REQUEST FOR AMENDMENT TO RADIOACTIVE MATERIALS LICENSE SUA-1471

ADDITION OF ZEOLITE WATER TREATMENT SYSTEMS

HOMESTAKE
Doing it right... ...Right to the end.
Grants Reclamation Project

Prepared by

Homestake Mining Company of California
Grants Reclamation Project
P.O. Box 98
Grants New Mexico 87020

December 2017

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EXHIBIT D: Worker Dose Assessment (ERG)

ACRONYMS:

CAP	Corrective Action Program (groundwater)
COC	Constituents of Concern
cy	Cubic yards
gpm	Gallons per minute
HDPE	High Density Polyethylene
HMC	Hometsake Mining Company
LTP	Large Tailings Pond
MSDS	Material Safety Data Sheet
NELAC	National Environmental Laboratory Accreditation Conference
NMED	New Mexico Environment Department
NRC	Nuclear Regulatory Commission
pcf	pounds per cubic foot
psf	pounds per square foot
PTT	Post Treatment Tank
PVC	Polyvinyl Chloride
RML	Radioactive Materials License
RO	Reverse Osmosis
s.u.	Standard units (pH)
WTP	Water Treatment Plant

1.0 INTRODUCTION

The Grants Reclamation Project (Site) is owned and operated by Homestake Mining Company of California (HMC). The NRC licensed boundary of the site occupies approximately 1,085 acres, located 5.5 miles north of Milan, New Mexico, in Cibola County (Figure 1-1). The site is a former uranium mill that processed ore from several local mines. Milling operations occurred from 1958 to 1990. Groundwater remedial action to mitigate the impacts of seepage from the unlined tailings impoundments into the underlying aquifer has been ongoing since 1977. HMC desires to add an additional groundwater treatment systems to increase its capacity to treat contaminated groundwater, reduce treatment costs, and accelerate the groundwater restoration schedule. This submittal provides the supporting technical basis for amending the HMC Radioactive Materials License (RML) SUA-1471 to license zeolite treatment systems for the removal of uranium from contaminated groundwater.

HMC manages a groundwater restoration program to restore concentrations of the constituents of concern (COCs) to levels that meet the accepted groundwater site standards for each COC in each aquifer. This program, referred to herein as a Corrective Action Program, is authorized and regulated under the U.S. Nuclear Regulatory Commission (NRC) RML SUA-1471, License Condition 35.C and the New Mexico Environment Department (NMED) Discharge Permit, DP-200. This program began in 1977 and is currently projected to continue past 2020. The program is implemented using an adaptive, ongoing strategy that includes monitoring, water management, water treatment, and source control.

The original groundwater Corrective Action Program (CAP) was added to the RML as Condition 35 in 1988 via License Amendment 3, and incorporated new groundwater detection monitoring program to comply with 10 CFR Part 40 Appendix A. The CAP monitoring program was modified in 1998 via License Amendment 4. License Amendment 5 in March of 1990, which among other things required a lined evaporation pond for management and treatment of impacted groundwater, was promptly followed by Amendments 7 and 8 in July of 1990 and Amendment 10 in January of 1991, which approved the construction of the lined evaporation pond and revised monitoring groundwater compliance locations and required periodic reporting of CAP progress. License Amendment 30 in March of 1998 approved construction of a water treatment plant using lime softening and RO. Subsequent amendments to the CAP have related primarily to modifications of the monitoring program and operation of the lined evaporation ponds. Additional modifications and updates to the CAP have been submitted to NRC in December of 2006 (HMC 2006) and March of 2012 (HMC, 2012), though the changes to the CAP identified in these submittals have not been incorporated in the RML. Exhibit A provides a summary of the Historical RML amendments.

The current CAP identified in License Condition 35C is based on the September 15, 1989 submittal (HMC, 1989) as modified by the addition of a reverse osmosis water treatment system described in the January 15, 1998 submittal, and includes the following elements:

Compliance Monitoring Groundwater monitoring of hydrologic gradients and water quality in the alluvial aquifer, the upper, middle, and lower Chinle Formation allows assessment of the groundwater plume hydrologic controls, flow of groundwater and transport of constituents of concern (COCs) in these aquifers, and the progress of the CAP in meeting groundwater quality requirements.

Plume Control Treated water from the RO water treatment plant (WTP) is injected to reverse local hydraulic gradients, thereby creating a hydraulic barrier to the migration of contaminated groundwater and hydraulically forcing COCs in the aquifer to collection/extraction wells.

RO Treatment Groundwater from the Shallow aquifers (alluvial, upper, middle, and lower Chinle aquifers) with elevated contaminant levels is sent to the RO-WTP. Treated product water is injected in the Shallow aquifers, and the process brine stream is sent to the evaporation ponds. Two collection ponds are used to store miscellaneous RO-WTP overflows and process water (blowdown), which are recycled to the RO-WTP influent stream for treatment or pumped to the evaporation ponds.

Evaporation There are three evaporation ponds located at the site. Most of the LTP collection and draindown water and RO-WTP process brine are evaporated with a resulting concentration of contaminants in the ponds. Evaporation rates are enhanced with spray systems and commercial spray evaporators. Precipitation and evaporation rates control the effectiveness of this strategy.

Injection of treated and low contaminant concentration water into the LTP to flush contaminants from the tailings as a form or contaminant source control has been discontinued. Land application of groundwater, used in the past, has been discontinued as a treatment method.

In an effort to accelerate groundwater restoration, expanded groundwater treatment capacity is needed. To expand its treatment capacity and to reduce treatment power requirements and waste stream volumes per unit volume of water treated, HMC has pilot tested zeolite-based treatment systems for uranium in water. These systems have been evaluated for treating groundwater from off-site locations (i.e., groundwater plume locations distal from the tailings pile and mill site) which have uranium as the only hazardous constituent that does not meet site groundwater compliance standards per RML 1471, Condition 35.B.

Zeolite pilot test systems have progressed from bench scale through progressively larger field scale pilot tests, including 50 gallons per minute (gpm), 300 gpm, and 1200 gpm systems. The zeolite pilot test systems pass uranium contaminated groundwater through a sequence of lined ponds that contain zeolite crystals, which absorbs the dissolved uranium onto the zeolite crystal through an exchange process with other cations (e.g., sodium, calcium or hydrogen).

HMC desires to formally add the 300 gpm and 1,200 gpm pilot tests systems to the existing portions of its licensed groundwater restoration program.

2.0 PROPOSED SYSTEM

2.1 GENERAL PROCESS DESCRIPTION

The proposed additional groundwater treatment system uses zeolite crystals for the sorption of uranium from contaminated groundwater. The proposed system consists of two units, one designed to process up to 300 gpm of contaminated groundwater and one to process up to 1,200 gpm for a combined process capacity of up to 1,500 gpm. However, it should be noted that this is their peak treatment capacity design and, when considered with down time for zeolite regeneration (flushing of loaded uranium from the zeolite), maintenance, and repairs, both systems have lower annual average flow capacities. Both units are located on top of the Large Tailings Pond (LTP) as illustrated in Figure 2-1.

2.1.1 Process Design

The zeolite systems were designed in stages, progressing from bench testing, to small (50 gpm) field pilot testing (Rimcon, 2013; see Exhibit B.1.1), through mid-scale field pilot testing (300 gpm; see Exhibit B.1.2 through B.1.4 and Exhibit C) to large scale (1200 gpm) pilot testing. Design and construction of the 1200 gpm zeolite treatment system was based on a detailed Feasibility Study (Rimcon, 2014a; see Exhibit B.2.1) and the subsequent Design Report (Rimcon, 2014b; see Exhibit B.2.2). Construction of the 1200 gpm zeolite treatment system was performed in compliance with the Execution Plan (HMC, 2015; see Exhibit B.2.3), which included detailed construction specifications and design drawings (included as last half of Exhibit B.2.3 as well as Exhibit B.2.4). A structural stability assessment of the LTP from the placement of the 1200 gpm zeolite treatment system was performed and is included in Exhibit B.2.5. As built construction QC data for the 1200 gpm system are included herein as Exhibit B.2.6, and include an as-built topographic survey, of the 1200 gpm zeolite system, earthwork compaction density test results, liner placement logs, destructive and non-destructive liner and seam test results and liner repair logs.

Each system consists of a series of three successive high-density polyethylene (HDPE) lined cells containing natural zeolite crystals through which the uranium contaminated groundwater flows, much like a series of ion exchange columns commonly used in the in-situ uranium recovery industry. The 300 gpm system consists of a single set of three cells (called a "train" of cells) while the 1200 gpm system consists of four independent and parallel trains of three cells, each train designed to treat up to 300 gpm. Figure 2-2 presents a conceptual schematic illustration of a three-cell train configuration.

Cells are designed with side slopes of 2 horizontal to 1 vertical (2H:1V), total depths of approximately 8 feet. The cells accommodate between 400 and 500 tons, or between approximately 600 and 800 cubic yards (cy) of zeolite (based on a range of in-place densities of between 46 pound per cubic feet (pcf) to 49 pcf (see Zeolite information sheet in Exhibit B.3). As a safeguard for containment, the system is designed with at least 2 feet of freeboard and could

operate at full capacity for approximately 20 hours while still providing freeboard within the containment. Figures 2-3 and 2-4 illustrates the existing 300 gpm zeolite treatment system cell laout and configuration while Figures 2-5 illustrates the 1200 gpm zeolite treatment cell layout. More detailed figures for these systems are presented in Exhibit B.1.2 (300 gpm system) and B.2 3 and B.2.4 (1200 gpm system).

Liners are welded HDPE with perimeter anchor trenches. Perimeter roadways and interior inter-cell berms have compacted earthen covers, which are all constructed over HDPE "rub sheets" that are located on top of continuously welded liner material. The minimal pipe penetrations through the liners (e.g., decant gravity feed lines between cells) all have pipe boot installations performed by a commercially certified liner contractor.

Process control for the zeolite treatment systems is designed to occur in small control buildings, which are constructed over continuously welded liner material. Sulfuric acid is contained within double-walled polyethylene acid storage tanks, which are anchored to the concrete slab upong which they are located. The acid delivery line is designed to pump directly to the regeneration tanks or to acid metering storage tanks (see detailed drawings in Exhibit B.1.2 [300 gpm system] and B.2.3 [1200 gpm system]).

2.1.2 Process Operation

Influent treatment water from off-site wells, which exceeds only the uranium groundwater protection standards in RML condition 35B, is pumped from the well field to the LTP zeolite treatment systems through existing piping. Pumping from on-site wells from locations where impacted groundwater exceeds only the uranium groundwater protection standards in RML condition 35B may be proposed in the future.

The zeolite feed water stream is amended at the zeolite treatment systems with minor amounts of sulfuric acid to reduce the influent stream pH to approximately 5.6 to 5.8 standard pH units (s.u.), which facilitates uranyl ion disassociation from bicarbonate ions and, consequently, uranyl ion exchange and sorption onto the zeolite. The influent stream is then pumped into the bottom of the first cell through perforated pipe embedded in washed river rock covered with a non-woven filter fabric (see Exhibit B.2.3, Sheet 26 Regen Pumping System and Water Distribution System Details at end of Technical Specifications document), which then percolates upward through the overlying zeolite. Water from the top surface of the first cell then flows by gravity via an HDPE pipe into the bottom of the second cell, which is constructed in a similar manner several feet lower in elevation than the first cell. This water then percolates upward through the zeolite in the second cell and this process is repeated with a third cell.

Discharge water from the third cell was originally intended to go to the tailings injection system. However, since injecting water into the LTP has been discontinued, zeolite-treated discharge now is transferred to the water treatment plant discharge tank at the main water treatment plant, where it is co-mingled with the effluent from the RO plant. These treated and complaint waters, which

meet all site groundwater protection standards identified in RML condition 35B, are injected into the site aquifers as part of the groundwater contaminant source control efforts of the CAP.

Water quality going into and out of the zeolite systems is monitored weekly for the constituents identified in Table 2-1. These samples are sent to a certified laboratory for analysis using the methods identified in Table 2-1. In addition, water quality at various points within the treatment system and leaving the third cell is monitored for uranium at the Site to allow prompt assessment of when the zeolite system is approaching being fully loaded and require regeneration. Zeolite treated discharge is discontinued before effluent dissolved uranium concentration reaches 0.16 mg/L, which is the alluvial aquifer groundwater protection standard for uranium identified in RML condition 35B.

2.1.3 Zeolite Regeneration

Once the zeolites have become sufficiently loaded and approaching the point where they are no longer able to strip dissolved uranium from the water feed stream to below 0.16 mg/L, zeolite regeneration (stripped of its loaded uranium from the zeolites) is initiated by ceasing untreated water inflow, draining the cells of treatment water, and replacing that flow with sulfuric acid solution of pH around 1.5 s.u.

The cells are first drained of treatment water by pumping from the bottom of cell 3, which also drains all the cells above it. Once drained, the sulfuric acid solution is sequentially passed through the three cells in the same manner as the water to be treated described above, except the regeneration effluent from the third cell in each train is cycled back to the first cell in a closed loop until the pH in all cells is reduced to 1.5 s.u. or below, and the measured dissolved uranium concentration stabilizes. The regeneration water is then drained to the Evaporation Pond 2 or other holding pond and the process repeated until the uranium in the regeneration solution is less than 0.01 mg/L. Once this target values is achieved, the final acid regeneration solution is pumped to Evaporation Pond 2 or the East Storage Pond, depending on the current stage and capacity of the respective ponds. Typically, more than two train volumes of acid regeneration is required to achieve the target uranium regeneration value.

Once all acid solutions are pumped out to one of the above referenced lined ponds, the cells are then flushed in sequence with impacted groundwater to bring the cell solution pH up to about 5 s.u. All water below this target pH value is also pumped to one of the above mentioned lined ponds. Once flushing water has a target pH of approximately 5.6 to 5.8 s.u. and cell 3 is confirmed to have a uranium concentration of less than 0.16 mg/L (typically it is lower than 0.03 mg/L after zeolite regeneration), cell 3 effluent discharge is switched to the RO post treatment tank (monitoring point SP2), where it is combined with RO plant treated effluent.

The following sections provide more specific detail for the 300 gpm and 1200 gpm zeolite treatment systems.

2.2 300 GPM SYSTEM

The 300 gpm zeolite system is located near the center and on the top of the LTP, and consists of a 60 mil HDPE welded liner placed on prepared subgrade materials of native compacted fill. The HDPE liner is configured as a single train of three cells.

Construction of the 300 gpm zeolite pilot-test system began in 2012 and was completed in early fall 2013. A water pump-back system was designed and constructed to allow flexibility in the system's operations (i.e., allowed water from the lowest cell to be pumped back to either of the two higher cells). Various safety systems have been incorporated into the 300 gpm pilot treatment system design, including the following:

1. Individual cells of the 300 gpm system are lined with 60 mil HDPE liner.
2. Cells have lined overflow trenches that allow for Cell #1 to overflow into Cell #2 and Cell #2 to overflow into Cell #3; an emergency overflow pipe connects Cell #3 to the discharge tank.
3. In the case of an overflow to the discharge tank, the tank drains by gravity to Evaporation Pond 2.
4. The acid storage tank is double-walled and equipped with an ultrasonic level indicator.
5. The process control building is on its own containment liner. Regeneration tanks are not in any containment structure; however, tanks are located on top of the LTP, they fill in about 20 minutes each, discharge in 30 minutes, and an operator is at the tanks at all times during regeneration. The regeneration process occurs approximately every 45 days.

Exhibit B.1.1 provides the results of the 50 gpm pilot test, which provided the design basis for the 300 gpm zeolite treatment system. Exhibit B.1.2 provides the design drawings for the 300 gpm system. The system was constructed per these drawings with no deviations noted. Exhibit B.1.3 provides photographs of the as-built system. The procedure for operating the 300 gpm zeolite system in provided in Exhibit B.1.4. Performance data from pilot testing is provided in Exhibit C.

2.2 1200 GPM SYSTEM

The design capacity of the 1200 gpm zeolite treatment system was based on the site restoration plans and objectives found in the updated 2012 CAP (HMC, 2012), as well as those found in the NMED Discharge Permit DP-200. Pilot testing of the 300 gpm pilot system showed that treatment using zeolites could achieve the site groundwater quality standards using a primary cell and secondary polishing cell configuration. Previous treatment systems at other sites have proven that flow rate and operational sizing of the zeolite system achieves an optimal balance at approximately the 300 to 400 gpm capacity range.

The 1200 gpm zeolite treatment system design was based on pilot testing of 50 gpm and 300 gpm zeolite treatment systems (Exhibit B.1) as documented in the Rimcon 1200 gpm Zeolite-Based Water Treatment System, Feasibility Study (Rimcon, 2014a) and the Rimcon 1200 gpm Zeolite-Based Water Treatment System, Design Report (Rimcon, 2014b), included herein as Exhibit B.2.1 and B.2.2, respectively. Technical specifications and detailed drawings for the construction of the 1200 gpm system are presented as the second half of the Execution Plan, which is included as

Exhibit B.2.3, electrical drawings for the 1200 gpm system are included as Exhibit B.2.4. As-built data and construction quality control data are included in Exhibit B.2.6.

2.2.1 Siting Information

Siting Information Technical and programmatic review of the preliminary designs for the proposed 1,200 gpm system were performed by HMC site personnel, design engineers, and consultants. Based on these reviews, it was determined that the system should be constructed on the southeast corner of the LTP, as shown in Exhibit B.2.6. This location is an area on the LTP where contaminated windblown deposits (material excavated from areas north and east of the mill site during the mid-1990s) were placed, and in an area where slime mill tailings are not believed to have been deposited.

A geotechnical investigation was conducted on the site during the reclamation of windblown tailings. A stability analysis was conducted on the LTP in 2010 (Kleinfelder, 2010; see Exhibit B.2.5), and a review of that analysis and the aforementioned geotechnical data by a registered Professional Engineer indicates that the zeolite cell and water surcharge load (130 to 150 pounds per square foot [psf] per foot of cell height) will not have an adverse effect on the stability of the LTP (see Exhibit B.2.5).

Locating the 1200 gpm zeolite system on the in the highly unlikely event of a zeolite cell wall failure or significant liner leak, provides for added protection of the environment because any discharge would be contained on the LTP (and the LTP is already subject to strict regulatory remediation mandates). In addition, this location provides for more efficient operation because it is near the 300 gpm pilot system.

2.2.2 System Configuration

The 1,200 gpm zeolite system consists of four parallel 300-gpm capacity units (i.e., trains), constructed side-by-side and sharing interior berms. Exhibit B.2.3 includes technical drawings illustrating the location of the system on the LTP and a general layout of the incoming feed water, distribution, and outgoing discharge water piping. Each of the four parallel 300 gpm trains that makes up the 1200 gpm system is composed of three treatment cells. The four trains, referred to as Trains A, B, C, and D, run parallel to each other from west to east. The three cells within their respective train are designated as A1, A2, A3; B1, B2, and B3; C1, C2, and C3; and, D1, D2, and D3 (See Figure 2-5).

The top of the LTP is relatively flat with a <2% slope to the east-southeast. The outer edge of the LTP is a roadway for operational access to wells on the LTP. The road is graded to a series of storm water discharge pipes that drain runoff from storms off of the LTP. All storm water is contained within the NRC license boundary with no off-site storm water discharge. This location on the LTP allows for sufficient room to construct the system without interfering with LTP injection, extraction, or monitoring wells.

2.2.3 Earthwork

The 1200 gm zeolite treatment system was constructed using clean fill on top of windblown cleanup materials, which was placed above the interim tailings cover as part of the mill site remedial action and decommissioning. Construction specifications are included in Exhibit B.2.3. Earthwork construction QA results are included in Exhibit B.2.6. An as-built totgraphic survey of the cells is also provided in Exhibit B.2.6

2.2.4 Liner System

The entire 1200 gpm zeolite treatment system within the containment berms will be lined with 60 mil (i.e., 60 thousandths of an inch) HDPE synthetic liner. The liner is anchored via anchor trench as illustrated in Exhibit B.2.3, (Technical Specifications, Sheet 13).

The liner was installed by a certified commercial liner installation contractor. Except for piping between the berms, all other piping was installed on top of the liner. Pipes between cells were buried. These pipes penetrated the liner on both sides of the berm were sealed with poly pipe boots. As with the liner, pipe boots were also installed by a commercially certified liner contractor. Liner construction QA information is provided in Exhibit B.2.6.

Earthen roadways and walkways were built on top of the liner and serve to anchor the interior of the liner. Construction of the roadway included a secondary layer of synthetic material (e.g., a poly "rub" sheet), which was placed on top of the liner system between Trains A and B and between Trains C and D. Approximately 6 inches of rock-free soil was spread on top of the rub sheet and compacted with a roller compactor. Coarse road base material was then placed on top of the compacted soil to complete the road system.

2.2.4 Tank Storage

The 1,200 gpm system requires the use of several tanks. Two 8,700-gallon double-walled, polyethylene acid storage tanks are installed on the west side of the system (see Exhibit B.2.2 and B2.3). This location allows for safe transport and off-loading of acid at the system. These tanks are installed on a concrete slab, anchored with cables, and tightened with turnbuckles. The acid tanks are designed to be accessible for delivery of acid by semi-load and acid load areas are within secondary containment areas. Acid levels are visually monitored by a float, electronic readout meter, and remotely via computer. Acid is conveyed using a commercial acid pump through a plastic pipeline equipped with Schedule 80 polyvinyl chloride (PVC) acid-safe valves directly to the regeneration tanks or to two 1,000-galion acid metering storage tanks located next to the process control buildings, which are also located within a secondary containment system (see figures and drawings in Exhibits B.2.2 and B.2.3).

Two 10,000-gallon polyethylene tanks are required for each of the north treatment trains (Trains A and B) and for the south treatment trains (Trains B and C) to mix zeolite regeneration solution and to supply the regeneration solution to the zeolite (see drawings in Technical Specifications Exhibit 2.2.3). The acid solution consists of a mix of sulfuric acid and water to form a weak acid solution (pH $\approx$ 1.5 s.u.). The tanks are designed to feed the zeolite cells by gravity flow.

2.2.5 Treated Effluent Monitoring

Draft Discharge Permit DP-200 describes the regulatory monitoring requirements for the zeolite water treatment system, which are summarized herein. Zeolite-treated water at the discharge point from Cell 3 of each train is sampled and analyzed weekly for the parameters identified in Table 2-1. Zeolite-treated water, which is now compliant with all license groundwater protection standards, is piped to the RO system post-treatment tank where is combined with treated water from the RO plant before use as injectate to the groundwater system as part of the source control effort. The regulatory compliance location for sampling purposes is downstream of the confluence of the RO and zeolite treated product waters (post-treatment Tank; sampling location SP2) per License Condition 35.C. Overall system monitoring during operations and zeolite regeneration is discussed in greater detail in Section 2.5, below.

2.2.6 Settlement Monitoring

Settlement monitoring of the LTP is a regulatory requirement to determine the stability of the LTP and its interim cover. Review of existing settlement data was performed to assess if construction and operation of the zeolite treatment system would be adversely affected by the system loading on the underlying LTP materials. Settlement monitoring data for the settlement monitoring points from the years 2001 through 2011 are shown in Exhibit B.2.5 (consecutive year-to-year comparison). A Technical Memorandum from registered Professional Engineer of record that assesses the issue of settlement is also provided in Exhibit B.2.5. the anticipated loading was not of sufficient concern to warrant collection of foundation material data with geotechnical boring for the design and construction of the zeolite treatment systems.

2.2.7 Decommissioning

Approximately 64,000 cubic yards of compacted clay soil was used to form the zeolite treatment cells for the 1200 gpm system. Once zeolite treatment is completed, HMC will perform a final regeneration of the zeolite to remove residual uranium and will drain the system. HMC will decommission both the 300 gpm and 1200 gpm zeolite treatment systems by removing equipment, piping, and portions of the liner. Liner that is not removed will be perforated to prevent accumulation of water. The clay and soil used to form the treatment cells, as well as the actual zeolite, will be graded into the existing interim cover, and the final cover will be placed over the graded area.

Prior to grading, the clay and soil underlying the treatment cell liner will be sampled to ensure that no leaks have occurred. Samples will be collected on a pre-determined grid or pattern and will be analyzed for uranium and radium. If radium activities remain consistent with the activities assumed in the design of the radon barrier, the zeolite cell materials will be graded into the interim cover. Otherwise, these materials will be disposed of at a designated alternate location. Decommissioning and reclamation of the zeolite treatment systems will be consistent with the requirements of license condition 37.

2.2.8 Safety Systems

Various safety systems have been incorporated into the 1,200 gpm treatment system design, including the following:

1. Twenty-hour retention of all water at a 1,200 gpm flow rate to prevent upsets from unexpected shutdowns or spills; this feature incorporates berms around the perimeter of all 12 cells and around the process facilities.
2. A 60 mil synthetic containment liner underlying the entire area within the berm to prevent treatment system leaks from the treatment cells, process treatment tanks, control buildings and distribution piping, which are all on lined containment.
3. Human hazard risk-control features have been incorporated into the design (e.g., safety showers, personal protective equipment, keyed acid nipples, dosed acid injection features, and eyewash stations).
4. Personal protection equipment - all operators and acid haulers will be required to wear safety attire including rubber or Tyvek clothing, eye shields, hardhats, and rubber gloves when working with the acid supply and storage equipment.
5. Acid metering equipment will be separated from the rest of the control building operations.
6. Acid storage tanks will be double-walled, placed on a concrete pad and anchored with cables, and located strategically for easy and safe access to the tank by acid haulers.
7. The acid offload site will be designed with a safety shower. In the unlikely event of a spill during offloading, the operator will have access to a pressurized emergency shower and eyewash.
8. Locating the treatment system and the acid tanks on the LTP will prevent spills from migrating onto un impacted soil and beyond the site boundary.
9. The third cell of each treatment train is designed to be equipped with an ultrasonic water level indicator that can be read at the control building or by remote computer; the level indicator will be programmed to read when the water level in the cells exceeds the operational water level range.

2.3 Effluents

Liquid effluent streams are the only waste products from the Zeoloite treatment systems. Two effluent streams will be generated from the proposed change: a compliant treated or product water stream and a regeneration water stream (waste), described previously. Treated effluent would not contain radionuclides that exceed established site standards, while the regeneration water would contain non-compliant uranium concentrations and pH levels. The volume of diluted acid solution needed for each cell regeneration cycle is approximately 18,000 gallons, though this varies with operation conditions. The gravel bed under the zeolite will hold approximately 9,000 gallons of solution, making the combined regeneration solution volume needed for each cell approximately 27,000 gallons. The amount of regeneration water generated annually is calculated as follows:

Regeneration Volume (combined 300 gpm and 1200 gpm systems):
27,000 gal/cell-rinse x 3 rinses/cell x 15 cells x 8 regeneration cycles/year = 9,720,000 gallons/year (1,215,000 gal per regeneration or 81,000 gal/train regeneration)

Regeneration water will be discharged to Evaporation Pond 2 for storage and evapo-concentration or to the collection ponds for use as RO feed. Regeneration solution data collected during the pilot testing period indicate that concentrations of certain parameters are provided in Table 2-1. Third rinse concentrations are anticipated to between Rinse #2 and compliance water quality identified in license condition 35B. All effluent is tested and confirmed to be compliant with all license condition standards prior to being discharged to the Post-treatment tank. All effluent not confirmed to be compliant is diverted to Evaporation Pond 2 for storage and evapo-concentration or to the collection ponds for use as RO feed.

Based on effluent volume information provided above, the regeneration water quantity will remain within the design capacity of the evaporation ponds. Therefore, no significant increase in liquid effluents beyond the current waste management design will occur. Furthermore, because uranium is in disequilibrium with radium in the influent groundwater and dissolved radium concentrations in the influent waters are below drinking water standards, radium is not present in the zeolite treatment system in significant quantities. Therefore, there is a reasonable assurance that no significant additional radon effluent will be generated. Current groundwater, air, and particulate monitoring systems will be sufficient to monitor any potential radiological effluent contributions from the proposed change. Occupational monitoring during pilot testing of these systems indicated no measurable change in occupational gamma or radon exposures.

2.4 MATERIALS AND REAGENTS

2.4.1 Zeolite

The 300 gpm and the 1200 gpm zeolite treatment systems use the same materials and reagents. The zeolite used is purchased from St. Cloud Mining Company of Truth or Consequences, New Mexico. Approximately 400 tons of granular zeolite sized to 14 x 40 mesh screen is placed in each cell (Exhibit B.2.3, Technical Specifications Section CS 11.1). Additional technical information regarding the zeolite, including the Material Safety Data Sheet (MSDS) is included in Exhibit B.3.

2.4.2 Sulfuric Acid

Sulfuric acid is used to lower influent treatment water pH to approximately 5.6 to 5.8 s.u. for effective sorption onto the zeolite as well as to make an acidic solution from off-site treatment water (pH approximately 1.5 s.u.) for zeolite regeneration. Exhibit B.3 provides the MSDS for the sulfuric acid used at the zeolite Treatment Systems.

2.5 OPERATINAL MONITORING

The zeolite water treatment program objective is to treat groundwater that has dissolved uranium as the only constituent above site standards to less than 0.16 mg/L. The purpose of operational monitoring is to document the operational conditions during water treatment and zeolite regeneration. The objective of the operational monitoring is to ensure efficient and effective water treatment management and to ensure that effluents from the treatment systems meet program

objectives. Operational monitoring is addressed in more detailing the Operation and Maintenance Manual - Zeolite Water Treatment Plant (HMC, 2017).

2.5.1 Monitoring Sample Collection Frequency

Water quality samples shall be collected at least weekly during water treatment cycles or more frequently as needed at operator discretion to ensure that treatment effluent to the Post Treatment Tank above the discharge standard of 0.16 mg/L dissolved natural uranium are not exceeded.

Water quality sampling during zeolite regeneration cycles may be taken at operator discretion and as needed to inform when the regeneration cycles have sufficiently stripped loaded constituents from the zeolite and when rinse water has restored cell pH and uranium concentrations to levels acceptable for discharge to the Post Treatment tank. All regeneration effluent shall be discharge to a permitted holding or evaporation pond.

2.5.2 Monitoring Sample Locations

Operational monitoring for physical conditions include the following:

- Influent instantaneous flow meters (gpm)
- Influent totalizing flow meters (total gallons)
- Acid Pump flow meters (str/min)
- Acid Tank totalizing flow meters (gallons)
- Regeneration Tank totalizing flow meters (gallons)
- Individual cells (cell fluid levels; feet)
- Feed line pH (standard pH units)

Flow meters readouts are located in the Pump Houses or on the actual flow meters on the process water lines just outside the Pump Houses, Regen Tanks, and Acid Tanks. Feed Line pH is reported on digital readouts in the Pump Houses.

The data collected at these monitoring locations are documented on Zeolite System Log forms, which are included in the Manual of Standard Practices, Policy Guidance Documents and Standard Operating Procedures, (Rev. 1), Procedure for Operating the 300 gpm Zeolite System, 300 gpm Zeolite Water Treatment System Training (Monitoring and Controlling pH).

Operational monitoring for water quality conditions consists of collecting water samples from the following locations, which are illustrated in Figures 2-1, 2-3, and 2-5.

- Influent feed line
- Treatment cell grab samples
- Treated effluent verification sampling

The attached Figure 2-1, 2-3 and 2-5 illustrate the system locations and sampling locations, which are discussed below.

Influent samples are collected at the Influent Feed Line for the process cell trains. For the 300 gpm treatment system, this location is illustrated in Figure 2-3. For the 1200 gpm treatment system, these locations are illustrated in Figure 2-5. There are two Influent Feed Line taps for the 1200 gpm treatment system. One tap is on the feed line from the Train A & B Pump House and one tap is on the feed line from the Train C & D Pump House. The taps are simply spigots with a valve.

Cell grab samples are collected by dipping a sample bottle at the end of a pole from the east end (downstream side) of each the cell. Samples are collected from just below the cell surface near the point where cell effluent flows in to the next lower cell or discharges form the last cell.

2.5.3 Monitoring Sampling and Analysis

Influent Samples:
The influent feed line tap is a spigot on the influent water lines (Figures 2-3 and 2-5). The tap is opened and the new sample bottle is rinsed with process water at least three times and then filled with a sample of process water. No preservation or filtration is performed.

Field pH is taken at this time either manually, using a hand-held pH meter or from the in-line water feed line pH meter in the Pump Houses. If collected manually, the hand-held pH meter shall be calibrated per the Manufacturer's specifications or applicable SOP.

Cell Grab Samples:
A sample bottle is attached to pole is dipped below the water surface of each cell near the cell discharge point, rinsed with process water at least three times, then filled with a sample (Figures Figures 2-3 and 2-5). The sample bottle is then decanted into a new sample bottle and then handled according to the Zeolite Operations Manual.

Treated Effluent Verification Sample:
The lines piping the treated effluent to the WTP post treatment tank (PTT) are accessed via a tap or spigot in the line (300 gpm system) or in valve a shed where the buried pipelines are accessed (1200 gpm system) at the locations illustrated in Figure 2-1.

Analysis of Process Water:
All weekly samples of process waters, including treated effluent verification samples collected during water treatment are analyzed for total natural uranium on-site using the KPA per the Manual of Standard Practices, Policy Guidance Documents and Standard Operating Procedures, (Rev. 1), Standard Operating Procedure, Kinetic Phosphorescent Analyzer. This analysis allows screening level assessment of uranium with a detection limits to at least 0.01 mg/L.

