Health Impact Assessment

Richmond Highway Transit Center

Fairfax County Health Department

August 15, 2014

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I. Acknowledgements

The Fairfax County Health Department (FCHD) would like to thank the following organizations and individuals for their ongoing contributions and support for the Richmond Highway Transit Center (RHTC) Health Impact Assessment (HIA).

Organization	Resources
National Association of County and City Health Officials (NACCHO)	A NACCHO Health Impact Assessment (HIA) Project Grant was awarded for the period of January through June 2014. The grant provided technical assistance, and $14,487 for a FCHD part-time staff position to conduct an HIA. The grant aimed to increase local expertise in HIA, and improve community design and built environment decisions by including health considerations in the process.
Partnership for a Healthier Fairfax (PFHF)	PFHF has developed a Community Health Improvement Plan to enhance the health of the community. One of the priority issues outlined in the plan is to promote healthy and safe physical environments. Conducting an HIA was one of the strategies discussed as a component of their Health in All Policies (HiAP) efforts. This project had support and involvement from the Healthy and Safe Physical Environment Priority Issue Team.
Virginia Department of Health (VDH)	A VDH Healthy Eating and Active Living Grant was awarded to increase knowledge of and support for the HiAP approach among government leaders in Fairfax County. The project period for the grant is January through September 2014, which aligns with the timing of the HIA. The RHTC HIA will be used as a relevant local example of how health considerations can inform policy making.

Project Sponsors	Role
Dr. Gloria Addo-Ayensu, Director, FCHD	Project guidance and oversight
Tom Biesiadny, Director, Fairfax County Department of Transportation (FCDOT)	Project guidance and oversight

Project Team	Responsibilities
Fairfax County Health Department	
Marie Custode, Strategic Planner	HIA project management
Sara Pappa, HIA Project Coordinator	HIA project coordination, including gathering data and research, convening stakeholders, analyzing the findings, developing recommendations, and writing the report
Sherryn Craig, Health Planner	Data analysis, research, and writing
Adrian Joye, Environmental Health Specialist	Geographic information system analysis
Shawn Kiernan, District Epidemiologist	Data analysis
David Lawrence, Environmental Health Specialist	Data analysis, research, and writing
Pieter Sheehan, Director, Environmental Health	Technical assistance and review
Robin Wilson, Public Health Analyst	Data analysis, research, and writing

Project Team	Responsibilities
Fairfax County Department of Transportation	
Arpita Chatterjee, Transportation Planner II	Traffic analysis, long range planning, technical assistance and review
Michael Guarino, Transportation Planner IV	RHTC project oversight and management
Caijun Luo, Transportation Planner III	RHTC project management and coordination
Douglas C. Miller, Environmental Program Coordinator	Technical assistance and review
Randall White, Transportation Planner III	Transit data and projections, transit facility needs, oversight and review
Additional Members	
Sharon Arndt, Project Director, Community Transformation Grant, Neighborhood and Community Services (NCS)	Cross-system integration of Health in All Policies
Christine Green, Co-Chair, Healthy and Safe Physical Environment Priority Team, PFHF	Technical assistance and review
Linda Hollis, Co-Chair, Healthy and Safe Physical Environment Priority Team, PFHF	Technical assistance and review
John Payne, Deputy Director, Housing and Community Development	Technical assistance and review
Patricia S. Rosend, Engineer II, Fairfax County Park Authority (FCPA)	Technical assistance and review

Technical Assistance
David R. Bowden, Director, Planning and Development, FCPA
Victoria Cardoza, CTG Project Analyst, NCS
Sophia Dutton, Management Analyst, FCNCS
Stuart Freudberg, Senior Director, Metropolitan Washington Council of Governments (MWCOG)
Elizabeth A. Hagg, Deputy Director, Office of Community Revitalization
Andrew M. Kolaitis, Right of Way Project Coordinator, FCDOT
Julie Maltzman, Continuum of Care Lead Manager, Office to Prevent and End Homelessness
Richard L. McEachin, VDOT Liaison Officer/Traffic Division, Fairfax County Police Department
Sophie Mintier, Regional Planner III, MWCOG
Karyn L. Moreland, Chief, Capital Projects, FCDOT
Kimberly M. Rybold, Planner III, Fairfax County Department of Planning and Zoning
Indrani Sistla, Senior Planner, Fairfax County Department of Planning and Zoning
Charlie Strunk, Bicycle Coordinator, FCDOT
Eric Teitelman, Chief, Capital Projects and Operations, FCDOT
Lloyd Tucker, Region 1 Manager, Regional Services and Center Operations, NCS
Chris Wells, Pedestrian Coordinator, FCDOT

Additional Stakeholders
Supervisor Jeff McKay, Fairfax County Board of Supervisors, Lee District
Supervisor Gerald Hyland, Fairfax County Board of Supervisors, Mt. Vernon District
Joan Clark, Staff Assistant, Fairfax County Board of Supervisors, Lee District
Latrice Hall, Senior Staff Aide, Fairfax County Board of Supervisors, Mount Vernon District
Pat Harrison, Deputy County Executive, Fairfax County
Rob Stalzer, Deputy County Executive, Fairfax County
Fairfax County Redevelopment and Housing Authority
Lee District Association of Civic Associations
Lee District Land Use Committee
Mount Vernon Council of Citizens' Associations
Mount Vernon-Lee Chamber of Commerce
South County Task Force for Human Services
Southeast Fairfax Development Corporation
VOICE (Virginians Organized for Interfaith Community Engagement) for Justice
Housing/apartment communities including (but not limited to): Audubon Community, Penbrook Village, Pinewood South, Murraygate, Gum Springs Village

II. Executive Summary

Richmond Highway is an important artery that connects major commercial, residential, and recreational points in Northern Virginia. It bisects the southeastern region of Fairfax County which is one of the most economically disadvantaged and transit dependent areas of the county. A new transit center along the Richmond Highway Corridor has been proposed to improve access to transportation and enhance existing bus services currently provided by the Fairfax County Department of Transportation (FCDOT) and Washington Metropolitan Area Transit Authority. Over 30 potential transit center sites have been evaluated and two viable alternatives were identified for further study, known as Site B and Site C. Site B is located perpendicular to Route 1, bound by Haft Drive to the north and Walmart to the south. Site C is farther south at the intersection of Richmond Highway and the southern end of Buckman Road adjacent to the South County Human Services Center.

To inform the site selection process, a Health Impact Assessment (HIA) was undertaken to examine the potential health effects of establishing the Richmond Highway Transit Center (RHTC) at each site. This six-step method incorporates data, research, and stakeholder input to determine a policy or project's impact on the health of a population. The HIA provides recommendations to support positive health outcomes, avoid harmful health impacts, and promote health equity.

Overall, the findings of the HIA indicate that the RHTC has the potential to positively impact the health of residents living near both potential transit sites. Considerations such as improvements to pedestrian and bicycle facilities could serve to greatly advance the new transit center's positive impact on health through improving walkability; improving access to employment and educational opportunities; reducing vehicle, pedestrian and bicycle traffic fatalities and injuries; and improving neighborhood safety and security. Recommendations across six focus areas were generated based on the assessment of public health impacts and benefits associated with the potential site choice for the RHTC.

Recommendations

Focus Area 1: Public transit access and mobility along the corridor

A new transit center at either site will likely improve access to public transit and mobility if the following are considered by decision makers and planners:

- Configure route spacing and timing to minimize potential increases in travel time due to the additional stop.
- Maintain street connectivity between the RHTC and neighborhoods within a 0.5 mile radius to allow pedestrian and bicycle access to the transit center from area businesses and housing units.
- Include safety features and amenities, such as traffic lights, cross walks, security cameras, bicycle racks, lighting, benches, trees and other greenery in the design of the RHTC to improve the safety and aesthetics of the center.
- Develop and implement a marketing plan for current and potential riders focusing on the use of the RHTC as a way to increase access to additional transit, reduce traffic crashes, decrease time spent driving and save on household transportation costs.

