Abandoned mine drainage (AMD) from the Bell Colliery Drift Discharge (Bell Colliery) near the village of Mary D, Schuylkill County is a significant pollution source in the Upper Schuylkill River headwaters. Previous monitoring found Bell Colliery's flows averaged 430 gal/min with average pH of 3.93, total acidity of 28.8 mg/L, concentrations of aluminum of 1.055 mg/L, iron of 3.987 mg/L, and manganese of 1.520 mg/L. Bell Colliery is one of the reasons the Upper Schuylkill River was designated as impaired on the Clean Water Act Section 303(d) List.

Funded through a $270,245.00 2002 Section 319(h) Nonpoint Source Management Grant awarded to the Schuylkill Conservation District (SCD), an AMD treatment system was constructed to significantly reduce pollution from Bell Colliery and improve downstream water quality in the Upper Schuylkill River. System components consisted of passing Bell Colliery water through two parallel down-flow limestone treatment cells (LTCs) followed by an aerobic wetland cell before entering the Upper Schuylkill River. The LTCs' roles in treatment are to generate excess alkalinity neutralizing acidity while increasing pH promoting metal precipitation. To prevent precipitated metals from clogging the LTCs, periodic flushing (quickly draining) is completed by opening two valves, one for each LTC. The aerobic wetland's roles in treatment are to allow precipitated metal particles time to settle from the water while providing a place for their permanent storage and double as the LTCs' flush water holding pond. Due to construction site space restrictions, the aerobic wetland is too small to retain flush water therefore all precipitated metals were not retained in the aerobic wetland.

Original Bell Colliery Treatment System Down-Flow Limestone Cells

The problem of effectively containing the LTCs' flush water to minimize precipitated metals discharged to the Upper Schuylkill River was addressed through $122,500.00 in funding secured by the Schuylkill Headwaters Association, Inc. in 2006. Known as Bell Colliery Phase II, this project constructed a larger basin on the opposite side of the Schuylkill River where ample space was available. This larger basin retained flush water for a sufficient time to allow settling/removal of precipitated metals.

Bell Colliery Phase II Limestone Treatment Cells' Flush Water Holding Pond

Beginning in 2009 a steady decrease in flow through the LTCs was observed and believed to be the result of either clogged limestone in the treatment cells or a clog in the piping of the flush system in the bottom of each LTC. In 2011, the SCD was awarded a Section 319(h) Nonpoint Source Management Grant in the amount of $347,355.00 to complete both design and construction to correct suspected issues with the flush system and implement design changes to maximize treatment effectiveness. Known as the Bell Colliery AMD Restoration, Phase III Project, many favorable features from other Anthracite AMD treatment systems were incorporated into the original project. Two trash racks were added to the intake structure first to prevent larger debris (branches, rocks, etc.), then smaller debris (twigs, leaves, etc.) from clogging the treatment system pipes. The berm separating the two LTCs was removed to create one large LTC capable of treating Bell Colliery's periodic higher flows. Reduced flow through the LTCs was the result of precipitated metals, unable to be removed during routine flushing, clogging the 2B stone around piping in the bottom of the LTCs. All existing piping was replaced

and to combat future clogging issues the new piping was surrounded by a larger sized (size #3) limestone. Flow pattern in the LTC was converted from down-flow to up-flow as piping in the bottom of the LTC now serves both to evenly distribute the influent water and collect water during a flush event. Clean outs were added to the piping system to allow for the pipe network and limestone to be back flushed to loosen precipitated metals in the limestone and improve routine flushing effectiveness. The plan was to reuse the existing limestone but testing of the existing limestone revealed it to be dolomitic limestone (poor quality) thus it needed to be replaced with calcitic limestone (higher quality). Removal of accumulated metals in the aerobic wetland increased its volume thus increasing its metal holding capacity. Construction was completed in September 2013.

Bell Colliery Phase III Single Large Up Flow Limestone Treatment Cell

Project success was made possible through the coordinated efforts of all partners involved. Representatives from local, state, and federal agencies and nonprofit organizations managed the completion of the Bell Colliery AMD Restoration, Phase III Project. The following were partners with the Schuylkill Conservation District on the Bell Colliery AMD Restoration, Phase III Project: Schuylkill Headwaters Association, Inc., PA Department of Environmental Protection, United States Geological Survey, Schuylkill Action Network, Rettew Associates, Inc. (engineering contractor), and RCH Services, LLC. (construction contractor).

Bell Colliery Phase III Completed Aerobic Wetland

The Bell Colliery AMD Restoration, Phase III Project is improving water quality in the Schuylkill River through pollution reductions that coincide with recommendations published in the Upper Schuylkill River Watershed TMDL for Acid Mine Drainage Affected Segments. Current monitoring of untreated Bell Colliery water shows flows averaged 272 gal/min with an average pH of 4.3, total acidity of 23.0 mg/L, concentrations of aluminum of 0.813 mg/L, iron of 3.528 mg/L, and manganese of 1.213 mg/L. Current monitoring of the Bell Colliery treatment system effluent shows an average pH of 7.0, total acidity of -28.3 mg/L (negative acidity denotes that amount of positive alkalinity), concentrations of aluminum of less than 0.500 mg/L, iron of 1.146 mg/L, manganese of 0.613 mg/L. Completion of the Bell Colliery AMD Restoration, Phase III Project moved the Schuylkill River Watershed one step closer to its eventual removal from Clean Water Act Section 303(d) List of Impaired Waterways.