 Cell Phone: (520) 260-3490
Secondary Contact/ Back-up ERC: Javier Toro Title: Executive Director, Mining	Coordinate onsite response/activities	Office Phone: (520) 589-1128 Cell Phone: (520) 307-0565
Vice President Contact: Javier Del Rio Title: Vice President South America and USA	Authorizes the response and provides resources	Cell Phone: (520) 449-3648

Note: Alternate ERCs may be assigned and would be available on-call for 24-hour emergency response.

All employees will be instructed to report all emergency situations to their supervisor immediately. If the supervisor is not available, employees will be instructed to report the emergency immediately to the mine or plant manager or site coordinator as appropriate.

13.2 EMERGENCY EQUIPMENT

The Project site and mining operation is being designed to meet or exceed prescriptive BADCT standards that are established and provide containment and discharge control to prevent unauthorized discharges from entering the vadose zone or groundwater.

Rosemont will contract for, or will keep onsite, equipment to respond to and investigate / mitigate potential unauthorized discharges to groundwater. Emergency equipment and materials will be parked and/or stored in designated areas for emergency response. Equipment and materials to be available for emergency response include:

- Spill containment materials (spill kits)
- Backhoe or similar type equipment
- Dozer or similar type equipment

This information is required per A.A.C. R18-9-A204(D)(5).

13.3 GENERAL PROVISIONS

The following measures will be enacted to address and respond to potential discharges to groundwater that result in an AL exceedance, or exceedance of an AQL or DL, or other permit condition where there is the potential for imminent and substantial endangerment to public health and the environment.

The following are covered in this section:

- Initial response measures
- Measures to enact during response
- Post response measures

13.3.1 Initial Response Measures

The primary ERC will be contacted first. In the event the primary ERC is unavailable, the secondary ERC will be contacted.

Upon being notified of an imminent or actual emergency situation, the ERC (or designee) must immediately:

- Determine whether this Contingency Plan is applicable to the situation and if it should be activated.
- Activate internal communication systems, as appropriate, to alert relevant facility personnel.
- Dispatch appropriate response personnel.

The ERC (or designee) must immediately identify the character, exact source, amount, and real extent of released material by observation, review of records, testing, or any other appropriate method.

13.3.2 Measures to Enact During Response

During the emergency, the ERC (or designee) must take all reasonable and appropriate measures. These measures must include, where applicable:

- Stopping processes and operations.
- Collecting or containing released wastes.
- Removing or isolating containers.
- Monitoring for leaks.

13.3.3 Post Response Measures

Immediately after the emergency, the ERC (or designee) must provide for treating, storing or disposing of recovered wastes or any material that results from a release. This may include:

- Marking and securing contaminated areas.
- Arranging for proper treatment and disposal, including manifesting.
- Arranging for alternate accumulation/identification areas.

13.4 DISCHARGE LIMITATION AND WATER QUALITY LIMIT EXCEEDANCES

The following are covered in this section:

- Discharge limitation (DL) exceedances (**Section 13.4.1**)
- Water quality limit (WQL) exceedances (**Section 13.4.2**)
- Alert level (AL) exceedances (**Section 13.4.3**)
- Aquifer quality level (AQL) or aquifer water quality standard (AWQS) exceedances (**Section 13.4.4**)

The notification or reporting timeframes indicated in the following sections are typical and will be updated in the Contingency / Emergency Response Plan based on the issued aquifer protection permit.

13.4.1 Discharge Limitation Exceedances

In the event of a DL exceedance, the ERC (or designee) will review the exceedance as soon as practicable and report the occurrence, including proposed mitigation measures as appropriate, to ADEQ’s Groundwater Protection Value Stream.

In addition, Rosemont will, as soon as practicable, submit a work plan to ADEQ to describe and mitigate the unauthorized discharge when potential pollution is involved.

13.4.2 Water Quality Limit Exceedances

This section outlines the actions that will be taken in the event of an Alert Level (AL), Aquifer Quality Limit (AQL) at a designated Point of Compliance (POC) monitor well.

13.4.2.1 Verification Sampling

If, based on laboratory analytical results, an exceedance of an AL, AQL, or numeric AWQS is discovered, the ERC (or designee) will ensure that verification sampling is conducted within five (5) days of becoming aware of the exceedance. Verification sampling and analysis will use the same protocols and test methods for the constituent(s) that exceeded the AL, AQL, or numeric AWQS (i.e., an approved sampling and analysis Plan [SAP]).

13.4.2.2 External Notification

If the AL or AQL exceedance is confirmed through verification sampling, the ERC (or designee) will notify ADEQ Water Quality Compliance Section in writing within five (5) days of receipt of the verification analytical results.

13.4.3 AL Exceedances

If the analytical results from the verification sampling confirm that an Alert Level (AL) has been exceeded, the ERC (or designee) will coordinate and implement the following actions.

1. The ERC (or designee) will coordinate and implement increased monitoring at the POC well in which the AL exceedance occurred.
2. As soon as practicable, the ERC (or designee) will immediately initiate an investigation as to the cause of the AL exceedance. The investigation may include inspection of all discharging facilities and all related pollution control devices, review of any operational and maintenance practices that may have resulted in an unexpected discharge, and hydrologic review of groundwater conditions, including a review of upgradient water quality data from existing wells.
3. The ERC (or designee) will initiate corrective actions. If a corrective action required to address the AL exceedance is not specified in the permit, the ERC (or designee) will coordinate with ADEQ to meet and discuss the proposed corrective action.
4. Alternatively, the ERC (or designee) will prepare and submit a technical demonstration for submittal to ADEQ if the constituent(s) causing the AL exceedance is not “reasonably expected to cause a violation of an AQL”.
5. Within thirty (30) days following confirmation of an AL exceedance, the ERC (or designee) will prepare a written report that includes the following:
    a. Identification and description of the exceedance;
    b. Description of the cause;
    c. The period of violation, including exact date(s) and time(s), if known, and the anticipated time period during which the violation is expected to continue;
    d. Any corrective action taken or planned to mitigate the effects of the violation, or to eliminate or prevent a recurrence; and
    e. Copies of the analytical results from the verification sampling.
6. Increased monitoring (monthly) will be reduced to the regular frequency when the results of three (3) sequential sampling events demonstrate that no constituents exceed an AL.

7. If the increased monitoring required as a result of an AL exceedance continues for more than six (6) months (six sequential sampling events), the ERC (or designee) will coordinate and prepare a second report documenting and investigation of the continued AL exceedance within thirty (30) days of the receipt of laboratory results of the sixth (6th) sampling event.

13.4.4 AQL or AWQS Exceedance Actions

A verified exceedance of an AQL or numeric aquifer water quality standard (AWQS) is considered a violation unless it is demonstrated within ninety (90) days of becoming aware of the AQL exceedance (or longer time if agreed to by ADEQ) that the exceedance was not caused or contributed to by pollutants discharged from the Project.

1. The ERC (or designee) will implement increased monitoring at the POC well in which the AQL or numeric AWQS exceedance occurred. Monitoring at the POC well will be increased to monthly.
2. The ERC (or designee) will initiate an investigation as to the cause of the AQL or numeric AWQS exceedance. The investigation may include inspection of all discharging facilities, review of any operational and maintenance practices that may have resulted in an unexpected discharge, and hydrologic review of groundwater conditions, including review of upgradient water quality data from existing wells.
3. If a corrective action not specific in the APP is required to address the AQL or numeric AWQS exceedance, Rosemont will coordinate with ADEQ to meet and discuss the proposed corrective action.
4. Corrective actions to be taken in the event of an AQL or numeric AWQS exceedance may include control of the source of discharge; cleanup of affected soil, surface water or groundwater; and/or mitigation of the impact of pollutants on existing uses of the aquifer.
5. Within thirty (30) days following confirmation of an AQL or numeric AWQS exceedance, the ERC (or designee) will prepare a written report that includes the following:
    a. Identification and description;
    b. Description of the cause;
    c. The period of permit violation, including exact date(s) and time(s), if known, and anticipated time period during which the violation is expected to continue;
    d. Any corrective action taken or planned to mitigate the effects of the violation, or to eliminate or prevent a recurrence of the violation;
    e. Any monitoring activity or other information which indicates that any other pollutants would be reasonably expected to cause a violation of a numeric AWQS at the POC;
    f. Proposed changes to the monitoring, which may include changes in constituents or increased frequency of monitoring;
    g. Description of any malfunction or failure of pollution control devices or other equipment or processes that may have contributed to the AQL or numeric AWQS exceedance; and
    h. Copies of laboratory analytical results.

