ATTACHMENT P

MONITORING PROGRAM

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1. INTRODUCTION

This Attachment was prepared in support of Excelsior Mining Arizona, Inc.'s (Excelsior's) Underground Injection Control (UIC) Permit application to the United States Environmental Protection Agency (USEPA). Excelsior is applying for an area Class III UIC permit to install a wellfield for in-situ recovery (ISR) of copper at the Gunnison Copper Project (Project), located in Cochise County, Arizona.

This attachment describes the monitoring program that Excelsior proposes to conduct in accordance with the monitoring requirements of Chapter 40 of the Code of Federal Regulations (CFR) §146.33(b).

Elements of this proposed monitoring program include:

- Monitoring of injected fluids
- Operational monitoring—injection pressure and flow
- Mechanical integrity monitoring
- Groundwater quality monitoring
    - POC Monitoring
    - Intermediate Monitor Wells
- Hydraulic control monitoring
    - Fluid Levels
    - Specific Conductance Monitoring

2. MONITORING

2.1 Injected Fluids

40 CFR §146.33(b)(1) requires monitoring of the nature of injected fluids with sufficient frequency to yield representative data on its characteristics. In addition, whenever the injection fluid is modified, monitoring is required.

The term "lixiviant" or "barren leach solution" is used in this application for the injected fluid. The anticipated composition of lixiviant is provided in Attachment H-2. The estimated chemical composition of mature barren leach solution is based on Johnson Camp Mine (JCM) raffinate, except fluoride, iron, and copper[1]. It should be noted that the chemical composition of the barren leach solution will evolve over the life of the mine from acidified groundwater to the mature composition as reported in Attachment H-2. The composition of the mature leach solution is reasonably consistent with time because the dissolution and precipitation reactions that control the composition approach equilibrium and no longer cause substantial changes in the leach solution chemical load.

Lixiviant solutions will be monitored on a *monthly* basis during leaching operations for the following analytes:

- Dissolved Metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, zinc.
- General Chemistry, alkalinity (milligrams per kilogram as CaCO3), pH (standard units.), total dissolved solids
- Anions: chloride, fluoride, nitrate (as N), sulfate
- Organics: Total Petroleum Hydrocarbons

In addition, on an *annual* basis during leaching operations, lixiviant will be analyzed for the following: Ra-226 + Ra-228 (picocuries per liter), and uranium (milligrams per liter).

[1] Projected fluoride concentrations in lixiviant were increased to adjust for a low bias caused by matrix interference in the JCM lixiviant. Projected iron concentrations in Gunnison Copper Project lixiviant were increased based on metallurgical testing of the Project ore. Copper concentrations in Project ore are based on an anticipated operational PLS grade of 1.5 grams per liter and standard SX/EW efficiency of 90 percent.

2.2 Injection Pressure and Flow Volumes

40 CFR §146.33(b)(2) requires "monitoring of injection pressure and either flow rate or volume semi-monthly, or metering and daily recording of injected and produced fluid volumes as appropriate."

Injection pressure will be monitored either in the main manifold supplying a series of wells or in the header pipe feeding an individual well with a pressure gauge to ensure that pressures don't exceed allowable limits. Injection pressures will be metered and recorded daily at the header station . The pressure will not exceed 0.75 pounds per square inch per foot (psi/ft), based on results of fracture gradient testing conducted in 2015. The fracture gradient testing report is provided in Attachment I-2.

Injection and recovery wells for each mining block will be plumbed to injection and extraction headers in a centralized header station. Mechanical equipment in the header station consists of flow control valves on the injection and recovery wells. Recovery wells will be equipped with submersible pumps with starters and controls near the header station. Sampling ports will be accessible at the header stations.

Instrumentation for the injection and recovery wells will be similar (see Figure K-6). Each well will be equipped with a magnetic flow meter.