Recommendations

Focus Area 2: Access to goods and services, healthy food, healthcare and community services

A new transit center at either site will likely improve access to goods and services, healthy food, healthcare and community services if the following are considered by decision makers and planners:

- Configure routes to maximize access of area residents to local food sources (i.e., grocery stores), healthcare centers, and community services during hours of operation for these types of businesses.
- Identify and prioritize the needs of those who are transit dependent. A survey or other research can be used to understand these needs.
- Develop and implement a marketing plan to increase awareness of the RHTC for patrons of area grocery stores, community centers and healthcare providers.
- Minimize the cost of using the new transit lines to individuals, with respect to current income and household and transportation cost estimates.

Focus Area 3: Access to places for physical activity, open spaces, parks and playgrounds

A new transit center at either site will likely improve access to places for physical activity, open spaces, parks and playgrounds if the following are considered by decision makers and planners:

- Include the proposed new soccer field if Site B is chosen. Ensure that the field will be maintained, safe and accessible to area residents.
- Include safety features and amenities, such as traffic lights, cross walks, bicycle racks, lighting, benches, trees and other greenery in the design of the RHTC to improve the safety and aesthetics of the center.
- Ensure good street connectivity between the RHTC and neighborhoods within a 0.5 mile radius.
- Develop and implement a marketing plan for current and potential riders focusing on the use of the RHTC as a way to be more physically active (active transport and commuting) and to save on household transportation costs.

Focus Area 4: Access to affordable housing, employment opportunities, and educational institutions

A new transit center at either site has the potential to maintain access to affordable housing and improve access to employment opportunities and educational advancement if the following are considered by decision makers and planners:

- Configure routes to maximize access of area residents to the Metro, centers of employment, and colleges and universities, especially during peak times of the day.
- Develop and implement a marketing plan to increase awareness of the RHTC for area employers, colleges and universities.
- Minimize the cost of using the new transit lines to individuals, with respect to current income and household and transportation cost estimates.
- Preserve existing affordable housing along the corridor as well as near the RHTC site.

Recommendations

Focus Area 5: Air quality and noise levels

A new transit center at either site will likely maintain current air quality and noise levels. However, it is recommended that the following are considered by decision makers and planners:

- Monitor the air quality during construction as well as post-construction so federal standards are met. Use Clean Construction models from the EPA.
- Use clean diesel combustion engines and follow EPA guidelines for heavy-duty engines and vehicle standards.
- Adhere to EPA guidelines for bus noise levels so as not to exceed 80 decibels.

Focus Area 6: Community safety and cohesion

A new transit center at either site will likely improve community safety and cohesion if the following are considered by decision makers and planners:

- Include safety features, such as lighting, security cameras, complete sidewalks and trails, crosswalks, crossing signals, police presence, bike racks and secure parking in the design of the RHTC.
- Solicit comments, suggestions and feedback from area residents before, during and after the site selection process and construction of the transit center.
- Develop and implement a marketing plan to inform area residents about the new transit center, including information about safety features, access, cost and amenities.

One challenge in conducting this HIA was the evolving site design and selection process for the transit center. One of the sites identified for analysis was deferred from consideration near the end of the HIA project period. At the time of this report, FCDOT was no longer pursuing Site B as a potential location for the RHTC. However, they were continuing to consider Site C, as well as researching additional site alternatives more centrally located near Site B. The HIA team believed that the data, impact analysis and recommendations identified through the HIA project could still be useful to help inform the final site location decision. However, the study will likely need to be updated depending on the location of alternative sites under consideration.

III. Background

Richmond Highway is an important artery that connects major commercial, residential, and recreational points in Northern Virginia. It bisects the southeastern region of Fairfax County which is one of the most economically disadvantaged and transit dependent areas of the county. Encouraging economic revitalization of the Richmond Highway Corridor has been a goal of the Fairfax County Board of Supervisors (BOS) for many years. In support of that goal, the FCDOT launched the Richmond Highway Public Transportation Initiative in 2004. Accomplishments have included the establishment of express bus service, reconfiguration of other bus routes, and improvements to intersections and sidewalks to increase pedestrian safety. Intersection and sidewalk improvements are ongoing, but limited by cost and the availability of right-of-way.

Many of the residents living in this region rely on public transportation, especially bus service. A new transit center along the Richmond Highway Corridor has been proposed to improve access to transportation and enhance existing bus services currently provided by the FCDOT and Washington Metropolitan Area Transit Authority. A well-located center would not only act as a transfer point for buses serving neighborhoods east of the corridor, but would also reduce the number of bus routes extending north and south along Richmond Highway. The goals of the RHTC project are to support revitalization and transportation objectives for the Richmond Highway Corridor, enhance existing bus services, allow more flexibility for transit users, reduce single occupancy vehicle traffic, and encourage the use of public transportation and foster economic development along the corridor.

Beginning in 2011, the FCDOT identified and prioritized potential transit center sites along Richmond Highway. FCDOT analyzed 30 potential transit center sites and began a conceptual design study for the most promising three sites. A charrette, a collaborative session to create a design concept, was held in April 2013, followed by a public information meeting held in the fall. In September 2013, FCDOT solicited input from the health department as well as other agencies and the community about the RHTC project. Consensus developed around two alternatives for further study, known as Site B and Site C. Both sites are located in the Lee District of Fairfax County and border the Mount Vernon District of Fairfax County (see Appendix A for the location of the two sites within the Supervisor Districts).

Site B is located perpendicular to Route 1, bound by Haft Drive to the north and Walmart to the south. Site B has the potential to provide both the largest number of bus bays and the highest number of bus routes. Site C, at the southern end of Buckman Road and Richmond Highway, is at the corridor's southern end, serving a smaller number of residents and providing fewer improvements to the corridor's overall bus service. To inform the site selection process, an HIA was undertaken to examine the potential health effects of establishing the RHTC at each of the two alternative sites.

IV. HIA Process

Health is not a consumable good that can be purchased or acquired within the four walls of a doctor's office. Health is multifactorial and is influenced by a variety of community, environmental, social, demographic and economic conditions. Housing, transportation, employment, commerce, parks, recreation, income, noise, air quality and social networks all have direct and indirect links to a community's health and safety. An HIA can be used to gather objective data on these factors to assess the effects of a planned policy or initiative on the health and well-being of a community.

The Partnership for a Healthier Fairfax (PFHF), a large multi-sector community coalition, is committed to promoting healthy and safe physical environments for all through increasing the number of connected streets, parks and transportation policies for the environment that support positive community health outcomes. Strategies such as conducting impact analyses of transportation, planning, zoning, and development projects are in alignment with the Community Health Improvement Plan (CHIP) for 2013-2018.

Fairfax County Health Department, in collaboration with the PFHF and FCDOT, received a NACCHO Health Impact Assessment Project Grant for the period of January through June 2014. The grant provided technical assistance and a part-time staff position to conduct an HIA. The grant has led to increased local expertise in HIA, and improved community design and built environment decisions by including health considerations in the process. The Health Department, FCDOT, Department of Housing, and PFHF, worked collaboratively to conduct the HIA and integrate health considerations into policy making across sectors. The HIA has enhanced local efforts to demonstrate the potential for improved community health outcomes using a Health in All Policies (HiAP) approach to decision making.

An HIA is a combination of procedures, methods and tools that incorporates data, research, and stakeholder input to determine a policy or project's impact on the health of a population. An HIA has six essential tasks: 1) screening, 2) scoping, 3) assessment, 4) recommendations, 5) reporting, and 6) monitoring. This process proactively takes into account the health implications of decisions to avoid harmful health impacts, support positive health outcomes, and promote health equity. An HIA can guide policy makers, governmental partners, and community stakeholders in the decision-making process by examining the health impacts of a project and offering recommendations to monitor and manage potential health effects.

Screening

FCHD and FCDOT met beginning in November 2013 to discuss the potential of conducting an HIA. This was the first of the six steps in the HIA process known as screening. It was determined that an HIA could inform residents and policy makers in the decision-making process by examining the health impacts of locating the transit station at either of the two proposed sites, and by offering recommendations to monitor and manage potential health effects. An HIA could also address community concerns about the impacts of the transit center on traffic safety, air pollution, access to parks, community violence, access to goods and services (i.e., healthy foods) and protection of community cohesion (i.e., small businesses). Fairfax County's decision-making process for selecting a site for the RHTC was anticipated to conclude in June 2014. Therefore, the HIA process was accelerated and FCHD pursued a rapid HIA in order to capitalize on the benefits of the HIA without sacrificing the opportunity to inform the process.

