ABSTRACT

Title of Document:	GREENWAY AS THE FRAMEWORK FOR COMMUNITY DESIGN ON THE PATAPSCO RIVER VALLEY.
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By the nature of their shared locality, greenway corridors and the communities along them share a unique set of socio-cultural and ecological resources that are rooted in the greenway's landscape form and character. When unified, greenways and surrounding communities foster a sense place that is deeply site specific. This thesis explores the unique characteristics of greenway landscapes, using them as a basis for formulating cohesive design criteria for creating vibrant greenway-adjacent communities. These criteria offer solutions for balancing growth and conservation strategies to guide community design within the framework of the greenway, achieve community and greenway sustainability, and support the integrity of the landscape. Using a site along Maryland's Patapsco River Valley, this thesis demonstrates how these criteria can work towards achieving an ideal community form where design highlights unique site features to create awareness of and support for the greenway context.

GREENWAY AS THE FRAMEWORK FOR COMMUNITY DESIGN ON THE PATAPSCO RIVER VALLEY.

By

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Chapter 1: Greenways for Shaping Community

Purpose

Communities along greenway corridors are important not only in ways that create places where people can live, work, and play, but also as gateways to some of the most cherished landscapes. Within these linked landscapes is where it is important to integrate human needs with a greenway's valuable natural resources because "greenways and the parklands they connect with neighborhoods, schools and mixed use centers provide the unifying element that allows urban and rural values to merge, producing a superior hybrid community form (Arendt 2011, 28)." As a cohesive unit, the greenway and community can "produce a network of linked landscapes (Arendt 2004, 242)" that not only "promotes a community-wide system of interconnected open spaces (Arendt 2004, 242)", but also captures an integrated sense of place and identity.

Connectivity and compatibility between greenway and community development are based on important considerations of social, cultural, transportation, and ecological context of the surrounding landscape. The success of community development is based on a set of factors that integrates these considerations to ultimately achieve community and greenway sustainability and support the overall integrity of the landscape. The term *development* herein refers to the process of subdividing the land into lots and altering the physical landscape for the purpose of housing and commercial use within communities.

While the term *community* refers to a local community that is not only place-based but also is one with connections that create a sense of place and identity. It can be viewed as an area where there are common social and cultural characteristics. By the nature of their shared locality, communities along greenway corridors have social and cultural connections that are rooted in the greenway's unique landscape form and character.

Examples/instances of community design that promotes a sense of place and considers a balance between growth and conservation are well documented in conservation subdivision design, smart growth, and new urbanism strategies. They are important development strategies that consider multiple growth and conservation objectives. Although each carries a different focus, integrated together they can form a balance between development and conservation objectives for achieving sustainable communities surrounding greenways.

Various forms of evaluation criteria have been published to help planners and designers make design decisions that support each of these strategies. For example, Randall Arendt has multiple publications that include general evaluation criteria towards conservation lands including those documented his book, *Envisioning Better Communities* supported by the American Planning Association and the Urban Land Institute. The United States Environmental Protection Agency (EPA) provides examples of over 15 different published criteria that are specifically written and used by municipalities throughout the country (EPA 2013). In addition, the *Smart Scorecard for Development Projects* is a general set of guidelines published in

collaboration with the Congress for New Urbanism and the EPA, which is used as a tool to help achieve smart growth objectives (Fleissig and Jacobsen 2002, 2).

What is lacking, however, is a set of design criteria specific to community development adjacent to greenway corridors. This thesis explores the unique social/cultural, transportation, and ecological connections that define community identity within the framework of greenway that can serve as a basis for formulating cohesive design criteria. A concept for community design within the framework of the Patapsco Heritage Greenway (PHG) in Howard County will be considered as a means to apply these criteria to a realistic scenario. It will evaluate how its unique social/cultural, transportation, and ecological characteristics can create a community that is deeply site specific in both form and character.

Greenway Defined

This thesis uses the concept of a greenway corridor as the primary driving force for shaping community design. Considering the varied perspectives and definitions associated with the term, "greenway", it is important to understand how the greenway is defined within the context of this thesis. A "greenway" broadly refers to a spatially linked network of any combination of open space, parks and protected areas of either natural or manmade landscapes (Ahern 2004, 35). Each can vary depending on location, spatial configuration, and scale and have a diverse combination of social/cultural, transportation, and environmental purposes. Under this interpretation, there is room for many types and combinations of landscapes to be considered greenways, including linear networks of city parks, scenic roadways or

parkways, or natural river corridors. Potentially even a utility corridor or a simple network of gardens could be considered a greenway under this definition.

For the purposes of this thesis, the following characteristics provide a more specific vision of the definition of a greenway:

- Comprised of a linear corridor of open spaces connecting people with nature and to adjacent communities.
- Comprised of conservation lands including historic forested and local heritage landscapes.
- Promotes sustainability whereby there is a connection and sense of harmony between humans, animals, and vegetation.
- Provides a variety of recreational opportunities and contains designated public recreation areas.
- Provides pedestrian and bicycle transportation through a trail network connecting to internal and external greenway destinations.

Considering these key characteristics, a fundamental definition of the term greenway that aptly applies is:

> An integrated network of green spaces "planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic or other purposes compatible with the concept of sustainable land use." (Ahern 2004, 35).

However, a major feature and function that is often considered in tandem to the definition of greenways is the associated network of trails, which act as the greenway's transportation system. Trails are the lifeline to the greenway's natural areas and enable human-nature connectivity in a way that promotes environmental awareness and reduces environmental degradation (Bell 2000). Although interrelated with social and cultural aspects of greenways, the critical role of a greenway's transportation network calls for distinction when considering a definition of greenways. As such, greenways can be defined as:

> A spatially integrated network of green spaces unified by an interrelationship of their core infrastructure - the shared social/cultural, ecological, and transportation resources.

With an emphasis on sustainability, the greenway and its network of trails creates a balanced relationship between people and natural resources that promotes livability that supports the long term viability of social/cultural and ecological landscape. Different sites have different manifestations of these defining elements. In the case of the PHG, it is an integrated network of green spaces and trails along the naturalized woodland landscape of the Patapsco River Valley corridor. Furthermore, the PHG encompasses a full spectrum of social/cultural, transportation, and ecological greenway purposes, as described in Table 1.

Table 1. Land Use Purposes of the PHG.

Purpose	PHG
Social/Cultural	Heritage Area –History from the 17th Century colonization to the industrialization of the Patapsco River Valley. Aesthetic aspect of the natural landscape. Nationally known for scenery (Maryland Department of Natural Resources, 2013).
Transportation	Formal and informal trails that provide non-motorized access to greenway and outside destinations. The trails are core infrastructure enabling the wide range of social activities and cultural connections including walking, hiking, biking and horseback riding as well as those connected to the river including swimming and fishing.
Ecological	State and county designated conservation land. Sustainable land use is a priority. Ongoing protection, restoration efforts towards water quality, riparian, wetland and habitat.

Envisioning the PHG as the infrastructure and foundation of surrounding communities, the greenway network reaches and extends beyond the river valley into the community network. In this way, the greenway represents a broader network of integrated open spaces between the PHG and surrounding communities and links recreation, cultural, aesthetic, conservation, and sustainable land use purposes, as represented in Table 2.

Table 2. Shared Landscape between PHG and Surrounding Communities.

Purpose	Interrelationship
Social/Cultural	PHG recreation interrelated with community parks and open space.
	A transparent cultural identity between community and PHG.
	Integration of aesthetic scenery and landscape form between the community and the PHG.
Transportation	Integration of PHG trails with community pedestrian routes including sidewalks, formal and informal trails.
Ecological	A linked network of community and PHG conservation lands.
	Comprehensively protect and enhance water quantity, quality, riparian, wetland and habitat connections between the community and the PHG.

The connectivity of humanity to nature is a basic but significant function that has been recognized since the turn of the century with the earliest versions of greenways and has been substantiated by modern thinkers, researchers, social scientists/ideas, examples, cases. Greenways achieve these connections to nature more so than other forms of parks and green landscapes "because of their linearity and high ratio of edge to interior area". (Hellmund et al 2006, 160). Social scientists have shown how the human nature and the connectivity of greenways can have wide reaching benefits towards physical, psychological, and emotional health and well-being. Furthermore, greenway studies have shown “increases to adjacent property values, new jobs, expanded local business and tax revenues” (Hellmund et al. 2006, 20). Furthermore, greenways have matured into multi-functional landscapes ranging from habitat and biodiversity protection to social and cultural applications such as heritage preservation and recreation**.** Urban planners and theorists have realized the

importance of the multiplicity of greenways "for stitching together fragmenting cities" with recognition of "open-space systems as the necessary, essential counter-form to the built environment (Walmsley 1995, 82)".

Today, greenways have not only become powerful catalysts for open space preservation; their functionality has taken on new dimensions that include aspects of transportation, education, and community planning. They are being incorporated into current initiatives throughout the country for formulating the urban fabric and have become part of the contemporary planning strategy known as *green infrastructure* (Walmsley 2006, 257). Green infrastructure recognizes that greenways and associated open space networks are just as necessary to development as are roads, utilities, hospitals or schools. It is the network of open spaces, parks, woodlands, corridors, and other natural areas that use natural systems to improve stormwater management and positively impact water quality and quantity (Girling, Kellett 2005, 59).

In 2001, the State of Maryland established the Maryland Greenprint Program, a statewide program for conservation that adopted green infrastructure within established planning initiatives (Rouse and Bunster-Ossa, 2002, 27). Furthermore, Howard County, where the PHG is located, recently updated its master plan, Plan Howard2030, that "considers a green infrastructure network plan, to create interconnected hubs and corridors where plants and animal communities can thrive. (PlanHoward2030 2013, 11)." Applying these strategies to the PHG makes the inter-connection between its natural, social, and cultural resources a formative consideration for structuring growth and development of surrounding communities.

Greenway Framework

When considering a greenway's landscape as integral in both physical form and character to surrounding communities, it is important to understand its structure. It can be viewed as an interrelated framework for forming important connections between natural and human environment. It is comprised of the following core concepts (Figure 1):

- Ecological networks containing valuable natural resources
- Social and cultural landscape environment
- Non-motorized transportation network that enables social and cultural connectivity

Figure 1. Greenway Framework (Nancy Britt).

Ecological Networks

By the nature of its spatially connected concentration of valuable natural resources, the greenway becomes an ecological network in the landscape fulfilling ecological functions such as biodiversity, pollution abatement, water quality, and flood control within the urban landscape. A greenway's ecological features often include important riparian and drainage networks of dense forested and vegetated areas along river corridors along topographic ridges and small mountain ranges (Ahern 2004, 37). The PHG exemplifies all of these with its historic woodland riparian forest along the Patapsco River.

Considering that greenways have “physical conditions necessary for ecosystems and species populations to survive in a human-dominated landscape (Jongman et al. 2004, 3)”, they are highly valued landscapes that support ecological integrity of the urban landscape. Conservation and preservation practices are integral to supporting these valued ecological networks and have become necessary elements for the sustainability of the greenway’s ecological infrastructure.

Social and Cultural Characteristics

Considering that a greenway’s landscape and associated resources are “explicitly and intentionally located in proximity where people live and work (Ahern 2004, 37)”, the social and cultural infrastructure are just as important as the ecological infrastructure of the greenway. The unique social and cultural identity features become important influences for forming overall sense of place for the surrounding communities.

The designation as a greenway implies that the landscape serves a special role within the surrounding community. Greenways become identified for their important role in providing nearby recreational opportunities and access to nature as well as for providing common ground for people to connect. They positively "influence patterns of social interaction within and between neighborhoods" and can realize significant benefits for social connectivity, “especially where they link together diverse populations.” (Hellmund et al 2006, 160).

Often times a greenway is formally designated for having historical significance as well. Just as with its ecological framework, a greenway’s natural

resources are at the core of its historic and cultural framework. Considering these resources have endured the test of time, features such as woodland forest, vegetative areas, and geological forms can be the most cherished within a greenway's cultural and historical framework. Within the PHG, its dense woodland forest along the steep terrain of the rivers edge are integral to and are widely associated as part of its cultural and historical identity.

Transportation

The greenway's power to become a connective thread for surrounding community fabric is strengthened by its network of trails. These trail systems provide non-motorized transportation with the unique rural, natural character of greenways much different from the typical hard pavement often associated with other alternative transportation networks. They not only enable accessibility to a greenway's natural areas for hikers and bikers while promoting environmental appreciation, but also have become an important form of alternative transportation for urban and suburban communities that create connections to greenway destinations, as well as outside destinations of surrounding communities (Bell 2000).

From the perspective of smart growth, greenway trail networks provide people access to recreation and alternative transportation close to where they live and work. Trails contribute to a broad range of smart growth objectives including reduction in car trips, enhanced air quality, promoting social interaction, promoting open space, and addressing public health issues (associated with the benefits of walking, running, biking, and active living). As a mechanism for smart growth, a greenway's

transportation framework has been recognized for creating walkable communities enhancing quality of life and sustainability (International City/County Management Association et al. 2002, 26).

Greenway Framework for Achieving Community Sustainability

The connectivity inherent in greenways for supporting and sustaining its core framework within the landscape cannot be fully realized without access and integration with the community beyond its boundaries. Walmsley stresses that together these lands are incomplete as a comprehensive green system without proper social connections that are needed to complete a metropolitan greenway system, "be they waterfront esplanades, bicycle paths, tree-lined 'promenade' streets, pedestrian ways, avenues, boulevards or parkways." (Walmsley 1995, 84). Highlighting and extending the greenway framework into adjacent communities can have a deeper impact to quality of life more than one might realize when considering benefits of promoting connections to nature. Because "bringing nature into people's daily lives" can have profound influence and play a critical role in physical, psychological, and emotional wellbeing of the community and its residents (Hellmund et al 2006, 160).

Communities designed along these greenway borders having shared landscape character can be the first in line to create these important greenway extensions and connections. Ultimately, the greenway's framework should be considered as integral to the development of surrounding communities and can play a critical role in achieving interrelated community and greenway landscape sustainability and wellbeing (Figure 2).

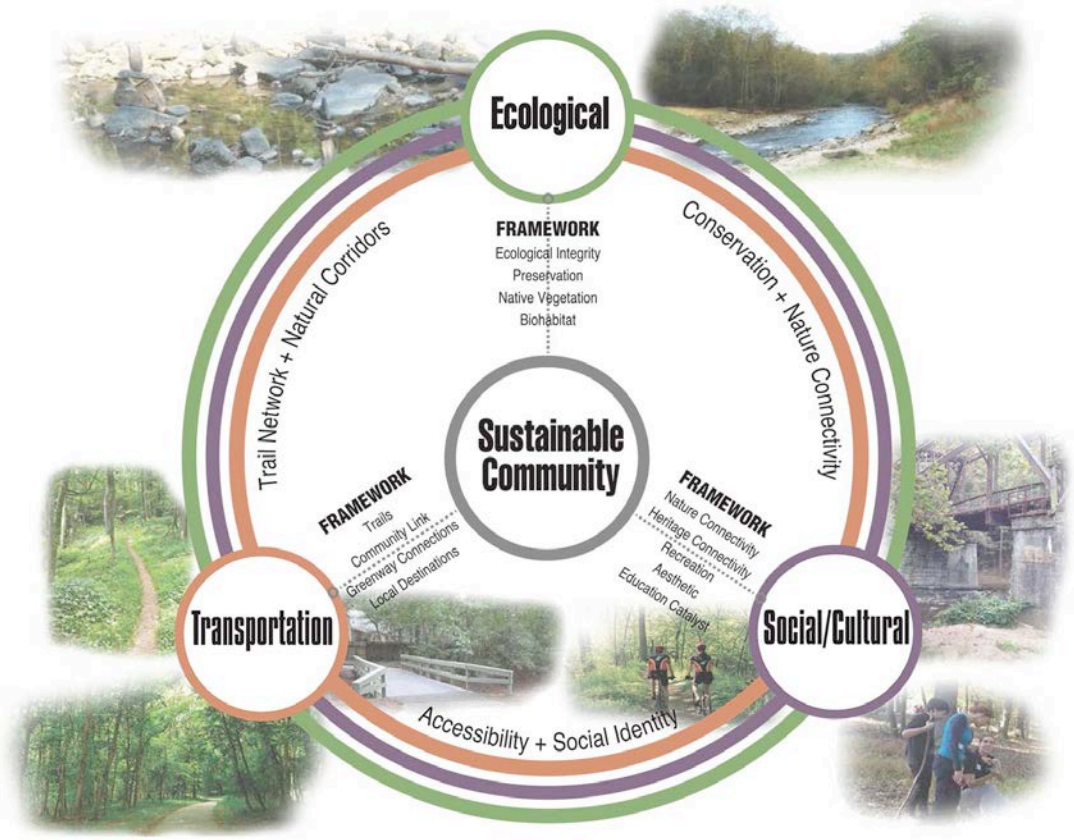

Figure 2. Greenway as the Framework for Community Design (Nancy Britt, photograph sources: Nancy Britt, www.patapscoheritagegreenway.org).

A Vision for Community Design

Just as important as the contemporary definitions and purpose, the origin of greenways contribute to an understanding of why they are important considerations of planning and development of surrounding communities and adjacent landscapes. The role of many early greenways primarily focused on social benefits and promoting human-nature connectivity, whereas environmental and ecological are more central in the contemporary greenway movement. Although neighborhood planning and design were not specifically addressed in their plans and designs, early leaders in American landscape architecture and planning, Frederick Law Olmsted and Calvert Vaux, as

well as their followers, emphasized the importance of making connections to residential neighborhoods (Little 1990, 11). Walmsley states that these connections "promoted for social and economic reasons--people would benefit from having parks and parkways part of their everyday experience, and promoters would find investment opportunities and homeowners enhanced property values around the parks or along the parkways (Walmsley 1995, 84)".

Historical Context

During the 19th century, immense growth in the built environment of urban America with city crowding, public health concerns and lack of accessibility to open green spaces led to the city park movement. Olmsted and Vaux's vision for bringing nature back to cities, as seen in their awe-inspiring 1858 plan for New York's Central Park, spread throughout the country to great extent (Walmsley 2006, 252). This period was truly significant to the history of greenways in that as early visionaries, Olmsted and Vaux foresaw that these standalone city parks were not enough and that "no single park, no matter how large and how well designed, would provide the citizens with the beneficial influences of nature (Little 1990, 11)". As early as their 1866 proposal for Brooklyn's Prospect Park, Olmsted and Vaux began to incorporate larger networked park systems connecting cities to their outer edges and into the countryside. The 1868 Olmsted plans for Buffalo, New York and Chicago, Illinois were among those widely considered as first versions of greenways emphasizing connections between networks of parks, cities, and residential neighborhoods (Little 1990, 11).

By the middle of the 20th century, the greenway concept lost momentum in the

face of modernistic ideologies of progress through innovation, science, and technology. The automobile age of America sparked by inventions and a new manufacturing world took hold with the intention of enriching lives through a freedom of movement in America. As a result, the fabric of the American landscape underwent immense changes, including expansion of roads and highways, the decline of urban populations, and massive suburbanization. Symptoms of sprawl including intensity of land consumption, segregated land uses, and disregard for context and human experience ultimately eliminated any clear connection to place and overshadowed the value of nature to humanity. The term *sprawl* herein is associated with development patterns that interrupt large areas of land without regard to the context and natural features of the landscape and results in accelerated and excessive land consumption and fragmentation of valuable natural resources.

During the 1960's, the tide changed and the environmental revolution was sparked by Rachel Carson's 1962 publication of *Silent Spring* and gained great momentum with Ian McHarg's 1969 publication of *Design With Nature*. (McHarg 1992). McHarg's influential theory set in motion the environmental movement within the fields of landscape architecture, planning, and development which recognized the importance of nature and landscape as driving factors for development and growth, not only to mitigate the damage to natural resources, but equally as important to quality of life and reestablishing a place and sense of identity. By the 1980's, planners, landscape architects, forestry professionals, and environmental leaders led the way to once again prioritize the value of greenways not only as a way to 'fix' the consequences of growth and over consumption, but also as a way to revive

historic priorities and ideas for using open space planning and greenways as integral to the built landscape. In 1987, the United States government gave momentum to the greenway movement with the President's Commission on Americans Outdoors advocating "A Vision for the Future; A Living Network of Greenways…to provide people with access to open spaces close to where they live, and to link together the rural and urban spaces in the American landscape (Walmsley 1995, 81)".

Contemporary Applications

The pressures of development and of preservation and conservation efforts are common dilemmas in contemporary land use and management practices especially in greenway areas, all of which have concentrations of valuable resources. Communities experiencing growth adjacent to historic greenway corridors should consider strategies that broaden the idea of environmental protection and emphasize the greenway framework in its entirety. This framework includes the social and cultural considerations that were recognized by historical landscape architects, as well as transportation, rather than limiting "environmental" protection to just natural resource protection or conservation.

Together, conservation subdivision design, smart growth, and new urbanism are sustainable growth and development strategies that can be used to guide growth and development based on the framework of a greenway. They emphasize the social/cultural, ecological, and transportation attributes of the landscape and can be applied to areas surrounding greenways. Conservation subdivision design establishes priorities and methods for balancing conservation and development goals. It is a formative strategy that is built upon McHarg's environmental methodology to design

with nature and preserve the natural form and character of the surrounding landscape. It aptly applies to development near conservation resources of greenways by addressing the negative environmental impacts of land development while promoting conservation of valuable ecological resources. While smart growth and new urbanism consider conservation, they are more oriented to strategies that address compact design with mixed use and transit oriented development. Their overarching goal focuses "in ways that support economic development and jobs; create strong neighborhoods with a range of housing, commercial, and transportation options; and achieve healthy communities that provide families with a clean environment (International City/County Management Association et al. 2002, i)".

As foundational and unifying elements within community design, greenways serve as environments for integrating these strategies and their goals towards the realization of sustainable communities (Figure 3). Derived from these strategies, the remainder of this chapter outlines core principles that address the social, cultural, and ecological objectives for growth and development collocated with greenway conservation landscapes. These principles form the basis for further discussions of formulating and applying the thesis design criteria.

