# Reusable and Optimized Piping Saves Potash Mine $9.8M in Capital Expenses

AFT FATHOM™
CASE STUDY

Mining & Metals | Leaching

System: Ethiopia | Company: Hatch, Ontario, Canada

## PROBLEM

Caitlin Roos, a piping engineer with Hatch, was tasked with developing an AFT Fathom model of a potash brine injection well mining system. Injection well mining pumps a solvent into porous rock formations to dissolve and extract mineral salts. The brine is then evaporated to isolate the mineral, in this case potash which is typically used as fertilizer.

The mine consisted of 750 injection wells/caverns connected by a network of 45.5 km (28 miles) of piping. The mine has several stages as only 50-60 caverns are serviced at a time over 12-18 months. Roos' model would inform pipe, pumps, and related equipment sizing to minimize cost while meeting design requirements. The solution also had limitations on delivery pressure to avoid fracturing, and thus decommissioning, any well sites. A layout of the mine's progression, as modeled in AFT Fathom, can be found in Figure 1.

## ANALYSIS

Initial power requirements and pipe sizes were based on the most hydraulically remote wells and wells with diverse depths. Operation at maximum and average capacity depending on the number of active well sites similarly informed sizing. The model was used to test several combinations of pipe material and size to ensure pressures were safe for operation. Due to the evolving nature of the mine through its life, 17 scenarios helped verify the design.

The hydraulic losses of the well sites were based on experimental loss data and considered the density change from the dissolved minerals using the Variable Fluid Properties feature. Each well's depth could be considered independently, even revealing cases where the additional downhole pumps were required to achieve the design flow.

A variable speed drive (VSD) on the pump could maintain the pump outlet pressure as well sites are turned on and off. Flow and delivery pressure to each site was further controlled by valve skids. The combination of these control systems ensures no caverns are overpressurized and adequate flow is supplied based on design requirements.

## SOLUTION

A unique aspect of the final design was the use of modular piping which could be disassembled and re-used for new injection sites as the mine progressed. Figure 1 distinguishes the re-usable branches and sub-headers from the single install main headers. This allows materials for 60 caverns to be reused across all 750 sites during the mine's life.

Roos cited the software's flexibility to size pipes and equipment based on the exact mining schedule, use measured experimental results, and estimate real-world results made the model a core design tool for the project.

The optimized pipe sizes verified across the many phases of the mine's life and other design deviations reduced capital expenses by $9.8M.

> **"The model estimated real world results to an amazing level of detail - the client was thrilled and the model was a core design tool for the project."**
>
> *- Caitlin Roos, Hatch*

**Platinum Pipe Award Winner**
**Operational Benefits and Sustainability**

## ELEMENTS OF SUCCESS

The sustainability efforts of designing reusable piping modules and significant capital savings earned Caitlin Roos and Hatch the Operational Benefits and Sustainability Platinum Pipe Award.

# FIGURE 1

A color-coded view of the model workspace highlights the blue, single-install main header and green modular, reusable branches. An individual well site is highlighted as well as the sized Mining Solvent Pump.