EXECUTIVE SUMMARY

The Upper Tioga River Watershed in northcentral Pennsylvania is severely impacted by abandoned mine drainage (AMD) from Fall Brook to Bear Creek, impairing or eliminating aquatic life in approximately 13 miles of the mainstem extending downstream to the Tioga/Hammond Dam Complex. Other tributaries in the watershed show reduced pH due to non-AMD acidity sources, including tannins from natural headwaters wetlands and acid rain. Although AMD production will decline over time by depletion of the acid-forming minerals, this is a very slow process, particularly for underground mines, and significant impacts could continue for centuries without some form of abatement. The most common form of abatement is direct treatment of the AMD discharges by either active (chemical) or passive (wetland) systems. Other alternatives may include re-mining or land capping to limit infiltration on disturbed sites, alkaline addition to abandoned surface and underground mine works, streambed sealing to prevent infiltration to mine pools, or indirect treatment, such as increasing the alkalinity of reaches upstream of the AMD sources.

Local stakeholders have expressed a final goal of restoring the Tioga River to a natural ecological condition, with interim water quality and ecological improvements to the affected tributaries, contributing to the restoration of the mainstem. While the goal of complete ecosystem restoration may take decades to achieve through implementation of the recommendations of this study as funding and new technologies are made available, many other interim benefits would be realized with the progressive treatment of the mine drainage pollution. These include increased recreational opportunities and revenues in the watershed and at the Tioga/Hammond Complex, increased aesthetic value of the river (decreased staining), decreased maintenance costs for bridges and other man-made structures, and increased benefits to potable water supplies.

Under a Pennsylvania Growing Greener Grant, the Susquehanna River Basin Commission (SRBC) undertook a water monitoring program in 2001 and 2002 to identify and sample the primary sources of AMD in the watershed and collect instream data to characterize its impact on the mainstem and major tributaries. As part of the grant, the SRBC retained Gannett Fleming, Inc. to develop conceptual treatment plans for the identified AMD sources and prepare a progressive restoration plan for the watershed. The monitoring program identified 36 AMD features in the Upper Tioga River Watershed; 20 were flowing and able to be sampled within the study period. Based on field review, Gannett Fleming determined that a number of the AMD sources could be combined in common treatment systems for an economy of scale, resulting in ten treatment plans covering three combined and seven individual treatment systems. For each plan, conceptual passive and chemical system designs were prepared using the Tarco Technologies, Inc. Watershed Restoration Analysis Model (WRAM v1.2), which generated conceptual component sizing requirements, construction cost estimates, operation and maintenance cost estimates, 15-year present values, and construction area requirement estimates. The more appropriate of the two treatment alternatives was selected based on construction area constraints, cost considerations, and ability of the technologies to meet water quality goals. Following development of the conceptual treatment plans, another component of WRAM was used to predict the downstream water quality improvements that could result from implementing these plans and to guide development of the progressive restoration plan.

Analyses determined that treatment efforts on Fall Brook and Johnson Creek would yield the greatest benefit/cost ratio, and would be the best starting points for restoration efforts, followed by Morris Run, and finally the combined watersheds of Coal and Bear Creeks. If fully implemented, the conceptual treatment activities would cost about $9.3 million to construct, $2.6 million per year to operate, and have a 15-year present value of $41 million. This equates to about $130,000 per stream mile per year for 8.4 miles of tributaries and 13.1 miles of mainstem, or 21.5 miles of total stream improvements throughout the watershed. These costs are specific to the construction, operation, and maintenance of the selected treatment alternatives over a 15-year projection period. There are a number of other factors that could not be predicted at this level of assessment, including property acquisition, access development, electric service, and design and permitting costs. The conceptual construction costs include a 25 percent contingency to estimate these factors, but the ultimate costs of implementing the individual treatment projects may be greater than stated.

The WRAM modeling showed that treatment of AMD acidity alone may not result in consistently net alkaline conditions in Fall Brook or the Tioga River mainstem below its confluence due to the presence of the non-AMD acidity sources. The slightly acidic, low-metals flows in the headwaters of Fall Brook and Morris Run, and found in Fellows Creek, McIntosh Hollow, and Taylor Run, are ideal for passive treatment, which would benefit the overall restoration efforts at a comparatively low cost. Based on findings from other projects, net alkaline conditions could be restored in these streams using vertical flow wetlands, or other passive technologies. Current estimates to implement vertical flow wetland treatment in the headwaters of Fall Brook and Morris Run would cost $560,000 and $340,000, respectively. Non-AMD acidity treatment also may be necessary on additional tributaries to fully restore the Tioga River mainstem to net alkaline conditions.