Weekly samples from treated effluent verification locations collected during active water treatment are also sent to a third party National Environmental Laboratory Accreditation Conference (NELAC) certified laboratory (Energy Laboratories Inc.-Casper, Wyoming) for the analyses listed

in Table 2-1. These data are reported annually in the Annual Monitoring Report, Section 2.1.2.5 (Quality of Treated Water).

- System performance monitoring
  - Daily Logs
    - Flow rate and total flow
    - pH (Influent, all cells, effluent)
    - Acid pump rate, totalized vol.
    - Product totalized vol.
    - Regen totalized vol.
    - Observations/leaks
    - Wells being pumped
  - Weekly
    - Wells being pumped
- Water Quality Monitoring
  - Operations Weekly samples
    - Influent, after acid/pH adjustment via sampling port
    - Grabs from surface of pond near discharge pipe inlet
    - Cell 3 discharge sample
  - Regen Samples
    - Grabs from surface of pond near discharge pipe inlet, as needed.

Process water qulaity samples are collected duing zeolite regeneration and analyzed only in-house using the KPA SOP (Exhibit B.4)

3.0 ENVIRONMENTAL REVIEW

The environmental conditions at the Homestake Grants Reclamation Project have most recent been detailed in the Environmental Report for the Construction of Evaporation pond #3 (EP3) and Associated Operations Boundary Expansion (NRC, 2007), and the Updated Corrective Action Program (CAP) (HMC, 2012). This amendment request includes those materials by reference.

Because the 300 gpm and 1200 gpm treatment systems consist of relatively small structures with limited footprint on top to the LTP, the environmental impacts from construction, operation, and decommissioning are very limited. Therefore, many of the affected environment topics are clearly not impacted by the construction, operation and decommissioning of the zeolite treatment systems. The following briefly identifies the document and associated sections that address the affected environment and characterizes the potential for adverse impact to the affected environment from construction, operations and decommissioning of the zeolite treatment systems. The reader is referred to the following documents and related document sections for more detailed discussion of those topics of the potentially affected environment.

- Land Use (NRC, 2007; Section 3.2) (HMC, 2012; Section 2.1, 2.8)
    - Observational data indicates that land use in the immediate area of the Grants Reclamation Project has not changed substantially since 2007. No aspect of construction, operation or decommissioning of the zeolite treatment system, conflict with or impact the current or potential future land uses. Therefore, no adverse impact on adjacent land use from construction, operation, and reclamation of the zeolite systems are anticipated.
- Socioeconomics (NRC, 2007; Section 3.3)
    - Because of the modest capital costs (<$2MM, mostly capital costs for materials), short construction period with limited labor demand (<6 mo., < 10 full time employees using local and regional labor pool), the use of existing personnel to operate the systems, and the relatively small increment additional reclamation costs associated with decommissioning and reclamation of the zeolite treatment systems, no significant adverse socioeconomic impacts are anticipated. Rather, net socioeconomic benefit is anticipated from transient increase use of local labor.
- Cultural Resources (NRC, 2007; Section 3.4)
    - Because the zeolite treatment systems are to be constructed, operated and reclaimed within the LTP and STP along with all associated waste products, no impact to cultural resources is expected.
- Climate and Meteorology (NRC, 2007; Section 3.5)
- Air Quality (NRC, 2007; Section 3.6)
    - All energized systems are electrical, no emissions from operations that could adversely impact air quality are anticipated.
- Noise (NRC, 2007; Section 3.7)
    - No sensitive noise receptors are located near the site. All energized system are electrical and no noise related PPE is prescribed for operations of the zeolite treatment systems. Therefore, no adverse noise impacts are anticipated.

- Geologic Setting (NRC, 2007; Section 3.8), (HMC, 2012; Section 2.4)
  - The geologic setting has been well characterized and described in the referenced documents. Because the entire zeolite treatment systems are located on top of the LTP, no adverse impact to geologic resources is anticipated.
- Hydrology (NRC, 2007; Section 3.9), (HMC, 2012; Section 2.4; 2.5, 2.7)
  - The hydrologic setting has been well characterized and described in the referenced documents.
  - This amendment addresses only the system for mitigation of extracted groundwater. Since these systems are lined and located on top of the LTP, which would serve to isolate them from the hydrologic system, and since no stormwater from on top of the LTP is allowed to leave the Site, there is reasonable assurance that no significant adverse impact to hydrologic resources is anticipated.

- Ecology (NRC, 2007; Section 3.10, 3.11)
  - Because the zeolite treatment systems are to be constructed, operated and reclaimed within the LTP and STP, no adverse impact to vegetative communities of the ecological system is anticipated.
  - Because the zeolite treatment systems are to be constructed, operated and reclaimed within the LTP and STP, no adverse impact to aquatic or mammalian wildlife is anticipated.
  - Because the water quality of zeolite treatment systems are not substantially different than the range of water qualities in the existing and much larger other bodies of open water (e.g., EP1, EP2, EP3, Storage ponds, etc.), the addition of these systems is not anticipated to significantly increase the potential for adverse impact to wildlife beyond that already assessed by NRC (NRC, 2007). No birds have been observed in the zeolite treatment cells during pilot testing.
- Transportation (NRC, 2007; Section 3.12)
  - No significant increase in commercial vehicular traffic associated with the operation of the zeolite treatment systems is anticipated as the system will be operated by existing personnel and the shipment of reagents will be less than one tanker truck per week. Therefore, no adverse impacts from vehicle traffic on local or regional roads are anticipated.
- Visual Resources (Hydrology (NRC, 2007; Section 3.13)
  - The zeolite treatment systems are located on top of the LTP slightly back from the LTP margins and have low incremental visibility impact when viewed from areas outside the Site Boundary. Therefore, no significant adverse impact to visual resources is anticipated.

3.1 Public and Occupational Health

Public and occupation dose is assessed regurlarly and all monitoring data reported to NRC semi-annually in the Semi-Annual Report and Annual Environmental Report. This includes individual occupational monitoring during routine operation on the Zeolite system including breathing zone monitoring for radon exposure as well as direct gamma exposure monitoring. Monitoring data

have consistently demonstrated that occupational and public exposures remained below the requirements identified in 10 CFR 20 and are ALARA.

Exhibit D provides a Techgnical Memorandum that provides conservative radiological dose and chemical toxicity assessments for workers at the Homestake Mining Company of California (HMC) Grants Reclamation Project whom could become occupationally exposed to uranium when working at the Zeolite water treatment facilities. This assessment considers two potential pathways for exposure.

1) Accidental ingestion of dissolved uranium in contaminated influent groundwater.
2) Incidental inhalation of airborne particulates from Zeolite beds when water treatment ponds are drained for maintenance and become exposed to the atmosphere (the media beds can dry out, and under this condition there is the potential for resuspension of Zeolite particulates to air).

The results of this assessment indicate that potential occupational exposures to uranium from Zeolite facility operations will not result in significant radiological doses or intakes with respect to toxicity concerns. The conservatively calculated estimate for each occupational health endpoint evaluated is far below any regulatory limits.

4.0 PROPOSED LICENSE AMENDMENT

Based on the information presented in the preceding Sections, referenced Exhibits, and referenced documents, HMC proposes to amend Radioactive Materials License SUA-1471, Condition 35 as indicated in the following redline/strikeout text:

35. The licensee shall implement a groundwater compliance monitoring program to assess the performance of the groundwater restoration program. This program is separate from the requirements in License Condition 15. The Licensee shall:

A. Implement the groundwater monitoring shown in Table 2 (8-99) submitted September 29, 1999, except that under "Reversal Wells," delete Well KF and replace with Well DZ, and except that well CW2 will remain in the sampling program monitoring annually for G list of parameters, and Cr is to be deleted from the D and F lists of parameters.

Well DD and one additional monitoring well to the middle of the southeast side of EP3 (to be named later) is to be added to the Table list and will be monitored semi-annually for the B and F list of parameters. The additional well is to be installed and monitored quarterly for at least two quarters prior to EP3 becoming operational to determine background water quality for the well.
B. The following ground water protection standards are established for each designated aquifer/zone as described in Ground-Water Hydrology for Support of Background Concentration at the Grants Reclamation Site (Hydro-Engineering, December 2001) and Background Water Quality Evaluation of the Chinle Aquifers (Homestake Mining Company and Hydro-Engineering, October 2003):

(no change to Table)

The constituents listed above for the alluvial aquifer must not exceed the specified concentration limit at compliance monitoring wells (former point of compliance wells) D1, X, and S4. At present, no compliance monitoring wells have been designated for the Chinle Mixing Zone or the Upper, Middle or Lower Chinle Non-Mixing Zones for the purpose of implementing the ground water protection standards listed above for these zones. The licensee shall propose compliance monitoring wells for the Chinle Mixing Zone and the Upper, Middle and Lower Chinle Non-Mixing Zones in a revised Corrective Action Plan to be submitted to the NRC no later than December 31, 2006. NRC will evaluate the proposed locations for the ground water protection standards listed above. NRC will notify the licensee and request new proposed compliance monitoring well locations from the licensee, if any of the well locations are determined to be unacceptable.

C. Implement the corrective action program described in the September 15, 1989 submittal, as modified by the reverse osmosis system described in the January 15, 1998 submittal, excluding all sampling and reporting requirements for Sample Point 1, with the objective of achieving the concentrations of all constituents listed in License Condition 35B. Composite samples from Sample Point 2 (SP2) will be taken monthly and analyzed for the constituents listed in License

Condition 35B; the results of these analyses will be reported in the semi-annual and annual reports required by License Conditions 15 and 42.

D. Operate evaporation ponds, EP1, EP2 and EP3, and enhanced evaporation systems located in each pond as described in the June 8 and 28, 1990; July 26, August 16, August 19, September 2 and 15, 1994; October 25, 2006, February 7, 2007, July 18, 2007, and March 17, 2008, submittals. Monitoring and mitigation measures for EP3 contained in the HMC Environmental Report dated January 30, 2007, are incorporated into this LC by reference.

E. Operate the zeolite water treatment systems located on the Large Tailings Pond (LTP) as described in the December, 2017 submittal, including all monitoring and mitigation requirements specified therein.

F. Submit by March 31 of each year, a performance review of the corrective action program that details the progress towards attaining groundwater protection standards.

[Applicable Amendments: 3, 4, 5, 7, 8, 10, 11, 16, 21, 28, 30, 31, 33, 34, 39, 41, 49, 50 (Order No. EA-16- 114)]

5.0 REFERENCES

HMC, 2006. Homestake Mining Company. Grants Reclamation Project Groundwater Corrective Action Program (CAP) Revision. December 12, 2006.

HMC, 2012. Homestake Mining Company. Grants Reclamation Project Updated Corrective Action Program (CAP). March 15, 2012.

HMC, 2015. Homestake Mining Company. 1200 gpm Zeolite Water Treatment System Project, Project Execution Plan. February, 2015

Kleinfelder, 2010. Stability Analysis of The Large Tailing Impoundment Homestake Grants Project. Technical Memorandum to Mr. Al Cox. January 21, 2010.

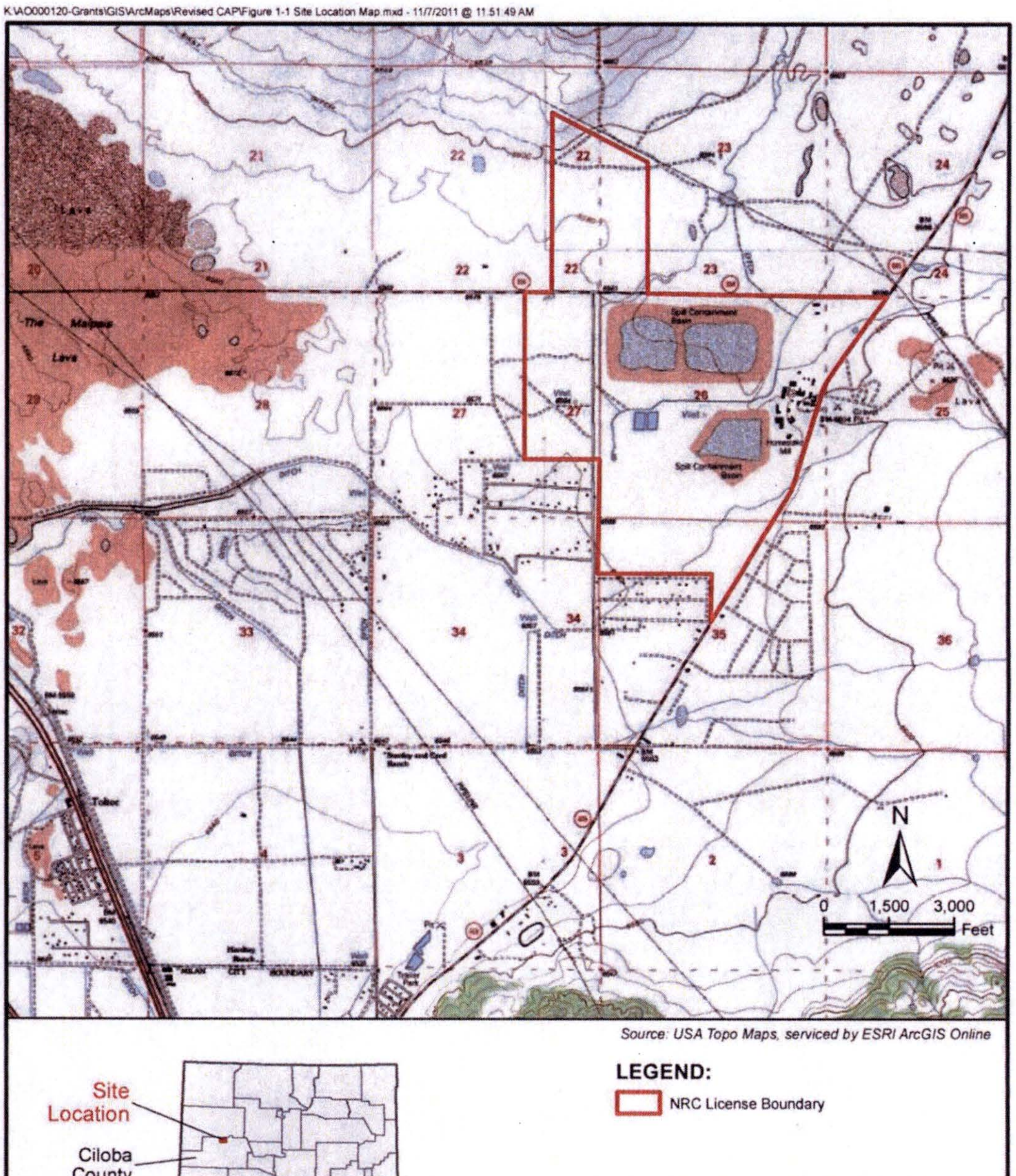
NRC, 2007. Nuclear Regulatory Commission. Environmental Report for the Construction of Evaporation pond #3 (EP3) and Associated Operations Boundary Expansion. U.S. NRC, Office of Nuclear Materials Safety and Safeguards, Division of Fuel Cycle Safety and Safeguards, Fuel Cycle Facilities Branch. Docket No. 040-08903, TAC JOO506. File No. 16977.4ER. January 30, 2007.

RIMCON, 2013. Rimcon Zeolite-Based Water Treatment System Test Results. RIMCON, LLC. January, 2013.

RIMCON, 2014a. Rimcon 1200 gpm Zeolite-Based Water Treatment System, Feasibility Study. RIMCON, LLC. April, 2014.

RIMCON, 2014b. 1200 gpm Zeolite-Based Uranium Water Treatment System, Design Report. RIMCON, LLC and Hydro Engineering. July 20014.

FIGURES



GRANTS RECLAMATION PROJECT
Updated Corrective Action Program (CAP)

FIGURE 1-1
SITE LOCATION MAP

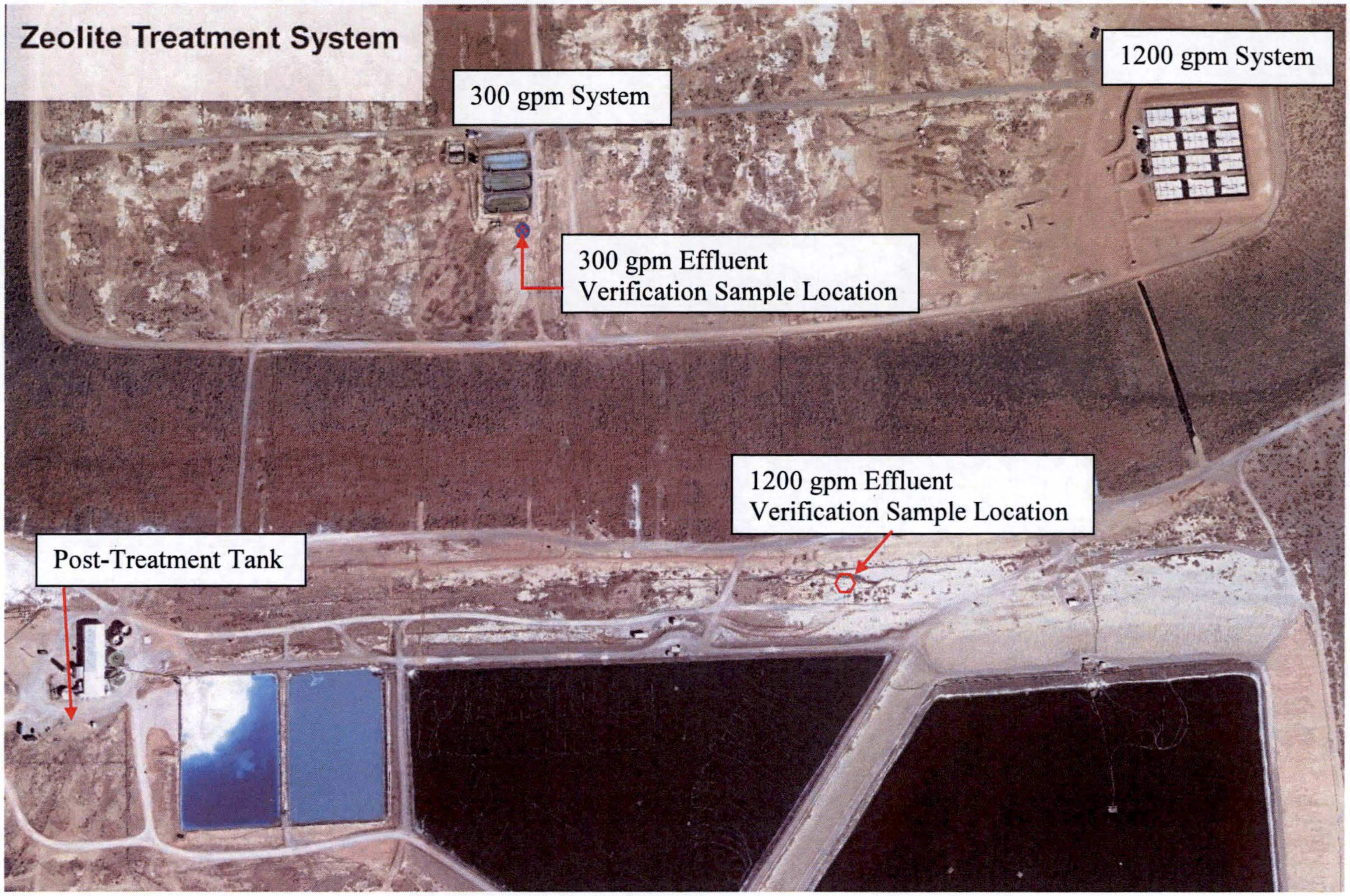
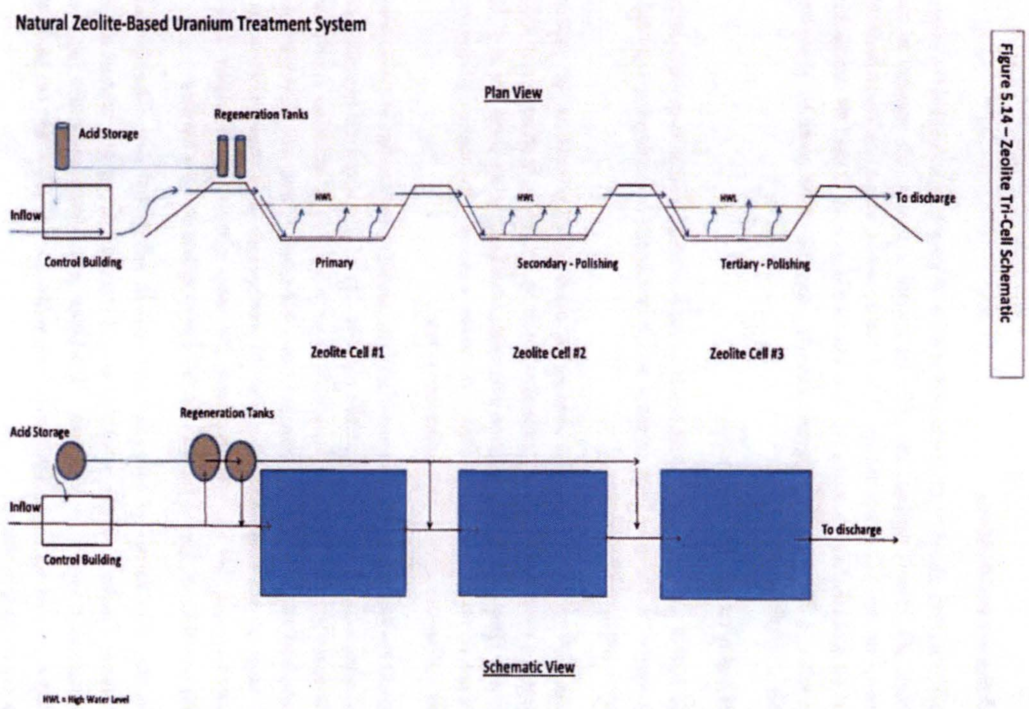


Figure 2-1 Zeolite Treatment System Layout and Monitoring Locations

Figure 2-2 Conceptual Schematic Illustration of a Three Cell Train Configuration



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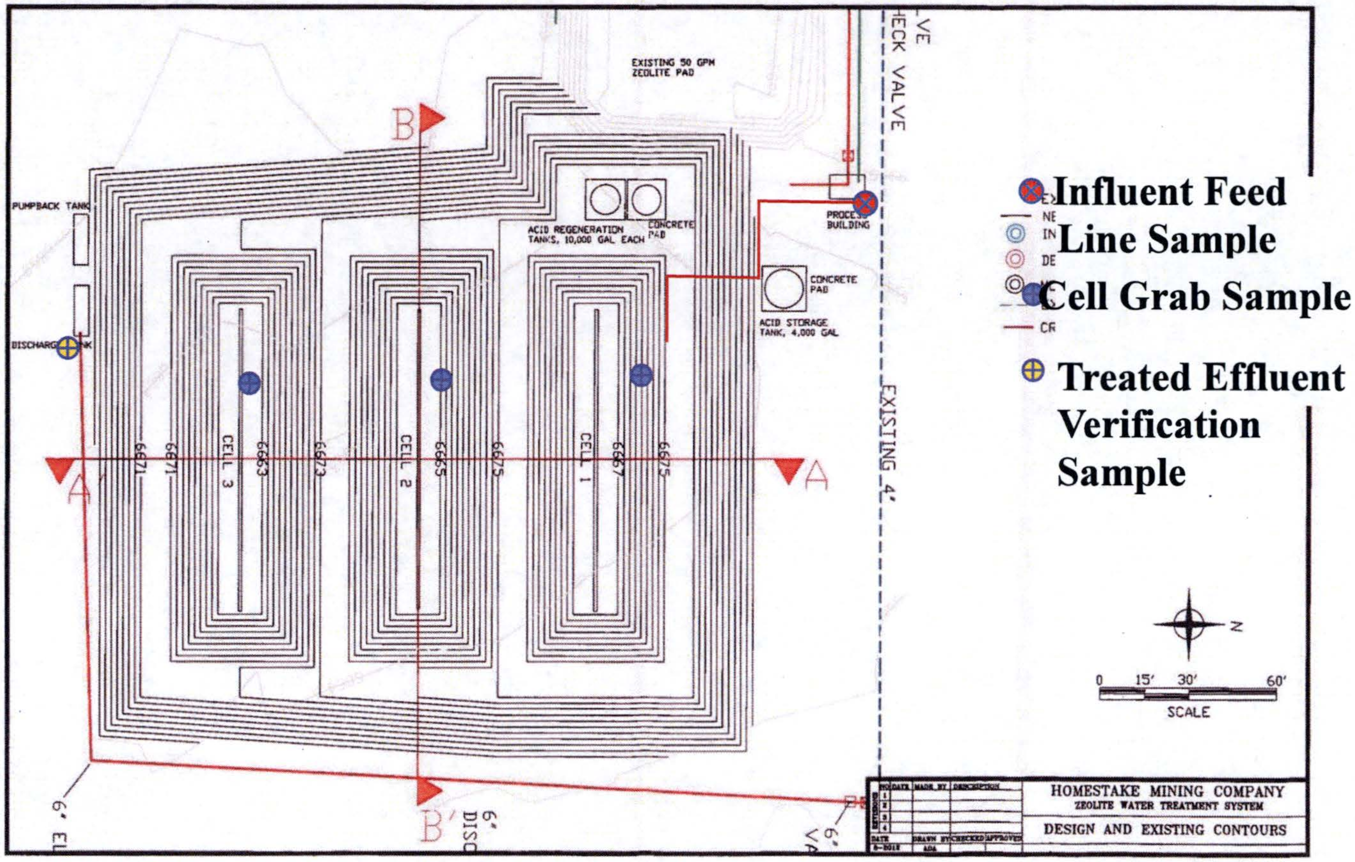


Figure 2-3 300 gpm Zeolite System Layout and Monitoring Points

Figure 2-4 300 gpm Zeolite System Layout Cross-Section

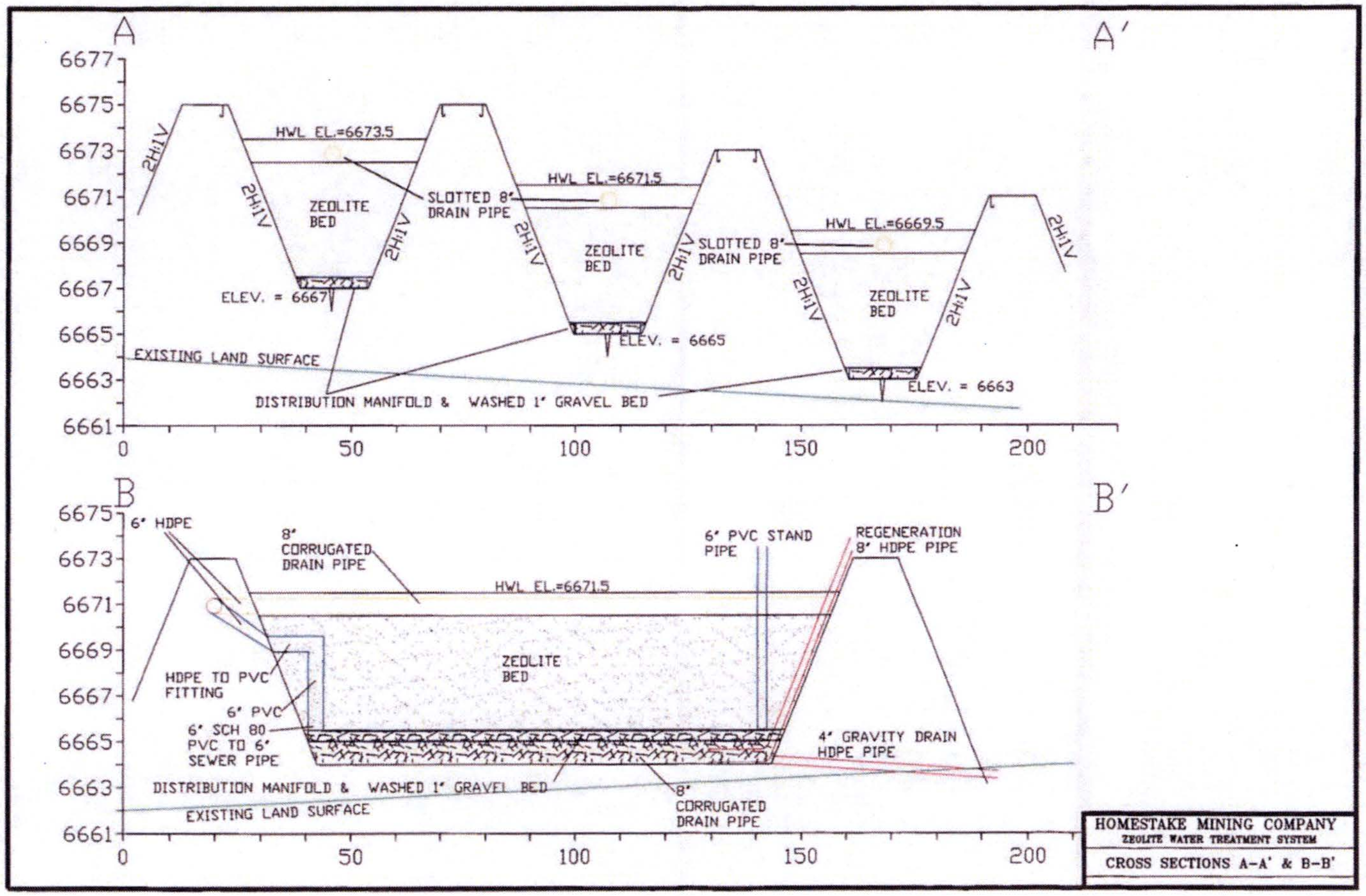
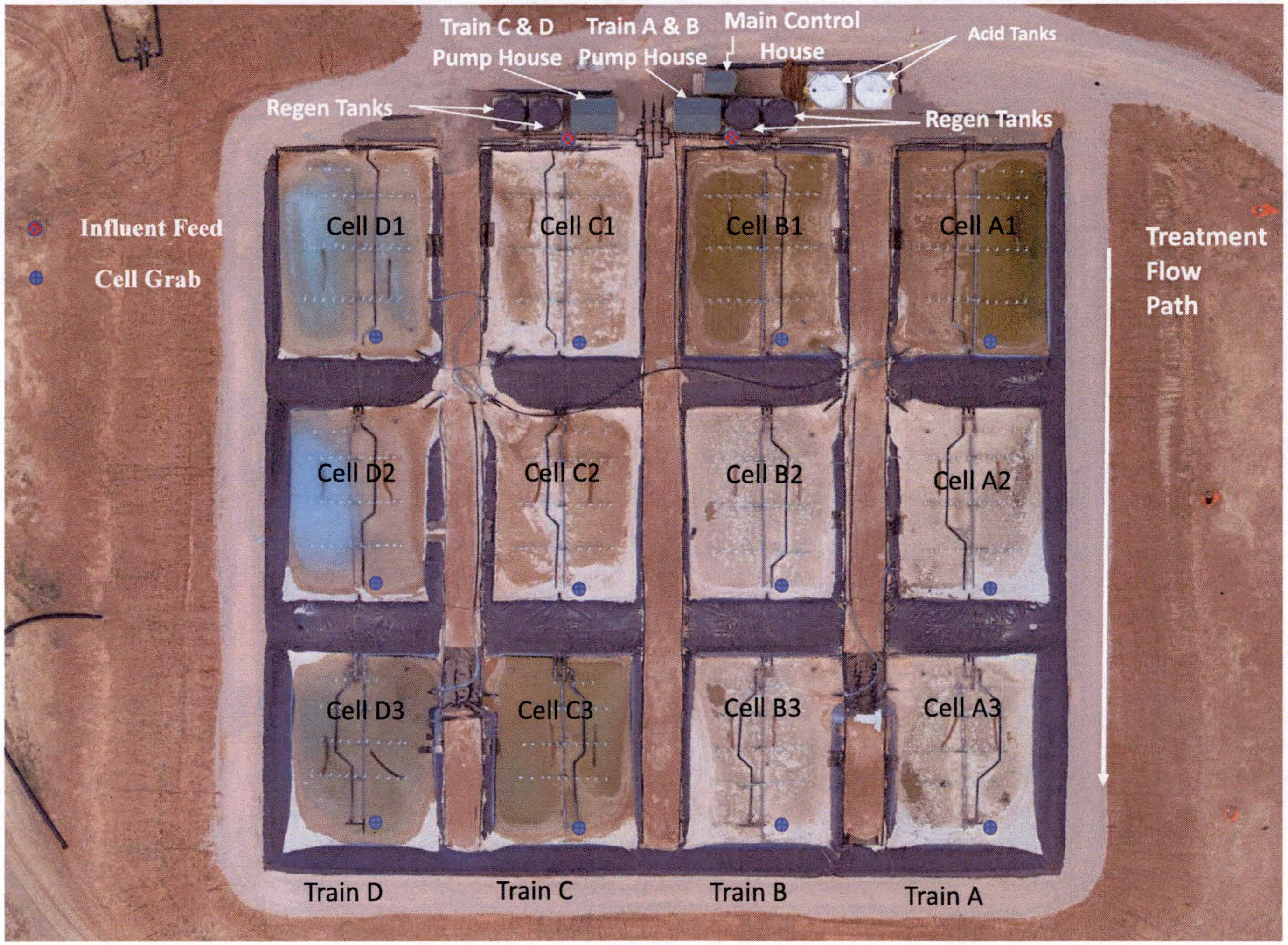