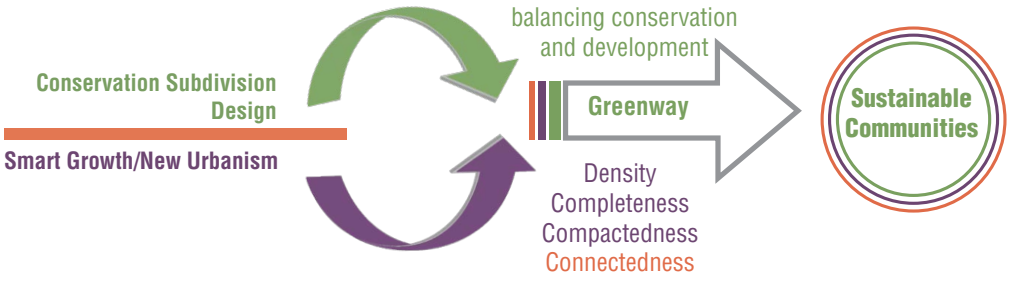

Figure 3. Greenway as Foundation for Integrating Design Strategies (Nancy Britt).

Walkable Connected Communities

Pedestrian and bicycle routes are important toward achieving sustainability, quality of life, and connected communities. “Traditional streets and highways have discouraged pedestrian movement, disrupted water, wildlife patterns and divide neighborhoods into fragments (Hester 2006, 52).” Street design that encourages pedestrian and social interaction, however, can have the opposite effect. By those prioritizing the pedestrian and bicycle and promoting green space, streets can strengthen and even repair important social and ecological connections.

Since the greenway's system of trails already is within reach to provide those connections, it lays the foundation for achieving a pedestrian oriented community through integration with the trail networks and natural resources of greenways: “Without natural or manmade corridors that are reserved, shaped and enhanced to facilitate walking, jogging, cycling as well as promote important social connections, residents and workers will always lack an essential component of truly civilized community design, including safe routes to school (Arendt 2011, 30).”

Connected Network of Open Space and Conservation Lands

Creating a shared community and greenway system of open spaces addresses multiple social and ecological objectives. Open space networks protect valuable natural resources while also creating a sense of place and identity. They also provide recreational amenities and aesthetically desirable green open spaces near people’s homes. When considering greenway connections, a system of community conservation and open space landscapes is critical in order to protect and regenerate critical ecosystem resource including wildlife travel corridors, mature woodlands, and

stream valleys.

Mixed Land Uses and Compact Design

Ideally sustainable communities consist of range of housing types. By providing a mix of land uses, including high-density buildings, attached homes, and single-family homes, these communities improve affordability and enhance community social networks by reaching a broader range of age groups and a more diverse population. When greenways are present, this mix increases social opportunities and promotes connectivity to nature, outdoor recreation, and physical activity. As a result, inequities and health disparities are also addressed by providing broader populations greater access to public facilities for outdoor recreation and physical activity. (Yanez et.al 2005, 1).

Furthermore, mixed-use development of residential, commercial, office, and other uses within a community creates a character that promotes quality of life, allowing people to live, work, and play within a unified landscape framework. Creating places of mixed uses that promotes density enhances connectivity as well as enabling a pedestrian and bicycle-oriented community, thereby reducing auto-dependence (International City/County Management Association 2002 et al., 7). The term "density" is used to describe compact development within any given area. Through connection with greenway trail networks, higher-density and mixed-use communities become more pedestrian and bicycle accessible and further expand access to the natural experience of the greenway to a wider ranger of populations.

Conservation Development

Compact development, which utilizes smaller lots, preserves valuable natural resources and open space. Housing is situated in compact areas to minimize footprint, which is a critical consideration within the context of valuable greenway landscapes (Milder 2007, 759). Clustering housing sites and streets away from priority conservation areas prioritizes land conservation while maintaining economic feasibility of subdivision development. By promoting and enhancing green spaces and common community areas, conservation development improves the social and recreational opportunities in that community. As with mixed-use and compact design principles, clustering development also reduces infrastructure and construction costs, such as, water and sewer lines (Arendt 2010, 51).

Sense of Place

Communities developed using greenways as the underlying framework have unique character and identity. Compatibility between the community and greenway is ultimately achieved by sense of place. Sense of place or *imageability* is defined as the quality that makes a community "distinct, recognizable and memorable (Clemente, Ewing 2013, 5)". Historical and cultural context is important in the definition of place and landscape image, especially in the case of heritage greenways. A design that is sensitive to and provides a perceptible link to the distinct physical environmental, cultural, or historical context of the greenway will contribute to fostering a sense of place and image of the community.

Chapter 2: Precedent Studies

The Precedents described herein provide real-world models of community designs that are in line with this thesis' strategy for balancing smart growth, new urban, and conservation development strategies. Although not necessarily adjacent to a formal greenway landscape as defined within this thesis, each model reflect design based upon the core strategies important to community development within a greenway setting that are documented in Chapter 1 (Table 3).

Table 3. Strategies for Development Utilized by Precedents (Nancy Britt).

Strategies for Development	**The Woodlands**	**Garnet Oaks**	**Serenbe**
Connected Network of Open Spaces and Conservation Lands	✔	✔	✔
Woodland Character and Sense of Place	✔	✔	✔
Network of Pedestrian Oriented Trails	✔	✔	✔
Conservation Development	✔	✔	✔
Mixed Land Uses	✔		✔

The Woodlands, Houston, Texas

The Woodlands, a Houston, Texas conservation community designed in the 1970s, is an example of a combined residential and mixed-use landscape that captures a sense of place in a forested setting with over 1,900 acres of preserved forest and an interconnected woodland trail/path network for non-motorized transportation (Figure 4). Although much larger in scale—covering over 27,000 acres—the Woodlands is an important precedent of a community with a dense forest landscape atmosphere and a

design based on social/cultural, transportation, and ecological conditions similar to those emphasized by this thesis. The Woodlands is the first of Ian McHarg's planned communities based on sustainability goals with a conservation emphasis that preserved the natural physical form and character of the site's landscape. It was a groundbreaking example of contemporary sustainable landscape community design, demonstrating how stormwater can be handled through a natural system of infiltration based off of the site's soil, hydrological, and vegetative conditions rather than a conventional engineered pipe system. McHarg himself considered the community to be one of the best examples of ecological "design with nature" within a community setting (Forsyth 2003, 12), a strategy he eloquently established in his book, *Design with Nature*, just the year prior to him taking on the task of designing this community.

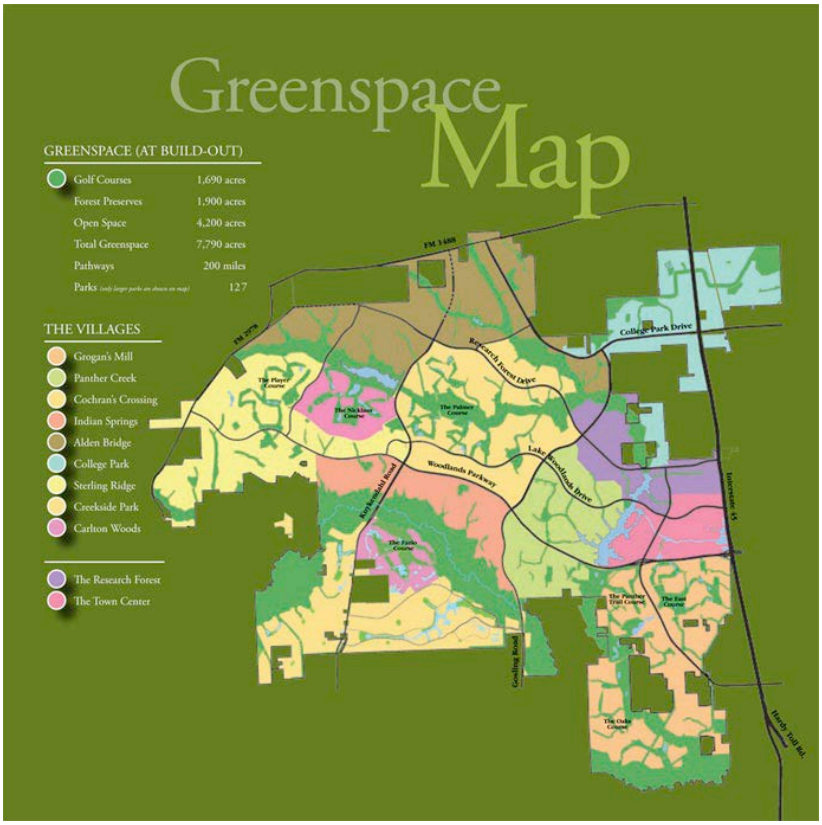

Figure 4. The Woodlands Green Space Map (The Woodlands, http://www.thewoodlands.com/nature/greenspace.html).

McHarg's ecological emphasis followed a systematic approach to design based on physical landscape form and natural conditions of the site. Within his approach, he created the concept of producing overlays for assessing a site's landscape form and character of the site's conditions to guide and influence design (Girling et al. 1994, 12). This approach was at the core of his design for the Woodlands and serves as a guiding example for this thesis. The Woodland's design emphasizes how physical form and character of the landscape as well as natural systems including hydrology and vegetative conditions are critical in determining physical developable boundaries and ultimately in preventing interruption and degradation of conditions associated with existing riparian areas, streams, and dense vegetation. This thesis relies upon this strategy as a guiding principle for forming developable and conservation areas, as well as incorporating natural stormwater management within low impact design (LID) solutions.

Social/cultural and transportation characteristics of the landscape as set forth by this thesis' framework were also core to the Woodlands community design. The Woodland's design incorporates mix of uses including schools, churches, and shopping within the community around a network of non-motorized trails. Although it does not fully achieve a total pedestrian-oriented network due to some of the constraints around its roadways, there are over 100-miles of pedestrian/non-motorized paths that wind through the woodland community (Forsyth 2003, 11). Much like the thesis site, its residential atmosphere is based upon a shared and adjacent dense woodland landscape. It maintains a forested character with patches of tree canopy enhanced and preserved throughout the community. The design is an example of one

that was sensitive to the surrounding landscape that focused on clear "image, identity and orientation (Forsyth 1994, 163)" within the community design.

Garnet Oaks, Delaware County, Pennsylvania

Although there have been many successful conservation subdivision designs since this community was developed, Garnet Oaks was a prototype for many community designs that followed in terms of accomplishing conservation and preservation of valuable woodland landscape form and character. It's design is also particularly relevant because it includes connected open spaces with a mile-long woodland trail network winding through the historic woodland conservation landscape (Figure 5), which is emphasized in this thesis. The site is a 58-acre conservation community that was developed during 1992-1994 in the Bethel Township of Delaware County, and is situated in the southeastern portion of Pennsylvania close to the Delaware line (Natural Lands Trust 2013, 1).

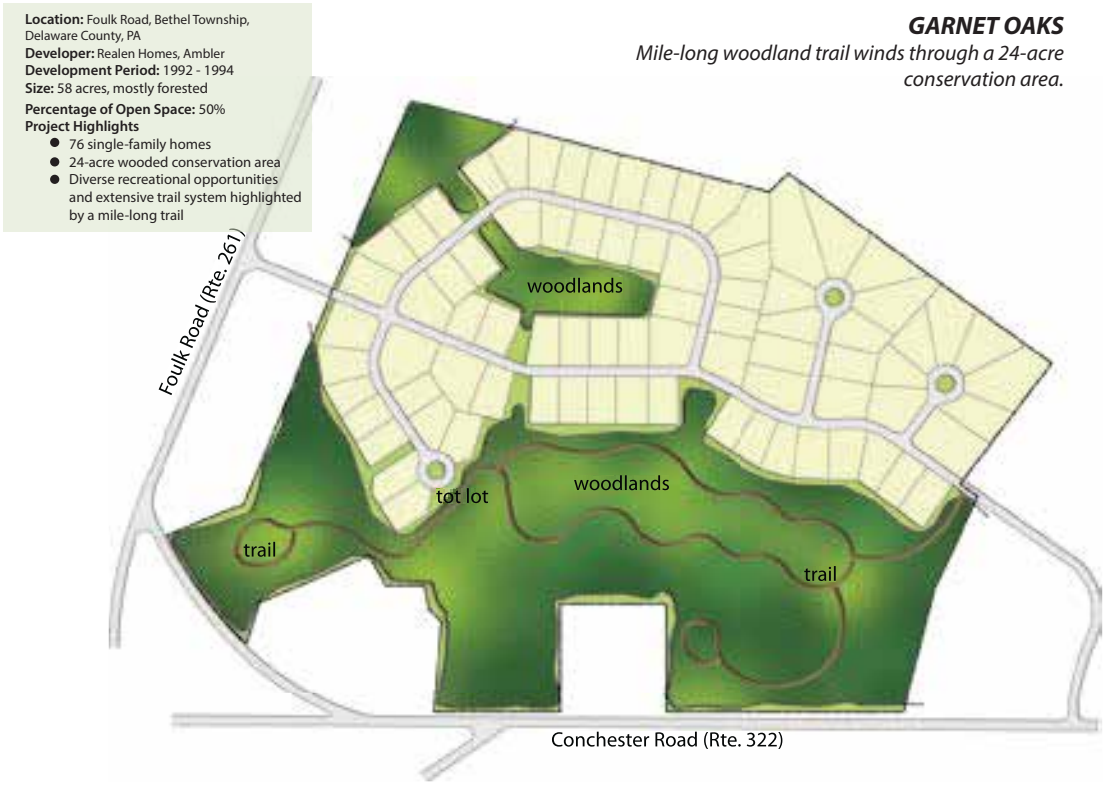

Figure 5. Garnet Oaks (Natural Lands Trust, http://www.natlands.org/wp-content/uploads/downloads/2013/11/Garnet-Oaks.pdf).

In addition to the pedestrian-oriented transportation advantages of its trail system, Garnet Oaks is a model for ecological aspects of community design. The community design is a precedent not only for preservation, but also for natural stormwater management based upon LID solutions. The community's narrow, short streets and compact block layout are major advantages for infiltration, significantly reducing impervious coverage in the landscape. The design further captures stormwater through LID techniques such as vegetated swales that nearly eliminate traditional engineered curb-and-gutter stormwater treatment along streets. Overall, the site's natural conservation areas and LID features nearly eliminate stormwater runoff by capturing and infiltrating the water.

Garnet Oaks' design highlights over fifty percent of preserved open space and a 24-acre woodland conservation area. It includes diverse recreational and environmental education features through its woodland trail system, much like that of greenway landscapes. Overall, it serves as a strong example of conservation subdivision design that emphasizes a combination of social/cultural and ecological features that are bound by an ecological oriented conservation design.

Serenbe, Atlanta Georgia

In addition to having common transportation and ecological features that are inherent to it be a greenway community, what makes Serenbe particularly inspiring as a model, is how it balances growth and conservation, as well as, emphasizes the social and cultural resources of the site. Located on a 1,000-acre community on the fringe of Atlanta, Georgia, it is a precedent of a community design that integrates the contemporary smart growth, new urbanism, and conservation subdivision strategies emphasized by this thesis. It is located in area of Atlanta experiencing tremendous growth. The abundance of development responding to growing populations surrounding the city makes it quite similar to the thesis site, which is situated in an area of Baltimore that is also experiencing rapid growth and development. As such, it exemplifies how a development can respond to contemporary growth trends while considering the importance of preserving natural landscape form and character.

Serenbe is a model for Atlanta of an ecologically sound, sustainable community design that blends conservation, high density, mixed uses, cluster development and pedestrian oriented strategies within the natural woodland

Chattahoochee hillside landscape a few miles east of the Chattahoochee River (Figure 6). Specifically, the design preserves 70 percent of valuable woodland and open space land within a traditional neighborhood new urban community design (Serenbe Community, 2013).

The Serenbe community design emphasizes mix of uses with smart growth objectives for a sustainable live, work, and play environment within a single community. Its layout promotes the new-urban style gradient of land use, with the denser mix of uses towards the more centrally accessible locations, transitioning to cottage clusters, many of which are on small densely compact lots, and then to lower densities. In this way, this model achieves smart growth patterns of development.

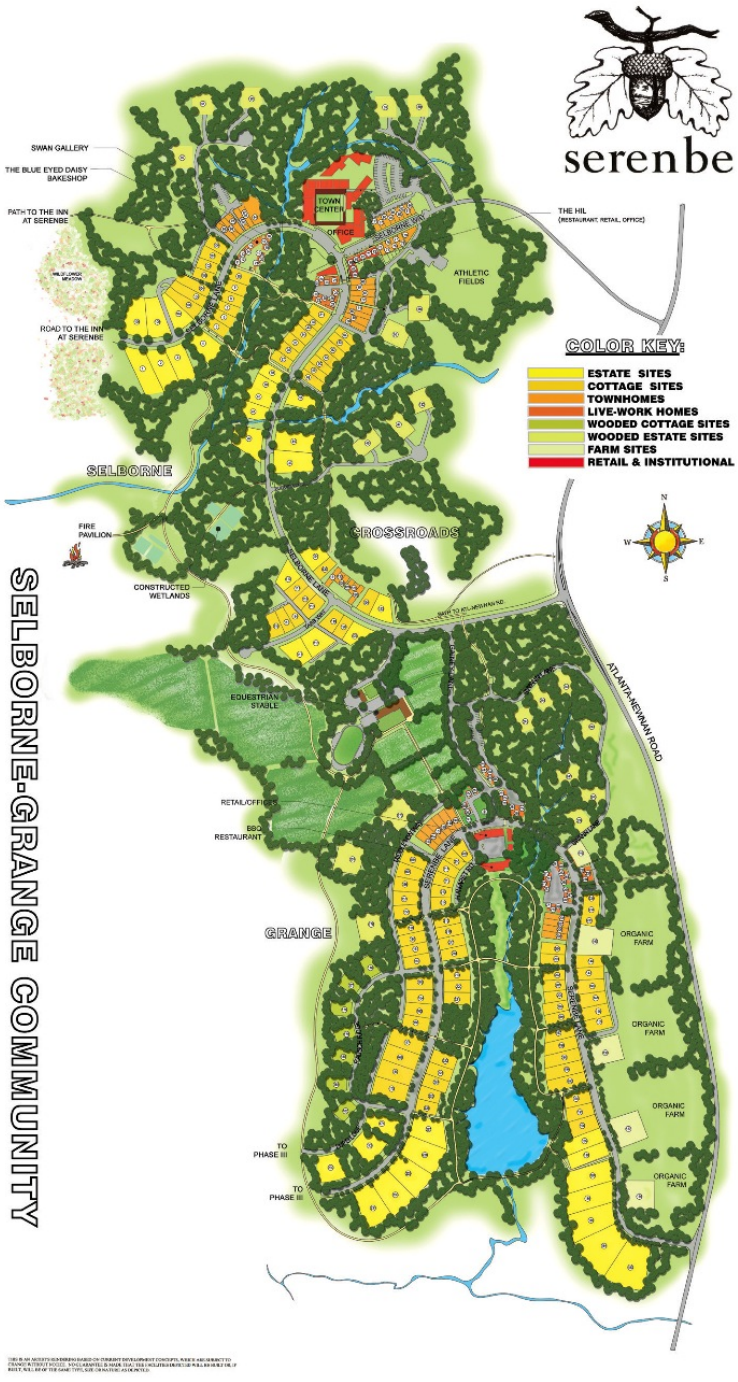

Figure 6. Serenbe Master Plan (Serenbe Community, http://www.serenbecommunity.com/docs/serenbephases1and2.pdf).

As an important example of a community that integrates the cultural framework, Serenbe consists of four sections, called “hamlets” (Serenbe Community, 2013), based upon the local heritage of the area and interconnected by a pedestrian-

oriented network. The community incorporates cottage-style architecture and cluster layout that reflects the type of image equated with a traditional neighborhood American heritage sense of place (Figure 7). Similar to the design goals within this thesis, the Serenbe features design elements—such as porches along streets—that foster that sense of community and social atmosphere. Just as important, it exemplifies options that promote a socially diverse environment including apartments above commercial establishments in mixed-use buildings, as well as attached homes and single-family cottage homes.

Figure 7. Serenbe Community Cottages (Serenbe Community, http://www.serenbecommunity.com/nest.html).

Homes are sited within the community based on the natural conditions of the physical landscape, taking advantage of woodland vistas while minimizing disturbance of natural landscape form. The community incorporates natural trails and "looping country roads" (Serenbe Community, 2013) promote walkability and connectivity while preserving a sense of place within the natural woodland setting.

Overall, it serves a powerful precedent of how woodland tree canopy and open space can be enhanced and preserved in a recently development new urban, mixed use and pedestrian oriented community. The Serenbe community guiding principles as documented on the Serenbe website include,

- "Nature… because people can live more fully when connected to nature's wonder"
- and "Bring people together to learn and explore ideas about environment, sensitive development and new ways of thinking and planning for the future" (Serenbe Communty 2013)"

Its principles aptly reflect the driving strategy of this thesis, with conservation and connection to the community's inherent natural setting balanced with smart growth and new urban strategies for community design.

Chapter 3: Methods

This design thesis site encompasses approximately 95-acres within Taylor Village, a developing community along the College Avenue corridor in Howard County, Maryland directly surrounded by the PHG. This chapter describes how the site was selected, provides the overall context of the site, and details how the site fits within the physical location of the PHG. Further, the chapter presents the historical background of the PHG that forms the framework for the site's character and landscape identity.

Site Selection

A landscape assessment formed the basis for selecting the site. The site location situated next to the PHG was imperative to the topic of the investigation. Just as important, the site had to have suitable social needs and appropriate environmental conditions for community development. Socially, Howard County initiatives and population factors were important to the selection. Environmentally, conditions of steep slopes and flood plain were core criteria of the landscape assessment that determined suitability for development and ultimately led to the site selection.

Howard County Initiatives and Population

Population trends and county initiatives can lend insight into which areas will experience community development. *PlanHoward2030*, the recently updated Howard County master plan, has targeted portions of the Taylor Village Community specifically as areas for growth and redevelopment (Figure 8) (Howard County Planning and Zoning 2013, 63). This indicates that the county supports increased

development in the area of the site. Furthermore, the 2010 United States census indicated over a 95 percent population growth in the area of the site (Figure 9). The census tract district directly to the south has also seen growth with a 59 percent population increase. From 2000 to 2010, Ellicott City's population went from 56,937 to 65,834, a 16.7 percent increase. The population growth has a direct correlation to the county initiatives for growth and development in this area. Furthermore, the ongoing development that surrounds the thesis site reflects how the county initiatives for growth have impacted the area. Together, the recent population spikes and the designation as a growth area were key factors towards site feasibility and selection.

Figure 8. Howard County Target Growth and Redevelopment Area within Taylor Village (Nancy Britt), Area Context Map (PlanHoward2030 2013, 69).

