<u>**Attachment H – Operating Data**</u>

This Attachment H has been prepared in support of an application (Application) by Fort Cady California Corporation (FCCC), to the United States Environmental Protection Agency (USEPA) for issuance of an Underground Injection Control Class III Area Permit (UIC Permit) for FCCC's planned Solution Mining Project (Fort Cady Project or Project) in San Bernardino County, California.

The Fort Cady Project colemanite ore body underlies portions of Sections 25, 26 and 27 of T8N, R5E, in San Bernardino County, California. The Fort Cady Project area is located near the Pisgah Crater, approximately 17 miles east of Newberry Springs, California, and two and one-half (2 ½) miles south of I-40 and the Burlington Northern Santa Fe Railway Pisgah siding in the Mojave Desert. The ore body is located in the central portion of the Project area and is bounded to the west and to the east by two faults. The Pisgah Fault, one of the major northwest-trending faults of the Mojave block, crosses the Project area approximately one-half to one mile southwest of the ore body. Fault B, a smaller, north-south trending fault, runs along the eastern portion of the Project area.

FCCC is proposing to establish a commercial "in-situ" mine to recover boric acid from the 412-acre ore body located an average of 1,400 feet (ft) below ground surface (bgs). The boric acid will be removed from the ground through a process that involves pumping a dilute acid solution into the colemanite to dissolve the borates, forming boric acid which will then be extracted by a reverse-pumping airlifting process.

This Attachment H provides the required information about wellfield operations.

a. **<u>Wellfield Operating Parameters</u>**

FCCC plans to operate all wells in the wellfield in a similar manner and from a centralized injection and extraction piping system (header manifold), which is available in Figure L-1. Boric acid will be removed from the ground through in-situ solution mining.

   a. As noted by RESPEC in their 2019 Formation Fracture Pressure Report, the formation fracture pressure is not controlled by the injection rate. Therefore, the injection rate will be dictated by the ability of the formation to accept fluids. This is also an important finding of the MGA&I Numerical Groundwater Flow Model Report. While the permeabilities in the native formation will be low at the beginning of the leaching process, significantly higher volumes of leach solution may be required to keep the fluids at an optimum level. Also, as discussed in Attachment C and included in the Monitoring and Corrective Action Plan, summarized in Attachment P, FCCC will conduct initial and limited annual step-rate injection tests to confirm the formation fracture pressure.
   b. Average daily rate and volume to be injected: The average daily rate of injection for each well is 25 gallons per minute (gpm). The volume will vary with time as leaching occurs and may be up to 200 gpm, based upon the groundwater model.
   c. Average and maximum injection pressure (measured at the injection header line): Average injection pressure is anticipated to be 150 pounds per square inch of pressure (psi). The maximum injection pressure is anticipated to be 250 psi. FCCC will operate all wells in its wellfield below the well-head fracture pressure of 250 psi. See Attachment I for additional information on fracture pressures.

d. Nature of annulus fluid: The annular space between the casing and geology will be cemented from top of ore body to surface. The fluid in the annular space between the tubing and casing will either be a dilute acid solution (injection solution) or boric acid (pregnant leach solution (PLS)).

e. Injection solution: The injection solution will be a dilute acid solution (<5% HCl and >95% recycled process water and/or make-up water). FCCC may also concentrate boric acid solutions by recirculating heated PLS back into the well.

f. Pregnant Leach Solution: PLS is the product of a chemical reaction between the injected dilute acid and the alkaline elements in the colemanite ore body forming a boric acid solution.

g. Extraction: PLS will be extracted by airlift and surface pumping then processed to produce boric acid, colemanite and/or borax.

h. The model predicts variable net fluid gains and losses during injection and extraction of barren and PLS, as permeabilities increase in the ore body. Some migration of injected solution is unavoidable, but modeling indicates it will be limited to nearby formation and will not migrate over time. Injection will be managed by establishing upper limits of pressures and if necessary, by durations of pressurization. FCCC will maintain a fluid balance of total injected fluids (barren and lean) and total recovered fluids, with a goal to recover at least 0.5% more than injected on a daily basis. Daily hydraulic control information will be summarized and submitted to EPA quarterly. Hydraulic control information collected on a daily basis will include total gallons injected through the manifold, injection pressure measured at the manifold and gallons recovered into the process plant and the pH and SC of injected and recovered solutions. The injection/recovery balance will be updated in the model annually and a report will be issued to EPA for comment.

