Blacksburg Freshwater Heritage

A Conceptual Plan to Highlight History, Heritage, and Environmental Stewardship at Owens Street, Spout Springs, and Five Chimneys Park

June 2009
The Community Design Assistance Center (CDAC) is an outreach center of the College of Architecture and Urban Studies and Virginia Tech that assists communities, neighborhood groups, and non-profit organizations in improving the natural and built environments through design, planning, and research. Through the integration of the learning and working environment, the Center will execute projects that link instruction and research and share its knowledge base with the general public.

CDAC Project Team for Blacksburg’s Freshwater Heritage

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# Acknowledgments

The CDAC design team would like to thank the excellent Town of Blacksburg staff for their assistance and guidance on the project:

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The Community Design Assistance Center worked with a team of project stakeholders to develop conceptual master plans for three town-owned properties: Spout Spring Park, Five Chimneys Park, and Owens Park. Each site contains fresh water and has opportunities for enhancement and education. The plans for each site highlight the history and heritage of freshwater resources in Blacksburg through design and signage, provide recommendations to improve water quality and soil stabilization through plantings, and demonstrate possible alternatives for stormwater management.

The Town of Blacksburg is located in Montgomery County in southwest Virginia. The three parks identified for this project are in or near the town’s historic 16 squares, in the heart of Blacksburg. Spout Spring, located at the corner of Clay and Wharton Streets, is a pocket park with an historic spring on the edge of the property. Five Chimneys Park, located at the corner of Draper Road and Washington Street, offers one of the few opportunities to see Stroubles Creek above ground in downtown Blacksburg. Owens Park, located near the intersection of Owens Street and Harding Avenue, is a neighborhood park that serves as a temporary detention basin during storm events. The map on the following page indicates the locations of the parks within the town.
Site Map: Blacksburg, VA
Design Process

Site Inventory and Analysis
A site inventory simply provides data about the site, so that opportunities and constraints can be identified. Inventory maps provide data needed for the next step of the design process, site analysis, along with simply documenting what exists on the site. This includes elements such as overhead wires, water features, telephone poles, etc. It provides information about the site, so that opportunities and constraints can be identified.

A variety of physical, biological, and cultural attributes can influence the suitability of a site for proposed uses. The scope of the inventory and analysis is narrowed by considering the assets and liabilities or the opportunities and constraints that the site poses for a specific program. A site analysis may be a single map that identifies significant opportunities and constraints for a proposed project. The site analysis summarizes the sites suitability for different programmed uses, so different goals for the projects can yield significantly different site analysis maps.

Design Development
Concept Plans spatially organize proposed site activities and improvements on the sites. More than one concept plan is often developed from a single site analysis. Creating two or more concept plans is particularly useful when seeking consensus from a diverse set of stakeholders. This shows clients and stakeholders that a range of potentially viable options were considered. An optimal concept plan may be created by merging two or more different concepts.

Project Design Process
Each of the three project sites went through a site inventory and analysis, which then transitions into the design development phase. In this phase two initial concepts were developed for each site. The concepts were presented to the stakeholders. Based on feedback, the concept designs were later combined into one final conceptual master plan for each site. Each final concept was accompanied by material and plant selections.
Inventory and Analysis

Analyzing each site and its context within the Stroubles Creek Watershed is an important step in planning and development. A selected subset of each site’s physical, biological, and cultural attributes were then analyzed in order to adapt a development program to the unique conditions of the site.

Site Inventory: Physical Attributes
The site inventory is an essential step in understanding the character of the site and the physical, biological, and the cultural linkages between the site and the surrounding landscape. A site’s physical attributes include hydrology, topography, and climate.

Site Inventory: Biological Attributes
A wide range of physical and biological attributes influence landscape biotic and abiotic processes. Landscape ecology provides a useful framework for studying these sites while making environmental planning, restoration, and management decisions.

Site Inventory: Cultural Attributes
Cultural context refers to the historical, legal, aesthetic, and other socially significant attributes associated with each site. Landscape cultural attributes can have a pronounced effect on a site’s future land uses. A sense of place is strengthened by using forms and materials that are common to the region or local area.

Site Analysis: Integration and Synthesis
A site analysis is a program-driven assessment of a site’s physical, biological, and cultural attributes. The site analysis identifies the opportunities and constraints for a specific land use program. The composite site analysis attempts to summarize all of the existing site and contextual conditions that could substantially influence the spatial organization for each site. Inventory of the physical site features and limitations.

The site analysis began with base maps and aerial photography provided by the Town of Blacksburg. In September 2008, the CDAC team members visited the Owens Street Park site. During this first initial visit, the team took photographs, inventoried existing vegetation, and assessed the various uses of focus areas, while conducting an overall site inventory. The findings for each of the project sites are described on the following pages.
Inventory and Analysis

Physical Attributes
The Owens Street Park is a 1.6 acre site that is located adjacent to private residential lots and Apartment Heights housing complex. While the majority of the site exists as open space, most the property edges lie within dense brush. The grass path that runs adjacent to the park is not part of the site, but is part of a future planned connection to the central Blacksburg Greenway. The existing playground equipment in the park is sited to avoid damage during flood events (See Figure 1). The west side of the site is a steep sloping area that elevates up to College View Drive. The existing storm inlets on the site are in a state of disrepair, and show corrosive fractures along with rusting.

Biological Attributes
Stroubles Creek runs directly up the middle of the park with one existing pedestrian bridge (See Figure 2). The park was designed to serve as a temporary flood storage area for storm events. The current maintenance of the park includes mowing to the edge of the creek, which is detrimental to the streams health. The banks along the stream show signs of vertical shearing which increases erosion throughout the site.

Cultural Attributes
There is an implied connection that runs from the pedestrian bridge to the College View Drive cul-de-sac. This human-formed connection is apparent with an eroded path which shows muddy tracks and dying grasses due to frequent use between local area residents and park users. Two main uses for the park include recreational opportunities for children and open space for dog owners.

Integration and Synthesis
Due to the current human use and nature of the site, integrating design with ecological education will help improve the health of Stroubles Creek within the area watershed. This can be achieved through best management practices such as riparian buffers and demonstration areas promoting human interaction with the ecological functions of the site. It is also important to note that adjacent to this site is a proposed connection to the Central Blacksburg Greenway located on the east side of the site.