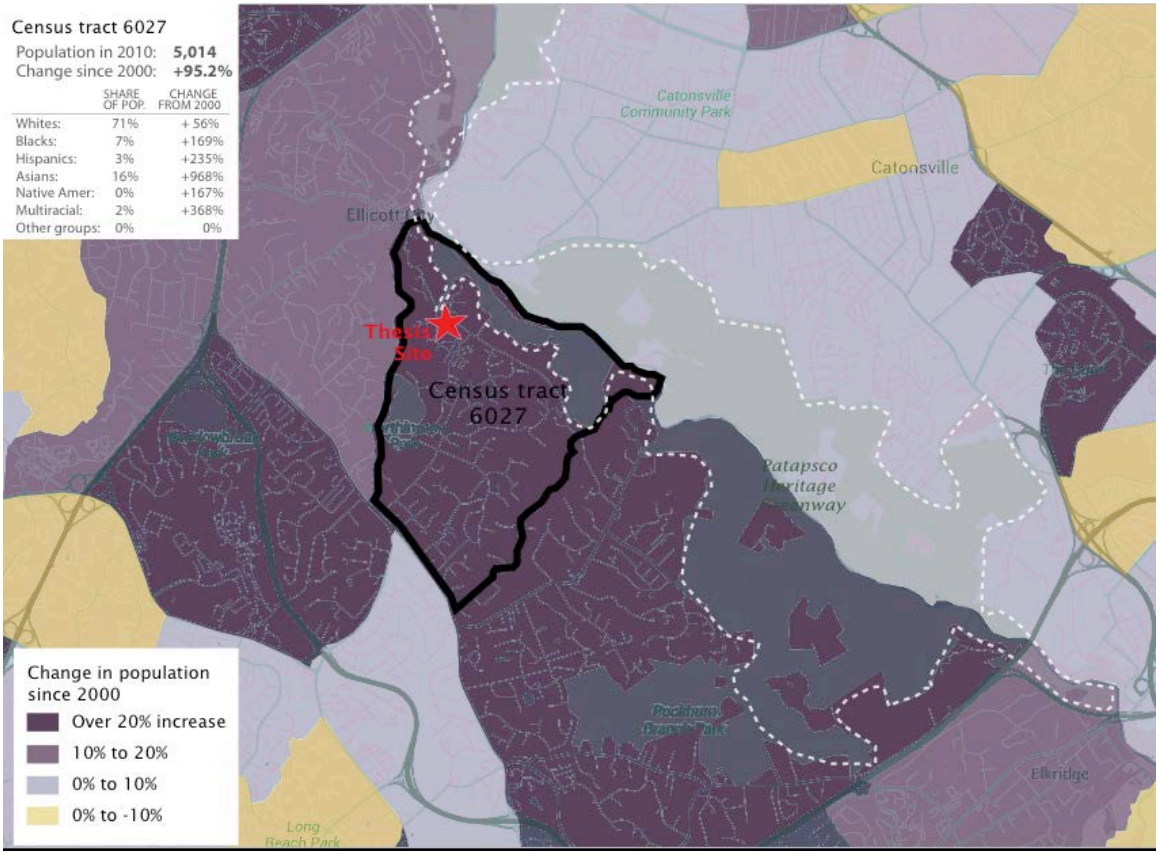

Figure 9. Change in Population Growth since 2000 (Britt, NY Times Census Explorer).

The southwestern portion of the thesis site lies within this target area and is in planning stages for housing and mixed-use type of development, as shown above in Figure 8. As described in Chapter 1, balancing mixed-use development with conservation development strategies is important towards long-term community viability built upon the greenway framework; therefore, the site was selected in great part for its potential as a mixed-use community within the context of the PHG.

While the northeastern portion of the site sits just outside the county growth area boundary, it is already under development, with single family and town homes situated on the edges of the PHG. With development underway, there is opportunity for the thesis investigation to evaluate, compare, and contrast the current design

standards with the thesis investigation and illustrate the differences between current design and alternatives for improving PHG connectivity and sense of place. The opportunity for a comparison of current practices in combination with linking together the mixed-use portion of the community with the PHG led to incorporation of this portion of the site within the thesis investigation.

Steep Slopes and Flood Plain

The topography of the project site is impacted by its location in the piedmont along the fall line. The fall line marks the geologic boundary where the hard, metamorphosed terrain of the piedmont transitions to the sandy, flatter coastal plain resulting in steep changes in elevation (Curtin et al. 2001, 10) (Figure 10). As a result, there are drastic elevation changes with rise and fall of steep slopes all around the PHG.

To prevent negative environmental impacts that disrupt natural conditions of the land, regulatory agencies generally prohibit modification of the land for development purposes on slopes greater than 25 percent. As such, Howard County subdivision and land development regulations prohibit any development on slopes greater than 25 percent (Howard County Planning and Zoning 2007, 21). In addition, Maryland Critical Area Commission states that “In order to protect water quality in Resource Conservation Areas (RCA) by managing runoff and controlling erosion in RCAs, local Critical Area regulations prohibit development and disturbance in areas where slopes exceed 15 percent (Maryland Department of Natural Resources 2014)”.

Considering the area around the PHG falls within the category of a RCA, any development that might disturb slopes above 15 percent could also be considered undesirable. Therefore, to determine suitability for site selection, slope analysis considered slopes over 25 percent as prohibitive to development while those within the range of 15-25 percent as more cautionary and undesirable.

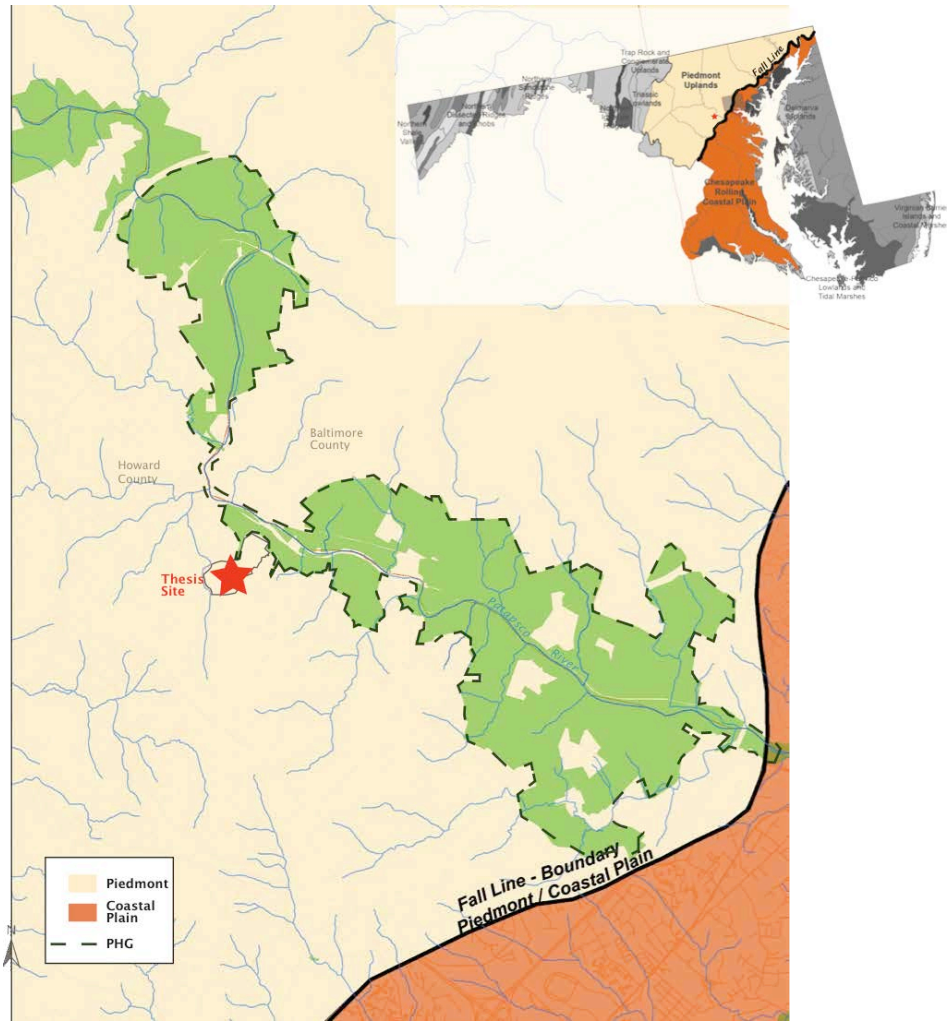

Figure 10. Fall Line (Nancy Britt), (Data Source: State of Maryland Department of Natural Resources GIS).

Steep slopes extend through large swaths of land throughout the landscape surrounding the PHG creating conditions unsuitable for development. While the site has steep slopes along its borders, 40 percent of the 95 acres contains continuous

areas with slopes less than 25 percent (Figure 11). In addition, with the site situated high above the river, thus outside the flood plain, this barrier was not a factor as compared to other sites along the Patapsco River that were considered for the thesis.

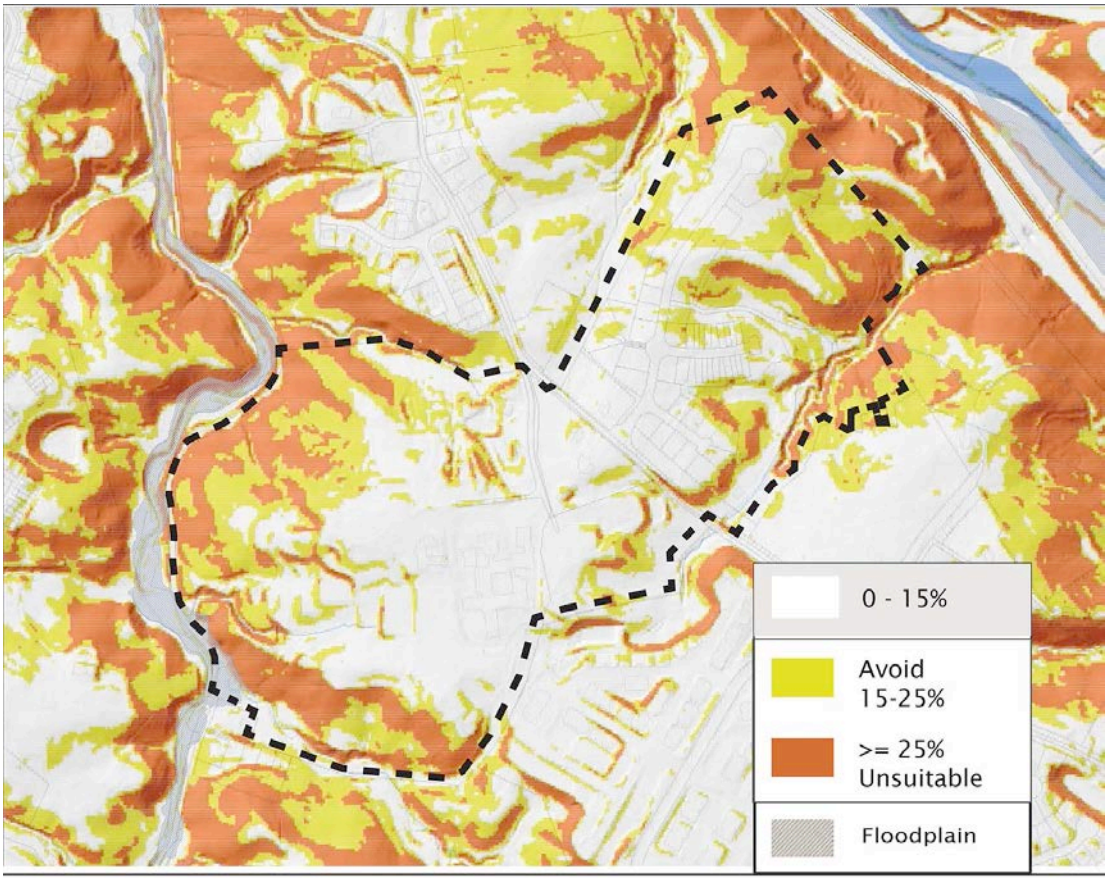

Figure 11. Slope Analysis and Floodplain (Nancy Britt), (Data Source: State of Maryland Department of Natural Resources GIS).

Physical Context

The thesis site is centrally located in Baltimore-Washington metropolitan area, situated approximately 10-miles southwest of downtown Baltimore and 25-miles northeast of Washington D.C. (Figure 12). The PHG, a historic linear corridor extending 14-miles along the natural scenic corridor of the Patapsco River Valley, surrounds the eastern portion of the site. The PHG, as a large section of open space

directly connected to the site, becomes intrinsically linked to both its form and character.

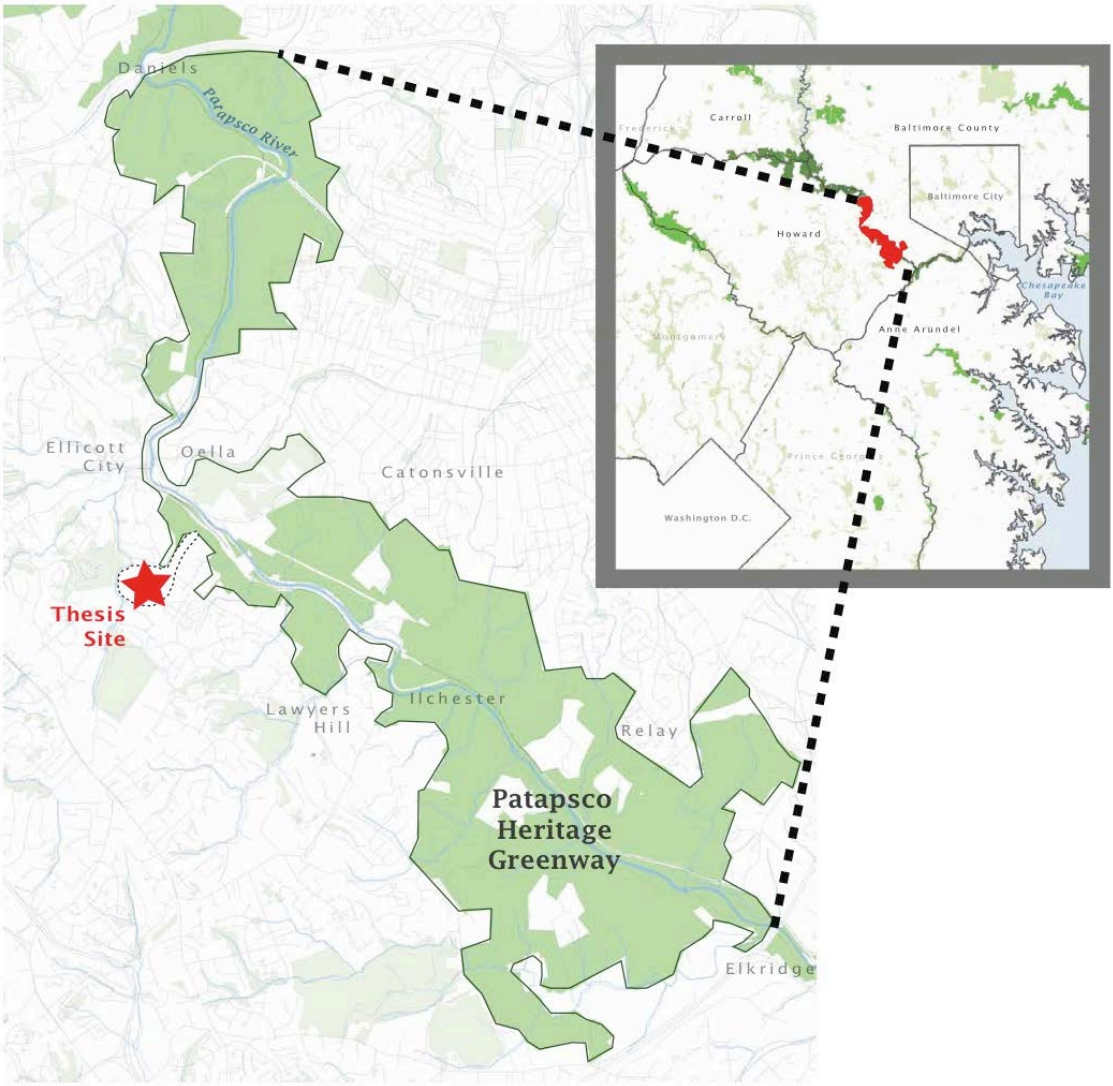

Figure 12. Site Context (Nancy Britt), (Data Source: State of Maryland Department of Natural Resources GIS).

The thesis site is part of the rapidly growing community of Taylor Village in Howard County just .8-miles south of the historic town of Ellicott City along the College Avenue corridor (Figure 13). Taylor Village is separated into eight sections,

or subdivisions, of which several have been completed and have achieved full occupancy (Figure 14). The land use within each subdivision is primarily residential, with varying densities including single-family homes, attached homes, and multi-family units.

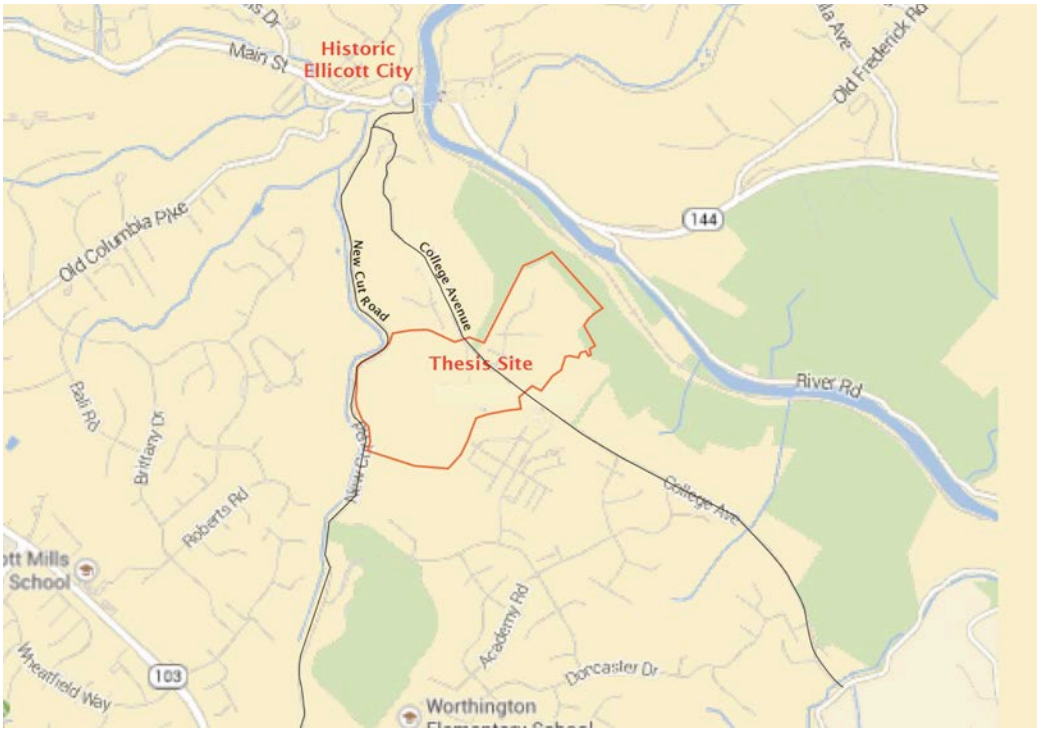

Figure 13. Local Context (Nancy Britt, Google Maps), (Data Sources: Howard County GIS, GoogleMaps).

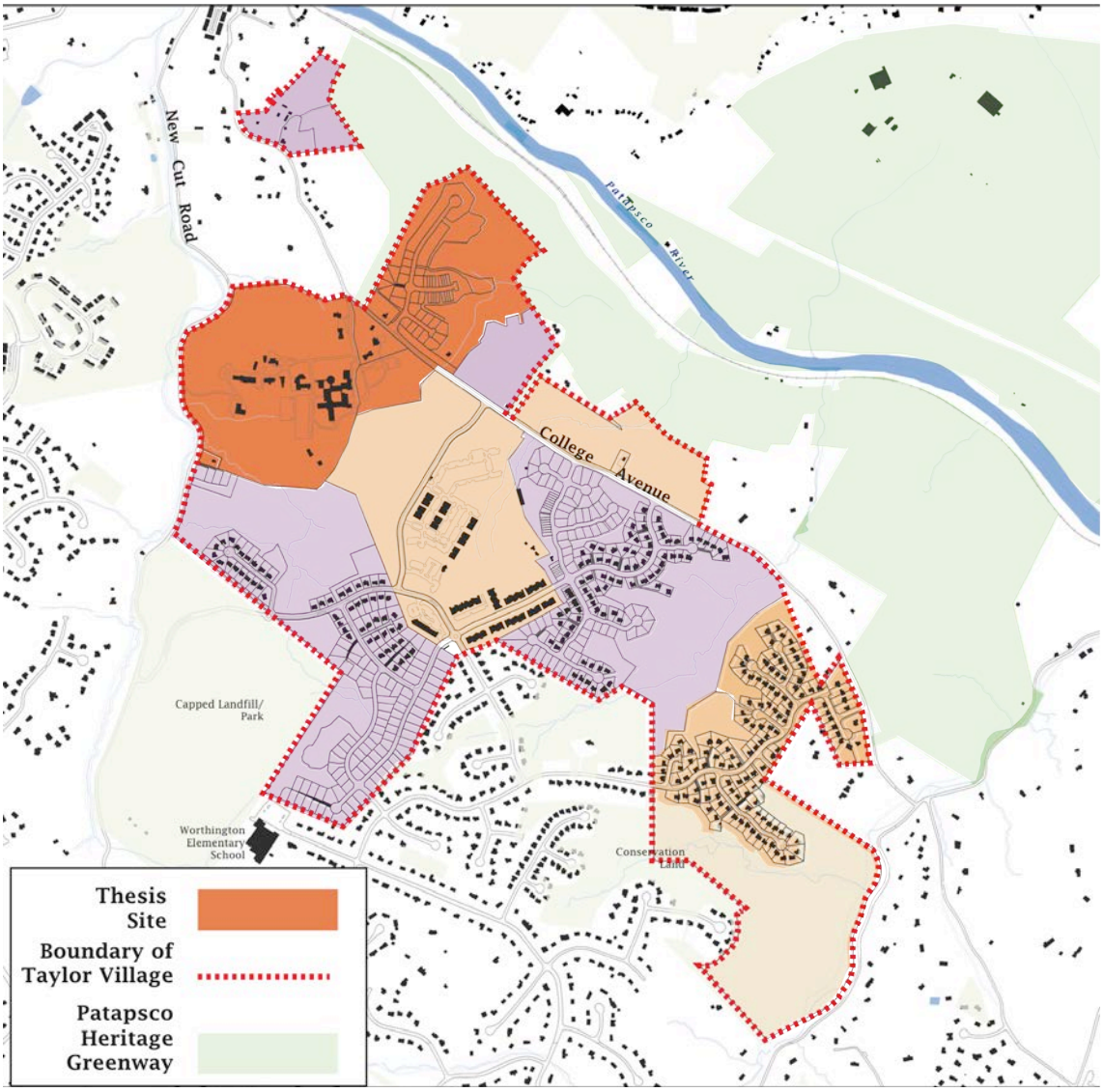

Figure 14. Taylor Village Community (Nancy Britt), (Data Sources: Howard County GIS).

