Appendix 5: Environmental Resources Analysis

Sustainability in Gaithersburg West

In the Gaithersburg West Plan, the overarching environmental goal is to "create a sustainable neighborhood that will attract nationwide interest for design and materials that minimize carbon emissions, maximize energy conservation, and preserve water and air quality." Sustainability is widely defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainability integrates the broad categories of water quality, air quality, wildlife habitat and biological diversity, human health and quality of life, and climate protection.

Designing and constructing sustainable communities begins with an awareness of existing resources. Through careful and sensitive environmental site design, existing natural resources can be identified and incorporated into the planning phase of development. In this way, a development can preserve as many of the existing resources as possible, take advantage of the inherent benefits of the resources, protect the resources through clustering, sensitive road design and application of appropriate buffers, and enhance the resources where appropriate through forest planting and creative landscaping.

In many cases, recommendations intended to accomplish one environmental goal will also help accomplish other goals. This should only serve to underscore the importance of implementing recommendations that address multiple sustainability goals. Of particular importance are recommendations for energy conservation and renewable energy use. These recommendations are in response to recent County legislation requiring the County to reduce its carbon footprint substantially over the next 40 years. These recommendations include an endorsement of Smart Growth for development in Life Sciences Center portion of the Gaithersburg West Master Plan. The Smart Growth principles of creating compact, walkable communities with a mix of land uses, served by public transit, provide the planning framework necessary to enable the long-term behavior changes required to reduce carbon emissions.

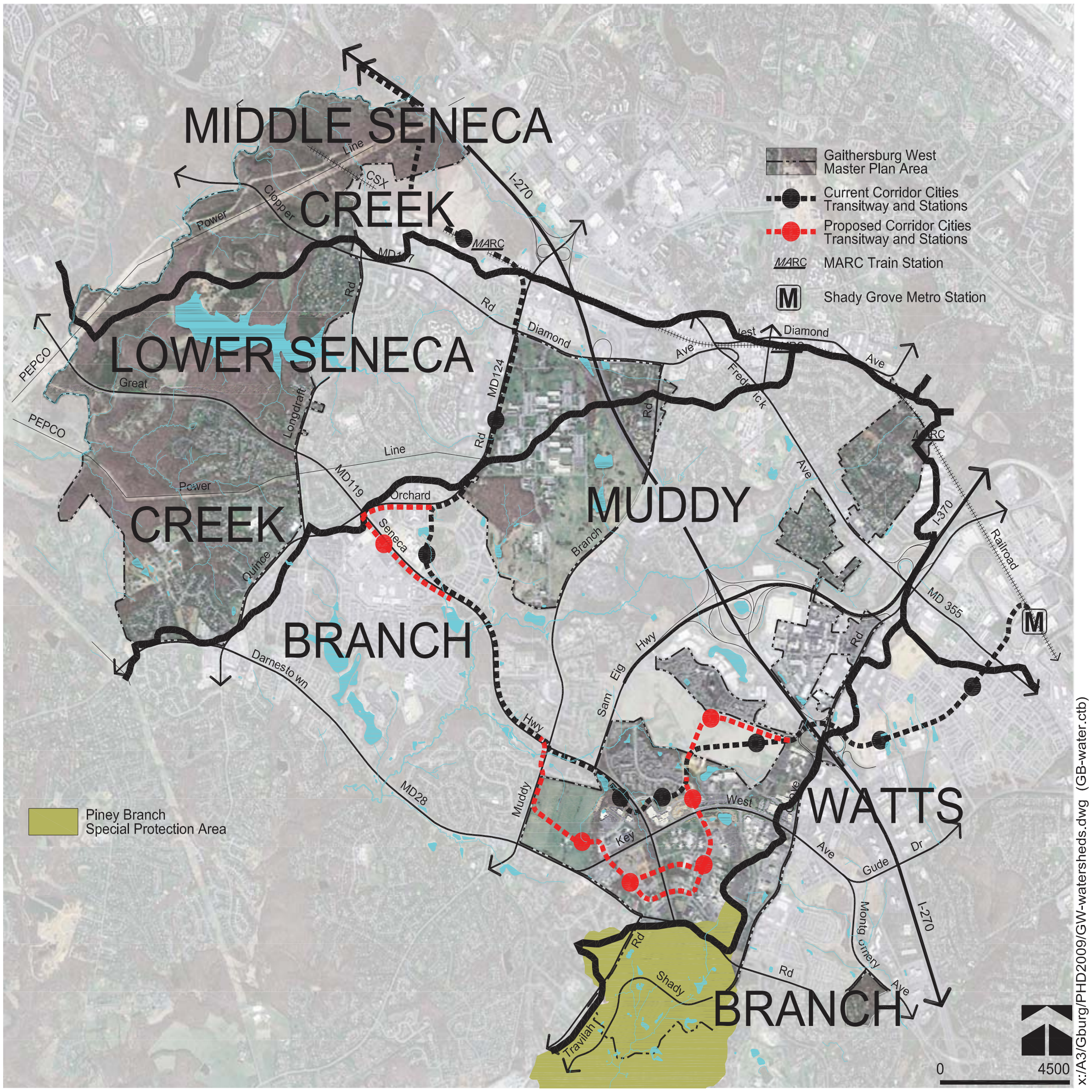
Sustainable communities, based in Smart Growth principles, fit comfortably within their natural settings and have a compact development pattern that allows residents, workers, and visitors to accomplish daily activities via short commutes offering alternatives to a private car. While new development itself means adding to the carbon footprint, it can be achieved more sustainably than in the past. New development and redevelopment should use operational, technical, and physical means from design through construction and operation to improve the sustainability of both buildings and the communities.

