Elk Headwaters

Watershed Protection Plan

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Downstream Strategies
building capacity for sustainability

EHWA Elk Headwaters Watershed Association

ABOUT THIS DOCUMENT

This protection plan operates as a watershed-based plan, and serves as a single document that references previous Elk Headwaters Watershed Association watershed planning and analysis activities. This protection plan is in addition to a binder of documents, tools, and resources, and refers to the deliverables from various planning and analysis activities since 2008.

ACKNOWLEDGEMENTS

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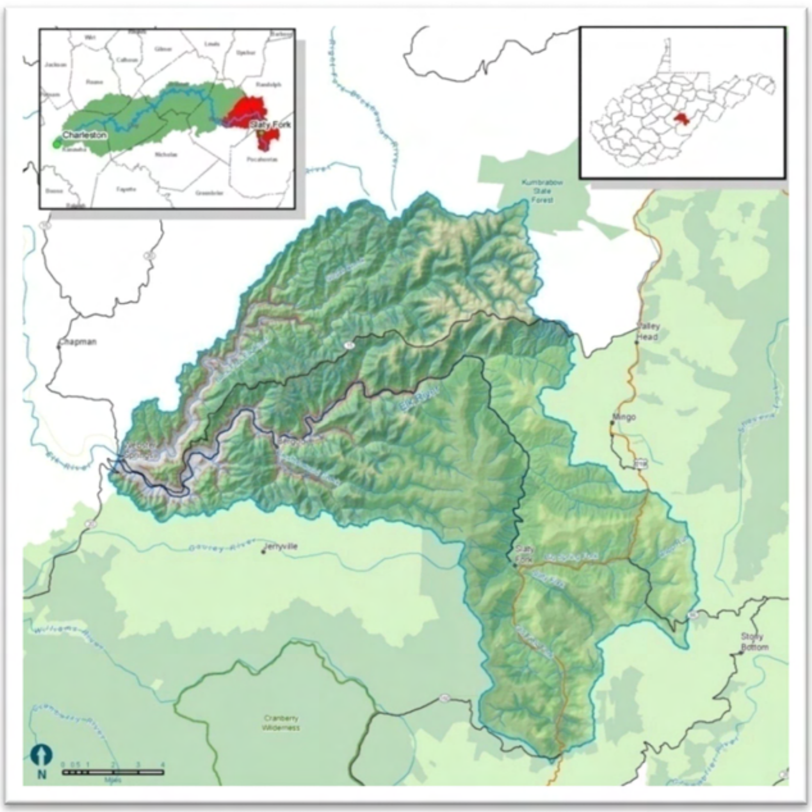
ABBREVIATIONS

BMP	best management practice
CNT	Center for Neighborhood Technology
CWP	Center for Watershed Protection
EHWA	Elk Headwaters Watershed Association
GIS	geographic information system
NSD	natural stream design
TSS	total suspended solids
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WVDEP	West Virginia Department of Environmental Protection
WVDHHR	West Virginia Department of Health and Human Resources

1. INTRODUCTION

The Elk River headwaters, flowing in Pocahontas, Randolph, and Webster Counties, are comprised of unique, high-quality, cold-water streams that support reproducing populations of brook, brown, and rainbow trout (Figure 1). The watershed drains about 241 square miles, and also supports diverse species of breeding birds and an endemic crayfish. This fragile watershed, located atop karst geology, includes underground rivers and caves. Historically supported by logging and agriculture, Pocahontas County has a population of about 9,000. Ecotourism, including Snowshoe Ski Resort and family-run businesses, accounts for millions of dollars of economic activity annually.

Figure 1: Elk headwaters watershed



The Elk Headwaters Watershed Association (EHWA) has demonstrated its commitment to the Elk headwaters watershed by completing the Elk Headwaters State of the Watershed (Hansen and Boettner, 2008) and the Elk Headwaters Common Vision for the Future (Hansen et al., 2009). Based on stakeholder consensus, current available resources, and the objectives of monitoring and remediation defined in the Quality Assurance Project Plan for Elk Headwaters Watershed Association Sediment Projects (Martin and Zegre, 2011a) and Elk Headwaters Water Quality Monitoring Plan (Martin and Zegre, 2011b), projects and monitoring are focused in the following subwatersheds: Old Field, Big Spring, and Slaty Forks (Figure 2). This watershed protection plan focuses on sediment and fecal coliform in these three high priority subwatersheds.

Figure 2: Subwatersheds in the Elk headwaters watershed

As part of its broader watershed planning and analysis efforts, EHWA has contracted with Downstream Strategies to complete a project that includes the following elements:

- a groundwater and surface water vulnerability analysis,
- a septic inventory,
- predicted septic failure rates,
- septic density thresholds,
- a decentralized wastewater option analysis,
- reachshed modeling for sediment and fecal coliform,
- a geographic information system (GIS) tool for water quality information and decision support,
- future land use scenarios,
- a water quality monitoring plan,
- a quality assurance project plan, and
- stream restoration conceptual designs.

Most of the items–including summary statistics and maps—are documented in the Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011). These analyses and data, previously-completed documents, and this watershed protection plan will be bound together to create a final work product.

2. POTENTIAL CAUSES AND SOURCES OF POLLUTION

The Elk requires clean, clear, cold water to maintain its trout fishery. Based on the Elk Headwaters State of the Watershed (Hansen and Boettner, 2008) and stakeholder consensus in the Elk Headwaters Common Vision for the Future (Hansen et al., 2009), significant threats to the health of the watershed include the following: second-home construction sites, landowner riparian disturbances, new impervious surfaces, logging operations, and farms. Pollutants of concern include bacteria, nutrients, organic loads, heat, and suspended solids. Additional pollutant loads and flow increases would reduce aquatic invertebrate populations and threaten the trout, other aquatic species, and birds that depend on them. Watershed residents and other stakeholders seek to maintain and improve the watershed and its good health.

For more detailed information about the extent to which pollution sources are present in the watershed, refer to the following documents:

- Elk Headwaters State of the Watershed (Hansen and Boettner, 2008)
- Elk Headwaters Common Vision for the Future (Hansen et al., 2009)
- Elk Headwaters On-the-ground Sediment Projects (Zegre and Gaujot, 2010)
- Quality Assurance Project Plan for the Elk Headwaters Watershed Association Sediment Projects (Martin and Zegre, 2011a)
- Elk Headwaters Water Quality Monitoring Plan (Martin and Zegre, 2011b)
- Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011)

The comprehensive watershed planning process, much of which is documented in the Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011), developed several tools to assist stakeholders and decision-makers. These tools include reachshed modeling, vulnerability analysis, and septic density threshold development. Data layers were developed for reachshed modeling such as a septic inventory and a map of impervious areas, both of which are useful for estimating causes and sources of pollution.

2.1 Sediment

Sedimentation occurs when dirt is washed from the land or streambanks into the streams, and is deposited on the stream bed. Erosion can be natural, but is greatly accelerated when land is disturbed without proper best management practices when houses are built, fields are plowed, and hills are logged. Petty et al. (2005) conducted an analysis to relate activities on land with elevated total suspended solids (TSS) concentrations. Three factors were found to be related to TSS concentrations measured in streams: the amount of harvested timberland, developed land, and roads. This analysis also specifically studied sediment issues in the Elk headwaters, using TSS and flow data to calculate mean TSS loads for subwatersheds across the watershed. The subwatersheds with the highest sediment loads within the study area include portions of the Big Spring Fork and Old Field Fork subwatersheds, which were prioritized in developing sediment projects.

2.1.1 *Streambank erosion*

Besides impervious area, another means to quantify sedimentation in the Elk headwaters watershed is through an inventory of eroded streambanks. The total length of *eroded* streambanks has not been identified in the watershed; however, there are a total of 312 linear miles of streambanks across the watershed (Table 1). Streambanks within forested areas are presumed to be stable unless direct evidence suggests otherwise. For this reason, we focus our calculations of potential projects and associated costs on the 67 miles of streambank that do not flow through forested areas.

Table 1: Streams and streambanks in the Elk headwaters watershed (miles)

Subwatershed	Streams	Streambanks	Unforested streambanks
Big Spring Fork	60	120	33
Old Field Fork	88	176	33
Slaty Fork	8	16	1
Total	**156**	**312**	**67**

Sources: Boettner et al. (2011) and Hansen and Boettner (2008).

