



# CLIMATE ASSESSMENT FOR TAKOMA PARK MINOR MASTER PLAN AMENDMENT PLANNING BOARD DRAFT

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## PURPOSE OF CLIMATE ASSESSMENTS

The Climate Action Plan (CAP) is Montgomery County’s strategic plan to cut greenhouse gas (GHG) emissions 80% by 2027 and 100% by 2035, compared to 2005 levels. To meet this mission, in July 2022, the County Council approved the Climate Assessment Bill (3-22) to better understand the anticipated impacts of proposed legislation and land-use decisions on the county’s GHG emissions. This bill requires planning staff to assess the GHG/climate impacts of each master and sector plan, as well as of zoning text amendments.

In compliance with the Climate Assessment Bill, this Climate Assessment evaluates the anticipated impacts of the Planning Board Draft of the Takoma Park Minor Master Plan Amendment (Plan) on the county’s GHG emissions and reductions. The assessment describes the potential GHG emissions, climate impacts, rationale, and implications of the Plan compared with the projected climate impacts and implications if the Plan were not adopted.

This assessment is focused on the effects of the land-use, transportation, and nature-based climate solutions recommendations in the proposed Plan on GHG emissions and carbon sequestration. While the Plan recommendations offer many co-benefits, such as improved health, equity, and biodiversity, these benefits are not the primary focus of this assessment.

The Climate Assessment was conducted in accordance with the [Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County](#), December 1, 2022, prepared by ICF International, Inc. It offers an approach based on available data and utilized for conducting a Climate Assessment either for a master plan (quantitative) or for a proposed zoning text amendment (qualitative).

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## SUMMARY

The Greenhouse Gas Quantification Tool (Quant Tool) used for the assessment is an updated version of a prior model used by Montgomery Planning. The original model was developed by King County, Washington, in 2007. It was revised in 2023 by ICF, using similar methodology with updated building lifetime assumptions (2020), the inclusion of life cycle/upstream emissions associated with fuel combusted production and transportation, and future electric vehicle penetration and fuel mix rates.

The model assesses emissions from four categories: building embodied emissions, building energy emissions, building waste emissions, and transportation emissions. For each category, the assessment uses the number of buildings or units, the types of buildings, and the total commercial square footage.

Sequestration is not an emissions category and based on existing and proposed land cover for forests, non-forest tree cover, wetland/meadow, grassland, and green roofs. The model compares base GHG emissions and sequestration levels for the existing master plan at full build-out with the proposed master plan recommendations at full-build out.

<b>Four GHG Emissions and One Land Cover Carbon Storage Sector</b>	
<b>Lifetime Embodied Building</b>	Based on building type, residents/daily occupancy of building, square footage, lifespan of building, embodied emissions associated with building pavement, and upstream fuel and end-of-life emissions associated with production, transportation, and disposal of different types of materials used for construction.
<b>Total Lifetime Building Energy</b>	Based on building type, projected floorspace, carbon coefficient, energy consumption, and lifespan to develop a lifespan estimate of energy-related emissions per thousand square feet.
<b>Total Lifetime Building Waste</b>	Based on material waste produced, waste management, landfill waste generation, combustion of solid waste, and trash generated within the building type. Includes waste from deconstruction and disposal of materials, the transportation of waste, processing, recycling, and/or disposal of materials.
<b>Total Lifetime Transportation</b>	Based on transportation according to building type, occupancy in the unit or building, square footage, building life, Maryland state vehicle related GHG emissions, life cycle/upstream emissions associated with fuel combusted, estimated building residents or daily occupants, emissions by transportation mode and vehicle type, EV penetration, and fuel mix rates
<b>Sequestration</b>	
<b>Land Cover &amp; Management Ecosystems Carbon Stock</b>	Changes in ecosystem carbon due to changes in area of forest, non-forest tree canopy, and green cover.

Using the new Quant Tool and assuming the Plan is adopted as proposed, at full build-out (every rezoned property is torn down and redeveloped at maximum allowance) the model projects an overall increase in GHG emissions of approximately 78% by the year 2045. However, it is noteworthy that while the model projects an overall increase in GHG emissions at full build-out, per-capita GHG emissions are projected to be reduced in all four emissions categories. Most emissions come from two of the four emissions categories: Lifetime Embodied Building Waste and Lifetime Transportation. Significantly lower emission increases are anticipated for Lifetime Embodied Building and Lifetime Building Energy Emissions.

The emissions levels associated with Lifetime Embodied Building Waste are calculated using the average number of people per building type (residential, commercial, etc.) multiplied by the annual average waste produced per person for each building, multiplied by the lifetime of the building. Lifetime Transportation emissions are calculated using vehicle miles traveled per person, vehicle type, and emissions factors. The increases in these two emissions factors can be linked to the Plan's anticipated rise in population from approximately 4,000 to over 10,000 people. As the population increases, so does the amount of waste generated and disposed of, and the amount of travel.

The Quant Tool is limited and many potential factors could reduce the projected GHG emissions, such as rapid acceleration in electric vehicle adoption that results in market penetration sooner than the model forecasts, expanded use of alternative modes of transportation, less than full redevelopment, adaptable reuse of existing buildings, requirements for new buildings to meet net zero or net positive standards, use of waste materials on-site, improvements in composting, and a reduced waste footprint through waste stream reductions.