Watersheds

The Plan area is within the headwaters of several watersheds, all draining to the Chesapeake Bay. These watersheds are Great Seneca Creek, Muddy Branch, and Watts Branch (via Piney Branch), and a small area of Rock Creek. Local efforts are critical to improving the Bay's water quality.

All the Plan area's watersheds, except Rock Creek, empty into the Potomac River above the intake for the Potomac Water Treatment Plant that provides most of the County's drinking water. Development in Gaithersburg West must maintain and improve water quality to sustain our drinking water supply.

Watersheds


MIDDLE SENECA
CREEK
LOWER SENECA
CREEK
MUDDY
BRANCH
WATTS
BRANCH
Gaithersburg West Master Plan Area
Current Corridor Cities Transitway and Stations
Proposed Corridor Cities Transitway and Stations
MARC Train Station
Shady Grove Metro Station
Piney Branch Special Protection Area
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Water Quality

The Gaithersburg West study area includes parts of three watersheds: Watts Branch, Muddy Branch, and Great Seneca Creek. A small area of the Oakmont area drains to Rock Creek, but it is so small as to be inconsequential for purposes of the Plan. Because water quality responds to the unique combination of land use conditions in each watershed, each watershed will be addressed separately.

Watts Branch The southern portion of the Life Sciences Center area, largely south of Darnestown Road, drains to Watts Branch via the Piney Branch. Concern about development impacts to water quality in the Piney Branch led to the establishment of the Piney Branch Special Protection Area in 1995. The 1998 Countywide Stream Protection Strategy (CSPS)indicated good stream conditions in the Upper Piney Branch and fair stream conditions in the rest of the Piney Branch (Figure 1).

Since then, monitoring has documented declining stream conditions as development has proceeded in the Upper Piney Branch portion of the Special Protection Area. Over the past several years, the Upper Piney Branch streams were rated fair to poor. The decrease in water quality is due in part to the immediate impacts of construction and land use change. Development results in both short-term and long-term impacts to water quality. Vegetation removal and land disturbance through cut and fill activities to bring a parcel to grade results in delivery of sediment and altered runoff volumes to the streams. This affects hydrology, stream channel shape, water quality, and biological communities during the construction process. Forest loss, land use changes, and increased impervious surfaces continue the change in the hydrologic regime of the watershed over the long-term. It is unclear how much the biological community will recover once development is complete and stormwater management is in place.

Muddy Branch Most of the Life Sciences Center and other portions of Gaithersburg West drain to the Muddy Branch. Water quality in the upper Life Sciences Center drainage area varies between good and fair (Figure 1). Most of this area has been stable for a number of years, so construction impacts are limited. Plan proposals for this area anticipate significant new development in the Life Sciences Center. This development carries the same potential for short-term and long-term water quality impacts noted above.

The greatest damage will occur in headwater stream areas where groundwater hydrology will change through land disturbance and land use changes. Undisturbed land filters and stores groundwater for release over time through springs and seeps at a stream headwaters. If this ground is disturbed through cut and fill activities, stream flow from groundwater will be reduced and stormwater runoff into the headwater stream increases. Essentially the stream will have a less steady flow between storms and a flashier storm runoff rate. The Plan recommends reduction of long-term impacts through the use of Environmental Site Design (ESD), including techniques that maximize groundwater recharge and minimize runoff.

Water quality in the Oakmont and Rosemont enclaves has been in the poor range for the past couple of monitoring cycles. Streams in both of these areas have been substantially altered, including sections that have been channelized and piped. Some of these streams receive runoff from highly impervious commercial areas. The upper Muddy Branch mainstem here has been identified as a priority for stream restoration in the Great Seneca and Muddy Branch Watershed Study and any improvements resulting from redevelopment will aid the stream restoration process (Figure 2). In addition, the following stormwater facilities have been identified as priorities for retrofitting:

- Shady Grove Development Park Regional (east of I-270 and south of Gaither Road)
- Shady Branch #5 Regional (northeast corner of Banks farm, south of Great Seneca Highway)
- Shady Grove Life Sciences Center (east of Great Seneca Highway and south of Blackwell Road).