The maps on the following pages indicate adjacent land uses and provide site inventor and analysis information.
Inventory and Analysis

Spout Springs Park

Physical Attributes
The Spout Springs Park is a 1.0 acre site that is located next to a private residential lot, First Baptist Church, the old Blacksburg Middle School property, and the Berryfield Apartment complex. The property runs along Clay Street and terminates at a resident-owned concrete wall. A gravel parking lot is located on the site and is separated from the park area by wooden bollards (see Figure 1).

Biological Attributes
The center half of the site consists of dense vegetation, where a stream flows from a spring on site. The edges of the site are open, grassed spaces with little to no programming or vegetation. This stream is piped underneath the open area of the site, parallel to the parking area. Erosion issues occur near the steep sloping boundaries of the site, next to Berryfield Apartments and along Clay Street (see Figure 2).

Cultural Attributes
The Spout Spring Park is named after one of the first springs to provide Blacksburg with drinking water. Known as Spout Spring this spring still exists on site within the confines of the dense vegetation. The lower corner of Spout Spring Park marks a corner of the Historic 16 squares, a street grid established during Blacksburg’s initial development.

Integration and Synthesis
An important goal for this site is to provide an engaging atmosphere that promotes exploration. Allowing people to explore the site will yield opportunities for education about the environment and history of the site. The site could provide enhanced pedestrian connectivity as well as highlight the stream and spring. The site will also seek to address the current transition of a natural vegetated environment into an urban corner of a town.

The following are a land ownership map and the inventory and analysis map, which summarizes the above information.
Inventory and Analysis

**Physical Attributes**
The Five Chimneys Park is a 0.5 acre site that is located next to lots and structures that were formerly residential. Five Chimneys is a town-owned structure/site. Behind Five Chimneys is a business and the Blacksburg Police Department. The property is located at the intersection of Washington Street and Draper Road. The Huckleberry Trail runs adjacent to the site. The inlet and outlet structures of the site are large and don’t function to their full potential (see Figure 1).

**Biological Attributes**
Five Chimneys Park contains one of the few urban sections of Stroubles Creek; however this stream is in immediate need of repair. The banks of the stream are slightly vegetated, but still display a lot of vertical sheering (see Figure 2). During storm events, this stream section is subject to large volumes of water causing previous attempts to control these flows to fail.

**Cultural Attributes**
Located on the extreme west side of the site is a historic path known as Huckleberry Trail that provides a connection through the site and follows an old train route. As a historic destination the majority of the Five Chimneys site is decorated with ornamental plant species (see Figure 3). The edge of the site at the intersection of Draper Road and Clay Street (see following maps), marks another corner of the Sixteen Squares street grid in Blacksburg. Dr. Smith, known as an avid horticulturist, owned this property in the 1800’s and gave the site its distinct outdoor rooms.

**Integration and Synthesis**
It is key for the Five Chimneys Park to integrate its history and culture with the ecological functions of the site. Currently, both of these functions are very segregated. Bringing design ideas together that incorporate a healthy stream and highlight a historical landmark will yield the best results for this park.
Design Development

The CDAC design team for this project was comprised of three members: Kim Steika, CDAC Project Coordinator; Josh Franklin, Landscape Architecture Student Designer; and Autumn Visconti, Landscape Architecture Student Designer.

CDAC made various site visits and one Blacksburg Stream Tour during the length of the project. The Stream Tour was led by Dr. Michael Rosenzweig, Project Stakeholder. The individual site visits began in September 2008 after meeting with stakeholders to learn about the opportunities and issues that are present, and the visions that the town had for the parks.

The CDAC design team took what they learned during the first site visit and created two design concepts for each park. One concept shows a scheme for immediate construction and the other concept implements future additions. These concepts were then presented to the stakeholders at the CDAC office on April 21, 2009. The design team took note of any needed changes that the community wanted for the designs and adjusted the plans to meet their needs.

On May 27, 2009, a final design concept was presented to stakeholders. The plans were refined to fit the needs of the community and the health of the stream. They also include an overview for plant specific massing and building materials.

Each site is presented in the pages that follow. Each design contains an initial concept diagram, Existing and proposed conditions for the site, and two concept designs. There is also a copy of the final master plan and material choices for each of the sites. The sites are presented on the following pages starting with Owens Street Park and ending with Five Chimneys Park.
Owens Street Park

Conceptual Design Diagram:
There is a large vegetative buffer that runs along the eastern part of the site, which is also adjacent to the proposed Central Blacksburg Greenway. The stream that runs directly up the middle of the site has been under-utilized and damaged due to constant lawn maintenance. A proposed vegetated buffer coupled with extended stream banks would promote a healthier stream corridor. The re-established entry onto the site would allow users to experience both social gathering and play areas. Images on the following pages provide a sense of proposed concepts and drawings.

Existing and Proposed Conditions:

Riparian Buffer:
A riparian buffer is a vegetated area near a stream, which helps shade and protect the stream from the impact of adjacent land uses. It plays a key role in increasing water quality in associated streams and rivers thus enhancing environmental benefits.

Structural Integrity:
The existing storm drain inlet is designed to drain excess rain and ground water from the park. Storm drains vary in design from small residential dry wells to large municipal systems. They are fed in areas which experience heavy rainfall and flooding during regular storms.

Stream Restoration:
A stream corridor is a complex and valuable ecosystem which includes the land, plants, animals, and network of streams within it. Recognition of the value of stream corridors has come with the understanding of what has been lost through uninformed actions on many streams and the watersheds that nourish them.

Conceptual Design 1:
This concept dealt with providing connections and improving the quality of Stroubles Creek. The design provides a more formal path that connects Owens Street to a cul-de-sac. There is also an improved stream corridor where the stream banks are pulled back and riparian plants are mixed into the existing vegetation. A reconstructed footbridge is also key for easy access to both sides of the park.

Conceptual Design 2:
An important design element for this project was providing space for people to recreate. The main design element is an outdoor pavilion near the existing playground. A path connects the pavilion to the reconstructed footbridge.

Feedback and Comments:
The client team liked components from both Conceptual Design 1 and 2. The idea of creating a visually interactive riparian area near the playground was well received. Since the park also serves as a detention basin in heavy rain events, the outdoor pavilion was deemed as impeding the storage capacity of the area. The client team did like the concept of shade, seating, and even a small overlook near the playground and encouraged the CDAC team to explore creating this area through grading rather than built structures. After discussions with Town Engineer Lee Hixon, the client team also expressed a desire to see additional plantings added to the northern half of the site. Both preliminary concepts showed gravel walking paths on site. The client team requested that those paths be removed from the design concepts, allowing users to define their own routes through the mowed grass areas.

