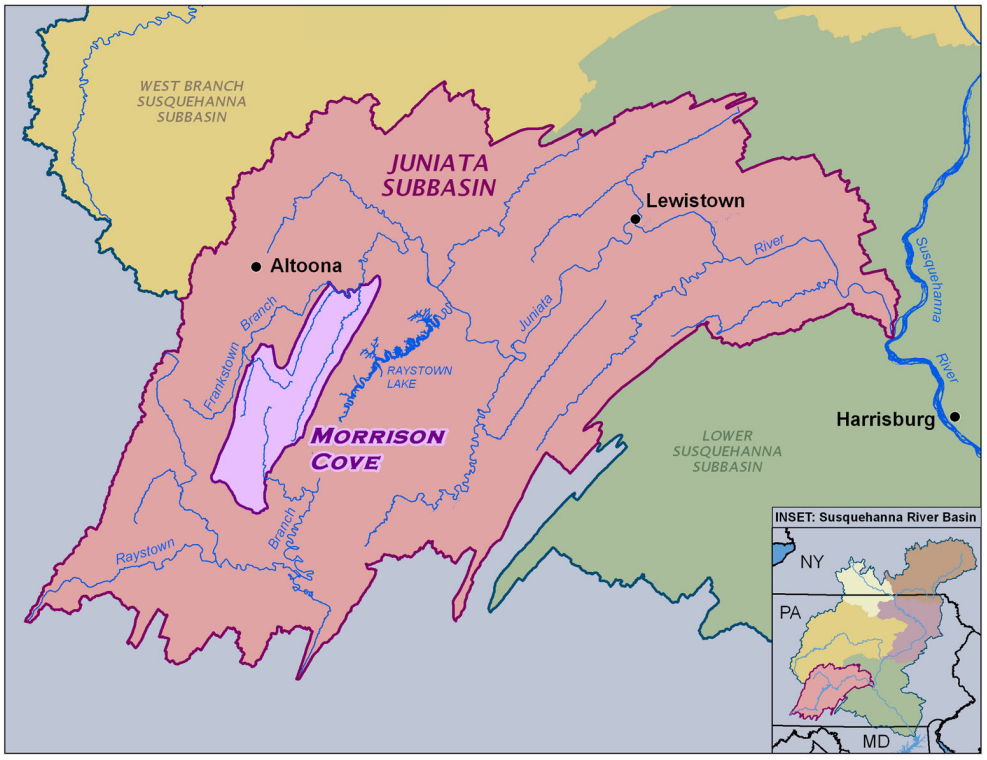
Morrison Cove Water Resources Availability Study

EXECUTIVE SUMMARY

The objectives of the Morrison Cove Water Resources Availability Study were to assess existing water resources, establish an estimated sustainable yield from the constituent watersheds, inventory current water uses, and evaluate water quantity and quality issues in the study area. Morrison Cove includes an area identified by the Susquehanna River Basin Commission (SRBC) as a "Potentially Stressed Area" and has a long history of agriculture-related water quality issues. A lack of flow data from U.S. Geological Survey gaging stations within Morrison Cove has precluded quantitative water resource assessment.

The Morrison Cove study area encompasses about 185 square miles in portions of Blair and Bedford counties, Pennsylvania. The predominant land uses, by area, are agricultural (55 percent) and forested (40 percent). Developed land use (including industrial, commercial, municipal, and residential) covers approximately 1 percent. Major population centers include the boroughs of Roaring Spring, Martinsburg, and Williamsburg.

Morrison Cove, located within the Ridge and Valley physiographic province, is an intermontane valley about 30 miles long and five to eight miles wide. The underlying bedrock is predominantly siliciclastics (primarily sandstone) in the ridges, and carbonates in the enclosed valley. The carbonates have solutionally enlarged fractures and conduits which substantially increase aquifer permeability. As a result, relatively high well yields are widely available within the valley portion of the study area for wells sited along major fractures and fracture traces.



Morrison Cove Study Area

A substantial amount of field work and analysis by SRBC and Meiser & Earl, Inc., as well as literature review and Geographic Information Systems mapping of previous study results, was conducted as part of the study. From spring through winter 2009, field work included: (1) establishing temporary gaging stations near the mouth of each major watershed and developing rating curves; (2) continuously monitoring streamflows, including a wide range of seasonal flows; (3) measuring over 200 groundwater levels for a water table contour map; (4) performing seepage runs to obtain a snapshot of contributing flows within each major watershed; and (5) obtaining select water chemistry data and evaluating aquatic habitat at each seepage run station.

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Full report is available on SRBC's web site at http://www.srbc.net/pubinfo/techdocs/Publication_277/techreport277.htm.