Figure 1
Gaithersburg West Water Quality

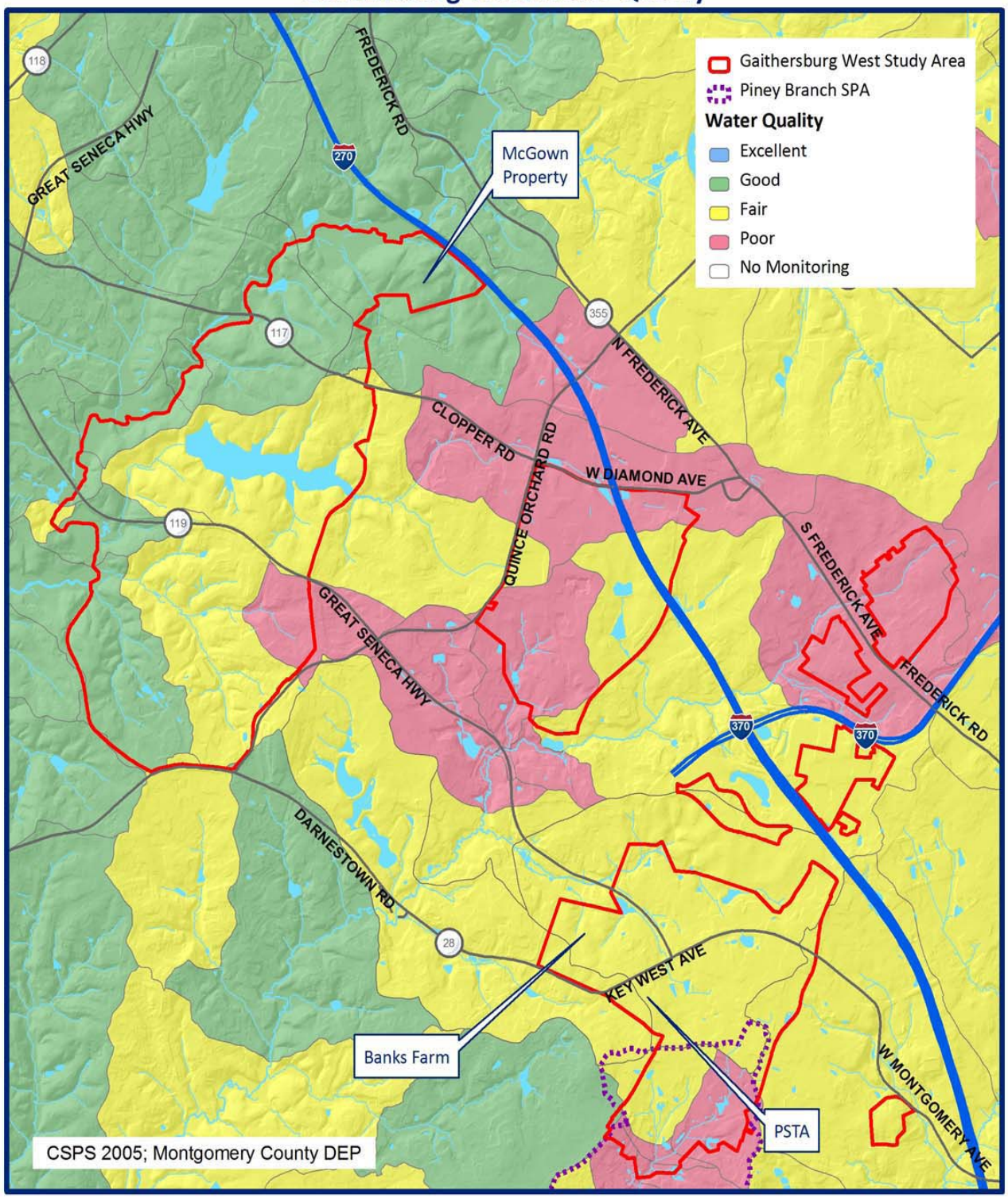
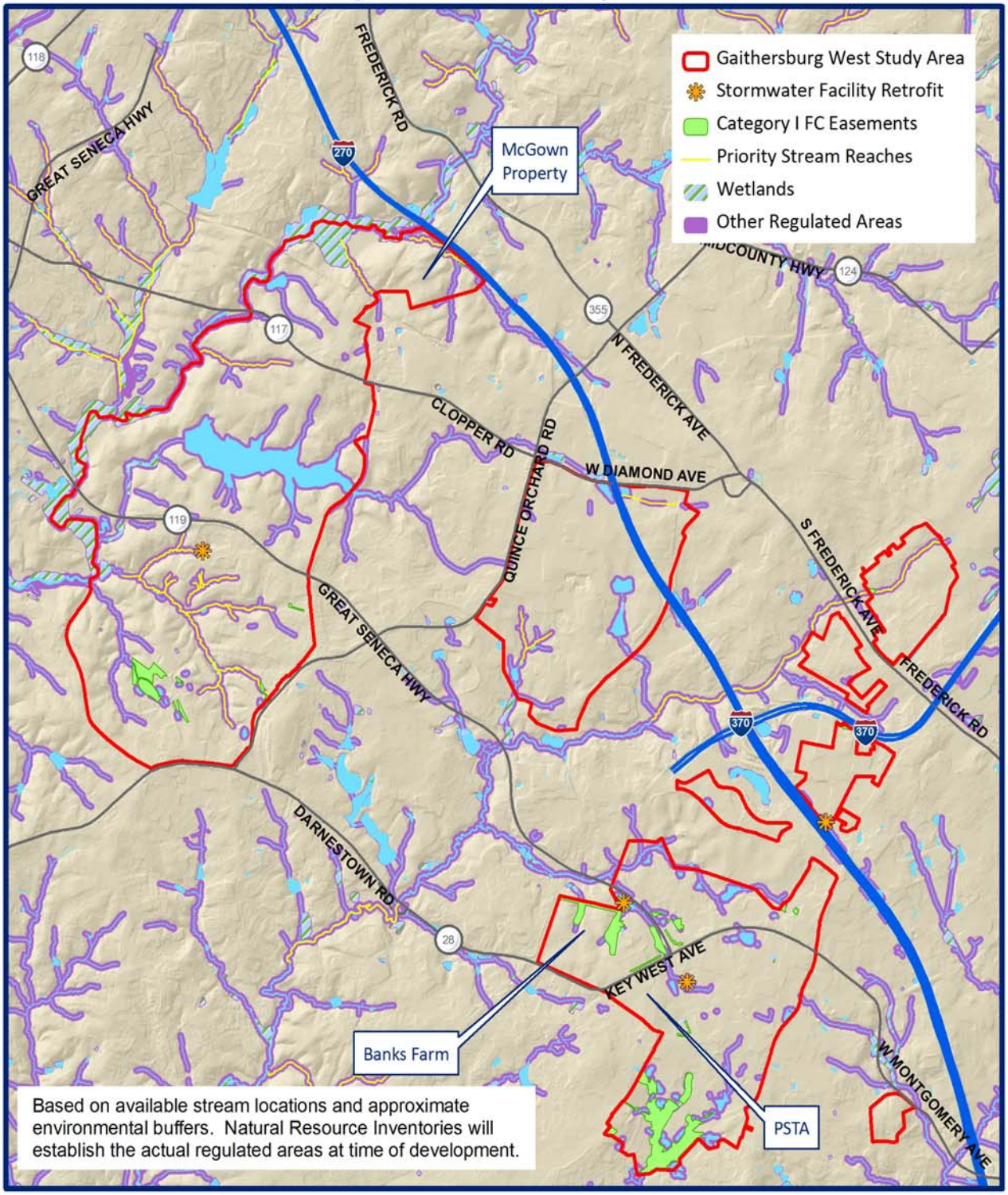