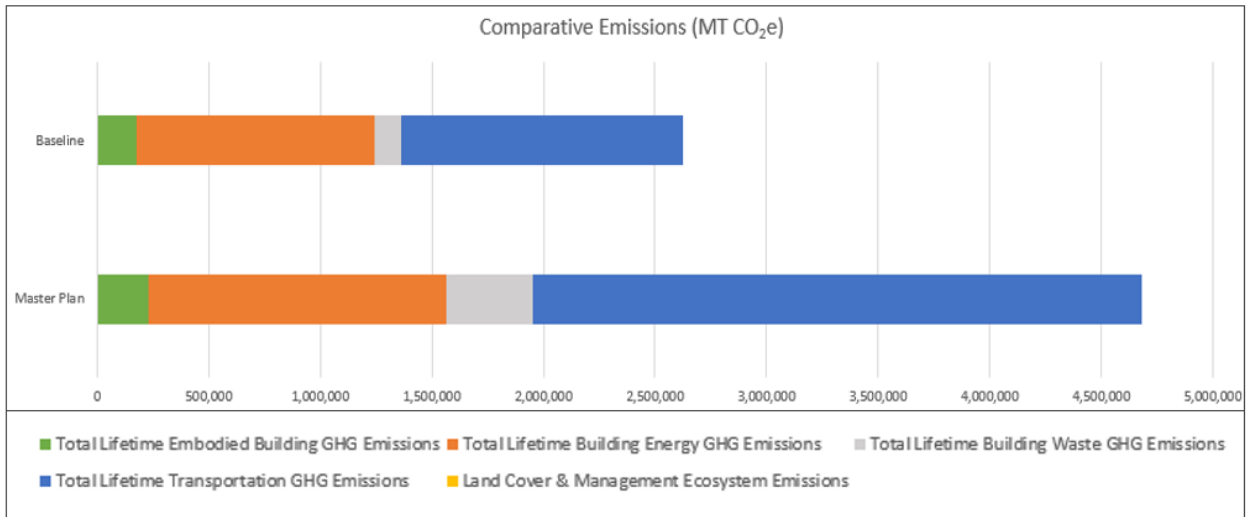
It's important to outline that all new or changed development leads to additional GHG emissions. Simultaneously, redevelopment in urbanized brownfields can reduce sprawl into greenfields and concentrate development where infrastructure such as metro lines, shops, community centers, and schools already exist. Redevelopment is required to comply with environmental building and energy standards that reduce energy demand and increase efficiencies. There are also new stormwater management and green cover requirements that will lead to fewer impervious surfaces, more shade trees, and improved water quality.

**Quant Tool Findings:**

The analysis compares GHG emissions of the “baseline” or existing master plan at full build-out with the “proposed” Master Plan at full build-out in 2045.

**Comparison of Emissions Per Emissions Sector**

	MT CO <sub>2</sub> e		
	Master Plan	Baseline	Percent Difference
<b>Total Lifetime Embodied Building GHG Emissions</b>	<b>226,807</b>	<b>173,980</b>	<b>30.36%</b>
<i>Lifetime Residential Emissions per residential unit</i>	21.06	21.73	-3.12%
<i>Lifetime Commercial Emissions per commercial square foot</i>	0.05	0.05	0.04%
<b>Total Lifetime Building Energy GHG Emissions</b>	<b>1,338,095</b>	<b>1,070,000</b>	<b>25.06%</b>
<i>Lifetime Residential Emissions per residential unit</i>	212.06	228.68	-7.27%
<i>Lifetime Commercial Emissions per commercial square foot</i>	0.40	0.62	-35.76%
<b>Total Lifetime Building Waste GHG Emissions</b>	<b>389,516</b>	<b>115,939</b>	<b>235.97%</b>
<i>Annual Total Building Waste Emissions</i>	4180.53	1244.33	235.97%
<i>Lifetime Residential Emissions per residential unit</i>	86.01	86.51	-0.58%
<i>Lifetime Commercial Emissions per commercial square foot</i>	0.00	0.00	0.09%
<b>Total Lifetime Transportation GHG Emissions</b>	<b>2,724,430</b>	<b>1,266,629</b>	<b>115.09%</b>
<b>Land Cover &amp; Management Ecosystem Emissions</b>	<b>-1,709</b> NA	<b>NA</b>	
<b>Total GHG Emissions</b>	<b>4,677,140</b>	<b>2,626,549</b>	<b>78.07%</b>



## BACKGROUND AND PURPOSE OF TAKOMA PARK MASTER PLAN AMENDMENT

The Takoma Park Minor Master Plan Amendment updates a portion of the approved and adopted 2000 *Takoma Park Master Plan*. It is a joint effort with the City of Takoma Park. The plan focuses on meeting the need for additional housing inside the Beltway with transit-oriented development, improving Maple Avenue, supporting the goals of the Washington Adventist Campus, and improving connectivity. Ancillary benefits are additional stormwater management and green cover.