Figure 2-5 1200 gpm Zeolite Treatment System Layout and Monitoring Points



TABLES

Table 2-1 Summary of Zeolite Water Treatment Monitoring Parameters

Parameter	Analytical Method	LLD	Units
pH	A4500-H B	0.01	s.u.
TDS	A2540 C	20	mg/L
SO_4	E300.0	4	mg/L
NO_3+NO_2 - N	E353.2	0.1	mg/L
Cl	E300.0	1	mg/L
CO_3	A2320 B	5	mg/L
HCO_3	A2320 B	5	mg/L
Ca	200.7	0.5	mg/L
K	200.7	0.5	mg/L
Mg	200.7	0.5	mg/L
Na	200.7	0.5	mg/L
Mo	200.8	0.03	mg/L
Se	200.8	0.005	mg/L
U	200.8	0.0003	mg/L
V	200.8	0.01	mg/L
Ra-226	E903.0	0.2	pCi/L
Ra-228	RA-05	1.5	pCi/L
Th-230	E908.0	0.1	pCi/L

LLD = Lower Limit of Detection

MDC= minimum detectable concentration

Table 2-2 Expected Regeneration Solution Quality Parameters

Parameter	Acid Solution	Water Rinse #1	Water Rinse #2
TDS - (mg/L)	30,000 to 35,000	9,000 to 12,000	2,000 to 3,000
Uranium - (mg/L)	25 to 40	5 to 15	0.5 to 1.0
Sulfate - (mg/L)	3,000 to 4,500	2,000 to 3,000	1,000 to 1,500
Chloride - (mg/L)	200 to 400	200 to 400	200 to 400
pH - std. units	0.5 to 1.5	3.0 to 4.0	5.0 to 6.0

EXHIBIT A
Summary of Licensing History

Appendix A. Summary of License SUA-1471 Amendments			
Amendment number	**Date**	**License Condition**	**Requested Change**
0	9/17/1986		Original version of license SUA-1471.
1	11/10/1986		Revision of License SUA-1471 based on comments and concerns by Homestake staff. Amendment 1 is a reissuance of the license in its entirety.
2	10/2/1987	Revise 10, 12, and 19. Add 32, 33, and 34.	(10) The word "will" denotes a requirement. (12) Dam evaluations and training of personnel for inspections to be conducted by registered PE. (19) Lists out requirements for soil sampling and gamma surveys; sets deadlines for clean-up of contaminated areas. (32) Sets lower limits of detection (LLD) for in-plant air and urine samples, and submittal of As Low As Reasonably Achievable (ALARA) report to the Nuclear Regulatory Commission (NRC). (33) Conduct spot-checks of eating and changing areas weekly, all lab surfaces used for bioassay preparation prior to sample analysis, all surveys and spot checks documented. (34) sets the parameter lists for quarterly and semi-annual sampling in wells P, Q, R, F, B, I, and BC.
3	11/9/1988	Add 35A, 35B, and 35C	(35A) Sample wells SV, SB, SE, SA, DB, DE, DG, DL, P, Q, R, DD. (35B) Wells in 35A shall be sampled for Cr, Mo, $Ra^{(226+228)}$, Se, Th, U, and V at a minimum. (35C) Submit the results of the above sample to NRC in the form of a license modification to establish compliance standards.
4	5/18/1989	Delete 34. Revise 35A, 35B, and 35C. Add 35D and 35E.	(34) Removed frequency and analyte list for groundwater monitoring wells. (35A) Established quarterly and semi-annual sampling criteria for monitoring well and which analytes will be analyzed based on well and sampling event. (35B) Established groundwater protection standards for Cr, Mo, Se, V, U, $^{(226+228)}Ra$, and ^{230}Th at Point of Compliance (POC) wells, and recognizing well P as background. (35C) Directive to implement a Corrective Action Program (CAP) due to exceeding groundwater protection standards (GWPS) and set a submittal date for CAP to NRC and date for CAP to be fully operational. (35D) Determine extent and concentration of COCs in the uppermost aquifer and propose comprehensive groundwater monitoring program. (35E) Establish POC wells for the inactive tailings.
5	3/16/1990	Revise 15, 31, and 35	(15) Changes that all groundwater monitoring data shall be reported as described in LC 35. (31) Propose a POC location for the brine evaporation pond on or before June 30, 1990. (35A) Implement monitoring program shown in Table 5-1 of September 15, 1989 submittal. All volumes of water injected and recovered shall be monitored and documented quarterly. (35D) Submit license amendment for proposal for an evaporation pond, a water balance and schedule for tailing dewatering, and a system to eliminate recharge from the scavenger ditch. (35E) Submit semi-annual groundwater monitoring reports. Submit a performance review of the CAP annually detailing progress toward attaining groundwater protection standards by January 31.
6	4/17/1990	Revise 10 and 19A, 19B, and 19C. Add 19D.	(10) Establishes submittal deadlines for ALARA-Radiation Protection Program, Quality Assurance Program for Radiological Monitoring, Mill Respiratory Program, Occupational and Environmental Monitoring and Surveillance Program, Emission Control Device Program, Uranium Mill Bioassay Program. (19A) Application of chemical stabilizer on tailings not covered by water shall be performed and then documented at least annually. (19B) Quarterly inspections and documentation of effectiveness of control measures limit blowing of tailings by the Radiation Protection Administrator (RPA). (19C) Annual technical evaluation of the effectiveness of measures implemented to control blowing of tailings. (19D) An annual soil sampling and gamma survey program shall be performed to verify effectiveness of measures used to control blowing of tailings.
7	7/12/1990	Revise 35B, 35C, and 35D	(35B) Add POC wells D1 and BP to the wells for the active tailings impoundment. (35C) IX column not to be operated after the evaporation pond is constructed. (35D) Construct and operate lined evaporation pond and enhanced evaporation system. Specifications for the enhanced evaporation pond to have at least 24 inches of freeboard and have documented weekly inspections. All soils used in construction compacted to 95 percent of Modified Proctor. Obtain measurements of radionuclides in air during construction activities and safety training given to all construction workers.

Appendix A. Summary of License SUA-1471 Amendments			
Amendment number	Date	License Condition	Requested Change
8	7/20/1990	Revise 31, 35B, 35C	(31) Removed statement on proposing POC well for the brine evaporation pond. Modified point of compliance wells, approval to construct a lined brine evaporation pond. (35B) Stating that well completion details shall be submitted in the form of a license amendment. (35C) Implement the corrective action program described in the September 15, 1989, submittal.
9	10/31/1990	Revise 28	(28) The licensee shall submit an interim surety instrument of no less than $20,000,000. The Final Reclamation Plan must be submitted by January 31, 1991.
10	1/16/1991	Revise 35B and 35D	(35B) Incorporation of POC wells S4, S3, M5. (35D) Removal language about construction of lined evaporation pond and enhanced evaporation system. States not to operate lined evaporation pond and enhanced evaporation system.
11	4/1/1992	Revise 35E	(35E) Change the required date for submittal of the performance review of the groundwater CAP from January 31 to February 28 of each year.
12	9/23/1992	Remove 29. Revise 9, 10, 12, and 28.	(9) Removed language about the requirement for radon daughter sampling at an ion exchange facility that has been decommissioned. (10) License authorizes the possession of residual uranium and by-product material and not processing of ore processing throughput of 3500 tons per day. (12) Remove specifications for a minimum beach of 50 feet and minimum freeboard of 5 feet. (28) Surety approval and establishes annual surety updates from the chief financial officer (CFO) of the parent company, auditors special report, schedule reconciling amounts in CFO's letter with financial statements, and parent company's guarantee if changes are appropriate. (29) Remove submittal of detailed decommissioning plan to NRC.
13	11/6/1992	Add 36	(36) Complete reclamation as per Reclamation Plan. Groundwater CAP conducted per license condition (LC) 35. Established completion dates for retrieval of windblown tailings and placement of the interim cover to decrease tailings dispersal. Sets average flux of standard for radon emissions.
14	7/23/1993	Revise 12. Add 37.	(12) An annual technical evaluation report (TER) of the Large Tailings Pile (LTP) and Small Tailings Pile (STP) under direction of a professional engineer (PE) experienced in dam design and include inspections of tailings impoundments, a review and assessment of all monitoring data and inspection reports, and judgment of effectiveness of the inspection program. A copy of the report submitted to the NRC within one month of completion of report. (37) Licensee shall reclaim LTP and STP with several additional requirements.
15	8/25/1993	Add 29	(29) Licensee shall decommission the Homestake Uranium Mill in accordance with the reclamation plan. Licensee shall perform a soil clean-up verification survey and sampling program.
16	9/23/1993	Revise 10 and 35A	(10) Removal of subsections A through F. Environmental monitoring program changes: groundwater, bioassay and respiratory protection programs. (35A) Removes statement requiring the monitoring and documentation of the volumes of water injected and recovered.
17	1/21/1994	Remove 19	(19 A-D) Remove implementation of an interim stabilization program for all tailings not covered by standing water, including: documentation of application of chemical stabilizers, quarterly inspections of effectiveness of control of blowing dust, annual soil sampling and gamma survey program.
18	2/14/1994	Add 38	(38) Use of water collected as part of GW CAP to be used for conditioning soils during the placement of interim cover on radon barrier of the tailings impoundments. Water samples shall be collected and if samples exceed 30 picoCuries per liter (pCi/L) then evaluation of potential impacts.
19	1/25/1995	Add 39	(39) Authorizes construction of second evaporation pond between EP-1 and brine ponds. Notify the NRC 30 days prior to the start of filling.
20	3/1/1995	Remove 29A, 29B, and 29C	(29 A-C) Removal soil cleanup verification survey and sampling program specifications.

Appendix A. Summary of License SUA-1471 Amendments			
Amendment number	**Date**	**License Condition**	**Requested Change**
21	5/5/1995	Remove 11, 20, 25, 27, 30, and 33. Revise 14 and 35A.	(11) Determine that employees leaving work are not contaminated with radioactive material. (14) Any equipment or personnel that encountered impacted materials will be determined that no radioactive material is leaving the site. (20) Need to post signs inside of mill stating that "any area within this mill may contain radioactive materials." (25) Remove monitoring and exposure calculations of ore dust and yellowcake exposure. (27) Liquid effluents from mill process discharged to the tailings impoundments. (30) Implement a program to minimize dispersal of dust from ore stockpile areas including written operating procedures and weekly documented inspections of effectiveness. (33) Spot check required for all eating areas and lab surfaces for surface contamination and documentation of checks. (35A) Implement monitoring program based on Table 3 of January 1995 submittal to NRC.
22	10/10/1995	Revise 36A (3) and 37A	(36A) Removes language about "above background". (37A) Removed specifications regarding cap thickness and material types.
23	1/30/1996	Revise 28	(28) Bond surety arrangements adjusted.
24	7/30/1996	Revise 10, 12, and 28	(10) Modified by letter dated March 7, 1996. (12) Removed requirement of inspections by PE, but can be conducted by knowledgeable individuals who are familiar with the site. Status report to be included in the second semi-annual monitoring report of each year. (28) Annual updates to the surety amount shall be submitted to the NRC at least 3 months prior to the anniversary date of January 30 of each year.
25	5/9/1997	Revise 36A (3) and 36B	(36A) Modified milestone for completion of final radon barrier. (36B) Milestone modification for the placement of erosion protection on the tailings pile.
26	5/21/1997	Revise 28	(28) Bond surety
27	9/25/1997	Remove 13, 18, 31, and 32A. Revise 21, 23, 37B, and 39.	(13) Remove licensee authorized to possess by product material in the form of tailings and other byproduct milling operations. (18) No changes to tailings retention system with prior NRC approval. (21) Since mill has been reclaimed, the word "mill" is replaced by "site". (23) Removed operational and non-operational language. (31) Removed groundwater monitoring requirements for "brine evaporation pond" as requirements stated in LC 35 and reclamation requirements stated in LC 37. (32A) Specification for the quantity of air sampled resulting in LLD for all in-plant sampling of at least 10 percent of maximum permissible concentration. (37B) Modification to barrier thickness. (39) As pond has been constructed, removed requirement to notify NRC of changes to the design and filling.
28	10/3/1997	Revise 35A	(35A) Implement the monitoring program revised by licensee's submittal August 25, 1997 and Table 3 from January 9, 1995.
29	12/22/1997	Revise 9	(9) Removed language of auxiliary ion exchange facility.
30	3/5/1998	Revise 35C	(35C) Implement corrective action plan as modified by RO system described in 1/15/98 submittal. Established the collection of composite samples from Sample Point 2 (SP-2) weekly for the first month, monthly for the first year, then quarterly thereafter, and analyzed for Mo and U. Decreased sampling dependent on demonstrating acceptable levels of constituents before decreasing frequency.
31	6/24/1998	Revise 14, 15, and 35. Delete 39.	(14) Revert language of LC 14 to prior to Amendment 21. (15) Remove reference to LC 35. (35) Changes to reporting requirements and removes POC from wording but wells remain the same in 35B. 35D includes operation of EP-2 and deletion of LC 39. (35E) Revised the submittal date of annual CAP performance review to March 31.

Appendix A. Summary of License SUA-1471 Amendments			
Amendment number	**Date**	**License Condition**	**Requested Change**
32	1/28/1999	Delete 29. Add 37J and 37K. Revise 37B.	(29) Removes LC on decommissioning the Uranium Mill in accordance with the Reclamation Plan and the specifications for soil cleanup verification surveys, gamma surveys, location and type of materials used to cover mill disposal area, the quality control (QC) program for soil cleanup, and the documentation of all decommissioning activities. (37B) The final reclamation of the STP and EP-1 and EP-2 include disposal of the contaminated restoration material and precipitated solids. (37J) Sets specification of soil clean-up program with the decommissioning of the GW restoration facilities and STP done as specified in submittals. (37K) Revision to LC 29E that a QC program be implemented for soil clean-up verification for 10 percent of sample sent to vendor laboratory and sets analytical method.
33	9/28/2000	Revise 35A through C	(35A) Revised GW monitoring program and removal of Cr from the D and F list of parameters. (35B) Removed wells BP, S3, M5, DQ from POC well list. (35C) RO Sample Point 2 composite samples collected monthly for U and Mo.
34	6/19/2002	Revise 12, 15, 28, 32B, and 35A. Delete 32C. Add 40, 41, 42, and 43.	(12) Modified language to state inspection to be done by staff familiar with embankment design. (15) Removed sample format for reporting monitoring data language. (28) Bond surety arrangements. (32B) Replace statement in guidance with one in standard LC language. (32C) Submittal of the annual ALARA audit to NRC 30 days after completion of audit. (35A) Replace well KF with well DZ as part of "reversal well" pair with well KZ. (40) Where notices and reports to be sent. (41) All unplanned releases need to be documented and specifies what is to be documented. Reporting of release to NRC requirements. (42) Specifies various annual reporting requirements. (43) The need for a cultural resource assessment for all developmental activities.
35	11/29/2003	Revise 28	(28) Proposed financial surety
36	2/6/2004	Revise 36A (3) and 36B (1). Add 36E.	(36A) Milestone extension for radon barrier. (36B) Milestone extensions erosion protection for impoundments. (36E) Radon flux survey to be performed annually and reported in the annual groundwater CAP report.
37	1/31/2005	Revise 28	(28) Bond surety
38	5/13/2005	Revise 28	(28) Bond surety
39	7/10/2006	Revise 35B	(35B) Proposed groundwater protection standards, add GWPS for POC wells in Chinle formation
40	8/7/2006	Revise 28	(28) Bond surety
41	8/7/2008	Revise 28, 35A, 35D, 37B, and 43	(28) Bond surety. (35A) Delete well KF from reversal wells and replace with DZ. Well DD and one to be named well to be monitored semi-annually for B and F parameters. Background well to be installed and monitored quarterly for background quality for EP-3. (35D) Add EP-3 and monitoring/mitigation measures for EP-3 in HMC Environmental Report incorporated in this LC. (37B) Includes three evaporation ponds. (43) Direction given on administering a cultural resources survey and when archaeological material are uncovered.
42	3/15/2010	Revise 28	(28) Bond surety
43	2/28/2011	Revise 28	(28) Bond surety
44	12/20/2011	Revise 28	(28) Bond surety
45	9/27/2012	Revise 36A (3) and 36B (1)	(36A) Set final date for placement of final radon barrier on LTP. (36B) Change erosion protection date for STP. Dates were inadvertently changed in Amendment 41.
46	3/27/2013	Revise 28	(28) Bond surety

Appendix A. Summary of License SUA-1471 Amendments			
Amendment number	**Date**	**License Condition**	**Requested Change**
47	7/19/2013	Revise 1	(1) Revised License name to Homestake Mining Company of California.
48	10/4/2016	Revise 28 and 40	(28) Bond surety. (40) Change to NRC address for written notices.
49	3/28/2017	Revise 15 and 35C. Add 44.	(15) Effluent and environmental monitoring semi-annually by set dates, Order No. EA-16-114. (35C) Results of the SP-2 composite samples will be reported semi-annually and annually and analyzed for constituents listed in LC 35B. (44) Perform all activities in accordance with Confirmatory Order No. EA-16-114 dated March 28, 2017.

Note: Conditions deleted from the License are indicated in red.

EXHIBIT B

EXHIBIT B.1
50 gpm and 300 gpm Pilot Systems Documents

EXHIBIT B.1.1
RIMCON, 2013.
Rimcon Zeolite-Based Water Treatment System Test Results

RESOURCE INVESTIGATION AND MANAGEMENT CONSULTANTS, LLC

RIMCON, LLC
INDUSTRIAL MINERAL TECHNOLOGIES

RIMCON ZEOLITE-BASED WATER TREATMENT SYSTEM TEST RESULTS

Prepared For:

Homestake Mining Company of California
P. O. Box 98
Grants, New Mexico 87020

Prepared By:

RIMCON, LLC
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Rapid City, South Dakota 57701

May 5, 2012
Updated: January, 2013

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EXECUTIVE SUMMARY

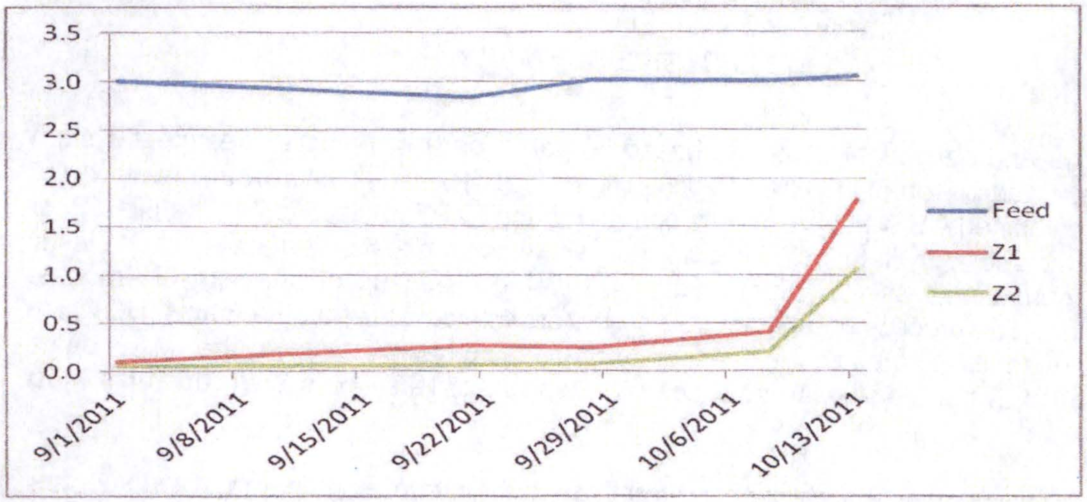
In late 2010 and early 2011, a zeolite based 50 gallon per minute water treatment system was constructed on top of the HMC large tailings pile (LTP). The system was developed to treat the combined CE well bank that is pumped to the LTP for injection into the pile. Prior testing of the zeolite system included laboratory scale column tests, field scale column tests, and a 5 gpm tank test. Uranium in the well water is tied up as uranium bicarbonate compounds. The process breaks up the bicarbonate with acid, freeing the uranyl (UO_2^+) ion for adsorption onto the zeolite based exchange complex. When the bicarbonate concentration in the feed water is reduced to 20 mg/L or less, the system operates most efficiently.

The system was started in February and ran through the end of August with mixed success. Operational problems associated with the acid feed system and problems resulting from extremely variable water flow rates prevented the system from producing acceptable results through the end of March. In addition, the system did not have any remote monitoring capabilities so system problems were not detected in a timely manner. In April, a new acid feed pump was installed that was designed to overcome the feed problems previously experienced. In addition, the variability of feed flow rates was reduced allowing for better acid feed efficiencies.

Acceptable uranium discharge concentrations were achieved for over one half of the April test period. But, in the last half of the month, the pH went up resulting in less dissolution of the bicarbonate and less adsorption of uranium. Results for June through July were very similar to the April results and operational issues were the same. That is, the ability to routinely monitor the acid feed pH data was still not totally functional. In late August, the software installation to monitor the system remotely was completed and allowed for offsite adjustments to acid drip rates.

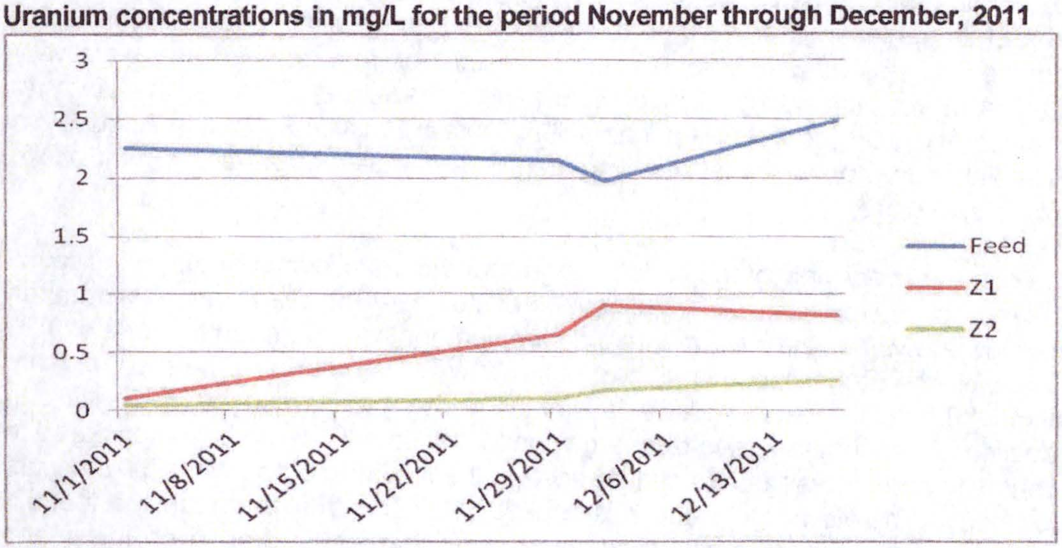
The system operated very well for the period September through December and is indicative of the efficiency of the process. Careful review of the data for the September through October periods shows that the system removed uranium for the test period at a rate of 92% removal (average discharge concentration of 0.18mg/L) as compared to the feed uranium concentration of 3.0 mg/L. For the first 30 days of the period, uranium adsorption resulted in a 96% reduction of uranium (average discharge concentration of 0.10 mg/L) as compared to the feed concentration. These trends can be seen in the following graph which also occurs in the report body. The discharge uranium is depicted as Z2. With further refinement of the acid drip efficiency, the concentration of uranium at discharge will drop even lower and removal efficiencies will increase further.

Uranium concentrations in mg/L for the period September through October, 2011



Results for the November through December test period are similar to the period above. While the average discharge uranium concentration for the period was 0.18 mg/L, as compared to 3.0 mg/L for the feed water, the discharge concentration for the first 30 days was only 0.10 mg/L for a reduction of 96%. The following figure, also shown in the main report, depicts the operating trends for uranium removal with the discharge uranium depicted as Z2.

Uranium concentrations in mg/L for the period November through December, 2011



Refinement of the acid drip process to achieve better bicarbonate dissolution will increase the adsorption efficiencies. The ability to remotely monitor the system and to make remote adjustments to the system has significantly lessened the operational problems. Based on the September through December testing results, a 300 gpm system is being designed.

LTP ZEOLITE-BASED WATER TREATMENT 2011 TEST RESULTS

1.0 BACKGROUND

RIMCON, LLC has been developing a zeolite based water treatment system at the Homestake Mining Company (HMC) Uranium Mill Site near Grants, New Mexico. Previous process testing included laboratory bench column testing, field column testing, and the operation of a 5 gallon per minute (gpm) test system on site. Water from the previous testing came from the CE wells. Results of that testing were encouraging and a decision was made by HMC to further test the process by constructing a 50 gpm water treatment system, based on top of the large tailings pile (LTP).

Construction of the LTP zeolite system for uranium removal was began in late fall 2010, approximately in the center of the pile. The system is designed to treat 50 gallons per minute with one hour retention time. The system treats water from the combined CE wells which are then pumped to the top of the LTP. Initial testing on the system was started in late January 2011 but was shut down due to very cold weather and power supply problems. Detailed system flow and process testing was begun in earnest during February, 2011. No testing was conducted during March 2011. The initial system testing was conducted at flow rates averaging 35 gpm and in early May testing at the full design 50 gpm was initiated. Near continuous operation of the system was conducted from June 2011 through December 2011.

Table 1.0, attached, lists all of the test data for 2011. Note that for the June to December period, fewer samples, along with fewer analyzed parameters, were taken for the laboratory analyses because of cost of analyses and because the samples were geared towards determining when regeneration was needed.

2.0 INITIAL SYSTEM STARTUP TESTING

Initial testing of the system was focused on examining how the system responded to the design flow rates. The initial inflow water rate was adjusted to 50 gpm and allowed to flow for several hours. No problems, such as blowouts, occurred and the zeolite was able to handle the design flow rate.

The system was then started up at a 50 gpm flow rate and acid drip rates were adjusted to try to achieve a Feed pH of 5.75. However, the pH level was not achieved because the Pulsatron acid drip pump could not maintain the necessary pH at these flow rates. The pump was rated to withstand 50 psi back pressure but could not overcome the back pressure created by the acid mixing tube, flow through the membrane contactors, and the 10 feet of head differential between the inline and the zeolite beds. In addition, flow rates fluctuated significantly (see next paragraph) also creating fluctuation in the pH. In order to achieve closer to the desired pH level, flow rates were adjusted back to around 35 gpm. At this flow rate, the average pH was better but still fluctuated significantly.

During this testing, flow rates were very erratic with flows being about 10.0+/- gpm of the design 50 gpm. Flows fluctuated significantly more during high wind periods. Several discussions were held with Hydro Engineering and site personnel and it was decided that an air relief valve be installed on the CE well line to see if fluctuations could be minimized. The air relief valve was installed during the next site visit and, while some fluctuation still existed, the flows were much more stable and manageable.

The system was operated, and adjusted as necessary, during the February testing period. Review of the laboratory data shows that the uranium concentrations in the composite CE well water averaged 2.57 mg/L during this time, with a range of 2.23 to 2.76 mg/L. This uranium concentration was 5 times higher than the CE5 well water treated during the previous zeolite pilot testing program. In addition, the bicarbonate levels in the composite water were also higher than levels previously treated. Results of this testing phase have been graphically presented in Figures 1.0, 2.0, and 3.0 attached.

Figure 1.0 shows the uranium concentrations for this test period. The best results occurred in zeolite bed Z1 where the average uranium concentration for the period was 1.32 mg/L, approximately one half the original feed concentrations. The result of the Z2 zeolite bed averaged 1.83 mg/L but was erratic with a range of 0.68 to 3.72 mg/L. As has been describe many times previously, the success of the process depends heavily on the dissolution of bicarbonate to free uranium as the uranyl (UO_2^+) ion. The best results occur when bicarbonate is reduced to 0 mg/L. Figure 3.0 shows the bicarbonate levels during the testing period. The average bicarbonate concentration in the Feed stream was 113.2 mg/L with a range of 0.0 to 329 mg/L and was only reduced to zero once when the pH was at 2.98, too low for the process to work correctly. While the Feed pH (see Figure 2.0) averaged 5.88 for the period, removal of the one low pH resulted in a pH average of 6.46 with this pH average being too high to insure complete dissolution of bicarbonate.

Evaluation of the pH of the Z1 and the Z2 beds shows that the beds were buffering the pH of the system significantly with pH averages well above the Feed pH average. For Z1, the average pH for this period was 6.75 as compared to 5.88 for the Feed water. For Z2, the average pH was 7.31; again well above the Feed pH. Normally, the zeolite is prepped with a weak acid rinse prior to start up of the system to remove all natural cations from the zeolite. In this case, the zeolite was not prepped with weak acid to see if the first run would be acceptable without spending extra operating costs on the system. A weak acid rinse prior to initial operation is necessary for the process and would likely have produced significantly better adsorption of uranium during this period.

The data suggests that when the pH, and resultant low bicarbonate level, is maintained correctly, and if an acid pre-rinse had been employed, the process would likely result in acceptable treatment of the higher uranium concentrations in the CE well composite water. Because the pump was not able to withstand the higher back pressure in the system and because of the erratic flow of the water, it was difficult to maintain the correct pH level. Installation of the air relief valve and replacement pumps would result in more consistent feed conditions for the system.

3.0 APRIL THROUGH MAY 4 TESTING

The system was not operated during March due largely to freezing temperatures. As stated above, an air relief valve was installed in the Composite CE Well line to see if flow rates could be stabilized. The system was then operated at a flow rate of 35 gpm throughout the month of April, 2011 and the acid drip was adjusted to try to achieve a pH of 5.75 or slightly less. The results of this test period have been graphically presented in attached Figure 4.0 – Uranium, Figure 5.0 – pH; and Figure 6.0 – Bicarbonate.

Review of Figure 4.0 shows significant improvement in the adsorption of uranium. The Feed uranium concentration averaged 2.09 mg/L, with a range of 1.64 to 2.51 mg/L, for the April test period. The average Z1 bed uranium concentration for the test period was 0.30 mg/L (range 0.0.145 to 0.535 mg/L) and the average uranium concentration for the Z2 bed was 0.22 mg/l (range 0.03 to 1.28 mg/L). The average reduction in uranium compared to the Feed water was 86% and 90%, for Z1 and Z2, respectively.

The uranium concentration in Z2 was rising on the last sampling date while the Z1 concentration for that date was still remaining relatively low in comparison. Normally, this would likely be a sign that the bed was loading and needed regeneration soon. While samples were not available for the few days before this period, it appears that the Feed pH likely dropped to less than 4.0 for a very short period before returning to normal and caused some uranium to be re-mobilized. Removal of the last sample result for Z2 would show that the average uranium concentration for Z2 for the majority of the test period would have been 0.09 mg/l or 96% removal.

Examination of Figures 5.0 and 6.0 shows that the removal efficiencies could have been even better with better control of the acid feed and complete dissolution of the bicarbonate. The average Feed water bicarbonate concentration for April was 88.0 mg/l and the average bicarbonate concentration for Z1 and Z2 for this period was 46.2 and 56.2 mg/l respectively. The pH of the Feed water must be adjusted down at least to 5.75 or even slightly lower to insure that the bicarbonate is being dissolved adequately. Given the bicarbonate levels, the adsorption of uranium within the Z1 and Z2 beds was good.

During the third week of April, Automation Electronics and DC Enterprises worked on computerizing the system so that the process could be monitored remotely. The automation allows for the system to be operated remotely in manual or automatic operation. While the system could be monitored from the HMC office, RIMCON did not receive the required software from Barrick to monitor the system until later. The ability to remotely monitor the system would have detected the changes in pH near the end of testing and would have allowed for correction of the acid feed. The acid feed pump shaft that controls the diaphragm corroded and an onsite replacement pump was found to use temporarily. While this pump operated sufficiently as a temporary pump, it had to be operated in manual mode and could not be operated in automatic mode or to supply data to the computer.

4.0 SYSTEM IMPROVEMENTS

A new Pulsatron acid metering pump, plus a backup pump, was ordered for the system and arrived on site for installation. These pumps are designed to allow for acid drips at a rate of up to 3.0 gph and can withstand back pressures of 150 psi or higher. Acid meter rates and subsequent tighter control of the Feed pH was expected to be more efficient and less variable. The completion of the remote monitoring capability, when implemented, would allow for significant improvement in overall process efficiencies. The pump rates of the CE wells were continued to be monitored and particular attention was paid to the CE5 well. This well continued to cut out frequently and also surged significantly when in operation. Valving this well down during operation may lessen the surges and stabilize the flow rates to the system.

5.0 JUNE THROUGH AUGUST TESTING

The system was operated essentially nearly continuously from June, 2011 through December, 2011 with shut down occurring to regenerate the zeolite. As with the previous testing, the key to success of the process was to create a uniform acid addition that results in the dissolution of bicarbonates. The breakup of the bicarbonates allows the uranyl ion to adsorb on the zeolite. When the bicarbonate is not totally dissolved, some of the uranium

will still be tied up as uranium bicarbonate and will pass through the system. Results of this testing are presented in Table 1.0.