Figure 2

Gaithersburg West Water Quality Considerations



Great Seneca Creek The northern portion of the NIST/Londonderry enclave has also demonstrated poor water quality in recent monitoring (Figure 1). The stream channel has been significantly altered with portions of the stream piped. Multifamily developments and light industrial and commercial areas drain to the stream. There is potential for some limited new development in the Londonderry area.

The Quince Orchard/McGown area benefits from having large areas of stable residential neighborhoods as well as substantial portions within the boundaries of Seneca Creek State Park. Stream conditions were good in the 1998 CSPS and evaluated as between fair and good in more recent studies. The McGown property occupies about 70 mostly wooded acres near Seneca Creek State Park. The topography here includes some significant steep slope areas. Large scale development in this area will have the high potential for significant negative impacts to stream conditions unless the development is carefully designed to maintain the natural topography, and the infiltration and runoff rate of the existing landscape. The Plan recommends that ESD techniques be employed to minimize any negative water quality impacts, but negative impacts will occur. The degree of recovery of the stream will depend on the extent to which ESD design is successfully applied to the area. Tributary streams draining the northern and southern portions of the McGown property and streams south of Great Seneca Highway east of the Seneca Creek mainstem in the Quince Orchard area are among those identified as priorities for stream restoration in the Great Seneca and Muddy Branch Watershed Study (Figure2). This study has also identified the stormwater management facility south of the end of Morning Light Terrace as a priority for retrofitting.