Scoping

The second step in the HIA process was scoping, which took place in January and February 2014 through engagement with governmental partners and community stakeholders. An HIA team was convened to further define the project by way of developing a project charter (see Appendix B for the project charter). The team identified several focus areas for the assessment, developed research questions, and specified the methods and sources for data collection (see Appendix C for the pathway diagram and Appendix D for the scoping worksheet). It was determined that the HIA would provide

stakeholders with much needed information about the potential effects of the transit center in the following focus areas:

1. Mobility along the corridor, including public transit options and opportunities for safe active travel;
2. Access to goods and services, including healthy food options, healthcare and community services;
3. Access to places for physical activity, including open space, playgrounds, parks and recreational facilities;
4. Availability of affordable housing, employment opportunities and educational institutions;
5. Environmental conditions, including air quality and noise levels; and
6. Community safety and community cohesion, specifically as it relates to the relocation of businesses.

Assessment

The third step of the HIA, the assessment phase, began in March and was completed in May. This included the collection of baseline data to describe the health status and populations affected by the proposed transit center sites based on peer-reviewed research and community health indicators. For the purposes of the HIA, a 0.5 mile radius border from each proposed site was considered the immediate community for analysis of potential health impacts (see Appendices E and F for the areas of study). The impact analysis was conducted via a literature review based primarily on peer-reviewed, empirical research.

Data that were collected and used came from several sources which are cited throughout the HIA. Sources for data on existing conditions include agency experts and subject matter experts; local, regional, state and national data sources; GIS mapping; government and agency websites; the U.S. Census Bureau; the Metropolitan Washington Council of Governments; and key informant interviews. Data were analyzed at sub-county levels when available. Therefore, data are presented by zip code (see Appendix G), by Human Services Region (see Appendix H), by Fairfax County Public Schools Attendance Area (see Appendix I), by census tracts (see Appendix J), and by Fairfax County Police Department District Station (see Appendix K).

Recommendations

For the fourth step in the HIA, recommendations were developed based on the synthesis of baseline data with literature review findings. The most important considerations for decision-makers and planners were identified for each of the focus areas. It is anticipated that these recommendations will be used to guide the site selection process and inform the design of the RHTC. This HIA can be used by policymakers, governmental partners and community stakeholders to inform and guide the decision-making process by examining the intended and unintended impacts of the proposed project. This HIA proactively took into account the health implications of decisions to avoid harmful health impacts, support positive health outcomes and promote health equity. It also provided a mechanism to develop strategies to mitigate potential health risks and monitor ongoing concerns.

Reporting

The HIA Draft Report was reviewed by the HIA team members, Fairfax County Health Department staff, and NACCHO staff from June to August 2014. A plan to communicate the findings of the HIA was developed. The HIA findings will be made available to other stakeholders and the general public in August 2014 in three formats: (1) full report, (2) an executive summary, and (3) a power point presentation. These will be posted online on the Fairfax County Health Department's website at http://www.fairfaxcounty.gov/hd/ and on www.healthimpactpartners.org. Additionally, county staff will present the findings to the South County Human Services Task Force and the Board of Supervisors (BOS) in fall 2014.

Monitoring

Process evaluation was conducted during all phases of the HIA and will continue after the HIA final report is completed. Progress was measured against the original project timeline during regular team meetings and bimonthly check-in conference calls with NACCHO. Once the final report is completed, a team member survey will be conducted to evaluate the HIA process, team member engagement and satisfaction, team communications, organizational capacity, lessons learned and outcomes. The results will be documented to inform and improve future HIAs. Impact evaluation will occur as the results of the HIA are disseminated to stakeholders and community members, once the site decision is made and in the future as the health impacts of the transit center continue to be monitored.

The monitoring plan includes short and long term monitoring. In the short term, the HIA team will monitor how and if the HIA was used in the final site selection. Key questions include: Did stakeholders consider the findings and recommendations in the HIA to inform the decision? Was the HIA shared with appropriate community groups, planners and elected officials? Was the HIA disseminated through proper channels to the public? At the time of the final report, the FCDOT and BOS were not ready to make the site selection. FCDOT will continue to keep the HIA team informed of their work, project decisions and timelines as they become available.

Long term monitoring will be completed by the FCHD and FCDOT. Final coordination with stakeholders to reach agreement on the location for the transit center will occur at a time to be determined. Based on the findings of the HIA and community input, FCDOT will make a recommendation for site selection to the BOS for their approval at that time. Outcomes include use of the HIA to inform the site selection decision and which, if any, of the recommendations were followed. A plan will be developed by the FCHD to monitor the health impacts to the community as reported in the HIA. See the pathway diagram for details on the health focus areas to be monitored.

V. Community Profile

Fairfax County is a 395 square mile area located in Northern Virginia in the Washington D.C. Metropolitan Area. Fairfax County is the most populous jurisdiction in both Virginia and the Washington, DC region. With more than 1.1 million residents, it has a population size larger than eight states and continues to grow each year. As an immigrant gateway, the population is racially and ethnically diverse, with minorities comprising 37% of the population. More than 120 languages are spoken in Fairfax County.
The sites under consideration for the RHTC are both located in the southeastern portion of the county which is often referred to as the Mount Vernon area. This area has been designated as a Medically Underserved Population by the Health Resources and Services Administration (HRSA) and has a higher rate of poverty than other regions of the county. The Mt. Vernon area has a large, low-income, African American and Hispanic population, including an increasing number of immigrants who face significant linguistic, cultural, and financial barriers to accessing healthcare. Health disparities exist among these cohorts for various cancers, cardiovascular diseases, cerebrovascular diseases, Alzheimer's disease, chronic respiratory disease, and diabetes mellitus mortality rates according to the Virginia Department of Health (VDH) (Verité, 2013).

The community's overall health, relative to other areas of the county, is less than favorable. A Community Needs Assessment, conducted by Inova Mount Vernon Hospital (IMVH) (Verite, 2013), analyzed inpatient discharge diagnosis codes and found that 67 percent of its discharges were associated with chronic disease. Discharges for chronic disease were concentrated in rheumatoid arthritis, depression, chronic kidney disease, heart failure, anemia, diabetes, hypertension, chronic obstructive pulmonary disease and bronchiectasis, atrial fibrillation and stroke (Ibid). Disproportionately large numbers of discharges for Ambulatory Care Sensitive Conditions (ACSC), indicative of poor access to primary healthcare, were most prevalent in the Mount Vernon South/Ft. Belvoir area (22060, 22308, and 22309) as well. Ten percent of IMVH discharges were found to be for ACSC (Ibid). ACSC are conditions where appropriate ambulatory care prevents or reduces the need for hospitalizations for people under age 75 (Agency, 2014).

The U.S. Department of Agriculture's Economic Research Service has designated the Mount Vernon South/Ft. Belvoir zip code of 22060 (the zip code just south of Site C) as a food desert. Healthy eating is a critical component to combatting cardiovascular risk factors as well as childhood and adult obesity. Providing frequent, easy access to healthy food choices is necessary to improve nutrition in the Richmond Highway Corridor.

Along with making healthy food accessible, opportunities for physical activity are critical to reducing the chronic disease burden. Built environment resources and community safety can affect physical activity pursuits. The Mount Vernon area is characterized by higher crime than other areas of the county. In 2010 and 2011, the Mt. Vernon District Station reported 6,098 and 6,382 criminal offenses. It was one of only two stations in Fairfax County with an increase from 2010 to 2011. Mt.Vernon District Station had a 4.7% increase and the Sully District Station had a 2% increase. The Franconia District Station had similar criminal offense numbers to Mt. Vernon District Station, with 6,230 in 2010 and 5,988 in 2011 (Fairfax County, Police, 2012).

VI. Stakeholder Engagement

Community concerns regarding proposed site locations for the RHTC precipitated the proposal to conduct an HIA. A public information meeting on the proposed project was held in September 2013. One potential location of the transit center, Site B, is located directly south of a public housing project, Murraygate Village, and east of a mobile home park, Audubon Estates. Because Murraygate Village is owned by the Fairfax County Redevelopment and Housing Authority, the Fairfax County Department of Housing and Community Development (DHCD) represented the residents' interests in this project.

