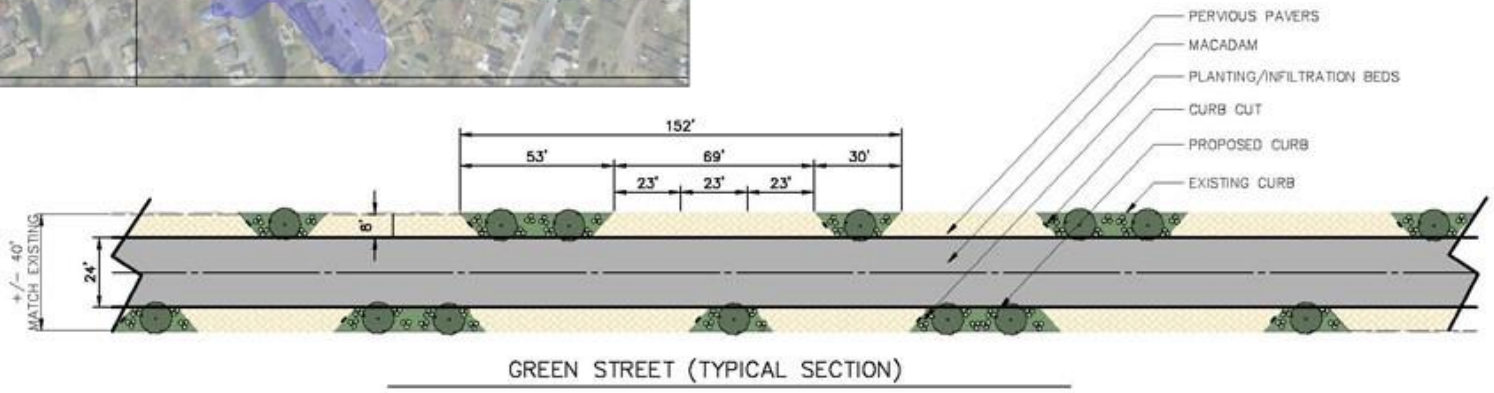

Green Infrastructure Implementation Plan

Martinsburg, West Virginia

March 1, 2019

Green Infrastructure Implementation Plan

Martinsburg, West Virginia

Prepared for:

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ABOUT THIS PLAN

Martinsburg is one of West Virginia's largest and fastest growing cities, yet approximately 30% of the city lacks traditional stormwater infrastructure. The City of Martinsburg seeks to implement green infrastructure demonstration projects in several highly visible areas within the city to reduce the impacts of stormwater, pollution loads, and flooding.

In partnership with the City of Martinsburg, Downstream Strategies, Harbor Engineering, and Canaan Valley Institute secured a Chesapeake Bay Technical Capacity Grant from the National Fish and Wildlife Foundation in 2017 to develop this implementation plan for green infrastructure demonstration sites in Martinsburg.

Through this grant-funded project, the team was tasked with the following primary activities:

1. prioritize 10 potential sites for green infrastructure improvements and create conceptual designs for each,
2. create detailed designs and cost estimates for the three highest-priority sites, and
3. develop educational materials to engage the public and secure broad support for green infrastructure solutions within the community.

This document presents the final designs, cost estimates, outreach plan, and overall implementation strategy developed through this project.

The implementation of green infrastructure projects identified and designed in this project will reduce sediment, phosphorus, and nitrogen pollution in local waters and in the Chesapeake Bay. This project will also support the City of Martinsburg's efforts to implement its municipal separate storm sewer system (MS4) permit while meeting West Virginia's Chesapeake Bay pollution reduction goals.

ACKNOWLEDGEMENTS

The project team would like to thank the National Fish and Wildlife Foundation for its financial support of this project. We would also like to thank staff from the City of Martinsburg Public Works Department for their contributions to this report and for providing funding for the geotechnical analysis.

ABOUT DOWNSTREAM STRATEGIES

Downstream Strategies is an environmental and economic development consulting firm with offices in Morgantown, Davis, and Alderson, West Virginia. We offer services that combine sound interdisciplinary skills with a core belief in the importance of protecting the environment and linking economic development with natural resource stewardship. Downstream Strategies is considered *the* go-to source for objective, data-based analyses, plans, and actions that strengthen economies, sustain healthy environments, and build resilient communities.