The Taylor Village Community and the adjacent PHG are in the most populated section of the Patapsco River Valley, at the heart of the Patapsco Valley State Park, between the rapidly expanding metropolitan areas of Howard and Baltimore Counties. Major transportation routes provide access to the area including I-95, I-695, I-70, Route 29 (Columbia Pike) and Route 40 (the Baltimore-National Pike).

Located .8-miles north of the thesis site is the historic town of Ellicott City, founded in 1772 and known for its industrial era main street. The town's foundation is based on the history of man's indelible mark on the environmental resources of the greenway during the industrial revolution. It is one that is directly tied to the environmental history of the PHG that was so impacted by the technology and progress of the industrial period. Its main street atmosphere influences the sense of place for much of the surrounding area, including the location of the thesis site. In addition, the historic district is a destination place and an amenity nearby the thesis site. Its restaurants, antique shops, and boutique shops create options for shopping, eating, and working within preserved historic architecture.

The PHG is home to abundant wildlife and vegetation and a wide range of recreation activities including hiking, biking, fishing, swimming, horseback riding, and canoeing. Within the connected corridor of landscape there are large patches for interior areas where wildlife thrive. It is known to have a large population of birds including bald eagle and great blue herons. In addition, the river is home to forty-two species of fish including small mouth bass, American shad, river herring, white perch, and yellow perch (Rhodeside and Harwell, Inc. 2012, 17). The majority of the PHG land is within the Patapsco Valley State Park; however, there is a small area along the river at Historic Ellicott City that is part of the PHG, but not formally considered Patapsco Valley State Park land.

Extending beyond the PHG, the Patapsco Valley State Park runs the 32-mile (51 km) length of the Patapsco River and encompasses over 16,000-acres (65 km^2) (Figure 15). It spans four Maryland counties with Carroll County to the north, Anne

Arundel County to the south, Howard County to the west, and Baltimore County to the east, with the Patapsco River serving as the physical boundary line that separates Howard and Baltimore Counties. It is one of the top three most visited state parks within Maryland, having over 620,000 visitors a year who value its expansive recreational, historical, cultural, and natural resources. It is nationally known for its trails, which traverse the scenic steep, forested hillsides along the river (Maryland Department of Natural Resources 2013). The park's trails facilitate access to the popular active and passive recreational activities within the PHG.

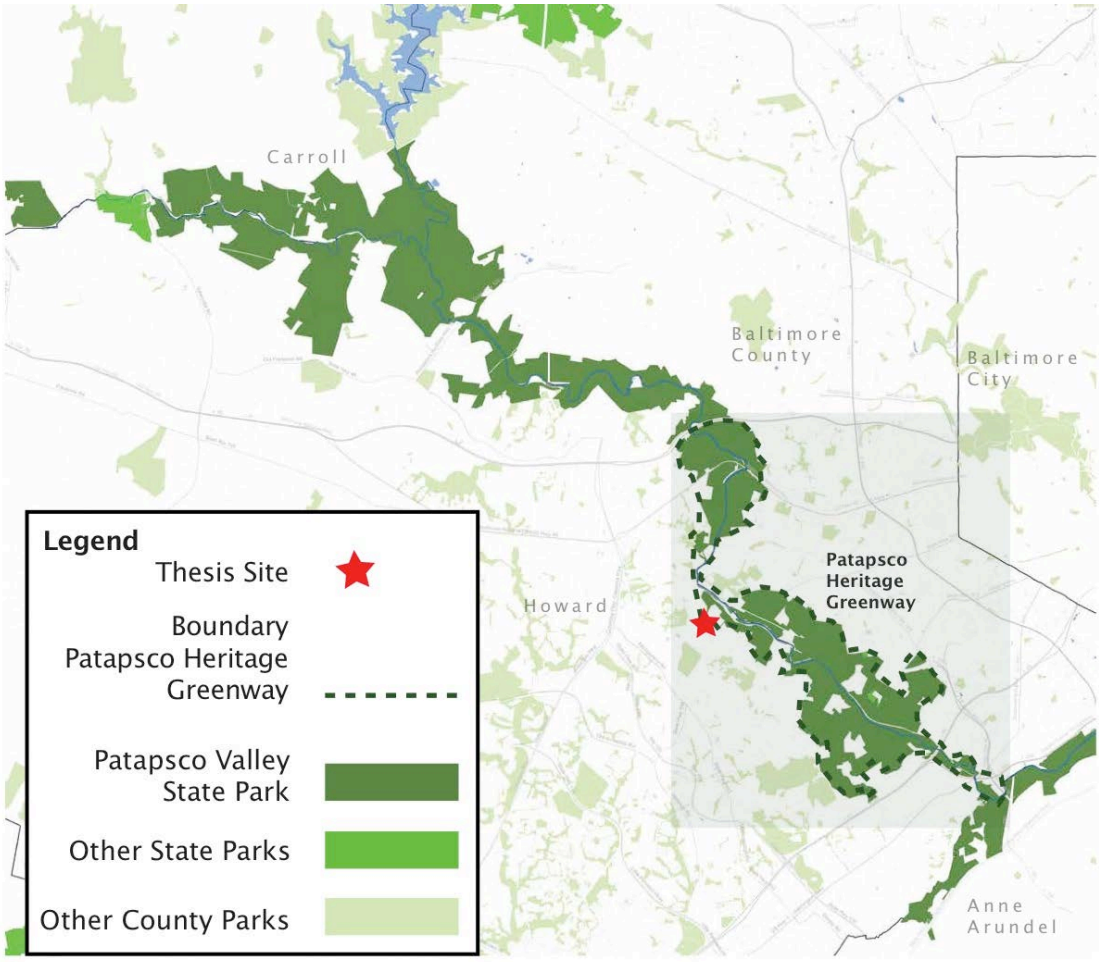

Figure 15. Map of Patapsco Valley State Park (Nancy Britt), (Data Sources: Maryland Department of Natural Resources GIS).

The Patapsco River is the heart of the PHG's landscape form. The Patapsco River's headwaters begin in Frederick and Carroll and flow south to meet the Port of Baltimore and the Chesapeake Bay. The Patapsco watershed has the highest population density of the 18 Maryland river basins with major population centers in the area of the thesis site. The watershed covers 118-square miles of which 38-square miles are within Howard County (Howard County Planning and Zoning 2006, v). The site is adjacent the fresh water portion of the river. Overall, the river is primarily fresh water estuary for most of its length; however, less than 10-miles south of the site, where the river flows into the northwest branch of the Baltimore Harbor, it transitions to a large tidal estuary inlet of the Chesapeake Bay. The site's critical location in context of the richness of its shared landscape with the PHG has great effect to the overall health of the entire Chesapeake Bay. While forest cover still remains to be significant, much of the area flanking its edges is developed with roadways, paved parking lots, and buildings. Within Howard County, approximately 49 percent of watershed is developed and 41 percent is forested. (Howard County Planning and Zoning 2006, 5). Currently Maryland Department of Natural Resources (DNR) and county agencies have ongoing projects to monitor, restore, and protect the Patapsco River and its tributaries. Their efforts have come a long way towards reducing runoff and erosion and improving the Patapsco River's water quality, however the associated impacts of increasing impervious surfaces and growing population along the PHG including the site's location within the Taylor Village community still put pressure on the Patapsco River's resources.

Historical Context

Understanding the site's unique character is critical towards inspiring community design that can respect the land and preserve its unique identity. With its deep ties to the industrial era, the changes in the PHG landscape, both socially and environmentally, reflect much of the change that occurred in our nation's landscape overall (Figure 16). As with many river corridors in the northeastern portion of the United States, its landscape was forever changed by the mecca of industry and supporting railroad along the river. This section describes the rich culture and history of the PHG that is intrinsically linked to the site and was ultimately the inspiration for this thesis.

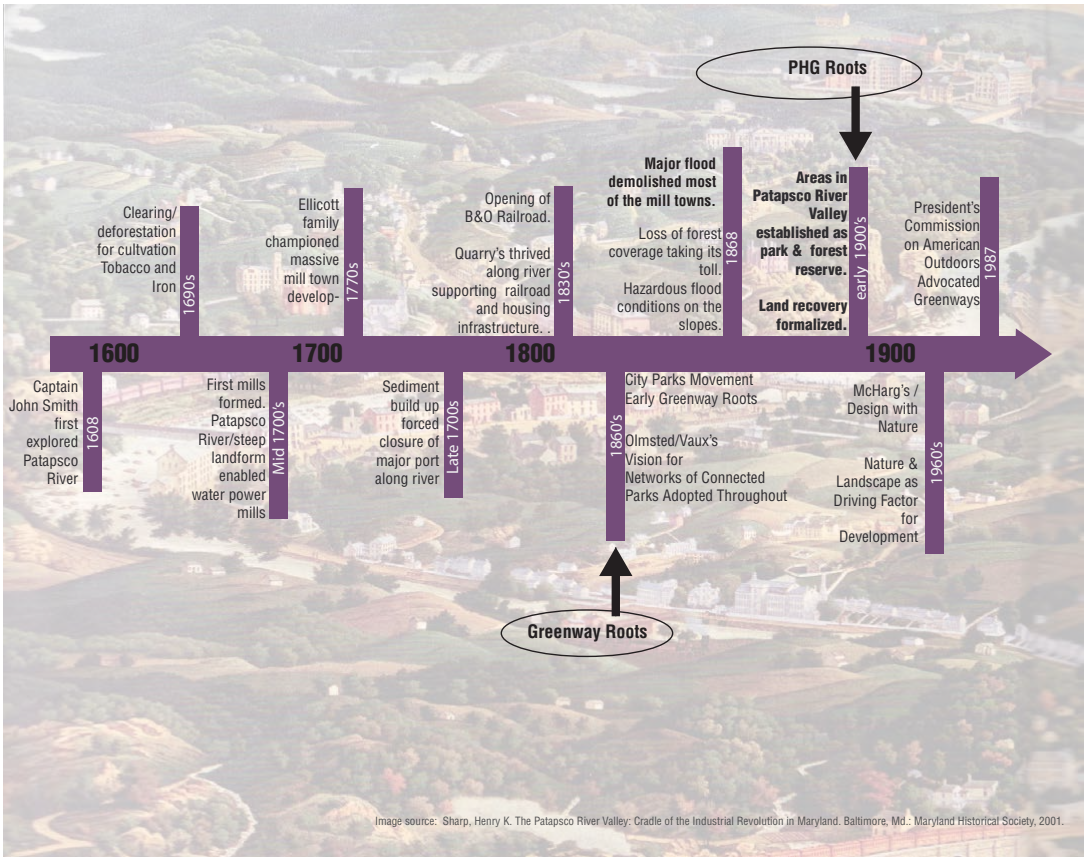

Figure 16. PHG Historical Context (Nancy Britt), (Background Image Source: Sharp 2001, Cover).

The PHG is significant as a historic greenway due to the rich industrial history of the Patapsco River Valley. Dating back over 200 years, the Patapsco River Valley has continually been shaped by its scenic river and valuable natural resources. Populations of Native Americans and early settlers flourished here. By the middle of the 18th Century, industry began to take control of the Valley's landscape. Changes along the river, including clearing of forest to accommodate development of mills and iron mining along its banks, are characteristic of the point in history when the character of the landscape transitioned to one in which the use of the Valley's natural resources became a force for economy and commerce.

The industrial era continued its charge to make indelible marks on the landscape, with the river's power enabling the rise of a vast array of mill towns. With the technology of water-powered mills, the Valley became a land full of dams and thriving industry, with clusters of mills and worker housing complexes along the river. Equally significant is the development of the B&O Railroad, the nation's first commercial railroad, along the scenic river corridor adjacent to the mill towns of that time. In the second half of the 19th century, mining of the granite resources from the slopes directly east of the site provided stone for construction of the B&O railroad infrastructure, including bridges and viaducts. There are remnants of the historic industrial quarry, including deteriorating stone building foundations that still remain on the hillside below the site, approximately 1,000 feet east of the site (Figure 17). These historic remnants have not been formally preserved and have been disappearing slowly over time. With the development of the railroad, industrial markets expanded and industry prospered within the PHG. The Valley's culture and

identity was forever transformed by the railroad and the mecca of mills that populated the landscape at the height of its industrial past. Under the power and control of man, the industrial era became the "environmental force" in the Valley and throughout America (Jackson 1984, 62).

Figure 17. Historic Foundation (Nancy Britt).

While industry and railroad transport became an important part of the Valley's identity, it remained a place of nature and beauty. A Frenchman visiting the Patapsco River valley in the mid-1790s recognized its scenic value in his diary of travels. He stated, "The situation of this place, encircled by mountains is truly romantic…The water is clear. The rocks are high and majestic; and I could have wished to enjoy one day longer this view." (Sharp 2001, xv). During the city park era in the early 1900's, it was again identified as a place of nature and beauty, and was widely recognized as a park for recreation and camping (Buckley et al. 2006, 100). In addition, in 1907, it formally became a state conservation area and named the "Patapsco Forest Reserve". With its designation of as a forest reserve its character held a distinction associated with more of a natural rustic setting as compared to other more formal and manicured

parks of that time. From this period, its greenway roots were formed, and the PHG became known for industry and natural beauty, a complementary legacy that has endured over time.

From the 1950's to the 1980's, even as Maryland experienced auto-dependent suburban expansion into Howard County, the Patapsco River Valley held on to its scenic historic character. During that time, to further protect the valuable resources of the PHG and prevent degradation and intrusion by ongoing development in the area, the state park expanded to protect over 32-miles and over 16,000 acres of scenic land along the Patapsco River corridor covering. The few mills that remained in production up until the 1990s further contributed to its lasting historic character. The last operating mill in the state of Maryland continues operations along the east side of the river approximately 1 mile north of the Taylor Village community at the site of Wilkins-Rogers/Washington Flour.

Over time, remnants of the PHG's historical past have been lost. Devastating floods, such as Hurricane Agnes in 1972, as well as the pressures of suburban development, have plagued the PHG and its river valley, diminishing valuable natural resources and many of the physical remnants of the mill towns that once existed. Erosion and runoff caused by increases in development, upstream agricultural activity, and tidal backwashes of pollutants from the Inner Harbor had great impact, decreasing ecological health of the river. The Clean Water Act and environmental legislation initiated the efforts to reverse the damage and as a result have greatly improved the quality of the Patapsco River.

Still, even in the midst of all of these environmental challenges, the natural curves and bends of the river, the forested slopes down to the water, and the changing shades of the season offer beauty and contrast to the surrounding built environment. Current state and county preservation and conservation efforts help the PHG's identify as a historic river valley. This thesis investigates how community development can capture the greenway's identity and preserve its legacy while accommodating the continual growth and development in the region.

Community Context

In order to envision community designs within the framework of this thesis, it is critical to understand the social, cultural, and natural resources of the site and the surrounding landscape. Combined, they can provide insight into patterns and solutions that will unify community development and the PHG.

Land Use and Local Amenities

The site is comprised of two distinct sections within the Taylor Village Community, divided by the main arterial access road, College Avenue (Figure 18). The land use surrounding the site is primarily residential with the exception of designated mixed land use areas in historic Ellicott City, as well as the two sections within Taylor Village (Figure 19). The section of Taylor Village adjacent and to the southeast of the site is designated as an active adult community with a small area consisting of neighborhood type commercial shops (Figure 20). This small commercial area is self-contained with approximately ten shops within a single building approximately 10,000 square feet fronted by a large parking lot. There is

opportunity to provide connectivity between the site and this community, thus providing access to a wider range of amenities within walking distances. This will be discussed further in the circulation section below.

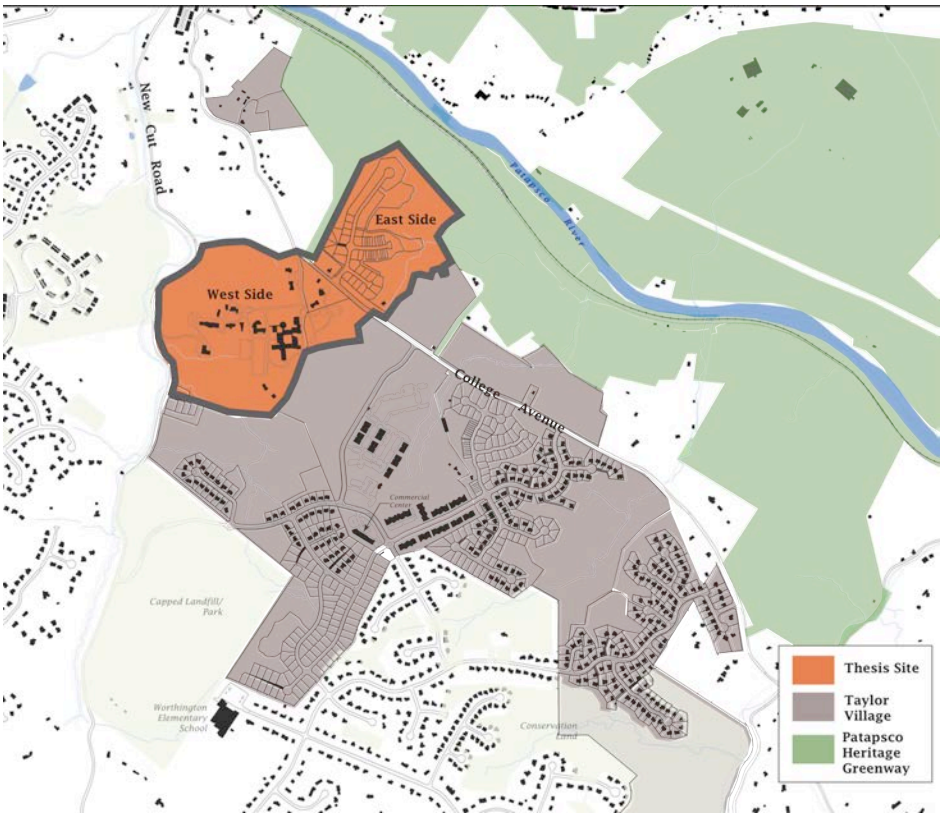

Figure 18. Thesis Site (Nancy Britt), (Data Sources: Howard County GIS).

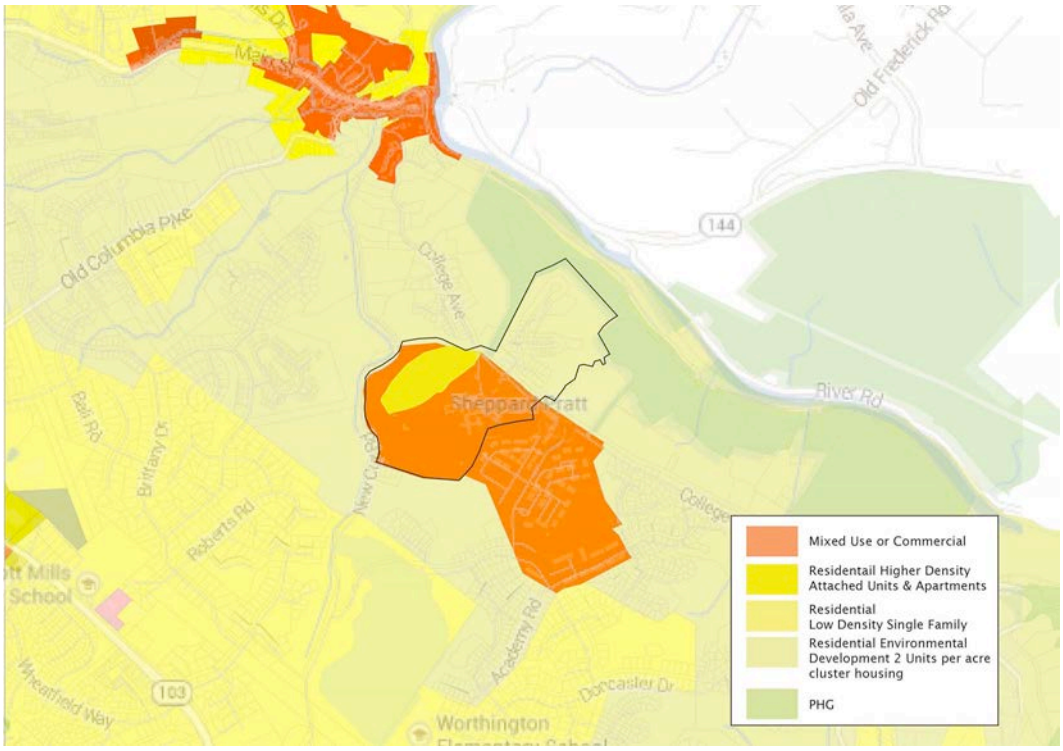

Figure 19. Land Use (Nancy Britt), (Data Source: Howard County GIS).

