

Science Notes



Restoring hydrologic processes and protecting karst resources at Antietam National Battlefield

Figure 1. The Piper Farm at Antietam National Battlefield Park participates in an agricultural permit program designed to retain the appearance of the landscape at the time of the Civil War, when the area was used as pasture and for crop production. Cattle waste and poor drainage, however, created conditions that could have been polluting groundwater and nearby Antietam Creek. Pictured are the historical farmhouse, a cannon that marks the location of artillery at the time of the battle, and a recently replanted apple orchard.

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LOCATED IN THE GREAT VALLEY REGION OF the Appalachian Valley and Ridge Province, Antietam National Battlefield (Maryland) encompasses 3,200 acres (1,295 ha) of farmland, pastures, and wooded areas. A portion of this acreage (1,927 acres [780 ha]) is federally managed. As part of the battlefield's agricultural permit program, local farmers use more than 1,200 acres (480 ha) of the federal acreage as cropland and pasture. This program helps restore the landscape to the rural, agricultural appearance it had when General Robert E. Lee's first invasion of the North ended on this battlefield in 1862. Antietam's geologic formations consist

mainly of carbonate rock, and contain karst features such as springs and sinkholes. With agriculture being the dominant land use, water quality is of special concern because groundwater in karstic areas is particularly susceptible to contamination.

In 1994, staff at Antietam developed a water quality monitoring program to detect potentially degraded water in the battlefield's springs. Preliminary analysis of the monitoring data revealed that the waters were impacted at least to some degree by agricultural practices. In 1997, investigators from the Maryland Department of Natural Resources sampled various sites at the battlefield, finding high levels of nutrients from agriculture. Siltation and algal growth were indicative of elevated erosion rates and nutrient levels. In order to maintain the agricultural setting, which the enabling legislation mandates, and protect the water in accordance with NPS

Management Policies 2001 (and the more recently updated *Management Policies 2006*), managers implemented various best management practices, focusing on Antietam's historic Piper Farm (fig. 1).

The Piper Farm includes 105 acres (42 ha) of pasture with a carrying capacity of 55 cattle. Though the battlefield's special use permits require 2 acres (0.8 ha) per animal unit (cow/calf), the only water source was a single well-fed trough in a low-lying section of pasture. Over time, congestion of the animals in this limited space caused deteriorating ground conditions, which raised concerns about sedimentation, soil erosion, and contamination of surface water. Further adding to the problem was



Figure 2. The restoration removed an intermittent pond and berm, improving drainage in the areas where cattle congregated. To disperse cattle, managers routed runoff to two troughs. The area was re-graded and seeded to complete the project, safeguarding groundwater and streams of the Chesapeake Bay watershed. NPS

an abandoned farm pond once fed by a system that historically drained adjacent fields. All that was left of the pond and old drainage system were a constructed berm and an exposed pipe that fed directly into the pasture. The resulting condition was a “wetland” that collected stagnant water and animal waste from congregating cattle. During wet weather, runoff from the site would flow over the pasture through an intermittent streambed that emptied into Antietam Creek. Considering the karstic nature of the area, contamination of groundwater was also likely. Antietam staff became increasingly concerned about the area and started to look for a way to both move the cattle's water source and eliminate the remnants of the pond. Park staff pursued a cost-

share partnership with the Washington County Soil Conservation District, which could provide needed technical assistance.

As a result of consultation with the Washington County Soil Conservation District, park staff developed two objectives and corresponding remediation projects. The first was to create two gravity-fed troughs in two pastures using the inflow of water from the old drainage system, grade the pond area to a more natural appearance, and dismantle the berm, eliminating the collection area for water (fig. 2). A new PVC pipe would connect to the existing outlet of the old system and carry the water away from this area to trough number 1 in the same pasture. The overflow from the first trough would then travel through a PVC pipe to fill trough number 2 in the far pasture adjacent to the Piper orchard. Any overflow from the second trough would be routed via PVC pipe to a natural stream channel. Fencing and a riparian buffer would protect this area. The second objective was to rehabilitate the barnyard and cattle chute area. With the two troughs relieving pressure from the current water source at the barnyard, contractors would re-grade and seed the area, following recommendations of the Washington County Soil Conservation District.

Park staff and cooperators successfully completed the project in May 2005. Two water sources now provide more flexibility for grazing operations and rotational grazing. The work was crucial because of the sensitive hydrologic system and because park waters eventually drain into Chesapeake Bay—the largest, most productive estuary in North America. The National Park Service partners with several states and agencies to protect and improve the bay and its resources; completion of the project supported this commitment. Today the water troughs are working as designed, the barnyard has less livestock pressure, and the water that once lay stagnant in the remnant pond is now on its way to Antietam Creek with a much reduced risk of pollution by livestock waste.

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