The mechanical equipment and instrumentation will be controlled and monitored by a computerized plant control system (PCS) located in the wellfield control room. Communications between the PCS and the wellfield are maintained using a fiber-optic/Ethernet network or other such appropriate communications network. Each header station will consist of a covered area with motor starters and monitoring and control equipment connected to the PCS. Communication between the PCS and the main control enclosure will be by fiber-optic cable. Pressure gauges will be read and recorded manually and flows will be controlled by manual adjustment of the control valves.

The operator in the control room will use the PCS to monitor flow rates at each well to ensure that flow balance is maintained. Conditions out of the operating range or needing correction will be reported to the wellfield operators who will manually adjust the controls. Sensitive electronic equipment will be kept cool and dry in a separate, air-conditioned compartment and a human-machine interface (HMI) in the "wet" side of the header station will allow the wellfield operators to monitor operational parameters, such as flow rates and power consumption, and adjust the flow control valves manually.

The PCS will also be equipped with data loggers to record information from the instruments at each well to enable the operator to examine trends, calculate local and cumulative flows, set alarm conditions, and maintain production records. The PCS will provide trending, historical and alarm data for flow and any other required instrumentation. Injection pressure will be recorded manually and entered electronically to the data loggers to ensure that injection pressure is stable and does not exceed the stipulated limits. Alarms will be triggered when flow rates or

fluctuations are out of limits set by the operator. Alarms will also be generated when there is a communications fault, equipment or instrument failure or a process that is out of control limits.

2.3 Mechanical Integrity

According to §146.08, an injection well has mechanical integrity if:

(1) there is no significant leak in the casing, tubing or packer; and
(2) there is no significant fluid movement into an underground source of drinking water through vertical channels adjacent to the injection well bore.

Existing core holes or other existing borings/wells used for intermediate monitoring will not be tested. The IMWs will be plugged and abandoned prior to injecting in the block in which they are located. Part 1 and Part 2 Mechanical Integrity Testing will be conducted as described below.

2.3.1 Part 1 Mechanical Integrity Testing

Part 1 Mechanical Integrity Testing will be conducted on all new injection and recovery wells, hydraulic control, observation, and POC wells.

After construction of an *injection/recovery well* is complete, Part 1 of the UIC mechanical integrity testing requirement will be addressed by the following method or another suitable method approved by ADEQ and EPA: A packer will be installed immediately above the bottom of the cased interval, and the casing will be completely filled with water. A hydraulic pressure equal to or above the maximum allowable wellhead injection pressure will be applied. The test will be conducted for a minimum of 30 minutes. The well will be considered to have passed if there is less than a five (5) percent loss of pressure during the 30 minute period. Part 1 mechanical integrity will be demonstrated before a Class III well is put into service and when there is reason to suspect a well failure.

If a packer completion is used (as shown on Figure M-3 in Attachment M), mechanical integrity testing of the tubing-casing annulus pressure will be conducted according to UIC requirements.

Part 1 Mechanical Integrity will be demonstrated before a Class III injection well is put into service, and every 5 years thereafter as long as the well is in use (or any time the well might go back into use if it has not been tested in the prior 5 years), and when there is a reason to suspect well failure.

2.3.2 Part 2 Mechanical Integrity

Part 2 mechanical integrity testing will be completed as part of the planned geophysical logging. As noted in Attachment I, Section 3.2, after injection/recovery well construction is complete, the well will be logged using the following borehole geophysical methods:

- Gamma
- Sonic (injection wells only)
- Temperature (all wells)
- Caliper
- ABI (Acoustic Borehole Image)
- Cement bond logs (only on wells with steel casing) for Part 2 Mechanical Integrity.
- Directional survey

The temperature logs will meet the Part 2 mechanical integrity requirement for wells constructed with PVC and/or FRP materials. The cement bond log will meet the Part 2 mechanical integrity requirement for wells with steel casing.

Existing core holes or other existing borings/wells used for intermediate monitoring will not be tested. The IMWs will be plugged and abandoned prior to injecting in the block in which they are located.