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INTRODUCTION

This plan provides recommendations, designs, and cost estimates for implementing green infrastructure in several highly visible areas within Martinsburg, West Virginia, to reduce the impacts of stormwater, pollution loads, and flooding.

Green infrastructure is an effective, economical way to manage stormwater runoff and pollution in urban and residential areas. While traditional gray infrastructure consists of costly pipes, tanks, and pumps made of metal and concrete, green infrastructure uses vegetation, soils, and other natural elements to better control stormwater and treat pollution. Green infrastructure offers a cost-effective way to reduce pollutant loads to the Chesapeake Bay while reducing local flooding. As a result, this plan supports the City's efforts to meet the requirements of its MS4 permit, achieve West Virginia's Chesapeake Bay pollution reduction goals, and build public awareness and understanding of green infrastructure opportunities.

STORMWATER IN MARTINSBURG

Known as the "Gateway to the Shenandoah Valley," Martinsburg lies in West Virginia's Eastern Panhandle within Berkeley County. Most of the city drains to Tuscarora Creek and Dry Run, tributaries of Opequon Creek, which flows directly to the Potomac River and ultimately the Chesapeake Bay.

With a population of approximately 17,000 people, Martinsburg is one of the state's largest and fastest growing cities. Designated as a municipal Phase II MS4 entity by the U.S. Environmental Protection Agency (EPA), the City holds a National Pollutant Discharge Elimination System (NPDES) stormwater permit and is required to reduce the discharge of pollutants to the maximum extent practicable, protect water quality, and satisfy the appropriate water quality requirements of the Clean Water Act. Specifically, Phase II MS4 programs are required to include six basic elements, including:

- public education and outreach,
- public participation/involvement,
- illicit discharge detection and elimination,
- construction site runoff control,
- post-construction runoff control, and
- pollution prevention/good housekeeping. (EPA, 2005)

Given its location within the greater Chesapeake Bay watershed, the City of Martinsburg is also required to meet West Virginia's Chesapeake Bay pollution reduction goals outlined in West Virginia's Phase II Watershed Implementation Plan (WIP).

As the City of Martinsburg prepares to implement its approved Stormwater Management Plan, it recognizes significant obstacles in its path. Approximately 30% of the area within city limits lacks traditional stormwater infrastructure. The combination of gently rolling-to-flat terrain and shallow soils contributes to the ponding of water on roads and in yards. Reports of nuisance flooding increase with storm events, and most runoff flows to low-lying areas and drains to Lake Thomas, a nearby abandoned quarry. This uncontrolled stormflow runoff contributes to pollution loads entering Tuscarora Creek. Local residents and leaders recognize

the problems in this part of the city, and complaints from residents are common.

West Virginia's Phase II WIP focuses efforts in MS4 areas on reducing stormwater inputs from new development and redevelopment projects. While such projects in Martinsburg meet the state-required performance standards, the karst bedrock underlying the area's shallow soils limits the effectiveness and practicality of some stormwater infrastructure in many parts of the city. Placing large underground tanks for infiltration is often impossible or extremely expensive in residential applications. In addition, caves and fractures in the karst limestone can funnel stormwater directly to groundwater, which impacts water quality in wells and groundwater-fed streams.

The City is committed to finding creative, cost-effective solutions and has identified green infrastructure as a key strategy for addressing its stormwater management issues and reducing pollutant loads to the Chesapeake Bay.

Funding limitations have prevented the City from employing green infrastructure measures to date; however, local leaders believe that implementing demonstration projects in highly visible areas in Martinsburg will raise public awareness and support, which will enable the City to leverage additional funding to implement green infrastructure improvements on a larger scale.

Implementing highly visible demonstration projects within Martinsburg will extend the reach of Martinsburg's existing stormwater management and address MS4 program measurable goals for four minimum control measures:

- public education and outreach,
- public participation/involvement,
- post-construction runoff control, and
- pollution prevention/good housekeeping.

PROJECT AREA

The focus area for this project is the west side of downtown Martinsburg, outlined in Figure 1.

With development dating back to the pre–Civil War era, this area of the city has extremely limited stormwater infrastructure. The map of existing infrastructure shown in Figure 2 reveals very few segments of stormwater pipe and virtually no open stormwater channels within this area.

In the older portions of the project area, yards are small to non-existent, and as streets have been widened to accommodate automobile traffic and on-street parking, little space remains for stormwater infrastructure.