The plan area already has a vibrant mix of residential, municipal, and institutional uses. It has affordable housing and a culturally diverse population. Residents have access to transit, schools, and several parks. However, the plan area also has a significant need for reinvestment to improve the aesthetics, increase green elements, and increase density. The 2000 *Takoma Park Master Plan* included recommendations designed to direct public dollars and to spur private development, but to date, there has been little private reinvestment.

The Takoma Park Minor Master Plan Amendment provides flexibility for market-ready development and public investment within the existing building and impervious footprints. The Amendment envisions a **reimagined, reconnected, and resilient community** with new housing and other uses, greener development, safer streets, and improved access to amenities.

*Thrive Montgomery 2050* is an update to the countywide General Plan that provides a blueprint for the growth of Montgomery County over the next several decades. The Takoma Park Minor Master Plan Amendment reflects the following key recommendations from *Thrive Montgomery 2050*:

- **Encourage co-location and adjacency of all essential and public services**, especially along growth corridors and in Complete Communities. A Complete Community is “grounded in the concept of 15-minute living, which seeks to locate as many services and amenities as feasible within walking distance of the center of a neighborhood to serve the daily needs of people who live or work within walking or biking distance.”
- **Retrofit centers of activity and large-scale older facilities** such as shopping centers, abandoned federal campuses, office parks, and other single-use developments to include a mixture of uses and diversity of housing types, and to provide a critical mass of housing, jobs, services, and amenities necessary for vibrant, dynamic Complete Communities.
- **Promote walkable, bikeable, transit-connected neighborhoods and commercial districts** that support economic vitality.
- **Implement land use and transportation strategies that encourage walking, biking, and transit use**, and improve environmental performance.

The Takoma Park Minor Master Plan Amendment is a comprehensive plan that will guide the future growth and development of the plan area. The plan is designed to create a connected and vibrant community for all residents.

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## VARIABLES THAT COULD AFFECT THE ASSESSMENT

The following climate-related variables were used or considered in the assessment of the Master Plan. Climate-related variables include GHG reduction, sequestration, resilience, and adaptive capacity activities as outlined in the qualitative checklists (Tables 1 and 8) within the *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County*.

### Greenhouse Data Entry–Related Variables:

Transportation: Vehicle Miles Traveled (VMT), number of trips, non-vehicle modes of transportation, public transportation use, electric vehicle infrastructure.

Building Embodied Emissions: Building certifications, building square footage, building lifespan, pavement infrastructure, material waste produced, use of green building materials.

Energy-related: Electricity usage, stationary fuel usage, electricity efficiency, stationary fuel efficiency.

Land Cover Change & Management: Retention and/or removal of forest, non-forest tree cover, and green space; proposed Nature-Based Solutions.

### Resilience-Related Variables:

Exposure-Related Factors: Activity in flood areas and Urban Heat Islands

Sensitivity-Related Factors: Changes to forest and non-tree canopy cover, quality of green cover, green roofs, perviousness, stormwater treatments, heat sources (pavements, AC, roofs, etc.), reduced urban heat, and improved air and water quality.

Adaptive Capacity-Related Variables: Changes to accessibility of community and public spaces, access to transportation, accessibility to local food sources, change in economic and financial resources, and change in community connectivity.

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## ANTICIPATED IMPACTS

The Plan has strong environmental recommendations to improve Takoma Park’s climate resiliency, carbon sequestration capacity, energy efficiency, water and air quality, and more. These are all goals set forth within the CAP, Thrive Montgomery 2050, and Takoma Park’s Sustainability and Climate Action Plan. The Plan proposes Smart Growth planning within the Beltway, which would bring many benefits, such as consolidating populations to reduce sprawl and protect greenfields. New construction will be required to meet today’s energy efficiency standards, as well as to implement Nature-Based Climate Solutions on each new development project, resulting in an increase in trees, green roofs, vegetated stormwater management, and forest restoration. These features can enhance a community’s climate resiliency by reducing runoff and building emissions and improving biodiversity. Concurrently, building demolition, construction, and increased transportation increase GHG emissions in the categories of building waste and transportation.

The following section describes the Plan’s positive or negative impacts for each climate activity variable associated with GHG emissions, sequestration, community resilience, and adaptive capacity category.