2.4 Groundwater Monitoring

It is proposed that, to the extent possible, ambient and compliance and groundwater monitoring conducted according to the pending Aquifer Protection Permit be provided to USEPA to meet groundwater monitoring requirements for the UIC permit. Proposed monitoring requirements below have been included in the draft APP.

2.4.1 POC Monitoring

Water Quality monitoring will be conducted at Point of Compliance (POC) wells established for the wellfield in the Aquifer Protection Permit (APP) by the Arizona Department of Environmental Quality (ADEQ) and under the UIC Permit by the EPA. The proposed locations of the five POC wells are provided on Figure P-1. Location coordinates are on Table P-1. The well locations are preliminary, pending approval of ADEQ and EPA. These wells will be located just inside the AOR boundary and they will not be used for injection/recovery.

POCs 1, 2 and 3 will be installed and ambient groundwater monitoring will be conducted prior to Stage 1 of mining. Installation and 8 rounds of ambient groundwater monitoring for POCs well 4 and 5 will be conducted prior to Stage 2 mining.

2.4.2 Monitoring Parameters

Prior to operation of the wellfield, POC monitor wells will be installed and monitored for ambient groundwater quality parameters in accordance with the schedule in section 2.4.1. The proposed parameters are provided on Table P-2. Groundwater samples will be obtained no more frequently than weekly and no less frequently than quarterly. After 8 rounds of ambient groundwater quality monitoring, the analytical results will be analyzed using statistical methods in ADEQ's standard methodology (ADEQ, 2004b) and alert levels, aquifer quality levels, and compliance groundwater monitoring parameters will be proposed. AQLs will only be calculated for those constituents having Aquifer Water Quality Standards (AWQSs) and EPA primary MCLs according to the methodology. Alert levels for other constituents or parameters (such as specific conductance at the observation wells) may be proposed if they are considered an indicator parameter for excursions, according to the methodology.

Compliance groundwater monitoring will be conducted quarterly. Quarterly and annual monitoring requirements are provided in Tables P-3 and P-4.

2.4.3 Analytical Methods

EPA-approved methods will be used for analyses. Detection limits will be sufficient to determine compliance with the regulatory limits of the permit. If regulatory limits have not been established, detection limits will be below applicable maximum contaminant levels and/or AWQSs. Analyses will be performed by a laboratory licensed by the Arizona Department of Health Services, Office of Laboratory Licensure and Certification. All analytical work will meet quality control standards specified in the approved methods.

2.4.4 Groundwater Sampling Protocols

A Sampling and Analyses Plan (SAP) will be prepared prior to implementation of the compliance groundwater monitoring program to ensure consistency and sample integrity. It will include schedules, analytical methods and detection limits, documentation forms and requirements, quality assurance and quality control measures, chain-of-custody requirements, and sample collection protocols.

2.5 Hydraulic Control Monitoring

2.5.1 Fluid Levels

Hydraulic control will be monitored by measuring fluid levels in observation well pairs installed in bedrock. One well of the pair will be located within a few (10-20) feet of a hydraulic control

well and the second will be located more distant from the ISR wellfield. Hydraulic control will be assessed by measuring and comparing water elevations in the paired wells.

Fluid level monitoring to evaluate hydraulic control will be accomplished using pressure transducers (or other appropriate devices) placed in the observation wells. Water levels in the observation wells will be measured daily. The initial permit condition for minimum gradient will be 0.01 ft/ft. In addition, during the first year of operations, Excelsior will pump the HC wells at a rate equivalent to one (1) percent of the injection rate. If this rate results in an excessive gradient (as measured at the observation wells), Excelsior will inform EPA and reduce the rate to a level needed to maintain an inward hydraulic gradient of 0.01 ft/ft or greater. Excelsior may also adjust the minimum hydraulic gradient, with concurrence of EPA, depending on the statistical variation of water level data at each observation well pair.