Although most homes in newly developed areas have significant off-street parking, the streets were originally designed for on-street parking, which leaves significant areas of lightly used pavement as shown below.

FIGURE 1: PROJECT AREA

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Green Infrastructure Implementation Plan and Demonstration Sites
Martinsburg, West Virginia

Focus area

FIGURE 2: EXISTING STORMWATER INFRASTRUCTURE

WATER QUALITY IMPAIRMENTS

Most of Martinsburg drains to Tuscarora Creek and Dry Run in the Opequon Creek watershed, a direct drain to the Potomac River. Water quality is an issue both in Tuscarora Creek and throughout the Opequon Creek watershed. Tuscarora Creek and its main tributary, Dry Run, are listed as impaired for biological impairments from excess nutrients and sediment and for high levels of fecal coliform bacteria. To address these impairments across the region, the West Virginia Department of Environmental Protection (WVDEP) developed a Total Maximum Daily Load (TMDL) for Selected Streams in the Potomac Direct Drains Watershed in 2013. The TMDL requires a 76% reduction in fecal coliform bacteria from residential and urban runoff in the watershed. In addition, the TMDL calls for a 13% reduction in streambank erosion within the MS4 areas of the watershed and a 0.8% reduction in sediment loads from residential and urban areas. (WVDEP, Canaan Valley Institute, and Opequon Creek Project Team, 2013)

Martinsburg has identified best management practices (BMPs) to meet these targeted reductions. These BMPs include:

- developing a pet waste program,
- identifying and controlling sanitary sewer inputs,
- enhancing commercial inspection for illicit discharge detection and elimination,
- enhancing construction site inspections,
- sweeping streets,
- developing a water conservation training program, and
- cleaning catch basins before storm events.

In addition to the TMDL, the City is also working to reduce nutrient sources as part of the WIP to reduce nutrient inputs to the Chesapeake Bay watershed.

In combination with the BMPs listed above, the City would like to incorporate green infrastructure practices to help achieve its target reductions in fecal coliform bacteria, sediment, and nutrients. The projects will also spur implementation of the watershed protection elements of the City's MS4 permit by reducing thermal impacts and creating and/or restoring some of the ecologically sensitive areas within Martinsburg.

GREEN INFRASTRUCTURE PRACTICES

For this project, the project team considered BMPs that incorporate vegetation, soils, and other natural elements to manage stormwater and create healthier urban and suburban environments.

Green infrastructure BMPs strive to mimic natural flows, prevent erosion and sedimentation, and minimize pollution discharges into streams. In designing a site, these goals can be met by reducing impervious cover and utilizing pervious surfaces or otherwise natural areas for addressing stormwater runoff. These BMPs also help reduce the pollutants of concerns in the Chesapeake Bay watershed, including phosphorus, nitrogen, and sediment.

BMPs are typically organized into two categories:

- **structural BMPs**, which include built structures; and
- **nonstructural BMPs**, which include processes or techniques such as preservation or planning.

This project focuses on implementing structural BMPs in developed areas; however, nonstructural BMPs should be included in future stormwater management activities in Martinsburg.

STRUCTURAL BMPS

The structural BMPs outlined below are used increasingly across the country to mimic natural processes such as infiltration and evapotranspiration and to capture and reuse stormwater. In addition to water quality improvements, structural BMPs typically reduce flooding and enhance aesthetic appeal. While the degree of stormwater volume and pollutant reduction achieved by these practices varies based on a range of factors (design, precipitation patterns, slope, etc.), these techniques have been successfully implemented in differing climates, terrains, and scales across the globe.

Rain gardens

Rain gardens, also known as bioretention cells, offer a decorative means of increasing infiltration. Using engineered soils and carefully chosen plants, rain gardens can increase infiltration rates by 30%, allowing them to handle more rainfall than typical turf lawns (WDNR, 2003). Rain gardens are also graded to create a shallow, depressed area so that rainwater can collect and pool in the area before infiltrating.

Photo: USEPA.

Bioswales

Bioswales are vegetated linear features or channels that help filter contaminants from stormwater runoff and may also allow for biological uptake of pollutants (EPA, 2007). They differ from traditional vegetated stormwater conveyance in that the plants and engineered soils are specially chosen to increase infiltration and filter pollutants from the runoff. Bioswales are widely used in parking lots and along roadways.

