

Stemming Flow Using Hydraulic Adit Plug Closure – A Comparison: Glengarry Mine, New World District, Montana and World's Fair Mine, Patagonia, Arizona

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Extended Abstract Two historically mined, abandoned adits were closed using hydraulic plug methods to eliminate acidic, metal-laden groundwater point source discharges to surface water (Table 1). The Glengarry Mine, located near Cooke City in south-central Montana, consists of a 800 m long, 1.5 × 2.1 m adit, driven in a competent quartz monzonite intrusive where it exposes gold- and copper-bearing massive sulfide ore. The Glengarry Mine was closed under a contract with the USDA Forest Service, Gallatin National Forest (R1).

The World's Fair adit, located in the Harshaw Mining District on the Coronado National Forest (R3), south of Patagonia, Arizona, was driven as a cross-cut structure in competent quartz diorite to serve as a main haulage from some 4,500 m of underground workings.

Following closure at the Glengarry Mine, groundwater behind the innermost adit plug rebounded over 120 meters, filling the cone of depression associated with the mine such that an underground monitoring well became artesian in just one month. In addition, two surface water tributaries overlying the mine transitioned from seasonal to perennial flow. Flow from the adit was reduced by 99 % with a reduction of metal loading to receiving waters of 99.9 %. Groundwater quality within the mine workings changed from pH 2.2 to 6.4, with reductions in Cu and Zn concentrations of about 2.5 and 1.5 orders of magnitude respectively. There has been no post

Parameter	Glengarry Mine, MT		World's Fair Mine, AZ	
	Pre-Closure	Post-Closure	Pre-Closure	Post-Closure
pH	as low as 2.2	as high as 6.4	3.2	no flow
Exceedances of HH		As, Ba, Cd, Cu, Fe, Mn, Pb, Se, Zn		
Average flow	50 gpm (189 L/min)	<0.5 gpm (<2 L/min)	11 gpm (42 L/min)	no flow
Flow reduction		99%		100%
Load to receiving SW	30%	<0.1%	40%	0%
Load Reduction		99.9		100%
Closure Method	Complex Closure with Multiple Features	<ul style="list-style-type: none"> • Raise plug • fault grouting • 4 adit plugs • cement & mine waste backfill • free draining portal plug 	Simple Closure	<ul style="list-style-type: none"> • 2 adit plugs, • mine waste backfill, • free draining portal plug
Cost		\$2,900,000		\$1,103,000
Project duration	2000 – 2005	5 years	06/09 to 02/11	17 months

Table 1. Comparison of Glengarry and World's Fair Hydraulic Adit Plug Closure Projects

closure flow from the World’s Fair mine adit. These results indicate that stemming flow with hydraulic adit plug closures can create a reliable “walk-away” solution for point source discharges with significant potential to improve groundwater and down-gradient surface water quality.