Final Design:
The final design proposes an improved stream bank corridor that is composed of riparian plant masses. The proposed plantings allow for a change in site maintenance that will enhance the stream bank and prevent sedimentation from the bank sloughing into the waterway. There are ample opportunities for users on the site to interact with the open stream, either at its edge or by simply crossing over it. Users can overlook the park from the proposed terraced bank that also serves as a gathering space. Educational signage is proposed near this area. The concept proposes planting the northern end of the site with larger size and quantities of vegetation such as woody shrubs and larger trees. The front of the site will be planted with perennials and medium-sized canopy trees to allow for open views from the street.
Conceptual Design Diagram:
Owens Street Park
Existing and Proposed Conditions  

Owens Street Park

Riparian Buffer

Existing:

![Existing Riparian Buffer Image]

Proposed:

![Proposed Riparian Buffer Image]

The Existing Stream that runs through the middle of Owens Street Park presents a great opportunity for developing a stream riparian buffer, similar to the buffer indicated in the proposed image.

Structural Integrity

Existing:

![Existing Structural Integrity Image]

Proposed:

![Proposed Structural Integrity Image]

Another design opportunity is evident through the restoration of the existing control structures of Owens Street Park. Developing the structure into a more appealing piece of site infrastructure will give the park more visual approval.

Stream Restoration

Existing:

![Existing Stream Restoration Image]

Proposed:

![Proposed Stream Restoration Image]

The stream banks along the edges of Owens Street Park are experiencing stream bank cut. A more sustainable stream bank should be introduced that gently slopes down toward the waters edge.
Concept Design 1:
Owens Street Park

Blacksburg Freshwater Heritage Project
Concept Design 2: Owens Street Park
Goals + Objectives:
To introduce a more natural setting within the fabric of the Stroubles Creek Watershed. The park should consist of natural and man-made elements that work together. This will be done through the following methods:

- Seasonal Mowing
- Stream Restoration
- Establish a Riparian Buffer
- Improve Structural Integrity
- Provide Interactive Opportunities
Goals + Objectives:

+ **Seasonal Mowing**
  Allow the stream corridor to grow back to its natural environment.

+ **Stream Restoration**
  The Stream banks in Owens Street Park are experiencing stream bank cut. A more sustainable stream bank should be introduced that gently slopes down towards the water's edge.

+ **Establish a Riparian Buffer**
  The existing stream that runs through the middle of Owens Street Park presents a great opportunity for developing a stream riparian buffer.

+ **Improve Structural Integrity**
  Another design opportunity through the restoration of the existing culvert installations of Owens Street Park by developing the structure into a more appealing part of site infrastructures.

+ **Provide Interactive Opportunities**
  The site provides opportunity for people to explore the natural condition of the creek as it runs through the park.

---

Creek Section:

This section crosses through the Interactive Area incorporating riparian buffer plant masses.

---

Legend

- **Existing Tree**
- **Proposed Tree**
- **Proposed Remnant Plant Masses**
- **Proposed Woody Plant Masses**
- **Existing Vegetation**
- **Riparian Grass Buffer**
- **2' Curvature**
- **Troubles Creek**

---

In order to approve the aesthetic qualities of the site, designing the inlet structure with stone will improve its overall appearance.
Spout Springs Park

Conceptual Design Diagram:
Being that the site is located on the corner of the original Blacksburg 16 Squares, there is a viable option to allow connection to the town for self-guided tours. Given the topographic features of the site, this allows for more over-looks to occur along the exposed stream corridor and towards the downtown area.

Existing and Proposed Conditions:
**Freshwater Heritage:**
Freshwater refers to naturally occurring water on the surface such as bogs, ponds, lakes, rivers and streams, and underground in aquifers and underground rivers. The use of water by humans for activities such as irrigation and industrial applications can have adverse impacts on down-stream ecosystems. A spring box is a structure engineered to make optimum use of a natural spring.

**Connections:**
Various meeting and observation areas would help establish a connection for users to learn more about the historical nature of the park and the existing spring box. The following page provides examples of existing conditions and proposed ideas.

**Conceptual Design 1:**
A key for this design was the day-lighting of a section of Stroubles Creek. By day-lighting the creek, the design allows people the opportunity to interact with the creek as well as the existing on site spring. A reconstructed spring box allows people to access a once important source of water for the Blacksburg community. The opportunities to interact with the stream come through the construction of decks connected by a boardwalk.

**Conceptual Design 2:**
This design interacts with the natural meandering of the existing stream in relation to the spring box. There is a proposed connection opportunity with both Clay Street and Berryfield Apartments. The proposed boardwalk allows an uninterrupted flow in the stream as it runs parallel to the walk. Both the deck and corner signage areas serve as gathering spaces for educational and social benefits.

Feedback and Comments:
Pedestrian circulation through the site, recognition of the site’s place within the 16 Squares and the history of the Town’s development, and identification and preservation of the springs on and adjacent to the site were the three primary areas of comment from the client team. Because of the area’s topography, the current increase in vehicular traffic on Clay Street, and the lack of pedestrian accommodations, this client team felt that this site should invite pedestrians into the site and offer a safe and visible walking route through the site. The client team expressed a preference for day lighting the creek and adding additional riparian buffers on the northern edge of the creek. The CDAC team was also encouraged to explore angled parking as a response to the parking area currently on site.

Final Design:
The final design for Spout Springs Park takes a gem in the rough and “polishes” it for the community to enjoy. Strategic pedestrian entry points onto the site offer the casual passerby a safe way to traverse this portion of Clay Street and invite residents and visitors to stop and explore a significant portion of the Town’s history found on the site. As a corner edge of the historic Sixteen Squares, the Spout Springs Park can serve as a gathering place for the start of walking tours. Site signage is proposed in this area.

Stroubles Creek is daylighted for the entirety of the site and pedestrian activity on the site is redefined to the southern half of the site, allowing natural plantings to protect and enhance the bank on the northern edge. The vehicular parking on site was adjusted to allow for more space for the creek. Proposed porous pavers will replace the gravel in the parking area. As users meander through the site, they will walk along a tree-covered boardwalk and pass by a constructed spring house, highlighting the original Town spring on the site. An additional spring is located across Clay Street. Signage is proposed for this area as well. A bioretention area will help keep stormwater from polluting the spring source. This design offers an inviting and educational way to enjoy and explore the historical nature of the site.
Conceptual Design Diagram:

Spout Springs Park

Blacksburg Freshwater Heritage Project
The Spout Spring site is home to one of the first springs used by Blacksburg residents. The spring should become a celebrated historical destination.