Infiltration pits

Infiltration pits are constructed sub-surface pits filled with clean stone that are designed to infiltrate stormwater from a contributing drainage area. Common uses for infiltration pits include capturing and infiltrating stormwater from rooftops, parking lots, driveways, and lawns.

Rain barrels and cisterns

Rain barrels and cisterns are storage vessels that are often connected to downspouts to harvest runoff from roofs. Runoff from a 40-foot by 30-foot roof will generate 75 gallons of water for every 0.1 inch of rainfall. Capturing and reusing runoff can keep thousands of gallons of water out of the sewer system while saving money on water use.

Traffic islands, curb extensions, and sidewalk landscaping

Curb extensions are vegetated areas that capture runoff from impervious surfaces such as roads. Besides adding aesthetic appeal, curb extensions have the added benefits of slowing traffic on residential streets and reducing or eliminating basement flooding.

Pervious pavement

Pervious asphalt and concrete can be poured over an aggregate base, which provides structural support, stores runoff, and filters pollutants. Pervious asphalt and concrete are ideal for parking lots, low-traffic streets, and basketball courts. Other pervious pavement technologies include interlocking pavers and plastic grid paving, which can both be planted with grass or filled with gravel to promote infiltration.

NON-STRUCTURAL BMPS

The non-structural BMPs outlined below use existing resources such as open space and natural systems to manage stormwater. These BMPs focus more on planning and policy measures to minimize disturbance and reduce the amount of impervious area.

Planned development

In addition to preserving open space at the site scale, neighborhoods and municipalities can take steps to encourage cluster development and redevelopment of previously developed sites. Concentrating new development in urban areas—rather than expanding into surrounding undeveloped areas—reduces the need for additional road and sewer systems, saving municipalities money and preserving open space for recreation and agriculture.

Preservation of open space

Even when an integral part of final site design, greenspace is often compacted during construction, stripped of topsoil, and reduced in area more than necessary. Conservation design promotes careful planning to preserve open space, including, for example, siting buildings away from wetlands and other ecologically important areas and clearing the minimum amount of land necessary to accommodate the construction.

Reduced-width roadways

Planning to reduce road widths can help preserve open space and reduce impervious surfaces. Shared driveways, reduced driveway widths, and two-track driveways can all preserve some degree of open space without compromising the functionality of driveways.

Preservation of existing trees and vegetation

Preserving existing trees is a low-cost way to reduce stormwater runoff and provide water quality benefits. The tree canopy catches some precipitation as it falls, a first step in reducing stormwater runoff. Even if trees, shrubs, or wildflowers are disconnected from the natural soil, runoff directed into planters will be taken up by the plants and released into the atmosphere. Re-vegetating disturbed areas with native plants can also reduce stormwater runoff.

Education and outreach

Developing thoughtful, clear, and appropriate education and outreach activities can help persuade home and business owners in the City to incorporate green infrastructure BMPs on their property. Without adoption of BMPs by local residents, it will be very difficult to achieve pollution reduction goals. Education and outreach efforts by the County or homeowners associations can include, but are not limited to the following:

- Encourage tree and vegetation plantings to stabilize eroded slopes and channels.
- Encourage the use of cisterns to collect and reuse stormwater runoff from dwelling roof areas.
- Encourage rain gardens and natural areas, as well as the naturalization of existing lawn areas.
- Provide free guidelines for rain garden and cistern design and installation and the use of collected rainwater.
- Provide a natural plantings plant list at no charge to homeowners.
- Discourage lawn fertilizer use to reduce the amount of nitrogen and phosphorus runoff into the watershed.

PROCESS

Staff members from the City's stormwater management program receive and document regular complaints about ponding water, erosion from fast-moving stormwater, and flooding of basements and yards after heavy rains and/or snow melt. They also collect information about issues reported by Public Works staff and other City departments, especially the Parks and Recreation Department. City staff cataloged these issues and mapped locations where green infrastructure could potentially improve conditions.

To launch this project, the project team toured the project area on April 5, 2018 and visited each potential site identified by the City. They identified available rights-of-way and parcels and collected other relevant field information.