2.5.2 Specific Conductance Monitoring

Specific conductance sensors will be installed in outer observation wells to augment hydraulic control monitoring. An increase in specific conductance in the outer observation well may indicate an excursion from the wellfield. Prior to operation of the associated HC well, eight to 12 ambient groundwater samples will be collected for specific conductance from the outer observation wells. The samples will be collected over 8 consecutive days prior to Phase 1 operations. The ambient specific conductivity data will be used to establish an alert level for specific conductivity for the outer observation well. Ambient monitoring reports will be submitted within 30 days prior to stage 1 operations and 30 days prior to start of operation of subsequent associated mining blocks as new observation wells are added.

For compliance monitoring daily specific conductance measurements will be recorded.

2.5.3 Injection vs. Extraction Volumes

Net solution extraction in the wellfield is a third component of hydraulic control for the wellfield. This net pumping rate will vary, depending on the location(s) of pumping at any given time. Initially, Excelsior will pump the HC wells at a rate equivalent to one (1) percent of the injection rate. If this rate results in excessive gradient at the observation wells, Excelsior will, with concurrence of EPA, reduce the rate to a level that results in an inward hydraulic gradient of not less than 0.01 ft/ft. Modeling in support of the AOR determination (Attachment A) shows a net drawdown within the AOR as a result of net extraction at the HC wells. As discussed in Section 2.2 of this attachment, total injection and production volumes will be monitored and recorded daily.

The proposed initial permit condition is to record the pumping volumes for injection, recovery, and HC on a daily basis and rebalance (i.e. maintain a 1% net extraction) on a 48-hour basis while maintaining required inward gradients at the observation wells. At the end of 60 days of operations, the data will be assessed as to whether a longer interval, such as 30 days would be as

protective. If it is, Excelsior will submit an operational and monitoring plan to demonstrate that a 30-day rolling average is as protective as the 48-hour flow volume re-balancing and request a revision to the permit condition.

2.5.4 Intermediate Monitor Wells

As indicated in Figure P-1, attached, a network of intermediate monitor wells (IMWs) will act as a real-time early warning system to ensure the appropriate hydraulic control wells are installed and operating during mining. The IMW system includes an inner and an outer ring of monitoring wells that expand as mining operations expand. IMW's will be monitored for specific conductance and water elevation.

The inner ring is primarily for operational use, allowing operators to observe the immediate effects of changes in operational conditions like injection or recovery rates. Some mining solutions are expected to be observed in these wells due to the sweep of solutions in and out of the margins of the active mining blocks. This is considered normal.

The outer ring is designed as an early warning system to ensure the appropriate hydraulic control wells are installed and operating. A minimum of eight rounds of daily monitoring for specific conductance will be conducted to establish alert levels for specific conductance in the outer ring of IMWs . Increasing trends above alert levels in outer wells would illicit the following response(s):

1. Continue daily monitoring of specific conductance for 7 days. If the additional measurements show that he AL exceedance no longer persists, no further action is required.
2. If the AL exceedance is confirmed, the permittee will notify ADEQ and EPA within 5 days.
3. The Permittee shall provide Groundwater Section with an action plan within 30 days after the confirmed exceedance of the AL. The Action Plan shall describe the proposed actions and their justification which may include but are not necessarily limited to any of the following:
    a. Continued monitoring
    b. Adjust operations to reverse the trend (pull back solutions)
    c. Adjust pumping in the appropriate HC wells
    d. Install and activate additional interceptor HC wells (if not already installed)
4. After the Action Plan is approved by EPA and ADEQ, the permittee shall implement the action plan and any reporting as specified in the action plan.

The location of the outer IMWs for Stage 1 is based on the aquifer testing that has already been completed in the proposed Stage 1 mining area. This aquifer testing shows the degree of connectivity between the pumping well and the surrounding observation wells. Figures A-9, A-

10, and A-11 of Attachment A-1 show the areas of influence of NSH-013, NSH-021C, and NSH-024, which are located within Stage 1 operations.