For the period June 1 through July 28, the system operated continuously until regeneration was conducted. The average flow rate for this period was 51.25 gpm. During this time, remote monitoring was still not available, pending installation of the remote monitoring software. The average uranium concentration of the feed water for this period was 2.0 mg/L with a range of 1.81 to 2.23 mg/L. The average discharge uranium concentration from the Z2 bed through June 22 was 0.25 mg/L with a range of 0.087 to 0.59 mg/L, indicating a uranium removal of about 90% for this time period. From June 10 through early August, the average uranium concentration from the Z2 discharge was 0.14 mg/L representing a reduction in uranium as compared to the Feed uranium of 93%. By August 15, the test data indicated that loading was occurring on the zeolite and regeneration was necessary. Refer to Figure 7.0 for an examination of this data.

The composite feed water bicarbonate concentration averaged 460 mg/L for this test period. The average bicarbonate concentration of the discharge water from Z2 averaged 100.4 mg/L for this test period. Figure 8.0 details the bicarbonate data for the period. It is clear that the acid drip did not sufficiently drop the bicarbonate to near zero, a condition that would have resulted in lower uranium discharge concentrations. In fact, on the day the uranium discharge concentration was 0.59 mg/L, representing 26% of the feed concentration, the bicarbonate level was 132 mg/L. Even after the bicarbonate reduction stabilized around June 22, the bicarbonate levels for all readings were in excess of 50 mg/L. Ninety percent reductions of the feed concentration is a good result given the lack of total bicarbonate dissolution, but is not acceptable given that the system can do better with better operational controls.

The system was regenerated on July 29 and 30 and restarted again on July 31. The system was operated following regeneration from July 31 until August 10 when it was shut down pending another regeneration cycle. Review of the data in Table 1.0 shows little uranium adsorption for this period when compared to other periods. The regeneration conducted on July 29 and 30 was done using acid from drums that had been stored on site for long periods of time. It is apparent from the data that this regeneration did not adequately

remove uranium and other cations from the zeolite and adsorption capacity was limited. This data has not been plotted for this report.

6.0 SEPTEMBER THROUGH OCTOBER TESTING

For the September and October test period, the remote monitoring system was operational and the added operational control proved significant in system efficiency improvement. The average inflow rate for this period was 52.5 gpm. As stated earlier only a few samples were taken, primarily to determine regeneration times. Review of the data in Table 1.0 and Figure 10 shows that from early September to sometime before October 13, the Z2 discharge uranium concentration averaged about 0.06 mg/L as compared to a feed concentration of nearly 3.0 mg/L (98% reduction). The increase in operational efficiencies over previous periods was a direct result of the ability to monitor the pH levels remotely. By October 13, after about a 45 day operating period, the discharge uranium concentration was up to 1.44 mg/L, indicating that a regeneration cycle was needed.

Bicarbonate concentrations for this period were variable for the Feed water but relatively consistent in the Z1 and Z2 waters as shown in Figure 11. The bicarbonate in the Z1 and Z2 started to go up to unacceptable levels around September 28. Examination of the pH data in Figure 12 shows that the pH values increased to levels above where bicarbonate would be largely dissolved. This is the same timeframe where the uranium concentrations began to increase.

The bicarbonate data for this timeframe for the Feed water shows significant spikes. During this time, the remote monitoring system allowed for a problem in the acid feed to be detected. The acid had stopped pumping due to air locks in the feed line. When the acid feed problem was fixed, the levels returned to more normal concentrations. As stated above, this operational cycle was ended on October 26 for a regeneration cycle. Regeneration for this period was completed on October 28, 2011.

7.0 NOVEMBER THROUGH DECEMBER TESTING

The system was re-started in November and operated until December 17 when a large snow storm caused electrical problems at the site and the system was turned off. The average flow rate for this period was 51.34 gpm. Limited data points were available for this period.

During this operating period, the discharge uranium concentration averaged 0.18 mg/L (92% reduction for the period), as compared to the feed concentration of 2.29 mg/L. For the first month of testing, the average uranium discharge concentration was 0.10 mg/L, a 96% reduction compared to the Feed uranium concentration. Refer to Figure 13 for a depiction of this data.

Referring to Figure 14 for the bicarbonate trends and Figure 15 for the pH trends, it is evident that the levels for both parameters could have been adjusted lower to increase uranium adsorption. At the end of the test period, the pH values did dip to very low levels indicating that too much acid was being injected. The flow rate to the system had dropped to less than 40 gpm, indicating that a well had gone down. Had the electrical failure not occurred, it was anticipated that the regeneration cycle would be necessary towards the end of December, again close to a 45 day operating window.

8.0 DISCUSSION

As with all previous testing, the key to the process efficiency is the ability to dissolve the majority of the bicarbonate in the system. When the bicarbonate is dissolved, the discharge uranium concentration is easily less that 0.10 mg/L or lower. Further reduction of the bicarbonate will reduce the uranium concentrations often to non-detect ranges for several weeks. Data for the time period September through December proves the system can operate efficiently and reduce the uranium concentrations significantly. These results show that the process, as developed, can adsorb uranium to very low levels when the pH and bicarbonate levels are adjusted correctly and consistently. The addition of the remote monitoring and operating capabilities significantly increased the efficiency of the system.

As with all new technologies, operational problems can lower efficiencies. The operational controls for bicarbonate reduction is based on pH data from inline pH probes following acid addition to the Feed water, in the Z1 discharge line, and in the Z2 discharge line. The pH goal in the field is about 5.75 standard units. However, laboratory pH values are consistently about 0.3 standard units higher, indicating that the field pH is reading lower than it actually is compared to the laboratory. This discrepancy is likely due to the presence of carbonic acid in the field water where the acid causes a lower pH reading. By the time a sample is analyzed at the laboratory, the carbonic acid has been released and the pH reads higher than the field. In order to assure that the bicarbonate is dissolved more completely, the acid will be adjusted to lower the Feed pH to about 5.4 or 5.5. This should produce significantly more adsorption of uranium to very low concentrations.

Data from the testing indicate that the system can operate approximately 45 days before significant loading of the zeolite occurs. It is likely that reducing the time between regenerations will allow for consistently low uranium concentrations in the discharge water. A trade off would be to determine an acceptable average uranium concentration before shutdown. That is, the system may operate at a concentration of 0.03 mg/L for 30 days, then, increase to 0.25 mg/L by 40 days, resulting in an average concentration of 0.10 mg/L. The added time between regeneration cycles would save on annual regeneration costs.

Based on the progress so far in the process development, a 300 gpm system is currently being designed to treat the Section 3 irrigation waters. While at a much higher flow rate, the inflow uranium concentrations will be approximately one tenth (0.35 mg/L average) that of the CE well concentrations with a discharge goal of approximately 0.05 mg/L or less. With improved operational efficiency, the removal efficiencies are expected to increase significantly.

An operating cost breakdown has previously been supplied to HMC for review. An estimate of the anticipated capitol costs of the 300 gpm system has been provided HMC, but will be detailed and refined following completion of the engineering phase of the project in the near future. In addition, the current 50 gpm system will be remodeled to jointly use some of the 300 gpm equipment, such as, a shared acid storage system and regeneration system. In addition, acid flow and handling will be automated and enclosed so that acid spills and the

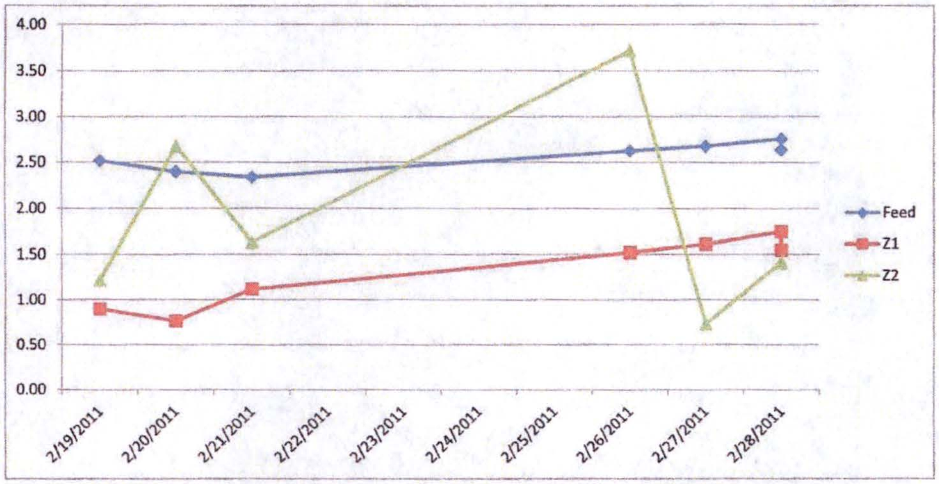
need to switch acid lines between totes will be eliminated. Both systems will be equipped for remote monitoring.

Table 1.0 - LTP Zeolite Testing Data for 2011

Sample Name	Date Sampled	EC umhos	pH	TDS mg/L	HCO3 mg/L	Cl mg/L	SO4 mg/L	Ca mg/L	Mg mg/L	Mo - Total mg/L	K mg/L	Na mg/L	U mg/L
CE Comp	1/23/2011	3100	7.44	2190	458	219	1180	301	72.7	1.97	4.45	395	2.73
Z-1	1/23/2011	3110	7.6	2180	461	222	1190	359	73.7	1.91	34.8	349	2.70
Z-2	1/23/2011	3050	7.66	2420	467	223	1180	404	84	1.85	32.1	299	2.62
CE Comp	2/19/2011	3090	7.58	1990	476	223	1150	305	70	1.84	4.7	414	2.47
Feed	2/19/2011	3110	7.24	2190	329	237	1270	312	71.9	1.92	4.64	433	2.52
Z-1	2/19/2011	3370	6.9	2420	230	225	1550	433	81.5	1.32	25.9	422	0.90
Z-2	2/19/2011	3360	7.33	2230	413	221	1470	449	85.3	1.38	24.2	394	1.22
Feed	2/20/2011	3160	6.2	2190	97.2	209	1480	327	76.4	1.76	4.63	411	2.40
Z-1	2/20/2011	3280	6.69	2190	197	204	1510	379	76.4	1.47	26.4	394	0.77
Z-2	2/20/2011	3200	7.52	2280	346	223	1390	391	72	1.71	25.5	364	0.68
Feed	2/20/2011	3140	5.78	2180	37.3	203	1510	324	77.7	1.69	4.18	441	2.23
Feed	2/21/2011	3130	6.4	2060	129	218	1430	314	72.6	1.76	4.44	429	2.34
Z-1	2/21/2011	3270	6.66	2260	184	220	1510	326	67.4	1.64	28.8	384	1.12
Z-2	2/21/2011	3290	7.41	2300	307	203	1450	381	65.2	1.54	25.9	388	1.63
Feed	2/26/2011	3140	5.97	2090	51	204	1500	286	66.4	1.67	5.14	434	2.63
Z-1	2/26/2011	3280	7.28	2400	343	219	1460	357	74.7	1.09	22.6	435	1.52
Z-2	2/26/2011	3100	7.84	2010	445	240	1220	368	66.2	1.89	21.8	414	3.72
Feed	2/27/2011	3130	6.2	2120	86.5	240	1510	305	70.7	1.61	4.97	437	2.68
Z-1	2/27/2011	3230	7.11	2250	172	240	1530	342	73.8	1.6	22.1	381	1.61
Z-2	2/27/2011	3300	7.26	2350	239	218	1550	343	73.7	1.41	24.5	390	0.73
Feed	2/28/2011	3810	2.86	2380	0	226	1770	297	70.3	1.59	5.86	442	2.76
Z-1	2/28/2011	3450	6.4	2340	140	215	1740	376	77	1.11	22.1	414	1.75
Z-2	2/28/2011	3370	6.88	2440	215	238	1490	351	74.1	1.27	23.6	392	1.42
Feed	2/28/2011	3160	6.29	2120	99.9	231	1410	305	70.9	1.55	5.07	393	2.64
Z-1	2/28/2011	3450	6.24	2390	120	234	1750	389	79.8	0.991	21.9	366	1.55
Z-2	2/28/2011	3420	6.93	2360	220	236	1580	414	85.5	1.17	24.1	371	1.41
Z1-Regen	4/1/2011	18700	1.79	16500	0	214	13100	477	524	0.171	24.5	725	10.2
Z1-Rinse-1	4/1/2011	5850	2.62	4940	0	185	3660	403	118	0.567	8.7	444	3.2
Z1-Rinse-2	4/1/2011	3530	3.63	2760	0	179	1730	324	76.3	0.529	6.02	328	1.87
Z2-Regen	4/2/2011	150000	0.61	32600	0	155	45100	682	381	0.761	214	1020	2.77
Z2-Rinse-1	4/2/2011	7270	2.2	4520	0	188	3980	572	122	0.381	19.2	340	1.97
Z2-Rinse-2	4/2/2011	4540	3.01	3720	0	194	2820	531	102	0.373	14.7	345	1.88
Z-1	4/3/2011	3510	5.97	2930	41.2	194	2030	553	53	0.066	14.8	275	0.954
Z-2	4/3/2011	4480	6.21	3970	138	210	2770	633	139	0.104	21.4	353	0.288
Feed	4/3/2011	2930	5.49	2230	21.1	204	1430	231	56.5	1.74	4.41	353	1.97
Z-1	4/3/2011	3330	6.17	2740	45.1	190	1800	464	37.4	0.333	16.9	302	0.519
Z-2	4/3/2011	4010	6.83	3390	88.8	209	2480	537	106	0.042	18.8	391	0.228
CE Comp	4/4/2011	2860	7.91	2040	442	194	511	225	63.1	1.71	4.49	388	1.86
Z-1	4/4/2011	3140	5.51	2510	20.1	196	1640	333	50.9	0.703	17.2	336	0.379
Z-2	4/4/2011	3580	6.02	3120	37.5	175	2100	484	60.4	0.018	16.5	374	0.116
Feed	4/4/2011	2900	6.51	2140	131	194	1300	220	60.8	1.76	4.23	381	1.89
Z-1	4/4/2011	3130	5.66	2330	19.4	198	1600	317	55.4	0.619	17.7	336	0.312
Z-2	4/4/2011	3530	5.96	3010	27.4	183	1960	454	46.2	0.03	17.3	228	0.102
Z-1	4/5/2011		5.42		28.5					1.59			0.175
Z-2	4/5/2011		5.48		21.4					0.247			0.064
Feed	4/5/2011		6.29		133					1.65			1.9
Z-1	4/5/2011		5.61		29.5					1.09			0.195
Z-2	4/5/2011		5.57		25.5					0.582			0.05
Feed	4/6/2011		3.57		0					1.73			2.12
Z-1	4/6/2011		5.87		41.5					1.65			0.145
Z-2	4/6/2011		5.95		33.7					1.12			0.03
Feed	4/7/2011		6.4		146					1.69			2.5
Z-1	4/7/2011		6.26		68.5					1.46			0.17
Z-2	4/7/2011		6.45		87.8					1.65			0.031
Feed	4/12/2011		6.37		165					1.5			2.51
Z-1	4/12/2011		6.29		102					1.33			0.535
Z-2	4/12/2011		6.64		143					1.55			0.103
Feed	4/21/2011		5.63		52.1					1.23			1.6
Z-1	4/21/2011		6		60.8					1.64			0.527
Z-2	4/21/2011		5.92		40.7					1.15			0.28
Feed	5/4/2011		5.86		59.4					1.48			1.64
Z-1	5/4/2011		3.31		0					1.13			0.959
Z-2	5/4/2011		5.7		37.3					0.817			0.93
Z1-Regen	5/25/2011		1.26		0					0.963			7.29
Z1-Rinse-1	5/26/2011		5.18		20.3					0.236			0.773
Z1-Rinse-2	5/26/2011		5.85		69.6					0.415			0.301
Z2-Regen	5/25/2011		1.95		0					0.244			11.2
Z2-Rinse-1	5/25/2011		3.52		0					0.334			2.27
Z2-Rinse-2	5/25/2011		4.75		< 10.0					0.367			1.08
Feed	6/1/2011		7.7		449					1.38			1.81
Z2- Rinse 3	6/1/2011		6.5		132					2.51			8.52
Z2-Rinse 3	6/1/2011		6.53		84.3					1.15			0.208
Feed	6/10/2011		6.2		105					1.4			2.10
Z-1	6/10/2011		6.24		134					1.6			2.19
Z-2	6/10/2011		6.37		132					1.4			0.59
Feed	6/20/2011		5.84		44.8			292	65.8	1.56	4.42	396	2.14
Z-1	6/20/2011		6.01		79.9			316	69.3	1.11	6.71	386	0.1
Z-2	6/20/2011		6.91		218			34	82.5	0.916	12	398	0.26

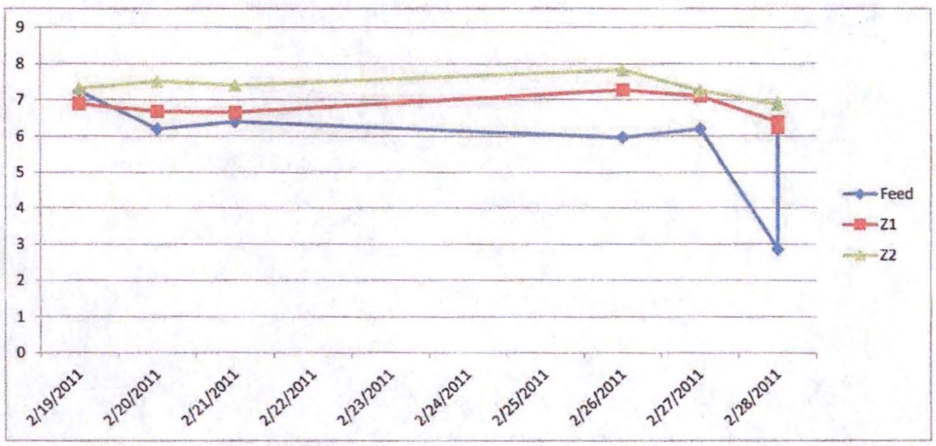
Sample Name	Date Sampled	EC umhos	pH	TDS mg/L	HCO3 mg/L	Cl mg/L	SO4 mg/L	Ca mg/L	Mg mg/L	Mo - Total mg/L	K mg/L	Na mg/L	U mg/L
Feed	6/21/2011		5.59		27.2			295	67.9	1.53	4.39	397	2.23
Z-1	6/21/2011		5.83		56.7			322	73.1	1.46	6.63	384	0.497
Z-2	6/21/2011		6.46		101			332	70.3	1.22	11.6	393	0.091
Feed	6/22/2011		5.85		43.2			554	98.4	1.38	4.42	343	2.13
Z-1	6/22/2011		5.66		44.8			307	69.4	1.54	6.39	390	1.35
Z-2	6/22/2011		6.22		82.4			293	66.2	1.24	12	403	0.09
Feed	7/15/2011		5.83		61.4					1.33			1.84
Z-1	7/15/2011		6.01		93.1					1.17			1.76
Z-2	7/15/2011		6.07		105					1.51			0.87
Feed	7/19/2011		5.44		27.5								1.71
Z-1	7/19/2011		5.74		55.6								1.61
Z-2	7/19/2011		5.83		68.3								1.44
Z1-Regen	7/29/2011		1.47		0					1.13			6.04
Z1-Rinse-1	7/30/2011		4.52		< 10.0					0.43			2.83
Z1-Rinse-1A	7/30/2011		3.02		0					0.445			9.08
Z2-Regen	7/30/2011		1.38		0					0.557			47.5
Z2-Rinse-1	7/30/2011		3.52		0					0.309			2.91
Z2-Rinse-1A	7/30/2011		2.91		0					0.313			4.01
Feed	7/31/2011		5.34		20.5					1.37			1.95
Z-1	7/31/2011		5.82		55.2					0.707			2.64
Z-2	7/31/2011		5.89		61.7					0.354			1.46
Feed	8/10/2011		5.49		21.6					1.19			2.08
Z-1	8/10/2011		5.33		22.8					1.75			0.691
Z-2	8/10/2011		5.15		16.4					1.81			1.54
Z1-Regen-1	8/27/2011		0.57		0								8.67
Z1-Regen-1A	8/27/2011		0.75		0								37.7
Z1-Rinse-1	8/27/2011		1.84		0								6.92
Z1-Rinse-1A	8/27/2011		1.65		0								9.56
Z1-Rinse-2	8/27/2011		2.59		0								3.6
Z1-Rinse-2A	8/28/2011		1.85		0								9.92
Z2-Regen-1	8/28/2011		0.62		0								10.1
Z2-Regen-1A	8/28/2011		0.61		0								54.9
Z2-Rinse-1	8/28/2011		1.69		0								12.7
Z2-Rinse-1A	8/28/2011		1.56		0								23
Z2-Rinse-2	8/28/2011		2.37		0								8
Z2-Rinse-2A	8/28/2011		1.96		0								17
Feed	8/31/2011		5.94		78.9								3.32
Z1-Rinse 3	8/31/2011		3.2		0								1.53
Z2 - Rinse 3	8/31/2011		3.79		0								4.36
CE Well Comp.	9/21/2011		7.73		463								2.78
Feed	9/21/2011		7.6		466								2.83
Z-1	9/21/2011		4.86		< 10.0								0.27
Z-2	9/21/2011		4.38		0								0.07
Feed	9/28/2011		5.25		16.7								3.02
Z-1	9/28/2011		5.78		57.8								0.243
Z-2	9/28/2011		6.08		103								0.074
Feed	10/13/2011		7.77		456					1.53			3.05
Z-1	10/13/2011		5.53		50.6					1.72			1.78
Z-2	10/13/2011		5.77		62					1.17			1.06
Z1-Regen	10/26/2011		0.63		0								65.5
Z2-Regen	10/26/2011		0.7		0								37.6
Z1-Rinse-1	10/27/2011		1.89		0								34.6
Z2-Rinse-1	10/27/2011		2.09		0								22.4
Z1-Rinse-2	10/27/2011		2.9		0								5.1
Feed	10/28/2011		6.56		227								2.78
Z1 - R3	10/28/2011		3.18		0								1.65
Z2 - R3	10/28/2011		3.53		0								7.02
Feed	12/2/2011		5.93		58.1					1.71			1.97
Z-1	12/2/2011		5.68		37.6					1.69			0.89
Z-2	12/2/2011		6.24		67.9					0.84			0.17
CE Comp	12/17/2011		7.53		448								2.41
Feed	12/17/2011		3.07		0								2.49
Z-1	12/17/2011		2.58		0								0.81
Z-2	12/17/2011		5.56		50.4								0.26

Figure 1.0 - Initial Testing Uranium in mg/l Concentrations



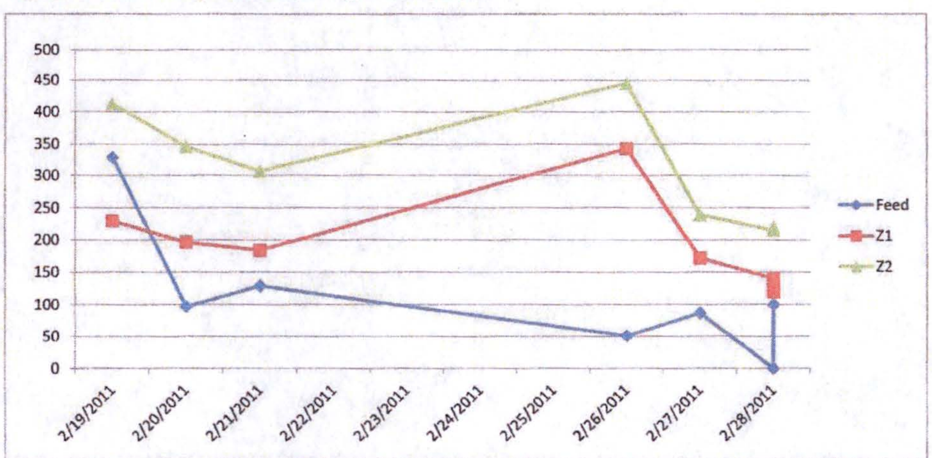
Note: Uranium concentrations increased due to increaing pH and bicarbonate level

Figure 2.0 - Initial Testing pH



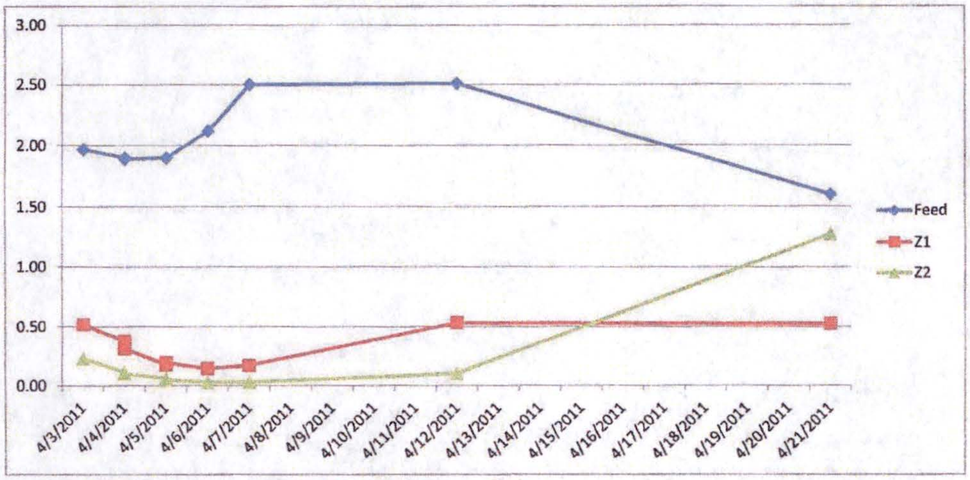
Note: pH levies were too high all through this testing phase

Figure 3.0 - Initial Testing Bicarbonate In mg/l Concentrations



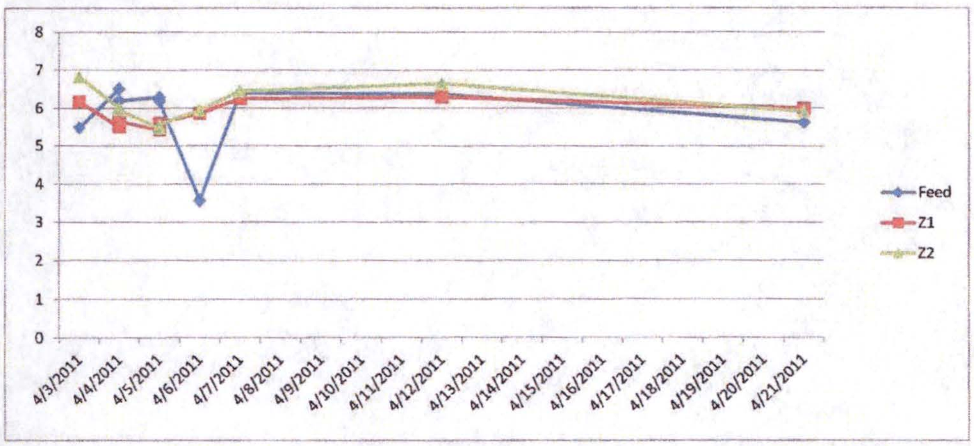
Note: Bicarbonate levels and uranium levels show a correlation between dissolved HCO3 and uranium adsorption.

Figure 4.0 - April Testing Uranium Concentrations in mg/l



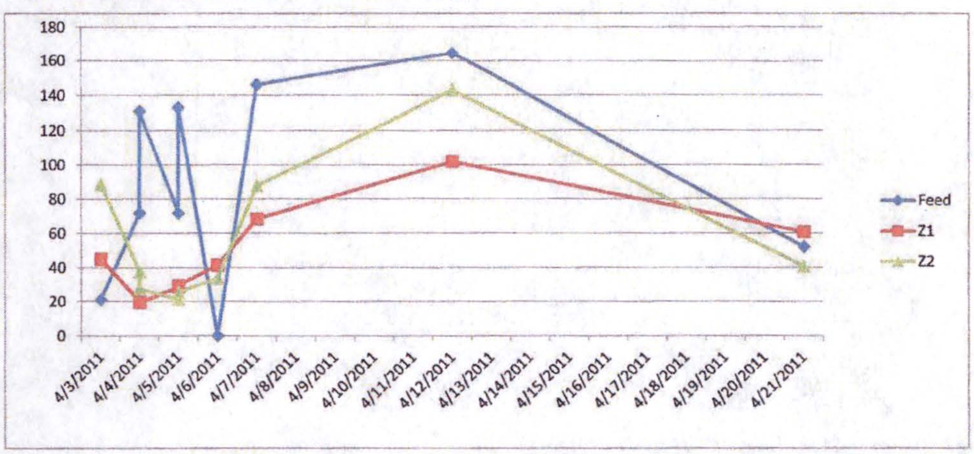
Note: Z2 Bed is ready to consider regeneration on 4/13.

Figure 5.0 - April Testing pH Levels



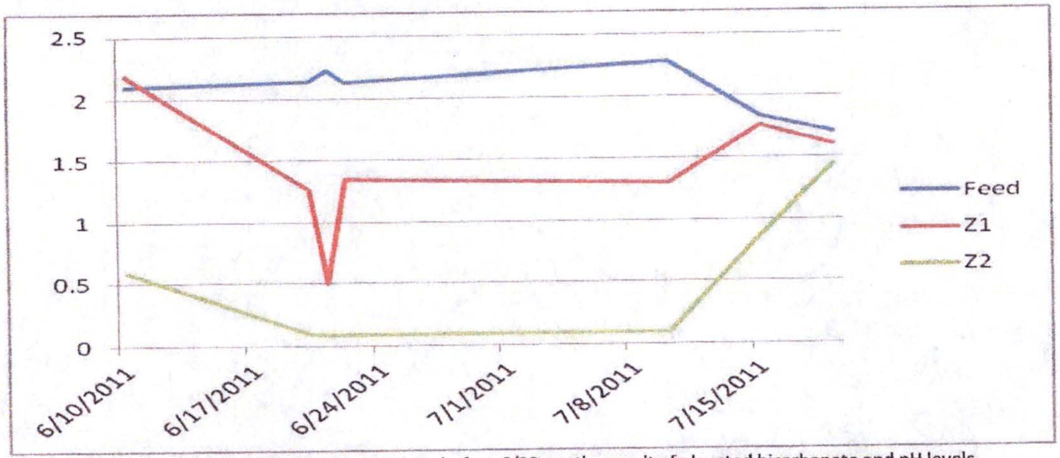
Note: pH levels became more consitent after 4/8 but are too high for bicarbonate dissolution.

Figure 6.0 - April Testing Bicarbonate Concentrations in mg/l



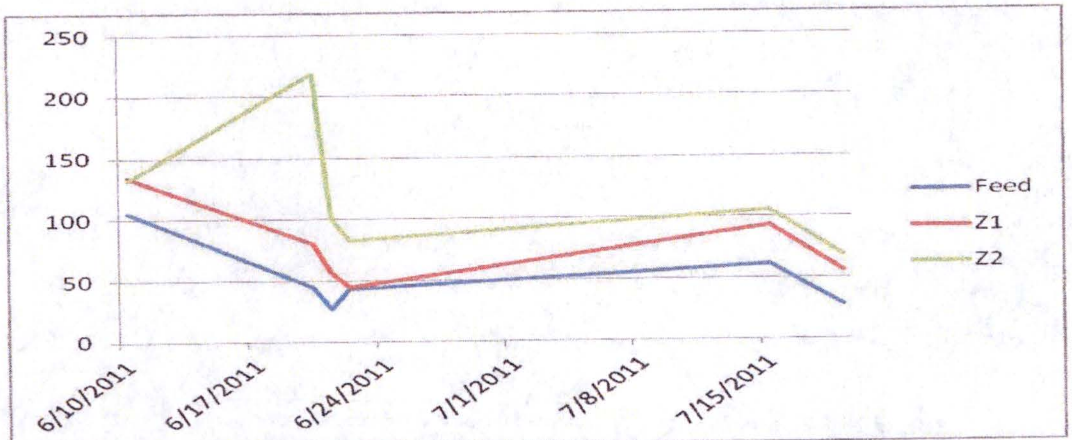
Note: Bicarbonate concentrations are indicative of pH levels being too high.

Figure 7.0 - Uranium Concentrations in mg/L For The Period 5/27 Through 7/28.



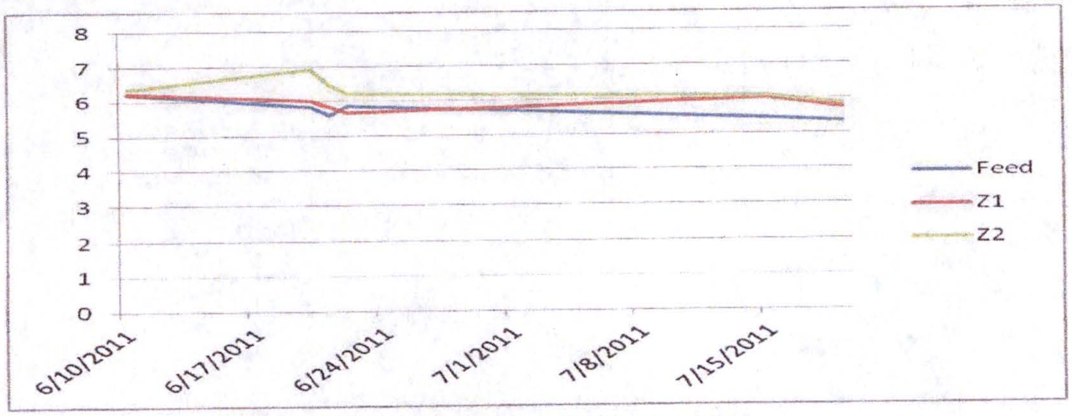
Note: elevated uranium concentrations before 6/20 are the result of elevated bicarbonate and pH levels.