A key design consideration for this site is the development of pathways through the site that allow people access to the entire Spout Spring site without difficulty.
Concept Design 1: Spout Springs Park
Concept Design 2: Spout Springs Park
**Goals + Objectives:**

To highlight the history of the Spout Spring through human interaction while improving the health of Troubles Creek. This will be done through the following methods:

**Connections**

**Freshwater Heritage**

**Treating Storm Water Run Off**
Goals + Objectives:

Connections
A key design consideration for this site is the development of pathways through the site that allow for people to access the entire Spout Spring site without difficulty.

Freshwater Heritage
The Spout Spring site is home to one of the first springers used by Blacksburg residents. The spring is located on site and should be celebrated as a historical artifact.

Treating Storm Water Run Off
The incorporation of a bio-swale along with tall fescue mix will allow for natural storm events to pass through the site without doing harm to the freshwater creek.

Boardwalk Path:

The raised wooden pathway runs through the well-vegetated part of the site. It provides a connection between the lower and upper ends of the park while providing opportunity for interaction with the Spring house, ultimately highlighting Spout Spring.

Daylighting:

Daylighting is the redirection of a stream into an above-ground channel. The banks of the channel will be planted with soft rushes - which help improve the health of the freshwater creek as well as ease maintenance issues for the site.

Creek Section:

The varied vegetation height between the street and the park allows for easy pedestrian and automobile visibility. This also creates an ample opportunity for users that are passing by the site to become aware of what the park offers.
Five Chimneys Park

Conceptual Design Diagram:
The stream corridor that runs through the Five Chimneys Site has undergone extensive stream bank erosion. A terraced stream bank edge would allow ample opportunity to re-vegetate and stabilize the health of the stream, also providing habitat for existing species. A communal gathering space is also needed and would allow users to experience the ornamental value of the site along with learning opportunities about the Huckleberry Trail and the stream corridor as it runs through the urbanized area of Blacksburg. The following page provides a conceptual diagram of these ideas.

Existing and Proposed Conditions:

Improve Stream Channel:
Natural channel design uses engineering, geological, and biological principles to improve the hydrology, habitat, and aesthetics of a stream, considering current and future watershed conditions. The natural channel design approach uses reference streams as a blueprint (stream shape and biology) to devise a comprehensive project aimed at restoring and maintaining natural stream functions over the long term.

Stabilize Stream Banks:
Natural stream functions and stability are threatened by changes in watershed hydrology and land use. This results in unstable streams with poor habitat and water quality. Impacts include eroding streambanks, unsafe water supplies, reservoir siltation, impaired habitat, fish kills, and loss of floodplain function. Causes of stream impairment include channelization, stormwater runoff, road crossings, sediment loads, and loss of riparian vegetation.

Reduce Flow Velocity:
Streamflow is the flow of water in streams, rivers, and other channels, and is a major element of the water cycle. It is one component of the runoff of water from the land to waterbodies, the other component being surface runoff. Water flowing in channels comes from surface runoff from adjacent topography, from groundwater flow out of the ground, and from water discharged from pipes.

Conceptual Design 1:
This design conceptualizes the need for terraced stream banks and learning opportunities where a proposed natural pond is located. The ponding area is suitable for energy dissipation as well as habitat for existing species. A new entry into the park is also proposed connecting the pedestrian movement of Draper Road directly to the proposed observation point.

Conceptual Design 2:
The second design proposal encompasses the need for increased pedestrian movement throughout the park. This design also proposes an observation point/pedestrian bridge over the 9’x4’ storm outlet. This will allow users to watch the stream move through the site from beneath their feet. This feature also provides ample opportunity for educational and directional signage.

Final Design:
The final design for Five Chimneys Park promotes a more inviting atmosphere for park users. The gathering space above the culvert combines a seating area/overlook with signage, and educational benefits. The health of the stream will be restored by transforming the stream banks into gentle terraces, along with re-establishing a strong root system through its plant massings. The existing ornamental nature on the site is also recognized in the proposed planting and hardscaping design.
Conceptual Design Diagram:

Five Chimneys Park

Blacksburg Freshwater Heritage Project
Existing and Proposed Conditions

Connections
Existing:

Rocks and naturalized perennial plantings along the channel will reinforce the edges between the stream and its banks.

Stabilize Stream Bank
Existing:

Plantings such as rushes, sedges, and grasses along with re-grading the stream back will recreate the original meanders of the stream.

Reduce Flow Velocity
Existing:

Proposed view flowing out of the outlet structure: the added boulders will dissipate the energy, slowing the water velocities and ultimately mitigating erosion.

Proposed:

Image Source: State of Virginia Department of Environment

Image Source: University of Virginia
Concept Design 1: Five Chimneys Park
Concept Design 2: Five Chimneys Park
Goals + Objectives:

To re-stabilize Stroubles Creek as it runs through Five Chimneys Park while implying design through the existing ornamental characteristics of the site. This will be done through the following methods:

+ Stabilize Stream Banks
+ Improve Stream Channel
+ Reduce Flow Velocity of the Stream
+ Provide a More Inviting Atmosphere
**Goals + Objectives:**

- **Stabilize Stream Banks**
  Rocks and naturalized perennial plantings along the channel will reinforce the edge between the stream and its banks.

- **Improve Stream Channel**
  Plantings such as rushes, sedges, and grasses along with re-grading the stream bank will improve the quality of the stream channel.

- **Reduce Flow Velocity of the Stream**
  Added boulders will dissipate the energy slowing the water velocities ultimately mitigating erosion.

- **Provide a More Inviting Atmosphere**
  By capturing the already existing mixture of the Five Chimneys SE community, plantings paired with inviting viewpoints will create an engaging atmosphere.

**Creek Section:**

The interlocking matrix of concrete blocks combine the favorable aspects of lightweight blankets and meshes, such as porosity, flexibility, vegetation encouragement, and habitat enhancement.

**Extended Stone Wall**

The stone wall in the above image would be a nice extension to the existing stone wall of the Five Chimneys site. It could also provide seating opportunities for individuals.
Conclusion

It is the intent of these proposals to encourage more people to take an interest in the Freshwater Heritage of Blacksburg, VA. The redesign of Owens Street, Spout Spring, and Five Chimneys Park will provide the Blacksburg community with more viable public space that highlight the history of Blacksburg as well as provides educational and recreational opportunities. Hopefully the implementation of these parks will spark an interest in the history of Blacksburg and the value of water to the community. Serving as demonstration projects, individuals can learn how to better enhance riparian corridors.