Although no comprehensive inventory of eroded streambanks exists in the Elk headwaters, several high priority projects have been identified and quantified. In summer 2010, EHWA partnered with Downstream Strategies and Canaan Valley Institute to perform stream assessments and develop conceptual stream restoration designs. Downstream Strategies worked with EHWA and other stakeholders to develop an initial list of potential projects that may address sedimentation issues. Snowball sampling, or asking people to identify other projects, was the primary method of developing the initial list of potential projects. Overall, the project team contacted 21 landowners in the Elk headwaters to discuss methods and resources to address sedimentation issues; 13 were met at their properties in June 2010.

These projects were prioritized based on two major factors: (1) the project's potential to reduce sedimentation, and (2) landowner willingness to see the project to successful completion. Other prioritization matrices used included the following: (a) potential to reduce fecal coliform; (b) potential for training and public outreach; (c) potential for matching funds and in-kind donations; (d) potential for overall success; and (e) physical conditions, including water quality, channel scouring/sediment deposition, channel stability, riparian habitat conditions, stream type, and slope characteristics. This effort served to prioritize three sites for four on-the-ground sediment projects in high priority subwatersheds, two of which are detailed in Elk Headwaters On-the-ground Sediment Projects (Zegre and Gaujot, 2010). The four prioritized projects are described in Table 2.

Table 2: Elk headwaters on-the-ground sediment projects and estimated total erosion

Project name	Subwatershed	Reach length (feet)	Streambank stabilized (feet)	Total erosion (tons/year)
Cup Run at Snowshoe	Big Spring Fork	3,093	6,186	1,056
Old Field Fork on Gibson property (mainstem)	Old Field Fork	3,329	6,658	1,450
Old Field Fork on Gibson property (tributary)	Old Field Fork	203	406	N/A
Big Spring Fork at Beckwith property	Big Spring Fork	1,089	2,178	178
Total		**7,511**	**15,022**	**2,684**

Source: Zegre and Gaujot (2010).

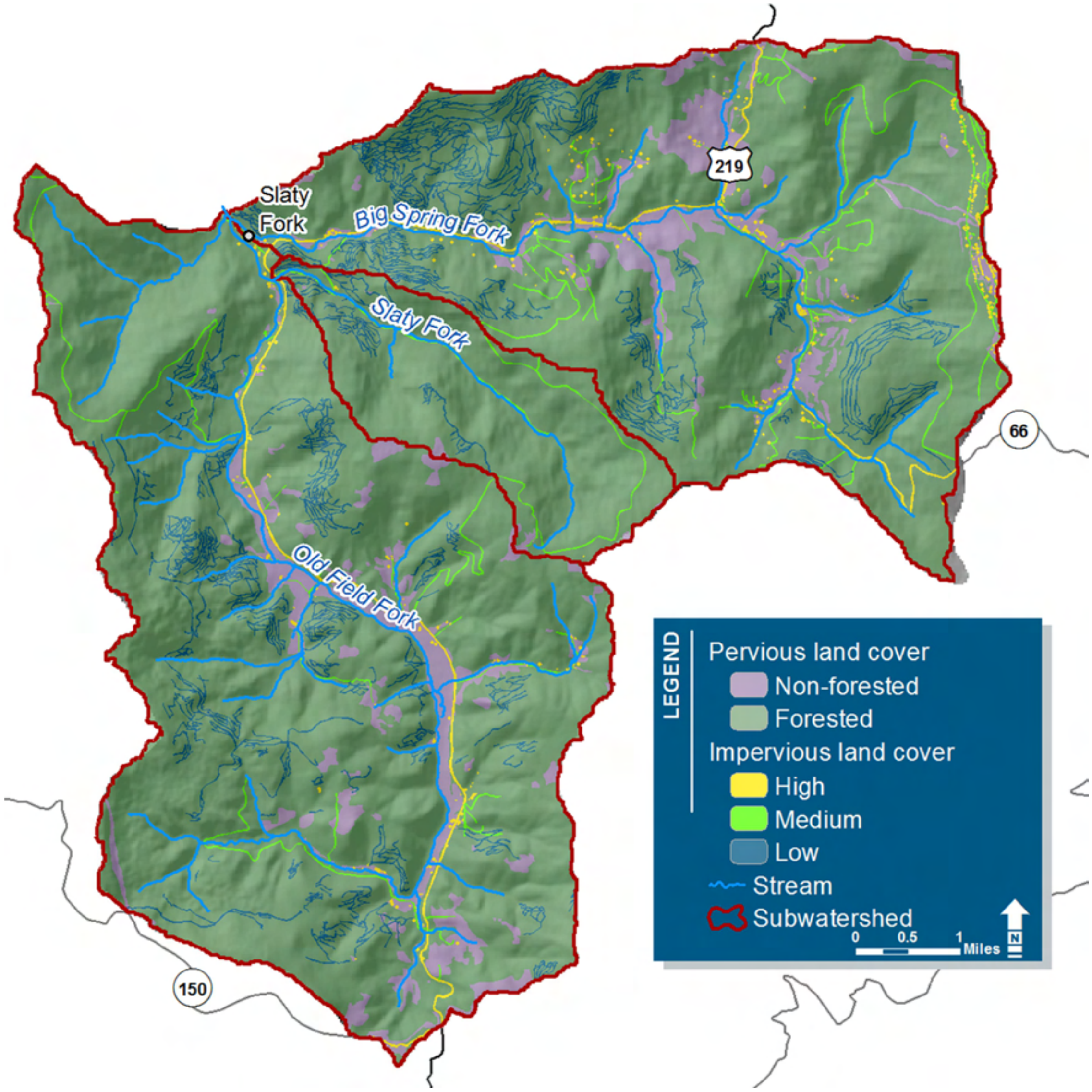
2.1.2 *Agriculture*

Agricultural activities, especially livestock, can cause erosion and sedimentation. The maximum length of streams flowing through pastures has been calculated based on updated land use data (Table 3). Comprehensive data are not available on type, number, or exact location of livestock within the watershed, but any livestock in the watershed presumably are located on open land as opposed to forest or developed areas. For this reason, our analysis included all open land—shown as pervious, non-forested in Figure 3—resulting in maximum estimates of stream length through pasture and corresponding maximum estimates of agricultural project costs.

Table 3: Maximum stream length through pasture (miles)

Subwatershed	Streams	Streambanks
Big Spring Fork	13.6	27.3
Old Field Fork	14.7	29.3
Slaty Fork	0.1	0.1
Total	**28.3**	**56.7**

Figure 3: Land cover (forested and non-forested) and imperviousness (low, medium, high)



Source: Boettner et al. (2011).

2.1.3 *Developed areas*

As found by Petty et al. (2005), sedimentation is directly linked to development, which can be quantified by the area of impervious surfaces. Imperviousness is an important indicator of water quality, and the quantification of imperviousness threshold levels directly assists in understanding the negative effects of urban runoff on in-stream water quality (Arnold and Gibbons, 1996; Brabec et al., 2002). Generally, research indicates that streams in catchments with greater than 10% imperviousness have a higher likelihood of experiencing water quality degradation. Common thresholds include catchments that are protected (less than 10%), impacted (10-30%), and degraded (greater than 30%) (Arnold and Gibbons, 1996; Brabec et al., 2002). These thresholds are still being refined; a more recent educational tool, for example, describes streams with catchments at 8-10% imperviousness as stable but with erosion apparent. This tool also notes a threshold of 20%, at which stream substrate quality decreases and erosion is active (CWP, 1998; 2004).

The Elk Headwaters State of the Watershed (Hansen and Boettner, 2008) compiled 2001 land use data across the Elk headwaters. The Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011) reclassified the land use layer to divide the impervious layer into three levels:

- high, which includes polygons for buildings, buffered structure layer points, and paved roads;
- medium, which includes "major" gravel and dirt roads; and
- low, which includes skid tracks and logging roads.

Table 4 and Figure 3 show the reclassified land cover in the watershed. Big Spring Folk has the highest percent of total impervious acres: 1.9%. In the Elk headwaters, impervious area is relatively low; however, impervious areas continue to grow as development proceeds.