Figure 8.0 - Bicarbonate Concentrations in mg/L For The Period 5/27 Through 7/28.



Note: The effect of elevated bicarbonate on the uranium concentrations is depicted in this Figure.

Figure 9.0 - pH Values For The Period 5/27 Through 7/28



Note: As previously shown, the pH levels shown here are higher than desired.

Figure 10 - Uranium Concentrations in mg/L For The Period 9/1 Through 10/25

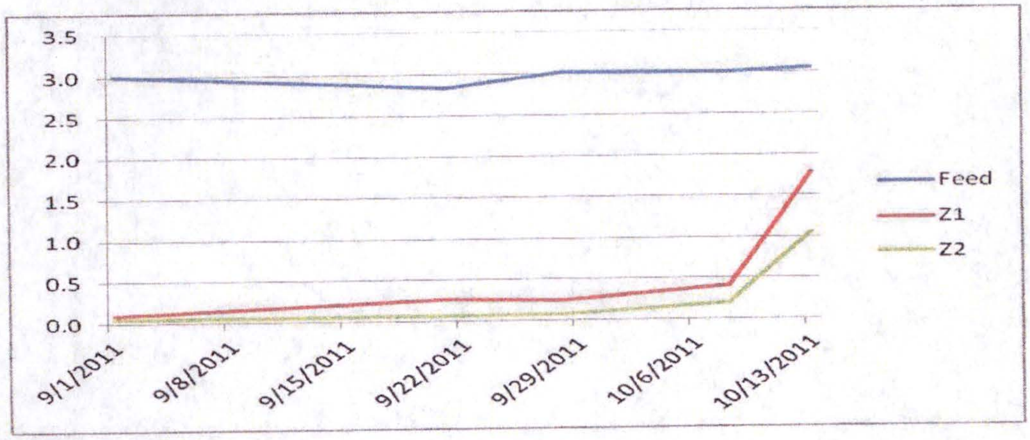
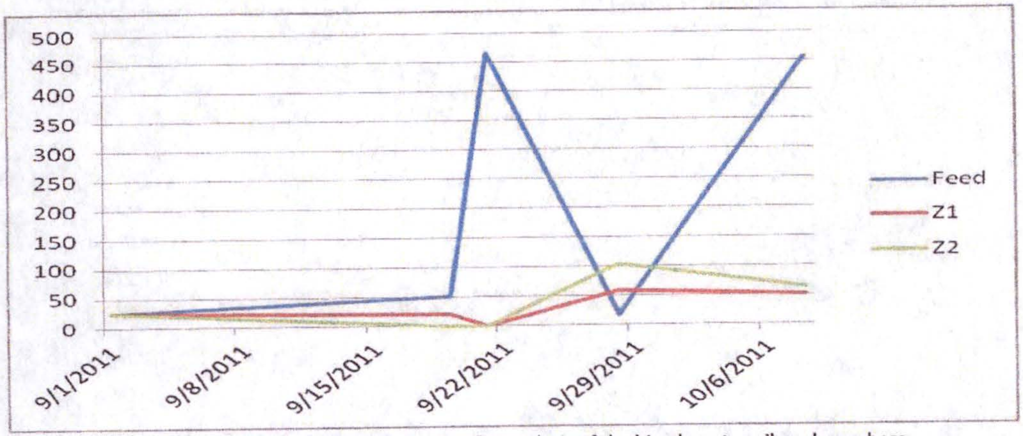


Figure 11 - Bicarbonate Concentration in mg/L For The Period 9/1 Through 10/25



Note: Refer to the discussion in Section 7 for analysis of the bicarbonate spikes shown here.

Figure 12 - pH Values For The Period 9/1 Through 10/25

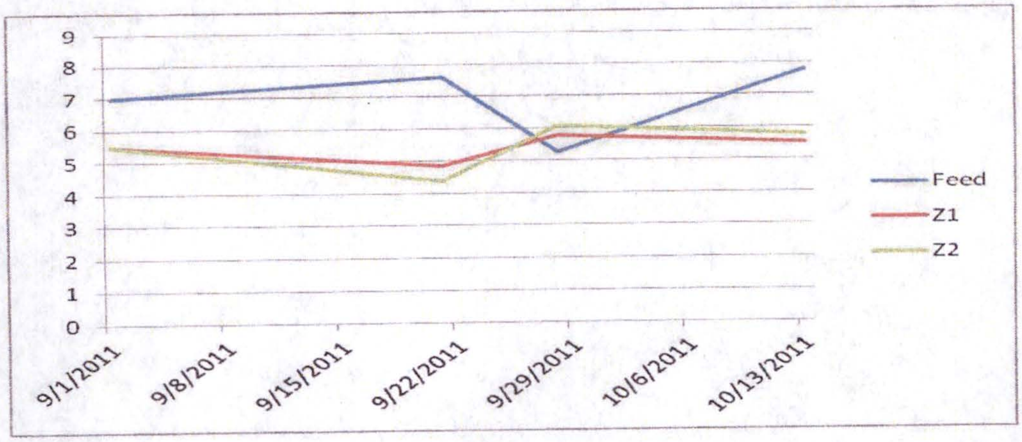


Figure 13 - Uranium concentrations in mg/L for the Period 11/1 Through 12/ 13.

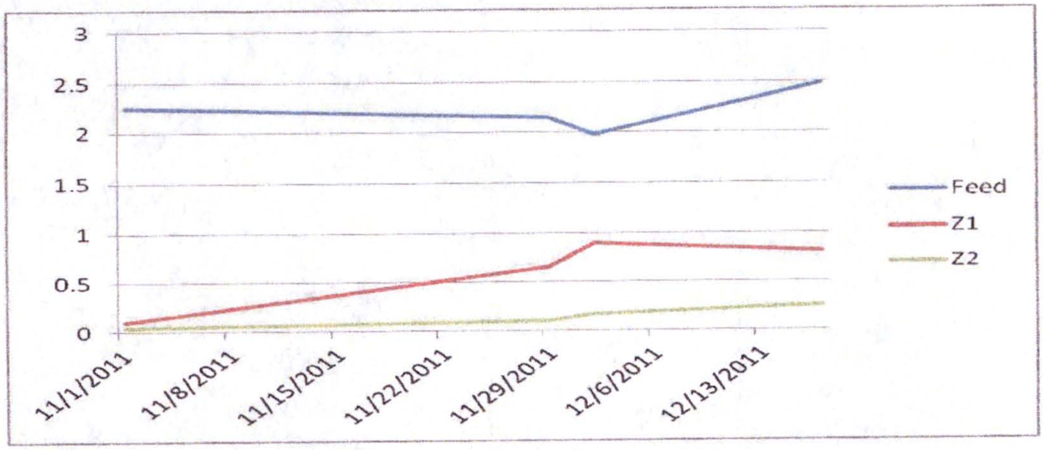
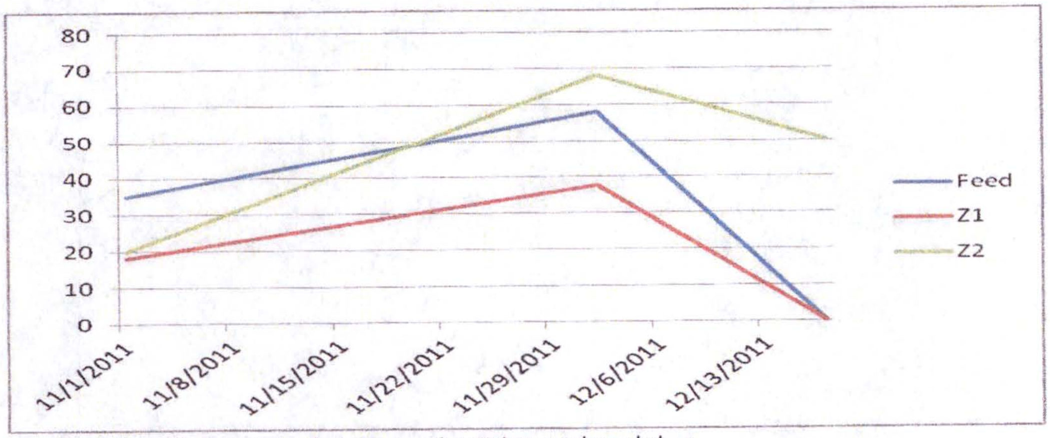


Figure 14 - Bicarbonate Concentrations in mg/L For The Period 11/1 Through 12/13.



Note: Bicarbonate levels drop when the pH drops as shown below.

Figure 15 - pH Values For The Period 11/1 Through 12/13.

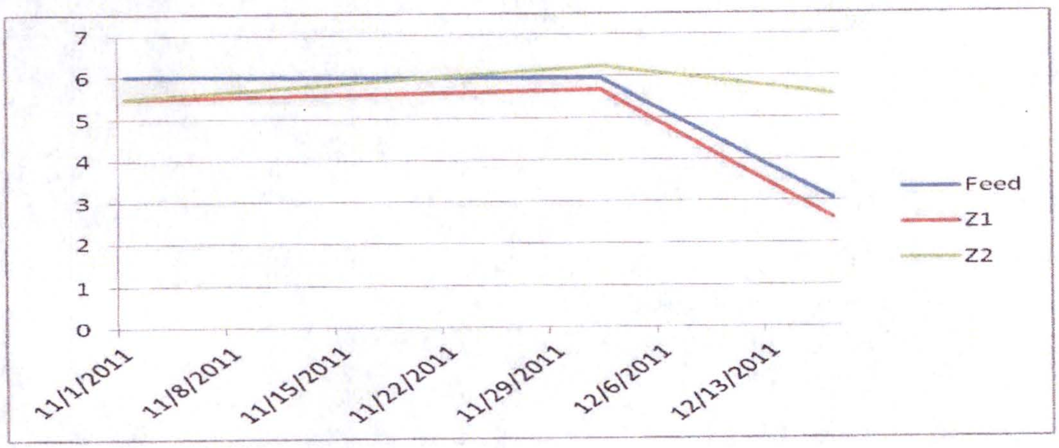


EXHIBIT B.1.2
300 gpm Zeolite System Design Drawings

HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM

DESIGNED BY:

RIMCON
&
HYDRO-ENGINEERING, LLC

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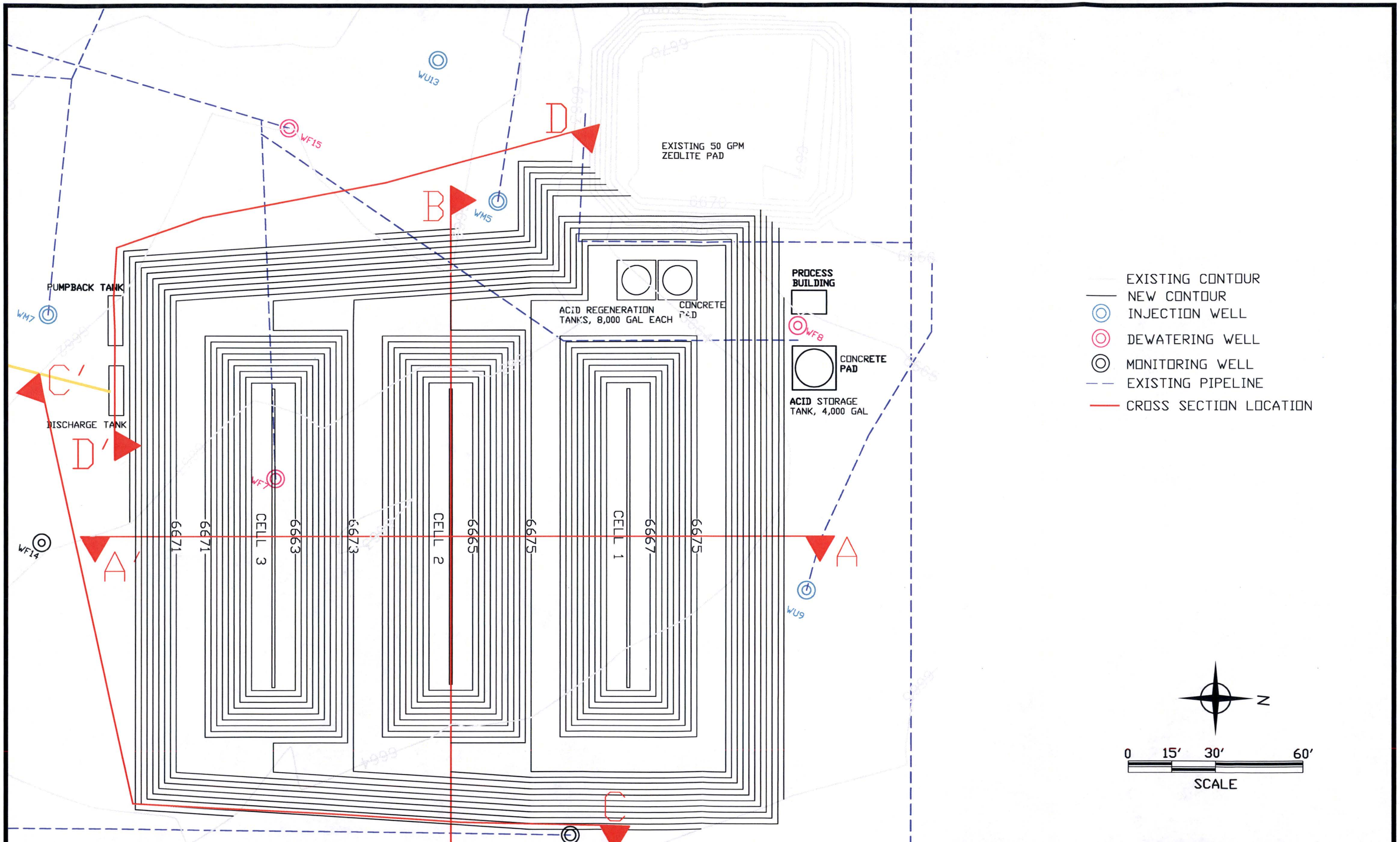
7-2012	ADA		

HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM

TITLE SHEET

SHEET 1



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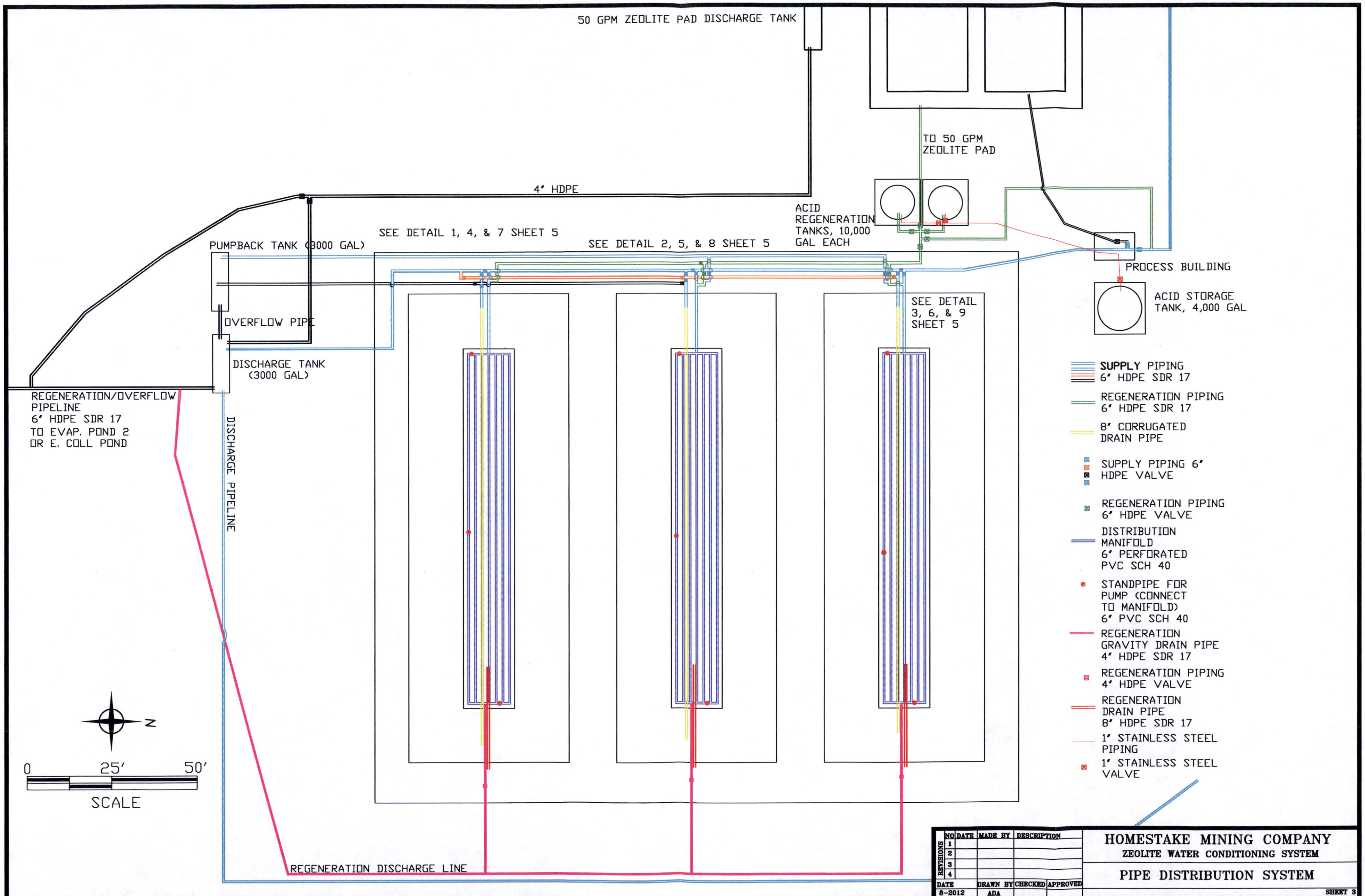
HOMESTAKE MINING COMPANY

ZEOLITE WATER CONDITIONING SYSTEM

NEW AND EXISTING CONTOURS

SHEET 2



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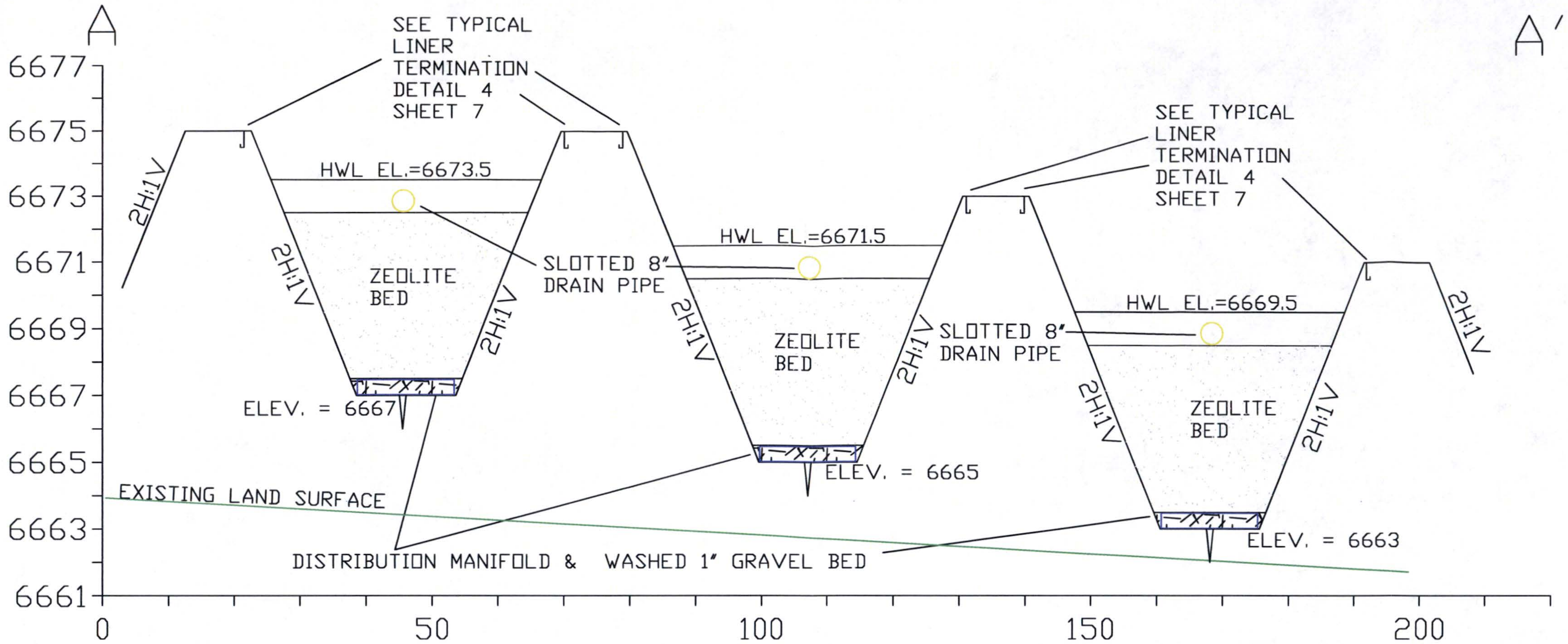
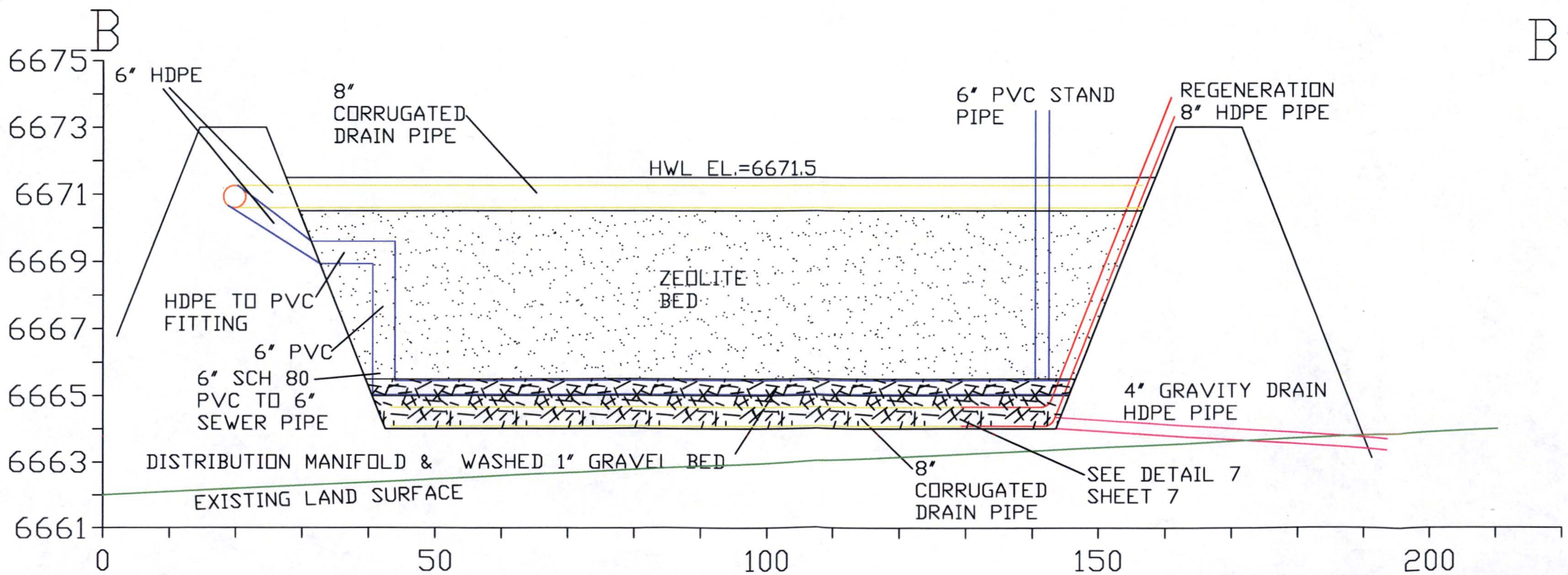
HOMESTAKE MINING COMPANY

ZEOLITE WATER CONDITIONING SYSTEM

PIPE DISTRIBUTION SYSTEM

SHEET 3





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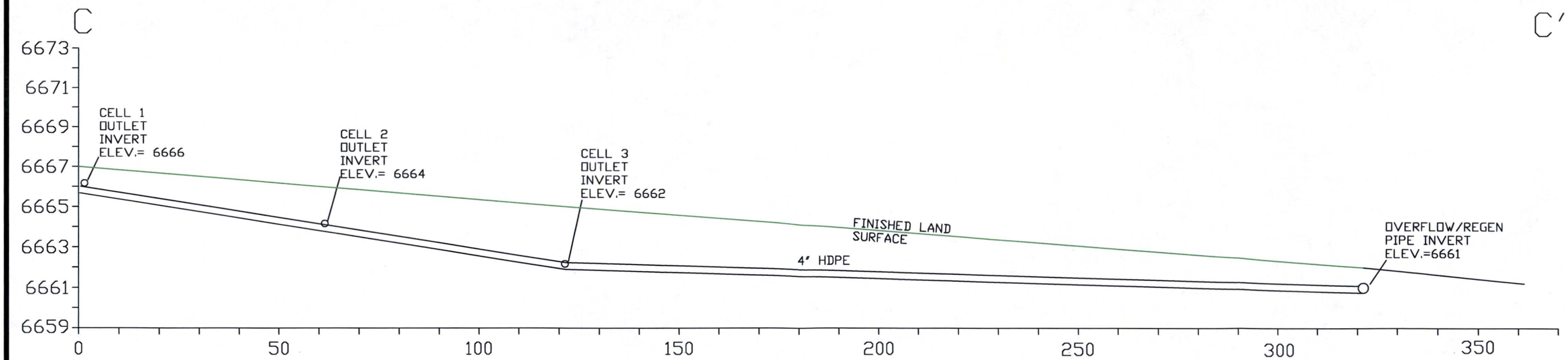
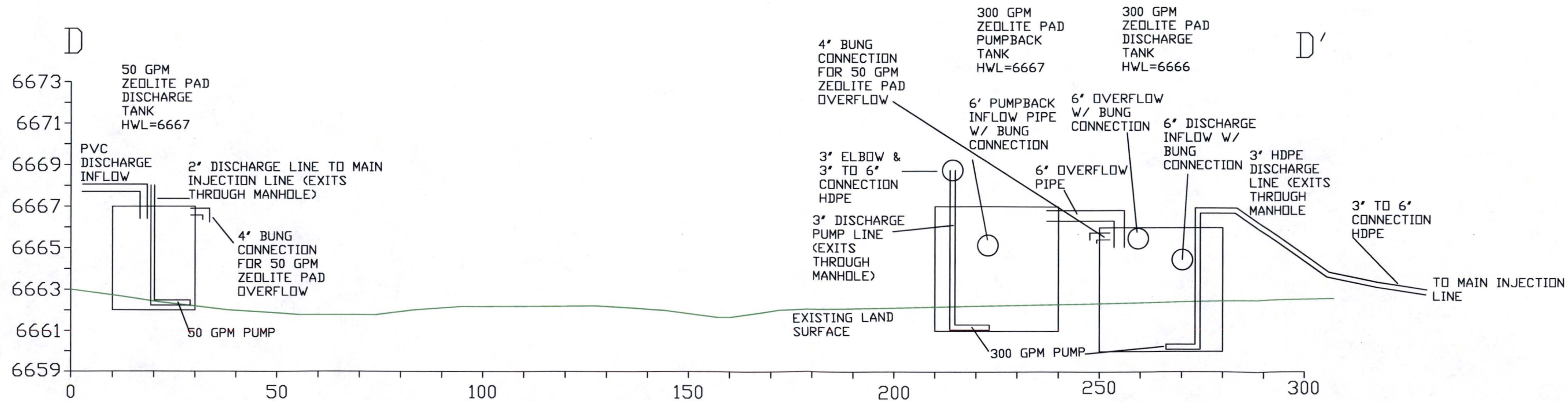
HOMESTAKE MINING COMPANY

ZEOLITE WATER CONDITIONING SYSTEM

PROFILES A-A' & B-B'

SHEET 4





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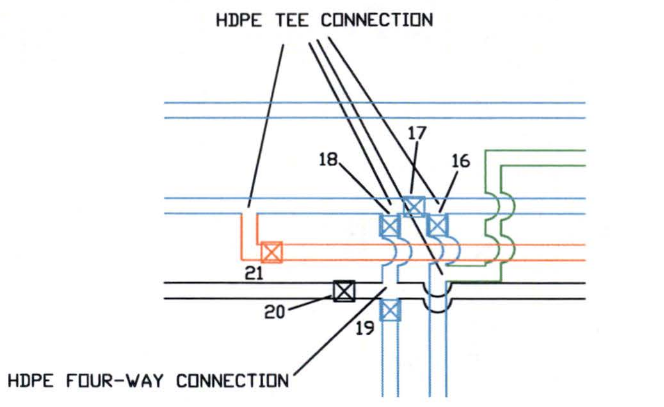
HOMESTAKE MINING COMPANY

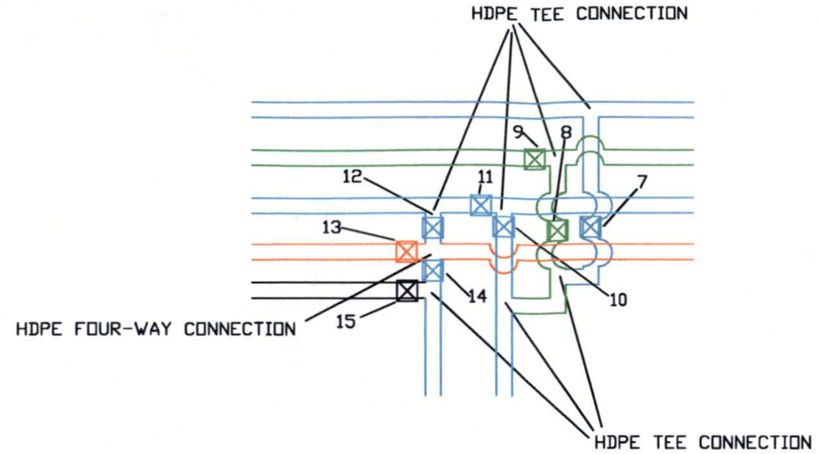
ZEOLITE WATER CONDITIONING SYSTEM

PROFILES C-C' & D-D'

SHEET 5



1 CELL 3 PIPING PLAN VIEW



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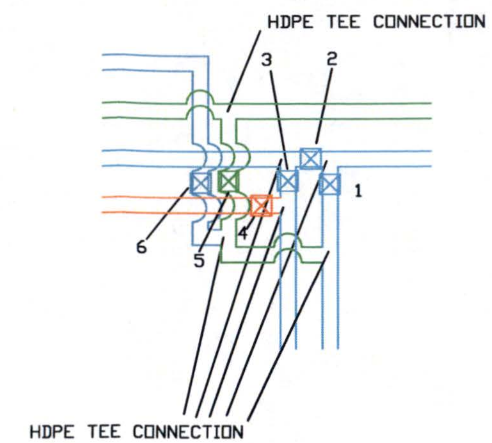

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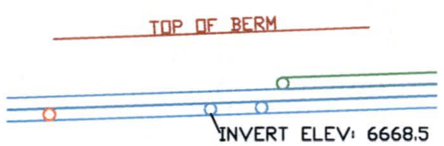

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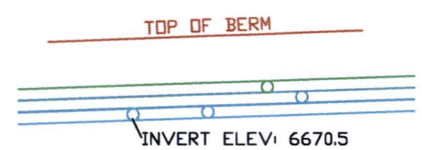

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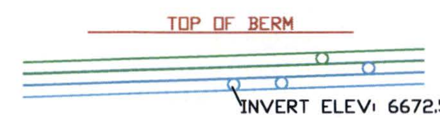

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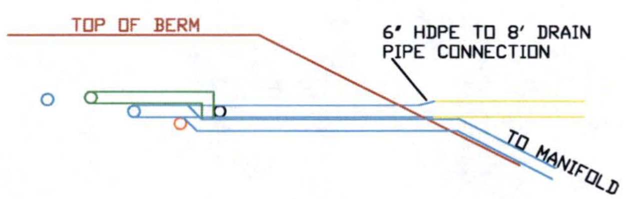
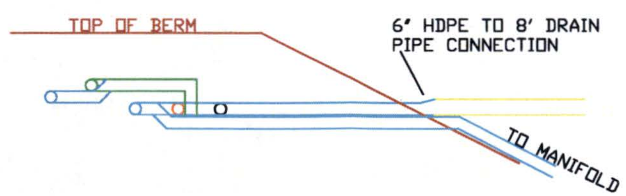
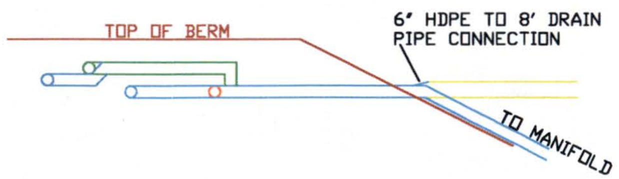


7 CELL 3 ACROSS BERM CROSS SECTION



8 CELL 2 ACROSS BERM CROSS SECTION



9 CELL 1 ACROSS BERM CROSS SECTION

NOTE: PIPING ALONG BERM SHOWN IN ORANGE AND BLACK SHOULD BE INSTALLED AT SAME ELEVATION AND SLOPE AS PIPING SHOWN IN CYAN. ORANGE AND BLACK PIPING IS ONLY USED WHEN CELL 3 IS Z1.