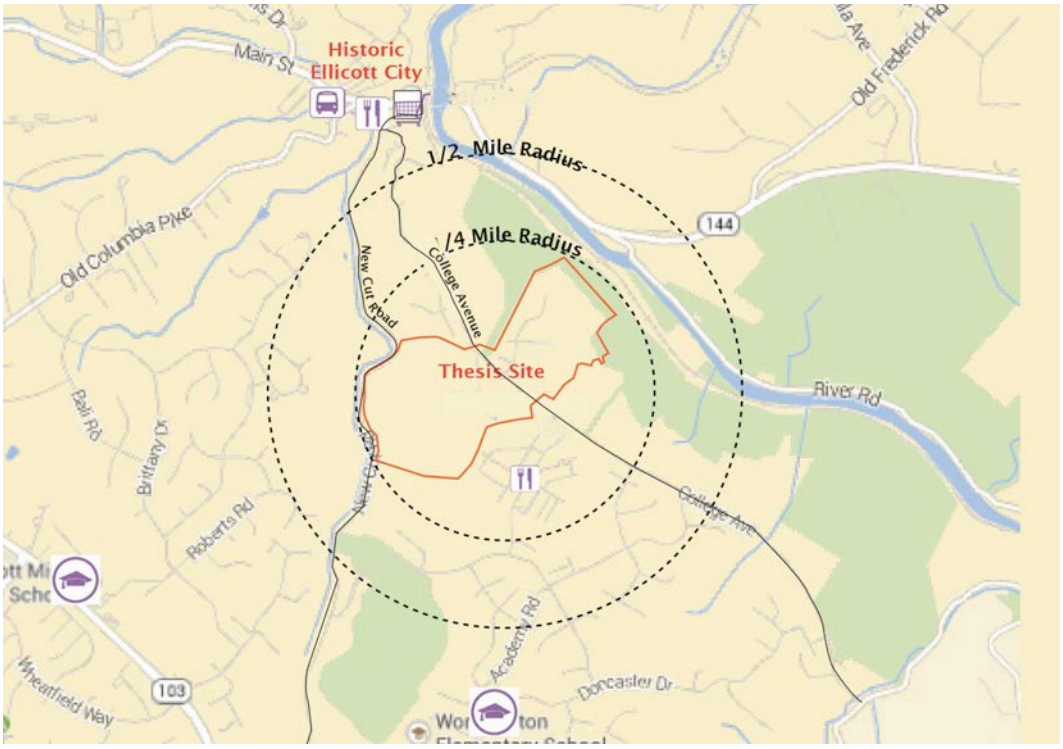

Figure 20. Local Amenities (Nancy Britt, Google Maps), (Data Sources: Howard County GIS, GoogleMaps).

The residential land use varies in densities, including single-family homes, attached homes, and multi-family units. However, as with the eastern portion of the thesis site, areas directly adjacent to the PHG have a county zoning designation of Residential Environmental Development (RED). The RED zoning designation "directs development to the most appropriate areas of the site, away from sensitive resources (Howard County Planning and Zoning 2013, 59)." With this designation, the county recognizes the shared landscape qualities between these lands and the greenway. It specifies two housing units per acre clustered together in locations that would have the least impact to the natural resources of the landscape. While the RED zoning emphasizes environmental and ecological interventions to protect the natural resources of the landscape, the challenge of how to broaden the emphasis to consider social and cultural interventions to "enable the site to emerge in a comprehensible manner (Girot 1999, 60)", and in doing so to maintain and enhance the unique sense of place and context of the PHG, remains. The county does not have a set of design elements or details on just how residential-type development may look to accomplish these standards of preservation in the context of the PHG, nor do they incorporate standards for preserving sense of place and extending greenway culture and form into the community.

The west side of the site is comprised of 64-acres of land. It is currently slated for redevelopment and is in early stages of planning. The land use designation is in the process of transitioning from the commercial zoning classification to a combined commercial and residential classification. With the changes in the recent zoning, there is greater flexibility in the type of residential densities as well as allowing

consideration for neighborhood commercial land use. This is an indication of Howard County's intentions to consider the land for mixed-use residential development.

This portion of the site is currently an aging behavioral health care campus known as Sheppard Pratt. The existing Sheppard Pratt buildings are built to outdated standards with the last major update dating back to 1968. There are a few older, 1970's era residential homes on the property as well. Howard County also has documented that the existing Sheppard Pratt buildings on the site are slated for demolition within the next five to ten years (Howard County Planning and Zoning 2013). Considering the site is in the preliminary stages of planning, it is an appropriate time for this thesis to consider the future of the community through the lens of the PHG – the community and PHG as a cohesive whole to sustain the integrity of the landscape.

Circulation – Trails

Trails are integral to enhancing social, cultural, and transportation framework between the site and the PHG. Although Taylor Village includes some options for pedestrian movement, there is no communitywide pedestrian non-motorized plan. The master plan for Taylor Village includes consideration for pedestrian connectivity, but it is self-contained.

In addition, despite the many and well-known trails along the Greenway, the trail system is incomplete near the site on the Howard County side of the river, without any connections to the Ellicott City Historic district. These largely unpaved trails include formal trails maintained by the State Park as well as informal trails

created over time by regularly travelled user-defined paths.

In 2013, the Patapsco Heritage Greenway, Inc., the Maryland DNR, Howard County, and Baltimore County worked with the Urban Land Institute (ULI) in Baltimore to evaluate the PHG. During this effort, the ULI documented the importance of improving PHG trail connections to the surrounding community as a means to "help create a sense of ownership and endowment of community place for area residents (Baltimore ULI 2013, 5)". With Taylor Village's central location along the Howard County side of the Greenway and the stated priority for enhancing connections through trails, there is opportunity to consider these important aspects of connectivity. In addition, the site's physical location, with close proximity to the PHG, presents opportunities to consider extending the existing plan for pedestrian and non-motorized connections to the PHG and outside destinations including historic Ellicott City; however, the potential placement of the greenway trail on or along steep slopes of the landscape needs to be carefully addressed because of erosion concerns and potential safety hazards. Trail development on extremely steep slopes could lead to a loss of habitat, as well as other impacts, such as, erosion.

Circulation - Roadway corridors

Other aspects of connectivity are the two roads, College Avenue and New Cut Roads, as shown above in Figure 20. Both of these roads are categorized by Howard County as scenic roads. Howard County defines scenic roads as having characteristics that include "outstanding natural features, outstanding views, historic association or

frontage on preservation easements (Howard County Planning and Zoning 2013, 43)".

Each of these roads provides a single-wide travel lane in each direction, with an overall width of 20 to 22 feet. These roads have narrow shoulders and lack pedestrian and bicycle accommodation. There are currently no signal intersections along either of these corridors. In addition, there is currently no bus service provided along either of these roads. Ellicott City is the closest area to bus service. However, considering the significant growth and increasing population along the College Avenue, there is viable potential for bus service to Taylor Village in the future.

1) College Avenue

College Avenue is the main arterial providing access to the Taylor Village Community. It is two miles in its full length. The road begins at Bonnie Branch Road 1.2 miles to the south and ends .8 miles north at the intersection of St. Paul Street and New Cut Road in the heart of Ellicott City Historic District, as shown above in Figure 20. Even with the new development along the corridor, it has maintained a character of scenic roadway winding along the steep terrain.

2) New Cut Road

New Cut Roads runs along the eastern side of the site. It also extends approximately two miles in length. The road begins at Montgomery Road one mile to the south of the site and ends one mile to the north where it meets College Avenue in historic Ellicott City. Although it is a connector road, it serves more as a secondary

entrance to the Taylor Village Community.

As stated in Chapter 1 above, pedestrian and non-motorized accessibility along neighborhood streets is an important consideration towards improving quality of life and sense of place within a community. Although a regional roadway transportation design is beyond the scope of the thesis, there is opportunity to consider a future vision for pedestrian-oriented elements and features, particularly along College Avenue within proximity of the thesis site.

Topography and Hydrology

With its location along the edges of the PHG, the site naturally shares the PHG's scenic topographic character, with the steep slopes leading down to the Patapsco River. It is set high above the Patapsco River with elevation changes as much as 300 feet from the high point on the west side of the site down to the river (Figure 21 and Figure 22). The sloping terrain creates viewsheds into the forested hillsides surrounding the site (Figure 23). These are important considerations for design element placement for protecting on site and distant skyline views that represent woodland character of the site.

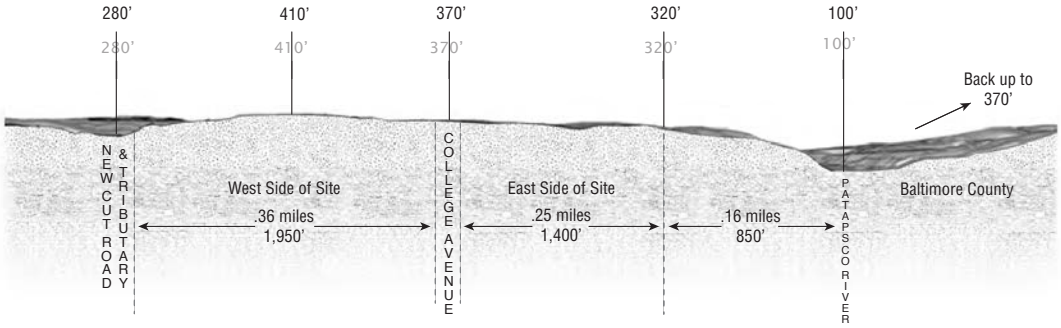

Figure 21. Site Elevation Section (Nancy Britt).

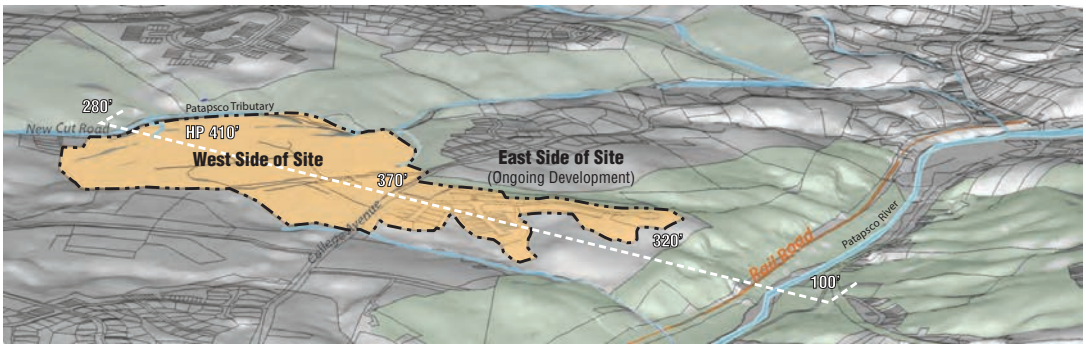

Figure 22. Site Elevation Birdseye (Nancy Britt).

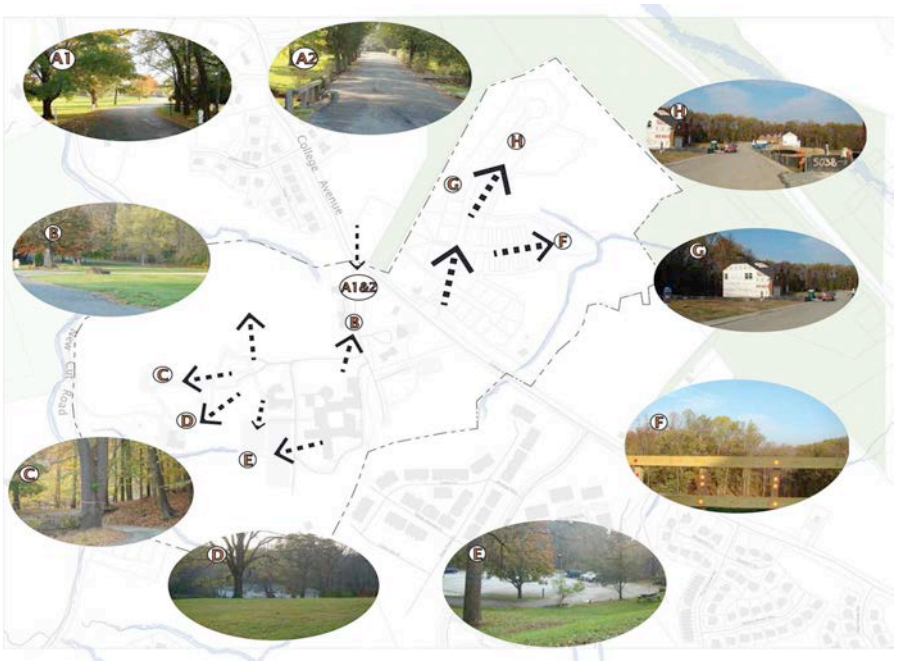

Figure 23. Viewsheds (Nancy Britt), (Data Sources: Howard County GIS).

Within the site, the steeper slopes are situated along the outer edges of the site. Approximately thirty continuous acres within the central portion of the site have slopes within the range of two to ten percent. The USDA National Resources Conservation Service indicates that these areas have well drained soils that do not tend to become inundated (Soil Survey Staff NRCS, 2013). In addition, multiple site visits indicated there were no signs of standing water or poor drainage areas.

With the steep slopes along the outer edges of the site, however, runoff is a significant consideration (Figure 24). The site is situated uphill and directly to the west of the Patapsco River. The site is within a freshwater non-tidal portion of the Patapsco River and the Patapsco River Basin's Lower North Branch (LNB) Bonnie Branch sub watershed (Figure 25). There are two small streams on the site. The first stream is along the eastern portion of the site at the southern edge and flows down into the Patapsco River. The second stream sits on the western portion of the site and flows down into a tributary of the river. A major concern regarding the health of the watershed is the impact development has on stormwater runoff and pollutants that flow from the site, into the streams and down to the river. The Howard County 2006 Watershed Restoration Action plan documents restoration and protection of the LNB as a high priority. In addition, Maryland and Howard County Public Works documents multiple ongoing stream and river restoration projects within the Bonnie Branch sub-watershed. Being located within such close proximity and at higher elevations, it is imperative to include LID solutions for improving and preventing runoff conditions.

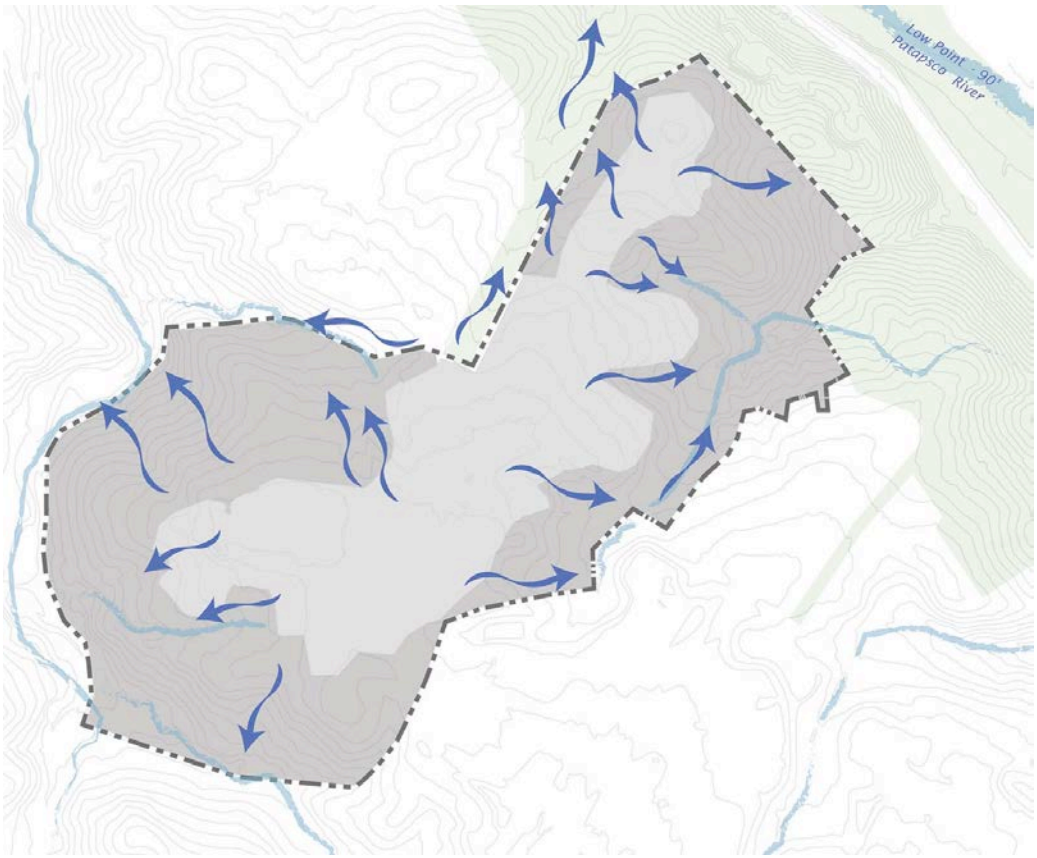

Figure 24. Hydrology (Nancy Britt), (Data Sources: Howard County GIS).

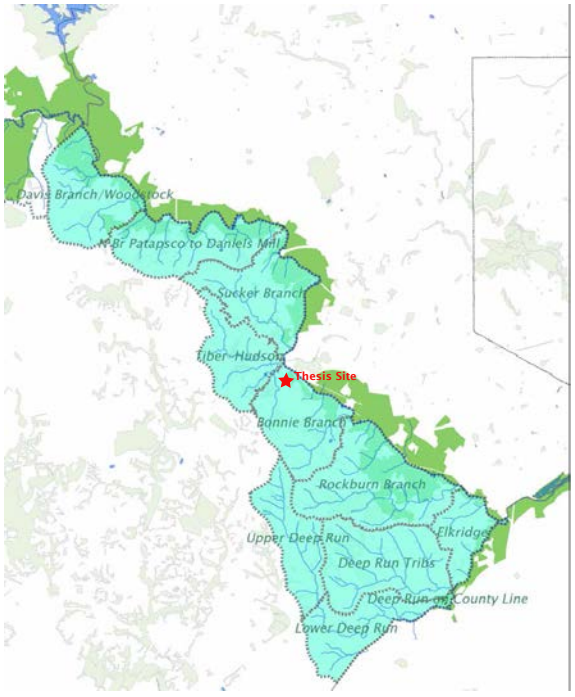

Figure 25. Lower Patapsco River/Bonnie Branch Subwatershed (Nancy Britt), (Data Sources: State of Maryland Department of Natural Resources GIS).

Geology

The PHG landscape is largely comprised of granite formations on the slopes leading down to the Patapsco River. The formation known as Ellicott City Granite is "dated at approximately 425-450 million years old (Rhodeside and Harwell, Inc. 2012, 15)". Showing the significance of the landscape form, the eastern border of the thesis site is flanked by one of the many large granite cliffs located in the PHG (Figure 26). Hikers, nearby residents, rock climbers and tourists come to this spot to experience the beauty of the granite's incredible scale and immense form. They perhaps also catch a glimpse of the PHG's industrial past in the few remaining remnants of the late 19th century stone foundations of the granite quarry buildings that still exist in this location. Considering the close proximity in the context of the site, the social and cultural value of the granite should be highlighted within the community design to link the PHG in both form and character within the site's landscape.

Figure 26. Facing West Towards Community Above B&O Railroad Tracks (Nancy Britt).

Vegetation

The concentration of woodland forest coverage is integral to the identity of a landscape designated as a greenway that represents the social, cultural, historical and ecological framework of the PHG. It is a foundation for the shared landscape between the PHG and adjacent communities. The site contains over 60-acres of dense forest along its outer edges that form critical connections with the surrounding PHG landscape (Figure 27). The woodland setting is an important part of the community design infrastructure to form connections between human and nature, and achieve an integrated sense of harmony with the woodland and river valley settings of the PHG.

Figure 27. Vegetation (Nancy Britt), (Data Sources: Howard County GIS).

The woodland landscape consists of a combination of upland and bottomland mixed hardwoods. In March of 1980, the Baltimore Regional Planning council documented over forty-nine deciduous and six coniferous tree canopy species, as well as twenty-three deciduous understory trees and over one hundred and sixty-tree ground cover species (Rhodeside and Harwell, Inc. 2012, 16). The shrubs and understory that exist along the exterior slopes include those such as black huckleberry (*Gaylussacia baccata*) and mountain laurel (*Kalmia latifolia*). Mature tree canopy varieties include basswood (*Tilia americana*), birch (*Betula nigra*), white and red oaks (*Quercus*), tulip poplar (*Liriodendron tulipifera*), American beach (*Facus grandifolia*) and black cherry (*Prunus serotina*). The mature tree coverage has strong ties to the industrial past of logging and charcoal mining industries along the Patapsco River. The dense concentrations of these mature native plants are essential because they provide food and habitat for wildlife and are integral to the ecological framework of the greenway. They reveal the ecological resiliency and represent connections to the historical and cultural foundations of the PHG and its surrounding landscape.

On the western portion of the site, there is an abundance of forested hillsides with hardwoods and dense undergrowth that exist within the site boundaries. Towards the center of the property, there are patches of dense vegetation, as well as manicured grassy areas with large tree specimens. These small patches of vegetation bring the atmosphere of the woodland character into the site.

On the eastern portion of the site, most of the vegetation exists on the forested hillsides just outside the boundaries of the development in the PHG. As such, they are

formally owned and managed by Patapsco Valley State Park. Comparing the current construction site within the boundaries of the site to the orthographic images before construction began, there are obvious signs where areas of vegetation that did exist were cleared in the development's designated residential housing parcels. Consideration for enhancing and restoring vegetation within the site is important to forming those important bonds to the woodland atmosphere.

Climate: Wind

When considering climate factors of sun and wind, landscape elements such as tree canopy and slope are integral to planning and design of location and placement of buildings and public open spaces throughout the site. The prevailing wind direction is from the west to northwest with a yearly average wind speed of 7.6 miles per hour. Winds are strongest in the winter months with highs above 20 miles per hour. Being situated at higher elevations as compared to the surrounding landscape, the site is somewhat unprotected from the winds; however, the surrounding tree canopy adds protection from the winds, particularly during the summer months when the leaves are on the trees (Figure 28).