Two land use factors have been identified as having a major influence on stream water quality: imperviousness and forest cover.

Imperviousness

Increasing levels of imperviousness have been linked to declines in water quality. Studies indicate that stream water quality indicators will begin to decline when watershed imperviousness exceeds about 10 percent. Watershed imperviousness levels above 25 percent are associated with severe levels of stream water quality degradation. Existing levels of imperviousness were analyzed within the boundaries of the Life Sciences Center and areas of the Gaithersburg West Master Plan (Table 1). In most of these areas, the Plan's projected growth projected is not expected to change impervious levels significantly. The exceptions are in the Life Sciences Center and on the McGown property.

Forest Cover

Though not as strongly correlated with water quality as percent impervious cover, the amount of a watershed maintained in forest has also been shown to have a complimentary effect on stream water quality. In a study of Montgomery County, streams with excellent water quality typically had an average forest cover of greater than 50 percent, while poor water quality streams had an average forest cover of less than 30 percent (Goetz et al., 2003). Forest cover tends to decrease as imperviousness increases.

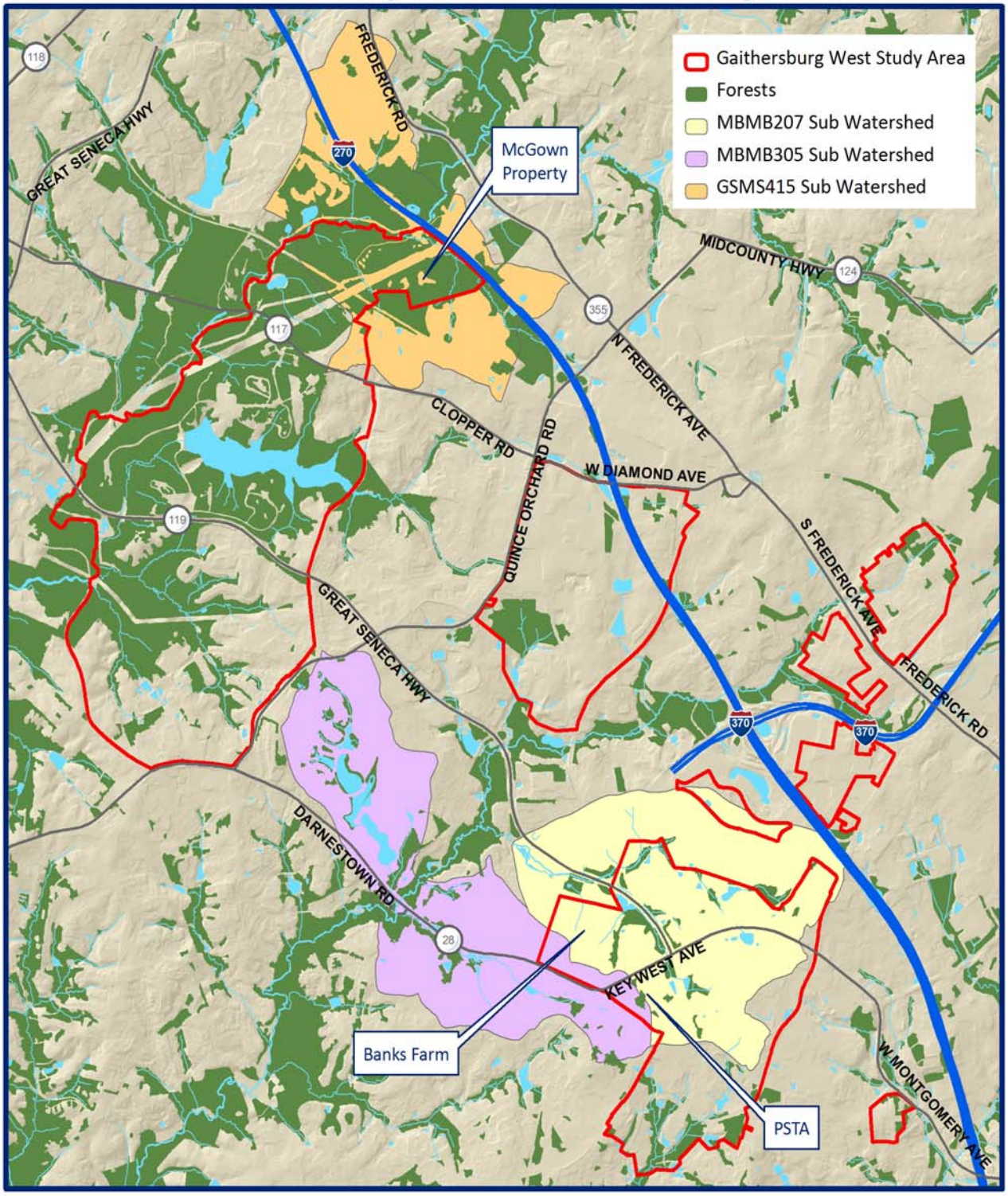
Most of the increase in imperviousness in the Life Sciences Center will occur in the areas of the Belward Campus of Johns Hopkins University and on the property currently occupied by the Public Safety Training Academy (PSTA). These two properties drain to two subwatersheds of the Muddy Branch. The McGown property drains to a subwatershed of the Great Seneca mainstem. The most critical consideration in these subwatersheds is the extent to which land use changes will increase the total imperviousness within the subwatersheds.