### Transportation Activities Related to Total Lifetime Transportation GHG Emissions

- Vehicle miles traveled by type (personal vehicles, commercial trucks or vehicles, rideshare, school buses, motorcycles). **Negative Impact.** Transportation Planning staff modeled an overall increase in vehicle miles traveled (VMT) within the transit area due to the projected increase in population from 4,033 to 10,669 people. This increase will result in a need for greater connectivity and transit to adjacent neighborhoods, shopping areas, work, and town centers (Takoma Park, Silver Spring, Piney Branch), which will impact VMT throughout the plan area.
- Number of trips (including single occupancy and carpool trips). **Positive Impact.** The number of trips per person is expected to slightly decrease and may decrease beyond the model projections if more local resources such as stores and entertainment increase and are within walking distance. Another factor that could reduce vehicle use is an increase in active walking and bicycling, which will be supported through the construction of improved sidewalks, bicycle lanes, and access to shared bike facilities.
- Non-vehicle modes of transportation (scooters, bikes, walking). **Positive Impact.** It is anticipated that non-vehicle modes of transportation will increase due to the proximity to the Takoma Park metro station and bus stops, increased bike-share stations, and improved sidewalks and pedestrian network. An increase in non-vehicle modes of transportation lowers the overall emissions associated with combustible fuel engines.
- Public transportation use (public bus and Metrorail). **Positive Impact.** It is anticipated that public transit trips will increase. The Plan proposes increases in public transportation availability, bus routes, stops, and frequency to make public transportation more accessible and easier. Increased use of public transportation lowers emissions per capita compared with the use of single-family internal combustion vehicles.
- Electric vehicle infrastructure access (i.e., charging stations). **Positive Impact.** It is anticipated that electric vehicle use will significantly increase within the next few decades due to national and local incentives, policies, and increased affordability. There is a general recommendation to increase the number of electric vehicle charging stations. However, no specific percentage increase was recommended, as it is not a requirement in the zoning code. Montgomery County has a working group called Charge Montgomery that is gathering expertise and will make recommendations for implementing sufficient electric vehicle charging stations throughout the county. All new development will be required to comply with new codes.

### Building Activities Related to Total Lifetime Embodied Building GHG Emissions

- Building Certifications. **Positive Impact.** There is a correlation between green building certification and lower emissions. While the master plan cannot dictate actual design and engineering of a building, the recommendations encourage all development to exceed the county's minimum energy standards and strive to meet net zero, net positive, and/or Living Building standards. New buildings will also be required to meet the county's energy standards and codes.

- Building square footage. **Negative Impact**. It is anticipated that there will be an increase in the overall square footage of large buildings. An increase in building square footage will increase material use for building construction (embodied energy), construction activities, and additional energy use in buildings, all of which will increase emissions. While many green building certification standards require materials to be sustainable or sourced within a certain distance, it is not possible to know whether this requirement will apply to new construction projects.
- Building lifespan. **Negative Impact**. A shorter building lifespan results in greater turnover of emissions associated with building demolition and the construction of new buildings. In contrast, a longer building lifetime results in lower overall embodied emissions. The Plan recommends upscaling density on most properties, which may increase embodied building emissions by approximately 31% and increase lifetime building energy emissions by 25%. To reduce embodied energy emissions, the plan suggests preserving existing buildings and materials on the Washington Adventist campus where feasible. Two buildings, Sligo Church (7700 Carroll Avenue) and the Heffner Park Community Center (42 Oswego Avenue), are up for historical designation. If designated, they would be protected from deconstruction. The Plan also recommends reusing historic crenellated stone retaining walls along both the southern and northern portions of Carroll Avenue and applying adaptive reuse of buildings and materials on the existing campus.
- Pavement infrastructure. **Positive Impact**. The manufacturing and use of pavements to create roadways, walkways, and buildings causes GHG emissions. The Plan recommends reducing impervious surfaces where they exceed 25% of the property and integrating nature-based climate solutions into the landscape and streetscape to further reduce the overall level of impervious surfaces.
- Use of green building materials. **Positive Impact**. It is not possible to know what materials will be used for future building; however, green building codes and standards often require the use of green construction materials. The county's adopted 2018 edition of the International Green Construction Code for all new buildings over 5,000 square feet will result in greener construction.

#### **Energy Activities Related to Total Lifetime Building Energy GHG Emissions**

- Electricity usage. **Positive Impact**. Most existing buildings within the plan area are over 50 years old. They overwhelmingly have poor insulation, have inefficient heating and cooling systems, and use fossil fuels for heating and cooling. New energy-efficient buildings will result in reduced energy demands and use. The Plan also recommends the use of on-site renewable resources such as solar, geothermal, micro-grids, and/or future renewable resources. The county is simultaneously moving toward county-wide electrification and the elimination of non-renewable resources as an energy source. In combination with the electric vehicle penetration projections, electricity usage will rise and GHG emissions will fall.
- Stationary fuel usage. **Positive Impact**. Stationary fuel usage refers to combustion equipment for generating steam or providing useful heat or energy. Stationary fuel usage results in direct GHG emissions. New construction standards and county/state/federal incentives and rebates for energy-efficient HVAC systems will reduce stationary fuel usage significantly, along with its associated GHG emissions.



- Electricity efficiency. **Positive Impact**. The Plan recommends that all new construction optimize solar building orientation where feasible and maximize passive and active energy, thereby reducing energy demand. New construction codes will further improve energy efficiencies by requiring tighter building envelopes and energy-efficient HVAC systems. The use of green roofs will aid in building insulation, reducing energy demands.
- Stationary fuel efficiency. **Indeterminate Impacts**. Stationary fuel efficiency capabilities refers to retrofitting existing buildings to improve fuel efficiencies. Master planning does not address existing stationary fuel efficiencies and retrofits such as insulation, new windows, and weather stripping. Therefore, it is impossible to make a GHG impact determination.

#### **Waste Activities Related to Total Lifetime Building Waste GHG Emissions**

- Material waste produced. **Negative Impact**. Material waste is sent to a combination of recycling, landfilling, and waste combusting facilities, which can increase GHG emissions. Although the Plan recommends salvaging building materials (steel, wood, brick, glass, asphalt, and concrete) during demolition, most of the property proposed for redevelopment and zoning changes will generate waste material and embodied emissions. An increase in population will also increase individual waste generation over the life of the Plan. This is the largest GHG emissions sources in the plan area.