PRIORITIZATION CRITERIA

After visiting 17 potential green infrastructure demonstration sites, the project team and City staff identified four important criteria for consideration:

- **Technical feasibility:** Given the geology, geography, and development patterns in the project area, technical feasibility considerations should include presence and depth to bedrock, space to install BMPs, and size of drainage area. The location and design of future stormwater management projects will need to consider the location of water, sewer, gas, and electric utilities. Reducing stormwater inflow and infiltration to sewage collection lines is an important benefit of stormwater management. Proposed green infrastructure projects should be designed to complement efforts the City has and continues to take to reduce stormwater entrainment in sewage collection lines.
- **Visibility:** City stormwater management staff want residents, business owners, and city leaders to be able to easily follow the development, installation, and operation of the BMPs.
- **Demonstration of various options:** Implementing a range of green infrastructure BMPs in visible locations will encourage a wider community discussion about incorporating sustainable methods to address existing stormwater issues.
- **Support from neighbors and landowners:** Support from neighbors and landowners will be critical to easing the way for installation of any proposed green infrastructure practices.

The project team believes that garnering support will pose less of a challenge in places where residents recognize stormwater management issues. Installing BMPs on City-owned property will give residents from other parts of Martinsburg and surrounding areas the opportunity to see how green infrastructure looks and functions, building their familiarity with and support for future projects. Addressing stormwater issues on City property has the added bonus of reducing maintenance issues and costs for the City.

SITE SELECTION

After the initial site visit, the project team revisited the prioritization criteria and identified the top 10 priority locations for green infrastructure development. These locations are shown in Figure 3 and described in Table 1.

FIGURE 3: PRIORITIZED SITES

TABLE 1: TOP 10 SITES

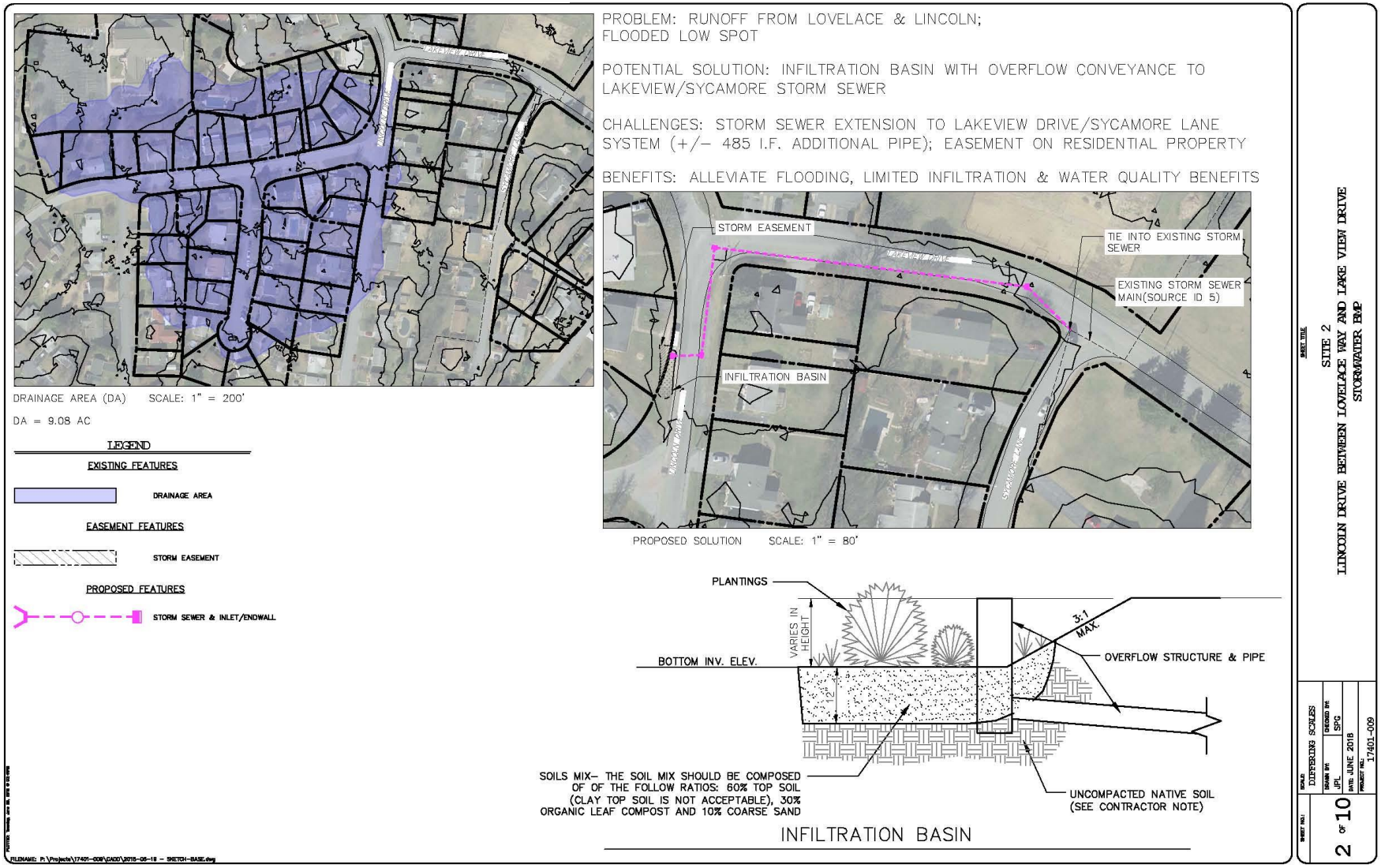
ID	Location	Comments from site visit
1	Hickory Court	Water running down street; floods multiple properties
2	Lincoln Drive between Lovelace Way and Lake View Drive	Runoff from Lovelace & Lincoln; flooded low spot
3	War Memorial Park between pavilions & volleyball court	Runoff from pavilion flows across volleyball court
4	W Race Street between Red Hill Road & Delaware Avenue	Lots of runoff downhill; good project site
5	W Martin Street between Delaware Avenue & Georgia Avenue	Lots of runoff down street
6	Intersection of Kentucky Avenue & Burke Street	Lots of runoff caught & sent to Lake Thomas
7	King Street from Red Hill Road to Valley Street	Lots of runoff down both sides of street
8	Intersection of Georgia Avenue & Stephen Street	Ponding; good project site
9	Carolina Avenue between Addition Street & Circle Drive	Some runoff; good project site
10	Intersection of Caroline Avenue & Georgia Avenue	Some runoff; good project site