Table 1 shows existing forest cover and imperviousness, and projected changes in imperviousness for these subwatersheds. See Figure 3 for subwatershed locations and existing forest cover.

Table 1. Imperviousness and Forest Cover in Key Gaithersburg West Subwatersheds

CSPS Subwatershed Station #	Current Imperviousness	Projected Imperviousness	Existing Forest Cover	CSPS Water Quality Rating
MBMB207	32%	45%	9%	Fair
MBMB305	31.5%	34.5%	7%	Fair
GSMS415	17.5%	25%	39%	Good

Figure 3
Gaithersburg West Current Forest Coverage



New development is also anticipated for the Hoyle's Addition area of the Londonderry/NIST enclave. The area of new development is so small, however, that no discernable change in total watershed imperviousness is projected.

The above results highlight the need to incorporate all available ESD approaches for new and redevelopment in the Life Sciences Center and McGown areas of Gaithersburg West to prevent further degradation of water quality.
Environmental Site Design

Environmental Site Design (ESD) is an approach to new development and redevelopment that incorporates a variety of practices that can be used to minimize adverse environmental impacts from development and increase overall sustainability. The purpose of ESD is to reduce the stormwater runoff generated by development, slow the delivery of runoff to stream systems, and reduce pollution and thermal impacts to receiving waterways. The basic principle behind ESD is to control stormwater runoff as close to its point of generation as possible rather than collecting, transporting, and concentrating it in large stormwater management (SWM) facilities. Use of ESD practices can ultimately reduce SWM costs by reducing the infrastructure necessary for collecting and transporting stormwater.

Environmental Site Design:

- incorporates SWM at the earliest stages of site design
- limits land disturbance and grading
- maximizes conservation of natural features
- minimizes impervious surfaces
- uses innovative and effective stormwater control and treatment and non-structural best management practices (BMPs) that minimize stormwater runoff, and maximize runoff treatment and infiltration.

Environmental Site Design BMPs include:

- bioretention facilities or rain gardens
- grass swales and channels
- vegetated rooftops
- rain barrels and cisterns
- vegetated filter strips
- permeable pavements
- pollution prevention.

The Maryland Stormwater Management Act of 2007 requires local jurisdictions to implement ESD to the maximum extent practicable and to amend their codes, regulations, and ordinances to remove impediments to implementing ESD.

Many of the natural features ESD is intended to conserve are contained within Montgomery County's regulated areas (Figure 2). Regulated areas include streams, wetlands and their buffers, as well as forest conservation easements.

Air Quality

The Environmental Protection Agency has designated Montgomery County as failing to meet minimum air quality standards, recently downgrading air quality to severe air pollution. The Plan's land use and transportation recommendations are intended to encourage transit use and discourage automobile use.

Green Infrastructure and Open Space System

Green infrastructure is a network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas that supports native species and contributes to clean air and water. The green infrastructure network is formally identified and mapped at a County wide scale according to criteria established in the County's draft Green Infrastructure Functional Master Plan. As an interconnected system, green infrastructure enhances environmental viability, value, and function.

Portions of the green infrastructure network identified in the draft plan are incorporated into the proposed open space system for Gaithersburg West. The proposed open space system goes beyond the mapped green infrastructure network, seeking to extend the functions and connections of the network into and through the Gaithersburg West Plan area. The open space system also seeks to connect the area to the greater green infrastructure network beyond the Plan area.

The design of the open space system in Gaithersburg West attempts to incorporate as many functions as possible to achieve multiple objectives:

- intercepting, filtering, and infiltrating stormwater
- producing oxygen, filtering air, and sequestering carbon
- reducing energy consumption by reducing urban heat-island effect
- providing wildlife habitat
- providing transportation connections for bicyclists and pedestrians
- providing aesthetic, recreation, and health benefits to the community.

Carbon Emission Analysis

Montgomery County Bill number 32-07 establishes a goal to stop increasing greenhouse gas emissions by the year 2010, and to reduce emissions to 20 percent of 2005 levels by the year 2050. Another Montgomery County law (Bill number 34-07) requires the Planning Board to estimate the carbon footprint of areas being master planned, and to make recommendations for carbon emissions reductions.