13.5 INVESTIGATION / MITIGATION MEASURES

After confirmation of an exceeded AL, AQL, or numeric AWQS by the results of verification sampling, the ERC (or designee) may select to implement one or more of the following mitigation measures:

1. Monitoring that may include increased frequency, additional constituents, or additional monitoring locations;

2. Inspection, testing, or maintenance of the discharge control features;
3. Evaluation of the effectiveness of discharge control technologies and consideration of technology upgrades;
4. Completion of a hydrogeologic study to assess the extent of soil or groundwater / aquifer impact; and/or
5. Corrective actions as described in the following **Section 13.6**.

13.6 CORRECTIVE ACTIONS

Once a discharge violation to groundwater has been identified and delineated, the ERC (or designee) in conjunction with ADEQ, will determine the appropriate corrective actions that may include the following per A.A.C. R18-9-A204(B)(8):

- Control of the source of an unauthorized discharge, such as repair of liners;
- Soil cleanup;
- Cleanup of affected surface waters;
- Cleanup of affected parts of the aquifer; or
- Mitigation to limit the impact of pollutants on existing uses of the aquifer.

After completion of any corrective action, the ERC (or designee) will submit to ADEQ, a written report describing the causes, impacts, and corrective actions completed to resolve the problem.

14.0 APP FACILITY INSPECTION AND MONITORING

Appendix K provides preliminary APP facility monitoring and inspection sheets for the area-wide APP regulated facilities described in this Application Document. These monitoring and inspection sheets wil be updated based on actual permit conditions.

In addition to these sheets, Operation Monitoring, and Maintenance Manuals (O&M Manuals) will be prepared for the facilities per the schedule presented in **Section 20**.

Monitoring and inspection sheets for the following facilities are provided in **Appendix K**:

- Tailings Storage Facility No. 1 (TSF-1) (**Appendix K.1**);
- Tailings Storage Facility No. 2 (TSF-2) (**Appendix K.2**);
- Waste Rock Facility (WRF) (**Appendix K.3**);
- Heap Leach Pad (HLP) (**Appendix K.4**);
- Pregnant Leach Solution (PLS) Pond (**Appendix K.5**);
- HLF North Stormwater Pond (**Appendix K.6**);
- HLF South Stormwater Pond (**Appendix K.7**);
- Raffinate Pond (**Appendix K.8**);
- Reclaim Pond (**Appendix K.9**);
- Process Area Stormwater Pond (**Appendix K.10**); and
- Primary Settling Pond (**Appendix K.11**).

Monitoring related to the open pits during operations will include the tracking of dewatering well volumes and water pumped from pit sumps. Pit wall stability assessments will also be performed. Post-closure monitoring will include measuring pit lake water levels and taking periodic water quality samples.

15.0 WASTE MANAGEMENT

This section provides an overview of the types of regulated wastes that will be generated at the Copper World Project. It is not anticipated that the Project site will have a permanent waste disposal facility such as a non-municipal waste landfill; therefore, wastes generated on-site will be stored and shipped off-site for disposal through licensed waste disposal contractors. All wastes handled and stored on the Project site will meet the requirements set forth in all applicable federal, state, and county regulations. The applicable regulations, management and handling procedures, monitoring and records for each type of waste are detailed in the Materials Management Plan (Rosemont, 2022e) provided in **Appendix L.1**.

15.1 NON-HAZARDOUS WASTE

Non-hazardous solid wastes will be managed in accordance with all applicable federal, state, and county regulations. Non-hazardous waste will be managed in dumpsters or other containers appropriate for the waste being managed. All accumulated non-hazardous waste will be shipped off-site to a licensed recycling or disposal facility. The applicable regulations, management and handling procedures, monitoring and records for non-hazardous wastes are detailed in the Materials Management Plan (Rosemont, 2022c) provided in **Appendix L.1**.

15.2 HAZARDOUS WASTES

Hazardous waste at the Project site will be managed in accordance with all applicable federal, state, and county laws. The primary regulation that applies to hazardous waste management at the site is the Resource Conservation and Recovery Act (RCRA). Although the Bevil Amendment exempts much of the waste generated at mining facilities, some hazardous waste generated at a mining site are subject to RCRA Subtitle C. It is anticipated that the Copper World Project will maintain very small quantity generator (VSQG) status as defined in RCRA Subtitle C for the Project's operational life. However, the RCRA generator status may change for short periods during construction. Rosemont will accordingly meet all requirements set forth by the regulations that apply to the appropriate generator status. The applicable regulations, management and handling procedures, monitoring and records for hazardous wastes are detailed in the Materials Management Plan (Rosemont, 2022c) provided in **Appendix L.1**.

15.3 CONSTRUCTION DEBRIS

Construction debris will be managed on site using dumpsters or other containers and be shipped off site to a licensed recycling or disposal facility. The applicable regulations, management and handling procedures, monitoring and records for construction debris are detailed in the Materials Management Plan (Rosemont, 2022c) provided in **Appendix L.1**.

15.4 LARGE TIRE DISPOSAL

Tires that are greater than three (3) feet in diameter are eligible for on-site burial as outlined in A.A.C. Title 18 Chapter 13, Article 12. Tires eligible for onsite disposal include tires from mine haul trucks, front loaders, and other non-tracked heavy equipment. It is anticipated that the large tire burial cell(s) will be placed at several locations within the Waste Rock Facility (WRF). Rosemont will meet all applicable federal, state, and county regulations regarding the on-site buriall of waste tires. The applicable regulations, management and handling procedures, monitoring and records for large waste tires are detailed in the Tire Disposal Strategy memorandum (Rosemont, 2022a) provided in **Appendix L.2**.

16.0 CLOSURE STRATEGY

As a component of the overall environmental stewardship policy of Hudbay and Rosemont Copper Company, a Conceptual Closure Plan (Wood, 2022k) has been developed to meet or exceed regulatory requirements. This closure strategy provides a template for further refinement of the reclamation and closure design during the operational phases of the Project. Wood (2022k) is provided in **Appendix M**.

Detailed sampling and analysis plans would be prepared as part of the final reclamation and closure strategy for the Project prior to the cessation of operations. A detailed solutions management plan would also be prepared at this time as part of closure planning as well as details on other post-closure activities, such as stormwater channel maintenance and reclamation cover monitoring. Post-closure activity reports would be prepared and shared with ADEQ along with test results and final facility configuration drawings, etc.

Major elements of the reclamation and closure plan are dictated by regulatory requirements contained in the Arizona Mined Land Reclamation Act administered by the Arizona State Mine Inspector (ASMI) and the Arizona Aquifer Protection Permit (APP) Program administered by ADEQ. Although other regulatory requirements may contribute mitigation elements, these two regulatory programs form the framework for the reclamation and closure plan developed for the Copper World Project.

Reclamation generally refers to the physical stabilization of a facility, which generally includes grading, erosion protection, structure removal, and revegetation. These aspects are generally regulated by ASMI and are detailed in the Mined Land Reclamation Plan (Rosemont, 2022d) developed for the Project (see **Appendix N.2**). Closure activities include solution management, reagent removal, and remediation activities. These aspects are generally regulated by ADEQ.

Per the Mined Land Reclamation Plan provided in **Appendix N.2**, the post-mining land uses are stated as on-going ranching and wildlife habitat. Public access restrictions are anticipated to remain in place post-mining.

In addition to the Conceptual Closure Plan (Wood, 2022k), the design and operation of the Project also provides protection of the environment via the implementation of best management practices (BMPs). These BMPs are primarily guided by the protection of surface water and groundwater resources. Sediment transport is addressed through design of stormwater control features such as sediment basins and dust control measures associated with air permit compliance requirements. Although the proposed reclamation / closure design elements for the Project do not incorporate phased or concurrent reclamation in the cost estimate, concurrent reclamation may be practicable for some of the facilities, such as for the waste rock facility (WRF). However, the reclamation / closure of facilities is staged based on the anticipated life of the facility, such as beginning closure of the heap leach facility starting in Year 10 of the 15-year mine life.