VOICE for Justice, or Virginians Organized for Interfaith Community Engagement, is a nonpartisan coalition focusing on better recreational facilities for young people in the Richmond Highway Corridor. VOICE for Justice has articulated the need for a soccer field to serve the residents of Murraygate Village and Audubon Estates. In response to this concern, FCDOT is working with its consultants and with the Fairfax County Park Authority (FCPA) on a proposed redesign of Site B to include land for a soccer field.

Another concern raised at the September 2013 public information meeting was Site B's location at an existing strip mall, requiring the relocation of 11 small businesses whose tenants are primarily second generation minority and ethnic business owners. Local residents depend on these businesses, which include ethnic food stores and restaurants, located in an area with limited access to nutritious, affordable foods. Business owners are concerned their customer base will erode, and they will be forced to close if they are relocated. The community is concerned that their access to healthy food choices will be further compromised.

Site B is located near a vacant parking lot known to be a high crime area, which impedes walkability for residents seeking safe opportunities for exercise and physical activity. On the other hand, Site C is adjacent to a day care center. One concern raised was that bus exhaust fumes could be hazardous to children playing outside. Parking was also mentioned as a concern for this site as it currently houses parking for employees and visitors of the South County Human Services Center, a hub for community and social services. Location of the transit center on this property would require the construction of a multi-level garage to accommodate vehicle parking.

The final decision-makers for the implementation and location of the RHTC are the Fairfax County Board of Supervisors. FCDOT, DHCD, and FCPA have met with Board members to discuss the status of the project and decide upon next steps. Feedback from the Southeast Fairfax Development Corporation has also been solicited, particularly on economic revitalization and the relocation of existing businesses. Residents of Southeastern Fairfax County are represented by the Mt. Vernon Council of Citizens Associations, the Lee District Association of Civic Associations, and the Lee District Land Use Committee.

VII. Health Equity

In addition to studying the six identified health focus areas, the HIA process included health equity considerations at each stage, by identifying differences between people living in the study area as compared to the rest of the county. Health equity is when everyone has the opportunity to "attain their full health potential" and no one is disadvantaged from achieving this potential because of their social position or other socially determined circumstance (Brennan Ramierez, et al., 2008). These opportunities are linked to a wide range of health and quality of life outcomes and risks. They also partially explain why some people are healthier than others.

The social determinants of health (SDOH) are the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities - the unfair and avoidable differences in health status seen within and between countries, states and even communities.

(WHO, 2008)

Each of these five determinant areas reflects a number of critical components and key issues that make up the underlying factors in the arena of SDOH:

- Economic Stability
  - Poverty
  - Employment Status
  - Access to Employment
  - Housing Stability (e.g., homelessness, foreclosure)
- Education
  - High School Graduation Rates
  - School Policies that Support Health Promotion
  - School Environments that are Safe and Conducive to Learning
  - Enrollment in Higher Education
- Social and Community Context
  - Family Structure
  - Social Cohesion
  - Perceptions of Discrimination and Equity
  - Civic Participation
  - Incarceration/Institutionalization

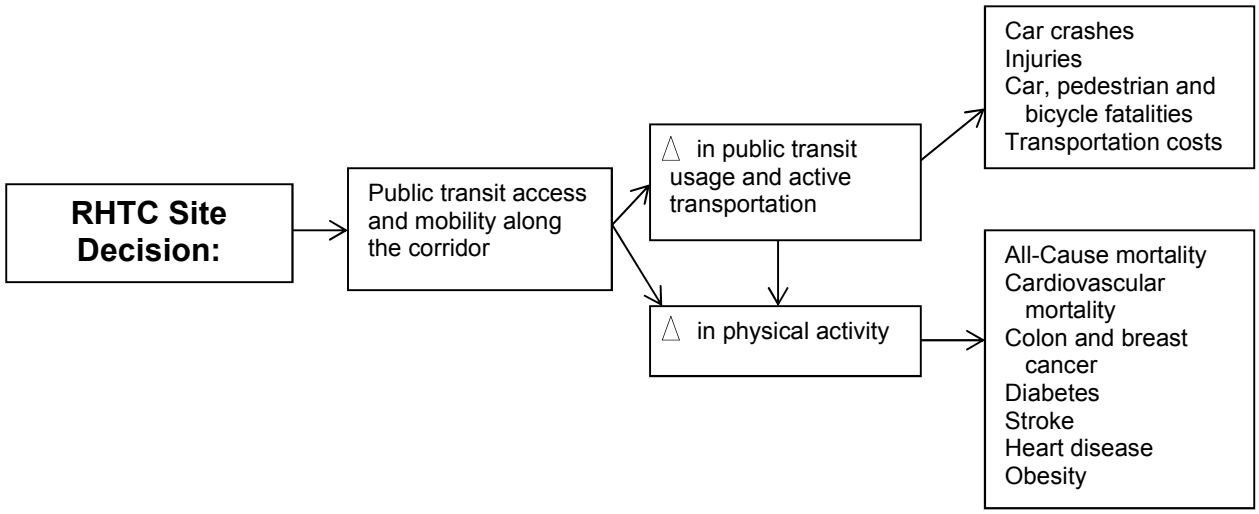
- Health and Health Care
  - Access to Health services—including clinical and preventive care
  - Access to Primary Care—including community-based health promotion and wellness programs
  - Health Technology
- Neighborhood and Built Environment
  - Quality of Housing
  - Crime and Violence
  - Environmental Conditions
  - Access to Healthy Foods and Active Living

In each of the focus area sections of the HIA, there is a brief reference to those SDOH that directly relate to that focus area and the specific health outcomes discussed. For a more detailed explanation of the SDOH, please visit http://www.cdc.gov/socialdeterminants.

VIII. Findings

Focus Area 1: Public Transit Access and Mobility Along the Corridor

Pathway Diagram



Recommendation

A new transit center at either site will likely improve access to public transit and mobility if the following are considered by decision makers and planners:

- Configure route spacing and timing to minimize potential increases in travel time due to the additional stop.
- Maintain street connectivity between the RHTC and neighborhoods within a 0.5 mile radius to allow pedestrian and bicycle access to the transit center from area businesses and housing units.
- Include safety features and amenities, such as traffic lights, cross walks, security cameras, bicycle racks, lighting, benches, trees and other greenery in the design of the RHTC to improve the safety and aesthetics of the center.
- Develop and implement a marketing plan for current and potential riders focusing on the use of the RHTC as a way to increase access to additional transit, reduce traffic crashes, decrease time spent driving and save on household transportation costs.

Summary

Health Considerations

- By encouraging more active travel, including commuting to work, enhanced transportation services can have positive impacts on health.
- Access to public transportation, especially for those who rely on it, is associated with improved health.
- One of the potential outcomes of the project is to increase bus ridership and decrease single vehicle miles driven. Travel by bus is considered to be safer than travel by car. In addition, there are fewer crashes and injuries when there are more pedestrians and bicyclists in an area.
- Using public transportation can save an individual an annual average of $10,181 per year over owning a car. In the Washington DC area, the same annual average savings over owning a car is $10,257.
- People who use public transportation typically get 19 minutes per day of transit-oriented physical activity. Twenty-nine percent of these people get the recommended amount of daily physical activity just from walking to and from transit.
- Regular physical activity is related to numerous health benefits, including lower risks of many chronic diseases including hypertension, cardiovascular disease, stroke, type 2 diabetes and some cancers. Additional benefits may include improved quality of life and mental health, healthy weight maintenance, reduced obesity and increased muscle mass and bone density.