Table 4: Imperviousness in the Elk headwaters watershed by level and subwatershed

		Impervious levels (acres)			
Subwatershed	**Total acres**	**Low**	**Medium**	**High**	**Total acres impervious**
Big Spring Fork	13,631	122.2 (0.9%)	79.7 (0.6%)	54.2 (0.4%)	256.1 (1.9%)
Old Field Fork	17,880	116.0 (0.7%)	45.9 (0.3%)	43.3 (0.2%)	205.2 (1.2%)
Slaty Fork	3,122	15.8 (0.5%)	18.2 (0.6%)	0.4 (<0.1%)	34.4 (1.1%)
Total	**34,633**	**254 (0.7%)**	**143.8 (0.4%)**	**97.9 (0.3%)**	**495.7 (1.4%)**

Source: Boettner et al. (2011).

2.2 Fecal coliform

The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with fecal material from people or warm-blooded animals. Bacteria from wastewater can enter streams if untreated or poorly treated human sewage is directly discharged to streams or if contaminated groundwater flows to surface waters. Stormwater runoff can direct bacteria to streams from pet manure in developed areas. Farm animals and wildlife also contribute bacteria to streams. Of the 76 instream fecal coliform data points compiled in the Elk Headwaters State of the Watershed (Hansen and Boettner, 2008), four data points—two from 1997 and two from 2008—exceed West Virginia's fecal coliform water quality standard of 400 cfu/100 mL. These exceedances were found in Big Spring Fork above Cup Run.

Despite the fact that high levels of fecal coliform bacteria have rarely been found in streams in the watershed, proper treatment of wastewater has been a concern in the Elk headwaters due to problems with existing centralized treatment systems and concerns over sensitive karst topography. If bacteria are not properly addressed, they can travel via karst into groundwater, potentially impacting drinking water wells.

2.2.1 *Agriculture*

In addition to erosion and sedimentation, fecal coliform pollution can be generated by farms, especially livestock operations.

2.2.2 *Wastewater treatment*

Since 2002, when the West Virginia Department of Environmental Protection (WVDEP) issued orders that cited numerous violations of Snowshoe Mountain Resort's National Pollutant Discharge System Elimination System permits for its three wastewater treatment plants, a vigorous debate has taken place regarding the most appropriate approach for meeting Snowshoe's needs, while also serving the valley. In fact, wastewater treatment has been the most high-profile water quality issue in the Elk headwaters watershed in the past decade. Various solutions have been proposed, including a new centralized wastewater treatment plant, upgrades to existing plants, or a more decentralized approach using onsite or cluster systems.

The Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011) developed several tools that will be helpful for stakeholders and decision-makers in identifying potential causes and sources of fecal coliform pollution, including the septic inventory, predicted septic failure rates, and septic density thresholds.

Downstream Strategies created a GIS data layer to represent locations of existing septic systems because such a GIS layer does not currently exist for Pocahontas County. Methods are described in the Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011). The data set contains 272 septic locations within the study area (Table 5).

Downstream Strategies also created a spatial dataset of at-risk areas for septic development; this analysis assesses the likelihood of septic system failure to help understand the potential discharges of untreated or poorly treated wastewater from these homes.

Table 5: Septic inventory

Subwatershed	Existing septics
Big Spring Fork	181
Old Field Fork	91
Slaty Fork	0
Total	**272**

Source: Boettner et al. (2011).

3. NONPOINT SOURCE MANAGEMENT MEASURES

A variety of tools developed through the comprehensive watershed planning process will be used to implement this plan. For example, the prioritized sediment projects serve as a key component to help meet sediment reduction goals. In addition, the vulnerability analysis and GIS tool will be used to identify critical areas for protection or management action.

3.1 Sediment

3.1.1 *Streambank erosion*

General measures to reduce streambank erosion include stabilizing streambanks using natural stream design (NSD). Streambank stabilization projects can promote appropriate riparian vegetation that prevents the banks from eroding during high flows. Principles of NSD can ensure that stream channels are of the appropriate size and dimensions to handle the flows that are generated by a watershed, and that inevitable high flows are handled appropriately. Many areas in the Elk headwaters, including the prioritized on-the-ground sediment projects in high priority subwatersheds, could benefit from NSD techniques such as use of brush mattresses (Figure 4) to maintain grade control, add in-stream habitat, and rebuild a native riparian floodplain adjacent to the channel. The specific management measures to be used in the prioritized on-the-ground sediment projects are detailed in Table 6.

Figure 4: Brush mattress preparation, before tie-down, and after one-year growth

Photos: Ryan Gaujot

Table 6: Management measures, pollution prevention, and cost for the on-the-ground sediment projects

Project name	Constructed riparian buffer (square feet)	Brush mattresses (feet)	Bankfull bench creation (cubic yards)	Fencing (feet)	Structures	Culvert retrofits	Water gaps	Sediment load reduction of 25% (tons/year)	Cost
Cup Run at Snowshoe	106,702	5,077	9,632	0	9-12	3	0	264	$343,384
Old Field Fork on Gibson property (mainstem)	270,714	1,909	21,136	3,369	0	0	0	363	$457,929
Old Field Fork on Gibson property (tributary)	5,744	406	4,054	0	8-12	1	0	N/A	N/A
Big Spring Fork at Beckwith property	46,121	1,217	9,417	1,275	6-8	1	1	45	$226,407
Total	**423,537**	**8,609**	**44,239**	**7,747**	**23-32**	**5**	**1**	**672**	**$1,027,720**

Source: Zegre and Gaujot (2010). Note: Load reduction and total project cost of Old Field Fork tributary is part of the Old Field Fork mainstem.

3.1.2 *Agriculture*

In agricultural areas, several best management practices (BMPs) can be used to prevent direct livestock access to streams, thereby protecting streambanks from disturbance. These agricultural BMPs not only reduce streambank erosion, but can also reduce fecal coliform pollution.

- **Livestock fencing.** If livestock are kept away from the streams, they cannot trample the streambanks and disturb the riparian vegetation.
- **Armored stream crossings**. Sometimes, it is necessary to preserve stream crossings so that livestock can be moved to other locations. Armored stream crossings can prevent livestock from disturbing riparian areas.
- **Alternative watering sources**. If livestock are fenced away from streams that had been used for watering, alternative watering sources such as springs may need to be developed.
- **Riparian buffers**. Stream buffers allow natural riparian vegetation to grow, stabilize streambanks, and filter pollutants contained in runoff before it is discharged into streams.

3.1.3 *Developed areas*

Stormwater runs off from land more quickly when forests and fields are developed into impervious surfaces. This runoff carries sediment, fecal coliform, and other pollutants to the streams. Measures can be taken during development or redevelopment to promote infiltration of rainwater, reducing runoff.

- **Pervious pavement**. Pervious pavement allows rainwater to infiltrate directly into the land, rather than washing into storm drains before discharging directly to streams.
- **Detention and retention ponds**. Ponds can hold back the initial runoff from a rainstorm so that runoff patterns mimic those during pre-construction periods.
- **Underground storage tanks**. In locations without enough surface area for ponds, storage tanks can be buried to hold back rain water. This approach is often used under parking lots in cities and towns.
- **Rain gardens**. Rain gardens are planted areas designed to absorb storm runoff from impervious areas such as roofs and pavement. They tend to absorb about 30% more than typical lawns. Several factors should be considered when creating a rain garden, including proximity to septic systems, soil permeability, plant selection, and runoff volume (Kassulke, 2003).
- **Rain barrels**. Rain barrels collect runoff from downspouts and hold it for later use watering lawns, washing cars and clothes, and other purposes not requiring potable water.
- **Wetland protection**. Wetlands naturally reduce runoff and flooding. Preserving wetland areas in the vicinity of urban and residential development will buffer the effects of increased runoff from impervious surfaces.

Table 7 details several site-level green infrastructure strategies, techniques, costs, and side benefits.

3.2 Fecal coliform

3.2.1 *Agriculture*

The agricultural BMPs described above in Section 3.1.2 for sediment can help not only reduce streambank erosion, but can also reduce fecal coliform pollution.