Roaring Spring outflow (instrumented weir provided daily flow measurements for use in this study).

Example of lack of riparian buffer in agricultural area along Clover Creek.

A detailed water availability analysis allowed SRBC to establish the amount of groundwater and surface water base flow currently available on a sustainable basis for use in each major watershed. For the purposes of this study, the sustainable limit of consumptive use is approximated by the 10-year base flow. The use of water utilization data representing the maximum approved or permitted daily use ensures a worse-case evaluation, and a conservative estimate of water availability.

The water resources in the Yellow Creek, Piney Creek, and Clover Creek Watersheds, and in the northern Gatesburg groundwater basin, are largely undeveloped. However, the amount of water currently withdrawn from the Roaring Spring exceeds the amount of water available on a sustainable basis. The amount of water currently consumptively withdrawn from the Halter Creek Watershed represents 87 percent of the 10-year base flow. Approximately 11 percent of the 10-year base flow is currently being utilized in the Plum Creek Watershed.

The Morrison Cove Watersheds were screened for potential designation as Pa. Act 220 Critical Water Planning Areas (CWPAs). The consumptive use in each watershed was compared to the appropriate Initial Screening Criterion (ISC). Consumptive use exceeded the ISC in the Halter Creek and Plum Creek Watersheds. However, the consumptive use in these watersheds is due to a few relatively stable, high volume withdrawals, and both watersheds support high quality aquatic habitat downstream of the withdrawal locations. Water use in Halter Creek and the Roaring Spring is largely driven by industrial use. Municipal and residential consumptive use is a small fraction of total use. Therefore, water use is not a function of population growth. Available data for industrial water use suggest overall stability, with no net increases in water demand in recent years. Designation of these watersheds as CWPAs does not appear to be warranted.

The greatest challenges for water supply in the Morrison Cove Study area are: (1) the concentration of major withdrawals in the Roaring Spring area, and (2) the widespread contamination of surface water and groundwater by agricultural activities. Under existing conditions, water demand exceeds available flow from the Roaring Spring during some summer and fall months in moderate drought years. In years with average hydrologic conditions, about 1-3 cubic feet per second of flow leaves the spring pool. This flow of high quality water is critical to the aquatic habitat in downstream reaches of Halter Creek.