In addition to summarizing the closure strategy for the Copper World Project, this section also discusses the potential for a temporary cessation of operations and the steps to be take in such an event.

16.1 PRESCRIPTIVE BADCT CLOSURE OBJECTIVES

The objectives of the Conceptual Closure Plan (Wood, 2022k) are to meet or exceed the Prescriptive BADCT closure and post-closure criteria for process facilities where such criteria have been established, which include non-stormwater ponds, process solution ponds, the heap leach facility, and the tailings storage facilities. The reclamation and closure objectives for other facilities not specifically addressed by Prescriptive BADCT criteria are to ensure long-term physical and chemical stability and to allow for the identified post-closure land use.

The Prescriptive BADCT closure and post-closure requirements are described in the following sections as provided in the Arizona Mining Guidance Manual BADCT (ADEQ, 2004). These criteria were applied to the relevant facilities associated with the Copper World Project.

16.1.1 Non-Stormwater Ponds

As part of the Copper World Project, the following non-stormwater ponds are planned, each of which may receive and hold process solutions for short periods of time during upsets:

- Process Area Stormwater Pond
- HLF North Stormwater Pond
- HLF South Stormwater Pond

The design of these non-stormwater ponds was described in the BADCT section (**Section 10.0)** and shown on the drawings provided in **Appendix I.10**. The closure of these ponds will follow the prescriptive BADCT methods as summarized below.

Element: Contain and control discharges after closure.

Prescriptive Criteria:1) Closure / Post-Closure Plan to be submitted to ADEQ for approval. 2) The following are elements of a closure strategy (A.R.S. 94-243.A.8) for a Prescriptive BADCT Non-Storm Water Pond:

- Excavated Ponds:
    - Removal and appropriate disposal of solid residue on the geomembrane.
    - Geomembrane inspection for evidence of holes, tears or defective seams that could have leaked.
    - Where there is no evidence of leakage, the geomembrane can be folded in place and buried or removed for appropriate disposal elsewhere.
    - Where geomembrane inspection reveals potential leaks, inspect soil for visual signs of impact. ADEQ may require soil sampling and analysis to determine the potential for threat to groundwater quality.
    - Conduct soil remediation if required to prevent groundwater impact.
    - After the residual soil conditions are approved by ADEQ, the geomembrane can be buried or be removed for appropriate disposal elsewhere, and the pond excavation backfilled.
    - The filled area will be graded to minimize infiltration.
    - Capping of the pond area with a low permeability cover may also be part of a closure strategy if it will achieve further discharge reduction that maintains compliance with AWQS at the point of compliance.
- Bermed Ponds:
    - Same closure procedures as for excavated ponds, except geomembranes will not be buried in place and must be appropriately disposed of elsewhere.

16.1.2 Process Solution Ponds

Ponds that continually contain process solution as a normal function of facility operations are considered Process Solution Ponds and will be designed in accordance with the criteria identified in the BADCT Manual. Prescriptive closure criteria are provided below.

As part of the Copper World Project, the following process solution ponds are planned:

- Pregnant Leach Solution (PLS) Pond
- Raffinate Pond
- Reclaim Pond

- Primary Settling Pond

The design of these process solution ponds was described in the BADCT section (**Section 10.0)** and shown on the drawings provided in **Appendix I.10**. The closure of these ponds will follow the prescriptive BADCT methods as summarized below.

Element: Contain and control discharges after closure

Prescriptive Criteria: 1) Closure / Post-Closure Plan to be submitted to ADEQ for approval. 2) The following are elements of a closure strategy (A.R.S. 94-243.A.8) for a Prescriptive BADCT Process Solution Pond:

- Excavated Ponds:
    - Removal and appropriate disposal of solid residue on the upper geomembrane.
    - Inspection of the lower geomembrane and underlying soils for any visual signs of liner damage, liner defects, or impact by leakage through the lower liner. ADEQ may require soil sampling and analysis to determine the potential for threat to groundwater quality.
    - Conduct soil remediation if required to prevent groundwater impact.
    - After the residual soil conditions are approved by ADEQ, the geomembranes can be buried or be removed for appropriate disposal elsewhere, and the pond excavation backfilled.
    - The filled area will be graded to minimize infiltration.
    - Capping of the pond area with a low permeability cover may also be part of a closure strategy if it will achieve further discharge reduction that maintains compliance with AWQS at the point of compliance.
- Bermed Ponds:
    - Same closure procedures as for excavated ponds, except geomembranes will not be buried in place and must be appropriately disposed of elsewhere.

16.1.3 Heap Leach Pad

The design of the Heap Leach Pad was described in the BADCT section (**Section 10.0)** and shown on the drawings provided in **Appendix I.10**. The closure of the HLP will follow the prescriptive BADCT methods as summarized below.

Element: Prevent, contain, or control discharges after closure.

Prescriptive Criteria: Closure / Post-Closure Plan to be submitted to ADEQ for approval. Closure Plan to eliminate, to the greatest extent practicable, any reasonable probability of further discharges and of exceeding AWQS at the point of compliance. 2) Neutralization or rinsing of all spent ore or waste residues. 3) Elimination of free liquids. 4) Stabilization of heap materials. 5) Recontouring of the heap as necessary to eliminate ponding.

Although one of the prescriptive criteria is neutralizing or rinsing the spent ore, ADEQ considers other alternatives due to the volume of water needed to neutralize or rinse ore on a heap leach pad. Conservation of water is extremely important and thus other methods for closure are considered and are applied to the heap leach pad (HLP) at the Copper World Project.

16.1.4 Tailings Storage Facility

Tailing impoundments receive and contain finely ground spent ore in the form of a thickened slurry from process facilities.

Element: Prevent, contain, or control discharges after closure

Prescriptive Criteria: 1) Closure / Post-Closure Plan submitted to ADEQ for approval. Closure Plan to eliminate, to the greatest extent practicable, any reasonable probability of future discharges and of exceeding AWQS at the point of compliance. 2) Tailing impoundment site will be stabilized and allowed to dry to permit safe access by heavy equipment. The surface will then be recontoured to eliminate ponding and limit infiltration utilizing an appropriately designed cover system. 3) Permanent closure for contained solutions can be by either physical removal or containment and evaporation.

16.2 CLOSURE DESIGN

The objectives of the Conceptual Closure Plan (Wood, 2022k) are to meet or exceed the Prescriptive BADCT closure and post-closure criteria, where such criteria exist. Where prescriptive criteria do not exist, the intent of the closure strategy is tio meet the requirements of A.R.S § 49-252. The reclamation and closure plan proposed for the Project has several key concepts that provide the basis for the reclamation and closure plan throughout the operational life of the facility. These concepts include:

- Designing facilities with reclamation and closure in mind, such as construction of facilities at the ultimate reclaimed slopes to avoid regrading after operations have ceased.
- Minimizing downstream hydrologic disturbances.
- Preparing a comprehensive drainage plan prioritizing diversion of non-contact stormwater to the extent practical.
- Using modern technology to minimize the generation of impacted water and maximizing the reuse of water.
- Managing operations to minimize environmental impacts.
- Reclaiming the facilities to enhance post-mining land use.
- Salvaging soil resources.
- Select vegetation removal; and
- Revegetation of reclaimed surfaces.

An important aspect of closure begins during construction of the facilities through salvage of growth media (soil) prior to construction of the mine facilities. This salvaged growth media will be used as cover for the reclaimed heap leach and tailings facilities during reclamation and closure. Up to 24 inches or more will mainly be salvaged within the footprints of the TSFs and HLP, including the processing plant area. Temporary storage areas for growth media may include locations within facility footprints prior to construction such as at TSF-2 and/or at locations within the waste rock facility (WRF). Approximately 5 million cubic yards (yd^3) of growth media will be salvaged from the footprints of the proposed facilities. About 4.7 million yd^3 of growth media are needed during reclamation and closure.