Table 7: Site-level green infrastructure strategies, techniques, costs, and side benefits

Strategy	Technique	Description	Cost	Side benefit
Infiltration	Pervious or permeable pavement	Paved surfaces designed to allow water to flow through	Pavers: $5-12/square foot Porous asphalt: $6-8/square foot Porous concrete: $6-12/square foot	Reduced maintenance costs
	Rain gardens	Depressed vegetated areas designed to infiltrate	$5-16/square foot	Improved aesthetics; wildlife habitat
Evapotranspiration	Urban trees	Trees in developed areas	$175-400/tree	Recreational area; wildlife habitat; improved air quality; carbon sequestration
	Stormwater planters	Depressed vegetated areas in sidewalks, parking lots, and streets	Planters: $1-25/square foot Native plants: $0.02-0.13/square foot	Improved aesthetics; urban heat-island reduction; traffic calming
	Green roofs	Lined vegetated areas on rooftops	$9-32/square foot	Longer life than traditional roof; energy savings
	Green walls	Vertical planters on the sides of buildings	$100-125/square foot	Added green space without loss of land area; energy savings
Capture and use	Rain barrels	Smaller containers to capture runoff for re-use	$1-3/gallon capacity	Water utility savings
	Cisterns	Larger containers to capture runoff for re-use	$1-3/gallon capacity	Water utility savings
Managed conveyance	Bioswales	Vegetated shallow ditch	$6-24/square foot	Improved aesthetics
	Downspout disconnection	Disconnecting roof drainage from sewer system	$8-156/spout	Reduced landscaping water costs
	Terraced planter systems	Series of planter boxes stepped into a sloped surface	Unavailable	Improved aesthetics; wildlife habitat
	Level spreaders	Stormwater structures that support filtering action of riparian buffers	Unavailable	Diffuse runoff; reduce sediment; wildlife habitat

Source: Cost estimates from CNT (2009), except green walls from Nephin (2009).

3.2.2 *Wastewater treatment*

There are many options for reducing fecal coliform discharges from onsite sewer systems.

- **Replacing and repairing onsite systems and leach fields**. In some cases, onsite systems are the most appropriate solution but are in need of replacement or repair. Traditional septic systems and drain fields can work well if properly installed and maintained. In addition, the West Virginia Department of Health and Human Resources (WVDHHR) will consider “alternative and experimental sewer systems” on sites of at least two acres (WVDHHR, 2003). These systems, commonly referred to as “class II,” may include “shallow fields, soil absorption mounds, shallow beds, low pressure pipe systems, elevated fields, evapotranspiration systems and unique systems designed for specific situations” (WVDHHR, 2003).
- **Installing mound systems**. Mound systems, in which drainfields are installed above the original soil surface in a sand mound, provide better wastewater treatment if the permeability of the original soil is too fast or slow, or if a home is located in a particularly sensitive area. The possible increased use of mound systems for new onsite wastewater treatment is discussed in the Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011).
- **Installing community cluster systems**. In some cases, cluster systems are a more practical or economical alternative. Cluster systems can serve up to hundreds of homes. These systems incorporate options that bridge the extremes between individual onsite systems and centralized

systems. Septic tanks are installed at each house, and the septic tank effluent is then piped to a central location for treatment and dispersal.

- **Extending lines for municipal and public service district systems**. Collection systems for large, centralized systems can be extended in some locations to take on new customers that are now discharging wastewater through failing or nonexistent onsite systems. Centralized systems may be the best approach for certain homes, depending on the distance from the treatment plant, the expense of extending lines, and whether the home is located near wetlands or floodplains or in a location where septics are likely to fail.

3.3 Conservation easements

Conservation easements voluntarily transfer land use rights for the purposes of land conservation. They typically involve the creation of a legally enforceable agreement created between a landowner and government or land trust entity to protect lands from certain forms of development or use. Although the land remains the private property of the landowner, the agreement restricts certain activities such as real estate development, commercial and industrial uses, and other specified activities. Conservation easements provide tax advantages for the landowners as well as environmental benefits. This management measure can be used to address both sediment and fecal coliform pollution related to streambank erosion, agriculture, or developed areas.

Nationally, organizations such as Trust for Public Land provide information and support for this conservation technique. For more information about Trust for Public Land, visit: www.tpl.org.

The West Virginia Land Trust works to conserve land in the state by undertaking or assisting in land or conservation easement acquisition. It also provides stewardship of such land or easements and coordinates assistance to the Coalition of West Virginia Land Trusts. For more information about the West Virginia Land Trust, visit: www.wvlandtrust.org.

The Coalition of West Virginia Land Trusts includes the following:

- Cacapon and Lost River Land Trust: www.cacapon.org
- Potomac Conservancy: www.potomac.org
- Land Trust of the Eastern Panhandle: www.landtrustepwv.org
- Greenbrier Land Conservation Trust
- The Nature Conservancy: www.nature.org
- Trust for Public Land: www.tpl.org
- National Committee for the New River: www.ncnr.org

The Coalition works to build partnerships with county farmland protection boards and public agencies to promote conservation in the state. State partnerships include:

- Statewide Farmland Protection Authority
- West Virginia Farmland Protection: www.wvfarmlandprotection.org

Regionally, the Pocahontas County Commission created the Pocahontas County Farmland Protection Board to provide for conservation easements as a quasi-governmental county agency. By its creation in 2004, the Commission acknowledged the local, regional, and statewide importance of agriculture in Pocahontas County. Values of the agricultural community included: enhancing tourism, protecting community values, preserving institutions and landscapes associated with traditional farming, and controlling urban expansion. For more information about the Pocahontas County Farmland Protection Board, visit: www.pocahontascountycommission.com/Boards/Farmland_Protection_Program.

4. ESTIMATED POLLUTION PREVENTION AND COSTS

There are no impaired waters in the Elk headwaters on West Virginia's 303(d) list; therefore, there are no total maximum daily load analyses from which to draw estimates of pollution prevention.

4.1 Sediment

4.1.1 *Streambank erosion*

The Elk Headwaters On-the-ground Sediment Projects proposal (Zegre and Gaujot, 2010) identifies projects that address identified sedimentation issues in high priority subwatersheds in the Elk headwaters. Anticipated benefits are detailed in Table 2 and Table 6. Additional sediment projects will build on successes of the initial projects.

4.1.2 *Agriculture*

In order to most effectively reduce streambank erosion in agricultural areas, it is necessary to keep livestock away from the streams. Riparian buffers may accelerate and protect streambank stabilization efforts. Additional measures are often necessary when livestock are fenced away from streams. These include armored stream crossings and alternative watering sources. Table 8 presents unit cost estimates for fencing, riparian buffer establishment, stream crossings, and alternative watering sources.

Table 8: Estimated costs of agricultural best management practices

Best management practice	Unit cost	Unit
Livestock fencing	$2	linear foot
Riparian buffer establishment	$1,000	acre
Armored stream crossing	$1,200	18-inch culvert, 20-foot length
	$2,800	30-inch culvert, 30-foot length
	$5,900	48-inch culvert, 40-foot length
Alternative watering source	$3,000	Per watering best management practice

Source: Hardy et al. (2007), Meyer and Olsen (2005), USDA (2008).

In order to estimate the total potential cost of agricultural BMPs, a GIS analysis was conducted to determine the acreage of pasture in the Elk headwaters watershed, as well as the linear feet of stream passing through pasture. This pasture land is concentrated in the Big Spring Fork and Old Field Fork subwatersheds in stream valleys. Table 9 shows the length of stream that flows through pasture. This is considered a maximum estimate of the length of stream that flows through agricultural land because not all areas characterized as pasture are likely to be agricultural land. The required length of fencing assumes that both sides of the stream through pasture would be fenced. The number of stream crossings and alternative watering sources assumes that one each is needed per 1,000 feet of stream through pasture.

Table 9 also shows each subwatershed's unforested stream length. These lengths are greater than the corresponding stream lengths through pasture because they also include developed areas. The calculation of acres of riparian buffer to be constructed assumes a 35-foot buffer on each side of the stream for all non-forested areas, including pasture and other areas.