CONCEPTUAL DESIGNS

Harbor Engineering developed conceptual designs for each of the 10 sites, identifying the BMP that best fit each site and analyzing the benefits and challenges from each. The sites covered a variety of issues and allowed for a good mix of possible BMPs.

A sample conceptual design for Site 2, Lincoln Drive, is shown in Figure 4. The full conceptual designs can be found in Appendix A.

FIGURE 4: CONCEPTUAL DESIGN FOR SITE 2, LINCOLN DRIVE



GEOTECHNICAL STUDIES

The City of Martinsburg engaged Triad Engineering to complete geotechnical testing to evaluate subsurface site conditions for stormwater infiltration for six of the 10 priority sites.

Only six sites were selected to manage costs. These six were selected by the project team because they represented a good mix of BMPs and also had a better likelihood of becoming project areas. Triad Engineering investigated subsurface conditions by drilling 12 auger probes, excavating six test pits, and performing 12 infiltration tests. Triad provided design and construction recommendations for each of the six sites, which included whether infiltration activities would be advised at each individual site. A summary of the geotechnical findings is provided in Table 2. The full report is included as Appendix B.

TABLE 2: SITES COVERED IN GEOTECHNICAL ANALYSIS

ID	Location	Geotechnical conclusions
1	Hickory Court	Groundwater at shallow depth, not suitable for infiltration
3	War Memorial Park between pavilions & volleyball court	Generally suitable for infiltration at 2 of 3 test sites
6	Intersection of Kentucky Avenue & Burke Street	Generally suitable for infiltration
8	Intersection of Georgia Avenue & Stephen Street	Shallow bedrock encountered at 2 of 3 test sites
9	Carolina Avenue between Addition Street & Circle Drive	Shallow bedrock encountered at 2 of 3 test sites
10	Intersection of Caroline Avenue & Georgia Avenue	Generally suitable for infiltration at 2 of 3 test sites

TOP THREE SITES

The project team met with City staff to discuss the results of the geotechnical studies and determine the top three sites for more detailed designs. Using the analysis in the geotechnical report and the original project criteria, the group settled on the following top three sites:

- **Site 1 - Hickory Court:** This site will be designed for storage and filtering BMPs. Because groundwater was found during the geotechnical analysis, infiltration BMPs will not be pursued.
- **Site 3 - War Memorial Park between pavilions & volleyball court:** This site will demonstrate an infiltration bed.
- **Site 6 - Intersection of Kentucky Avenue & Burke Street:** This site will incorporate bioswales and check dams to slow and filter stormwater before draining to Lake Thomas and Tuscarora Creek.