16.2.1 Non-stormwater Ponds

Non-stormwater ponds as defined by the Arizona Mining Guidance Manual BADCT for the Project include the two HLF stormwater ponds (North and South) and the Process Area Stormwater Pond. Methods for closure of non-stormwater ponds will be in accordance with ADEQ BADCT Prescriptive requirements as described in **Section 16.1.1**. Because these ponds will be partially excavated, Rosemont will use the prescriptive closure method for excavated ponds. The HLF North Stormwater Pond will be converted to an evaporation cell during closure of the HLF as described in **Section 10.2.3.7 and Section 16.2.3.1**.

16.2.2 Process Ponds

Process ponds include ponds that are designed to contain process solution either from the plant site or from the HLF. Process ponds for the Project include the PLS Pond, Raffinate Pond, Primary Settling Pond, and Reclaim Pond. Because these ponds will be partially excavated, Rosemont will use the prescriptive closure method for excavated ponds. Prescriptive closure methods that will be used for closure of the process ponds at the Project are provided in **Section 16.1.2**. These methods will be used to close the process ponds except for the PLS Pond, which will be converted to an evaporation cell during the closure of HLF, as described in **Section 10.2.2.7 and Section 16.2.3.**1.

16.2.3 Heap Leach Facility

Closure and reclamation of the HLF will focus on managing of draindown from the heap leach and long-term management of stormwater. Closure methods will be in accordance with ADEQ BADCT Prescriptive requirements for heap leach facilities, i.e., the requirements of A.A.C R18-9-A209(B) will be met.

16.2.3.1 Draindown Management

The solution contained within the HLF at closure, and precipitation that infiltrates onto the HLP and asociated ponds after closure, will be considered draindown solution (contact water) and managed using the PLS Pond. Immediately following closure, draindown from the HLP will be processed to recover copper resources. Once it is no longer economic to recover copper from the solution, draindown will be actively managed through enhanced evaporation techniques to reduce the volume of solution in the heap. Active evaporation may include using devices such as snowmakers on the heap to enhance solution evaporation of solution. Active management of solution will continue until the volume of draindown can be passively evaporated from an evaporation cell.

Based on results from the Heap Leach Draindown Estimator (HLDE), passive evaporation would be started approximately eight (8) years following start of active evaporation. The PLS Pond will be used during active evaporation to store draindown solution prior to pumping to the evaporators on the top of the heap. Prior to conversion to passive evaporation, the PLS Pond and the HLF North Stormwater Pond will be converted to evaporation cells.

Surface water control features developed for this strategy include provisions for managing the offsite, run-on stormwater flows as well as stormwater generated from precipitation falling directly onto the Project site. Primary features of the closure strategy include diversions up-gradient of the facilities, surface grading, on-site stormwater management through stormwater and erosion control, and cover design.

16.2.3.2 Infiltration and Erosion Control

Following the completion of active evaporation (estimated approximately eight [8] years in duration), the top surface of the heap will be graded to minimize ponding and promote runoff. The top surfaces will be graded to a minimum of one (1) percent grade toward the slopes of the facility. Inner bench slopes will also be graded to promote runoff. Once grading is completed, an 18-inch soil cover will be placed on the heap top and side slopes. This 18-inch soil cover will provide for water retention and will have the evapotranspirative characteristics necessary to limit net infiltration and support native vegetation growth.

In addition, the slopes created on the top of HLF will promote runoff toward the slopes and off of the facility. Benches on the reclaimed heap will reduce runoff velocities. Runoff from the reclaimed leach pile will ultimately flow into a diversion channel and to a natural drainage. This closure strategy utilizes a vegetated cover with a site-specific native seed mix.

16.2.4 Tailings Storage Facilities

Closure and reclamation of the tailings storage facilites (TSFs) will focus on managing both draindown from the tailings and long-term stormwater management. Closure methods will be in accordance with ADEQ BADCT Prescriptive requirements for tailings storage facilities prior to closure, the requirements of A.A.C R18-9-A209(B) will be met.

16.2.4.1 Draindown Management

The solution contained within the TSFs at closure, and precipitation that infiltrates onto the tailings after closure, will be managed as draindown (contact water). Immediately following closure, draindown from the TSFs will be actively managed through enhanced evaporation techniques to reduce draindown volumes. Active evaporation may include using devices such as snowmakers on the TSFs to enhance solution evaporation. Active management of solution will continue until the volume of draindown can be passively managed using sulfate reducing cells. The actual need for the sulfate reducing cells will be evaluated during the post-closure period.

Using the Heap Leach Draindown Estimator (HLDE), passive management would be started after approximately 30 years following cessation of active deposition at TSF-1 and after approximately 12 years at TSF-2. The Primary Settling Pond will be used during active evaporation to store draindown solutions prior to pumping to the evaporators on top of the TSFs.

Once draindown volumes are low enough to be passively managed, the existing seepage collection trenches, used during operations for collection of seepage via the seepage collection system, will be converted to sulface reducing treatment cells. Based on testing, the tailings seepage is expected to exceed EPA MCLs for sulfate and TDS. Converting the seepage collection trenches to sulfate reducing treatment cells will reduce sulfate and TDS to a level that allows infiltration of the solution into the ground following treatment. Testing (bench and pilot scale) will be conducted during operations to refine the proper cell design to ultimately allow infiltration of the solution into the ground. Additionally, the treated draindown solutions from the sulfate treatment cells may be released to surface drainages depending on the quality of the water. In this case a surface discharge permit would be obtained from ADEQ if required. As noted above, the actual need for the sulfate reducting cells will be evaluated during the post-closure period.

The following provides a summary of the draindown management for the TSFs.

- TSF embankment slopes constructed to final slope configuration
- Allow draindown of solution to occur and drying of surface
- Manage draindown solution through active evaporation
- Long-term management of draindown solution through the use of treatment cells – convert existing seepage collection trenches to sulfate reducing treatment cells.
- Once the surface is stable enough or equipment, grade the surface to promote run-off and minimize infiltration
- Place and grade cover material – 24 inches on embankment slopes and 18 inches on top of the tailings
- Revegetation
- Post-closure monitoring of Point of Compliance (POC) wells and facility maintenance

Surface water control features incorporated with this strategy include provisions for managing the offsite, run-on stormwater flows and stormwater generated from precipitation falling directly onto the Project site. Primary features of the closure strategy include diversions up-gradient of the facilities, surface grading, onsite stormwater management through stormwater and erosion control, and cover design.

16.2.4.2 Stormwater Management

One of the closure strategy objetives is to manage stormwater run-on and run-off to reduce net infiltration into the tailings and minimize erosion. Diversion ditches will be constructed during operations to divert water around the TSF and prevent erosion of the TSF embankment. Details of the stormwater management system are presented in Site Water Management Plan (Wood, 2022g).

16.2.4.3 Impoundment Runoff Control

The closure design concept for the tailings impoundment is to place a growth media cover on the tailings top and embankment, routing of stormwater run-off from the covered tailings, and convey that stormwater to a diversion channel at the toe of the TSF embankment.

As active draindown management occurs, the tailings surface will begin to dry and consolidate. Once the top surface has dried and consolidated sufficiently to allow equipment to safely operate on the surface, the final growth media cover will be placed. The growth media will be hauled from the growth media stockpile. Approximatley 18 inches of growth media will be placed on the tailings surface and 24 inches on the tailings embankment slopes. This depth of growth media will provide storage capacity for precipitation, thus providing moisture for vegetation growth. This will aid in limiting infiltration into the tailings material.

Once equipment is able to safely access the tailings surface, downchute channels will be constructed from the decant pool of each cell to convey stormwater run-off from the TSF surface. Stormwater will be routed down the slope of the TSF embankment to a diversion channel that will convey the runoff to a natural drainage. The downchutes have been designed to manage the runoff from the 1,000-year, 24-hour storm event. **Table 10.08** provides the channel size and riprap size for TSF-1 and TSF-2 channels.

The downchutes will be constructed from the decant pool through a breach in the TSF embankment and down the slope of the embankment. The channel will be protected using a geofabric on the base of the channel with riprap or other erosion protection on the sides and bottom of the channel. The area of the embankment breach will also be protected with riprap or other erosion protection. Larger riprap will be place in the discharge point where the downchute directs stormwater into the diversion channel. Ultimately, the channel along the embankment toe will connect to into an existing natural drainage. Additonal stormwater channels will be constructed on the tailings side slopes to route stormwater to the downchutes.