Table 9: Maximum agricultural measures required

Subwatershed	Stream length through pasture (miles)	Unforested stream length (miles)	Fencing required (miles)	Riparian buffer required (acres)	Stream crossings and alternative watering sources
Big Spring Fork	13.6	16.3	27.3	138.7	72
Old Field Fork	14.7	16.7	29.3	141.4	78
Slaty Fork	0.1	0.6	0.1	5.0	1
Total	**28.3**	**33.6**	**56.7**	**285.0**	**151**

Note: Unforested stream length includes stream length through pasture and developed areas. Fencing is calculated as twice the stream length through pasture. A 35-foot riparian buffer is calculated for all unforested stream miles, not limited to pasture land.

Sediment load reduction efficiencies of 75% and 56% can be assumed for fencing and riparian buffer best management practices, respectively (Chesapeake Bay Program, 2007). Riparian buffer and total reductions can be calculated by assuming that of the 25% of sediment still reaching the stream after fencing is in place, 56% will be trapped by the addition of a riparian buffer, for a total reduction of 89%.

For this plan, a goal of installing agricultural BMPs on 15% of affected streambanks translates to a maximum of 8.5 miles of fencing and 36 acres of riparian buffer in pasture land.[1] An 89% sediment reduction rate for projects along affected streambanks would result in a 13% reduction of total sediment sourced from agricultural lands across the watershed.[2]

Table 10 shows the estimated costs of fencing, riparian buffer, stream crossings, and alternative watering sources. Because some parcels classified as pasture may already be fenced and other parcels may not be active pasture land, the cost estimates should be considered an upper bound.

Table 10: Estimated costs of agricultural best management practices by subwatershed

Subwatershed	Fencing	Riparian buffer	Stream crossings	Alternative watering sources	Total
Big Spring Fork	$288,000	$139,000	$202,000	$216,000	$845,000
Old Field Fork	$310,000	$141,000	$218,000	$234,000	$903,000
Slaty Fork	$1,000	$5,000	$3,000	$3,000	$12,000
Total	**$599,000**	**$285,000**	**$423,000**	**$453,000**	**$1,760,000**

Note: These calculations were performed using the data presented in Table 8 and Table 9, including the middle estimate for stream crossing cost. Riparian buffer cost is calculated for all unforested stream miles and is not limited to pasture land.

To develop more precise cost estimates for agricultural areas, it will be necessary to initiate a process with agencies and local organizations that interface with the agricultural community. Ultimately, the projects implemented will depend upon the size, function, and layout of individual farms.

4.1.3 *Developed areas*

As described above, the calculated acres of riparian buffer area are based on each subwatershed's unforested stream length, which includes developed areas in addition to pasture land. Approximately 16% of this stream length is through developed areas, with the remainder through pasture land; therefore, a mitigation goal of 15% of would require approximately 7 acres of riparian buffer along streams through developed areas.

A second goal is to implement at least 20 site-level green infrastructure strategies such as those detailed in Table 7. This could include, for example, some combination of rain barrels and rain gardens.

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[1] An additional 7 acres of riparian buffer in developed areas is discussed below in Section 4.1.3.

[2] Assuming unforested land not classified as impervious is agricultural, an 89% reduction on 15% of the land would result in a 13% reduction: 0.89 x 0.15 = 0.13.

4.2 Fecal coliform

4.2.1 *Agriculture*

The agricultural BMPs described above in Section 4.1.2 for sediment can help not only reduce streambank erosion, but can also reduce fecal coliform pollution. When agricultural areas are targeted, consideration should be given to identifying measures that will reduce both sediment and fecal coliform. In this way, efficiencies are created because single projects can address both types of impairments.

Fecal coliform reduction efficiencies of 70% can be assumed for fencing pasture away from streams and for planting riparian buffers (Hardy et al., 2007). Riparian buffer and total reductions can be calculated by assuming that of the 30% of bacteria still reaching the stream after fencing is in place, 70% will be trapped by the addition of a riparian buffer, for a total reduction of 91%.

The same goal as above of installing agricultural BMPs on 15% of affected streambanks would result in a 14% reduction of total fecal coliform sourced from agricultural lands across the watershed.[3]

4.2.2 *Wastewater treatment*

The Pocahontas County Public Service District is debating the best path forward for its centralized treatment plants. No matter which path is taken by the District, there will still be numerous homes not served by centralized treatment, which must rely on onsite or cluster systems. There is no estimate available of the fecal coliform loads currently discharged by untreated wastewater, failing onsite systems, or discharges from permitted facilities over and above permit limits. Estimates are also not available for load reductions that can be achieved by the District or by individual homeowners.

[3] If all unforested land not classified as impervious is agricultural, a 91% reduction on 15% of the land would result in a 14% reduction: 0.91 x 0.15 = 0.14.

5. ASSISTANCE NEEDED

A combination of federal and state agencies, academic institutions, watershed organizations, consultants, and citizens will be involved in providing technical and financial assistance for Elk headwaters watershed projects. Some listed entities are more appropriate to address sediment issues and some are more appropriate for fecal coliform. Others provide assistance to help address both types of issues.

In general, technical assistance is needed for the following tasks:

- collecting data at pollution sources to design and implement remediation projects;
- creating conceptual designs of remediation projects;
- creating detailed engineering designs of remediation projects;
- performing project management, including putting projects out for bid, managing projects, and tracking their progress;
- monitoring in-stream and source water quality following the installation of remediation projects to document their effectiveness; and
- managing systems after installation, where appropriate.

5.1 Elk Headwaters Watershed Association

EHWA, which spearheaded the development of the comprehensive watershed plan, will continue to play a key role in compiling and disseminating information and in developing partnerships. A strong organization that takes a watershed-focused approach is essential to plan implementation. EHWA will take a leading role in the development of projects to implement this plan. EHWA provides a significant number of volunteer hours, applies for and administers grants, and helps coordinate government agencies and local entities.

5.2 West Virginia Department of Environmental Protection

Once this plan is approved, the watershed will be eligible for Section 319 funds through the United States Environmental Protection Agency (USEPA). Section 319 grants—administered by WVDEP—can be used to help implement nonpoint source pollution control projects such as those that address streambank erosion. A 40% match is required. For more information visit: http://www.dep.wv.gov/nonpoint

WVDEP and other state agencies have partnered to offer low-interest loans from participating banks to address pollution from nonpoint sources using BMPs approved by USEPA. For more information visit: www.dep.wv.gov/WWE/Programs/SRF/Pages/default.aspx.

The West Virginia Housing Development Fund has partnered with WVDEP to implement the Onsite System Loan Program, which provides low-interest loans to homeowners and those on long-term leases. Loans of up to $10,000 are to be used to replace or repair existing septic tanks or to connect to a public water treatment system.

5.3 West Virginia Conservation Agency

The West Virginia Conservation Agency provides support to local watershed organizations by helping to coordinate and implement 319 projects, especially those related to agriculture and streambank stabilization.

5.4 Natural Resources Conservation Service

The federal Natural Resources Conservation Service offers several grant opportunities, which may be applied for separately or may be used as matching funds for a 319 proposal:

