| TITLE AND LOCATION (*CITY AND STATE*) | YEAR COMPLETED | |
|---|---|---|
| RIO CHICAMA BASIN HYDROGEOLOGICAL STUDY CHICAMA RIVER BASIN, NORTHERN PERU | PROFESSIONAL SVCS: 2007 – 2008 | CONSTRUCTION (*IF APPLICABLE*) N/A |
| PROJECT OWNER'S INFORMATION | | |
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**RIZZO Associates** developed and calibrated a mathematical model capable of simulating the Rio Chicama basin hydrogeological behavior. The study was divided into two scenarios based on the need to model water behavior in different Sayaatoc mineral deposit areas:



- Rio Chicama Upper Basin, including the site proposed for the leach pad, spoil banks, and an area to be used as a possible site for a tailings pond (Study I); and

- Rio Chicama Lower Basin, including its irrigation system by means of pumping wells, irrigation channels, drainage systems (Study II).

The Rio Chicama Basin is located in the northern area of Peru, belonging to the Pacific Ocean hydrographic network. Rio Chicama is an important source of irrigation for this vast area. At present, intensive agriculture, mainly oriented to the growing of rice, grapevine and sugar cane, is developed in the valley. The use of mathematical hydrogeological models for surface water and groundwater is a strategic tool that facilitates workings, allowing the optimal management of water resources, which are required for both production operations and community activities. In most cases, poor water management gives rise to social and environmental conflicts, adversely affecting both parties due to wrong handling and use.
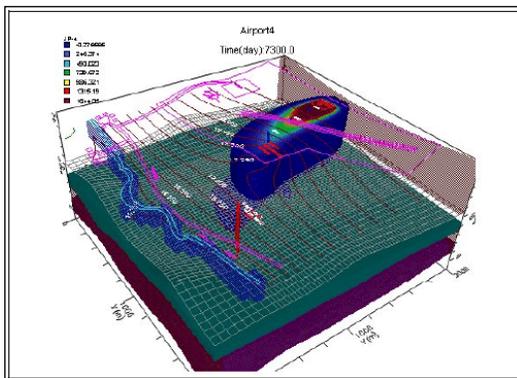


RIZZO used such hydrogeological models as HELP, HEC-HMS, and others to assess precipitation, infiltration, and water flow in surface soils. RIZZO also used MODFLOW for the simulation of flow from several existing aquifers. The information to be collected by MSM in relation to the water quality baseline in the Rio Chicama Upper Basin will be of vital importance to quantify water quality natural rates in sub-basins. Thus, the surface water chemical baseline may be compared with any indicator of chemical presence during mining operations, in order to determine if there exists effluent migration related to these operations.

Results from the hydrological studies and from the hydrogeological model were used by RIZZO to compare alternative locations for leach pads and spoil banks. Results were used to identify the most appropriate areas and designs to contain leaching and to avoid flood problems. The hydrogeological model results were also used for basin-behavior forecasting. Particularly, it will be possible to identify eventual contaminant migration from the upper basin to the lower one, to compare contaminant concentration, to estimate contaminant time-of-travel, to establish response time available for mitigation measures, and to define environmental impact levels caused by surface water and groundwater. The studies also helped measure the degree of contamination existing in Rio Chicama basin; the information obtained was useful to understand the surface water and groundwater availability system, and thus specific scenarios for the evaluation of potentially adverse environmental impacts could be forecasted.