#### **Land Cover Change & Management Activities Related to Land Cover & Management Ecosystems Carbon Stock (Sequestration)**

- Area of forest. **Positive Impact**. Forests act as sinks for carbon dioxide emissions by sequestering and storing carbon in wood and soil. Forests sequester more carbon when they are healthy and free from invasive species, erosion, disease, and pests. The Plan recommends prioritizing forest retention during redevelopment and using forest restoration where there are invasive plants. These recommendations apply to all land with existing forests.
- Area of non-forest tree canopy. **Positive Impact**. Individual trees that not in forests still sequester and store carbon, provide shade in developed landscapes, improve habitat, beautify the landscape, and improve quality of life for all residents. Collectively, trees can create linear green corridors connecting forest clusters that improve migration, habitat, and biodiversity for many species. On private property, excluding existing forests, there is a minimum of 35% green cover in the developed portion of the property. The Plan recommends increasing non-forest tree canopy cover on private property and within the right-of-way to achieve an overall 60% tree canopy cover within the plan area.
- Area of green cover. **Positive Impact**. Green cover in the form of green roofs, trees, shrubs, and/or herbaceous cover can sequester and store carbon as biomass, restore and build soils, and provide food and habitat for coevolved species. Green cover is especially important in urbanized areas with high levels of impervious surfaces, as it helps reduce the heat island effect and cools streetscapes, walkways, roads, and open space. The Plan has many recommendations to improve and integrate green cover into the landscape using nature-based climate solutions and design. It recommends planting more native street trees, providing stormwater management bioretention,

adding green roofs, doing forest restoration, and planting native trees, shrubs, and perennials on private development. One recommendation requires all new development to achieve a minimum of 35% green cover by planting native canopy trees, installing a green roof, or doing both.

- Implementation of Nature-Based Climate Solutions. **Positive Impact.** Nature-Based Climate Solutions are a broad range of actions to restore and mitigate lost natural systems and functions to enhance climate adaptation and sequestration capacities, biodiversity, water and air quality, and human health. The Plan has multiple Nature Based Solutions recommendations to increase native tree and forest cover, provide stormwater bioretention, add green roofs, improve forest protection, and increase stratified native vegetation.

## COMMUNITY RESILIENCE AND ADAPTIVE CAPACITY

Urban resilience is the inverse of vulnerability. It is the capacity to function so that people who are living and working in the area, particularly those who are lower income or otherwise vulnerable, can survive and thrive no matter what stresses or shocks they encounter. This section addresses the Plan's Resiliency and Adaptive Capacity for three core vulnerability areas: Exposure (the level of contact that people, systems, and assets have with climate hazards); Sensitivity factors (an increase or decrease in the severity of impacts to people, systems, and assets from a climate hazard); and Adaptive capacity (factors that increase or decrease people or society's ability to cope with adverse impacts). Each vulnerability area has several potential impact factors that increase or decrease resiliency. The worksheet associated with this category requires a broad yes-or-no impact and positive-or-negative determination. Positive impacts will not happen quickly. They are uncertain and dependent on the rate of redevelopment, transportation funding and implementation, and city/county initiatives.

### Exposure-Related Factors

- Activity in flood risk areas. **Positive Impact.** Flooding has occurred within the low-lying floodplain of Sligo Creek, certain residential properties, and the Takoma Park library. In part this is due to the removal of the original natural landscapes above Takoma Park and the lack of stormwater management that could retain, detain, and infiltrate storm runoff. The Plan requires all new development to meet or exceed the stormwater requirements of Takoma Park, thereby reducing runoff that contributes to flooding. It is anticipated that impervious surfaces will be reduced, furthering protections from flood risks.
- Activity in urban heat island. **Positive Impact.** The plan area is susceptible to extreme heat and heat islands due to a lack of tree canopy cover and high levels of impervious surfaces in the developed areas. This could negatively affect community resilience by increasing the effects of high thermal temperatures and heat exposure. Certain populations (e.g., young children, the elderly, those with asthma or other pre-existing conditions) can be especially sensitive to extreme heat. The Plan recommends implementing Nature-Based Climate Solutions into the landscape and streetscape during redevelopment and street renovation projects. These solutions will cool surfaces and thermal temperatures, reducing urban heat.

- Exposure to other hazards (e.g., storms, wind, drought). **No Impact.** Severe storms and wind can negatively affect public safety and cause damage and disruptions to critical infrastructure (e.g., loss of power, damage to buildings). High winds can discourage sustainable forms of transportation such as biking and walking. The Plan recommendations will have no impact on exposure to these hazards. However, if such conditions occur, the Plan area has an emergency shelter at the municipal center.