Discussing final plant recommendations

Reviewing the final design for Five Chimneys Park

The community of Blacksburg has many freshwater opportunities

Greenspace is an important part of an active community
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As part of the Freshwater Heritage Project the CDAC team mapped the exposed areas of Stroubles Creek. This map developed after a tour with Mike Rosenzwieg and displayed the exposed stretches of Stroubles Creek. The map shows that Stroubles Creek has many different environmental conditions as it travels through the Town of Blacksburg. Some sections are in a very urban setting, while others resemble much more of a natural setting. By mapping out these conditions it gave the team the ability to see opportunities for improvement throughout the Stroubles Creek Watershed. It also provided ideas for what could potentially change in the site designs for the freshwater heritage project to benefit their sustainability.
## Blacksburg Freshwater Heritage Project

### Plant scientific name | Common name | Size at Maturity | Hardiness | Native Y/N | Form and habit | Seasonal characteristics | Culture | Notes
--- | --- | --- | --- | --- | --- | --- | --- | ---
Acer x freemanii 'Armstrong' | Freeman maple | 40-55' tall, 30-40' wide to zone 3 | N | deciduous tree | red fall foliage | Full sun to part shade, medium to wet soils. | This is the fruitless cultivar. |
Liquidambar styraciflua 'Rotundifoloba' | Sweet gum | 60-70' tall, 20-30' wide to zone 5 | Y | deciduous tree | yellow, purple, or red fall color | Full sun, medium to wet soils |
Platanus occidentalis | Sycamore | 75-100' tall and wide to zone 4 | Y | deciduous tree | Full sun, medium to wet soils |
Taxodium distichum | Bald cypress | 30-75' tall, 20-45' wide to zone 4 | Y | deciduous conifer | orange-brown fall color | Full sun, medium to wet soils |
Aronia melanocarpa* | Black chokeberry | 3-6' to zone 3 | Y | deciduous shrub | white flowers in spring, blue berries, purple/red fall color | Full sun to part shade, medium to wet soils. Spreads by suckering, will form a colony. Can withstand wet conditions. |
Clethra alnifolia | Sweet pepperbush | 3-8' tall, 4-6' wide to zone 3 | Y | deciduous shrub | fragrant white flowers mid summer, yellow fall color | Full sun to part shade, medium to wet soils. |
Cornus sericea 'Cardinal' | Redosier dogwood | 8-10'tall and wide to zone 2 | Y | deciduous shrub | white flowers late spring, reddish purple fall color, red stems in winter | Full sun to part shade, medium to wet soils. Effective as a bank cover, holds soil well. May control erosion on moist streambanks. Spreads by rhizomes, may also self seed. Best color on young stems, pruning is not necessary but for best color prune close to ground in early spring. |
Caltha palustris* | Marsh marigold | 1-2' to zone 3 | Y | flowering perennial | yellow flowers April-June | Full sun to part shade in wet soil to shallow water |
Carex turfa* | Saltmarsh sedge | 1.5-3' to zone 3 | Y | perennial grass | seedheads resemble sweetgum balls | Full sun to part shade, wet to moist soil |
Iris virginica* | Southern blue flag | 1-3' to zone 5 | Y | flowering perennial | blue/purple flowers in May | Full sun to part shade in wet soils, or under water |
Juncus effusus* | Soft rush | 2-4' to zone 4 | Y | grass like perennial | foliage yellow in fall, brown in winter | Full sun to part shade, wet to moist soil. |
Panicum virgatum 'Rostralbusch' | Red switch grass | 4-6' to zone 5 | Y | perennial grass | silvery green grass, turning burgundy in the fall, tan/beige in winter | Full sun to part shade, medium to wet soils |
Acorus gramineus 'Ogon' | Variegated sweet flag | 1' to zone 5 | N | herbaceous perennial | golden variegated evergreen foliage | Full sun to part shade, medium to wet soils. |
Carex flaccosperma | Blue wood sedge | 8” to 10” to zone 5 | Y | evergreen sedge | | Part shade to full shade, wet to moist soil |
Hosta sieboldiana 'Elegans' | Hosta | 2-3' tall, 3-4' wide to zone 4 | N | herbaceous perennial | white flowers May-July, bold blue-green foliage | Part shade to full shade, well drained soils |
Lythrum salicaria 'Aurea' | Creeping jenny | 3-6' tall, 1-1.5’ wide to zone 3 | N | herbaceous perennial groundcover | yellow flowers early summer, lime green foliage throughout growing season | Full sun to part shade, medium to wet soils. |
Matteuccia struthiopteris | Ostrich fern | 2-5’ to zone 3 | Y | fern | bold plumelike foliage | Part shade to full shade, medium to wet soils |
Osmunda cinnamon | Cinnamon fern | 2-3’ to zone 3 | Y | fern | foliage turns yellow in the fall | Part shade to full shade, medium to wet soil |
*Riparian Plantings
<table>
<thead>
<tr>
<th>Recommended Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Owens Street Park</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plant</th>
<th>Image</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Taxodium distichum</em></td>
<td>Bald cypress</td>
<td></td>
</tr>
<tr>
<td><em>Platanus occidentalis</em>, <em>Sycamore</em></td>
<td>Sycamore</td>
<td></td>
</tr>
<tr>
<td><em>Liquidambar styraciflua</em></td>
<td><em>Rotundiloba</em></td>
<td>Sweetgum</td>
</tr>
<tr>
<td><em>Acer x freemanii</em> ‘Armstrong’</td>
<td>Freeman maple</td>
<td></td>
</tr>
<tr>
<td><em>Aronia melanocarpa</em></td>
<td>Black chokeberry</td>
<td></td>
</tr>
<tr>
<td><em>Clethra alnifolia</em></td>
<td>Sweet pepperbush</td>
<td></td>
</tr>
</tbody>
</table>
Cornus sericea ‘Cardinal’
Redosier dogwood

Caltha palustris
Marsh marigold

Carex lurida
Sallow sedge

Iris virginica
Southern blue flag

Juncus effusus
Soft rush

Panicum virgatum ‘Rostrahlbusch’
Red switch grass
Recommended Plants
Owens Street Park