Existing Conditions

- Average commute time in the Washington DC metro area is 33.4 minutes.
- For those 16 years and older, 14.1% of workers in this area use public transportation.
- For households in the area of study, those in Site B average 1.9 cars per household while those in Site C average two cars per household.
- Daily transit ridership is 926 at Site B and 498 at Site C. Average miles driven annually per household are 19,565 and 21,134 for Sites B and C, respectively.
- At Site B, there are currently five bus routes (Connector 151, 152, 159, and 171, and Metrobus REX) serving the site. Two additional routes (Connector 161 and 162) would be rerouted to serve the new transit center site. At Site C there are two routes (Connector 171 and Metrobus REX) that directly serve the site. Two additional routes (Connector 151 and 159) would be rerouted to serve the site.
- Transit travel time along the corridor (eight mile stretch from Ft. Belvoir to I-495) during free flow is 11 minutes compared to 15 minutes during congested times. The average time for a bus to travel the route during morning peak (co9ngested) time is 34.17 minutes.
- Site B has five intersections with six or more crashes per year while Site C has two such intersections. The total number of crashes is higher for Site B, as would be expected with more qualifying (having six or more crashes) intersections.
- There are currently not any transit centers or transportation hubs within a 0.5 mile radius of either site.
- Crash data suggest that the area has a low number of fatalities due to car, bicycle and pedestrian crashes. Neither site had a fatality in 2011. However, there were three fatalities in Site B in 2012 compared to one fatality in Site C.
- Household transportation costs are 13% of income at Site B and 14% at Site C. The average in Fairfax County is 13%.
- When looking at all types of households by zip code (owners and renters), housing costs are 32% of income at Site B compared to 30% at Site C. The average housing cost in Fairfax County is 29% of income.
- Calls for transportation assistance in this area are approximately 3.5 times greater than other parts of the county.

Summary

Impact Analysis

- The RHTC may increase ridership. However, the FCDOT does not have any projection data at the present time. If ridership does increase, this may reduce personal vehicle miles traveled.
- The RHTC has the potential to decrease car, pedestrian and bicycle crashes and related fatalities.
- If public transit use increases, the RHTC may decrease household transportation costs in the area. It is unlikely that car ownership will change.
- For the areas of study where the RHTC may be built, the households will have immediate access to enhanced transportation services.
- The addition of the RHTC is likely to reduce the number of calls made to request transportation assistance. The enhanced service and potential new routes may help to meet residents' needs.
- Both proposed sites have the potential to increase levels of physical activity as the opportunity for public transit use will increase. People who use public transit spend a median of 19 minutes per day walking to and from transit.

1A. Health Considerations

The transportation system helps shape how communities operate, and it can have many impacts on public health. Transportation affects air pollution and the environment, safety, physical activity, and access to jobs, services, healthcare, and recreational opportunities. During the transportation planning process, stakeholders and planners can mitigate the negative health impacts of transportation by reducing air pollution, preventing traffic injuries and deaths, and promoting physical activity (US Department of Transportation, 2014). When properly planned and designed, transportation can have a positive effect on public health. Increased access to transit can positively impact access to employment, education, healthcare, civic participation, healthy foods and opportunities for physical activity. These can, in turn, impact the socioeconomic status of local residents.

Type, quality and safety of transit centers are important factors to be considered by planners and developers in addition to simply adding more transit services spaces (Lee, et al. 2012). Moreover, safety devices, such as traffic lights, crossing aids and street amenities, including benches, all increase the use of public transportation in neighborhoods. In a study looking at accessibility of transit, Chandra et al. stress the importance of transportation system upgrades to improve travel options for residents, including access and mobility to more destinations (2013). In a review article, Giuliano stresses the importance of servicing the transit dependent population (2005). She reports that, planners need to make sure the needs of those using the service are getting the best, most efficient and reliable service possible, rather than focusing on new transit markets.

Travel by bus is considered to be safer than travel by car. Buses have fewer crashes than personal vehicles (National, 2014). The risk of injury or death resulting from a motor vehicle crash will decrease as bus ridership increases. Reduction of miles driven can also be beneficial to health. The stress of driving, especially in a large metropolitan area, can have negative health effects. This includes headaches, body aches and reduced mental capacity. It can also increase discretionary time by allowing users to read or listen to music while traveling.

Transportation and housing together comprise the two largest expenses faced by individuals and families. Having access to affordable housing and reasonable transportation costs allows for more income to be used for healthy food purchases, preventive healthcare and leisure activities, which in turn improve health (Srinivasan, et al., 2003).

The short and long term health benefits of regular physical activity are well documented (Blair and Morris, 2009). People who engage in regular, moderate-intensity physical activity typically enjoy lower risks of many chronic diseases including hypertension, high cholesterol, cardiovascular disease, stroke, type 2 diabetes and some cancers. Additional benefits may include improved quality of life and mental health, healthy weight maintenance, reduced obesity and increased muscle mass and bone density. This type of physical activity does not need to be strenuous and can include activities such as walking, participating in a fitness class, house work, gardening and bicycling. These health benefits are also possible with less vigorous and shorter bouts of regular physical activity. Walking and bicycling are excellent forms of physical activity that are relatively inexpensive and accessible. People who have access to and use public transit typically get more physical activity on a daily basis than those who do not. Besser reports that Americans who use public transit spend a median of 19 minutes per day walking to and from transit (2005). Twenty-nine percent of these people get the recommended amount of daily physical activity just from walking to and from transit. In addition, rail users, minorities, people in low-income households and in urban areas were more likely to spend 30 or more minutes walking to and from transit.

The SDOH that directly relate to this focus area are:

- **Economic Stability**
  - Poverty
  - Employment Status
  - Access to Employment
- **Social and Community Context**
  - Perceptions of Discrimination and Equity
  - Civic Participation
- **Neighborhood and Built Environment**
  - Environmental Conditions

1B. Existing Conditions

Daily bus ridership varies between the two sites. As shown in Table 1, there are almost double the number of daily riders at Site B than at Site C. Daily transit ridership is 926 people at site B and 498 at Site C. There are also substantially more jobs at Site B than at Site C. At the present time, FCDOT has not investigated the impact on ridership due to the transit center. As a result, a senior planner with FCDOT reports that at Site B, there are no projections for a change in ridership specifically due to the proposed transit center. The most likely source of new riders would be the residential area adjacent to the north end of the site. For Site C, there are also no projections on a change in ridership specifically due to the proposed transit center, although ridership will likely increase if commuter parking is included as part of the project. Per household, average miles driven annually by people in Site B (zip code 22306) is 19,565 and 21,134 for Site C (22309). In addition, transit trips on an annual basis number 265 for 22306 and 181 for 22309 (204 for all of Fairfax County).

Table 1: Current Ridership

Within 0.5 mile walking distance (different than 0.5 mile radius)	**Site B**	**Site C**
Employment (# of jobs)	512	279
Daily transit ridership (both NB and SB)	926	498

(FCDOT,Demographic, 2014; MWCOG, 2.3)

Regarding travel time along the corridor, in 2007, car speeds were 43 MPH free flow and 31 MPH congested. Route 1 is (roughly) 8 miles from I-495 to Fort Belvoir. Free flow travel time would be 8 miles / 43 MPH = 0.186 hours or 11 minutes and the congested travel time would be 8 miles / 31 MPH = 0.258 hours or 15 minutes. Therefore, travel during times of congestion is approximately 36% longer than during free flow. For those using public transit, the time averages 34.17 minutes during peak travel time to travel the corridor. See Table 2.

Table 2: AM Peak Period Transit Stop to Stop Run Times from the 2010 Base Model for Route 1 Corridor

Route 1 Segments		Stop-to-Stop Run Times (min)			Avg. Travel Time (min)
From Stop	To Stop	REX	F171	F151	
Belovoir Rd	Old Mill Rd.	1.84	3.62		2.73
Old Mill Rd.	Sacremento Dr.	1.20	2.38		1.79
Sacremento Dr.	Fryer Rd.	2.32	4.57		3.45
Fryer Rd.	Sherwood Hall Ln.	4.40	8.70		6.55
Sherwood Hall Ln.	Arlington Dr.	2.57	5.08	3.04	3.56
Arlington Dr.	Lockheed Blvd.	0.79	1.55	0.94	1.09
Lockheed Blvd.	Beacon Hill Rd.	2.56	5.04	3.02	3.54
Beacon Hill Rd.	Franklin St.	1.07	2.13	1.28	1.49
Franklin St.	N Kings Hwy.	0.61	1.19	1.35	1.05
N Kings Hwy.	Huntington Ave.	2.64	5.22		3.93
Huntington Ave.	Huntington Metro Stn.	3.35	6.62		4.99
					34.17

(MWCOG, 2.2)

Currently, there are no transportation hubs within a 0.5 mile radius of either site. Current bus routes available within the 0.5 mile radius for Site B include Connector 151, 152, 159, and 171, and Metrobus REX. Two additional routes Connector 161 and 162 would be rerouted to serve the new transit center site. At Site C, two routes Connector 171 and Metrobus REX directly serve the site. Two additional routes Connector 151 and 159 would be rerouted to serve the site.