These sites will incorporate different BMPs at differing scales, thus enabling the City to demonstrate green infrastructure projects for a wide variety of applications.

The City is also interested in demonstrating green infrastructure practices associated with green streets, including pervious pavement, traffic islands, curb extensions, and sidewalk landscaping. As a result, the project team agreed to provide additional conceptual drawings for these BMPs that could be used on a larger project to address stormwater on King Street—one of the city's main thoroughfares.

DESIGNS AND POLLUTION REDUCTIONS

Harbor Engineering completed detailed design drawings for the top three sites. The designs include approximate volume and pollutant load reductions, approximate costs, and general associated plans and details. The base mapping used for each of the sites is based upon aerial imagery, LiDAR topography, and field observation. Table 3 includes an estimate of the pounds of these pollutants that will be prevented from entering Tuscarora Creek and the Chesapeake Bay from each site. The complete design materials are included in Appendix C.

Site 1 – Hickory Court

This site is a residential cul-de-sac where stormwater funnels down the street, flooding multiple properties at the end of the street at the bottom of a slope. The proposed solution will collect the runoff from the street and convey it through the currently impacted properties to green space near Tuscarora Creek. The existing green space will be preserved in a conservation easement, which will filter the stormwater and slow its discharge into the creek. This project will require cooperation from multiple property owners; however, since these property owners are impacted by repeated flooding to their homes and yards, they are willing to discuss possible solutions. While this site is just outside of the original project area, it is in a similar neighborhood with limited stormwater infrastructure, and the damage to properties from repeating flooding is significant.

Site 3 – War Memorial Park between pavilions & volleyball court

This site is located near the main entrance to the City-owned and operated park. Stormwater runs from parking lots and a pavilion, washing soil and sand from recreation areas onto the entrance road and nearby grassed areas. After consulting with City staff, Harbor Engineering proposes a bioretention cell—sometimes called a rain garden—for the lower edge of the existing volleyball court, treating 1.45 acres. This infiltration bed will incorporate attractive, low maintenance native plants into an area that will collect stormwater, encourage infiltration, and filter out pollutants. This site is in a highly visible location and is planned to incorporate signage describing the benefits and maintenance needs of green infrastructure BMPs.

Site 6 – Intersection of Kentucky Avenue & Burke Street

This site runs between Kentucky Avenue and Lake Thomas, an abandoned quarry located close to downtown Martinsburg. Stormwater from the collection area carries large amounts of debris towards the lake and has eroded an old ditch, making steep gullies to the lake. A long bioswale combined with a riprap channel have been proposed to treat stormwater from 20 acres through this large-scale BMP.

TABLE 3: ESTIMATED POLLUTION REDUCTIONS

Site	Acres treated	Volume treated (cf)	Sediment capture (lbs/yr)	N capture (lbs/yr)	P capture (lbs/yr)
Hickory Court	8.18	2,271	175.8	2.0	1.2
War Memorial Park	1.45	1,299	49.8	0.7	0.4
Kentucky Avenue	20	5,200	385.0	4.5	2.7

COST ESTIMATES

Pulling together the site visit, geotechnical information, proposed solutions, and initial design work, Harbor Engineering developed cost estimates for the three detailed design sites. These are based on the current understanding of the sites and constructions costs and are presented for planning purposes only.

TABLE 4: ESTIMATED COSTS (THOUSAND $)

Site	Design	Construction	Total
Hickory Court	$20-25	$60-70	$80-95
War Memorial Park	$10-15	$15-20	$25-35
Kentucky Avenue	$15-20	$100-120	$115-140

In addition to construction costs, the proposed projects will require long-term maintenance and upkeep just like any other built infrastructure in the city. Maintenance tasks are included on the design drawings for each site. The following tasks are general requirements that are applicable to each site.

- BMPs must be inspected at least twice a year and after every major storm event.
- All pipes and BMPs must be keep clear of debris, obstructions, and sediment.
- Vegetative cover must be maintained around all sites to protect areas from scour.

The Hickory Court conservation area is meant to be protected from disturbance. After it is installed, all maintenance activities will need to be completed with care.

IMPLEMENTATION RECOMMENDATIONS

The City of Martinsburg should consider the following recommendations when implementing its green infrastructure projects at demonstration sites.

