Appendix F – Success Story

Cherry Creek
Acid Mine Drainage Mitigation
Cuts Pollutant Loads

Cherry Creek Acid Mine Drainage Mitigation Cuts Pollutant Loads

Waterbodies Improved

Cherry Creek as it flows thru wetlands in the mid watershed.

For many years, abandoned coal mines in the Cherry Creek watershed caused low pH and high metals loads in the stream, which flowed into Deep Creek Lake in Garrett County, Maryland. The Maryland Dept. of the Environment (MDE) added the Deep Creek Lake watershed to the state's Clean Water Act (CWA) section 303(d) list in 1996 for pH. Because Cherry Creek was known to be the primary cause of the pH impairment, acid mine drainage (AMD) mitigation projects were implemented. As a result, Cherry Creek now consistently meets the total maximum daily load (TMDL) for pH and pollution caused by excess acidity, iron and aluminum is significantly reduced.

View of the AMD treatment systems -- Glotfelty site.

Problem

The Cherry Creek name can be traced to the deep reddish color of it waters that were historically caused by bog tannins from Sphagnum sp. wetlands. These wetland complexes include coniferous forest and marshes that contribute to a stream pH of about 4.5 due to natural organic acidity.

Cherry Creek begins near Savage River State Forest and it flows about 8 miles thru a 7900-acre watershed that is 69% woodland and 12% wetland with the remainder being mixed agriculture and developed lands.

In its upper reaches, Cherry Creek is low-gradient, slow-flowing, wadeable stream. In its lower reaches, Cherry Creek is a fast-flowing mountain stream as it approaches its mouth at Deep Creek Lake. The Lake is a popular manmade recreational impoundment that supports fishing, boating, and numerous with vacation homes. Outflow from the Lake enters the Youghiogheny River, which is in the Monongahela River watershed in the Ohio River basin.

In the 1920's Cherry Creek was a natural trout stream where a trout rearing station was constructed in 1922. Spawning runs of rainbow trout and brook trout were reported in 1925. During the next several decades acid mine drainage (AMD) associated with coal mining increased. In 1957, a large fish kill caused by low pH brought an end to trout stocking in Cherry Creek. A 1973 study reported that almost the entire mainstem of Cherry Creek was either

severely or moderately polluted by AMD. This study also estimated that one-fourth of the acid load in Cherry Creek is derived from mines and the rest is from natural sources. In the 1980s, it was estimated that Cherry Creek was the source of half the acidity entering Deep Creek Lake.

Before project implementation, AMD generally lowered in-stream pH to the 4.0 to 4.3 range with pH as low as 3.2 during low flow. To address this impairment, the total daily maximum load (TMDL) approved for Cherry Creek calls for pH to be 4.6 or higher. The level approved in the TMDL takes into account the naturally low pH arising from the Sphagnum wetlands that characterize Cherry Creek.

Project Highlights

Between 1986 and 1989, MDE created a series of treatment wetlands to help reduce AMD impacts in the Cherry Creek watershed. MDE constructed additional AMD treatment systems between 1998 and 2001 including successive acid producing systems, more treatment wetlands and several commercial AMD treatment systems including an Aluminator, a Pyrolusite cell and a Boxholm doser. All together, the Cherry Creek mitigation incorporates approximately 6,760 tons of limestone not counting the lime used for the doser. Overall, the AMD mitigation projects in the Cherry Creek watershed capital cost totals approximately a half million dollars over 15 years.

Cherry Creek lime doser located in a steep mountain valley.

Results

In-stream sampling conducted following the AMD implementation from 2003 thru the present below the lime doser demonstrate that the TMDL has been met consistently. Sampling data shows that during that period pH is generally greater than 6.0 and is always greater than 5.2.

The pollutant reduction summary table shows that individual AMD treatment sites have significantly reduced concentrations of pollutants and increased alkalinity. An MDE report on AMD mitigation at the Glotfelty site said that it annually removes 8 tons of acidity, 3 tons of iron, and 275 pounds of aluminum.

Pollutant Reduction Summary for Cherry Creek AMD Mitigation (average mg/l)

	pH		Acidity		Alkalinty		Iron		Aluminum	
	Before	After	Before	After	Before	After	Before	After	Before	After
Everhart site	3.5	6.1	300	21	0.0	23	65	1.5	4.9	0.1
Glotfelty site	5.3 to 5.9	6.9	372	0.0			111 to 147	0.83	1.5 to 3.5	0.1
Teets site	3.1	7.1	486	0.0	0.0	106	73	1.2	37	0.1
KEY: Before: Untreated AMD before implementation. After: Treated discharge for AMD mitigation project.										

The mitigation of AMD impacts has allowed for improvement in fish populations. In 1971, only three species of lake fish were found in Cherry Creek and they were only near the confluence of the Creek with Deep Creek Lake. In 2004 after implementation of AMD mitigation, a survey conducted DNR Fisheries Service documented seven fish species in Cherry Creek. DNR's survey report indicated that rainbow trout, brown trout and smallmouth bass were common enough to support some recreational fishing and several fish species ranged from the Lake about 1.5 miles upstream to the vicinity of the lime doser. A 2012 analysis of all benthic macroinvertebrate data for Cherry Creek found that the Benthic Index of Biological Integrity may have improved but it continues to be poor overall. This biological impairment may be due to several potential factors: AMD inputs from one tributary, naturally acid conditions, and poor physical habitat.

Partners and Funding

The Maryland Department of the Environment Abandoned Mine Lands Division (formerly Bureau of Mines) was the primary implementer of the Cherry Creek AMD mitigation projects. Funds for the mitigation project implementation came from the State of Maryland, the US Dept. of Interior Surface Mining, and US EPA (not 319(h) Grant). Additionally, the private Sprenger-Lang Foundation paid for purchase and construction of the lime doser, which is located on property owned by the Rock Creek Trust. Funds for doser O&M come from the State of Maryland and the US Dept. of Interior.

Cherry Creek Watershed AMD Mitigation Cost Summary

Project/ Site Name	Year Completed	Major Practices	Total Capital Cost ($)	Total Annual O&M Cost ($)
Doser	2001	Boxholm lime doser	92,000*	18,328*
Everhart	1986	Treatment wetland	103,121*	3,488*
	2000	Aluminator, aeration, SAPS		
Glotfelty	1999	ALD, oxidation pond, SAPS, two treatment wetlands	93,861*	3,765*
Opal	1987	Treatment wetland		
Teets	1989	Phase 1: Treatment wetland	207,000*	5,267*
	1998-2001	Phase 2: Pyrolusite cell(s), SAPS		
OVERALL			495,982	30,848

Footnotes for table:
ALD = anoxic limestone drain.
Aluminator® treatment cell designed to precipitate aluminum while keeping iron in soluble form.
Pyrolusite® bioremediation using limestone and bacteria to remove metals.
SAPS = successive alkalinity producing system.
* Cost figures generated in October 2008.

Other partners have been and continue to be important Cherry Creek management and monitoring: Maryland Dept. of Natural Resources Fisheries Service and the University of Maryland Appalachian Lab.

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