16.2.4.4 Infiltration and Erosion Control

The objective of TSF cover design is to provide a durable and functional cover that limits erosion while limiting, to the greatest extent practicable, net percolation into the underlying tailings. This closure strategy addresses the cover of the impoundment surface as well as the embankment slopes.

This closure strategy utilizes a vegetated cover with a site-specific native seed mix that represents surrounding vegetation. The 18-inch soil cover on the tailings top surface, and 24-inch soil cover on the TSF embankment slopes, is anticipated to provide the water retention and evapotranspirative characteristics necessary to limit net infiltration and support native vegetation growth. Channels will also be constructed to route stormwater off the facility.

The top surface of the tailings will be maintained with a gentle grade of 0.5 percent during tailings deposition toward the proposed decant pool. This gentle grade mitigates runoff velocities as well as the erosive forces. This grade of 0.5 percent is utilized in the design throughout the majority of the surface to not only minimize surface erosion but to also promote the sustainability of the vegetation cover. A portion of the former decant pool basin and discharge channel will be graded slightly steeper at about 1.0 to 2.0 percent based on final operational grades. Additional erosion protection in the decant pool area will be added as needed.

16.2.4.5 Closure Sequencing

The closure strategy design considers the efficient deposition of tailings throughout the life of the TSFs, that requires limited re-contouring at closure. Minimal grading of the heap is also anticipated due to the construction of slopes to the overall configuration. Addressing the sequencing of closure operations, the strategy has four (4) phases to meet the final closure objectives:

Phase 1 – Closure Activities During Operation

During operations, the TSF starter dams, TSF operational slopes, and heap leach slopes will be constructed to the final overall slope. This will eliminate the need for extensive grading of the slopes following cessation of operations. In addition, long-term diversion channels will be sized and constructed for post-closure use, thus eliminating the needed for resizing the diversion channels.

Phase 2 – Closure Activities During the Final Years of Operation

Near the final years of operation for each TSF cell, tailings deposition will be managed to create a pool location to facilitate closure of the facility. The pool location for each TSF cell will be optimal for development of a discharge channel to convey runoff from the reclaimed TSF surface and into a diversion channel located at the toe of the TSF embankment. The diversion channel will then convey runoff to an existing natural drainage.

Sufficiently dry areas of the TSF, and areas that meet the final grade contours with no additional tailings deposition, will be covered with the growth media. These tailings areas must be sufficiently dry to support low ground pressure equipment that will place the cover material. The cover material can also be placed on the slopes of the TSFs once the embankment is at its final elevation.

Closure of the HLF will begin following cessation of oxide ore placement (Year 9) and active leaching (estimated Year 10). Active evaporation of the HLP draindown solutions is expected to take about (8) eight years followed by passive evaporation in evaporation cells. Passive evaporation is expected to begin one to two years following the cessation of mining activity.

Other closure activities that may take place during the latter years of operation include placing growth media on the HLF slopes, ripping and seeding portions of the WRF, and reclamation of roads that are no longer needed for operations.

Phase 3 – Post-Operation Closure Activities

The surfaces of the TSF embankments, and the heap leach slopes, are anticipated to be stable for placement of the growth media immediately upon achieving the ultimate height. As such, some portions of the slopes may be covered during the final years of operation, with the remainder of the facilities being covered with growth media following the cessation of operations.

A key issue with closure of the TSF impoundment surfaces is the anticipated settlement due to the saturated nature of the fined grained tailings stored within the impoundments. Settlement magnitude and rate will depend on the depth of tailings and tailings characteristics, including particle size gradation and degree of saturation. Settlements of two (2) feet or more are anticipated within the impoundment, with saturated conditions existing in the interior of the impoundments for decades after tailings deposition has ceased and draindown continues. Uneven settling is anticipated with greater settlement occurring in areas with higher deposition depths due to the native ground slope.

Settlement of embankment breach areas for the discharge channel and side slope channels should be minimal. The cover soils can be placed once the upper portion of the tailings surface has dried sufficiently enough to support haul and spreading equipment. Localized ground stabilization methods along haul routes, including geogrids, may be required. Once sufficient settling of the surface has occurred, the long-term drainage channels from the individual TSF ponding areas will be constructed.

Disturbed areas of the Project will be seeded with an approved site-specific native seed mix. Drill seeding will be the primary method of revegetation, including mulch application. Hydroseeding with appropriate mulches or tackifiers may be utilized as well in areas inaccessible to drill seeding equipment. Vegetation establishment will be one of the primary factors in minimizing erosion and development of a productive post-mining land use.

Phase 4 – Post Closure Monitoring and Maintenance

A monitoring and maintenance program will be initiated following the reclamation activities and will be performed for a minimum of five (5) years after closure activities are completed. This monitoring and maintenance program will be conduced on a semi-annual basis, or after significant precipitation events, and will focus on evaluating the performance of the drainage control surface features and facility cover systems. Maintenance (additional erosion protection and/or seeding) will be performed as required based on the inspections, to correct noted deficiencies.

Additional monitoring will be focused on water quality and will include sampling and testing of stormwater runoff, seepage water, and groundwater at the point of complaince (POC) wells.

- Groundwater monitoring will be conducted at the POCs approved by ADEQ. The proposed POCs are shown on **Figure 36** with locations described in **Section 12.3**. All the POCs will be groundwater wells with the screened portion in the bedrock aquifer. Post-closure monitoring at the POC wells is planned to be conducted for a period of 35 years following the cessation of mining.
- If compliance issues are identified during the post-closure monitoring period, more frequent monitoring will be conducted based on coordination with ADEQ to determine if the compliance issue is an anomaly or is a trend. Based on the additional monitoring results, Rosemont will work with ADEQ to determine future needs.

16.3 TEMPORARY CESSATION OF OPERATIONS

In addition to the Conceptual Closure Plan (Wood, 2022k), Rosemont has identified actions to be taken to secure and stabilize the Project site in the event that operations temporary cease. During temporary cessation of operation (interim closure), Rosemont will:

- Provide notification of cessation of operation to the ADEQ.
- Maintain security on-site and active on a 24-hour basis to ensure access to the operations areas is restricted to authorized personnel.
- Perform an orderly shut-down of operations including but not limited to:
    - Wash milling equipment and concentrator
    - Drain flotation cells and wash
    - Perform an orderly drain-drown of the thickeners and fill with water
    - Maintain tailings seepage collection systems and initiate as needed solution evaporation
    - Continue SX-EW plant operation until grade diminishes, initiate as needed solution evaporation
    - Clean as needed silos, tanks and bins according to contents
    - Maintain ponds to five feet below freeboard level
    - Fill water tank on-site and shut down pump stations and well field, use on-site water wells as backup
    - Arrange for waste shipments
    - Perform and orderly shut-down of mobile equipment and park
- Ensure operations and maintenance personnel maintain scheduled pump and generator maintenance for operational readiness.
- Ensure monitoring is scheduled and personnel are available to perform monitoring as required and in coordination with ADEQ.

17.0 COST ESTIMATES

Per A.A.C. R18-9-A201(B)(5), this section covers cost estimates for facility construction, operation, maintenance, closure and post-closure. These costs are related to APP regulated facilities. APP regulated facilities shall be designed, constructed, operated, and maintained to meet the requirement of Per A.R.S. §49-243(B) and A.A.C R18-9-A202(A)(5).

In addition to facilities regulated under the ADEQ's APP Program, reclamation costs associated with ASMI's Mined Land Reclamation Program are also summarized herein. Closure / reclamation costs were apportioned between these programs to avoid double-bonding.

17.1 CONSTRUCTION, OPERATING AND MAINTENANCE COSTS

The construction (or capital) costs for the Project are summarized in **Table 17.01**. The costs are split between two components: the Engineering, Procurement, Construction Management (EPCM) cost and the owner (Rosemont) cost.

The EPCM cost estimate includes the sulfide grinding and milling circuit as well as the SX-EW plant. The sitewide service cost includes the main utility power and water lines as well as distribution throughout. The mining cost includes facility buildings such as the mine workshops and other minor mine infrastructure facilities.