The following table suggests that the area has a low number of fatalities due to car, bicycle and pedestrian crashes. Neither site had a fatality in 2011. However, there were three in Site B in 2012 compared to one in Site C.

Table 3: Car, Pedestrian and Bicycle Fatalities

	2011 Zip 22306 Site B	2012 Zip 22306 Site B	2011 Zip 22309 Site C	2012 Zip 22309 Site C	2011 All FC	2012 All FC
Transport fatalities (ground)	N/A	N/A	N/A	N/A	79	84
Number of car crash fatalities	0	2	0	1	11	12
Number of pedestrian and bicycle fatalities	0	1	0	0	15	17

(VDH Vital Statistics, 2011 & 2012)

In 2013, the two sites had similar numbers for emergency department (ED) visits related to motor vehicle crashes. However, the two zip codes covering the two transit center sites have the third and fourth highest number of ED visits due to motor vehicle crashes of all zip codes in Fairfax County. See Table 4.

Table 4: Motor Vehicle Crashes as Emergency Department Complaint

	2013 All FC	2013 Zip 22306	2013 Zip 22309
Number of motor vehicle crashes (as ED chief complaint)	4,885	232	248

(Fairfax County, Health, 2014)

This table lists the intersections along Richmond Highway and at each potential transit center site that have six or more reported crashes.

Table 5: Intersections with Six or More Crashes

	Site	**2011**	**2012**	**2013**	**Total (3 yrs)**
		Number of crashes at each intersection			
Richmond Hwy/Sherwood Hall Ln	B	8	15	11	34
Richmond Hwy/Fordson Rd	B	12	7	10	29
Richmond Hwy/Mt Vernon Hwy	B	6	9	9	15
Richmond Hwy/Ladson Ln	B	8	15	7	30
Richmond Hwy/Buckman Rd	B	10	14	7	31
Total Site B					**139**
Richmond Hwy/Frye Rd	C	6	4	12	22
Richmond Hwy/Russell Rd	C	8	7	8	23
Total Site C					**45**

(Fairfax County, Police, Operations, 2014)

Site B has five intersections with six or more crashes per year while Site C has two. The total number of crashes at intersections with six or more crashes is higher for Site B (total crashes at these intersection over three years was 139), as would be expected with more qualifying (six or more crashes) intersections in the report.

Average miles driven annually per household are 19,565 and 21,134 for Sites B and C respectively. Average commute time in the Washington DC metro area is 33.4 minutes (McKenzie & Rapino, 2011). For workers 16 years and older, 14.1% in the DC area use public transportation for travel to work (McKenzie, 2010).

Household transportation costs are estimated using the Location Affordability Index, which uses data from the 2006-2010 American Community Survey (www.locationaffordability.info). Household transportation costs are 13% of income at Site B and 14% at Site C. The average in Fairfax County is 13%. When looking at all types of households by zip code (owners and renters), housing costs are 32% at Site B compared to 30% at Site C. The average housing cost for Fairfax County is 29%. See Table 6.

Table 6: Housing and Transportation Costs

			Site B			Site C		
Per household	**DC Region**	**Fairfax County**	**Hybla Valley (22306) All types**	**Hybla Valley (22306) Renters**	**Hybla Valley (22306) Owners**	**Mt. Vernon (22309) All types**	**Mt. Vernon (22309) Renters**	**Mt. Vernon (22309) Owners**
Percent owner occupied	(VA) 67.8%	69.7%	N/A	N/A	45.9%	N/A	N/A	66.1%
Percent renter occupied	(VA) 32.2%	30.3%	N/A	54.1%	N/A	N/A	33.9%	N/A
Average commute time	33.4 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vehicles owned	N/A	1.9	1.9	N/A	N/A	2	N/A	N/A
Miles driven annually	N/A	19,804	19,565	N/A	N/A	21,134	N/A	
Transit trips annually	N/A	204	265	N/A	N/A	181	N/A	N/A
Housing costs	N/A	29%	32%	19%	35%	30%	18%	36%
Transportation costs	N/A	13%	13%	13%	13%	14%	14%	14%
Housing + Transportation costs (location affordability)	N/A	42%	45%	32%	48%	44%	32%	50%

(US Census, 2014; McKenzie & Rapino, 2009)

According to Fairfax County Department of Neighborhood and Community Services, calls for transportation assistance in Human Services Region 1 where both sites are located are approximately 3.5 times greater than other parts of the county (see Appendix H for a map of Human Services Regions).

Table 7: Calls for Transportation Assistance

7/1/12 – 12/31/13	Region 1	Region 2	Region 3	Region 4	22306	22309
Total number of calls for any assistance	23,008	24,674	13,932	16,036	2,320	2,186
Total number of calls for public/mass transit assistance	522	151	103	96	48	63
% of calls for transit assistance	2.27%	0.61%	0.74%	0.60%	2.07%	2.90%

(Fairfax County, Department of Neighborhood and Community Services, 2014)

1C. Impact Analysis

Access to reliable public transportation is essential to successful communities, especially those in and around large metropolitan areas. Transit is important for access to goods and services as well as jobs and education. It is anticipated that the RHTC will increase access to public transit by adding an additional stop, transfer station and additional routes along the corridor. Type, quality and safety of transit centers are important factors to consider in addition to adding more transit services spaces (Lee, et al. 2012). Safety devices, such as traffic lights and crossing aids, and street amenities, such as benches, all increase use of public spaces in neighborhoods. In a study looking at accessibility of transit, Chandra et al. stress the importance of transportation system upgrades to improve travel options for residents

including access and mobility to more destinations (2013). The metropolitan areas of Washington DC and Baltimore were studied to see if transportation-oriented development (TOD) reduced vehicle miles traveled (Nasri & Zhang, 2014). Results indicated that residents near TOD do tend to drive less, around 38% in Washington DC than in non TOD areas. Although the proposed RHTC project is not considered true TOD, enhanced transit services have the potential to reduce vehicle miles traveled.

There is not strong evidence that the transit center itself will cause an increase in ridership. If there is an increase, it may be due to improved quality of service, more efficient route planning and increased bus service. Other reasons include increases in employment opportunities and population growth (Greater, 2014). Key FCDOT personnel report that increased ridership was not one of the main goals of the transit center project; planners will monitor to determine if an increase occurs over time. While additional stops can mean increased geographic access, they can also mean longer travel times and thus decreased efficiency for some riders (Murray & Wu, 2003). This could ultimately decrease demand and usage of the transit service. Travel and usage needs of current and potential riders should to be evaluated on a regular basis.

Research in the area of pedestrian and car volume in relation to the number of crashes is somewhat contradictory. The majority of the research shows that drivers of cars go slower if there are more pedestrians and bicyclists in an area (Jacobsen, 2003). This behavior of motorists acts as a traffic calming measure. In another study, Leden found that the risk of a traffic crash involving pedestrians went down with increased pedestrian flow (2002). He also found that the risk increased with increased vehicle flow. Based on this research, injuries and crashes will be reduced if more people walk and bike and fewer people drive cars. However it should be noted that in more recent articles, Bhatia & Wier and Maizlish et al. found that this “safety in numbers” concept did not always hold true (2011; 2013). The authors discuss the need for more detailed research in this area including enhanced safety measures for walkers and bicyclists.

In addition to potential benefits to pedestrians, bus riders also have a reduced risk of injury or death. Injury Facts® compares four modes of transportation: scheduled airlines, railroad passenger trains, buses and light duty vehicles (includes passenger cars, light trucks, vans and sports utility vehicles regardless of wheelbase). In general, buses, trains and airlines have much lower death rates than light duty vehicles when the risk is expressed as passenger deaths per passenger mile of travel (light duty vehicle drivers are considered passengers but operators and crew of planes, trains and buses are not) (National, 2014). In 2011, the passenger death rate in light duty vehicles was 0.48 per 100 million passenger-miles. The rates for buses, trains and airlines were 0.06, 0.03, and 0.00 respectively. The risk of injury or death resulting from a motor vehicle crash will decrease as bus ridership increases.