- The Environmental Quality Initiatives Program offers financial and technical assistance to help producers and landowners plan and implement conservation practices to conserve biodiversity and restore and maintain fish and wildlife habitat. The program provides up to a 75% cost-share as well as incentive payments, technical assistance, and education to landowners. Eligible conservation practices include riparian buffers, filter strips, manure management buildings, and wildlife habitat improvement. In addition, incentive payments are provided to landowners who employ nutrient, manure, and integrated pest management practices. For more information visit: www.wv.nrcs.usda.gov/programs/fb_08_FY_2011_Programs/eqip_11/eqip11.html.
- The Wildlife Habitat Incentives Program is a voluntary program that offers financial and technical assistance to help producers and landowners plan and implement conservation practices to conserve biodiversity and restore and maintain fish and wildlife habitat. Wildlife habitat may include upland, wetland, riparian, and aquatic habitat. The projects must target a specific species for habitat improvement, generally require an agreement of 5-10 years, and offer up to 75% cost-share assistance. Eligible projects can help address streambank erosion. The program is primarily targeted toward habitat restoration on private lands, but can also be used to assist landowners in preparing a wildlife habitat development plan. For more information visit: www.wv.nrcs.usda.gov/programs/fb_08_FY_2011_Programs/whip_11/whip11.html.
- The Conservation Stewardship Program provides financial and technical assistance to eligible producers to conserve and enhance soil, water, air, and related natural resources on their land. For more information visit: www.nrcs.usda.gov/programs/new_csp/csp.html.
- The Conservation Reserve Enhancement Program is a federal/state land retirement program targeted to address agriculture-related environmental problems. This program offers financial incentives to encourage farmers to enroll in the Conservation Reserve Program in contracts of 10 to 15 years to remove marginal lands from agricultural production. Eligible land includes cropland or marginal pasture land that has been owned and operated for at least a year and that demonstrates a need, such as wildlife habitat restoration or erosion control. The government pays the rental value of the retired land plus $100/acre, as well as some portion of the costs for necessary improvements. If the project includes active restoration (as opposed to natural regeneration), a cost-share incentive is offered. In West Virginia, this program aims to reduce the occurrence of runoff, sediment, and nutrients from agricultural enterprises by installing, establishing, or restoring riparian buffers, filter strips, wetland areas, trees, and grasses to improve and protect water quality and enhance soil, water, and wildlife resources. For more information visit: www.wv.nrcs.usda.gov/programs/crep.html.
- The Cooperative Forestry Assistance Program provides grants to state forestry agencies to assist in the advancement of forest resources management on non-federal forests and other rural lands. Among the program's objectives are to improve and maintain fish and wildlife habitat. For more information visit: www.fs.fed.us/spf/coop.

5.5 West Virginia Division of Forestry

The West Virginia Division of Forestry has been involved in planning activities in the Elk headwaters watershed in the past, and should be involved in plan implementation in the future.

5.6 United States Fish and Wildlife Service

The United States Fish and Wildlife Service (USFWS) provides several opportunities for technical and financial assistance. Partners for Wildlife can provide technical and financial assistance to retain, create, or manage wetland habitat for wildlife. This voluntary program primarily involves streambank fencing, tree planting, and invasive species control. USFWS offers technical and financial assistance to conserve or restore native ecosystems. The USFWS Cooperative Conservation Initiative provides a 50% match to private individuals to support efforts to restore natural resources and establish or expand wildlife habitat. The Standard Grants Program provides funding for wetland protection.

5.7 United States Environmental Protection Agency

USEPA has created a site for watershed organizations and state and local governments that includes resources to help achieve the goal of the Clean Water Act to improve water quality. The Web site provides tools, databases, and information about sources of funding to protect watersheds. For more information visit: www.epa.gov/owow/funding.html.

USEPA's Center for Environmental Finance hosts a guidebook of financial tools that includes references to various methods to pay for environmental systems, including bonds and grants. For more information visit: www.epa.gov/efinpage/publications/GFT2008.pdf.

5.8 Appalachian Regional Commission

The Appalachian Regional Commission awards grants to public bodies and nonprofit organizations for projects that create opportunities for self-sustaining economic development and improved quality of life for the people of Appalachia. Demonstration project grants fund analyses of funding gaps in drinking water and wastewater projects in the region. Projects related to environmental protection include water and wastewater treatment systems: www.arc.gov/index.do?nodeId=101.

5.9 Other federal programs

The United States Forest Service has participated in the Elk headwaters watershed visioning and planning activities in the past; EHWA should continue to involve the local office throughout plan implementation.

The Transportation Equity Act for the 21st Century authorizes over $200 billion to improve the nation's transportation infrastructure, enhance economic growth, and protect the environment. State and local governments coordinate the transportation project planning and funding processes. The Act provides funding for environmental protection initiatives through grants and set-asides for a wide variety of water quality enhancement and transportation enhancement initiatives. Eligible water quality enhancement initiatives include wetlands mitigation banking, wetlands restoration, and the mitigation of water pollution due to highway runoff. For more information visit: www.epa.gov/owow/tea/teafact.html.

The Federal Emergency Management Agency provides several grants and assistance programs related to flooding, especially where damage to built structures occurs. It also provides assistance for flood mapping. For more information visit: www.fema.gov/government/grant/index.shtm. For more information about the Repetitive Flood Claims Program visit: www.fema.gov/government/grant/rfc/index.shtm.

Compensatory mitigation and mitigation banking opportunities may be available through in-lieu fee programs, if such fees are required as part of the Section 404 permitting process. For more information visit: water.epa.gov/lawsregs/guidance/wetlands/wetlandsmitigation_index.cfm.

The Section 504 Low Income Housing Repair Program, through the United States Department of Agriculture Rural Development Office, is available for rural homeowner-occupants who earn less than 50% of the area median income. The low-interest loans are to be used specifically to render the home more safe or sanitary. Homeowners over 62 years old may be eligible for grants.

5.10 Pocahontas County and neighboring counties

The Pocahontas County Commission, which has actively participated in the planning process, will continue to be a crucial partner. The Pocahontas County Commission has supported EHWA in the past through financial support of the stakeholder visioning process and the planning document, Elk Headwaters Common Vision for the Future (Hansen et al., 2009). Randolph and Webster County Commissions also serve the Elk headwaters and will be brought into the plan implementation process. Pocahontas County may be approached to provide in-kind support for water improvement projects occurring in the watershed. The County may also be approached to support and enforce ordinances related to wastewater management.

The Pocahontas County Water Resources Task Force is working in parallel with these watershed planning activities; its mission includes many similar tasks related to identifying, inventorying, monitoring, raising awareness about, managing, and protecting the county's water resources. Synergies between this plan's implementation and the task force will be important. The task force is currently supporting watershed planning by leading a county-wide water resource management plan that will feed into the state-wide plan.

The Pocahontas County Public Service District, with members appointed by the County Commission, has specific responsibility regarding centralized wastewater treatment and can serve as a resource. The District has been responsible for siting and building a new wastewater treatment plant in the watershed and has interacted with this planning process. This and other districts are important partners to help address issues related to wastewater.

5.11 Trout Unlimited

Trout Unlimited is a nonprofit organization dedicated to the conservation, preservation, and protection of cold water fisheries and their watersheds in the US. Grants are available for river restoration projects. For more information visit: www.tu.org. Trout Unlimited has provided technical and financial support—as well as volunteers—for projects in the Elk headwaters. The West Virginia Council of Trout Unlimited has helped develop this plan and will also play key future roles.

5.12 National Audubon Society and The Nature Conservancy

In alliance with Toyota, the National Audubon Society provided financial support to EHWA in the past for the stakeholder visioning process and the planning document, Elk Headwaters Common Vision for the Future (Hansen et al., 2009). This support was provided through the TogetherGreen Innovation Grant. The Nature Conservancy can help gather planning resources and can partner with private landowners interested in conservation.

5.13 Local entities

Many other organizations and businesses have helped develop the plan and will also play key future roles. Businesses can lead by example by developing and implementing green practices that demonstrate the effectiveness of approaches that protect the environment and support the long-term development of the watershed. A few specific examples follow.

- Snowshoe Mountain Resort helped develop this plan and helped design a proposal for an on-the-ground sediment project. Snowshoe has an opportunity to work in the watershed to prevent, mitigate, or improve damages caused by associated development. Specifically, Snowshoe may be able to help with equipment, labor, or in-kind or matching funds.

- Beckwith Lumber Company helped develop this plan and may be able to help with equipment, labor, materials such as logs, or funding.
- Eight Rivers Safe Development helped develop this plan, providing in-kind technical assistance; it can help guide site evaluations with respect to known caves, springs, and underground streams.
- Quarry owners may be able to help with equipment, labor, or materials such as rock.
- As the watershed continues to develop, private developers will play a key role in determining the biological impacts that will result from their actions. Partnerships with developers will likely be important for maintaining and improving the biological health of the watershed, especially within the Big Spring Fork subwatershed, the location of Snowshoe Mountain Resort.

Many stakeholders participated in the visioning process and in the creation of the planning document, Elk Headwaters Common Vision for the Future (Hansen et al., 2009); those participants were committed to the process, and can be called upon to provide support for the watershed. Besides the individuals listed above, the following businesses or organizations were involved in the process and may be called upon to support implementation of this plan:

- Elk River Inn Restaurant and Guide Service,
- Elk Springs Resort,
- Fisher Enterprises,
- George Construction,
- Green Rivers, LLC,
- Hidden River Farm,
- Pleasant Valley Farms,
- RE/MAX,
- The Sharp Farm,
- Snowshoe Property Owners Council,
- Sunset Mountain Enterprises, and
- West Virginia Sportsman Association.