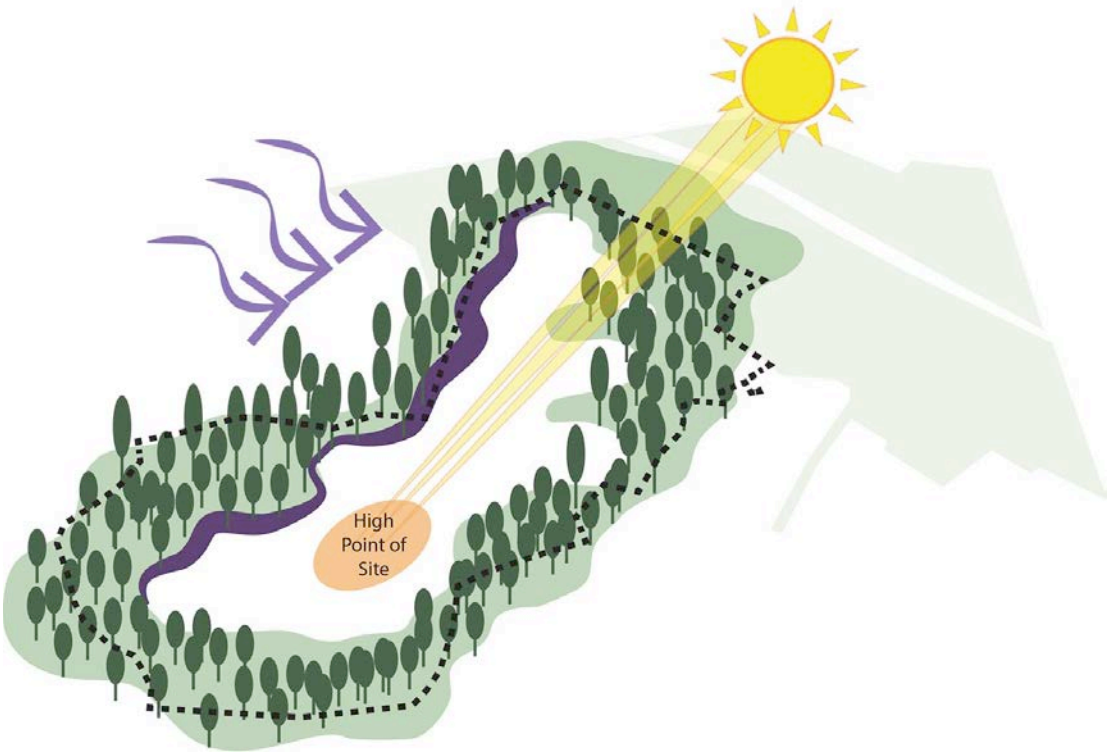

Figure 28. Climate (Nancy Britt), (Data Sources: Howard County GIS).

Climate: Sun

The site has good southern exposure. During the winter months, southern exposure can be utilized for warmth especially at the higher elevation at the central portion of the site, the most exposed to those conditions. In the heat of the summer months, meanwhile, there should be consideration for protecting this central area from strong solar rays. Design opportunities such as tree placement and green roofs can be implemented to make homes more energy efficient. Existing tree canopy and additional tree placement can alleviate heat island effect and have a significant impact on indoor temperatures and energy use. Large trees should be planted on the west, east, and southwest sides of home. Trees that provide shade in the spring and summer can reduce temperatures and heat island effect as much as 20 to 45 degrees, while in

the fall and winter, deciduous trees shed their leaves and allow sun to help warm the homes (American Society of Landscape Architects 2013).

The PHG's dense tree canopy provides natural windbreaks on portions of the northwest side of the sight. Placement of buildings and homes along this edge can take advantage of this protection. Additionally, planting evergreens and tree varieties along the north and west of buildings should be considered to protect areas of the site that are more exposed than those located along the northwest border. These additional tree plantings will serve to not only protect from climate, but also to provide on-site visual cues and signals to woodland and PHG natural landscape form.

Determining Conservation Lands

From the inventory and analysis, an overall assessment of the site's inherent naturalized landscape resulted in a large continuous area encompassing the site to be targeted as conservation land. The principles of the assessment are founded upon the McHarg layering approach, in which the opportunities and constraints of the physiography of the site are analyzed to determine development and conservation patterns.

The physiographic features that were considered included the distinct blanket of woodland vegetation, the natural sloping topography, geological form, and hydrological conditions inherent in the landscape. Together, these layers clearly reveal the dense formation of landscape resources surrounding the site. Out of the 99-acres, 60-acres are targeted for continuous conservation land, while the remaining 39-acres are designated as developable (Figure 29). In turn, the central portion of the site

designated as the target area of development becomes the template for which the design criteria can be applied. The extent of the conservation target versus development area within the landscape illustrates the significance of the valuable woodland PHG landscape character that is bound to the site's character. From here, guided by the criteria, the design process can apply strategies and form patterns of design for live, work, and play communities while preserving the critical intrinsic qualities of the linked PHG landscape.

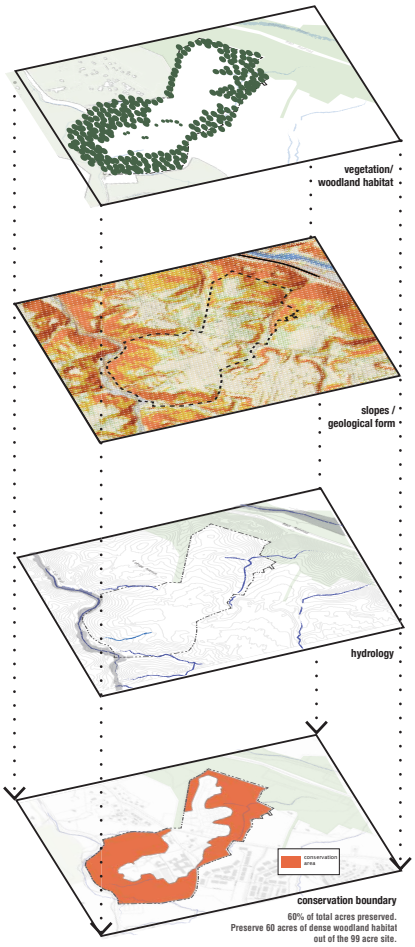

Figure 29. Determining Conservation Boundary (Nancy Britt).

Chapter 4: Design Response

This thesis seeks to create a vision for greenway-based community designs that strikes a balance between growth and conservation whereby higher density, mixed-use, and pedestrian oriented development patterns can be achieved while embracing the form and character of greenways. The thesis investigation uses a two-step approach towards realizing this vision of greenway-based community design. The first step entails defining and articulating a set of features and criteria that address multiple growth and conservation objectives specifically integrated by the framework of greenways. These criteria offer crucial insight on the elements of community design that help integrate the natural and built systems and extend the greenway landscape into the fabric of the community. Following on from this, the second step evaluates and applies the features and criteria towards opportunities and constraints of a specific site along the PHG to create a concept for mixed-use, pedestrian-oriented greenway community in Howard County, Maryland. The purpose here centers on illustrating how these forms and patterns can be applied towards an actual greenway community design, thereby increasing an understanding of the impact they can have towards achieving quality of life, sense of place and sustainability.

Design Criteria

The level of success of community design within a greenway-adjacent context is based on a complex set of criteria that bridges together the greenway framework with concepts from sustainable landscape planning and with design principles

including conservation subdivision design, new urbanism, and smart growth strategies. Planning and design of communities in this context should further incorporate a hybrid landscape form to promote a more compact, greener, and healthier atmosphere (Arendt 2011, 28). Essentially, the community should preserve and enhance natural greenway landscape form while "carefully interweaving a more modern grid-like street network into the greenway fabric to achieve the best of both worlds (Arendt 2011, 33)" and thus, create a community design that meets human needs while improving ecological performance within the greenway landscape. Based upon the context of a greenway landscape, the hybrid community form essentially focuses on:

- Smaller building footprints and compact design to preserve more vegetative land and absorb and filter rainwater, which in turn reduces flooding, increases infiltration, and lowers the amount of runoff pollution.
- Pedestrian oriented streets arranged in a connected, grid-like pattern to encourage fewer automobile trips while promoting walking and biking.
- Preserving and extending the greenway woodland landscape within the community to enhance habitat protection, promote tree canopy to provide shade, filter the air, and help recharge water aquifers.

Using a holistic approach to integrate these strategies, the greenway framework becomes the essential structuring element of the community. This section presents the comprehensive set of design criteria that reflect such an approach, based on the framework of greenways that together assist in producing a resilient sustainable community. The section is organized to show how the design criteria take

into account the social/cultural, transportation, and ecological elements of the greenway framework.

Social/Cultural Design Criteria

Connectivity and compatibility cannot be achieved without the establishing a sense of place. Sense of place or "imageability" is defined as the quality that makes a community "distinct, recognizable and memorable" (Clemente, Ewing 2013, 5). Conveying the social and cultural image or sense of place refers to establishing a mood, sense of identity, and social/cultural belonging within the community (Gerot 1999, 59). While this principle is emphasized within new urbanism, smart growth, and conservation design strategies with broad applications, the criteria herein focus on conveying sense of place specifically within greenway landscapes. These criteria also attempt to correct the tendency in contemporary practices of these strategies to focus on environment and ecology to the point that they overshadow the importance of the social and cultural context.

The criteria herein seek to emphasize the broader context of sense of place, highlighting the importance of the social and cultural within the context of the surrounding greenway landscape. It exemplifies how these elements can be highlighted symbolically through a wide variety of forms in the community landscape design including physical representation and interpretive elements. These criteria evolved from the idea that a design that is sensitive —and provides a perceptible link —to the framework of the greenway will contribute to fostering identity and image within the community design.

Table 4. Social/Cultural Design Criteria.

Social/Cultural	Design Feature
Visual Cues and Signals *Promotes connections to nature.*	Orient woodland clusters of trees and understory in visually prominent locations.
	Homes and buildings should be located with easy access to woodland setting and greenway.
	Scale and placement of homes, buildings, streets and other design elements should preserve view sheds to greenway.
	Multi-functional sidewalks and trails that connect to woodland areas, greenway, open space and common areas.
	Landscape and architectural materials and textures that reflect and symbolize natural features, historic woodland and cultural heritage. (Examples of materials to consider - surface materials for streets, trails, sidewalks as well as benches, fencing, lighting).
Historical and Cultural Preservation	Design elements that enhance and preserve views to historic woodland and greenway setting.
Capture texture and feel of historic landscape form of	Conceptual interpretive design elements that produce perceptible image of cultural greenway heritage.
	Interpretive elements, such as signage, exhibits and markers.
	Homes and building architectural typology (to reflect context of greenway heritage).
	Landscape materials and texture.
Transparency	Placement of homes, buildings, streets and other design elements that enhance and preserve view to historic woodland and greenway setting.
	Orient woodland areas, green space and common areas in visually prominant locations.
Public Space/Social Cohesion with the Greenway	Network of sidewalks and trails that connect buildings and homes to the greenway and natural settings.
Promote and reflect natural condition of greenway within community atmosphere	Woodland green spaces, common areas and parks linked to each other and the greenway through system of landscape streets, pedestrian, sidewalks and trails.
Promote Social Interaction	Orient green space and common areas in visually prominent locations.
	Homes and buildings should be integrated with shared common areas, open spaces and woodland setting.
	Close connections between buildings and homes with walkable pedestrian oriented streets.
Balance Private versus Public Space	Define personal boundaries near homes through a combination of landscape design elements.
	Architectural elements to define semi-private / transition spaces such as porches.
	Homes and bulding should be integrated with shared common areas,
Orientation	Woodland, green space and common areas oriented in visually prominent location.
	Homes and buildings should face woodland green spaces, parks, sidewalks and trails.

Transportation Design Criteria – Accessibility and Pedestrian Oriented Design

"Without natural or man made corridors that are reserved, shaped and enhanced to facilitate walking, jogging, skating, cycling, residents and workers will always lack an essential component of truly civilized community design (Arendt 2011, 30)". In the framework of this design, the walkability of parks and woodland green spaces within the community and the adjacent greenway are important to achieving these activities as well as promoting social contact and social cohesion (Duany 2010, 26). The walkability criteria herein are focused upon enhancing community design for open space and greenway walkability, but these criteria also apply to a range of broader smart growth and new urbanism walkability goals including contributing towards overall pedestrian mobility and reducing automobile usage and associated negative environmental consequences.

Table 5. Transportation Design Criteria

Transportation	Design Feature
Accessibility	Multi-functional sidewalks and trails that connect to woodland areas, greenway, open space and common areas.
	Walkable pedestrian oriented streets.
	Sidewalk and trail options for different abililties and ADA.
	Public and community common areas should be linked through a system of landscape streets, pedestrian sidewalks and trails.
Pedestrian Streetscape	Walkable pedestrian oriented streets.
	Narrow streets, short blocks and interconnectivity that prioritizes pedestrian and slows traffic.
	Separation of street and pedestrian sidewalks and pathway network that include connections to open spaces and the PHG.
	Automobile storage behind residences and buildings/rear access garages when possible.
	One way loops/loop lanes with central rain gardens or central greens preferred over cul-de-sac.
	Streets designed in a grid layout to promote connectivity when possible.
Prioritize Pedestrian over Automobile	Hierarchy of roads that create quite locl neighborhood and smaller access streets on community interior that activate social interactive setting near residences.
	Minimizes street parking in front of homes.
	Create areas where cars can be parked out of the way.

Ecological Design Criteria

Using an ecologically based approach to development of greenway communities depends on an understanding of the inherent greenway framework and the importance of natural systems of the landscape to helping create sustainable communities. The design criteria seek to make the greenway framework the fuel of a sustainable community. The greenway becomes a critical part of considering natural processes and ecological performance within the landscape, especially when the community is located within reach of greenways. As part of this, communities should protect the valuable natural resources of the surrounding greenway landscape including riparian corridors and critical groundwater infiltration areas, habitat and wildlife refuge corridors, and overall connectivity of naturalized landscape corridors. Within this context, community design becomes bound to objectives that maintain and enhance biodiversity, and to ecosystem services that are inherent and integral to these greenway landscapes. These objectives include preservation of open green space, protection of valuable landscape resources, promotion of connectivity to the greenway landscape, minimization of impervious surface, and management of stormwater runoff. Guided by these objectives, the following ecological design criteria include important sustainable design features that should be incorporated within community development adjacent to valuable landscapes of greenway corridors.

Table 6. Ecological Design Criteria

Ecological	Design Feature
Integrative Green Spaces	Tree Canopy and vegetative ares in streetscape, parks and open space. Set goal of 40% tree canopy coverage. (Girling 2005, 117).
Network of Open Space	Connected network of open woodland landscape, other community green spaces and community parks. Extend Connections to greenway and other adjacent woodland areas.
Natural Resource Conservation	Incorporate and enhance existing patches and corridors of natural resources. Restore as deemed necessary any key ecological features of conservation areas such as riparian areas and stream corridors.
Compact and Cluster Development	Design develops less than half of the land. (Arendt
Spatial Connectivity	Linear green spaces that promote open space connectivity to greenway and adjacent communities.
Compact and Cluster Development	Design develops less than half of the land. (Arendt
Spatial Connectivity	Linear green spaces that promote open space connectivity to greenway and adjacent communities.
Transparent Boundaries	Create edges and buffers of woodland plantings that border the community. Incorporate local natives and plantings well suited to greenway and local conditions of the site. Consider natives that are pre-adpated to local climate and soil.
Minimize Land Alteration	Goal - less than half. (Milder 2009, 4).
Promote native species / and Enhance Biohabitat	Create micro-climates and improve soil conditions with edge boundaries* of physcial development elements to promote native species and biodiversity. Incorporate local natives and plantings well suited to greenway and local conditions of the site. Create edges and buffers of woodland plantings that border the community. Avoid disruption to riparian buffers by development.
Minimize Fragmentation	Avoid development that perforates/interupts patches of habitat. Avoid continuous barriers between site and greenway that divides habitat into smaller patches.

Ecological (cont.)	Design Feature
Promote Community Land Management	Funding of ongoing managment activities. Partner with conservation organizations to share responsibility of conservation areas. Regular montitoring of site's biodiversity. Convenants requiring private land conservation management in support of shared resources between site and greenway. Promote private owner involvement of maintaining conservation areas and connection to greenway.
Promote Infiltration, Disconnect Impervious Cover and Reduce Runoff *Protect streams and riparian areas of the site and greenway.*	Minimize impervious roads, driveways, sidewalks, parking lots and building footprints while still providing necessary human functions and needs within the built environment (homes, buildings, roads, etc.) of community. LID practices to consider: Bioretention areas or rain gardens Vegetated swales. Pervious pavements. Green roofs. Water harvesting and recycling techniques.

* Edge Effect – "The net change in the portion land that abuts existing natural habitat by proximity to altered land. Negative edge effects include those that put conservation at risk such as Alternation of land abutting natural habitats can be interpreted as alteration of microclimate, hydrologic conditions, plant species composition, soil composition, animal species composition and animal species behavior." (Milder 2008, 73). The edge effect distances that should be considered for evaluating impact of development are:
8m for narrow driveways
15 m for buildings with minimal clearing
30 m for local roads and houses with lawns
60 m for major roads and wide swaths of developed land
(Milder 2008, 73).

Thesis Site Design

The goal of the thesis design is to apply the criteria to a specific site along the PHG to show how the unique social/cultural, transportation, and ecological greenway infrastructure can become the framework for the surrounding site's form and identity. The design outcomes exemplify how the criteria can help preserve landscape integrity between the site and the PHG, as well as improve livability of greenway communities. By associating the site's opportunities and constraints with the design criteria, the following objectives were formulated:

Social/Cultural

- Convey a sense of identity and cultural connections to the historic woodland, geological, and naturalized landscape form and character of the PHG.
- Extend functions and form of the PHG to the community landscape.
- Construct a connected network of community woodland character and public green spaces that form critical connections to the PHG.
- Create a range of housing types to allow diverse groups to realize benefits of a community based upon human-nature connections.

Transportation

- Create a network of sidewalks and trails to improve non-motorized connections between the site, the PHG, and adjacent communities.
- Create streetscape design form and layout that prioritizes pedestrian connections to the PHG.

Ecological

- Protect natural conditions of the shared landscape of the community and PHG.
- Promote conservation of natural woodlands surrounding the site.
- Promote wildlife habitat and water quality and protect aquifer recharge.

The Design Concept

The overall concept for a greenway community design on this 99-acre site built upon these goals of objectives seeks to promote critical relationships between the community and the greenway landscape via the design criteria (Figure 30). The

concept is rooted in the understanding that building balanced relationships between people, the supporting community, and greenway infrastructure such as homes, buildings, roadways, plants, and wildlife promotes sustainability and the long-term viability of the community. This concept considers interconnectivity of the landscape across scales in establishing a place for both human and environmental needs and emphasizes the greenway landscape as an integrated whole towards achieving sustainable communities. As such, the design seeks to create a vision for this integration that forms a new order of greenway communities in Howard County: one that supports growth while enhancing those critical connections to the social/cultural, transportation, and ecological resources of the PHG.

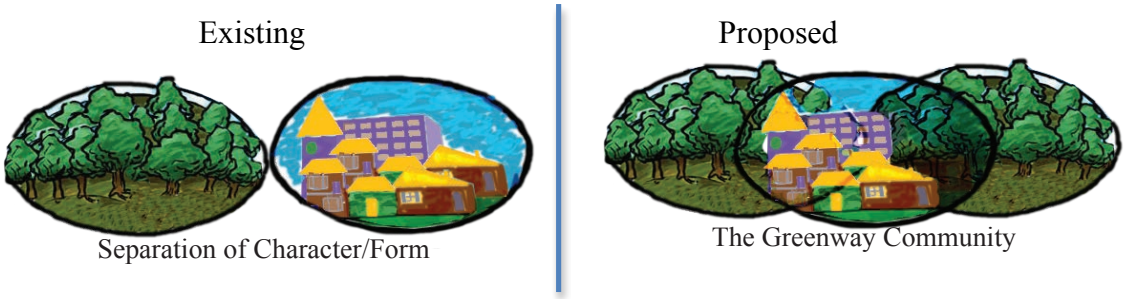

Figure 30. Concept Diagram Showing the Inter-dependency of Greenway and Community Form and Character (Nancy Britt).

Master Plan

Following on from this concept, the master plan of the thesis site reflects the application of the design criteria in an effort to improve the integration between the built form of community and the inherent natural greenway landscape (Figure 31). Guided by the social/cultural, transportation, and ecological principles within the criteria, the design creates a woodland character, pedestrian-oriented community with naturalized open spaces, an interconnected trail network, and reforested woodland

corridor connections to the PHG while responding to population trends and to Howard County's plan for growth and development in the community of Taylor Village.

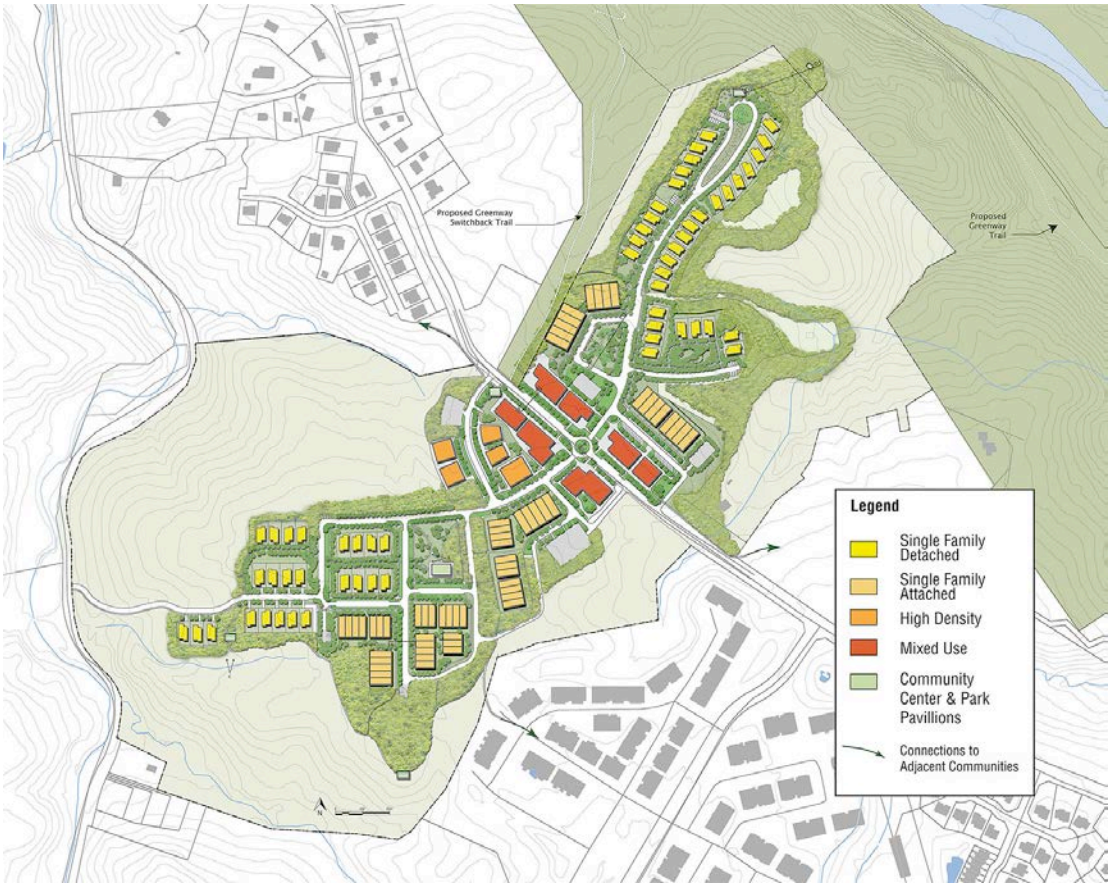

Figure 31. Proposed Master Plan for 99-acre Site within Taylor Village Community (Nancy Britt).