- **Acorus gramineus ‘Ogon’**
  Variegated sweet flag

- **Carex flaccosperma**
  Blue wood sedge

- **Lysimachia nummularia ‘Aurea’**
  Creeping jenny

- **Hosta sieboldiana ‘Elegans’**
  Hosta

- **Matteuccia struthiopteris**
  Ostrich fern

- **Osmunda cinnamomea**
  Cinnamon fern
<table>
<thead>
<tr>
<th>Plant scientific name</th>
<th>Plant common name</th>
<th>Size at Maturity</th>
<th>Hardiness</th>
<th>Native Y/N</th>
<th>Form and habit</th>
<th>Seasonal characteristics</th>
<th>Culture</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betula nigra</td>
<td>river birch</td>
<td>40-70' tall, 40-60' wide</td>
<td>to zone 4</td>
<td>Y</td>
<td>deciduous tree</td>
<td>yellow fall color</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Ostrya virginiana</td>
<td>American hophornbeam</td>
<td>25-40' tall, 20-30' wide</td>
<td>to zone 3</td>
<td>Y</td>
<td>deciduous tree</td>
<td>yellow fall color, male catkins throughout winter</td>
<td>Full sun to part shade, moist, well drained soils</td>
<td></td>
</tr>
<tr>
<td>Taxus cuspidata 'Capitata'</td>
<td>Japanese yew</td>
<td>10-25' tall, 5-10' wide</td>
<td>to zone N</td>
<td>N</td>
<td>needle evergreen shrub</td>
<td>evergreen foliage</td>
<td>Full sun to part shade, medium moisture, well drained soils</td>
<td>Can be pruned at any time during the year.</td>
</tr>
<tr>
<td>Abelia x grandiflora 'Sherwoodii'</td>
<td>glossy abelia</td>
<td>3-4' tall and wide</td>
<td>to zone 5</td>
<td>N</td>
<td>deciduous shrub</td>
<td>white tinge pink flowers summer till frost, semi evergreen foliage</td>
<td>Full sun to part shade, medium well drained soils</td>
<td></td>
</tr>
<tr>
<td>Aronia melanocarpa 'Morton' (Iroquois Beauty)*</td>
<td>black chokeberry</td>
<td>2-3' tall, 4-5' wide</td>
<td>to zone 3</td>
<td>Y</td>
<td>deciduous shrub</td>
<td>white flowers in spring, blue berries, purple/red fall color</td>
<td>Full sun to part shade, medium to wet soils</td>
<td>Spreads by suckering, will form a colony</td>
</tr>
<tr>
<td>Clethra alnifolia 'Hummingbird*'</td>
<td>sweet pepperbush</td>
<td>2-4' tall, 3-5' wide</td>
<td>to zone 3</td>
<td>Y</td>
<td>deciduous shrub</td>
<td>fragrant white flowers mid summer, yellow fall color</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Forsythia intermedia 'Courtsaol' (Gold Tide)</td>
<td>forsythia</td>
<td>1-2' tall, 1-4' wide</td>
<td>to zone 5</td>
<td>N</td>
<td>deciduous shrub</td>
<td>Yellow flowers early spring</td>
<td>Full sun to part shade, average well drained soils</td>
<td></td>
</tr>
<tr>
<td>Hydrangea quercifolia 'Pee Wee'</td>
<td>oakleaf hydrangea</td>
<td>3-4' tall, 2.5-3' wide</td>
<td>to zone 5</td>
<td>Y</td>
<td>deciduous shrub</td>
<td>White panicles of flowers early to late summer</td>
<td>Full sun to part shade, medium moisture, well drained soils</td>
<td></td>
</tr>
<tr>
<td>Acorus gramineus 'Ogon*'</td>
<td>variegated sweet flag</td>
<td>1'</td>
<td>to zone 5</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>golden variegated evergreen foliage</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Artemisia 'Powis Castle'</td>
<td>wormwood</td>
<td>2-3' tall, 1-2' wide</td>
<td>to zone 6</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>silvery foliage</td>
<td>Full sun, well drained soils</td>
<td>semi-woody habit, can be pruned in early spring</td>
</tr>
<tr>
<td>Geranium macrorrhizum*</td>
<td>bigroot geranium</td>
<td>1' tall, 1.5-2' wide</td>
<td>to zone 3</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>magenta flowers late spring through early summer, red fall foliage</td>
<td>Full sun to part shade, well drained soils</td>
<td>spreads by rhizomes to form a ground cover</td>
</tr>
<tr>
<td>Hosta 'Sum and Substance'</td>
<td>hosta</td>
<td>2-3' tall, 3-5' wide</td>
<td>to zone 3</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>white flowers in August</td>
<td>Full sun to part shade</td>
<td>Part shade to full shade, medium to wet soils</td>
</tr>
<tr>
<td>Matteuccia struthiopetala*</td>
<td>ostrich fern</td>
<td>2-5'</td>
<td>to zone 3</td>
<td>Y</td>
<td>fern</td>
<td>bold plumelike foliage</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Pennisetum aleepecuroides 'Hameln'</td>
<td>fountain grass</td>
<td>1.5-2.5' tall and wide</td>
<td>to zone 5</td>
<td>N</td>
<td>ornamental grass</td>
<td>wheatlike flower spikes in late summer</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Salvia nemorosa 'Ostfriesland' (East Friesland)</td>
<td>garden sage</td>
<td>1-1.5' tall, 1' wide</td>
<td>to zone 4</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>purple flower spikes in summer</td>
<td>Full sun, well drained soils</td>
<td></td>
</tr>
</tbody>
</table>