According to the American Public Transportation Association, public transportation can save an individual an average of $10,181 per year over owning a car (APTA, Due to, 2014). In the Washington DC area, the annual individual average savings is $10,257. The Transit Savings Report (by APTA) looked at the cost of owning and driving a vehicle including gas prices and parking as compared to commuting by public transportation. Another report found that actual transportation costs to be saved may depend on whether or not households actually reduce the number of cars they have as a result of switching to public transportation (Center, 2008). Other factors include number of vehicles and drivers in each household and substitution toward using public transportation on a regular basis.

Enhanced transit services and facilities have the potential to reduce the transportation costs of some households who rely on public transportation (Ferguson, et al., 2012). Access to transportation will increase as household transportation costs decrease. This might also free up some household income to be used for other needed goods and services. If access is indeed improved, it would be anticipated that calls to request transportation assistance would decrease.

The addition of the RHTC will likely increase access to daily physical activity for area residents. This is due to potential increased use of transit and the potential for a community soccer field at Site B, providing an additional place for physical activity at that site. Cohen et al. found that close proximity to parks and

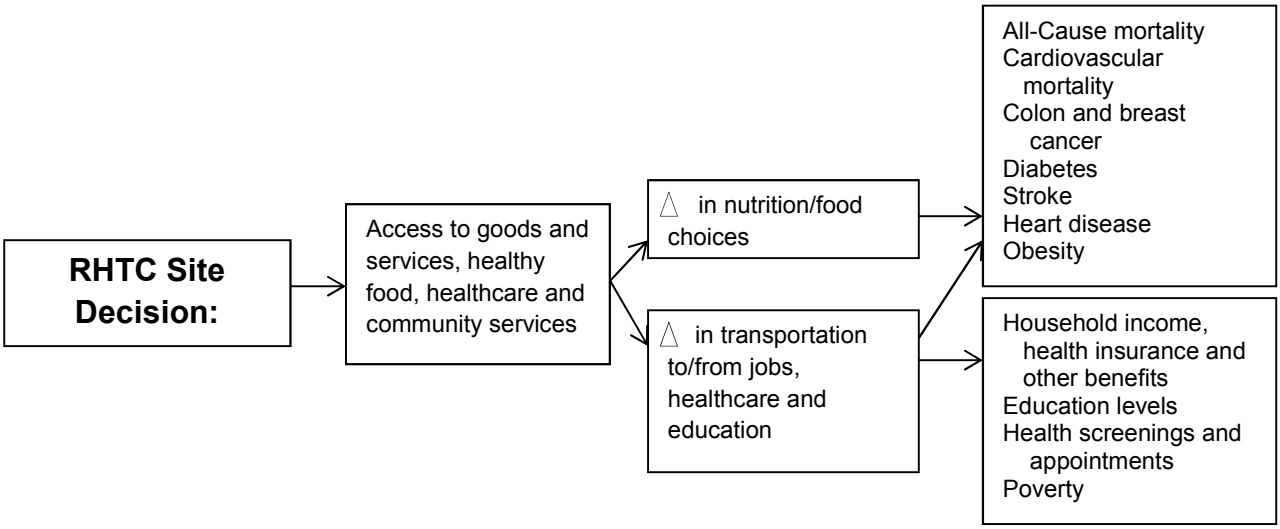
open spaces in an urban setting increased the likelihood that minority groups were physically active (2007). Also, people who have access to and use public transit typically get more physical activity on a daily basis than those who do not. Besser reports that Americans who use public transit spend a median of 19 minutes per day walking to and from transit (2005). These people are getting 29% of the recommended 30 or more minutes of physical activity per day. In addition, rail users, minorities, people in low-income households and in urban areas were more likely to spend 30 or more minutes walking to and from transit.

1D. Equity Considerations

The SDOH are the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities - the unfair and avoidable differences in health status seen within and between countries (CDC, Social, 2014). Fairfax County residents who live within a 0.5 mile radius of both potential transit center sites are living at a lower socioeconomic status than the majority of the county. The RHTC will not by itself improve the socioeconomic status of area residents. However, it has the potential to reduce the transportation costs of some households who rely on public transportation (Ferguson, et al., 2012). Planners need to consider route configuration, including proximity of routes to local and regional transportation hubs. Planners and developers need to make sure the needs of those actually using the services are getting the best, most efficient and reliable service possible. In addition, attention must be paid to research and evaluation of how transportation projects do or do not benefit those at the lower end of the socioeconomic scale (Sanchez, 2008).

Focus Area 2: Access to Goods and Services, Healthy Food, Healthcare and Community Services

Pathway Diagram



Recommendation

A new transit center at either site will likely improve access to goods and services, healthy food, healthcare and community services if the following are considered by decision makers and planners:

- Configure routes to maximize access of area residents to local food sources (i.e., grocery stores), healthcare centers, and community services during hours of operation for these types of businesses.
- Identify and prioritize the needs of those who are transit dependent. A survey or other research can be used to understand these needs.
- Develop and implement a marketing plan to increase awareness of the RHTC for patrons of area grocery stores, community centers and healthcare providers.
- Minimize the cost of using the new transit lines to individuals, with respect to current income and household and transportation cost estimates.

Summary

Health Considerations

- Access to healthy foods is associated with improved health, including lower body mass index (BMI) and lower risks of obesity and chronic diseases, including diabetes, hypertension, heart disease and some cancers.
- Access to healthcare, preventive and other community services is also associated with improved health and lower healthcare costs.
- Improved access to public transportation has the potential to improve socioeconomic status and reduce health disparities by improving access to healthy foods, healthcare (including preventive screenings and procedures) and other community services.

Existing Conditions

- Both sites currently have multiple restaurants, carry outs and grocery stores. Site B has more than Site C, including two supercenters Walmart and Costco.
- There are six hospitals and six public health facilities within a 30 minute commute to both sites.
- The main community and social service facility in the area, South County Human Services Center, is located at Site C.
- At Site B, there are currently five bus routes (Connector 151, 152, 159, and 171, and Metrobus REX) serving the site. Two additional routes (Connector 161 and 162) will be rerouted to serve the new transit center site. At Site C there are two routes (Connector 171 and Metrobus REX) that directly serve the site. Two additional routes (Connector 151 and 159) will be rerouted to serve the site.
- While there are no current subpopulation data for adults, the Fairfax County Youth Survey shows that 26.9% of high school students at Site B are getting the recommended number of fruits and vegetables on a daily basis compared to 19.7% at Site C.
- The Richmond Highway Corridor is a highly underserved area within Fairfax County. It has been designated a Medically Underserved Population by the Health Resources and Services Administration (HRSA) and has a higher rate of poverty than other regions of the county. The community has a large, low-income, African American and Hispanic population, including an increasing number of immigrants who face significant linguistic, cultural and financial barriers to accessing healthcare. Health disparities exist among these cohorts for various cancers, cardiovascular diseases, cerebrovascular diseases, Alzheimer's disease, chronic respiratory disease, and diabetes mellitus mortality rates.

Impact Analysis

- The RHTC is not expected to affect the number of healthy food sources in the community; but it has the potential to increase access to these businesses in close proximity to the proposed transit center sites (i.e. people coming into the neighborhood to access these services from other parts of the county) and other businesses in the county (i.e. people living close to the site using transit to access businesses farther away).
- The RHTC is expected to increase access of other county residents to area healthcare and community services, more so at Site C since it is the location of the South County Human Services Center.
- If the RHTC is built at Site B, the number of bus routes that serve the area will increase from five to seven. If it is built at Site C, the number of bus routes will increase from two to four.
- The RHTC is expected to improve access to public transportation and thus has the potential to improve socioeconomic status and reduce health disparities by improving access to healthy foods, healthcare (including preventive screenings and procedures) and other community services, to both people living within close proximity to the proposed sites and other county residents who will be better able to access services near transit sites.