Our current greenhouse gas modeling effort uses a version of the spreadsheet model developed by King County, Washington. While many of the inputs are derived from national averages, wherever possible we have substituted Montgomery County data derived by the Planning Department's Research and Technology Division. While the model considers all greenhouse gas emissions, results are reported in terms of the equivalent effect of a given volume of carbon dioxide (carbon dioxide equivalents).
To project total emissions for an area, the spreadsheet model considers embodied energy emissions, building energy emissions, and transportation emissions. The model documentation defines embodied emissions as "emissions that are created through the extraction, processing, transportation, construction and disposal of building materials as well as emissions created through landscape disturbance" (by both soil disturbance and changes in above ground biomass). Building energy emissions are created in the normal operation of a building including lighting, heating cooling and ventilation, operation of computers and appliances, etc. Transportation emissions are released by the operation of cars, trucks, buses, motorcycles, etc.

Inputs for each planning area include the numbers and types of housing units and the square footage of different categories of retail, commercial, and public buildings. The model is run once using 2005 data to establish baseline results. The model is run again using housing units, and commercial and retail space projected to develop under the master plan to estimate future greenhouse gas emissions. The model estimates emissions over the life of the development, and results are given in metric tons of CO_2 equivalents. This is different from the County Emissions Inventory prepared by the Montgomery County Department of Environmental Protection, which estimates annual emissions.

The model only deals with emissions; no calculations are included to estimate potential carbon offsets from best management practices. The estimates also assume "business as usual" when projecting emissions. As estimates of building energy consumption, vehicle fuel efficiency, vehicle miles travelled, and other input parameters change, it may be possible to re-run the model for projected emissions to see how improvements in technology and design affect projected outcomes. Many of these parameters are changing constantly, so input parameters are a moving target.

The results are also restricted to estimates for a specific master plan. Overall greenhouse gas emissions are projected to increase due to increased population and commercial development within a given master or sector plan area. As model results are evaluated, we must bear in mind that Montgomery County's greenhouse gas reduction targets are considered at a County wide scale.

Modeling results using these assumptions, along with sprawl scenario estimates are shown below. Results are given separately for the Life Sciences Center and for the rest of the Gaithersburg West Plan area outside of the Life Sciences Center, as well as a total for the entire Plan area.

The first grouping of outputs shows existing emissions based on 2005 data; these data are a baseline for comparison. The second grouping shows estimated emissions if the area built out completely under zoning that exists in the 1990 Master Plan. The third grouping presents estimated emissions assuming full buildout under the proposed Plan, including an estimate of the additional carbon that would be generated if the area built out in a sprawl scenario. Sprawl scenario estimates are made by assuming that growth beyond buildout of the 1990 Master Plan would have occurred in a sprawl pattern, causing the emission of 40 percent more carbon than if it were built in a Smart Growth pattern.

Estimated Baseline and Projected Carbon Emissions

Year	Emissions
	*MTCO2e**
2005 (Baseline) Life Sciences Center	16,000,000
2005 (Baseline) Outside LSC	12,000,000
2005 Total Gaithersburg West	28,000,000
Buildout (current zoning) LSC	26,000,000
Buildout (current zoning) Outside LSC	13,000,000
Buildout Total Gaithersburg West	39,000,000
2030 LSC	48,000,000
2030 Outside LSC	14,000,000
2030 Total Gaithersburg West	62,000,000
2030 Total Gaithersburg West – Sprawl Scenario	71,000,000

*Metric Tons Carbon Dioxide Equivalents
(over the life of the development)

In keeping with the Smart Growth approach to development recommended in this Plan, most of the growth projected to occur in Gaithersburg West is being concentrated in the area of the Life Sciences Center. Although per capita emissions should be reduced by creating compact, mixed-use, transit-served development, overall emissions will still increase due to the increase in population anticipated in the Life Sciences Center. Compared to the emissions that would result from more traditional sprawling, single-use land development patterns, the land use pattern in the Life Sciences Center will prevent the emission of approximately nine million metric tons over the lifetime of development. This reflects the physical savings of more compact building types and reduced vehicle miles traveled as compared to the sprawl scenarios. These results are also shown below.