### Sensitivity-Related Factors

- Change to forest cover. **Positive Impact.** There are 17.7 acres of existing forest cover within the plan area. A forest is defined as 10,000 square feet or greater than 50 feet wide. Forest protection and mitigation is a high priority for the Plan area. The Plan requires forest retention and forest mitigation on redevelopment sites with degraded forests on steep slopes. The Sligo Creek Stream Valley buffer now owned by Washington Adventist is being proposed as parkland for permanent protection.
- Area of non-forest tree canopy. **Positive Impact.** Non-forest trees, especially in urbanized areas, provide multiple ecological and human benefits, including cooling streetscapes, providing microclimates, reducing urban heat island temperatures, sequestering GHG, reducing energy demand (3 to 30%<sup>1</sup>), and providing wildlife habitat, food, and pollinators. The Plan recommends increasing non-forest tree canopy cover upon redevelopment on private and public properties, including the street right-of-way.
- Change to quality or quantity of other green areas (meadows, green roofs, planting beds, etc.). **Positive Impact.** Adding and mitigating green areas, especially where there are impervious surfaces, will improve community resilience by aiding in temperature reduction and reducing the impacts of extreme heat on human health. It can also add stormwater treatment capacity by converting impervious surfaces into green cover with soils and vegetation that filters and absorbs water. The Plan has many recommendations to integrate green cover into the landscape through Nature-Based Climate Solutions, including stormwater management bioretention, green roofs, and native tree and vegetation on all redevelopment and street improvement projects.
- Change impacts of heat (e.g., cool pavements, cool roofs, air conditioning, energy efficiency improvements). **Positive Impact.** Temperatures are expected to increase in Montgomery County, posing a growing threat to human and animal health, natural resources, and infrastructure. Equity is also an important consideration when addressing heat. Often, lower income housing does not have adequate air conditioning and/or access to cooling stations. In the master plan area, there are many low-income, disabled, and elderly populations, some of whom lack air conditioning. Any new construction will have to comply with heating and cooling codes and strict building insulation requirements, which will benefit all buildings but especially the affordable housing units.  
The plan area has nearly 48% impervious surfaces in the developed areas, exposing residents to higher outdoor thermal temperatures than in the surrounded shaded communities. This

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<sup>1</sup> Climate Assessment Recommendations for Zoning Text Amendments and Master Plans in Montgomery County

heightens the risk of heat-related illness, heat strokes, and disease. While the community has access to nearby parks, pedestrians who are walking or sitting in outdoor spaces may still suffer from the heat. The lack of tree canopy cover can also elevate indoor room temperatures, increasing the cost of air conditioning or exposure to long-term heat stressors.

The Plan recommends increasing shade cover and decreasing impervious surfaces. This will not only cool the landscape and reduce the heat island effect, it will also improve environmental equity by greening the community to match the surrounding neighborhoods. Recommendations include adding green roofs, increasing tree and vegetation cover, installing bioretention devices, shading surface parking, exceeding the county's energy efficiency standards, and replacing dark impervious surfaces with lighter, cooler, porous ones.

- Change in perviousness. **Positive Impact.** Increases in pervious surfaces (e.g., permeable pavement, soil, grass, forest) typically contribute to community resilience by improving the ground's capacity to absorb water, cool surface and air temperatures, aid in flood reduction, and improve water quality. The Plan recommends the use of pervious surfaces and the reduction of impervious surfaces through the planting of trees, installation of bioretention, and replacement of impervious surfaces with green cover.
- Change in stormwater management system treatments. **Positive Impact.** Much of the plan area was constructed prior to current state and local stormwater management requirements. Consequently, there are few treatment facilities within the plan area to capture the quantity of runoff generated. The Plan requires all new development over 5,000 sq. ft. to comply with the City of Takoma Park's stormwater management standards. The recommendations also suggest that all new development meet or exceed the City's existing stormwater management standards. In addition to improving stormwater discharge to Sligo Creek, treatments could reduce flood rates.
- Change to water quality or quantity. **Positive Impact.** As noted above, all new development will be required to comply with Takoma Park's stormwater management regulations as well as to implement Nature-Based Climate Solutions, resulting in improved water quality discharges to Sligo Creek.
- Change to air quality. **Positive Impact.** Exposure to air pollution can lead to higher rates of premature birth and cancer, and increased risk of respiratory illness and cardiovascular disease. Reducing the use of petroleum and non-renewable resources can reduce GHG emissions and improve air quality. The Plan recommendations encourage exceeding the county's minimum energy standards and striving for net zero, net positive, and/or Living Building standards, which will reduce energy demands and encourage alternative energy sources. Simultaneously, the county has a goal to reach net zero by 2035, which means that emissions rates could further be reduced. Transportation recommendations will increase access to alternative modes of transportation, reducing single occupancy vehicle use. The proposed tree and non-forest green cover will increase sequestration and draw down GHG emissions to improve air quality.
- Infrastructure design decisions. **Indeterminate Impacts.** Infrastructure design can have a bearing on climate resiliency. By nature, sector or master plan do not address infrastructure design decisions such as culverts or drainage sizing.