*Bioswale Plantings
Recommended Plants
Spout Spring Park

- **Betula nigra**
  - River birch

- **Ostrya virginiana**
  - American hop hornbeam

- **Taxus cuspidata** ‘Capitata’
  - Japanese yew

- **Abelia x grandiflora** ‘Sherwoodii’
  - Glossy abelia

- **Aronia melanocarpa** ‘Morton’
  - (Iroquois Beauty)
  - Black chokeberry

- **Clethra alnifolia** ‘Hummingbird’
  - Sweet pepperbush

Photo courtesy mobot.org
## Recommended Plants

### Spout Spring Park

<table>
<thead>
<tr>
<th>Plant</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forsythia x intermedia ‘Courtasol’ (Gold Tide)</td>
<td><img src="image1" alt="Forsythia x intermedia ‘Courtasol’" /></td>
</tr>
<tr>
<td>Forsythia</td>
<td><img src="image2" alt="Forsythia" /></td>
</tr>
<tr>
<td>Hydrangea quercifolia ‘Pee Wee’ Oakleaf hydrangea</td>
<td><img src="image3" alt="Hydrangea quercifolia ‘Pee Wee’ Oakleaf hydrangea" /></td>
</tr>
<tr>
<td>Acorus gramineus ‘Ogon’ Variegated sweet flag</td>
<td><img src="image4" alt="Acorus gramineus ‘Ogon’ Variegated sweet flag" /></td>
</tr>
<tr>
<td>Artemisia ‘Powis Castle’ Wormwood</td>
<td><img src="image5" alt="Artemisia ‘Powis Castle’ Wormwood" /></td>
</tr>
<tr>
<td>Geranium macrorrhizum Bigroot geranium</td>
<td><img src="image6" alt="Geranium macrorrhizum Bigroot geranium" /></td>
</tr>
<tr>
<td>Hosta ‘Sum and Substance’</td>
<td><img src="image7" alt="Hosta ‘Sum and Substance’" /></td>
</tr>
</tbody>
</table>

---

**Blacksburg Freshwater Heritage Project**
Recommended Plants
Spout Spring Park

Matteuccia struthiopteris
Ostrich fern

Pennisetum alepecuroides ‘Hameln’
Fountain grass

Salvia nemorosa 'Ostfriesland' (East Friesland)
Garden sage

Photo courtesy mobot.org
## Five Chimneys Park - Plant Specifications

<table>
<thead>
<tr>
<th>Plant scientific name</th>
<th>Common name</th>
<th>Size at Maturity</th>
<th>Hardiness</th>
<th>Native Y/N</th>
<th>Form and habit</th>
<th>Seasonal characteristics</th>
<th>Culture</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betula nigra ‘Little King’ (Fox Valley)</td>
<td>River birch</td>
<td>8-10' tall, 9-12' wide</td>
<td>to zone 4</td>
<td>N</td>
<td>multi-stemmed deciduous shrub</td>
<td>exfoliating bark, yellow fall foliage</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Cercis canadensis ‘Covey’</td>
<td>Weeping eastern redbud</td>
<td>4-10' tall and wide</td>
<td>to zone 4</td>
<td>N</td>
<td>weeping deciduous tree</td>
<td>lavender flowers early spring, yellow fall foliage</td>
<td>Full sun to part shade, medium, well drained soils</td>
<td>May be staked to promote upright habit to desired height</td>
</tr>
<tr>
<td>Magnolia virginiana ‘Jim Wilson’ (Moonglow)</td>
<td>Sweetbay magnolia</td>
<td>15-35' tall, 10-20' wide</td>
<td>to zone 5</td>
<td>N</td>
<td>broadleaf evergreen tree</td>
<td>white flowers May-June, evergreen foliage</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Acorus gramineus ‘Ogon’</td>
<td>Variegated sweet flag</td>
<td>1'</td>
<td>to zone 5</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>golden variegated evergreen foliage</td>
<td>full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Miscanthus sinensis ‘Zebrinus’</td>
<td>Zebra grass</td>
<td>5-8' tall, 4-6' wide</td>
<td>to zone 5</td>
<td>N</td>
<td>perennial grass</td>
<td>white flower spikes late summer through winter</td>
<td>Full sun to part shade, well drained soils</td>
<td>Cut down grasses in late winter, early spring</td>
</tr>
<tr>
<td>Panicum virgatum ‘Rostralhusch’</td>
<td>Red switch grass</td>
<td>4-5'</td>
<td>to zone 5</td>
<td>Y</td>
<td>perennial grass</td>
<td>silvery green grass, turning burgundy in the fall, tan/beige in winter</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Pennisetum alepecreunoides ‘Hameln’</td>
<td>Fountain grass</td>
<td>1.5-2.5' tall and wide</td>
<td>to zone 5</td>
<td>N</td>
<td>perennial grass</td>
<td>wheatlike flower spikes in late summer</td>
<td>Full sun to part shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Aronia melanocarpa ‘Morton’ (Iroquois Beauty)</td>
<td>Black chokeberry</td>
<td>2-3' tall, 4-5' wide</td>
<td>to zone 3</td>
<td>Y</td>
<td>deciduous shrub</td>
<td>white flowers in spring, blue berries, purple/red fall color</td>
<td>Full sun to part shade, medium to wet soils</td>
<td>Spreads by suckering, will form a colony</td>
</tr>
<tr>
<td>Dicentra spectabilis</td>
<td>Bleeding heart</td>
<td>2-3' tall, 1-5-2.5' wide</td>
<td>to zone 3</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>pink flowers early spring</td>
<td>Part shade to full shade, moist soils</td>
<td>Foliage fades in summer, plant among later blooming perennials</td>
</tr>
<tr>
<td>Geranium macrorrhizum</td>
<td>bigroot geranium</td>
<td>1' tall, 1.5-2' wide</td>
<td>to zone 3</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>magenta flowers late spring through early summer, red fall foliage</td>
<td>Full sun to part shade, well drained soils</td>
<td>spreads by rhizomes to form a groundcover</td>
</tr>
<tr>
<td>Helleborus foetidus</td>
<td>Bearsfoot hellebore</td>
<td>1-2' tall and wide</td>
<td>to zone 5</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>white flowers late winter, early spring, evergreen foliage</td>
<td>Part shade to full shade, moist soils</td>
<td></td>
</tr>
<tr>
<td>Heuchera villosa ‘Autumn Bride’</td>
<td>Hairy alumroot</td>
<td>1.5-3' tall, 1.5-2' wide</td>
<td>to zone 3</td>
<td>N</td>
<td>herbaceous perennial</td>
<td>white flowers late summer til frost</td>
<td>Full sun to part shade</td>
<td></td>
</tr>
<tr>
<td>Matteuccia struthiopteris</td>
<td>Ostrich fern</td>
<td>2-5'</td>
<td>to zone 3</td>
<td>Y</td>
<td>fern</td>
<td>bold plumelike foliage</td>
<td>Part shade to full shade, medium to wet soils</td>
<td></td>
</tr>
<tr>
<td>Mertensia virginica</td>
<td>Virginia bluebells</td>
<td>1.5-2' tall and wide</td>
<td>to zone 3</td>
<td>Y</td>
<td>herbaceous perennial</td>
<td>blue flowers in early spring</td>
<td>Part shade to full shade, moist soils</td>
<td>Foliage fades in summer, plant among later blooming perennials</td>
</tr>
</tbody>
</table>
Recommended Plants
Five Chimneys Park