b. Wellfield Sequencing

The ore body wellfield will encompass approximately 273 acres of surface disturbance (412 acres of subsurface disturbance) and include approximately 450 wells required over the life of the mine (LOM). The overall number of wells may increase or decrease based upon the recoveries during operations. It is currently anticipated that 70 to 80 I/R wells, two mining groups of 35 – 40 wells, may be operating simultaneously.

Well flow recovery rates are estimated to be a daily average of 75 gpm during the PLS recovery phase. Based on well recovery flow rates and PLS boric acid head grade (3.0-5.0% H_3BO_3), of which <0.5% H_3BO_3 is re-injected, each well will produce approximately 1,700 tons of BA per year with each well estimated to have a life of 3 to 8 years.

Mining is planned to commence in year one in Block 2, with the completion of five (5) I/R wells. The number of wells is expected to increase to 35 - 40 wells during years two or three. After which, wells will be added as needed. The total number of wells may be increased or decreased during the LOM, depending upon recovery rates. Infrastructure will be developed in sequence with the wellfield and will consist of main trunk lines and branch lines.

c. Injection Fluid

The injection solution, a dilute acid solution (<5% HCl and >95% recycled process water and/or make-up water), will be injected into the ore body. The dilute HCl will dissolve the colemanite mineral to form an aqueous solution of boric acid, calcium chloride and trace minerals. The PLS is anticipated to have a boric

acid head grade of 3.0-5.0% H_3BO_3 as the product of a chemical reaction between the injected dilute acid and the alkaline elements in the colemanite ore body forming a boric acid solution.

1. Initial Injection Fluids
Injection solution will initially include up to 5% HCl and 95% make-up water. The make-up water may be from wells MWW-1 or MWW-2 (from the aquifer west of Pisgah Fault), or from PW-1 or PW-2 (from the aquifer east of Fault B). Representative analytical results from MWW-1 and PW-2 are included in Table H-1.

2. Supersaturation of Pregnant Leach Solution
PLS removed from the wells will be pumped to the plant for processing or may be reheated and reinjected into the well, (lean solution) to increase borate content prior to processing. PLS will include the ore body minerals amenable to leaching. An approximation of the PLS analysis is also available in Table H-1.

3. Processing Operations and Recycled Injection Solution
PLS not reinjected into the well as lean solution will be pumped to the processing plant for mineral recovery. The general processing steps are:
- Clarification of the Pregnant Leach Solution (PLS)
- Solvent extraction to purify BA and increase BA concentration
- Evaporative crystallization to generate pure BA crystals
- BA crystal dewatering and drying
- Regeneration of the weak raffinate by sulfuric acid to precipitate calcium as gypsum, producing hydrochloric acid (HCl)
- Regeneration of waters reclaimed from the gypsum precipitation process by the addition of HCl as needed.
- Dewatering and storage of the gypsum product for sale
- Zero liquid discharge (ZLD) circuit for solids removal
- Sale of products, including:
    - BA
    - Gypsum
    - SOP
    - HCl

Figure H-1 provides the conceptual processing plant flow diagram.

PLS pumped from the wellfield is first clarified and then filtered through a multimedia filter bed to remove insoluble materials. The Solvent Extraction (SX) process upgrades the PLS from the BA from the wellfield to approximately 8% BA while rejecting non-BA materials, including chlorides.
In the SX circuit, the PLS flows through the following steps:
1. Solvent extraction heating tank
2. Solvent extraction circuit (SX)
3. Washing circuit (scrubber)
4. Stripping circuit

In the SX circuit, the BA is readily and preferentially extracted using a solvent, such as iso-octanol and kerosene. The solvents selected are specific to BA and are unable to extract non-BA anionic or cationic metals allowing them to flow through for subsequent capture.