## Adaptive Capacity Factors

- Change to accessibility or prevalence of community and public spaces (e.g., libraries, air-conditioned cooling centers). **Positive Impact.** This factor influences the accessibility or prevalence of community and public spaces. Community spaces are generally associated with increased community resilience and adaptive capacity. For example, air-conditioned community spaces such as libraries can be used as cooling centers during heat waves. Resilience hubs also increase the resilience of a community to power outages, extreme weather events, and other natural disasters. The Plan recommends incorporating on-site energy hubs and emergency shelters where needed. The plan area also has existing indoor cooling and community spaces at the library, community center, and (in an emergency) the Takoma Park Middle School.
- Change to emergency response and recovery capabilities. **No Impact.** Expanding emergency response and recovery capabilities is generally associated with increased community resilience and adaptive capacity. For example, if there are more emergency responders available during a flood event or storm, more people can be dispatched to check on vulnerable residents and residents will be more likely to receive the help they need. The Plan does not address this factor.
- Change in access to transportation. **Positive Impact.** The Plan recommends expanding access, routes, and frequency of public transit, offering the community more options to take public transit rather than using single occupancy vehicles. Expanding affordability and access to public transit will enhance community resilience and help the county reduce community GHG emissions.
- Change to accessibility or prevalence of local food sources and other goods. **Positive Impact.** Expanding the accessibility and prevalence of local food sources enhances community resilience by reducing reliance on distant food sources and the supply chain. This situation is especially acute for socially vulnerable groups in times of crisis, such as during a pandemic outbreak when access to food is difficult and prices increase. Local food systems improve self-reliance, strengthen social networks, enhance social capital, increase jobs, support a circular economy, improve nutrition and health, and provide ecological benefits. The Plan recommendations propose permitting commercial food kitchens, small-scale food processing, and rooftop farms. This supports local food businesses, production, and accessibility. The Plan also supports increases in community gardens, rooftop gardens, food forests, and urban agriculture.
- Change in availability or distribution of economic and financial resources (i.e., to what extent the master plan will influence the accessibility or distribution of economic and financial resources). **Potential Impact.** The plan encourages mixed uses which could increase the local labor force, creating jobs and increasing income. This effect is not guaranteed, as mixed use is optional in the master plan and does not guarantee an increase in local jobs.
- Change to community connectivity (e.g., social connections, sense of place, belonging). **Positive Impact.** Studies show that social cohesion and community connectivity are directly linked with resilience and often help strengthen a community, especially in post-disaster recovery situations. Community connectivity can also reduce mental health challenges and post-traumatic stress for individuals who are impacted by natural disasters. The Plan will significantly improve community connectivity by enhancing public gathering spaces, which provide opportunities to make social

connections. The Plan supports the retention of community centers and institutions, including the neighborhood library, civic center, church, and the Washington Adventist College. Streetscape improvements such as new bicycle and pedestrian pathways through and between neighborhoods, activity centers, public gathering spaces, and public parks provide further opportunities for community connection.

- Change in distribution of resources and support (influencing the equitable distribution of resources and providing policies, institutional knowledge, training, and resources). **Potential Impact.** While the master plan does not directly make recommendations to provide additional resources and support in this category, there are potential benefits should the City of Takoma Park and M-NCPPC aspire to achieve these goals.

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#### RELATIONSHIP TO GREENHOUSE GAS REDUCTION AND SEQUESTRATION ACTIONS CONTAINED IN THE MONTGOMERY COUNTY CLIMATE ACTION PLAN (CAP)

The CAP details the effects of a changing climate on Montgomery County and includes interagency strategies to reduce greenhouse gas emissions and climate-related risks to the county's residents, businesses, and the built and natural environment.

The CAP includes 86 climate actions as a pathway to meet the county's ambitious climate goals while building a healthy, equitable, and resilient community. Each county department has responsibilities for specific climate actions that are relevant to the work of that department. The following section provides a list of the CAP action items relevant to Montgomery Planning and addressed within the Takoma Park Minor Master Plan. While it is not possible to know the rate of implementation, development, funding, or other implications, each action item was rated high, medium, or low for its potential to reduce GHG gasses or sequester carbon.

#### Clean Energy Actions

- E-3: Promote Private Solar Photovoltaic Systems. **Medium.** One recommendation promotes the use of on-site alternative energy systems.

#### Building Actions

- B-7: Net Zero Energy Building Code for New Construction. **Medium.** All new construction is encouraged to exceed the county's energy standard and reach net zero, net positive, and/or Living Building standards.

#### Transportation Actions

- T-1: Expand Public Transit. **High.** There are recommendations for increasing access, stations, stops, and frequency of public transit.
- T-2: Expand Active Transportation and Micro-mobility Network. **High.** There are recommendations to construct bicycle lanes, improve sidewalks, and increase access, stations, and frequency of public transit.

- T-4: Constrain Cars in Urban Areas, Limit Major New Road Construction. **Low.** There are recommendations to expand roads within the Adventist campus. However, no major roadways are proposed.
- T-7: Expand the Electric Vehicle Charging Network. **Medium.** There is a recommendation to increase charging stations.
- T-8: Transportation Demand Management. **High.** There are many recommendations intended to influence people’s transportation choices and reduce use of single occupancy vehicles.