Betula nigra ‘Little King’ (Fox Valley)
River birch

Cercis canadensis ‘Covey’
Weeping eastern redbud

Magnolia virginiana 'Jim Wilson'
(Moonglow)
Sweetbay magnolia

Acorus gramineus ‘Ogon’
Variegated sweet flag

Panicum virgatum ‘Rostrahlbusch’ red switch grass

Pennisetum alepecuroides ‘Hameln’
Fountain grass
Recommended Plants
Five Chimneys Park

**Miscanthus sinensis** ‘Zebrinus’ Zebra grass

**Aronia melanocarpa** ‘Morton’ (Iroquois Beauty) Black chokeberry

**Dicentra spectabilis**, Bleeding heart

**Geranium macrorrhizum** Bigroot geranium

**Hellebous foetidas** Bearsfoot hellebore

**Heuchera villosa** ‘Autumn bride’ Hairy alumroot
Recommended Plants
Five Chimneys Park

Matteuccia struthiopteris
Ostrich fern

Mertensia virginica
Virginia bluebells

Allium giganteum
Giant onion

Aster novae-angliae ‘Purple Dome’
New England aster

Hemerocallis ‘Happy Returns’
Daylily

Hosta ‘Sum and Substance’
Hosta
Recommended Plants

Five Chimneys Park

Narcissus hybrids Daffodil

Salvia nemorosa 'Ostfriesland' (East Friesland) Garden sage

Veronica prostrate Prostrate veronica
Interlocking Blocks

Interlocking blocks for the stabilization of stream and river banks and cut lines, road bed embankments, and boat ramps, are made of concrete, and have a high proportion of open area. Interlocking connections between adjacent blocks are made by radial projecting members and recesses on the periphery of each block, the projecting members of one block fitting into the recesses on adjacent blocks (see page A16). Projections and recesses are alternately provided at regular angular intervals such that blocks can be assembled in either square or an equilateral triangular patterns. A layer of filter cloth material is laid on the sloping surface and upon which the blocks are then placed; this filter cloth slows down the leaching of water through the open areas between the interlocking blocks and prevents the washing away of sand and silt by stream or river water or rainwater runoff (see page A15).

Concrete blocks cemented to a fabric liner or linked by cables form a flexible and porous mat that allows grasses and other plants to grow through the openings in the mat. The blocks are available from several manufacturers in numerous sizes, shapes, sizes, and colors. The block mats are limited to mild slopes and mild velocities because the mats can be undermined by turbulent, debris-filled floodwaters. Their effectiveness is dependent on their mass and their ability to resist being dislocated and transported by flowing water. The same limitations that apply to rip-rap apply to these systems.

ArmorFlex Blocks

Though there is some variation between the different types of systems (size, strength, durability, etc.) most solve the same problem in a similar fashion. The information on the following pages is provided by ArmorTec Erosion Control Systems. The specific system ArmorTec markets is calling ArmorFlex. The following pages discuss the products features and benefits as well as installation process.

Information provided by ArmorTec

The Interlocking block systems can prevent erosion situations similar to this image from happening. Image provided by: http://soer.justice.tas.gov.au/2003/image/108/index.php
Armoflex is a flexible, interlocking matrix of concrete blocks of uniform size, shape and weight connected by a series of cables which pass longitudinally through preformed ducts in each block. Armoflex is installed over site-specific filter fabric on a prepared surface. Armoflex revetment systems combine the favorable aspects of lightweight, blankets, and mesh, such as porosity, flexibility, vegetation encouragement, and habitat enhancement with nonintrusive, self-weight, and high-tensile-force resistance of a rigid lining.

Armoflex has proven to be an aesthetic and functional alternative to dumped stone riprap, gabions, structural concrete, and other heavy-duty, durable erosion protection systems. Armoflex is easy to install, therefore, can dramatically reduce overall project costs. More specifically, when compared to other systems, life-cycle costs have been reduced because Armoflex is a permanent system and saves on subsequent maintenance expenses.

### Block Styles

<table>
<thead>
<tr>
<th>OPEN CELL</th>
<th>CLOSED CELL</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% OPEN</td>
<td>10% OPEN</td>
</tr>
</tbody>
</table>

When placed on a site-specific filter fabric, the permeability of the revetment system relieves hydrostatic pressure in the subgrade. The system’s capability for soil retention prevents leaching of subsols throughout the installation.

### Flexibility

Armoflex blocks are interconnected by flexible cables, providing articulation between adjacent blocks. Block walls are designed with beveled side walls to allow for flexibility in all directions.

### Features & Benefits

- Stability
- Flexibility
- Performance
- Cost-effective
- Vegetation
- Permeability
- Easy to install

Before

After

Dams, Spillways, and High Velocity Channels

Armoflex unique Tapered block design offers superior protection for embankment dams, spillways, and high-velocity channels and chutes. The essential design component of the Armoflex Tapered system is a 0.5-inch taper that virtually eliminates destabilizing impact flow forces, thereby providing higher factors of safety. The Armoflex Tapered block system has been successfully tested under hydraulic jump conditions at Colorado State University.
Signage

An additional goal of this project was to provide some insight for signage opportunities on the three sites. It is important to create a sign that displays important information about the site, but also ties into the existing signage of the Town of Blacksburg. For this reason, the signage board uses a template already developed for future signage in Blacksburg and modifies it to fit the needs of the parks. The following page displays an example for signage on the Spout Spring site (see page A19). It provides information about the spring that runs through the site as well as the historic spring house located on Wharton Street.

The logo below represents the Historic Sixteen Squares - the sixteen original planned blocks in the Town of Blacksburg. The logo was modified slightly for the signage board to help reference where the parks are within the Sixteen Squares.
Spout Springs

Spout Spring is a natural spring that begins at the headwaters of Stroubles Creek on the northern part of the town of Blacksburg, VA. This spring marks the origin of Blacksburg’s early water supply. Throughout its history the importance of this spring has been forgotten and lost within the vegetation of the town property. Spout Spring Park revives this once forgotten asset of the town by creating a place that people seek to explore.

Spout Spring House

The Spout Spring House, also known as the Tucker House is one of Blacksburg’s oldest standing structures. This house built partly of log timber construction seems to be oriented to the grid of Blacksburg which would date it after 1797. This house sits on top of a small hill located to the southwest side of Spout Spring directly in line with Washington Street.

Town of Blacksburg