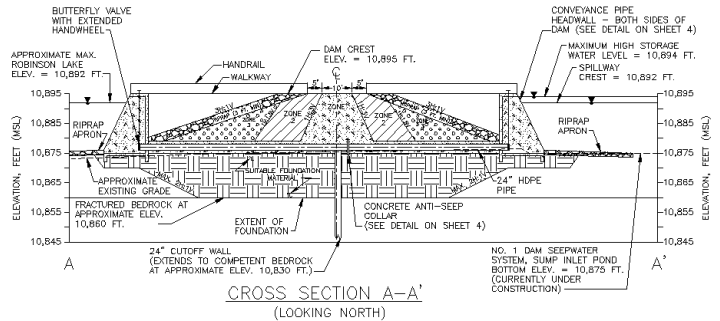




## FACILITY OPERATIONS ENGINEERING SUPPORT

EMC<sup>2</sup> staff provide environmental and civil engineering support services to active facility operations. As demonstrated in the following project descriptions, EMC<sup>2</sup> personnel have evaluated existing facilities operations and developed designs, construction plans, specifications and bid packages for new facilities and existing facilities rehabilitation. EMC<sup>2</sup> focuses project planning/scheduling to prevent or minimize impacts to production operations.

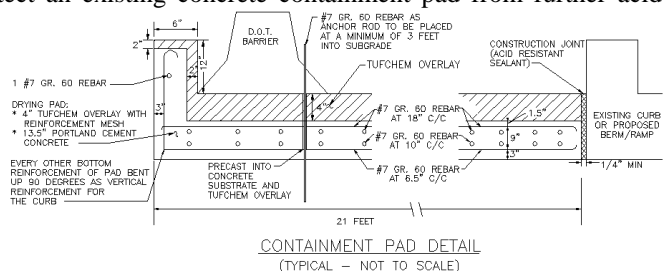
**Climax Mine Seep Water Impoundment Design** - EMC<sup>2</sup> staff developed a design for a 20 foot high, 1,200 foot long, three zone earthen dam with a 20-to-60 foot deep slurry cutoff wall through fractured bedrock to: contain and prevent impacted seep water flows from mixing with a fresh water reservoir down gradient of the dam; and facilitate eventual sale of the clean reservoir water to area ski resorts for snowmaking. Design and project work included: geotechnical evaluations to identify suitable borrow materials for dam/slurry wall design; packer tests, soil permeability and flow net modeling/analyses to evaluate seepage; slope stability analyses considering steady state and rapid drawdown conditions for dam stability with each side of the dam impounding water; filtration analyses to specify gradation requirements for the three dam zones; dam spillway, underdrain and headwall designs; and development of construction plans/specifications.



**Miami Mine Pregnant Leachate Solution Conveyance** - EMC<sup>2</sup> staff developed a design and construction bid package for a low maintenance, 4,000 gpm gravity flow, 1,000 foot-long inclined borehole conveyance system to connect two pregnant leachate solution ponds and facilitate expansion of copper leaching operations. Design alternatives and cost-benefit evaluations included another gravity-feed pipeline and pressure pipelines with barge pumps. A separate seepage interception basin design was developed as a back-up system to contain potential solution flows along the bedrock interface from an unlined pond.

**Morenci Mine Silver Basin Reservoir Seepage Abatement** - EMC<sup>2</sup> staff conducted a field investigation program to abate ten-acre-feet-per-day seep losses from a 150 acre reservoir that served as a primary water supply for mining operations. Field investigations undertaken to supplement reservoir data gathered from researching mine archives included: geophysical surveys of the reservoir bottom; piezometer installations to monitor suspected fault locations; and underwater video surveillance of the reservoir bottom to locate high seep zones. Alternative conceptual construction plans to reduce seepage were developed along with associated costs.

**Tohono Mine Corporation Agglomeration Plant Containment Structure** - EMC<sup>2</sup> staff designed a Turfchem® overlay to refurbish and protect an existing concrete containment pad from further acid degradation. A new reinforced concrete truck loading pad was also designed with the overlay to support 50 ton haul trucks and withstand acid degradation. Construction plans, specifications and scheduling were developed to: phase utilities relocation and site regrading prior to construction; phase construction to minimize impacts to ongoing plant operations; and facilitate future plant maintenance operations by designing an acid resistant sump and clean-out pump and piping for removal of solid/liquid materials washed off the pads during maintenance.



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