Design Form and Layout

Built upon the greenway framework, the design responds to the increases in population and growth target of the area by promoting a live/work/play community with a network of trails oriented to the PHG. The idea is to promote a hybrid community form that incorporates the diverse recreational landscape and human-

nature bonds inherent in the greenway landscape within a mixed-use community setting (Figure 32). Overall, the design promotes a multifunctional landscape of high density, mixed uses, and pedestrian access to the PHG. While preserving the landscape form and integrating the community to the surrounding PHG context, the design arrangement includes a defined center along the College Avenue corridor, incorporates woodland oriented public spaces, and organizes buildings in relation to one another to create a human scale while preserving views to the PHG.

The overall form of the design is based upon a gradient layout. Advocated within new urbanism strategies for development, a gradient layout promotes more efficient use of the land wherein there is a progression from higher densities to lower densities further from the central core. The idea of the gradient is to provide for a variety of lifestyles while supporting the overall objectives set forth by the design criteria.

To accomplish this, the design uses a compact layout that forms cohesive clusters from mixed-use and high-density buildings to attached and detached single-family homes. This layout is held together by the framework of the PHG integrated with a community-wide network of woodland open spaces. This strategy enables residents to have direct access to neighborhood amenities as well as community-wide networks of naturalized open spaces that reflect the greenway character and form. By promoting density and compact forms with connections and orientation to the woodland character of the PHG, the design advocates an overall healthier and more socially oriented community environment where “individuals can live longer, safer,

healthier lives than their peers in metro areas with sprawl (Smart Growth America 2014, 2)."

Figure 32. Functional Program – Density Gradient and Layout (Nancy Britt).

Social and Cultural Design Elements

In response to the design criteria, the gradient-and-clustering strategy also places strong emphasis on the elements of the social/cultural greenway framework that are important to creating close ties between the community and the PHG. The orientation of housing clusters towards woodland greens and shared common spaces fosters social vitality within the context of the PHG. The compact layout forms

clusters of buildings tightly grouped together while emphasizing the cultural heritage of PHG through design elements such as American heritage and cottage-style architecture (Figures 33A-33C). The American heritage and cottage topology is a style that emerged from the colonial to the industrial periods within the US, tracing back to the mill town housing character that was prevalent throughout the PHG's history. In terms of the style, height, orientation, and placement within the community, these architectural elements emphasize a respectful relationship with the PHG both by reflecting its cultural history and by maintaining viewsheds. From a broader perspective, the overall design layout and form interweaves a full range of features and elements within social/cultural framework of the PHG as summarized below (Table 7).

Table 7. Social and Cultural Features - Design Layout and Form.

Social/Cultural	**Design Feature**
Visual Cues and Signals	Home and building placement promotes accessibility to woodland settings & PHG. Scale and character preserve viewsheds.
Historical and Cultural Preservation	Homes and buildings' architectural typology reflects context of greenway heritage.
Promoting Social Interaction	Homes and buildings integrated with shared common areas, open spaces and woodland setting. Close connections between buildings and homes with walkable, pedestrian-oriented streets.
Balancing Public and Private Space	Personal boundaries near homes defined through a combination of landscape design elements. Architectural elements, such as front porches, promote semi-private and create transition spaces.

By applying these aspects of the criteria, the community promotes a sense of greenway character while fostering important social interaction, cultural belonging, and overall sustainability and quality of life. Although the emphasis in this section is

skewed towards the social/cultural, this design layout also forms the basis for the transportation and ecological framework, as discussed in forthcoming sections within this document.

Figure 33A. Precedent-Pinehills Plymouth, MA (National Association of Home Builders, http://www.nahb.org/fileUpload_details.aspx?contentTypeID=3&contentID=17373&subContentID=447067).

Figure 33B. Precedent-Greene St. East Greenwich, RI (GoogleEarth).

Figure 33C. Conover Commons, Redland WA (The Cottage Company, www.cottagecompany.com).

Figure 33D. Danielson Grove, Kirkland WA (The Cottage Company, www.cottagecompany.com).

Design Layout Analysis

With an emphasis on the PHG framework, the density strategy and the cluster organizing pattern of the design was further analyzed to better understand its overall landscape performance potential (Figure 34). The proposed compact pattern of

growth advances the idea of balancing development and conservation. It results in decreased footprint and an overall significantly reduction of land consumption. Out of the 99-acres, 59-acres or 60 percent are held in conservation with 40-acres or 40 percent of the landscape considered for development of the community. Out of the 40-acres considered for development, 15-acres make up the built landscape - homes buildings, roads, sidewalks, trails - while 25 of the 40-acres are designated as open space or parks.

Compact design translates to higher densities, and is a precondition for reduced land consumption and increased conservation (Girling and Kellett 2005, 97). Density is typically used as a measure describing the number of dwelling units per acre. In contrast, traditional sprawl development equates to lower-density single use development (International City/County Management Association 2002, 7). In comparison to sprawl, the design outcomes show a significant increase in density and a reduction in lands consumption. Within the 40-acre development area of the thesis site, there are 6.2 density units per acre. This number is derived from the total 247 combined housing and commercial units within the 40-acres considered for development. With traditional sprawl development, the 247 units would spread throughout the entire 99-acre site interrupting the value resources of the landscape. With sprawl, the outcome would show a marked decrease in density of 2.5 units per acre over 99-acres. The proposed design shows a marked improvement increasing density from 2.5 to 6.2. This is a 248 percent in comparison to what would have resulted in a typical sprawling development.

Overall, the gradient, compact, and cluster pattern approaches contribute towards a better understanding of how and where development should be encouraged (Arendt 2010, 7). These patterns not only reduce the footprint on the land and help promote accessibility towards neighborhood centers and a sense of community, but also direct development in ways that can promote networks of permanent woodland green spaces throughout the community and form critical connections to the PHG.

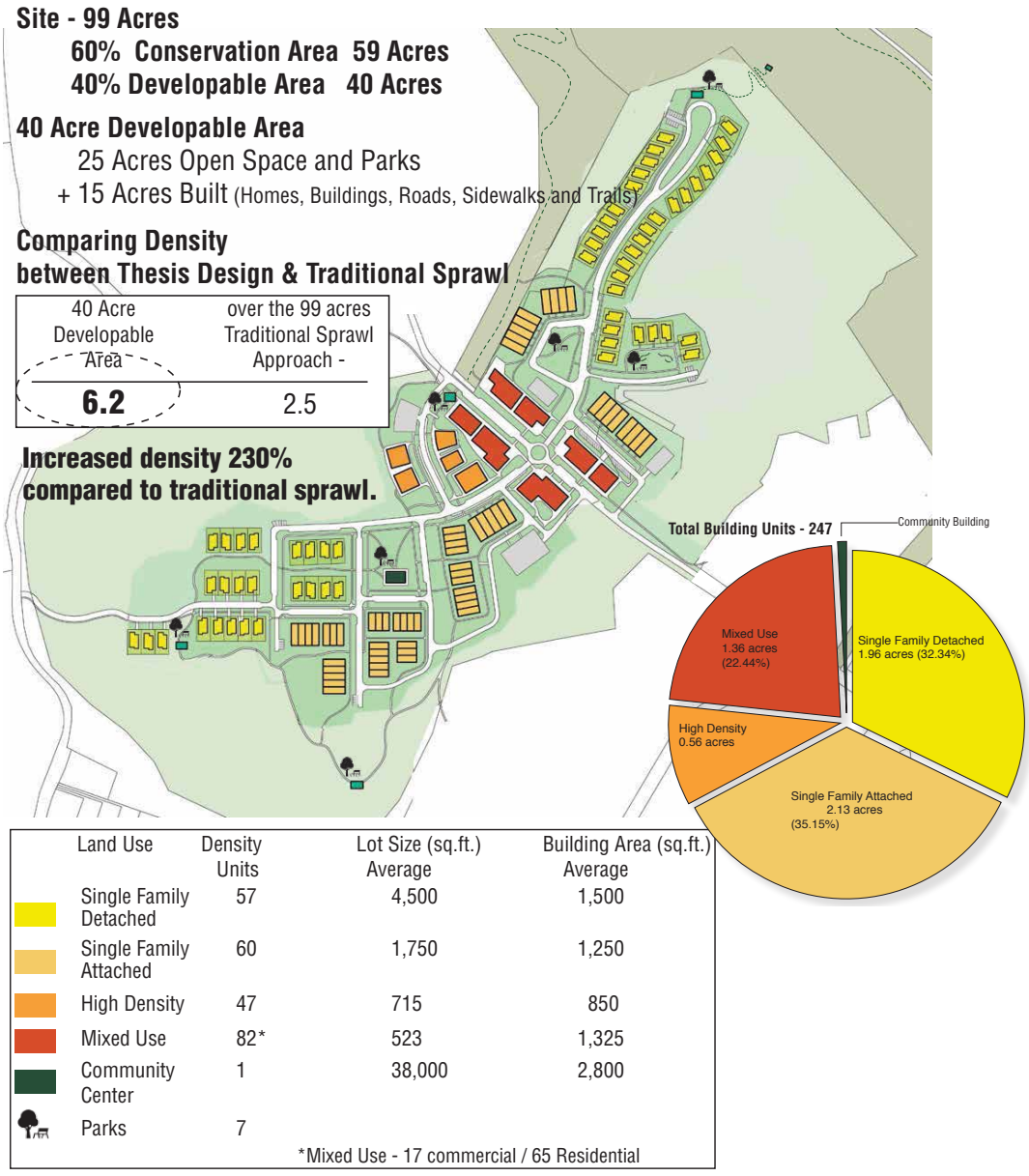

Figure 34. Density and Compactness Performance Results (Nancy Britt).

Between the 59-acres of designated conservation landscape and the 25-acres of green space including community common areas, parks, and other planned green spaces, 84 percent of the design is devoted to a system of community green space directly linked to the framework of the PHG. Conservation lands and reforested corridors contain more naturalized landscapes that are much like those within the PHG, whereas community common areas, parks, and other green spaces are a combination of woodland clusters with dense understory and green spaces with open forms of tree canopy and vegetation. Together, the open space and woodland tree canopy are at the heart of the plan, providing the critical link to the form and character of the PHG (Figure 35). Bounded by its woodland and open space form, the community becomes a setting that can realize the underlying health benefits rooted in human nature connectivity including tranquility, comfort, restoration, and healing (Frumkin, Fox 2011, 230).

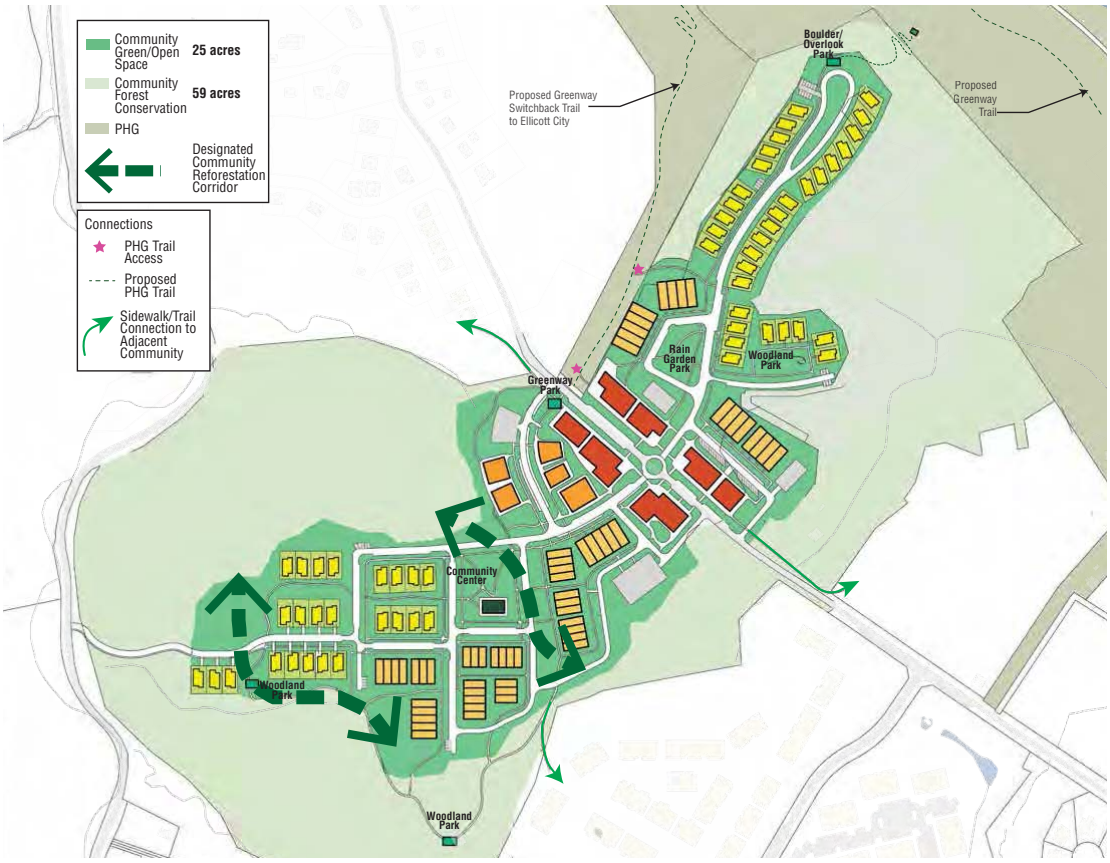

Figure 35. Functional Program - Community Wide Woodland Green Spaces (Nancy Britt).

As specified in the criteria, this integration with the PHG enables connectivity and compatibility by:

- Becoming the green infrastructure that instills those important social/cultural and ecological connections between the community and PHG.

- Setting up appropriate conditions for a non-motorized transportation trail network.

The open space network is designed to work in conjunction with the PHG by weaving together open space, reforested woodland corridors, common areas, and

parks into all levels of the community design to form a cohesive landscape. Private yards and green spaces directly connect to woodland-oriented common areas and seven designated community parks. One of those parks encompasses the community center complex, thereby reinforcing the connection between ecological and social functions and resources within the community (Figures 34 and 35). The outdoor spaces of the community are designed around and form critical connections to the larger scale PHG framework. In the broader context, the woodland green space patterns and connections central to the design criteria become the guiding principle of the plan and hold together the fabric of the community giving it vitality.

The pedestrian-oriented network of parks and woodland open space within the design is the key to achieving a vibrant greenway-oriented community atmosphere. The dominant woodland landscape form is the basis for PHG presence within the community. Furthermore, by orienting and integrating land uses of commercial, high density buildings and single family attached and detached homes to woodland green spaces with direct access to the PHG, the design promotes places to linger, socialize, recreate, educate, and appreciate nature. Inspired by the PHG landscape form, the woodland clusters of trees enhance the greenway experience forming spatial boundaries and a sense of scale throughout community green spaces. Based on the social/cultural design criteria described previously (Table 4), the structure of the design, therefore, engages the public realm all around creating a sense of place and atmosphere centered on the PHG.

A view outside the community center provides perspective into the look and feel of the community atmosphere (Figure 36). Bounded by a reforested woodland

corridor, the experience adapts the distinct character of the PHG and becomes a scene that encapsulates the woodland and natural form of the landscape. Centrally located as a destination along the community wide system of connected sidewalks and trails, it provides a place to gather and engage in community activities close to home in which residents can access by foot or bike. As one moves around the grounds of the community center, they can walk through the nature trails in the woodland corridor situated directly adjacent and surrounding the northeast side of the center, as well as take in views to the skyline of the conservation lands in the distance. Beyond the center, the perspective view of trails leading to small scale cottage style homes linked to shared community commons further emphasizes a close connection between the homes, networks of trails, and woodland spaces. As an illustration of the recurring theme throughout the design, the experience as a whole is highlighted with landscape elements that contribute towards a sense of greenway atmosphere within the community, such as purposefully arranged boulders, woodland tree canopy, native vegetation, and interpretive signs. Overall, the perspective illustrates several of the core design features within the social/cultural design criteria that enable the community character and vitality within the framework. These are summarized as:

- Connection and integration with woodland corridor capturing a sense of the PHG landscape form
- Orientation towards woodland landscape and conservation lands directly connected to the PHG
- Proximity and accessibility via the connected network of sidewalks and trails.
- Interpretive elements that provide perceptible connections to the PHG

Figure 36. View from Community Center (Nancy Britt).

Integration of PHG Form and Character

Further guided by the historical and cultural preservation considerations within the criteria, the design also realized the crucial role that the historic PHG landscape form can play in creating distinctive representation of place. Being situated along the fall line, the landscape patterns that are created and their unique geological formations are the basis for the identity of the PHG's regional landscape, as well as being suited in form and function to contribute to the community place-making. This unique geologic landscape form can contribute to instilling a sense of cultural belonging and provide meaningful links between past, present, and future uses of land and historic site.

Within the design, granite rock formations indigenous to the landscape help to shape and activate the design, and to capture the essence of cultural identity. Just as in the natural hills of the PHG, granite rock forms are preserved or enhanced throughout

the landscape of the community to appear throughout woodland green spaces, tree-lined sidewalks, trails, and streets as if naturally formed from deep within the surfaces of the landscape. Following the geologic patterns of the landscape, where the granite suddenly makes a magnificent appearance on the eastern hillside of the site, so too does the granite in the design, with the culmination of the theme emerging in a community park (Figure 37). As one moves through the community and approaches the park, the granite in the landscape changes in form. The park design is populated with large granite boulders arranged to support rock climbing. As such, the pattern and size of the granite becomes a form of imagery tied to the how the granite takes on a grand transformation out of the surface of the landscape along that eastern edge of the site leading down to the Patapsco River.

The park design seeks to recognize the granite not only as representative of the unique form and aesthetic of the landscape, but also as culturally symbolic to the quarry history of the PHG as well as its current day use for rock climbing. The design proposes the arrangement of the rock climbing structures to form a procession through the park that leads to a proposed woodland trail. In this vision of the scene, the trail culminates at a proposed platform overlooking the actual granite that was once the site of a quarry. Within the design, while activating a unique social setting of rock climbing, the community park also becomes a place that generates discoveries that are distinctly site specific, invokes imaginative horizons, and traces into the history of the PHG while celebrating emergent patterns of use.

Figure 37. Community Rock Park and Overlook /Traces of History (Nancy Britt).

Transportation Design Elements

The proposed pedestrian-oriented transportation network becomes the backbone that ties the community together. Guided by design criteria specified above in Table 5, the design includes pedestrian friendly features through an interconnected network of sidewalks, trails, and a compact street system integrated with a greenway

community setting. This section presents the proposed transportation hierarchy, illustrating the relationship between the trails, sidewalks, and streets as well as the connections they promote.

An interconnected network of naturalized woodland trails and sidewalks is woven throughout the entire community to enable pedestrians to walk or bike easily to the multi-functional land areas of the community, as well as to the PHG and adjacent communities (Figure 38). Within the design, sidewalks coincide with streetscape, whereas trails are purposefully designed to fit within the more naturalized landscape portions of the community including community parks, common areas, reforested corridors, and areas near or within the PHG. A perspective view from the conservation landscape within the community illustrates the naturalized character of the community's trails (Figure 39). The proposed layout of the circulation network seeks to create a seamless and transparent integration between community woodland sidewalks, trails, and the existing PHG trail system, thereby maximizing accessibility and creating a greenway atmosphere within the community. In addition, landscape elements are proposed, such as crushed granite for the majority of trails and for some of the sidewalks in the community as a way to form symbolic connections to the PHG granite resource and associated emergent uses (Figure 40). As emphasized within the design criteria, when combined together as part of a complete design, details and elements such as these help to achieve an atmosphere and sense of greenway character within the community.

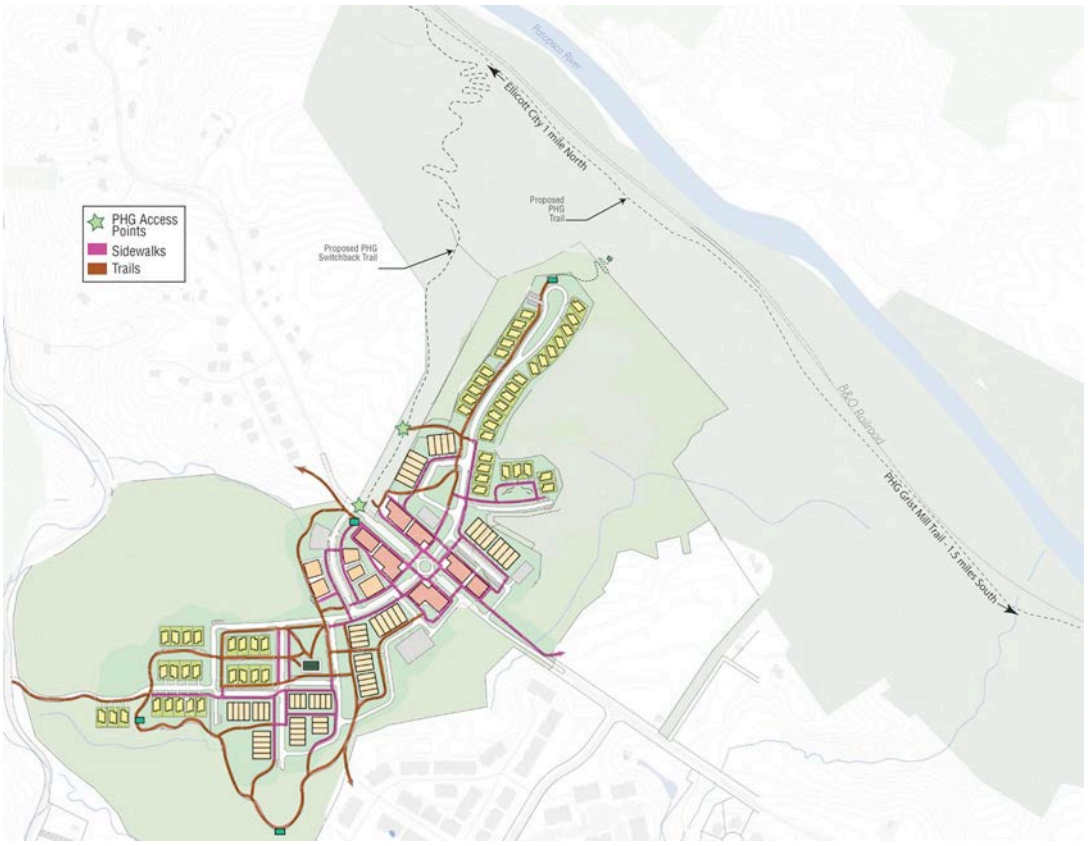

Figure 38. Sidewalks and Trails (Nancy Britt).