Owner's costs include purchasing mining equipment, the cost of site preparation, and pre-stripping activities prior to full-scale mining operation. The owner's costs for mining are based on conventional open pit equipment (hydraulic excavator, 250t trucks capacity), and support equipment such as track dozers, graders, and additional ancillary equipment.

The cost of the earthworks for roads, haul roads, waste rock facilities, stockpiles, tailings storage facilities, heap leach pad and ponds, process plant platform areas, and water management facilities was estimated by Hudbay's technical team and Wood Engineering. Indirect costs include mobilization, demobilization, temporary equipment / infrastructure as well as the cost of labor from Hudbay personnel and third-party management costs incurred during the construction period.

Table 17.01: Summary of Construction Costs

Description	Unit	Total
EPCM Costs		
Sitewide Services	$M	$15
Mining	$M	$38
Processing	$M	686
Primary Crushing	*$M*	*$31*
Sulfide Plant	*$M*	*$227*
Molybdenum Plant	*$M*	*$15*
Reagents	*$M*	*$9*
Plant Services	*$M*	*$29*
SX/EW Plant	*$M*	*$190*
Concentrate Leach Plant	*$M*	*$88*
Acid Plant	*$M*	*$77*

Description	Unit	Total
Precious Metals Recovery Plant	*$M*	*$20*
Site services and utilities (site ponds and fluid management)	*$M*	*$3*
Internal Infrastructure (tailings facilities, roads, and administration buildings)	*$M*	*$19*
External Infrastructure (external roads, water and power supply)	*$M*	*$102*
Common Construction Facilities and Services	$M	$84,
Engineering Procurement & Construction Management	$M	$173
Contingency	$M	$224
Sub Total	$M	**$1,345**
Owner's Costs		
Mine Pre-Stripping	$M	$57
Mining Fleet and Equipment	$M	$186
Tailings Storage Facilities (TSFs)	$M	$20
Heap Leach Pad (HLP) and Ponds	$M	$45
Earthworks and Roads*	$M	$28
G&A (Environmental, Legal, Human Resources, Safety, Community, others)	$M	$156
Indirect and Contingency	$M	$79
Sub Total (Owner)	$M	**$572**
Grand Total	$M	**$1,917**

Note: (*) include costs of plants earthworks, surface water management, roads, haul roads, platforms, stock, and waste rock facility.

The operating costs were estimated on a per ton of material mined basis and include the following:

- Mining: $1.42/ton moved
- Processing: $5.57/ton processed
- Onsite G&A: $0.89/ton processed

Maintenance will ensure the operations continue at a steady production rate during the life of mine. The cost indicated below includes maintenance of the main mine and process plant equipment for the life of mine, including as needed facility expansions/repairs, etc.

- Maintenance cost: $531 million

17.2 RECLAMATION, CLOSURE AND POST-CLOSURE COST ESTIMATES

The estimated closure and post-closure costs prepared for the APP regulated facilities reflect the closure and post-closure strategies presented in the Conceptual Closure Plan (Wood, 2022k) provided in **Appendix M**. The closure strategy includes the tailings storage facilities (TSFs), heap leach facility (HLF), ponds, drainage diversions and process fluid management associated with the Project. The estimated closure and post-closure costs for APP regulated facilities is approximately $91.6 million.

Details are provided in **Section 17.2.1**. The closure plan cost estimate presented herein was developed with sufficient detail to meet the requirements of ADEQ as provided in A.A.C. R18-9-A209 and A.R.S. § 49-201.

Section 17.2.2 summarizes the reclamation costs attributable to ASMI's Mined Land Reclamation Program. Costs attributable to ASMI include items such demolition of the plant structures, removal of the power and water utilities, and revegetation of all disturbance areas, including the waste rock, tailings and heap leach areas.

Closure activities will begin in about year 10 of the 15-year life of the Project following the cessation of oxide ore addition to the HLP.

17.2.1 ADEQ Closure and Post-Closure Costs

Table 17.02 presents a summary of the estimated closure and post-closure cost attributable to ADEQ's APP program. Costs are detailed in the Conceptual Closure Plan (Wood, 2022k) in **Appendix M**. The closure cost estimate is also presented in **Appendix N.1** and provides details of the construction activities, quantities, unit of measure (units), unit rates, and total cost for each construction activity associated with facility closure. The closure activities and quantities were developed based on the strategy discussed in the Conceptual Closure Plan and summarized in **Section 16**.

Closure Stage 1 consists of the closure of the HLF which will be closed during active operations starting in Year 10 due to the cessation of oxide ore delivery to the heap leach pad (HLP) in Year 9.

Closure Stage 2 consists of closure of the TSFs and ponds, which begins following cessation of mining and processing operations in Year 15.

The estimated closure cost attributable to ADEQ is approximately $91.7 million. The basis of this cost estimate is discussed in the **Sections 17.2.2 and 17.2.2**.

Table 17.02: Summary of APP Regulated Facility Closure Costs

Facility	Labor	Equipment	Materials	Total
Process Ponds	$84,590	$195,578	$0	$280,168
Heap Leach	$549,724	$1,364,406	$5,850	$1,919,980
Tailings Storage Facilities	$3,448,938	$9,278,150	$0	$12,727,088
Drainage	$1,234,744	$279,749	$623,303	$2,137,796
Monitoring	$1,348,376	$1,161,534	$167,810	$2,677,720
Solid Waste Disposal	$0	$0	$0	$50,235
Process Fluid Management	$28,199,233	$16,880,189	$4,257,125	$49,386,547
Construction Management	$882,488	$825,237	$19,879	$1,727,604
Mob/Demob	$201,254	$0	$0	$201,254
Indirect Costs *	$0	$0	$0	$20,620,343
Total	$35,949,347	$29,984,843	$5,073,967	$91,678,735

* Engineering/Design/Construction Plan, Contingency, Insurance, Performance Bond, Contractor Profit, Contract Administration, Government Indirect Costs

17.2.2 Unit Rate Development

The unit rates and cost calculations for closure activities were from the Standardized Reclamation Cost Estimator (SRCE) and the Process Fluid Cost Estimator (PFCE), which were developed to provide standardized methods for reclamation and closure activities. The SRCE provides the costs and calculations for physical reclamation / closure of a site and the PFCE provides costs to address fluid management from heap leach and tailings facilities. In addition to these cost models, the HLDE was also used to estimate the timeframe needed to address process fluid management after cessation of operations. This model uses material property data and other estimated / assumed values to determine the length of time needed to actively reduce process solutions to a point where long-term passive management can occur of the draindown solution.

The TSF HLDE, HLF HLDE, SRCE and PFCE models (including inputs) are provided in the Conceptual Closure Plan (Wood, 2022k) provided in **Appendix M**. Many of the unit costs used in the models are from RSMeans equipment designations and Caterpillar equipment model designations, which is similar to other methods used to calculate closure costs.

Cost estimate line items are provided which include columns for labor, equipment, and materials. Material take-off quantities were totaled and applied to each reclamation and closure line item. The contractor crew size was applied to each bid item based on equipment operating efficiently for a 10-hour workday.

The cover material source for the TSFs and HLF were assumed to be sourced from growth media stockpiles which will either be located within the WRF area or within the HLP area. The growth media will mainly be salvaged from the footprints of the TSFs and HLP.

17.2.3 Other Costs

Construction cost estimates include direct and indirect costs to account for specific items that are not included in the line-item unit rates and are applicable to the third-party contractor. The cost estimate incorporates the following direct and indirect costs:

- Engineering, Design and Construction Plan (4%)
- Contingency (4%)
- Insurance (1.5% of labor)
- Performance Bond (3% of operations and maintenance [O&M] costs)
- Contractor Profit (10% of O&M costs)
- Contract Administration (6%)
- Government Indirect Costs (21% of Contract Administration)

17.3 ASMI RECLAMATION COSTS

The reclamation costs attributable to ASMI's Mined Land Reclamation Program include items such as demolition of the plant structures, removal of the power and water utilities, and revegetation of all disturbance areas, including the waste rock, tailings and heap leach areas. Costs are summarized in **Table 17.03**. The Mined Land Reclamation Plan (MLRP) developed for the Copper World Project is provided in **Appendix N.2** for reference.