After SX, the BA solution is scrubbed to remove any remaining acids. The stripping circuit then separates the solvents from the BA. The stripped solution is held in a tank to allow separation of the solvents from the water. As noted, the solvents do not commingle with water and have a specific gravity (SP) of less than 1, so they will float at the top of the tank. The solvents are skimmed from the top of the tank for reuse in the SX circuit. Recycled water is drawn from the bottom of the tank for use as injection solution. This process prevents solvents from being injected into the wellfield. However, to ensure there is no solvent carry over, injection fluids will be sampled for solvents, specifically TPH, BTEX and octane, on a semi-annual basis (see Table P-2). Approximately 85% of the process water is recycled as injection solution.

The BA solution then moves to the crystallizers, where the boric acid is crystallized, dried and loaded for shipment. Gypsum and metal salts are recovered from the non-BA solution and sold as product.

The recovered (recycled) process water will contain any minerals from the ore body that are not precipitated during the process. Therefore, recycled waters are considered to be similar to formation water and make-up water, as presented in Table H-1. Table H-1 also includes the estimated constituents in the initial injectate, make-up water plus HCl, and the regenerated injectate, the water recovered from the gypsum precipitation process and HCl added as required. These are estimates only, it is anticipated that the actual chemical composition will vary.

Table H-1: Chemistry of possible PLS, formation water [SMT-1 (pre-leaching), SMT-93-2 (post-rinsing)] and make-up water (MWW-1 & PW-2).