The general principle is to locate outer IMW's along the more conductive fluid pathways (bedding parallel and structures), at distance of several hundred feet from the active mining area, in a radial pattern spatially distributed and surrounding the mining area. Irrespective of the IMW's exact location, the aquifer test results show that all the structures are hydrologically well connected, and as long as the IMW intersects either a structure or bedding parallel feature, it should respond to and detect potential migrations outside the active mining area in that direction. IMWs will consist of existing core, observation or aquifer test wells, supplemented where considered necessary by additional wells to be drilled. Figures P-2, P-3, P-4 and P-5 show proposed IMW's for Year 1, Year 5, Year 10, and Year 13 respectively. Figure P-6 shows cross sections through Stage 1 blocks, showing the IMW locations and the significant structures that they intersect. Given the spacing and location of existing drill holes available to be used as an IMW, two additional holes will be installed to extend coverage beyond existing locations. These drill holes (shown as stars on the above mentioned figures) will be drilled and installed as IMWs prior to commencement of production. As new mining blocks come online, any IMWs encompassed within that mining block will be abandoned.

A yearly schedule of proposed IMWs for Stages 1 and 2 is provided in Table P-3, along with well name, location, and open (or screened) interval. The primary structure(s) intercepted by the proposed Stage 1 and Stage 2 IMWs are provided on Table P-4. IMWs for Stage 3 will be identified according to a compliance schedule in the APP. As operational experience is gained, alternate or additional IMWs may be proposed, but in any event adhering to the general principle of IMWs. Excelsior will notify EPA and ADEQ prior to implementing significant departures from this plan.

As mining proceeds and rinsing operations are completed within a block or group of blocks, a selection of the old injection or recovery wells will be converted to IMWs to monitor for later excursions into rinsed areas.

Before beginning Stage 3 operations, Excelsior will provide a report to EPA and ADEQ proposing IMWs for Stage 3 operations. The report will provide background specific conductance data and proposed Alert Levels that will be used to make operational decisions for Stage 3 wellfield operations.

TABLE P-1
POC, Observation, and Hydraulic Control Well Information

Well Name	Latitude			Longitude			Associated Facility
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds	
Point of Compliance Wells							
1	32	4	46.4	110	2	25.5	ISR Wellfield
2	32	4	48.6	110	2	3.5	ISR Wellfield
3	32	5	1.0	110	2	5.4	ISR Wellfield
4	32	5	18.4	110	2	19.9	ISR Wellfield
5	32	5	25.3	110	2	39.0	ISR Wellfield
Observation Wells							
OW-01-I	32	4	47.4	110	2	41.1	
OW-01-O	32	4	46.5	110	2	41.4	
OW-04-I	32	4	47.3	110	2	31.0	
OW-04-O	32	4	46.4	110	2	30.0	
OW-07-I	32	4	47.8	110	2	21.3	
OW-07-O	32	4	46.3	110	2	20.4	
OW-10-I	32	4	52.8	110	2	18.8	
OW-10-O	32	4	52.8	110	2	16.7	
OW-13-I	32	4	58.6	110	2	20.0	
OW-13-O	32	4	58.3	110	2	17.9	
OW-16-I	32	5	3.5	110	2	23.7	
OW-16-O	32	5	3.5	110	2	21.5	
OW-19-I	32	5	6.6	110	2	28.1	
OW-19-O	32	5	7.9	110	2	26.5	
OW-22-I	32	5	9.7	110	2	33.9	
OW-22-O	32	5	10.8	110	2	32.3	
OW-25-I	32	5	18.6	110	2	37.4	
OW-25-O	32	5	19.5	110	2	35.6	
OW-28-I	32	5	21.6	110	2	44.1	
OW-28-O	32	5	23.5	110	2	43.0	
OW-30-I	32	5	2.6	110	2	44.5	
OW-30-O	32	5	0.8	110	2	44.8	
Hydraulic Control wells							
HC-01	32	4	47.4	110	2	37.8	
HC-02	32	4	47.4	110	2	41.3	
HC-03	32	4	47.5	110	2	34.3	
HC-04	32	4	47.4	110	2	30.8	
HC-05	32	4	47.6	110	2	27.4	
HC-06	32	4	48.0	110	2	23.7	
HC-07	32	4	48.0	110	2	21.4	
HC-08	32	4	48.8	110	2	19.1	
HC-09	32	4	50.8	110	2	17.9	
HC-10	32	4	52.8	110	2	19.1	
HC-11	32	4	54.7	110	2	19.1	
HC-12	32	4	56.7	110	2	19.1	
HC-13	32	4	58.7	110	2	20.2	
HC-14	32	5	0.7	110	2	21.4	
HC-15	32	5	1.7	110	2	23.7	