0 4' 8' 16'

SCALE

REVISIONS NO	DATE	MADE BY	DESCRIPTION
1			
2			
3			
4			

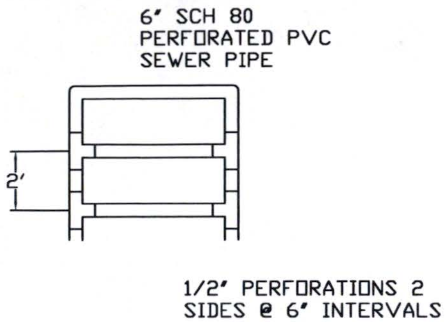
DATE	DRAWN BY	CHECKED	APPROVED
7-2012	ADA		

HOMESTAKE MINING COMPANY

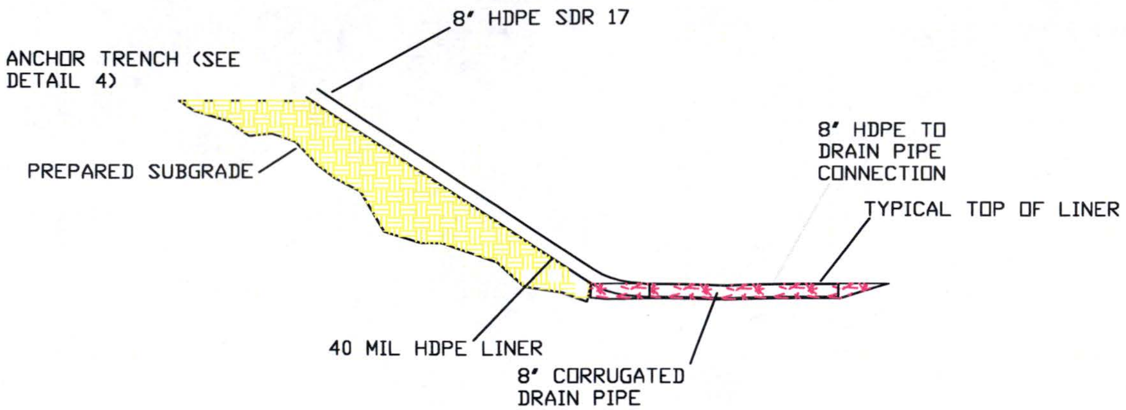
ZEOLITE WATER CONDITIONING SYSTEM

PIPING DETAILS

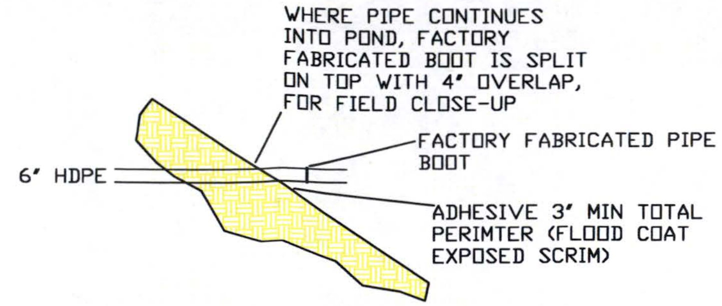
SHEET 6



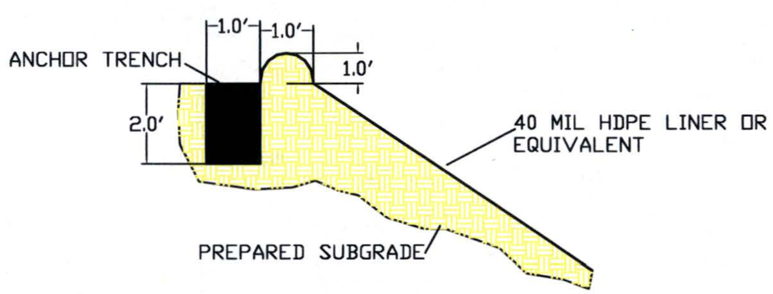
1 TYPICAL DISTRIBUTION MANIFOLD



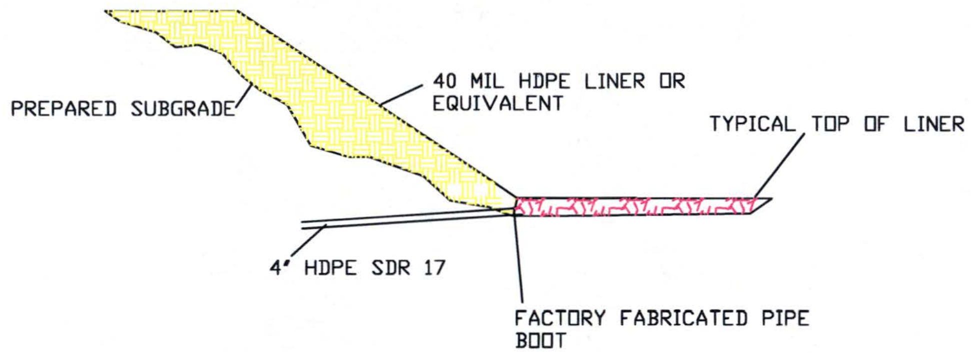
2 TYPICAL REGENERATION PUMP DRAIN PIPE



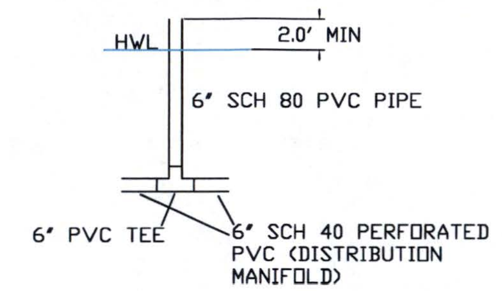
3 TYPICAL PIPE PENETRATION



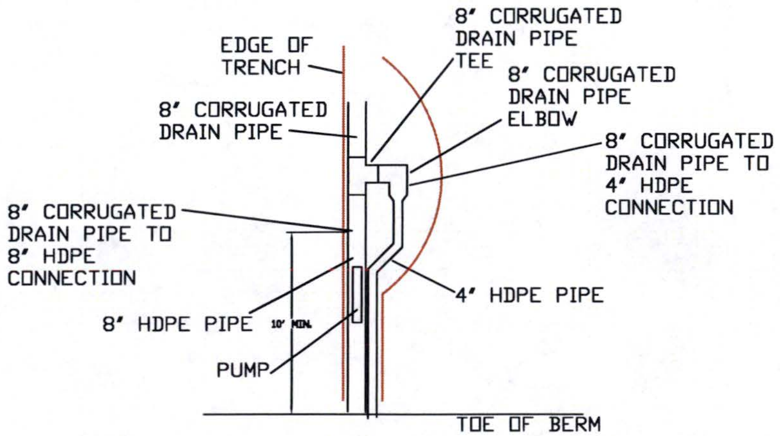
4 TYPICAL TERMINATION - UNCOVERED LINER

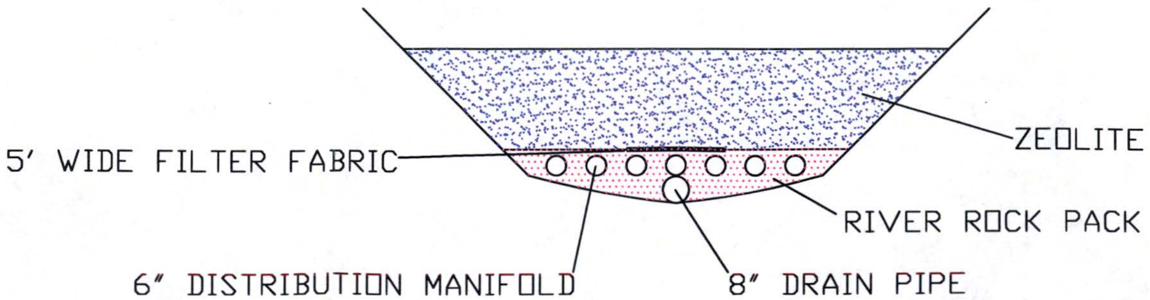


5 TYPICAL GRAVITY DRAIN



6 TYPICAL STAND PIPE ASSEMBLY





8 NORTH-SOUTH CROSS SECTION DETAIL

7 TYPICAL SUMP CONNECTIONS

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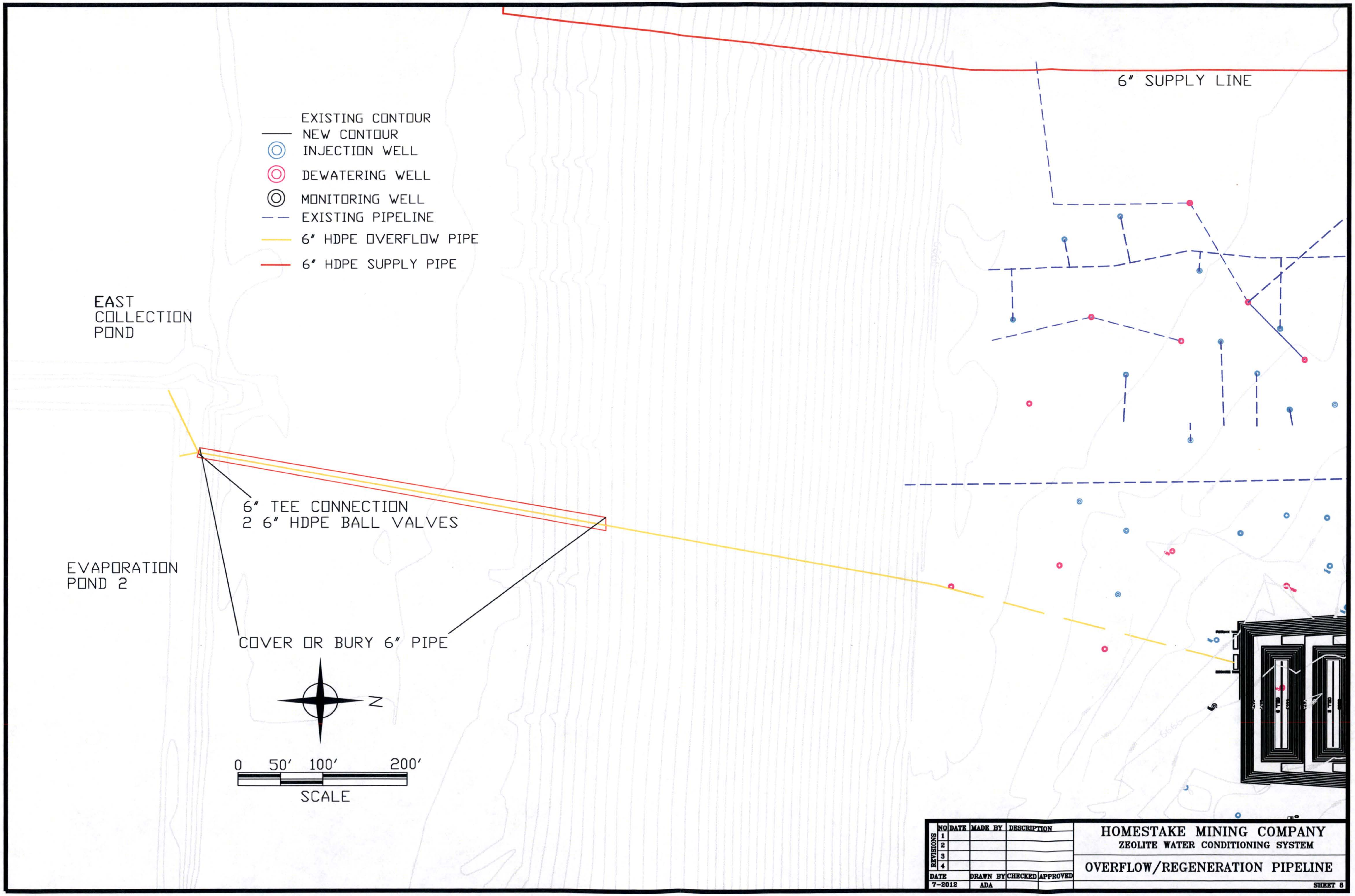
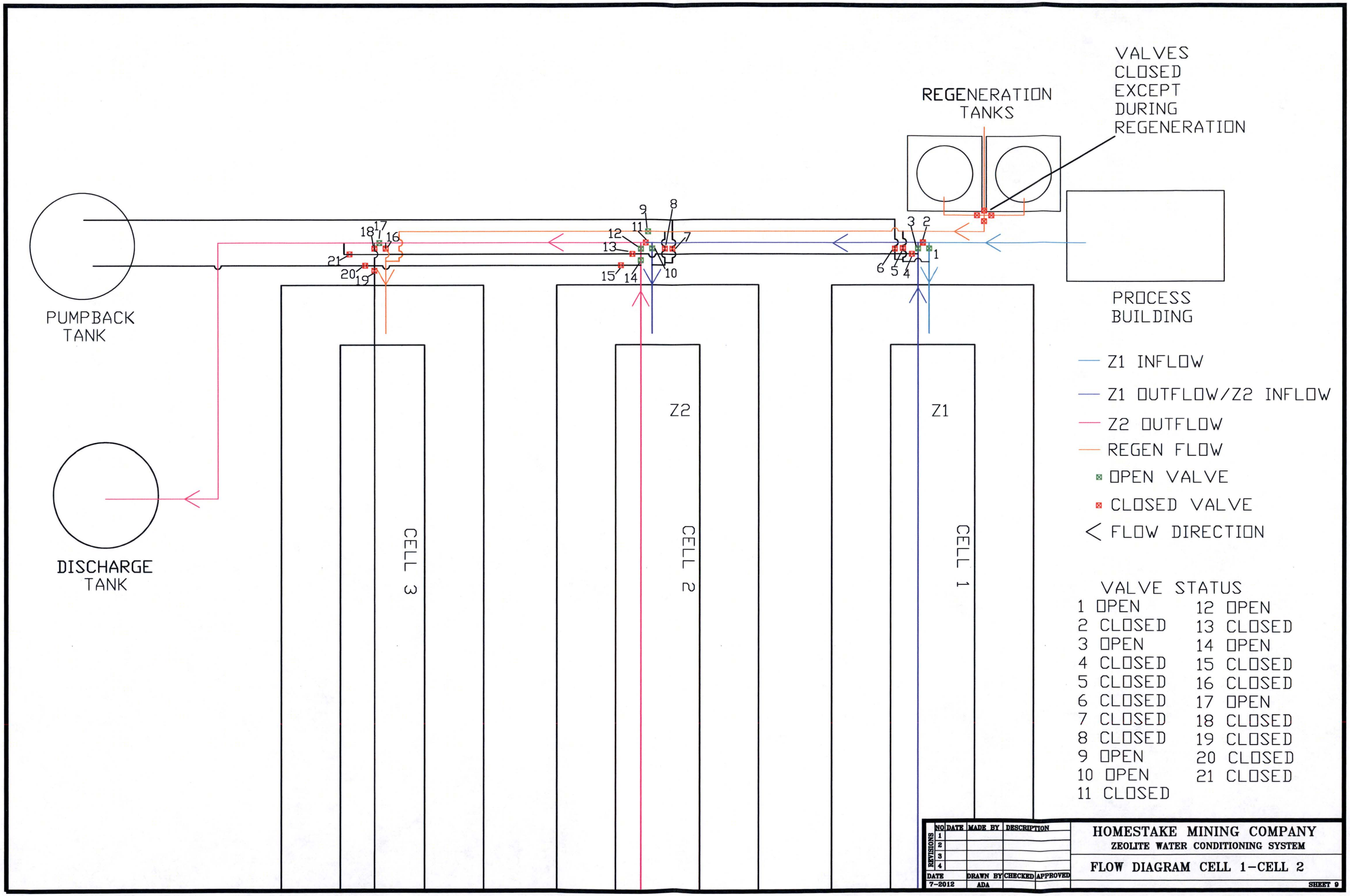
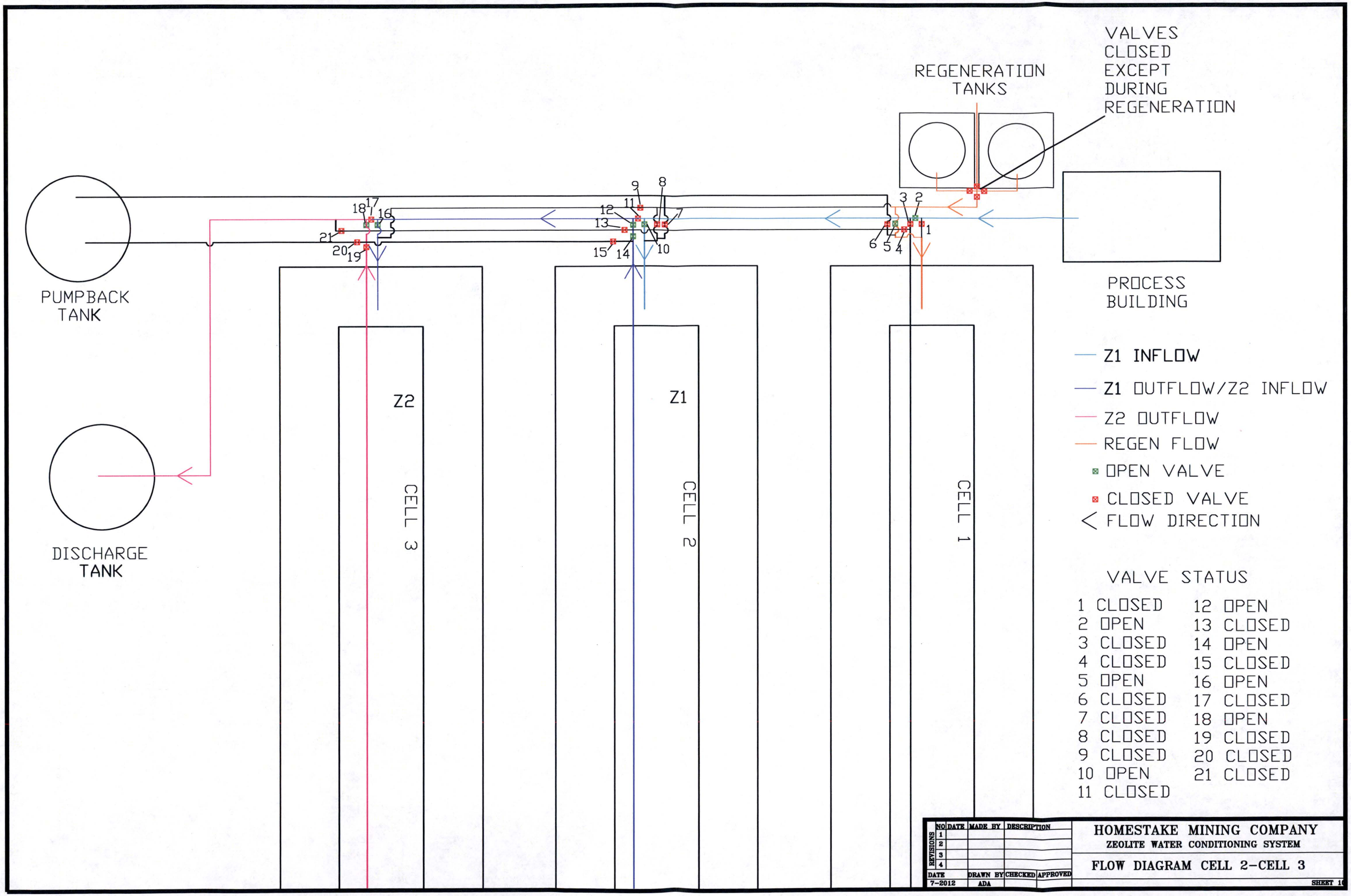
DATE	DRAWN BY	CHECKED	APPROVED
10-2012	ADA		

HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM
DETAILS

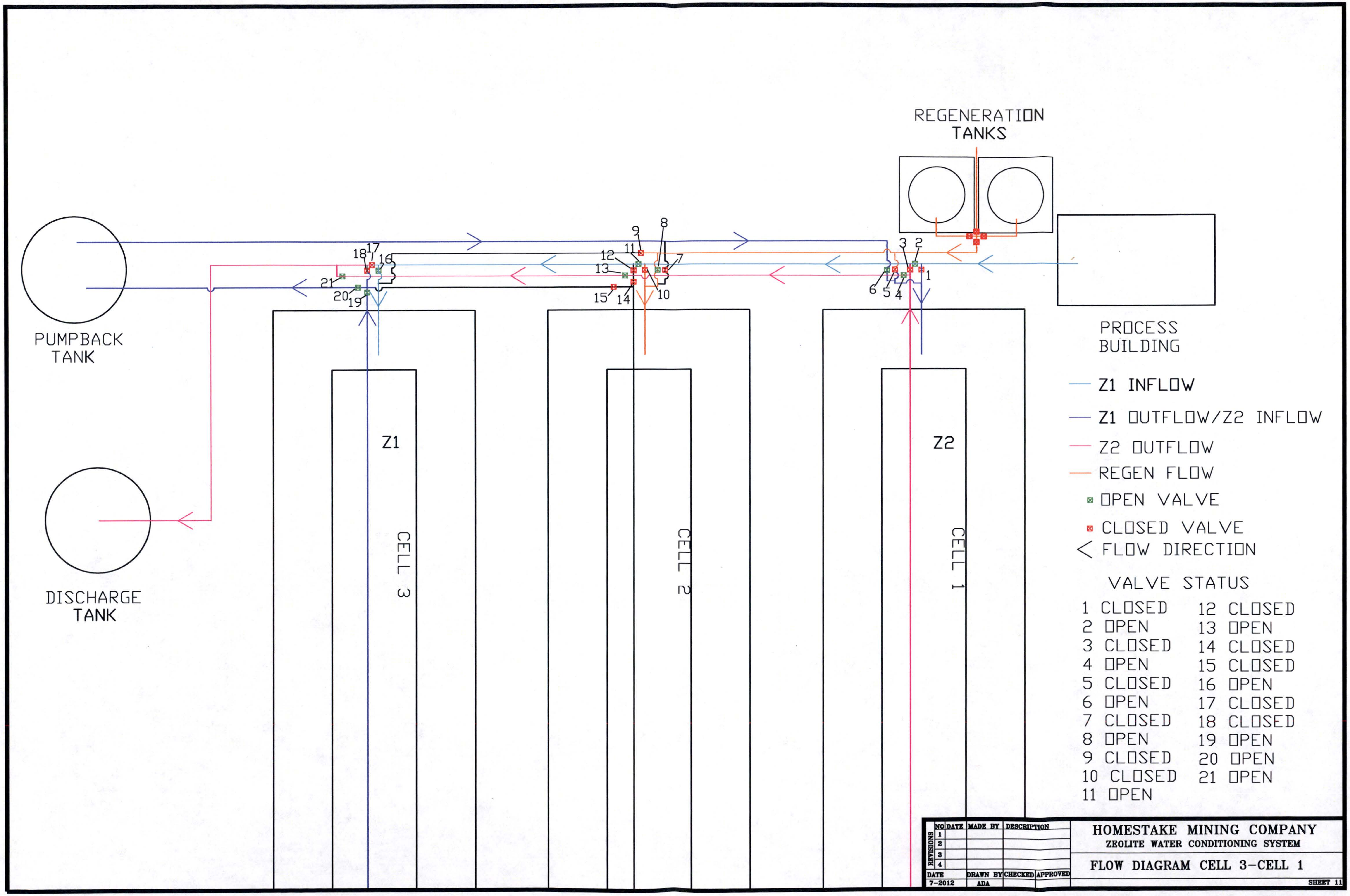
SHEET 7

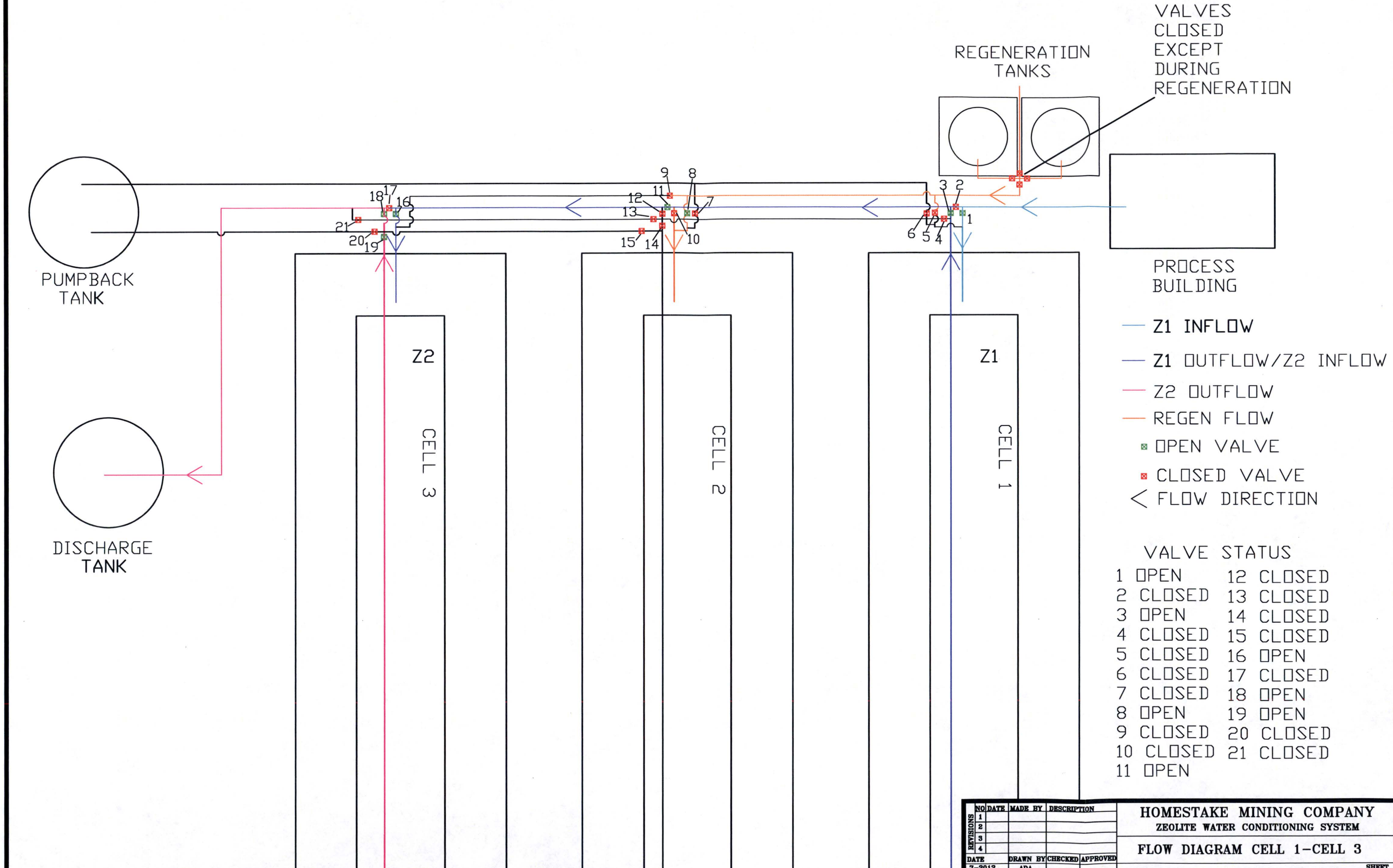

6" SUPPLY LINE
EXISTING CONTOUR
NEW CONTOUR
INJECTION WELL
DEWATERING WELL
MONITORING WELL
EXISTING PIPELINE
6" HDPE OVERFLOW PIPE
6" HDPE SUPPLY PIPE
EAST COLLECTION POND
6" TEE CONNECTION
2 6" HDPE BALL VALVES
EVAPORATION POND 2
COVER OR BURY 6" PIPE
N
0 50' 100' 200'
SCALE
REVISIONS
NO DATE MADE BY DESCRIPTION
1
2
3
4
DATE 7-2012
DRAWN BY ADA
CHECKED
APPROVED
HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM
OVERFLOW/REGENERATION PIPELINE
SHEET 8


VALVES CLOSED EXCEPT DURING REGENERATION
REGENERATION TANKS
PUMPBACK TANK
DISCHARGE TANK
PROCESS BUILDING
Z2
Z1
CELL 3
CELL 2
CELL 1
Z1 INFLOW
Z1 OUTFLOW/Z2 INFLOW
Z2 OUTFLOW
REGEN FLOW
OPEN VALVE
CLOSED VALVE
FLOW DIRECTION
VALVE STATUS
1 OPEN
2 CLOSED
3 OPEN
4 CLOSED
5 CLOSED
6 CLOSED
7 CLOSED
8 CLOSED
9 OPEN
10 OPEN
11 CLOSED
12 OPEN
13 CLOSED
14 OPEN
15 CLOSED
16 CLOSED
17 OPEN
18 CLOSED
19 CLOSED
20 CLOSED
21 CLOSED
HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM
FLOW DIAGRAM CELL 1-CELL 2
REVISIONS NO DATE MADE BY DESCRIPTION
DATE 7-2012 DRAWN BY ADA CHECKED APPROVED
SHEET 9



REGENERATION TANKS
VALVES CLOSED EXCEPT DURING REGENERATION
PUMPBACK TANK
DISCHARGE TANK
PROCESS BUILDING
Z2
Z1
CELL 3
CELL 2
CELL 1
Z1 INFLOW
Z1 OUTFLOW/Z2 INFLOW
Z2 OUTFLOW
REGEN FLOW
OPEN VALVE
CLOSED VALVE
< FLOW DIRECTION
VALVE STATUS
1 CLOSED
2 OPEN
3 CLOSED
4 CLOSED
5 OPEN
6 CLOSED
7 CLOSED
8 CLOSED
9 CLOSED
10 OPEN
11 CLOSED
12 OPEN
13 CLOSED
14 OPEN
15 CLOSED
16 OPEN
17 CLOSED
18 OPEN
19 CLOSED
20 CLOSED
21 CLOSED
HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM
FLOW DIAGRAM CELL 2-CELL 3
REVISIONS
NO DATE MADE BY DESCRIPTION
1
2
3
4
DATE 7-2012
DRAWN BY ADA
CHECKED
APPROVED
SHEET 1


REGENERATION TANKS
PUMPBACK TANK
DISCHARGE TANK
PROCESS BUILDING
Z1
Z2
CELL 3
CELL 2
CELL 1
Z1 INFLOW
Z1 OUTFLOW/Z2 INFLOW
Z2 OUTFLOW
REGEN FLOW
OPEN VALVE
CLOSED VALVE
FLOW DIRECTION
VALVE STATUS
1 CLOSED
2 OPEN
3 CLOSED
4 OPEN
5 CLOSED
6 OPEN
7 CLOSED
8 OPEN
9 CLOSED
10 CLOSED
11 OPEN
12 CLOSED
13 OPEN
14 CLOSED
15 CLOSED
16 OPEN
17 CLOSED
18 CLOSED
19 OPEN
20 OPEN
21 OPEN
HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM
FLOW DIAGRAM CELL 3-CELL 1
REVISIONS NO DATE MADE BY DESCRIPTION
DATE 7-2012
DRAWN BY ADA
CHECKED
APPROVED
SHEET 11



VALVE STATUS

1	OPEN	12	CLOSED
2	CLOSED	13	CLOSED
3	OPEN	14	CLOSED
4	CLOSED	15	CLOSED
5	CLOSED	16	OPEN
6	CLOSED	17	CLOSED
7	CLOSED	18	OPEN
8	OPEN	19	OPEN
9	CLOSED	20	CLOSED
10	CLOSED	21	CLOSED
11	OPEN		