| Analyte (in mg/l)	MCL	SMT-1 (Duval 1981)	PLS (Mann, 1981)	MWW-1	PW-2	Regenerated Solution	Initial Injection Solution	SMT-93-2
Date Sampled		1981	1981	2018	2018	Est.	Est	2018
Alkalinity, Bicarbonate (As CaCO3)	-			98	245			360
Alkalinity, Carbonate (As CaCO3)	-			ND	ND			46
Alkalinity, Hydroxide (As CaCO3)	-			ND	ND			ND
Alkalinity, Total (As CaCO3)	-	120		98	245			410
Aluminum	1			ND	ND	113	110	ND
Antimony	0.006			ND	ND			ND
Arsenic	0.01			0.054	0.048			0.15
Barium	1	ND		0.02	0.088	3320	3250	ND
Beryllium	0.004			ND	ND			ND
Boron	-	2,360	23,200	12	6.7			150
Cadmium	0.005			ND	ND			ND
Calcium	-	648	10,700	51	120	79000	77300	140
Chloride	250	3,200	14,600	62	400	226400	229000	2400
Chromium	0.05			0.046	ND			ND
Copper	1			0.004	ND			ND
Fluoride	2			1.2	2			14
Iron	0.3	ND		4.9	56	310	310	ND
Kjeldahl, Nitrogen	-			ND	5.8			0.3
Lead	0.015			ND	ND			ND
Lithium	-	29.9		ND	ND			3
Magnesium	-			5	16	10200	10000	12
Manganese	0.05	8.3		0.1	0.78			0.07
Mercury	0.002			0.0002	ND			0.0001
Nickel	0.1			0.004	0.013			0.01
Nitrate as N	10	1.8		ND	ND			ND
Nitrite as N	1			ND	ND			ND
Nitrogen, Nitrate-Nitrite	-			6.8	ND			ND
Nitrogen, Total	10			ND	5.8			ND
pH (S.I.)	6.5-8.5	8.84	0.4	7.79	7.65	0 - 2	<0	8.38
Potassium	-	1,200		3	34	2710	2660	23
Selenium	0.05			ND	0.029			0.07
Silver	0.1			ND	ND			ND
Sodium	-	5,300	4,400	430	970	13400	13100	3800
Sulfate	250	11,400	2,600	940	1500			6100
Sulfuric Acid								
Thallium	0.002			ND	ND			ND
Total Dissolved Solids	500	23,300		1500	3100			12000
Tungsten	-			ND	0.021			ND
Zinc	5			0.24	ND			ND
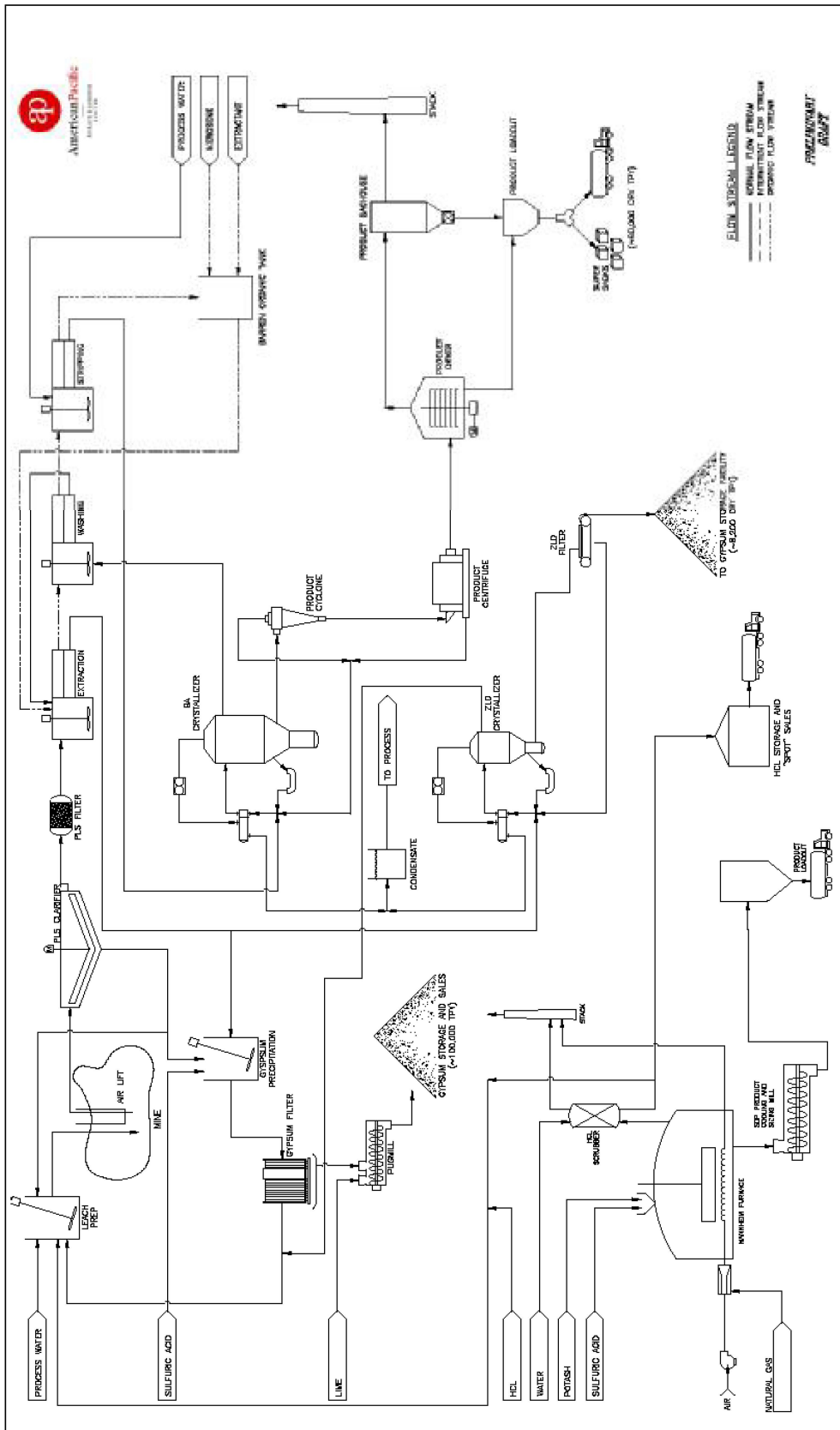
Figure H-1: Conceptual Processing Plant Flow Diagram