TABLE P-1
POC, Observation, and Hydraulic Control Well Information

Well Name	Latitude			Longitude			Associated Facility
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds	
HC-16	32	5	3.4	110	2	23.8	
HC-17	32	5	4.1	110	2	25.2	
HC-18	32	5	4.9	110	2	26.9	
HC-19	32	5	6.6	110	2	28.3	
HC-20	32	5	7.6	110	2	30.7	
HC-21	32	5	9.6	110	2	34.1	
HC-22	32	5	9.6	110	2	31.8	
HC-23	32	5	14.5	110	2	36.5	
HC-24	32	5	16.5	110	2	36.5	
HC-25	32	5	18.5	110	2	37.6	
HC-26	32	5	19.5	110	2	41.2	
HC-27	32	5	20.1	110	2	38.8	
HC-28	32	5	21.6	110	2	43.8	
HC-29	32	5	2.8	110	2	52.9	
HC-30	32	5	2.7	110	2	44.4	

Notes:
ISR = in-situ recovery
PLS = pregnant leach solution

TABLE P-2
Proposed Ambient Groundwater Quality Monitoring Parameters--POC wells

GENERAL CHEMISTRY		
Parameter	**AQL**	**AL**
Depth to water (feet)	None	Monitor
Ph (field)	None	Monitor
Specific conductance (field)	None	Monitor
Temperature (field)	None	Monitor
Total Alkalinity	None	Monitor
Bicarbonate	None	Monitor
Calcium	None	Monitor
Carbonate	None	Monitor
Hydroxide		
Chloride	None	Monitor
Fluoride	TBD	TBD
Magnesium	None	Monitor
Nitrate+ Nitrite as N	TBD	TBD
Potassium	None	Monitor
Sodium	None	Monitor
Sulfate	None	Monitor
TDS	None	Monitor

METALS		
Parameter	**AQL**	**AL**
Aluminum	None	Monitor
Antimony	TBD	TBD
Arsenic	TBD	TBD
Barium	TBD	TBD
Beryllium	TBD	TBD
Cadmium	TBD	TBD
Chromium (total)	TBD	TBD
Cobalt	None	Monitor
Copper	None	Monitor
Iron	None	Monitor
Lead	TBD	TBD
Manganese	None	Monitor
Mercury	TBD	TBD
Molybdenum	None	Monitor
Nickel	TBD	TBD
Selenium	TBD	TBD
Thallium	TBD	TBD
Zinc	None	Monitor

ORGANICS		
Parameter	**AQL**	**AL**
Benzene	TBD	TBD
Toluene	TBD	TBD
Ethylbenzene	TBD	TBD
Xylenes	TBD	TBD

RADIOCHEMICALS		
Parameter	**AQL**	**AL**
Adjusted Gross Alpha	TBD	TBD
Uranium Isotopes activity	Monitor	Monitor
Radium 226 + Radium 228	TBD	TBD
Uranium (total)	Monitor	Monitor

Notes:

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TABLE P-3
Quarterly POC Well Compliance Groundwater Monitoring