6. INFORMATION AND EDUCATION

6.1 Elk Headwaters Watershed Association

EHWA has been performing outreach and education on water quality issues since its founding in 2003. EHWA will continue with outreach and education initiatives that enhance public understanding and encourage early and continued participation in implementing the nonpoint source management measures. EHWA will integrate information about remediation projects into outreach and educational efforts. Throughout the planning process, EHWA has disseminated materials via written documents, the Internet, and presentations. As part of an ongoing education and awareness campaign, all resources can be made available in written and online forms. In addition, presentations could be used to communicate with local organizations, landowners, and government entities. EHWA meetings are held at least every quarter. These meetings update members and other invited stakeholders about planned nonpoint source remediation projects and about remediation priorities. For more information visit: www.elkheadwaters.org.

Many educational efforts were listed in the vision document (Hansen et al., 2009), which could play important roles in implementing this plan:

- **Develop a green marketing plan.** Building upon existing marketing efforts, a targeted environmental marketing plan for the Elk headwaters watershed can help leverage the green attributes of the area. Such a plan can help sustain the tourism industry, attract new non-tourism businesses, and foster sustainable home development.
- **Generate a developer's guide to sustainable development in the Elk headwaters**. As development proceeds, practices can be used to prevent erosion and sedimentation and to prevent fast flushes of stormwater that can cause flooding and streambank erosion. Local guidelines and management practices can help ensure that development proceeds in a manner that protects water resources. A guide could also highlight areas most vulnerable to groundwater or surface water pollution.
- **Research sustainable farming practices.** Because a thriving agricultural sector is envisioned to grow locally produced food while maintaining the watershed's visual beauty and protecting its water resources, resources on sustainable farming practices will be useful.
- **Develop wastewater treatment information.** Useful information would highlight alternative technologies and provide suitability maps that help developers and homeowners make decisions about onsite, decentralized and centralized wastewater options. The Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011) documents a variety of useful information.
- **Research funding sources for landowners.** Funding is sometimes available for use by private landowners to build projects that are consistent with the stakeholder vision and the plan. By researching funding sources before they are needed, a menu of options can be provided to willing landowners. Since 2009, EHWA has researched and applied for various funding opportunities for landowners; many of those opportunities are listed in this plan.

EHWA uses a number of efforts to provide public education and is actively involved in educating residents and stakeholders about the watershed. In the course of learning how to make observations, collect samples, analyze results, and help with restoration projects, participants in the Stream Samplers Program develop an understanding of the interconnectedness of activities and impacts in the watershed while helping to monitor the streams. EHWA has engaged various residents and stakeholders in education, including foresters, fishermen, recreationalists, developers, and farmers. This public education has occurred through the planning process, such as in the creation of the Elk Headwaters State of the Watershed (Hansen and Boettner, 2008) and the Elk Headwaters Common Vision for the Future (Hansen et al., 2009).

In summer 2010, EHWA partnered with Downstream Strategies and Canaan Valley Institute to perform stream assessments and develop conceptual stream restoration designs. The project team contacted 21 landowners to discuss methods and resources to address sedimentation issues. While actual projects were only developed for a subset of these landowners, the outreach process provided public education and will be used as a model for future public education and project development

Efforts to educate the public are also included in the Elk Headwaters On-the-ground Sediment Projects (Zegre and Gaujot, 2010). This item includes formal and informal education of private landowners, public officials, and watershed stakeholders, and will also incorporate informational meetings, onsite visits, and monitoring activities by EHWA. Interpretive signs designating the project and the sponsors, including all in-kind donations, will be placed at each project site during and, where appropriate, for a period after the project. Participating landowners have expressed interest and offered ideas for the projects to provide training, outreach, and education to residents and stakeholders of the watershed. Those landowner-based ideas include, but are not limited to holding public events, training ski-tourism employees to work in the off-season, and providing education alongside agri-tourism opportunities. Besides providing training and education, these sediment projects can also serve as non-contentious grounds to create success stories in a watershed where individuals are divided over contentious issues related to the site selection for a wastewater treatment plant.

6.2 West Virginia Department of Environmental Protection

Prior to initiating its regular five-year monitoring effort, WVDEP will hold a public meeting in the watershed to gather suggestions for monitoring locations. WVDEP will include information at this meeting on the status of plans for remediating nonpoint source pollution in the watershed.

7. CRITERIA, MILESTONES, AND SCHEDULE

Because this is a watershed protection plan, the primary goal is to protect the watershed from impairment. Therefore, in general, the plan will be successful if monitoring demonstrates that the criteria detailed below continue to be met. In addition, trends will be examined with the goal that no individual sites get worse over time. Monitoring results will also be analyzed to document whether improvements occur directly below the on-the-ground sediment project sites.

7.1 Criteria

Quarterly water quality monitoring will provide quantitative indicators of implementation progress and pollution reduction. Visual surveys, conducted at least annually as part of regular water quality monitoring efforts, will provide qualitative indicators.

7.1.1 *Quantitative criteria*

West Virginia has no water quality standard for TSS. While it has a standard for turbidity, this standard is only applied using monitoring data from above and below sediment sources, and is therefore not an appropriate metric to assess whether an entire watershed is meeting its sediment goals. Consistent with the Elk Headwaters GIS Analysis, Data, and Management System (Boettner et al., 2011), a TSS goal of 10.8 mg/L and a turbidity goal of 10 NTU are used as criteria for levels of sediment required to protect the health of the Elk headwaters. A turbidity value of 10 NTU is based on established single-sample criteria of 10 NTU for trout waters or cold water fisheries in the following states: Arizona, Minnesota, North Carolina, and Vermont (USEPA, 2004). For reference, many other states, including Arkansas, Delaware, Montana, New Hampshire, Oklahoma, Rhode Island, Utah, Washington, West Virginia (when background is less than 50 NTU), and Wyoming have established a criterion of no more than 10 NTU over background conditions for coldwater fisheries and trout waters. Using the equation developed by Petty et al. (2005) for the Elk headwaters, a turbidity measurement of 10 NTU corresponds with a TSS measurement of 10.8 mg/L.

The state fecal coliform surface water quality standard will be used as the criterion for fecal coliform. The standard for Category A (Public Water Supply) and Category C (Water Contact Recreation) is as follows:

> "Maximum allowable level of fecal coliform content for Primary Contact Recreation…shall not exceed 200/100 ml as a monthly geometric mean based on not less than 5 samples per month; nor to exceed 400/100 ml in more than ten percent of all samples taken during the month."[4]

7.1.2 *Qualitative criteria*

During visual surveys, physical conditions and landscape changes will be documented and assessed using methods in WVDEP's Save our Streams Level 3 protocol. USEPA's rapid bioassessment protocols may also be used to provide qualitative measures of stream health. These evaluations will be performed at least once per year; if EHWA is more ambitious, then evaluations will occur once each in the spring and fall.

The first qualitative criterion, "Surrounding habitat," refers to the percentage of the reach that is shaded. The goal is to maintain or improve surrounding habitat so that all reaches fall into excellent or good ranges, as shown in Table 11.

[4] 47 CSR 2, Appendix E, Section 8.13.

Table 11: Surrounding habitat ranges

Score	Rating
> 80	Excellent
60 - 80	Good
40 - 60	Marginal
< 40	Poor

Source: WVDEP (2011).

The second qualitative criterion, "Habitat conditions," is assessed on a scale from one to 20, and includes the following measures:

- Sediment deposition,
- Embeddedness,
- Riffle frequency,
- Attachment sites for invertebrates,
- Velocity/depth regimes,
- channel flow status,
- Channel alterations,
- Bank vegetative protection,
- Bank stability, and
- Riparian buffer width (the last three conditions are assessed on both sides of the channel).

The total habitat score will be used to measure conditions. The habitat conditions goal is to maintain or improve habitat conditions so that all reaches are classified as excellent, very good, or good.

