CASE STUDY

Friendship Hill National Historic Site
Fayette County, Pennsylvania

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Prepared by
The Interstate Technology & Regulatory Council
Mining Waste Team

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TABLE OF CONTENTS

LIST OF FIGURES

FRIENDSHIP HILL NATIONAL HISTORIC SITE
FAYETTE COUNTY, PENNSYLVANIA

1. SITE INFORMATION

1.1 Contacts

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1.2 Name, Location, and Description

The Friendship Hill National Historic site is located in Fayette County Pennsylvania. The media affected are surface water, surface pool water (e.g., lakes, ponds, and pools), and groundwater.

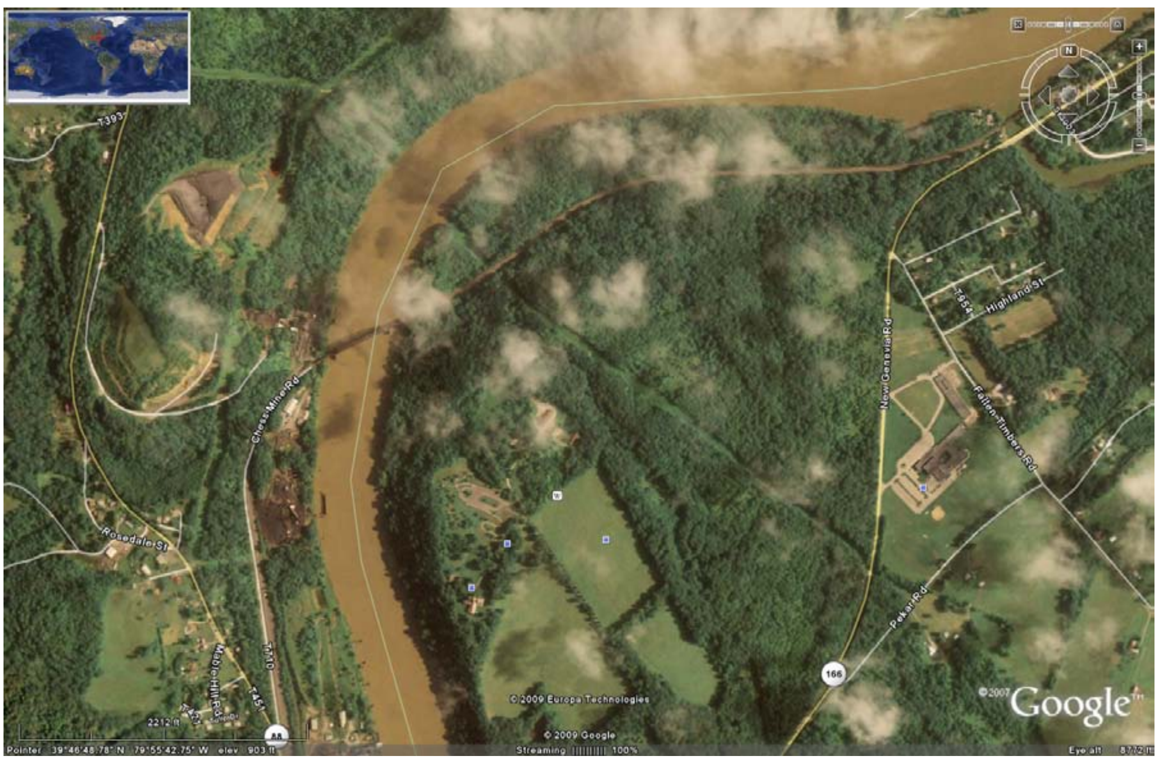

Figure 1-1. Aerial view of the Friendship Hill National Historic Site area.

2. REMEDIAL ACTION AND TECHNOLOGIES

The Friendship Hill Historic Site is being treated with a pulsed limestone bed process, a new process using pulsed, fluidized limestone beds, which was tested for the remediation of acid mine drainage at this site located in southwestern Pennsylvania (Sibrell and Watten 2003; Sibrell, Watten, and Boone 2003; Watten, Sibrell, and Schwartz 2005). A 230–liter per minute treatment system was constructed and operated over a 14-month period from June 2000 through September 2001. Over this period of time, 50 metric tons of limestone was used to treat 50 million liters of water. The influent water pH was 2.5, and acidity was 1000 mg/L as $CaCO_3$. Despite the high potential for armoring at the site, effluent pH during normal plant operation ranged 5.7–7.8 and averaged 6.8.

3. PERFORMANCE

As a result of the high influent acidity, sufficient CO_2 was generated and recycled to provide a net alkaline discharge with about 50 mg/L as $CaCO_3$ alkalinity. Additions of commercial CO_2 increased effluent alkalinity to as high as 300 mg/L and could be a useful process management tool for transient high flows or acidities. Metal removal rates were 95% for aluminum (60 mg/L in influent); 50%–90% for iron (Fe), depending on the ratio of ferrous to ferric iron, which varied seasonally (200 mg/L in influent); and <10% of manganese (Mn) (10 mg/L in influent). Ferrous iron and Mn removal was incomplete because of the high pH required for precipitation of these species. Iron removal could be improved by increased aeration following neutralization, and Mn removal could be effected by a post-treatment passive settling/oxidation pond. Metal hydroxide sludges were settled in settling tanks and then hauled from the site for aesthetic purposes. Over 450 metric tons of sludge was removed from the water over the life of the project. The dried sludge was tested by the Toxicity Characteristics Leaching Protocol and was found to be nonhazardous.

4. COSTS

Treatment costs were \$43,000/year and \$1.08/m^3 but could be decreased to \$22,000 and \$0.51/m^3 by decreasing labor use and by on-site sludge handling. These results confirm the utility of the new process in treatment of acid-impaired waters that were previously not amenable to low-cost limestone treatment.

5. REGULATORY CHALLENGES

None encountered.

6. STAKEHOLDER CHALLENGES

None reported.

7. OTHER CHALLENGES AND LESSONS LEARNED

None reported.

8. REFERENCES

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Watten, B. J., P. L. Sibrell, and M. F. Schwartz. 2005. “Acid Neutralization within Limestone Sand Reactors Receiving Coals Mine Drainage,” *Environmental Pollution* **137**(2): 295–304.