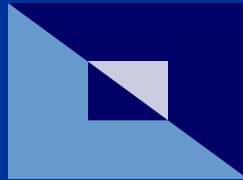


Short Course: Mine Water Treatment – Technologies, Case Studies and Costs

Water Treatment Costs

May 3, 2015



COST ESTIMATES FOR SELECTED PROJECTS

BCRs at Jerritt Canyon

- Engineer's construction cost estimates (excluding mob/demob, general reqmts., contingency or engineering):
 - Marlboro Canyon: \$330,000
 - Gracie: \$753,000
 - Snow Canyon: \$1.72 MM
- Capital cost of about \$900/lb sulfate/day

Kensington Mine – Seep Water Treatment

- Design flow rate: 60 gpm
- Technology: RCTS + filters
- Capital Cost: \$250,000
 - Includes equipment and engineering
 - Not including Connexes or installation
- Annual O&M: NA
- Year: 2009

Veris Gold – DASH Water (Rock Disposal Area = RDA)

- Design flow rate: 15 gpm
- Technology: Barium carbonate precip.
- Capital Cost: \$1.26 MM
- Annual O&M: \$176,000
- Year: 2013

Veris Gold – DASH Water (RDA)

- Design flow rate: 15 gpm
- Technology: Standard evaporator
- Capital Cost: \$2.75 million
- Annual O&M: \$175,000
- Year: 2013

Veris Gold – DASH Water (RDA)

- Design flow rate: 15 gpm
- Technology: TSAES evaporator
- Capital Cost: \$1.24 million
- Annual O&M: \$195,000
- Year: 2013

Veris Gold – Smith Mine Water

- Design flow rate: 6,000 gpm
- Technology: CF + AM
- Capital Cost: \$11.7 MM
- Annual O&M: \$2.2 MM
- Year: 2014

Veris Gold – Smith Mine Water

- Design flow rate: 3,200 gpm
- Technology: RO
- Capital Cost: \$1.35 MM + installation
- Annual O&M: \$250,000 (not including brine disposal)
- Year: 2014

Kensington Mine – Nitrogen Removal

- Design flow rate: 1,000 gpm
- Technology: MBBR
- Capital Cost: \$1.11 MM + installation
- Annual O&M: unknown
- Year: 2008

Stillwater East Boulder – Nitrogen Removal

- Design flow rate: 350 gpm
- Technology: MBBR
- Capital Cost: \$400,000 + installation
- Annual O&M: unknown
- Year: 2006

Client	Project	Technology	Flow (gpm)	Capital Cost*	Annual O&M	Year
Kensington	Seep Water	RCTS + filters	60	\$250,000+	NA	2009
Veris Gold	DASH RDA	Barium carbonate	15	\$1.26 MM	\$176,000	2013
		Standard evaporator		\$2.75 MM	\$175,000	2013
		TSAES evaporator		\$1.24 MM	\$195,000	2015
Veris Gold	Mine Water	CF + AM	6,000	\$11.7 MM	\$2.2 MM	2014
		RO	3,200	\$1.35 MM+	\$250,000	2014
Veris Gold	MC RDA	BCR	5.4	\$330,000	low	2014
	Gracie RDA	BCR	11.5	\$753,000	low	2014
	SC RDA	BCR	49	\$1.72 MM	low	2014
Kensington	Nitrogen	MBBR	1,000	\$1.1 MM+	NA	2008
Stillwater East Boulder	Nitrogen	MBBR	350	\$400,000+	NA	2006

* "+" indicates cost does not include installation

Costs from Literature

- Use as last resort
- Both capital and O&M estimates may be much higher than our experience shows

COSTS FOR 1-MGD (694 GPM) SYSTEM*

Technology	Capital Cost	Annual Cost	Notes
Fluidized bed bioreactor	\$11.8 MM	\$3.2 MM	
Reverse osmosis	\$42.9 MM	\$3.2 MM	Not incl. brine disposal
Zero valent iron	\$13.9 MM	\$3.3 MM	
Coagulation/filtration	\$11.8 MM	\$4.3 MM	
Ion exchange	\$4.3 MM	\$13.5 MM	Incl. brine disposal
ABMet biological treatment	\$32 MM	\$3.2 MM	

* From "Reference Guide to Treatment Technologies for Mining-Influenced Water" (EPA, 2014)