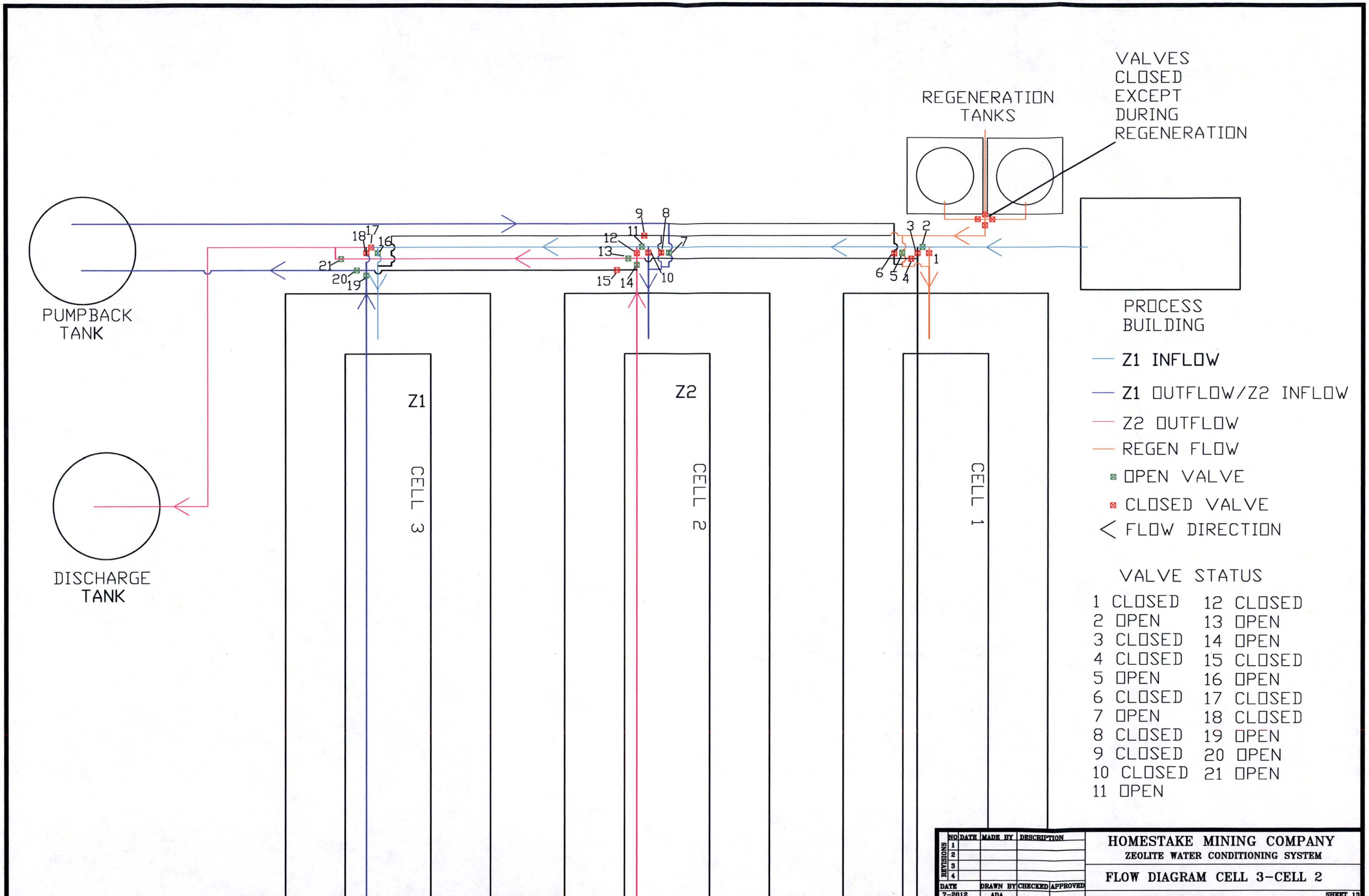
REVISIONS NO	DATE	MADE BY	DESCRIPTION
1			
2			
3			
4			

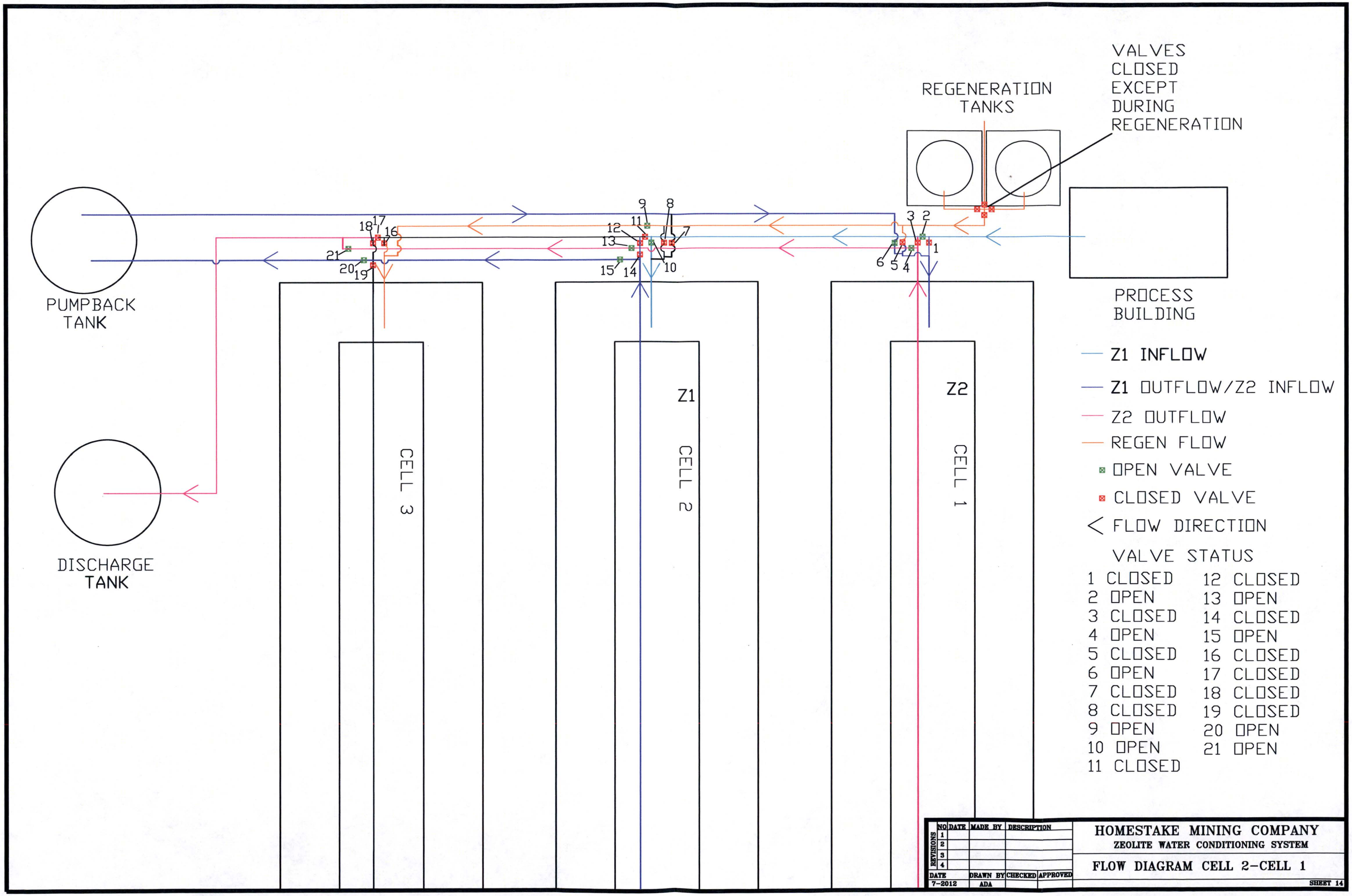
DATE	DRAWN BY	CHECKED	APPROVED
7-2012	ADA		

HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM

FLOW DIAGRAM CELL 1-CELL 3

SHEET 12


VALVES
CLOSED
EXCEPT
DURING
REGENERATION
REGENERATION
TANKS
PUMPBACK
TANK
DISCHARGE
TANK
PROCESS
BUILDING
Z1
Z2
CELL 3
CELL 2
CELL 1
Z1 INFLOW
Z1 OUTFLOW/Z2 INFLOW
Z2 OUTFLOW
REGEN FLOW
OPEN VALVE
CLOSED VALVE
FLOW DIRECTION
VALVE STATUS
1 CLOSED
2 OPEN
3 CLOSED
4 CLOSED
5 OPEN
6 CLOSED
7 OPEN
8 CLOSED
9 CLOSED
10 CLOSED
11 OPEN
12 CLOSED
13 OPEN
14 OPEN
15 CLOSED
16 OPEN
17 CLOSED
18 CLOSED
19 OPEN
20 OPEN
21 OPEN
REVISIONS
NO DATE MADE BY DESCRIPTION
1
2
3
4
DATE
7-2012
DRAWN BY
ADA
CHECKED
APPROVED
HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM
FLOW DIAGRAM CELL 3-CELL 2
SHEET 13



VALVES CLOSED EXCEPT DURING REGENERATION
REGENERATION TANKS
PUMPBACK TANK
DISCHARGE TANK
PROCESS BUILDING
CELL 3
CELL 2
CELL 1
Z1
Z2
Z1 INFLOW
Z1 OUTFLOW/Z2 INFLOW
Z2 OUTFLOW
REGEN FLOW
OPEN VALVE
CLOSED VALVE
FLOW DIRECTION
VALVE STATUS
1 CLOSED
2 OPEN
3 CLOSED
4 OPEN
5 CLOSED
6 OPEN
7 CLOSED
8 CLOSED
9 OPEN
10 OPEN
11 CLOSED
12 CLOSED
13 OPEN
14 CLOSED
15 OPEN
16 CLOSED
17 CLOSED
18 CLOSED
19 CLOSED
20 OPEN
21 OPEN
REVISIONS
NO DATE MADE BY DESCRIPTION
1
2
3
4
DATE 7-2012
DRAWN BY ADA
CHECKED
APPROVED
HOMESTAKE MINING COMPANY
ZEOLITE WATER CONDITIONING SYSTEM
FLOW DIAGRAM CELL 2-CELL 1
SHEET 14

EXHIBIT B.1.3
Photographs of 300 gpm Zeolite System


Morgan
CONTROL ROOM
NO SMOKING
OR OPEN FLAMES
RESTRICTED AREA
UNAUTHORIZED PERSONS KEEP OUT
SAFETY FIRST
SAFETY GLASSES REQUIRED IN THIS AREA


Morgan
CONTROL ROOM
NO SMOKING OR OPEN FLAMES
RESTRICTED AREA
UNAUTHORIZED PERSONS KEEP OUT
SAFETY FIRST
SAFETY GLASSES REQUIRED IN THIS AREA

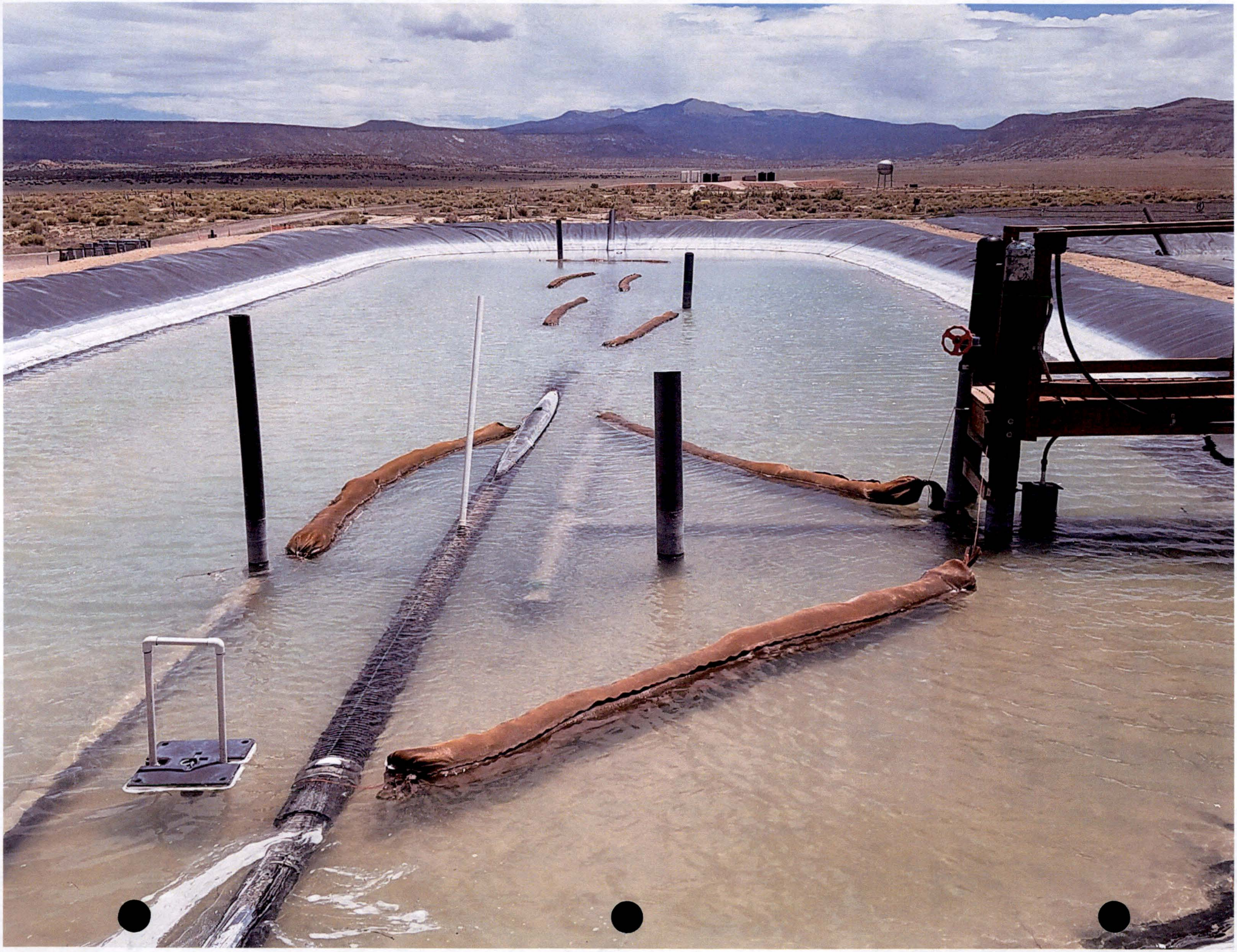


EXHIBIT B.1.4
Procedure for Operating the 300 gpm Zeolite System

Procedure for Operating the 300 gpm Zeolite System

Objective

This procedure outlines all the requirements all Homestake staff and crew and contracted personnel must follow in order to properly start, operate, or shut down the 300 gpm Zeolite System.

Scope

This policy applies to all Homestake staff and crewmembers. These Zeolite procedures **MUST** be obeyed every time the following activities are being engaged: installing, adjusting, repairing, servicing, cleaning, testing, inspecting, or upgrading machinery or equipment.

Location of Zeolite System, Cells, Valves and Pumps

The 300 gpm Zeolite is located on the top of the Large Tailing Pile (LTP). There are three cells in the Zeolite System. The cell that is farthest to the north is Cell 1. The middle cell is Cell 2. The cell that is farthest to the south is Cell 3. All cells have their own set of control valves. All cell control valves are located west of each cell. Cell 1 has control valves 1-6. Cell 2 has control valves 7-15. Cell 3 has control valves 16-21. All cells have a discharge valve that drains water into Evaporation Pond No. 2 (EP2). The discharge valves are located on the eastside of each cell. The discharge pump is located at the bottom of the Zeolite System south of Cell 3. The South Collection Valve (A) and the Zeolite Feed Valves (B, C) are approximately 1000 feet west of the 300 gpm Zeolite System. All valves are labeled. The Control Room is located north of the Zeolite System. The Acid Pump is located in the Control Room. Acid Valves #2 and #3 are in the Control Room. Acid Valve #1 is located at the bottom of the 4000 gal acid tank on the west side.

Starting the System

1. Perform an FLRA and fill out *Valve Line-Up* Forms as appropriate.
2. **INSPECT** all valves on top Zeolite cells 1, 2, and 3, to make sure they are in the correct position. Refer to *Operating Zeolite Cells*.
3. **INSPECT** all drain valves to cells 1, 2, and 3 to make sure they are in the **CLOSED** position.
4. Perform and document a Valve Line-Up to start South Collection Wells.
5. **OPEN** Zeolite Feed Valves marked B and C. Refer to *Location of Zeolite, Cells, Valves and Pumps.*
6. **CLOSE** South Collection Valve marked A. Refer to *Location of Zeolite, Cells, Valves and Pumps.*
7. **CLOSE** Acid Valve marked #3. Document this on *Valve Line-Up* Form. Refer to *Location of Zeolite, Cells, Valves and Pumps.*
8. **OPEN** Acid Valves marked #1 and #2. Document this on *Valve Line-Up* Form. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

9. **START** Acid Pump. Document this on *Valve Line-Up* Form. Refer to *Location of Zeolite, Cells, Valves and Pumps.*

10. **ADJUST** Acid flow such that pH is between 4.5 and 5.0. Refer to *Starting and Stopping Acid Pump.*

11. **INSPECT** Product Pump to make sure it is operating.

Operating Zeolite Cells

Follow these steps for operating Zeolite cells 1, 2, and 3. Fill out *Valve Line-Up* Form. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

1. **LOCATE Zeolite Cell 1**
2. **OPEN** valve #1
3. **CLOSE** valve #2
4. **OPEN** valve #3
5. **LOCATE Zeolite Cell 2**
6. **OPEN** valve #10
7. **CLOSE** valve #11
8. **OPEN** valve #12
9. **LOCATE Zeolite Cell 3**
10. **OPEN** valve #16
11. **CLOSE** valve #17
12. **OPEN** valve #18

Follow these steps for operating Zeolite cells 1 and 2. Fill out *Valve Line-Up* Form. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

1. **LOCATE Zeolite Cell 1**
2. **OPEN** valve #1
3. **CLOSE** valve #2
4. **OPEN** valve #3
5. **LOCATE Zeolite Cell 2**
6. **OPEN** valve #10

7. **CLOSE** valve #11
8. **OPEN** valve #12
9. **LOCATE Zeolite Cell 3**
10. **CLOSE** valve #16
11. **OPEN** valve #17
12. **CLOSE** valve #18

Follow these steps for operating Zeolite cells 1 and 3. Fill out *Valve Line-Up Form.* Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

1. **LOCATE Zeolite Cell 1**
2. **OPEN** valve #1
3. **CLOSE** valve #2
4. **OPEN** valve #3
5. **Locate Zeolite Cell 2**
6. **CLOSE** valve #10
7. **OPEN** valve #11
8. **CLOSE** valve #12
9. **LOCATE Zeolite Cell 3**
10. **OPEN** valve #16
11. **CLOSE** valve #17
12. **OPEN** valve #18

Follow these steps for operating Zeolite cells 2 and 3. Fill out *Valve Line-Up form.* Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

1. **LOCATE Zeolite Cell 1**
2. **CLOSE** valve #1
3. **OPEN** valve #2
4. **CLOSE** valve #3
5. **LOCATE Zeolite Cell 2**

6. **OPEN** valve #10
7. **CLOSE** valve #11
8. **OPEN** valve #12
9. **LOCATE Zeolite Cell 3**
10. **OPEN** valve #16
11. **CLOSE** valve #17
12. **OPEN** valve #18

Starting and Stopping Acid Pump

Follow these steps for starting and stopping the Acid Pump for the 300 gpm Zeolite System.

Starting

1. Perform an FLRA and fill out *Valve Line-Up* Forms.
2. Verify Acid Valves #1 and #2 are **OPEN** and Acid Valve #3 is **CLOSED**. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*
3. Verify Acid Pump is plugged in.
4. Hold down the "mode" button until the word "speed" starts blinking next to the "1" in the top left corner.
5. Release "mode" button.
6. Use the buttons with the arrows up and down (↑ ↓) to adjust the rate.
7. Hold down the "mode" button until the word 'speed' disappears.
8. Release "mode" button.
9. If the screen changes when you release the "mode" button, and there is a "2" in the top left corner, press the "mode" button repeatedly until there is a "1" in the top left corner.
10. Press the "start" button.

Stopping

1. Perform an FLRA and fill out *Valve Line-Up* Forms.
2. Press the "stop" button or unplug Acid Pump.
3. Close Acid Valve #1, Refer to *Location of Zeolite System, Cells, Valves, and Pumps.*

Securing the System

Follow these steps to secure the system or in case of an emergency:

1. Follow SWIMS procedure.
2. Report to Supervisor.
3. **STOP** Acid Pump. Refer to *Starting and Stopping Acid Pump.*
4. **CLOSE** Acid Valve #1. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*
5. **OPEN** South Collection Valve A. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*
6. **CLOSE** Zeolite Feed Valve B. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

Procedure for Conducting a Safety and Environmental Review Panel (SERP)

[Potentially Applicable Regulatory Basis or Bases: SUA-1471, Conditions 14, 16, 21, 22, 23, 24, 28, 32, and 43].
[Potentially Applicable Regulatory Guidance: 10 CFR Part 20, 10 CFR Part 40, and 10 CFR 50.59]
[Special Guidance: The Updated and Revised Corrective Action Program (CAP) submitted to NRC in March 2012].

Introduction and Purpose

Introduction

The purpose of this procedure is to ensure that environmental, health, and safety risks are properly considered in reviewing a proposed change. Guidance for the proper manner in which to conduct SERPs can be drawn from Chapter 10 of the Code of Federal Regulations (CFR) 50.59, as well as 10 CFR Parts 20 and 40.

The regulatory basis for conducting SERPs can most directly be traced to SUA-1471 (Homestake's NRC-issued RML), Conditions 16 and 43.

One of the reasons HMC may be compelled to pursue an activity not previously assessed, is to more broadly satisfy a provision of its RML. Of special and particular concern is License Condition 35C, which charges HMC with implementing a Corrective Action Program (CAP). In December of 2006, HMC submitted to NRC a revised CAP, which was itself subsequently updated and revised in March 2012. Neither of these CAP revisions has been approved as of the date of this procedure.

Consequently, until the NRC officially approves the Updated and Revised 2012 CAP, a SERP may not directly base any safety or environmental approvals on this document. However, due to the fact that HMC has pursued several corrective actions under the auspices of the Revised 2006

300gpm Zeolite Water Treatment System Training

(Monitoring and Controlling pH)

Written by

Kyle Martinez

Prepared for

Homestake Crew

Date

14 June 2016

INTRODUCTION

The 300gpm Zeolite System is a Water Treatment System that requires inspection and maintenance on a daily basis. This maintenance includes fixing and monitoring for leaks, adjusting water flow, and adjusting acid flow which then controls pH.

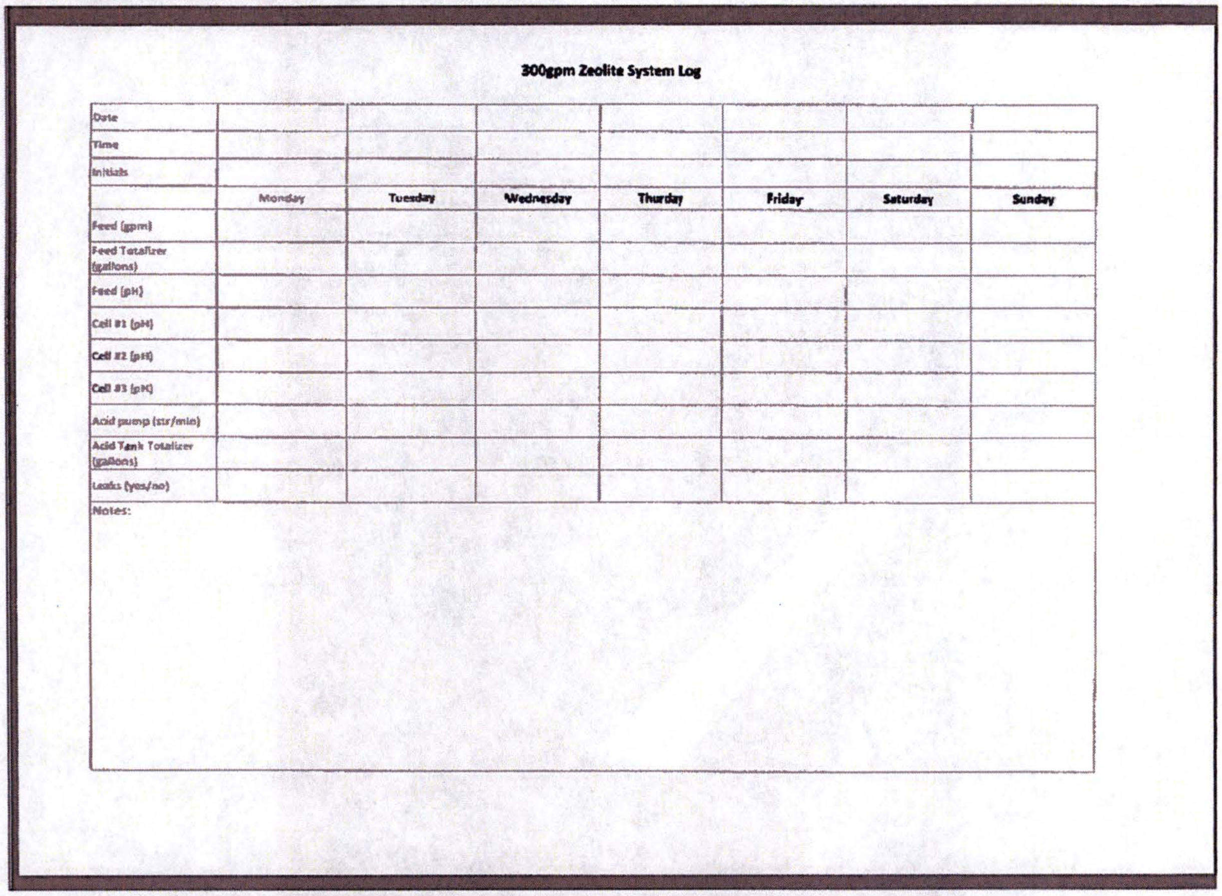
Every Homestake crew member is responsible for recording the data rounds and inspecting the system for leaks or any other maintenance issues during his weekend on the water watch schedule.

In order to get the proper water treatment in the system sulfuric acid must be added to the water flow to bring down the pH to between 5.6 and 5.8. If the pH is above 5.8 no water treatment is taking place. If the pH is below 5.0, the sulfuric acid is stripping the uranium off of the zeolite.

This report will provide training so that every Homestake crew member is able to properly operate the 300gpm Zeolite System.

OPERATION

Every Monday a data log sheet will be printed out and placed in the Control Building for the 300gpm Zeolite System. Every Homestake crew member has access to this data sheet. To print the data sheet go to **Computer▶General▶RO Sheets▶300gpm zeolite log.** Figure 1 below shows a copy of the daily log sheet.



300gpm Zeolite System Log

Date							
Time							
Initials							
	Monday	Tuesday	Wednesday	Thurday	Friday	Saturday	Sunday
Feed (gpm)							
Feed Totalizer (gallons)							
Feed (pH)							
Cell #1 (pH)							
Cell #2 (pH)							
Cell #3 (pH)							
Acid pump (str/min)							
Acid Tank Totalizer (gallons)							
Leaks (yes/no)							

Notes:

Figure1. 300gpm Zeolite System Log Sheet

The first three rows of the data sheet include the Date, Time, and the Initials of the crew member that is preforming the inspection. The next row has every day of the week listed. The next two rows are the **Feed (gpm)** and the **Feed Totalizer (gallons).** To get these readings the meter is located in a box on the North side of the Control Building as shown in Figure 2.

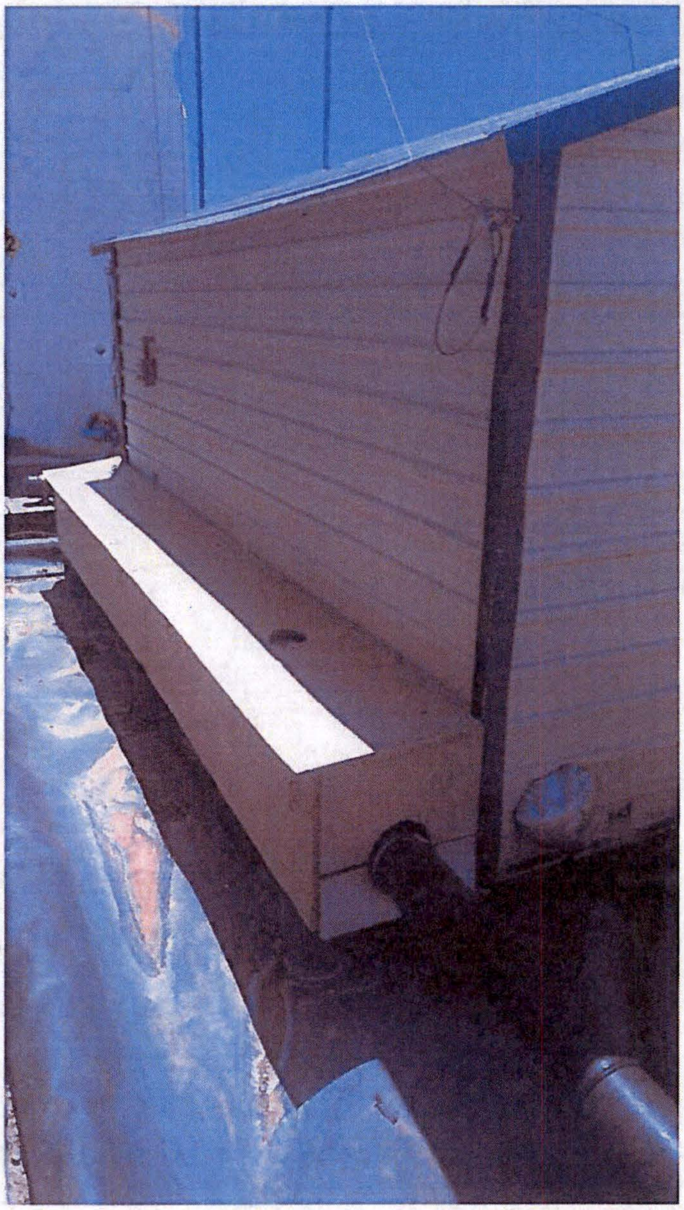
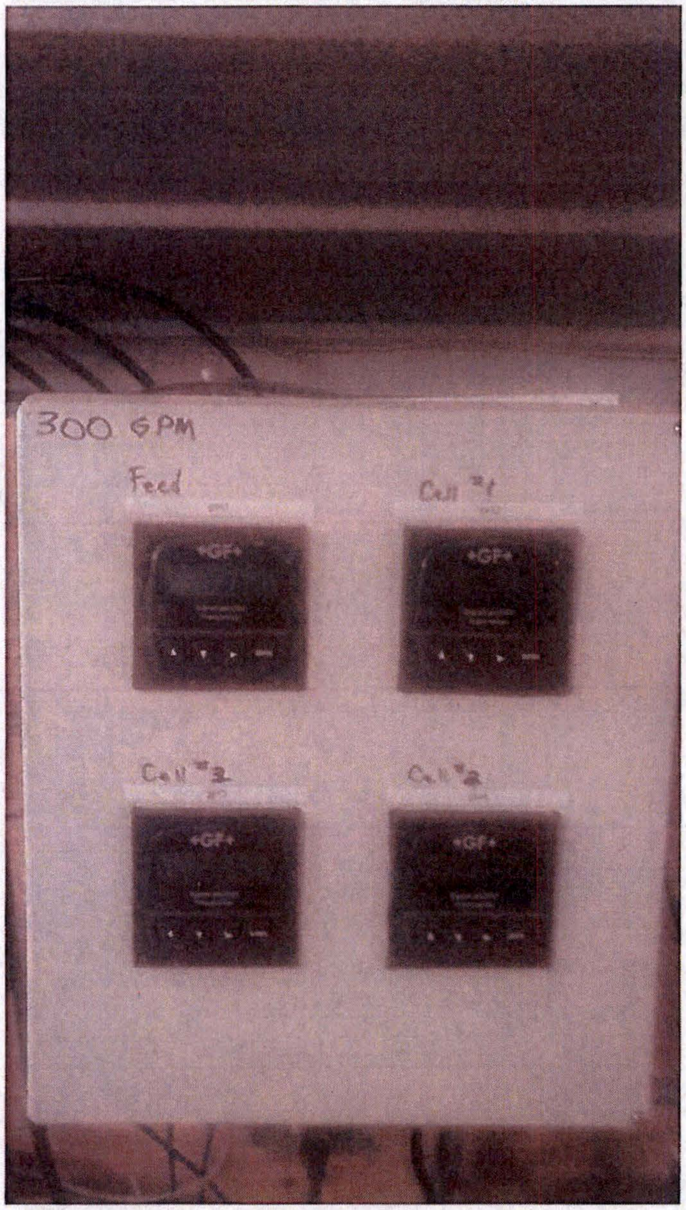


Figure 2. Meter Box

The flow meter in the box is shown below in Figure 3.

Figure 3. 300gpm Zeolite System Flow Meter

The next four rows in the data sheet in Figure 1 are the pH readings. These reading are displayed and labeled on a monitor inside the Control Room shown in Figure 4 below.



.Figure 4. pH Monitor Readings

However, if any of the display screens show a "Check Sensor" reading the pH reading must be taken manually. In order to take a manual pH, a grab sample must be taken from the feed line shown below in Figure 5.

Figure 5. Feed Line Sampling Location

A grab sample must be taken and tested with a handheld pH meter and the information must be recorded in the data sheet. A pH meter will be available in the Control Room at all times. Pour the water from the feed line into the pH meter and press the pH button on the meter. This displays the reading so you can adjust accordingly. A pH meter is shown below in Figure 6.

Figure 6. Handheld pH Meter

Remember, pH is very important in order to get good water treatment. The feed water pH needs to be between 5.6 and 5.8. If the pH is above 5.8 the acid pump inside the Control Room needs to be adjusted to a higher rate. If the pH is below 5.0 the acid pump needs to be reduced to a lower rate.

In front of the acid pump there are two arrows pointing up and down. To increase the acid rate press the "arrow up" and to decrease the acid rate press the "arrow down". In case of an emergency press the "stop" button or unplug the pump. The person on

water watch also needs to record the acid strokes on the **Acid Pump (str/min)** row in the data sheet. A picture of the acid pump is shown below in Figure 7.