Alternative Energy

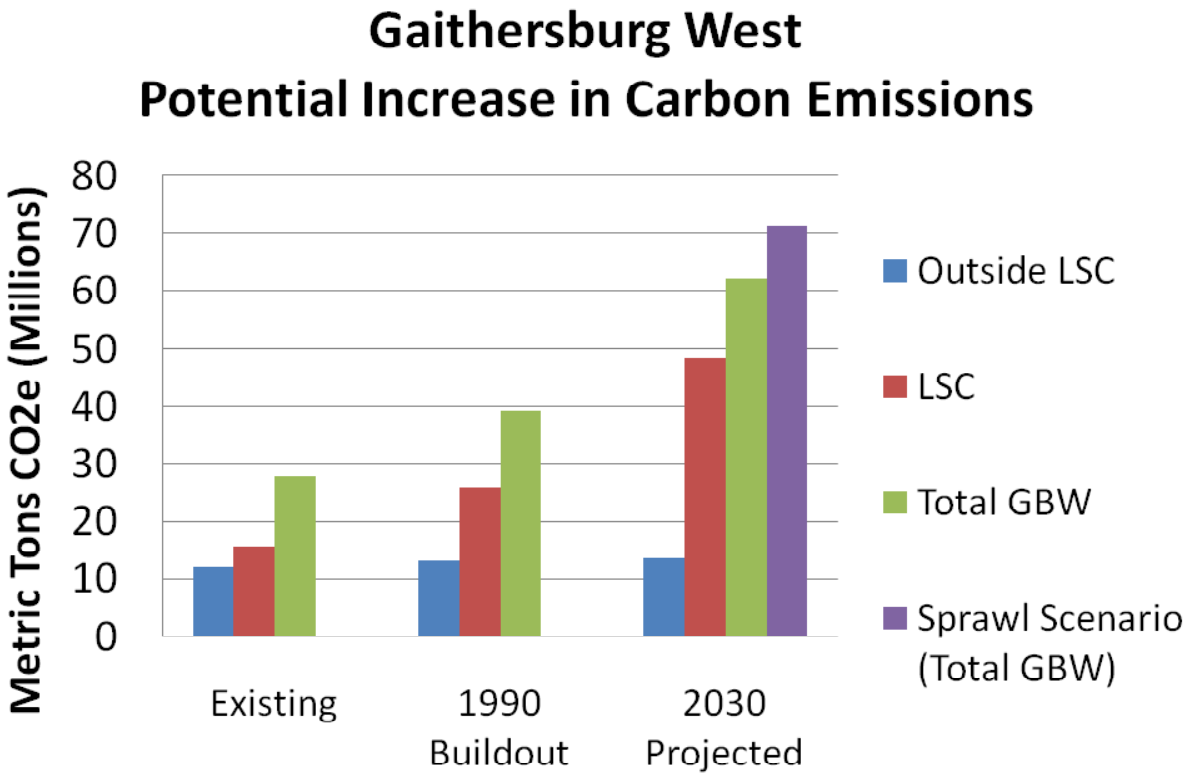
The Plan makes several recommendations intended to reduce carbon emissions, beginning with the recommendation to make the Life Sciences Center a model of Smart Growth. Some of the Smart Growth effects are modeled in the results above but it is difficult to know the full range of behavior changes that the new Life Sciences Center will inspire. The vision is to create a compact community of mixed uses, enabling residents to live, work, and shop in a walkable area. The smart growth approach is enhanced by the provision of mass transit service (in the form of the Corridor Cities Transitway), further enabling people to run errands and to commute without a car.

There are many Plan recommendations that will promote reductions in carbon emissions (such as the open space recommendations, bicycle and pedestrian networks) and many programs outside the planning process that will result in substantial savings over time. Further reductions in carbon footprint will come from changes in building and site design, improvements in technology for vehicles and building energy conservation, as well as the behavioral changes enabled by a compact, livable urban environment.

Water and Sewer

The Washington Suburban Sanitary Commission provides public water and sewer service to the Gaithersburg West Plan area. Public sewer and water capacity is adequate to cover projected growth through 2020 based on the latest forecasts, consistent with the planning and policies adopted in the Comprehensive Water Supply and Sewerage Systems Plan. Local sewer capacity will be addressed for each project as development proposals are submitted for review.

A high pressure water main traverses the area of the Life Sciences Center, entering the Plan area just southwest of the Human Genome Sciences complex south of Darnestown Road and bearing northeast, eventually exiting the planning area near the planned CCT station location on the Crown Farm. Along the way, the water main passes through the PSTA and under the RICA complex. Developments in this area may be asked to consider this line at time of development review. The location of this water main may affect road improvements or improvements tothe main may need to be included in road or redevelopment projects.



Other Plans and Initiatives

A number of environmental plans and initiatives are underway in Montgomery County and their recommendations will supplement and may supersede this Plan's recommendations.

These plans and initiatives include:

- the Water Quality Functional Master Plan for Montgomery County
- the Green Infrastructure Functional Master Plan
- Revisions to the County's stormwater management regulations
- Revisions to the County's forest conservation regulations.
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References

Goetz, S.J., R.K. Wright, A.J. Smith, E. Zinecker, and E. Schaub. 2003. IKONOS Imagery for Resource Management: Tree Cover, Impervious Surfaces, and Riparian Buffer Analyses in the Mid-Atlantic Region.
Remote Sensing of Environment 88 (2003), p 195-208.