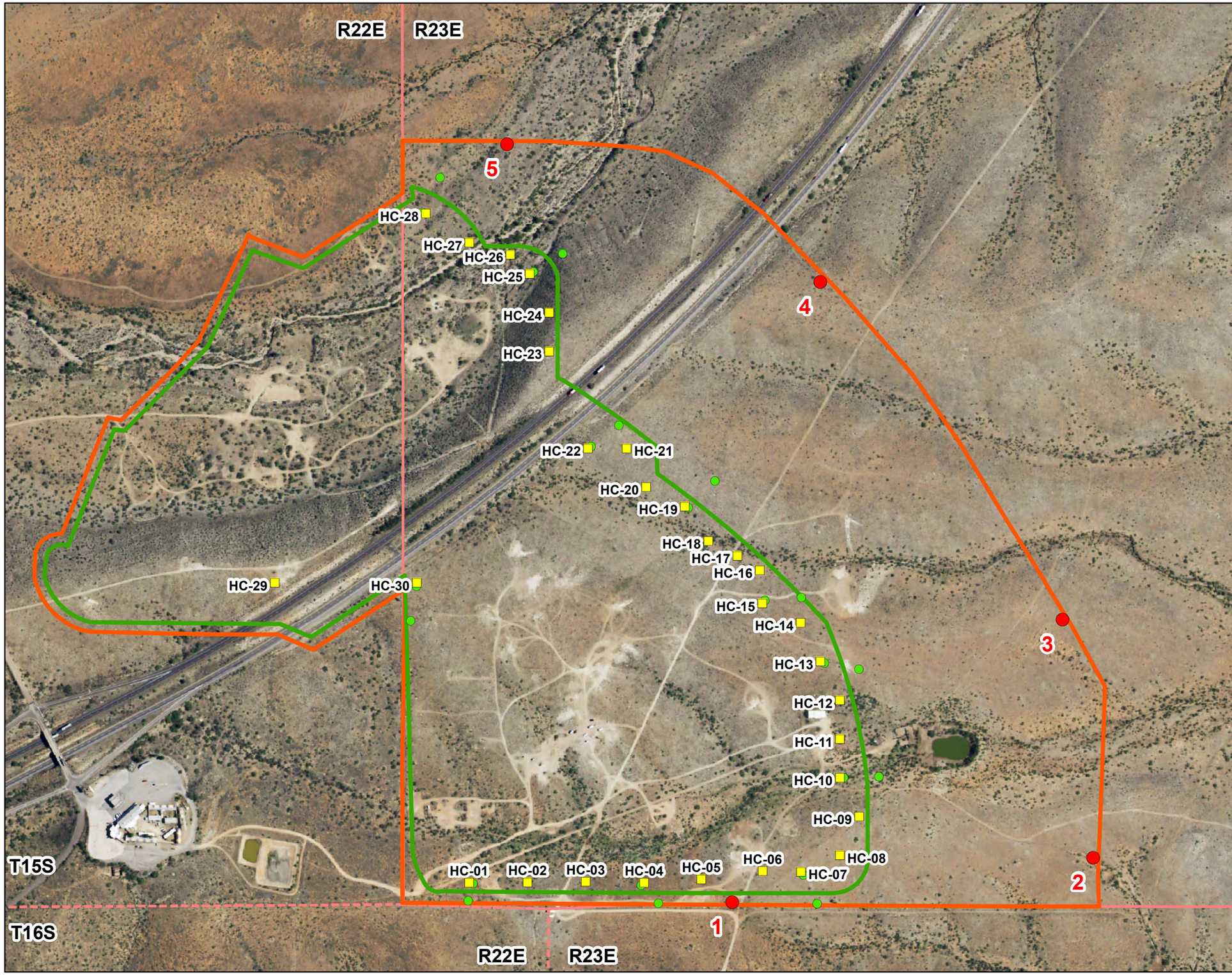
Parameter	POC Well #1		POC Well #2		POC Well #3		POC Well #4		POC Well #5	
	AQL	AL	AQL	AL	AQL	AL	AQL	AL	AQL	AL
Depth to Groundwater (ft. bgs)	Monitor[1]	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Water Level Elevation (ft. amsl)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
pH- field (S.U.)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Specific Conductance- field (µmhos/cm)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Temperature- field (°F)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Sulfate (mg/L)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Total Dissolved Solids (mg/L)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor

Notes:
AQL = aquifer quality limit
AL = alert level
mg/L = milligrams per Liter
ft bgs = feet below ground surface
ft amsl = feet above mean sea level
S.U. = standard units
µmhos/cm = micromhos per centimeter
°F = degrees Fahrenheit

TABLE P-4
Annual POC Well Compliance Groundwater Monitoring

Parameter[1] (mg/L unless noted otherwise)	POC Well #1		POC Well #2		POC Well #3		POC Well #4		POC Well #5	
	AQL	AL	AQL	AL	AQL	AL	AQL	AL	AQL	AL
Depth to Groundwater (ft. bgs)	Monitor[2]	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Water Level Elevation (ft. amsl)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
pH- field (S.U.)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Specific Conductance- field (µmhos/cm)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Temperature- field (°F)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
pH - lab (S.U.)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Specific Conductance- lab (µmhos/cm)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Total Dissolved Solids	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Total Alkalinity	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Bicarbonate	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Carbonate	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Hydroxide	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Sulfate	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Chloride	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Fluoride	Reserved[3]	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Nitrate + Nitrite	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Calcium	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Magnesium	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Potassium	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Sodium	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Iron	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Aluminum	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Antimony	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Arsenic	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Barium	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Beryllium	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Cadmium	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Chromium	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Cobalt	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Copper	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Lead	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Manganese	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Mercury	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Molybdenum	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Nickel	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Selenium	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Thallium	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Zinc	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Adjusted Gross Alpha (pCi/L)[4]	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Radium 226+228 (pCi/L)	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Uranium Isotopes (pCi/L)[5]	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor
Benzene	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Toluene	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Ethylbenzene	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Total Xylenes	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Uranium, Total (µg/L)	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor	Monitor

Notes:
AL = alert level
AQL = aquifer quality limit
ft amsl = feet above mean sea level
ft bgs = feet below ground surface
°F = degrees Fahrenheit
mg/L = milligrams per Liter
pCi/L = picoCuries per Liter
S.U. = standard units
µg/L = micrograms per Liter
µmhos/cm = micromhos per centimeter
[1]Metals must be analyzed as dissolved metals
[2]Monitoring required, but no AQL or AL will be established in the permit
[3]At the conclusion of ambient groundwater monitoring; the permittee shall submit an Ambient Groundwater Quality Report and a permit amendment to propose AQLs and ALs in accordance with Section 2.7.4.5 and CSI Nos. 1, 5, and 6 in Section 3.0. AQLs and ALs shall be established as required in Sections 2.5.3.1.2, 2.6.3.1.2.1 and 2.5.3.1.3. SMRF reporting is required after completion of ambient groundwater monitoring.
[4]The adjusted gross alpha particle activity is the gross alpha particle activity, including radium 226, and any other alpha emitters, if present in the water sample, minus radon and total uranium (the sum of uranium 238, uranium 235 and uranium 234 isotopes). The gross alpha analytical procedure (evaporation technique: EPA Method 900.0) drives off radon gas in the water samples. Therefore, the Adjusted Gross Alpha should be calculated using the following formula: (Laboratory Reported Gross Alpha MINUS Sum of the Uranium Isotopes).
[5]Uranium Isotope activity results must be used for calculating Adjusted Gross Alpha.



Legend

- Point of Compliance Well
- Observation Well
- Hydraulic Control Well
- Area of Review
- ISR Wellfield

Observation Wells will have same number as associated hydraulic control well.

Example: At HC-1, observation wells will be named:

OW-1-I (inner)
OW-1-O (outer)

0 250 500 1,000
Feet

Excelsior Mining Arizona, Inc.
Gunnison Copper Project
UIC Permit Application
February 2016
Revised November 2016

Date	File ID
12/12/16	373-035C

CLEAR CREEK ASSOCIATES

FIGURE P-1
Area of Review, Point of Compliance, Hydraulic Control, and Observation Well Locations