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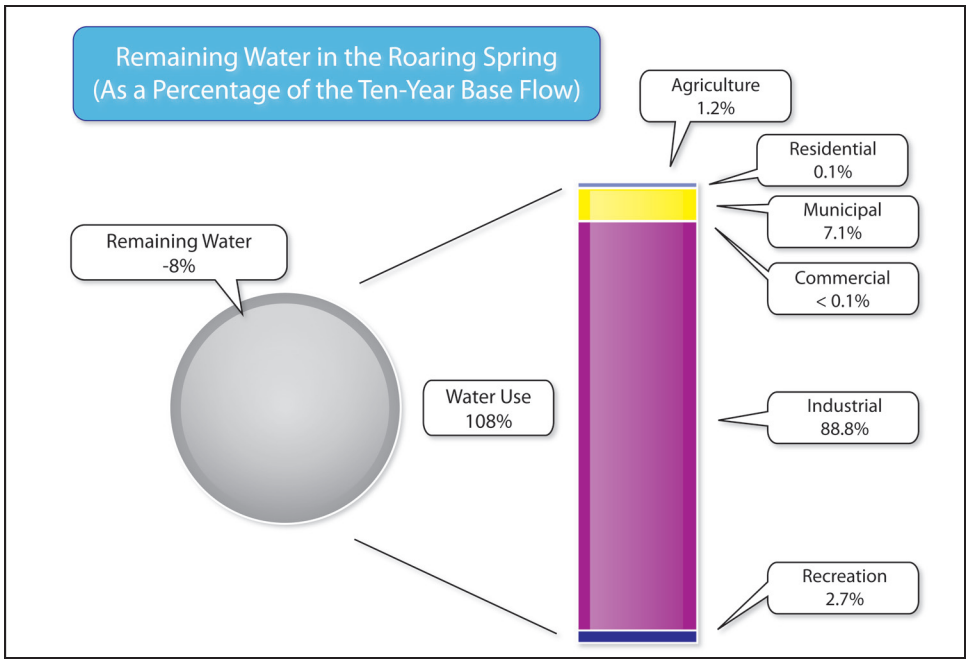
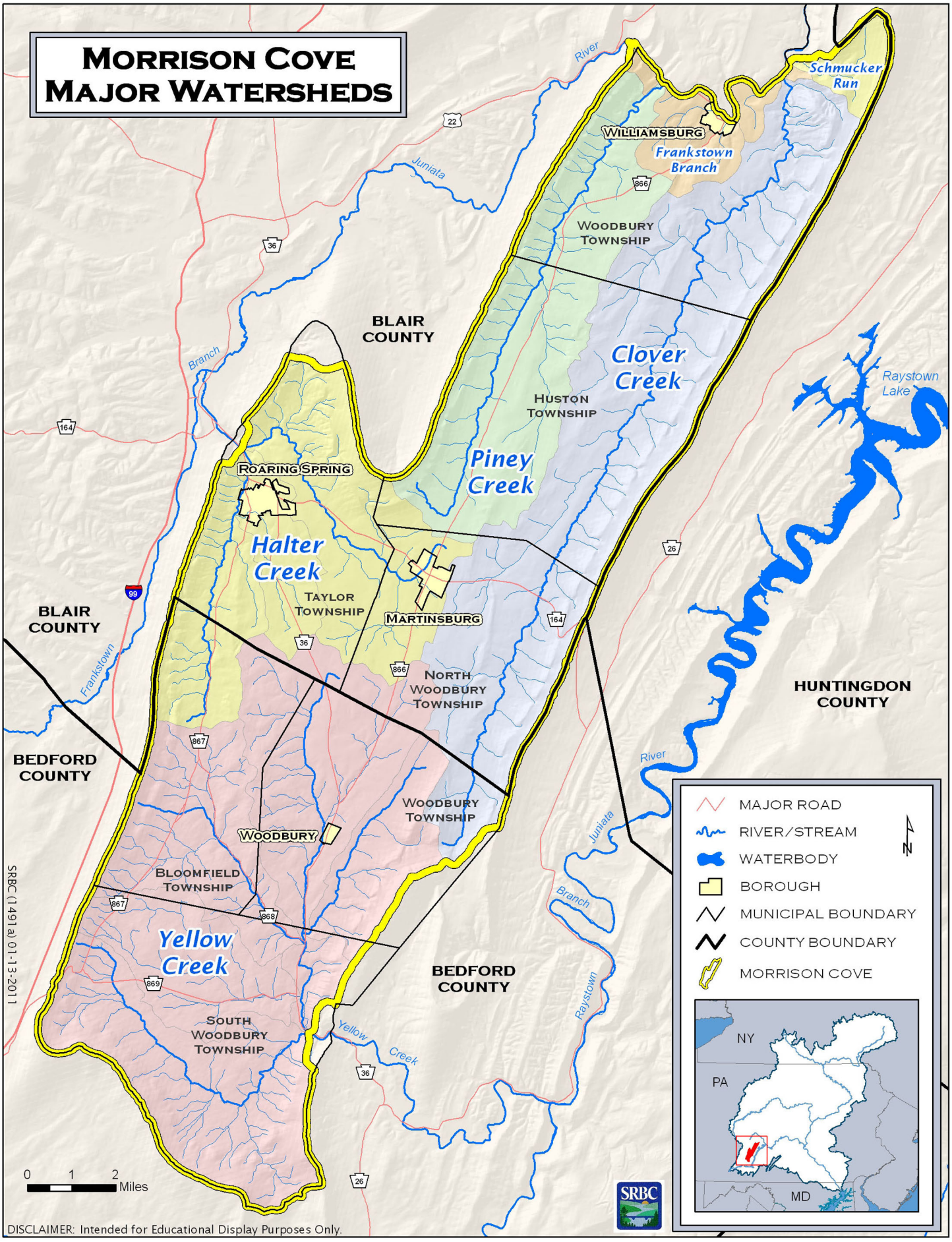
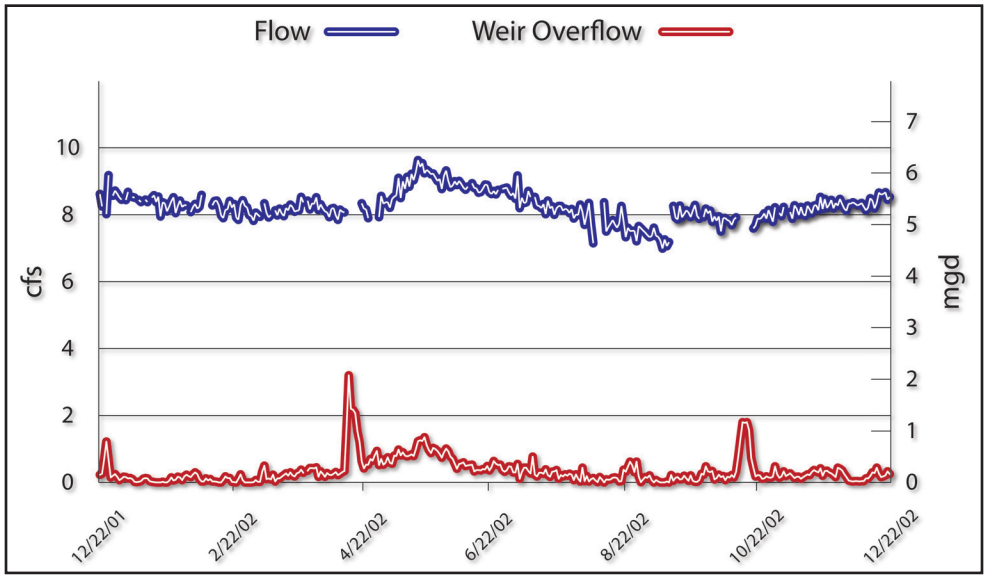