Table 17.03: Summary of ASMI Reclamation Costs

Cost Element	Labor	Equipment	Material	Total
Earthwork/Recontouring	$1,041,222	$1,723,624	$149,289	$2,914,135
Revegetation/Stabilization	$482,124	$172,189	$1,344,698	$1,999,011

Waste Disposal	-	-	-	$143,213
Structure, Equipment, and Facility Removal	$8,718,267	$3,663,271	$266,568	$12,648,106
Monitoring	$105,331	$23,913	$134,469	$263,713
Construction Management and Support	$33,677	$6,578	$0	$40,255
Indirect Costs	-	-	-	$6,401,034
Total	$10,380,621	$5,589,575	$1,895,024	$24,409,467

17.4 POST-CLOSURE MONITORING AND MAINTENANCE COSTS

The following sections describe the long-term maintenance and monitoring activities, cost basis, and costs associated with both APP regulated facilities and those attributed to ASMI as described in the Copper World Mined Land Reclamation Plan.

17.4.1 ADEQ

Post-closure activities consist of maintaining the integrity of facility soil covers and monitoring at POC wells. Maintenance activities will begin the year following completion of both Closure Stage 1 and Closure Stage 2 reclamation activities and will occur for at least 5 years following final closure activities at the HLF such as construction of passive evaporation cells. Post-closure monitoring activities will include inspections to ensure erosion protection best management practices (BMPs) and revegetation are successful. For cost estimating purposes, it is assumed that inspections will be conducted for a period of 5 years. Costs also assume that 10 percent of reclaimed areas will require additional erosion protection maintenance and 10 percent of the revegetated areas will require reseeding to achieve a stable post-closure condition.

Post-closure water quality monitoring at the POCs will be conducted for a period of 35 years following cessation of mining and processing activity at the Project. For purposes of the cost estimate, this 35-year period of POC sampling will begin following cessation of mining and processing activities.

The estimated cost for post-closure monitoring and maintenance is about $3.0 million dollars. Details regarding the development of the cost estimate for post-closure monitoring and maintenance are in the Closure Plan provided in **Appendix M**. Post-closure fluid management costs are estimated to be $49.3 million dollars.

17.4.2 ASMI

For reclamation maintenance associated with the MLRP, it was also assumed that 10% of the total revegetation area would need to be reseeded per year. It was also assumed that 10% of the graded and reclaimed area would need erosion maintenance per year. Maintenance was assumed to occur for 5 years. This includes those reclaimed areas associated with the larger facilities such as the heap, tailings and WRF. Costs for reclamation monitoring during the 5-year reclamation and monitoring period was included in the MLRP costs. The estimated post-closure monitoring and maintenance cost attributable to the MLRP is about $264,000.

18.0 DEMONSTRATION OF TECHNICAL CAPABILITY

As part of the technical requirements in Title 18 Chapter 9 Article 2 Part A202.B, this section and the statement of qualifications and/or resumes provided in **Appendix O** demonstrate the technical capabilities from Rosemont Copper Company's internal experts and consultants, including Piteau Associates Inc., Wood Environment & Infrastructure Solution, Inc., Bowman Consulting, Ltd., Paterson & Cooke, and Ausenco. A brief description of the experience of each company involved in the preparation of this Application is presented below. Qualification and/or resumes for key staff are provided in **Appendix O**.

18.1 HUDBAY MINERALS INC., ROSEMONT COPPER COMPANY

Rosemont Copper Company (Rosemont) is a subsidiary of Hudbay Minerals Inc. (Hudbay), a diversified mining company in the production of copper concentrate and zinc metal. This Application was prepared under the direction of Hubday team members. See **Appendix O.1** for qualifications of key Hudbay personnel.

18.2 PITEAU ASSOCIATES INC.

Piteau Associates Inc. (Piteau) is a global organization specializing in water management and geotechnical issues. Piteau is an industry leader with respect to slope stability design, geotechnical assessment, hydrogeologic investigation and mine water management. Piteau's mining hydrogeology team merges extensive global experience, practical mine site knowledge and high-level technical analysis to develop practical, manageable and effective solutions to water issues. Piteau has over 150 professional staff distributed between ten offices, across the US, Canada, South Africa, UK, Spain, Peru, and Chile. Piteau was responsible for developing the groundwater model, geochemical characterization, Pit Lake study, and Hydrogeologic Characterization. See **Appendix O.2** for applicable resumes associated with development of the Copper World Project technical deliverables. As a note, Piteau was recently acquired by Tetra Tech.

18.3 WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, INC.

Wood Environment & Infrastructure Solutions, Inc. (Wood) is a worldwide company with more than 55,000 professional staff with experience in the largest and most complex project in the mining industry, oil and gas business, and for other private clients and governmental agencies. Wood draws on an experienced local footprint with a wide geographical reach to support customers' needs related to mining engineering, engineering and design, consulting, and construction. With access to technical experts across the US, Canada, UK, Europe, Australia, and Latin America. Wood was responsible for the preparation of the design of the TSF, HLP, WRD, and BADCT analysis. See **Appendix O.3** for applicable staff resumes associated with development of the Copper World Project deliverables.

18.4 BOWMAN CONSULTING

Bowman Consulting, Ltd. (Bowman), is a multi-faceted consulting firm offering a broad range of infrastructure, environmental management, energy and real estate solutions to both public and private clients across the country. Bowman provides a full range of engineering services, from conceptual design through construction administration and construction project management. Bowman provided support to Piteau for concept level facility grading plan, and preparation of concept level engineering design drawings. See **Appendix O.4** for applicable staff resumes associated with development of the Copper World Project deliverables. Bowman

18.5 PATERSON & COOKE

Paterson & Cooke (P&C) is a consulting service specializing in hydraulics and hydrotransport to the mining industry. P&C provides the full range of engineering services from conceptual to detailed engineering of tailings, mine backfill and long-distance pipelines as well as conventional cyclone sands tailings systems. P&C developed the transport and processing aspects of the conventional cyclone sands tailings system of the Project. See **Appendix O.5** for applicable staff resumes associated with development of the Copper World Project deliverables.

18.6 AUSENCO

Ausenco Engineering USA South Inc. (Ausenco) is a consulting service that provides plant designs, operations, and maintenance services. Ausenco's involvement with the Copper World Project started with an engineering effort to develop a pre-feasibility level design of the Process Plant with corresponding capital and operating costs estimates. See **Appendix O.6** for applicable staff resumes associated with development of the Copper World Project deliverables.

19.0 DEMONSTRATION OF FINANCIAL CAPABILITY

Per A.A.C R18-9-A203.B, the project applicant shall demonstrate financial capability to construct, operate, close, and ensure proper post-closure care of the facility in compliance with A.R.S. Title 49, Chapter 2, Article 3.

19.1 SUMMARY OF CLOSURE AND POST-CLOSURE COST ESTIMATE

This section summarizes the closure costs attributable to ADEQ for the closure of APP regulated facilities and for which amount a financial assurance mechanism will need to be established with ADEQ. Details were provided in **Section 17.0** regarding the reclamation and closure costs attributable to ADEQ versus ASMI. A summary of the APP closure costs is provided in **Table 19.01.** Closure costs attributable to ADEQ were estimated to be about $91.7 million.