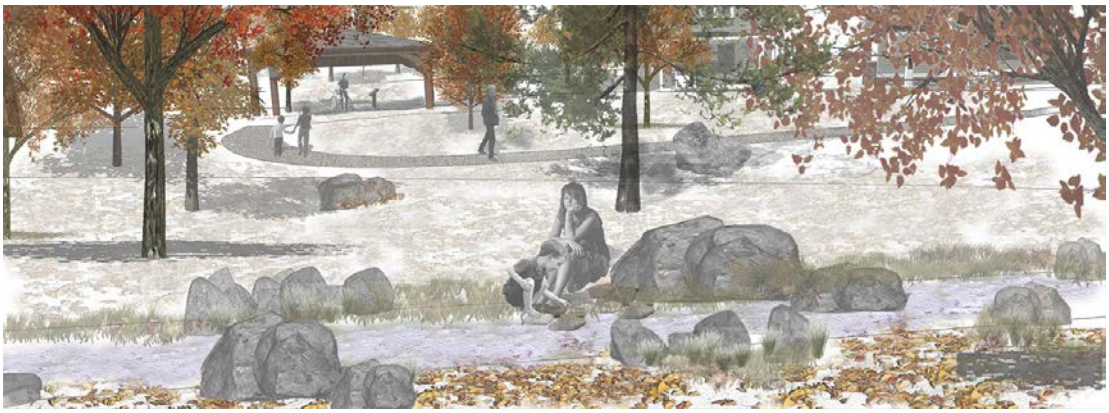

Figure 39. Woodland Community Park / PHG Atmosphere (Nancy Britt).


A.


B.

Figure 40. Precedent for Granite Sidewalks and Trails (A. Lubbock Arboretum http://lubbockonline.com/stories/041604/lif_0416040034.shtml, B. Nancy Britt)

To create those important connections directly to the PHG and extend the PHG into the community, the plan proposes augmentation of the PHG trail network to enable community access to its recreational and programmed park destinations as well as to create a formal non-motorized alternative transportation route to historic Ellicott City located 1 mile north. As shown in Figure 38 above, there are two proposed community access points to the PHG that in turn lead to a switchback trail to further destinations.

Prioritizing pedestrian and non-motorized transportation and incorporating the character of the PHG, the streets are fully interconnected with the multifunctional network of sidewalks and trails. Within the design, finely scaled streets and pedestrian-friendly infrastructural elements are proposed to support walkability and enhance the social quality with the character of a greenway. These elements include narrow local streets with widths of 20 feet or less and short blocks for traffic calming, sidewalk and trail widths to support multiple uses, and vegetative areas to separate pedestrians from streets. Vegetative areas separate street and sidewalk and are used as central islands in loop lanes to incorporate green spaces and a woodland atmosphere within the community streetscape. Comparing the existing streetscape within Taylor

Village to the same street redesigned with the proposed streetscape illustrates the difference between a streetscape with little regard to character and one that fully regards character and is united by the shared natural landscape of the PHG (Figure 41). In addition, these vegetative areas also help to promote smooth transitions between public sidewalk areas and semi-private yards in front of homes. Combined with elements such as low fences and covered porches, they become part of series of layers that promote a balance between the public and private realms of the community.

Figure 41. Pedestrian Street Character Before and After (Nancy Britt).

Following transportation design criteria and in support of the proposed gradient layout, the street hierarchy promotes an interconnected circulation system using a combination of a grid layout on the southwest portion of the site and loop lanes on the northeast portion of the site (Figure 42). The hierarchy proposes a

redesign of College Avenue, an arterial connector, to support the surrounding mixed-use center (Figure 43). The redesign includes a narrow two-lane street, on-street parking, vegetative bioretention, and tree-lined buffers separating streets from bikes and pedestrians. Closer to College Avenue, the proposed community main street design is similar in structure. The two access streets from College Avenue are purposefully positioned to incorporate existing tree-lined street conditions. Within the community, as stated above, the design proposes to integrate a woodland atmosphere by forming a pattern of green streets using narrow street widths, sidewalks, bioretention, and woodland buffers (Figure 44). These vegetative areas throughout the street hierarchy complement the built structure and create rhythms to bring a naturalized landscape into the everyday experience of the community. Integration of the PHG character becomes a matter of course rather than an exception, forming a cohesive transportation network that gives prominence to the pedestrian while creating a harmonious relationship with the natural greenway landscape.

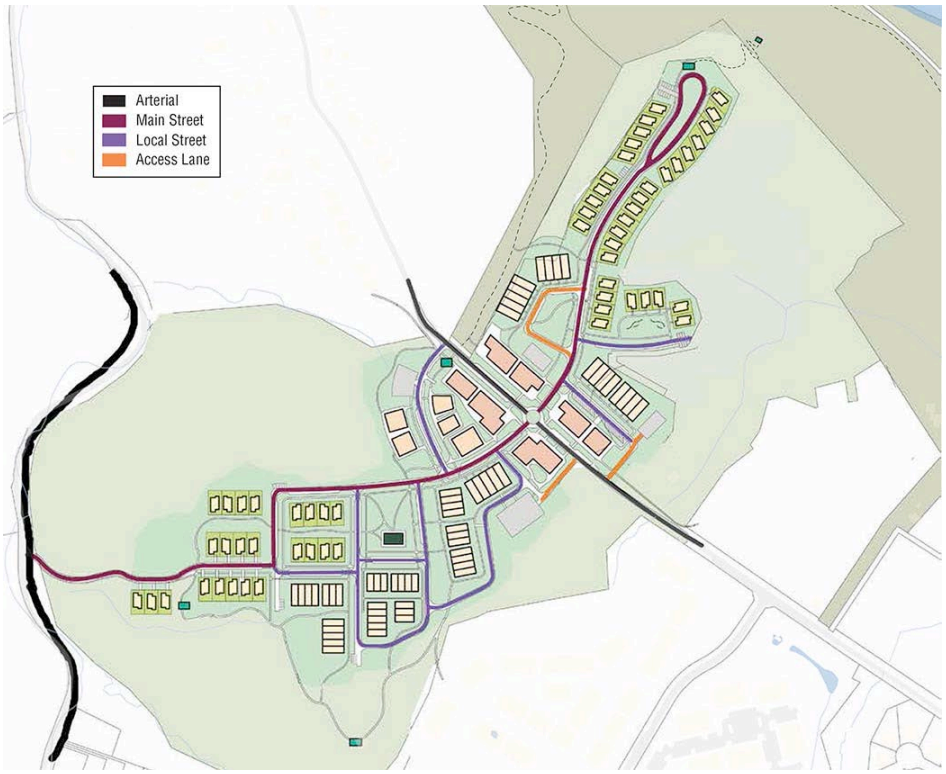

Figure 42. Street Hierarchy (Nancy Britt).

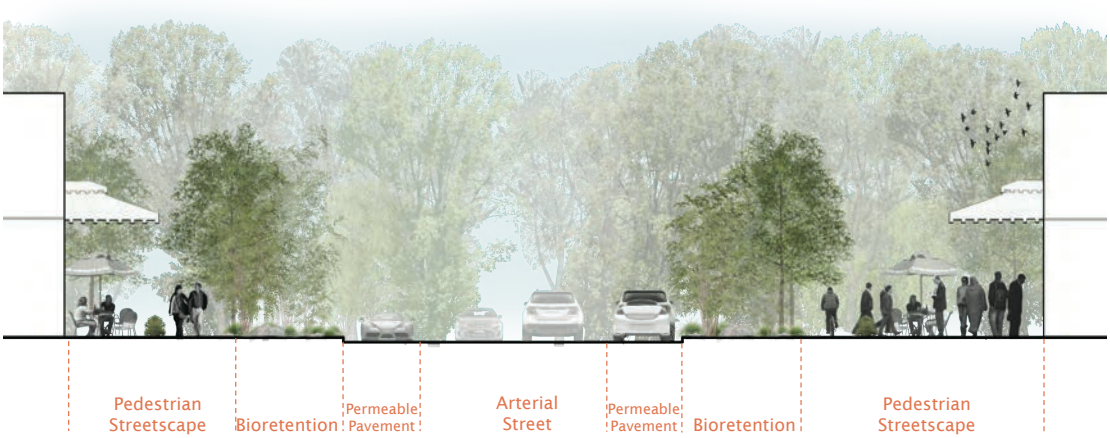

Figure 43. Streetscape –Arterial Street - College Avenue Enhancements (Nancy Britt).

Figure 44. Streetscape - Local Street (Nancy Britt).

Ecological Design Elements

Guided by the criteria (Table 6), the design weaves together the natural landscape form of the PHG and low impact development (LID) features to form the green infrastructure of the community. The green infrastructure functions as a working landscape that captures and cleans the water before it flows to the PHG and surrounding stream corridors. By harnessing natural systems, the naturalized woodland vegetation and proposed LID features throughout the community disconnect impervious surface, infiltrate and reduce stormwater runoff. LID features proposed include rain gardens, bioretention areas, pervious pavement, green roofs, and rain barrels. Each is placed purposefully in green spaces of the community to preserve and enhance the natural landscape and treat stormwater. The following section describes how the natural landscape form and the LID features contribute to the green infrastructure and the associated impact to the overall ecological performance of the community.

Conservation Lands and Reforested Corridors

Perhaps the most significant aspects of the community green infrastructure are the proposed protected network of conservation land surrounding the community and the connected reforested corridors within the community as shown above in Figure 35. The woodland vegetation can be considered as the environmental workhorse of the community providing ecological services that protect against the negative impacts of development while contributing to the overall greenway character of the community. Closely linked to the ecological form and function of the PHG and integrated together in a connected network of dense forested woodland, these areas perform important ecological functions including evapotranspiration, stormwater filtration, and detention. As interwoven natural systems, they also promote biodiversity, create connected corridors, and provide patches of habitat for native species and wildlife.

Following the design criteria, edges and buffers are recommended elements to enhance and protect the resources of the greenway landscape. Applying this to the thesis site, the design includes edges and buffer areas planted with layers of native woodland vegetation and other dense planting in transition zones between the development and the conservation landscape. These buffer areas not only enhance the functional size of core conservation areas, they protect conservation lands from influences of development and impacts of associated stormwater runoff (Milder 2007, 764).

Woodland Common Areas and Parks

Clusters of woodland trees and native vegetation create pockets of dense vegetation throughout common areas and parks. In addition, rain gardens are purposefully placed to enhance surrounding open areas that would otherwise not be as ecologically productive. To reduce runoff, water is directed from impervious surfaces such as parking areas and rooftops to these areas. While the rain gardens are designed to work together with the naturalized landscape to treat stormwater and promote habitat and biodiversity, they also contribute to the overall aesthetic experience and sense of place (Figure 45). There are 0.7-acres, or 30,600 square feet, of total rain gardens proposed within the design. Using a guideline in which 20 percent of water could potentially be captured out of 4 feet of well drained soils proposed for the rain gardens, these areas have the capability to treat approximately 24,500 cubic feet of stormwater in a given rain event (Figure 46). This is a preliminary estimate and further study would be required to calculate combined capacities of woodland clusters and rain gardens based on specific site conditions including slope and soil capacity.

Figure 45. Parks and Rain Gardens (Nancy Britt).

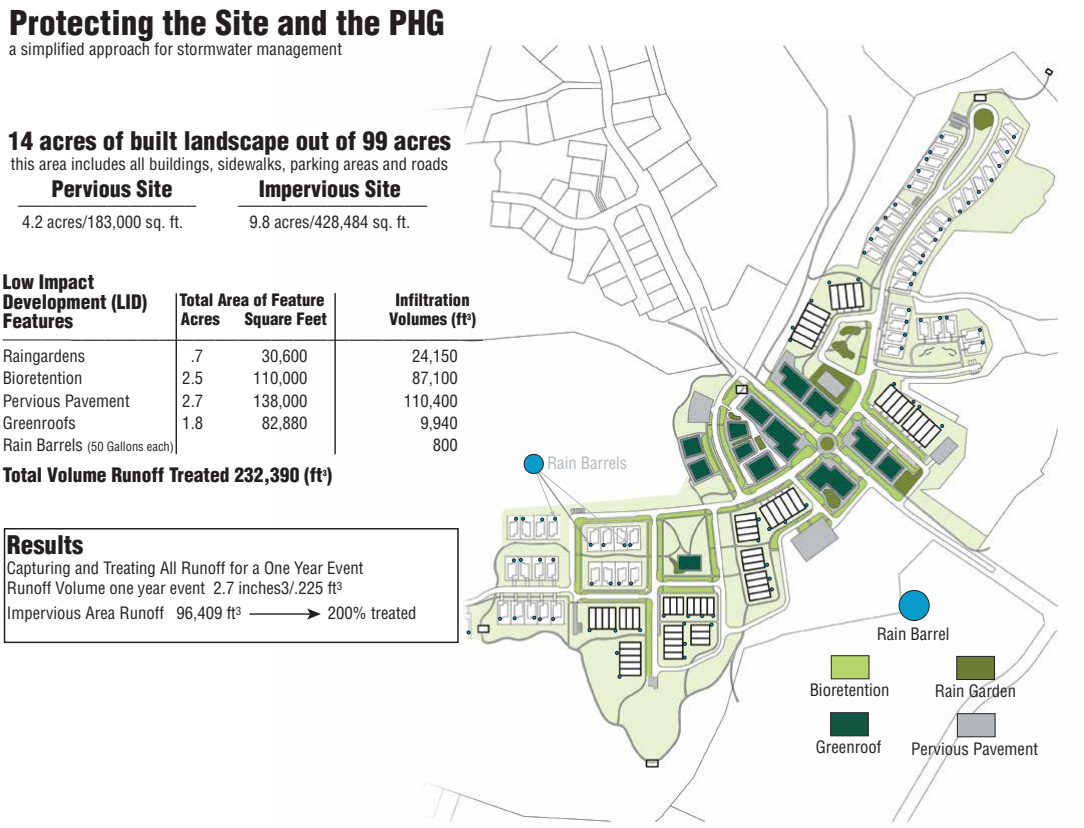

Figure 46. Stormwater Management and Environment Side Design (Nancy Britt).

Green Transportation Network

Illustrated previously in the chapter in Figure 43 and Figure 44, the streetscape is surrounded by woodland vegetation and bioretention areas. As with rain gardens, the bioretention areas work together to capture and clean street runoff while supporting the social/cultural framework of the design criteria. In the bioretention areas alone, the design proposes a total of 2.5-acres, or 110,000 square feet, of bioretention surrounding streetscape. Based upon the same guidelines as rain gardens, the bioretention areas have the capability to infiltrate and capture of 87,100 cubic feet of stormwater. These are preliminary capacity estimates and further study would be

required based on specific site conditions to calculate overall capacities of vegetative areas within the streetscape.

To further enhance the ecological performance of the community, the design proposes to use materials for walks and trails including pervious pavers and permeable crushed granite. Pervious pavement is proposed in parking areas and parking lanes in areas with slopes of 5 percent or less. Pervious pavement is also proposed for sidewalks specifically surrounding the mixed-use center and the high-density residential cluster within the community. In addition, the proposed crushed granite material is proposed along the many trails that surround the community. Crushed granite has a similar capacity to pervious pavers. Together, they can substantially reduce stormwater runoff as compared to traditional impervious material commonly used on sidewalks and parking surfaces. Within the proposed design, there are 2.7-acres or 138,000 square feet of pervious pavers and crushed granite trails. Based on a 40 percent capture rate and two feet of pavement volume, these areas have the capability to treat up to 110,400 cubic feet of stormwater.

Green Roofs and Rain Barrels

Further supporting built infrastructure, a combination of green roofs and rain barrels are proposed to treat stormwater and recycle water directly from roof tops. The design proposed green roofs on the mixed use and high-density buildings within the community. While green roofs treat stormwater, they also provide naturalized areas on rooftops that can provide additional outdoor common spaces and enhance biodiversity. Within the proposed design, there are 1.8-acres or 82,880 square feet of

green roofs. Based on a guideline of 20 percent capture rate and four inches of capacity, these areas have the capability to capture up to 9,940 cubic feet of water.

In addition, adjacent to attached and detached single-family building units, 50-gallon rain barrels are proposed to capture and recycle water for irrigation. There are approximately 75 rain barrels proposed community-wide which result in the potential to capture and recycle 800 cubic feet of stormwater. While this number may be small relative to the other LID features in the community, the large numbers of rain barrels create a visible theme in the public realm of the community and significantly contribute to environmental awareness within the context of the PHG.

Ecological Performance Evaluation

Out of the 99-acres of the site, the design proposes 14-acres of built infrastructure including streets, buildings, sidewalks, community trails, and parking areas. Within the 14-acres, there are 4.2-acres or 183,000 square feet of pervious surface, and 9.8-acres or 428,484 square feet of impervious surfaces. A preliminary evaluation of the overall ecological performance of the design was performed for a one-year storm event (Figure 46). In Howard County, the runoff volume for a one year event equates to 2.7-inches or .225 cubic feet of water. Based upon this, the runoff from impervious areas equates to 96,409 cubic feet. The ecological performance of the LID features results in a total treated volume of 232,390 cubic feet or 200 percent treatment for a one-year rain event. Further study would be required to form more accurate calculations of stormwater treatment to include the naturalized vegetative open spaces within the design, as well as specific site conditions including slope and soil capacity. Overall, the results indicate that the proposed outcomes of the design provide a

substantial contribution to ecological performance of the community while supporting the overall framework of the PHG.

Chapter 5. Conclusion

Overall, the criteria enabled the design to achieve a synergy between the community and greenway. It incorporated the essential attributes of the criteria that are necessary for stitching together the fabric of community based on the framework of the greenway. These attributes merge to create a vibrant community that provides connection to the naturalized landscape of the PHG, meets more daily needs within walkable distances, and protects the conservation lands of the PHG. By applying the design criteria, the design sparks difference and generates a community that is deeply site-specific and magnifies the landscape form and character of the PHG.

Design Reflections

While the overall design was effective in addressing the social/cultural, transportation, and ecological elements of the criteria, there were site-specific characteristics that presented challenges to meeting the full set of ideal criteria. The large area of conservation land, existing tree-lined streets, other existing tree canopy, and site elevation put constraints on space and form in certain areas, and as such impacted implementation of the design criteria. Some of these constraints included:

- Limited internal block sizes, which resulted in smaller size of common spaces and/or prevented parking behind rear of homes.

- Constraints related to community streetscape, including limited widths for sidewalks and/or prevented separate bicycle lanes.

- Steep terrain, which placed limitations on number of formal access points and associated trail design that could provide connections from the community to the PHG.

- Site elevation, which required a lower number of building units and thus lower overall density within the community in order to preserve important view sheds to the PHG and avoid overwhelming the sense of place provided by its woodland character.

None of these compromises were made lightly, but rather in a considered attempt to balance the overlapping priorities of the site's social/cultural, transportation, and environmental resources; however, future iterations of the design should consider alternatives that address these issues within the framework of the PHG.

Design elements related to a broader area of transportation beyond Taylor Village were beyond the scope of this thesis. Although the design promotes connectivity to historic Ellicott City by way of the PHG, additional non-motorized transportation alternatives by way of arterial roadway were not included in the design. This would strengthen not only access to additional amenities of Ellicott City, but also integration of the heritage of the Patapsco River Valley. Furthermore, connectivity to the PHG depends upon extending the PHG trail system surrounding the site, a process further complicated by the steep slopes those trails would need to traverse. Although the design incorporates a concept to enhance the trail system and create connections from the site to the PHG, further design would be required to

expand upon extensions of the PHG trails from the site to north and south destinations. These expanded transportation networks would be priorities in any work seeking to build upon the design proposed in this thesis.

Looking Ahead

The design in this thesis demonstrates the viability of the proposed design criteria for applications to other sites experiencing growth and development in proximity to greenways. As the constraints encountered in this design demonstrate, in applying the design criteria to any site, they must be interpreted based on each site's distinct and varied landscape characteristics. Furthermore, any landscape architect, planner or developer seeking to apply these criteria must remain mindful for economic and public policy.

Economic Considerations

While aspects of the design criteria, such as — LID features, bike lanes, trail infrastructure, parks and reforestation— may result in additional investment by developers, many of these costs can be offset by the final sales prices for the development. In addition, they may also be offset by a number of economic benefits associated with development of greenway communities. These benefits include:

- Increased property values due to naturalized landscape and proximity to greenway (Arendt 2010, 51).
- Competitive market opportunities created by a sustainable healthier environment, which attracts businesses and homeowners (Rouse and Bunster-Ossa 2013, 12).

- Reduced infrastructure and development costs such as water, sewer lines, and site grading due to strategies including density, compact development, and green infrastructure (Arendt 2010, 51).
- Public policy and regulation incentives for conservation and compact development strategies (Rouse and Bunster-Ossa 2013, 34).

Although these economic benefits make a case for the community design based on the framework of greenways, incentives for this approach to development would be strengthened in the future with a comprehensive cost-benefit analysis.

Public Policy

Considering the pace of development and urbanization in jurisdictions such as Howard County, public policy can further benefit from strategies that help to instill a sense of place in communities along greenway corridors. To be fully successful, public policy, planning, design, and development must work in concert to create vibrant greenway communities. Without public policy, although certain elements of the criteria could be considered, it would likely be difficult to implement the criteria in full as an approach to community development. To incorporate strategies proposed by this thesis would require policy makers to broaden focus beyond an environmental emphasis to include the greenway framework as an integrated whole to drive community design.

The design criteria could be a recipe for policy makers to help uplift policy and formulate more progressive design regulations that integrate the greenway framework into community design regulation. As development regulations expand

upon the ecological to include social/cultural and transportation conditions, municipalities will have a more complete set of regulatory tools to promote the greenway framework as a valuable community infrastructure and move development of greenway-oriented communities in sustainable directions.

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