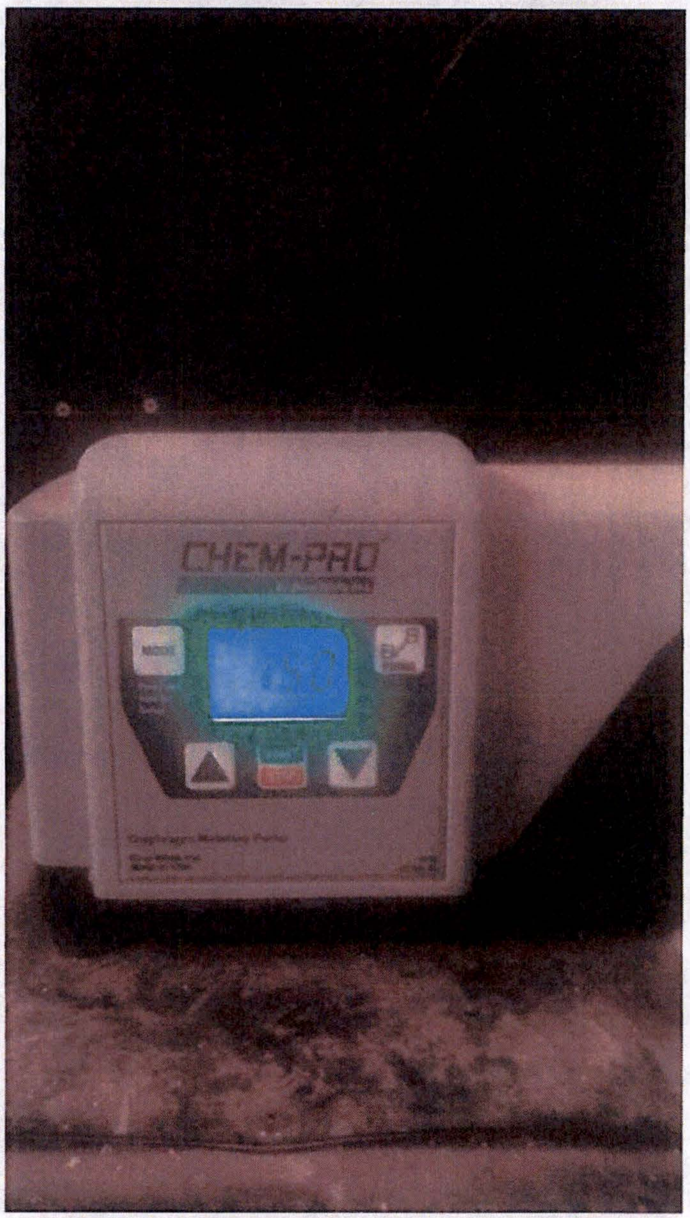


Figure 7. Acid Pump

The next row on the data sheet is recording the amount of gallons left in the acid tank. The meter for the acid tank is located on the North side of the acid tank shown in Figure 8 below.

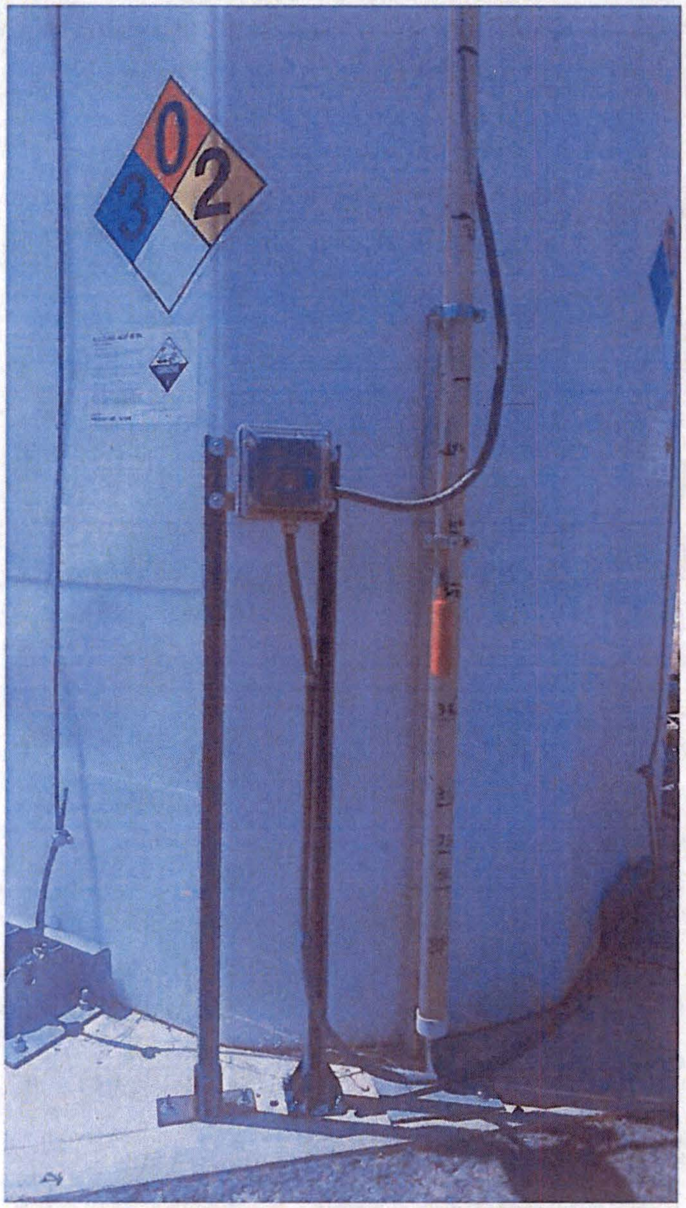


Figure 8. Acid Meter on Acid Tank

The last items to record on the data sheet are checking the system for any leaks and writing any notes you might have. This could include changing a rate on the acid pump or fixing a leak on the system. Recording the data every day is very important because it helps us determine how much acid we are using and it lets us know if we're putting the right amount of acid into the system. Report any issues with the system to your supervisor immediately.

Standard Operating Procedure (SOP) for Burping Cells for 300gpm Zeolite System

1. Verify if the Zeolite cells are overflowing through the overflow pipe under the deck on the daily log sheet.
2. If not overflowing write **NO.**
3. If cells are overflowing write **YES.**
4. Open drain valve located at the bottom east side of Zeolite System.
5. Routinely check Zeolite System until water is approximately 6 inches below overflow pipe.
6. Record how long you burb the system on the daily sheet.
7. Close valves.

300gpm Ze[illegible]ystem Log

Date							
Time							
Initials							
	Monday	**Tuesday**	**Wednesday**	**Thurday**	**Friday**	**Saturday**	**Sunday**
Burp Cells 1 and 2 (yes/no)							
Time started Burb							
Time stopped Burb							
Feed (gpm)							
Feed Totalizer (gallons)							
Feed (pH)							
Cell #1 (pH)							
Cell #2 (pH)							
Cell #3 (pH)							
Acid pump (str/min)							
Acid Tank Totalizer (gallons)							
Product Totalizer 8"(gallons)							
Regen Totalizer 6"(gallons							
Leaks (yes/no							

Notes:

1200 gpm Zeolite System-Log Sheet								
Date								
Time								
Initials								
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Plant Flow	gpm							
Train #1	gpm							
Train #1	Totalizer							
Train #2	gpm							
Train #2	Totalizer							
Train #3	gpm							
Train #3	Totalizer							
Train #4	gpm							
Train #4	Totalizer							
Train #1-Cell #1	pH							
Train #1-Cell #2	pH							
Train #1-Cell #3	pH							
Train #2-Cell #1	pH							
Train #2-Cell #2	pH							
Train #2-Cell #3	pH							
Train #3-Cell #1	pH							
Train #3-Cell #2	pH							
Train #3-Cell #3	pH							
Train #4-Cell #1	pH							
Train #4-Cell #2	pH							
Train #4-Cell #3	pH							
Train #1-Cell #3 Level	ft.							
Train #2-Cell #3 Level	ft.							
Train #3-Cell #3 Level	ft.							
Train #4-Cell #3 Level	ft.							
Acid Pump #1	str/min							
Acid Pump #2	str/min							
Acid Pump #3	str/min							
Acid Pump #4	str/min							
Acid Tank #1	gallons							
Acid Tank #2	gallons							
Regen 6" Meter	gpm							
Regen 6" Meter	Totalizer							

Notes:

300gpm Zeolite Water Treatment System Training

(Monitoring and Controlling pH)

Written by

Kyle Martinez

Prepared for

Homestake Crew

Date

14 June 2016

INTRODUCTION

The 300gpm Zeolite System is a Water Treatment System that requires inspection and maintenance on a daily basis. This maintenance includes fixing and monitoring for leaks, adjusting water flow, and adjusting acid flow which then controls pH.

Every Homestake crew member is responsible for recording the data rounds and inspecting the system for leaks or any other maintenance issues during his weekend on the water watch schedule.

In order to get the proper water treatment in the system sulfuric acid must be added to the water flow to bring down the pH to between 5.6 and 5.8. If the pH is above 5.8 no water treatment is taking place. If the pH is below 5.0, the sulfuric acid is stripping the uranium off of the zeolite.

This report will provide training so that every Homestake crew member is able to properly operate the 300gpm Zeolite System.

OPERATION

Every Monday a data log sheet will be printed out and placed in the Control Building for the 300gpm Zeolite System. Every Homestake crew member has access to this data sheet. To print the data sheet go to **Computer►General►RO Sheets►300gpm zeolite log.** Figure 1 below shows a copy of the daily log sheet.

300gpm Zeolite System Log

Date							
Time							
Initials							
	Monday	Tuesday	Wednesday	Thurday	Friday	Saturday	Sunday
Feed (gpm)							
Feed Totalizer (gallons)							
Feed (pH)							
Cell #1 (pH)							
Cell #2 (pH)							
Cell #3 (pH)							
Acid pump (str/min)							
Acid Tank Totalizer (gallons)							
Leaks (yes/no)							
Notes:							

Figure1. 300gpm Zeolite System Log Sheet

The first three rows of the data sheet include the Date, Time, and the Initials of the crew member that is preforming the inspection. The next row has every day of the week listed. The next two rows are the **Feed (gpm**) and the **Feed Totalizer (gallons).** To get these readings the meter is located in a box on the North side of the Control Building as shown in Figure 2.

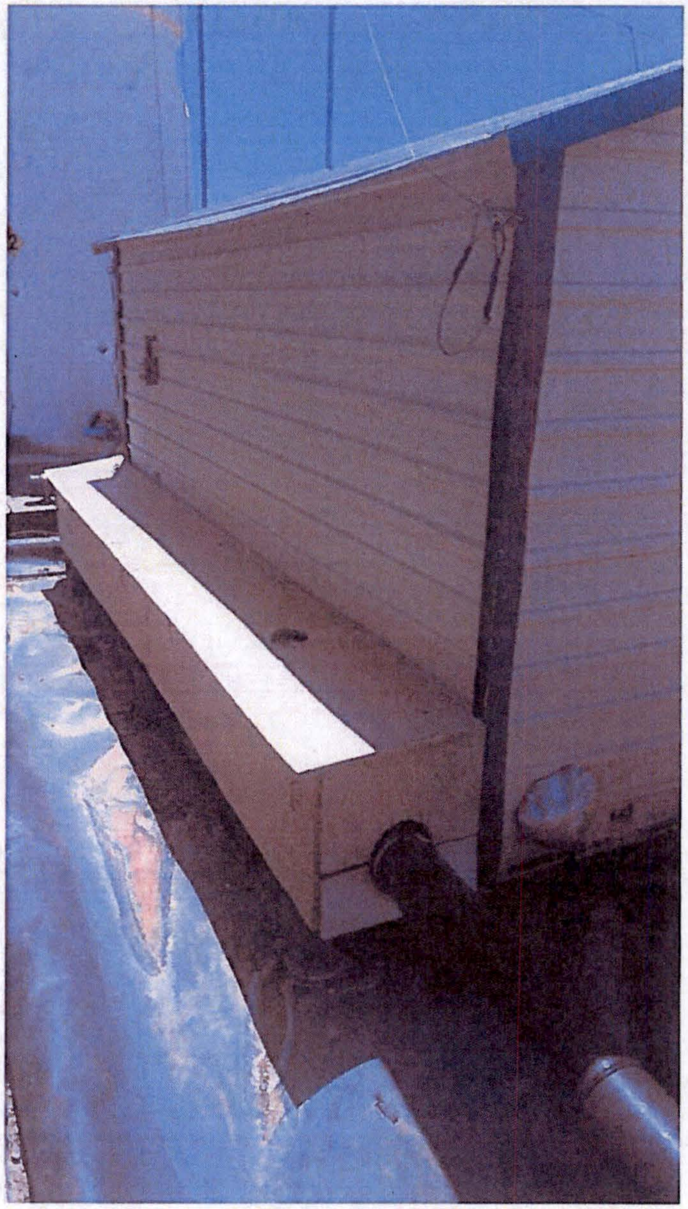


Figure 2. Meter Box

The flow meter in the box is shown below in Figure 3.

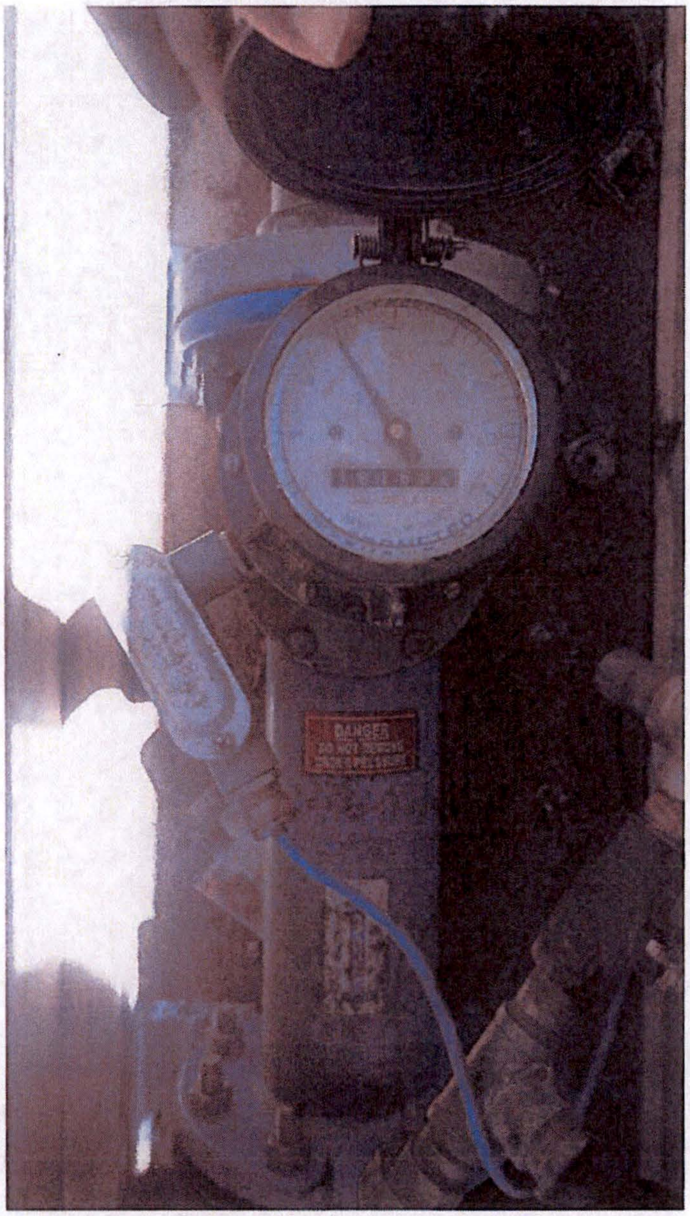
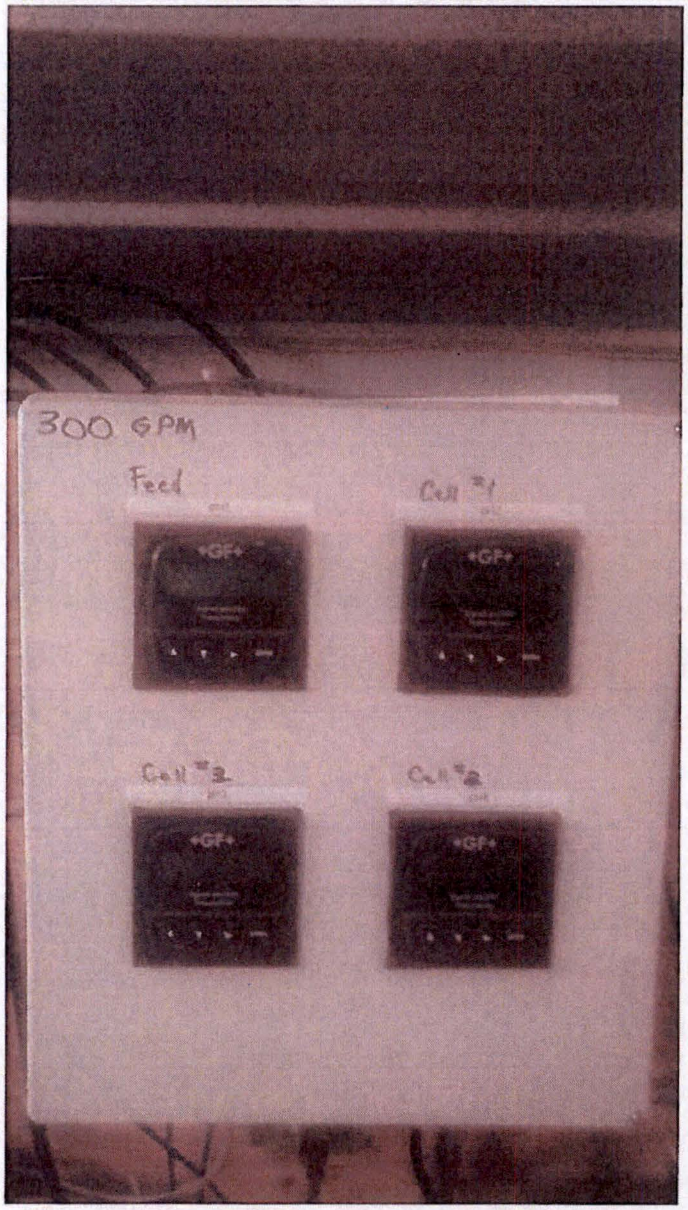


Figure 3. 300gpm Zeolite System Flow Meter

The next four rows in the data sheet in Figure 1 are the pH readings. These reading are displayed and labeled on a monitor inside the Control Room shown in Figure 4 below.



.Figure 4. pH Monitor Readings

However, if any of the display screens show a "Check Sensor" reading the pH reading must be taken manually. In order to take a manual pH, a grab sample must be taken from the feed line shown below in Figure 5.

Figure 5. Feed Line Sampling Location

A grab sample must be taken and tested with a handheld pH meter and the information must be recorded in the data sheet. A pH meter will be available in the Control Room at all times. Pour the water from the feed line into the pH meter and press the pH button on the meter. This displays the reading so you can adjust accordingly. A pH meter is shown below in Figure 6.

Figure 6. Handheld pH Meter

Remember, pH is very important in order to get good water treatment. The feed water pH needs to be between 5.6 and 5.8. If the pH is above 5.8 the acid pump inside the Control Room needs to be adjusted to a higher rate. If the pH is below 5.0 the acid pump needs to be reduced to a lower rate.

In front of the acid pump there are two arrows pointing up and down. To increase the acid rate press the "arrow up" and to decrease the acid rate press the "arrow down". In case of an emergency press the "stop" button or unplug the pump. The person on

water watch also needs to record the acid strokes on the **Acid Pump (str/min)** row in the data sheet. A picture of the acid pump is shown below in Figure 7.

Figure 7. Acid Pump

The next row on the data sheet is recording the amount of gallons left in the acid tank. The meter for the acid tank is located on the North side of the acid tank shown in Figure 8 below.

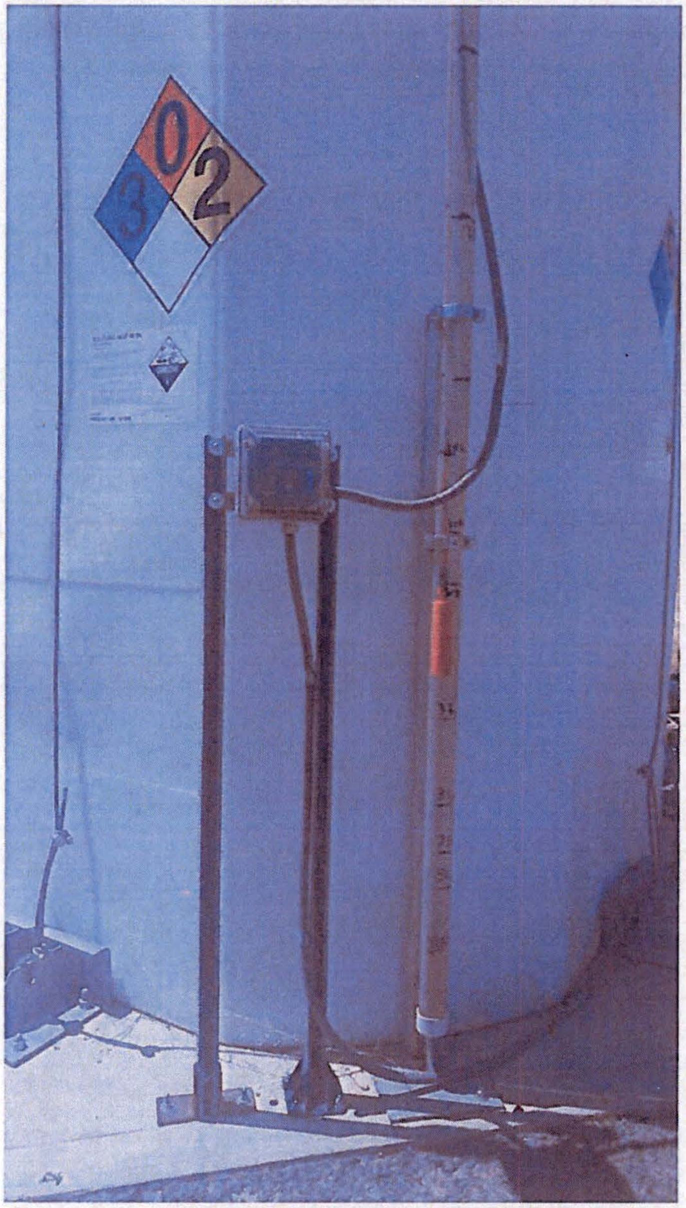


Figure 8. Acid Meter on Acid Tank

The last items to record on the data sheet are checking the system for any leaks and writing any notes you might have. This could include changing a rate on the acid pump or fixing a leak on the system. Recording the data every day is very important because it helps us determine how much acid we are using and it lets us know if we're putting the right amount of acid into the system. Report any issues with the system to your supervisor immediately.

Standard Operating Procedure (SOP) for Burping Cells for 300gpm Zeolite System

1. Verify if the Zeolite cells are overflowing through the overflow pipe under the deck on the daily log sheet.
2. If not overflowing write **NO.**
3. If cells are overflowing write **YES.**
4. Open drain valve located at the bottom east side of Zeolite System.
5. Routinely check Zeolite System until water is approximately 6 inches below overflow pipe.
6. Record how long you burb the system on the daily sheet.
7. Close valves.

300gpm Ze[illegible]ystem Log

Date							
Time							
Initials							
	Monday	**Tuesday**	**Wednesday**	**Thurday**	**Friday**	**Saturday**	**Sunday**
Burp Cells 1 and 2 (yes/no)							
Time started Burb							
Time stopped Burb							
Feed (gpm)							
Feed Totalizer (gallons)							
Feed (pH)							
Cell #1 (pH)							
Cell #2 (pH)							
Cell #3 (pH)							
Acid pump (str/min)							
Acid Tank Totalizer (gallons)							
Product Totalizer 8"(gallons)							
Regen Totalizer 6"(gallons							
Leaks (yes/no							

Notes:

1200 gpm Zeolite System-Log Sheet								
Date								
Time								
Initials								
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Plant Flow	gpm							
Train #1	gpm							
Train #1	Totalizer							
Train #2	gpm							
Train #2	Totalizer							
Train #3	gpm							
Train #3	Totalizer							
Train #4	gpm							
Train #4	Totalizer							
Train #1-Cell #1	pH							
Train #1-Cell #2	pH							
Train #1-Cell #3	pH							
Train #2-Cell #1	pH							
Train #2-Cell #2	pH							
Train #2-Cell #3	pH							
Train #3-Cell #1	pH							
Train #3-Cell #2	pH							
Train #3-Cell #3	pH							
Train #4-Cell #1	pH							
Train #4-Cell #2	pH							
Train #4-Cell #3	pH							
Train #1-Cell #3 Level	ft.							
Train #2-Cell #3 Level	ft.							
Train #3-Cell #3 Level	ft.							
Train #4-Cell #3 Level	ft.							
Acid Pump #1	str/min							
Acid Pump #2	str/min							
Acid Pump #3	str/min							
Acid Pump #4	str/min							
Acid Tank #1	gallons							
Acid Tank #2	gallons							
Regen 6" Meter	gpm							
Regen 6" Meter	Totalizer							
Notes:								

Procedure for Operating the 300 gpm Zeolite System

Objective

This procedure outlines all the requirements all Homestake staff and crew and contracted personnel must follow in order to properly start, operate, or shut down the 300 gpm Zeolite System.

Scope

This policy applies to all Homestake staff and crewmembers. These Zeolite procedures **MUST** be obeyed every time the following activities are being engaged: installing, adjusting, repairing, servicing, cleaning, testing, inspecting, or upgrading machinery or equipment.

Location of Zeolite System, Cells, Valves and Pumps

The 300 gpm Zeolite is located on the top of the Large Tailing Pile (LTP). There are three cells in the Zeolite System. The cell that is farthest to the north is Cell 1. The middle cell is Cell 2. The cell that is farthest to the south is Cell 3. All cells have their own set of control valves. All cell control valves are located west of each cell. Cell 1 has control valves 1-6. Cell 2 has control valves 7-15. Cell 3 has control valves 16-21. All cells have a discharge valve that drains water into Evaporation Pond No. 2 (EP2). The discharge valves are located on the eastside of each cell. The discharge pump is located at the bottom of the Zeolite System south of Cell 3. The South Collection Valve (A) and the Zeolite Feed Valves (B, C) are approximately 1000 feet west of the 300 gpm Zeolite System. All valves are labeled. The Control Room is located north of the Zeolite System. The Acid Pump is located in the Control Room. Acid Valves #2 and #3 are in the Control Room. Acid Valve #1 is located at the bottom of the 4000 gal acid tank on the west side.

Starting the System

1. Perform an FLRA and fill out *Valve Line-Up* Forms as appropriate.
2. **INSPECT** all valves on top Zeolite cells 1, 2, and 3, to make sure they are in the correct position. Refer to *Operating Zeolite Cells*.
3. **INSPECT** all drain valves to cells 1, 2, and 3 to make sure they are in the **CLOSED** position.
4. Perform and document a Valve Line-Up to start South Collection Wells.
5. **OPEN** Zeolite Feed Valves marked B and C. Refer to *Location of Zeolite, Cells, Valves and Pumps.*
6. **CLOSE** South Collection Valve marked A. Refer to *Location of Zeolite, Cells, Valves and Pumps.*
7. **CLOSE** Acid Valve marked #3. Document this on *Valve Line-Up* Form. Refer to *Location of Zeolite, Cells, Valves and Pumps.*
8. **OPEN** Acid Valves marked #1 and #2. Document this on *Valve Line-Up* Form. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

9. **START** Acid Pump. Document this on *Valve Line-Up* Form. Refer to *Location of Zeolite, Cells, Valves and Pumps.*

10. **ADJUST** Acid flow such that pH is between 4.5 and 5.0. Refer to *Starting and Stopping Acid Pump.*

11. **INSPECT** Product Pump to make sure it is operating.

Operating Zeolite Cells

Follow these steps for operating Zeolite cells 1, 2, and 3. Fill out *Valve Line-Up* Form. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

1. **LOCATE** Zeolite Cell 1
2. **OPEN** valve #1
3. **CLOSE** valve #2
4. **OPEN** valve #3
5. **LOCATE** Zeolite Cell 2
6. **OPEN** valve #10
7. **CLOSE** valve #11
8. **OPEN** valve #12
9. **LOCATE** Zeolite Cell 3
10. **OPEN** valve #16
11. **CLOSE** valve #17
12. **OPEN** valve #18

Follow these steps for operating Zeolite cells 1 and 2. Fill out *Valve Line-Up* Form. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

1. **LOCATE** Zeolite Cell 1
2. **OPEN** valve #1
3. **CLOSE** valve #2
4. **OPEN** valve #3
5. **LOCATE** Zeolite Cell 2
6. **OPEN** valve #10

7. **CLOSE** valve #11

8. **OPEN** valve #12

9. **LOCATE Zeolite Cell 3**

10. **CLOSE** valve #16

11. **OPEN** valve #17

12. **CLOSE** valve #18

Follow these steps for operating Zeolite cells 1 and 3. Fill out *Valve Line-Up Form*. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

1. **LOCATE Zeolite Cell 1**

2. **OPEN** valve #1

3. **CLOSE** valve #2

4. **OPEN** valve #3

5. **Locate Zeolite Cell 2**

6. **CLOSE** valve #10

7. **OPEN** valve #11

8. **CLOSE** valve #12

9. **LOCATE Zeolite Cell 3**

10. **OPEN** valve #16

11. **CLOSE** valve #17

12. **OPEN** valve #18

Follow these steps for operating Zeolite cells 2 and 3. Fill out *Valve Line-Up form*. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

1. **LOCATE Zeolite Cell 1**

2. **CLOSE** valve #1

3. **OPEN** valve #2

4. **CLOSE** valve #3

5. **LOCATE Zeolite Cell 2**

6. **OPEN** valve #10
7. **CLOSE** valve #11
8. **OPEN** valve #12
9. **LOCATE Zeolite Cell 3**
10. **OPEN** valve #16
11. **CLOSE** valve #17
12. **OPEN** valve #18

Starting and Stopping Acid Pump

Follow these steps for starting and stopping the Acid Pump for the 300 gpm Zeolite System.

Starting

1. Perform an FLRA and fill out *Valve Line-Up* Forms.
2. Verify Acid Valves #1 and #2 are **OPEN** and Acid Valve #3 is **CLOSED**. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*
3. Verify Acid Pump is plugged in.
4. Hold down the "mode" button until the word "speed" starts blinking next to the "1" in the top left corner.
5. Release "mode" button.
6. Use the buttons with the arrows up and down (↑ ↓) to adjust the rate.
7. Hold down the "mode" button until the word 'speed' disappears.
8. Release "mode" button.
9. If the screen changes when you release the "mode" button, and there is a "2" in the top left corner, press the "mode" button repeatedly until there is a "1" in the top left corner.
10. Press the "start" button.

Stopping

1. Perform an FLRA and fill out *Valve Line-Up* Forms.
2. Press the "stop" button or unplug Acid Pump.
3. Close Acid Valve #1, Refer to *Location of Zeolite System, Cells, Valves, and Pumps.*

Securing the System

Follow these steps to secure the system or in case of an emergency:

1. Follow SWIMS procedure.
2. Report to Supervisor.
3. **STOP** Acid Pump. Refer to *Starting and Stopping Acid Pump.*
4. **CLOSE** Acid Valve #1. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*
5. **OPEN** South Collection Valve A. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*
6. **CLOSE** Zeolite Feed Valve B. Refer to *Location of Zeolite System, Cells, Valves and Pumps.*

Procedure for Conducting a Safety and Environmental Review Panel (SERP)

[Potentially Applicable Regulatory Basis or Bases: SUA-1471, Conditions 14, 16, 21, 22, 23, 24, 28, 32, and 43].
[Potentially Applicable Regulatory Guidance: 10 CFR Part 20, 10 CFR Part 40, and 10 CFR 50.59]
[Special Guidance: The Updated and Revised Corrective Action Program (CAP) submitted to NRC in March 2012].

Introduction and Purpose

Introduction

The purpose of this procedure is to ensure that environmental, health, and safety risks are properly considered in reviewing a proposed change. Guidance for the proper manner in which to conduct SERPs can be drawn from Chapter 10 of the Code of Federal Regulations (CFR) 50.59, as well as 10 CFR Parts 20 and 40.

The regulatory basis for conducting SERPs can most directly be traced to SUA-1471 (Homestake's NRC-issued RML), Conditions 16 and 43.

One of the reasons HMC may be compelled to pursue an activity not previously assessed, is to more broadly satisfy a provision of its RML. Of special and particular concern is License Condition 35C, which charges HMC with implementing a Corrective Action Program (CAP). In December of 2006, HMC submitted to NRC a revised CAP, which was itself subsequently updated and revised in March 2012. Neither of these CAP revisions has been approved as of the date of this procedure.

Consequently, until the NRC officially approves the Updated and Revised 2012 CAP, a SERP may not directly base any safety or environmental approvals on this document. However, due to the fact that HMC has pursued several corrective actions under the auspices of the Revised 2006