Table 12: Habitat conditions ranges

Score	Rating
> 170	Excellent
150 - 170	Very good
120 - 149	Good
90 - 119	Marginal
< 90	Poor

Source: WVDEP (2011).

A third qualitative criterion, biological conditions, is assessed through field monitoring and scoring using the West Virginia Stream Condition Index. The goal is to keep all scores above 68, which classifies streams as unimpaired. In addition, during regular field monitoring, changes in macroinvertebrate composition may trigger management action or additional monitoring.

Finally, pebble counts and assessments of physical conditions and land use will be conducted at the same locations, and will be compared year to year as a way of monitoring change. Changes may trigger management action or additional monitoring. If, for example, an odor of sewage is detected, it would be prudent to monitor for fecal coliform.

7.2 Milestones and implementation schedule

7.2.1 *Sediment*

Streambank erosion

The work plan for the proposed on-the-ground sediment projects includes two phases. Phase I includes assessment, design, and permitting. Phase II includes construction and bidding, construction oversight and implementation, and monitoring. Both phases include training. The two phases will be completed in succession for each project, as described in Table 13.

Table 13: Elk headwaters sediment project timeline

Milestone	Timeframe
First project	
Phase I	
Submit project proposal to WVDEP	June 2011
Announcement of 319 incremental funding	Upon approval by USEPA
Assessment and design	April 2012
Permitting	May-July 2012
Phase II	
Construction and bidding (*future application*)	July-August 2013
Construction oversight and implementation (*future application*)	August-September 2013
Second project	
Phase I	
Submit project proposal to WVDEP	June 2012
Announcement of 319 incremental funding	Upon approval by USEPA
Assessment and design	April 2013
Permitting	May-July 2013
Phase II	
Construction and bidding (*future application*)	July-August 2014
Construction oversight and implementation (*future application*)	August-September 2014
General	
Monitoring (*future application*)	Quarterly (2011-2019)
Publicize award and conduct community outreach	Summer 2012, 2013, 2014
Training for community members	Summer 2012, 2013, 2014
Achieve load reductions of 25%	May 2015

Agriculture

For this plan, a goal of installing agricultural BMPs on 15% of affected streambanks translates to a maximum of 8.5 miles of fencing through agricultural land. The final goal is to install this fencing by 2015. An interim milestone is to install 2 miles of fencing by 2013.

The final goal for agriculture is to install 36 acres of riparian buffer through agricultural land by 2015. An interim milestone is to create 9 acres of riparian buffer through agricultural land by 2013.

Developed areas

The final goal is to install 7 acres of riparian buffers through developed areas by 2015. An interim milestone is to install 2 acres of riparian buffer along streams through developed areas by 2013.

In addition, the final goal is to implement, by 2015, at least 20 site-level green infrastructure strategies such as those detailed in Table 7. This could include, for example, some combination of rain barrels and rain gardens. An interim milestone is to implement five site-level green infrastructure strategies by 2013.

7.2.2 *Fecal coliform*

Agriculture

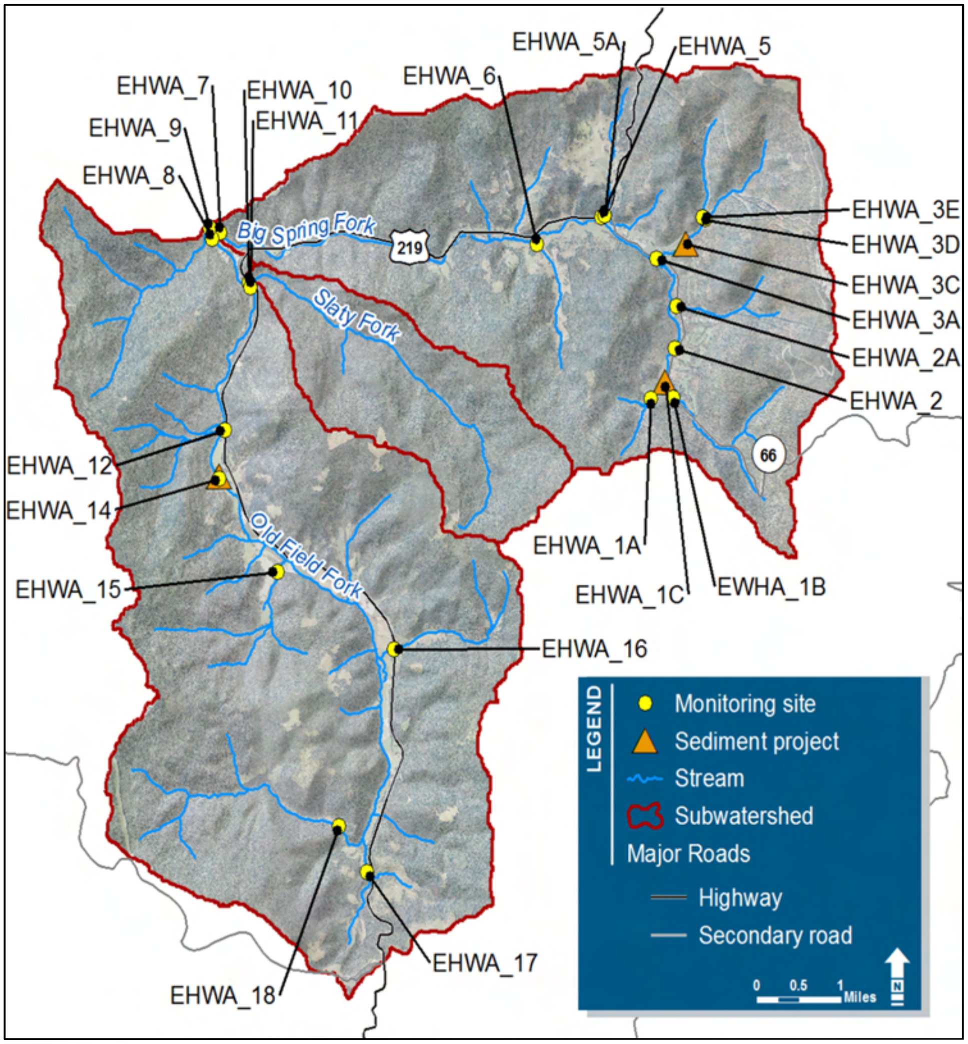
The interim milestone described above for sediment from agricultural land will also address fecal coliform from agricultural land.

Wastewater treatment

The schedule for addressing fecal coliform from wastewater treatment is dictated to a large degree by the decision-making process of the Pocahontas County Public Service District. Pursuant to an Order from the West Virginia Public Service Commission, the District has initiated an engineering study to consider options for a decentralized approach to wastewater treatment; this plan is due to be completed in November 2011. Only after this plan is completed will the District hold public meetings and make a final decision. A schedule and milestones for addressing wastewater treatment can be set once the District has made a final decision.

8. MONITORING

Figure 5. Elk Headwaters monitoring locations



Source: Elk Headwaters Water Quality Monitoring Plan (Martin and Zegre, 2011b).

EHWA will conduct quarterly monitoring to assess pollution reductions at key sites throughout the watershed, including at each of the proposed sediment projects. A map of these sites is included in Appendix A. This monitoring will assess progress at the project sites prior to, and 1-5 years after, sediment project implementation. Monitoring will occur quarterly, or more frequently to capture a variety of hydrologic conditions as per the Elk Headwaters Water Quality Monitoring Plan (Martin and Zegre, 2011b).[5] Field measurements will be taken at least annually using WVDEP's (2010) standard operating procedures; additional monitoring materials can also serve as reference (WVDEP, 2006; USEPA, 2008). Monitoring protocols will follow those outlined in the Quality Assurance Project Plan for the Elk Headwaters Watershed Association Sediment Projects (Martin and Zegre, 2011a).

Additional data will be compiled, including WVDEP's Watershed Assessment Program data, which are collected on a five-year cycle, with the next round in the Elk headwaters occurring in 2012. All monitoring results will be analyzed on a quarterly basis to identify trends, sources, and the effects of any remediation activity. The monitoring results will be measured against criteria described above in Section 7.1.

[5] This plan will be available on the EHWA Web site: www.elkheadwaters.org.

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