ENGINEERING AND PERMITTING REQUIREMENTS

The design plans incorporated herein for the three sites are intended to demonstrate the feasibility for each BMP. The following actions would need to be taken for each site to be ready and permitted for construction:

- Detailed site feature, topographic, and property boundary surveys must be obtained for each site.
- For the Hickory Court site, easements will need to be obtained from multiple property owners for permission to install a stormwater conveyance pipe and inlets on their properties. Permission would also be needed for the BMP facility and conservation area easement on the property to the south of Mill Race Drive.
- Permits must be obtained from the applicable agencies, including but not limited to the Berkeley County Conservation District, WVDEP, and the City of Martinsburg. For sites with over one acre of earth disturbance, NPDES permits will also be required.

EDUCATION AND OUTREACH STRATEGY

As part of this project, the project team worked closely with City staff to develop a plan for reaching out to residents and landowners near the highest priority sites. The plan takes into account that two of the three priority sites are on City-owned property. The project identified City entities, including the Parks and Recreation Department and Martinsburg City Council, for which specific outreach and education messages about green infrastructure and the proposed practices would be needed.

The project team then developed a list of outreach and education tasks that will keep the momentum of this project moving and build support for implementation of the top three projects identified in this plan—plus other green infrastructure efforts in the city, like adding green streets practices to King Street and other major roadways. These tasks include:

- presenting to City departments, the Martinsburg City Council, and community groups; and
- developing signage for the War Memorial Park and other highly visible implementation sites.

The first task will be to build support by sharing the results of the project with critical City departments and the Martinsburg City Council. Stormwater managers will present information about green infrastructure and the proposed projects to managers in the Public Works Department and the Parks and Recreation Department. They can share this report as a way to build confidence that green infrastructure projects are realistic solutions for the city. Stormwater management staff can then incorporate feedback from these critical departments into their presentation and discussions with the City Council.

Expanding the outreach to local residents will include presentations to community groups like Rotary clubs, garden clubs, scout troops, and many others. This kind of outreach spreads the word widely about stormwater efforts and can build networks of supporters, including volunteers to help install and maintain plantings and signage. It can also identify the most common concerns local residents have about green infrastructure, helping City stormwater management staff develop strategies to address these concerns and improve the likelihood of getting projects completed.

In the long term, the War Memorial Park site will provide a great opportunity to engage area residents when they visit the park. Signage will be critical to explaining the purpose and benefits of green infrastructure at this site.

Adapting available materials

There are many resources available that explain the purpose and value of green infrastructure practices, including many materials developed specifically for the Chesapeake Bay watershed. City stormwater management staff have already developed fact sheets explaining what green infrastructure practices are and the benefits of implementing these practices.

Working with City staff, the project team created a standard presentation (included as Appendix D) that can be adapted for various audiences. This presentation includes general slides describing green infrastructure as well as the three top-priority projects. Additions to this presentation can be easily made as green infrastructure projects progress through design, implementation, and management. The project team reviewed these materials and adapted them to speak specifically to issues and concerns of Martinsburg residents, landowners, and municipal leaders.

The presentation can be used at public meetings and for outreach to community groups and can also evolve as the projects develop. The existing fact sheets can be mailed or hand-delivered to residents near the project locations and given out during presentations to residents and community groups. Developing appropriate interpretive signs for projects on public property will allow stormwater managers to continue widening understanding of and support for green infrastructure in Martinsburg and broadly across the Opequon watershed. In addition, this report itself can be shared widely in the city to provide information about green infrastructure to local leaders and residents.

NEXT STEPS

Critical next steps for the project include outreach to city departments, city council, and residents near the proposed project sites. Securing public and city support for the projects will allow stormwater management staff to begin building the funding streams necessary to implement the projects. Another critical task will be to refine the cost estimates for completing construction designs, permitting, and construction of the projects.

CONCLUSION

Green infrastructure offers practical and cost-effective solutions for addressing stormwater management issues across West Virginia and beyond. Improving stormwater management is critical in Martinsburg as the City seeks to address nuisance flooding, reduce runoff rates, and limit pollution heading into the Chesapeake Bay. Armed with designs and implementation recommendations, this plan prepares the City for developing three green infrastructure demonstration sites that will tackle Martinsburg's stormwater issues head-on while enhancing green spaces for the greater community to enjoy.

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APPENDICES

Appendix A: Conceptual Site Designs

Appendix B: Geotechnical Exploration Report

Appendix C: Detailed Site Designs

Appendix D: Standard Presentation