#### **Carbon Sequestration Actions**

- S-1: Retain and Increase Forests. **High** (for forest retention), **Low** (for increase in forest). Recommendations require forest retention and restoration, but no new forest is proposed due to the small size of the Plan area and lack of unprotected forest cover.
- S-2: Retain and Increase Tree Canopy. **Medium.** Recommendations include increasing tree canopy cover on open space, within the right-of-way, and on new development. There are no recommendations to retain existing trees (not forest) on individual properties; however, each development will have to comply with Takoma Park’s Tree Ordinance, which requires tree protection.
- S-5: Restore Soil Fertility, Microbial Activity, and Moisture-Holding Capacity. **High.** Upon redevelopment, new development shall restore soil using methodologies from Virginia Tech.

#### **Climate Adaptation Actions.**

- A-18: Expanded Community Gardens. **High.** Recommendations support community and rooftop garden expansion.
- A-7: Green Public Spaces. **High.** All development, public space, and the right-of-way must include native tree and vegetative plantings.
- A-10: Green Infrastructure. **High.** Green infrastructure is essentially the same as Nature-Based Design Solutions and the terms are used interchangeably. It is recommended for all new development and road retrofits.
- A-13: Ban Stormwater Management Requirement Waivers. **Medium.** The Plan recommends that the city maximize stormwater management practices and minimize deviation from Chapter 19 of the county’s Stormwater Management requirements.

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#### **RECOMMENDED AMENDMENTS**

One of the objectives of the CAP is to phase out petroleum-based automobiles by 2035. This means replacing them with potentially hundreds of thousands of electric vehicles. Existing standards for new construction only require two electric vehicle charging stations per 100 vehicle parking spaces. This is not enough to accommodate the anticipated electric vehicle use. Montgomery County has established an electric vehicle working group called Charge Montgomery to establish protocols for the electric vehicle rollout. One outcome may be establishing new minimum electric vehicle charging station standards for new development and road projects. The new standards should meet or exceed the International Green Construction Code and/or the future county standards.

## SOURCES OF INFORMATION, ASSUMPTIONS, AND METHODOLOGIES USED

The climate assessment for the Takoma Park Minor Master Plan Amendment Planning Board Draft was prepared using the methodology for master plans contained within the [\*Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County\*](#), December 1, 2022.

The approach for modeling greenhouse gas emissions from existing and future (2045) land use and transportation growth was done using a GHG quantification spreadsheet (Quant Tool). The spreadsheet provides totals emissions by type, including lifetime embodied building GHG emissions, lifetime building energy GHG emissions, lifetime building waste GHG emissions, lifetime transportation GHG emissions, and sequestration rates for land cover and management. The original model was developed in 2007 by King County, Washington, using national averages for transportation, and estimates emissions factors for the lifetime of buildings associated with the master plan's development. The model was revised in 2022 by ICF consultants, using similar methodology with updated building lifetime assumptions (2020), the inclusion of life cycle/upstream emissions associated with fossil fuel production and transportation, and future electric vehicle penetration and fuel mix rates.

Many assumptions were made for the transportation data inputs that modeled the vehicle miles traveled per capita. Variables such as future employment, changes to the transportation network, bus stops, express lanes, use of single occupancy vs. public transit use, and so on were based on standard transportation zone analysis data that may or may not transpire, or that may not have been factored into the model.

### Sources of Information

- *Climate Assessment Recommendations for Master Plans and Zoning Text Amendments in Montgomery County*, December 2022
- *Montgomery County Climate Action Plan*, June 2021
- *Thrive Montgomery 2050*, October 2022
- GHG Quant Tool inputs:
  - **Land Use**—Master Plan Parcel GIS (land use attributes from county parcel layer); residential units and commercial floor area values adjusted for the Existing Policy and Master Plan scenarios (based on theoretical maximum possible build-out for each scenario's zoning allowances)
  - **Pavement/Impervious Surfaces**—Montgomery County Planimetric GIS, 2020 (coverage values adjusted for projected Master Plan build-out)
  - **Transportation (VMT)**—Montgomery County Planning transportation staff modeling program, March 2023
  - **Land Cover**—Montgomery County Tree, non-forest, turf, and soil cover (Montgomery County GIS, 2015)



## GHG Quant Tool Assumptions

- The Existing Policy scenario calculates GHG emissions for a theoretical maximum possible build-out by 2045 of land-use development (i.e., residential units and commercial building area) and resulting vehicle miles traveled consistent with the existing allowable development potential for current zoning districts.
- The Master Plan scenario calculates GHG emissions for a theoretical maximum possible build-out by 2045 of land use development (i.e., residential units and commercial building area) and resulting vehicle miles traveled consistent with the theoretical maximum build-out for zoning districts as recommended by the Master Plan.
- The Master Plan scenario assumes an electric vehicle market penetration rate in the GHG Quant Tool of 90% by the year 2035. This estimate is consistent with Montgomery County’s goal for transitioning vehicles to 100% electric by 2035, adjusted down by 10% to allow for a possible slower market uptake. However, electric vehicle use could increase at a faster rate than the penetration rate projects.
- The Quant assessment holds a constant impervious surface area of 61.3 acres for existing and proposed plans. The decision to retain the existing impervious surface forecast was due to a desire for prudence since the rate of impervious reduction is unknown.
- The Master Plan scenario assumes a 35% increase in green cover for all new development based on the proposed requirement. Green cover can be tree canopy cover, green roofs, or both.
- The Master Plan scenario for 60% total green cover includes all existing forests, the right-of-way, and public and private property.