Table 19.01: Summary of APP Regulated Facility Closure Costs

Facility	Labor	Equipment	Materials	Total
Process Ponds	$84,590	$195,578	$0	$280,168
Heap Leach	$549,724	$1,364,406	$5,850	$1,919,980
Tailings Storage Facilities	$3,448,938	$9,278,150	$0	$12,727,088
Drainage	$1,234,744	$279,749	$623,303	$2,137,796
Monitoring	$1,348,376	$1,161,534	$167,810	$2,677,720
Process Fluid Management	$28,199,233	$16,880,189	$4,257,125	$49,386,547
Construction Management	$882,488	$825,237	$19,879	$1,727,604
Mob/Demob	$201,254	$0	$0	$201,254
Indirect Costs *	$0	$0	$0	$20,620,343
Total	$35,949,347	$29,984,843	$5,073,967	$91,678,735

* Engineering/Design/Construction Plan, Contingency, Insurance, Performance Bond, Contractor Profit, Contract Administration, Government Indirect Costs

19.2 FINANCIAL ASSURANCE DEMONSTRATION AND MECHANISM

A.A.C. R18-9-A203.B requires the project applicant’s chief financial officer to submit a statement indicating that the applicant is financially capable of meeting the costs described in A.A.C. R18-9-A203.A

The Financial Assurance Demonstration is provided in **Appendix P** and includes:

- A letter from the Chief Financial Officer, provided in **Appendix P.1**;
- The 2022 First Quarter Report to Shareholders, provided in **Appendix P.2**; and
- The Management Discussion and Analysis for First Three Months of 2022 Ending March 31, 2008, provided in **Appendix P.3**.

Financial assurance demonstration and mechanisms have not been fully defined at the time of this application submission. However, all financial assurance will be part of a larger financial assurance package covering reclamation and closure of the entire facility. This package will likely be part of the overall project financing, with funding tied to permit issuance (conditional issuance). If required, Rosemont is prepared to provide the detailed financial insurance necessary prior to APP issuance.

Additionally, a staged bonding approach will be requested. It is anticipated that the staged bonding requite would be ties to the following timeframes:

- Permit issuance;
- Start of construction; and
- Start of operations (full bonding).

20.0 COMPLIANCE SCHEDULE

The following section provides the anticipated post-permit deliverables for the Copper World Project. The timelines indicated in the following sections are typical and will be updated based on the issued aquifer protection permit.

20.1 SAMPLING AND ANALYSIS PLAN

A Water Programs Sampling and Analysis Plan (SAP) will be developed for all regulatory programs that require groundwater and surface water monitoring. The SAP will document procedures for the collection of samples, including quality control.

The SAP will be provided to ADEQ for review and approval prior to initiating ambient groundwater monitoring associated with the approved POC wells.

20.2 POC WELL INSTALLATION WORK PLAN

Point of Compliance (POC) wells will be installed at those locations approved as part of the aquifer protection permit (APP) process. A POC Work Plan will be developed for each of the POC wells and provided to ADEQ for approval prior to installation. The work plan will include information such as well design and location. Well design details shall indicate the screened interval and installation schedule.

The POC Work Plan shall be provided to ADEQ for approval at least thirty (30) days prior to installation.

20.3 POC WELL INSTALLATION

POC well installation shall be initiated within thirty (30) days following approval of the POC Work Plan by ADEQ. POC wells shall be constructed in accordance with ADWR requirements.

20.4 POC WELL INSTALLATION REPORTS

POC well completion reports shall be prepared that include details on well installation and development. Geological and well construction logs shall also be provided along with the ADWR NOI information, cadastral coordinates, pump test information, etc.

Well installation reports shall be provided to ADEQ within forty-five (45) days of installation of each well.

20.5 AMBIENT GROUNDWATER MONITORING

Ambient groundwater monitoring at POC well location shall commence within thirty (30) days following installation of a POC well. Ambient groundwater monitoring shall follow the Water Programs SAP submitted to ADEQ for approval. Groundwater parameters will follow those listed in the APP issued for the Project.

Ambient groundwater monitoring will be conducted at each POC well location for eight (8) quarters.

20.6 AMBIENT GROUNDWATER MONITORING REPORTS

Ambient groundwater monitoring will be conducted at each POC well location for eight (8) months. An Ambient Groundwater Monitoring Report will be prepared for each POC well and will include copies of all laboratory analytical reports, field notes, and the QA/QC limits used in collection and analysis of the samples. The report will also include statistical calculations of the Als and AQLs.

Ambient Groundwater Monitoring Reports will be prepared and submitted to ADEQ within ninety (90) days following receipt of the last analytical lab report for each respective well location, i.e., a report shall be prepared separately for each POC well. The reports shall also include the information previously provided in the well installation reports.

20.7 DESIGN DRAWINGS, SPECIFICATIONS AND CQA PLAN

Final designs or “Issued for Construction (IFC)” drawings, construction specifications and construction quality assurance (CQA) plan for APP regulated facilities will be submitted to ADEQ prior to the start of construction. In accordance BADCT guidance, a CQA program will be implemented to document the construction methods and provide verification of the Quality Control (QC) results.

20.8 AS-BUILT DRAWINGS AND CQA REPORT

As-built drawings and CQA Report will be prepared for each APP regulated facility and submitted to ADEQ. The CQA report will confirm that the facility was constructed in accordance with the design report, engineering plans and specifications submitted to ADEQ.

A CQA Report shall be submitted to ADEQ prior to discharging under the APP (start-up of facility) and within ninety (90) days following the completion of construction / commissioning of each facility or group of facilities.

The CQA report will include certifications from a third-party quality assurance engineer (QAE) that items such as subgrade preparation and testing, liner installation and testing, and underdrain installation and testing, etc., were completed according to approved specifications.

20.9 AS-BUILT REPORTS AND DRAWINGS FOR APP EXEMPT FACILITIES AND STORMWATER FACILITIES

As-built reports and drawings will be prepared that document the construction methods, quality assurance/quality control (QA/QC) testing results, and commissioning activities associated with APP exempt facilities. These records will be maintained onsite and available for review by ADEQ if requested.

20.10 OPERATIONS, MONITORING, AND MAINTENANCE MANUAL(S)

Operations, Monitoring and Maintenance Manuals (O&M Manuals) will be prepared, as needed, for each of the area-wide APP regulated facilities. The O&M Manuals shall include operating conditions / limits and as well as instrumentation and/or practices to ensure the facility is operated within designed parameters. O&M Manuals will be prepared prior to operations of the facility and will be maintained onsite and available for review by ADEQ if requested.

20.11 CONTINGENCY / EMERGENCY RESPONSE PLAN

An updated Contingency / Emergency Response Plan will be prepared for the Copper World Project prior to the start of construction. This plan will met the requirements of A.A.C. R18-9-A204, and will be part of a broader plan that addresses other programs or topics, such as Risk Management Plan (ICMM Good Practice Guide), Failure Modes and Effect Analysis (FMEA), Trigger Action Response Plan (TARP), Emergency Preparedness and Response Plan (EPRP), Operations, Maintenance, and Surveillance (OMS), and Title 40 of the Code of Federal Regulations (40 CFR), Part 112, Oil Pollution Prevention and Title 11, Article 22 of the Arizona Administrative Code dealing with the use of cyanide in the precious metals recovery circuit. The Contingency / Emergency Response Plan will be maintained onsite and will be modified during the life of the Project to reflect updated contact information, operational stage, and emergency response procedures, etc.

20.12 SUMMARY OF SUGGESTED COMPLIANCE SCHEDULE TIMELINE

Table 20.01 summarizes the Compliance Schedule items that will be completed along with suggested timing of submittals.

Table 20.01: Compliance Schedule

Item	Expected Submission/Completion
Sampling and Analysis Plan (SAP)	Submit to ADEQ for review and comment prior to ambient groundwater monitoring at approved POC well locations
POC Well Installation Work Plan	Submit to ADEQ for review and approval at least 30 days prior to well installation
POC Well Installation	POC well installations shall be Initiated at least 30 days following approval of the POC Installation Work Plan
POC Well Installation Reports	Submit to ADEQ within 45 days following installation of each well
Ambient Groundwater Monitoring	Monitoring shall be conducted at each POC well for 8 months
Ambient Groundwater Monitoring Reports	Submit to ADEQ within 90 days following the receipt of the last analytical report for each POC well location
Design Drawings, Specifications and CQA Plan for APP Regulated Facilities	Submit to ADEQ prior to construction of each APP regulated facility
CQA Reports and As-Bult Drawings for APP Regulated Facilities	Within 90 days of completion of construction/commissioning
As-Built Reports for APP Exempt Facilities abf Stormwater Facilities	Maintained onsite and available for review
Operations, Monitoring, and Maintenance Manual(s)	Prepared prior to operation of the APP regulated facility. Maintained onsite and available for review
Contingency / Emergency Response Plan	Prepared prior to the start of construction of the Copper World Project. Maintained onsite and available for review

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