Remaining Water in the Roaring Spring



Morrison Cove Watersheds



Hydrograph of spring flow and spring pool discharge for the Roaring Spring during the 2001-2002 drought. The 'weir overflow' is the amount of water remaining after water user withdrawals. The amount of water withdrawn essentially equaled the total spring flow on several occasions.

The study identified two unusually permeable hydrogeologic terrains as Critical Aquifer Recharge Areas. The central portions of the study area are underlain by highly permeable sandy carbonates and sandstones of the Gatesburg Formation (Gatesburg Terrain). These are overlain by a relatively thick mantle of weathering residuum composed largely of fine sand. The sandy residuum has a very high infiltration rate and correspondingly low runoff rate, and is a nearly ideal medium for maximizing and storing recharge. The Gatesburg Terrain provides groundwater to the largest springs in the study area. The Gatesburg Terrain also provides the only water in the valley that is relatively low in agrichemical constituents.

The second unusually permeable terrain consists of a narrow belt of highly soluble limestones situated along the toeslope of the surrounding ridges. The ridges provide relatively acidic, but otherwise high quality, groundwater and surface water runoff to the soluble limestones where extensive strike-oriented karst conduits have developed. These conduits convey most of the local and mountainside recharge to springs and seeps located in the downstream reaches of the watersheds. They are largely responsible for the generally high quality aquatic habitat available in the downstream reaches of the ridge-parallel streams.

Nitrate levels in the base flow of streams were generally below state and federal drinking water standards, in contrast to the surrounding groundwater. This was taken to be the result of nitrogen uptake in riparian zones. Until the elevated nitrate levels in the groundwater of the Interior Carbonate Terrain are addressed, the stream water may be a viable alternative water supply source for some uses. Surface water withdrawals from the downstream reaches of the Yellow Creek, Piney Creek, and Clover Creek Watersheds could supply water needs with minimal impacts to existing users and aquatic habitat. Stream water quality may be further improved by restoration of riparian zone vegetation. The resulting improvements would include water quality, aquatic habitat, and channel stabilization.

In light of the study findings, SRBC has developed the following recommendations to help secure adequate yields, ensure the protection of current uses and aquatic and riparian needs, and help prevent adverse impacts to the water resources and aquatic habitat of Morrison Cove.

SRBC Recommendations

- Manage withdrawals from the Roaring Spring to ensure their sustainability, and to maintain and protect aquatic habitat in Halter Creek.
- Focus groundwater development for municipal grade wells on the aquifers having both high quality water and sufficient permeability to allow high production rates (i.e., the Gatesburg Terrains).
- Locate municipal-grade surface water withdrawals at downstream locations where the maximum amount of water is available and where impacts to existing users and the environment would be minimized.
- Locate large groundwater withdrawals in the downgradient portions of major recharge areas, where more water is available.
- Locate large groundwater withdrawals within watersheds in the downstream reaches to minimize the stream miles with reduced base flow and altered flow regime.
- Protect water quality in the two major Critical Aquifer Recharge Areas: the Gatesburg North and South Terrains through use of appropriate Best Management Practices (BMPs).
- Protect water quantity in the Gatesburg Terrain areas (north and south) through use of Stormwater and Development BMPs, to minimize impervious cover.
- Treat waters for nitrate levels that exceed federal Safe Drinking Water standard (10 mg/l), as is typical in the Interior Carbonates Terrain.
- Develop and implement methods to eliminate surplus manure.
- Encourage the restoration of riparian vegetation to increase the natural treatment of water and to improve aquatic habitat.
- Measure and record flow through the existing weirs on Plum and Halter Creeks, and on the Roaring Spring pool discharge on a daily basis.
- Continue and expand the collection of reported water use data.