2A. Health Considerations

Access to healthy foods is associated with increased consumption of fruits and vegetables and improved health. Poor dietary intake and obesity are both risk factors of chronic disease, including diabetes, hypertension, heart disease and some cancers (CDC, Prevention, 2014). These factors, along with others, such as social support, poverty, public safety and the built environment are examples of social determinants of health (WHO, 2008). These determinants are linked to a wide range of health and quality of life outcomes and risks. They also partially explain why some people are healthier than others. By improving access to public transportation, the potential exists to improve access to healthy foods, goods and healthcare services.

The SDOH that directly relate to this focus area are:

- **Economic Stability**
  - Poverty
  - Employment Status
  - Access to Employment
- **Social and Community Context**
  - Civic Participation
- **Health and Health Care**
  - Access to Health services—including clinical and preventive care
  - Access to Primary Care—including community-based health promotion and wellness programs
  - Health Technology
- **Neighborhood and Built Environment**
  - Access to Healthy Foods

2B. Existing Conditions

Access to goods and healthy foods

According to the most recent County Health Rankings, the food environment index is a measure ranging from 0 (worst) to 10 (best) which equally weights two indicators: access to healthy foods and food insecurity (University, 2014). The first is limited access to healthy foods, which estimates the proportion of the population who are low income and do not live close to a grocery store. Living close to a grocery store in non-rural areas is defined as less than 1 mile. Low income is having an annual family income of less than or equal to 200 percent of the federal poverty threshold for the family size. The second indicator is food insecurity, which estimates the proportion of the population who did not have access to a reliable food source during the past year. The food environment index for the top 10% in the US is 8.7. For Virginia, the number is 8.5. Fairfax County's score was a 9.6 for 2013, a notably high score. However it should be noted, the U.S. Department of Agriculture's Economic Research Service has designated the Mount Vernon South/Ft. Belvoir zip code of 22060 (the zip code just south of Site C) as a food desert.

Sources of healthy foods within 0.5 miles of both sites are plentiful; however, there are substantially more in Site B. There are approximately 35 restaurants, carry-outs and grocery stores in Site B, including Shoppers, Walmart and a Costco. There are also 10 fast food restaurants and seven ethnic grocery stores. A seasonal farmer's market is located just at the 0.5 mile radius border, at 2501 Sherwood Hall Lane. Site C has 16 food sources, including an Aldi's grocery store and three ethnic grocery stores. There is a Safeway grocery store located just outside the 0.5 mile radius. However, there is not a farmer's market at this site (*GIS mapping; www.yellowpages.com).*

Healthy eating is a critical component to combatting cardiovascular risk factors as well as childhood and adult obesity. Providing frequent, easy access to healthy food choices is necessary to improve nutrition in all areas of the Richmond Highway Corridor.

Access to healthcare and community services

Healthcare resources in the area include six hospitals and/or healthplexes within a 30 minute commute (VDH, Office, 2012) of both sites. Mapquest was used to verify length of the walk and commute. In addition, there are six public health facilities within the same distance. In 2010, there were 20,314 emergency department (ED) visits in the surrounding zip codes of 22060 (nearby Ft. Belvoir), 22309, 22306 and 22308 (*Verite, 2013).* Preventive service and primary care office data were not available for the purposes of this project. The South County Human Services Center, located at Site C, houses many health and human services programs that the county offers.

Current bus routes available within a 0.5 mile radius of Site B are Connector 151, 152, 159, and 171, and Metrobus REX. Two additional routes, Connector 161 and 162, would be rerouted to serve the new transit center site. At Site C, two routes, Connector 171 and Metrobus REX, directly serve the site. Two additional routes Connector 151 and 159 would be rerouted to serve the site.

There are no data available at the sub-county level for the percentage of adults who get the recommended number of servings of fruits and vegetables each day. For youth, data on high school students can be seen in the table below.

Table 8: Fruit and Vegetable Consumption

	United States	Virginia	Fairfax County	Site B	Site C
Percent of high school students getting the recommended servings of fruits and vegetables daily	17.1% (2010)	N/A	25.9%	26.9%	19.7%
Percent of census tracts with at least one healthier food retailer within 0.5 mile to tract boundary	69.5%	70.3%	N/A	100%	100%

(CDC, 2013; Fairfax County Youth, 2012)

High school students at Site B report eating the daily recommended servings of fruits and vegetables more than the students at Site C (Fairfax County Youth, 2012).

The CDC defines a healthier food retailer as large grocery stores, supermarkets, supercenters, warehouse clubs and fruit and vegetable specialty stores. Each potential transit center site has at least one of these types of stores within the 0.5 mile radius border. Both sites have a higher percentage of healthier food retailers than the state of Virginia and the United States (CDC, 2013).

The Richmond Highway Corridor is a highly underserved area within Fairfax County and has been designated a Medically Underserved Population by the Health Resources and Services Administration (HRSA) and has a higher rate of poverty than other regions of the county. Mt. Vernon has a large, low-income, African American and Hispanic population, including an increasing number of immigrants who face significant linguistic, cultural, and financial barriers to accessing healthcare. Health disparities exist among these cohorts for various cancers, cardiovascular diseases, cerebrovascular diseases, Alzheimer's disease, chronic respiratory disease, and diabetes mellitus mortality rates according to the Virginia Department of Health (VDH) (Verité, 2013).

The community's overall health, relative to other areas of the county, is less than favorable. A Community Needs Assessment, conducted by Inova Mount Vernon Hospital (Verite, 2013), analyzed inpatient discharge diagnosis codes and found that 67 percent of its discharges were associated with chronic disease. Discharges for chronic disease were concentrated in rheumatoid arthritis, depression, chronic kidney disease, heart failure, anemia, diabetes, hypertension, chronic obstructive pulmonary disease and bronchiectasis, atrial fibrillation, and stroke (Ibid). Disproportionately large numbers of discharges for

Ambulatory Care Sensitive Conditions (ACSC), indicative of poor access to primary healthcare, were most prevalent in the Mount Vernon South/Ft. Belvoir area (22060, 22308, and 22309) as well. Ten percent of IMVH discharges were found to be for ACSC (Ibid).

Table 9: Asthma Data

	United States	Virginia	FC: Mt. Vernon area	Site B 22306	Site C 22309
Mt. Vernon Hospital adults discharged for asthma	N/A	N/A	78 (in 2010)	N/A	N/A
Mt. Vernon Hospital adult ED visits for asthma	N/A	N/A	449 (in 2010)	N/A	N/A
Mt. Vernon Hospital children discharged with asthma	N/A	N/A	0.77% of pediatric cases	N/A	N/A
Asthma as ED chief complaint (in 2013)	N/A	N/A	1,684 cases (All FC)	128 cases	113 cases
Adult asthma prevalence (self-reported) (BRFSS, 2012)	13.45%	13.58%	N/A	N/A	N/A

(Verite, 2013; FCHD, 2014)

For the chief complaint of asthma, the two zip codes that house the two potential transit center sites have higher numbers than all other zip codes in Fairfax County.

In terms of the leading causes of death, there are some similarities and some differences between the county as a whole and the two zip codes where the transit center will potentially be located. Lung cancer was not in the top five for either site in 2011, but was in the top five in 2012. Causes related to heart disease (heart attack, stroke, congestive heart failure) were also more common in 2011 for these zip codes. Stroke was the fifth leading cause in 2011 for the county and zip code 22306 and the top cause for zip code 22309 that year. See Table 10.

Table 10: Leading Causes of Death

	All Fairfax County	Site B 22306	Site C 22309
Top five causes of death (2012)	1. Dementia 2. Lung/bronchus cancer 3. Heart disease 4. Heart attack 5. Congestive heart failure	1. Dementia 2. Pancreatic cancer 3. Lung/bronchus cancer 4. COPD 5. Heart disease	1. Dementia 2. Lung/bronchus cancer 3. Heart attack 4. (tied) Heart disease; Pancreatic cancer
Top five causes of death (2011)	1. Dementia 2. Heart disease 3. Lung/bronchus cancer 4. Congestive heart failure 5. Stroke	1. Dementia 2. Heart disease 3. Congestive heart failure 4. Alzheimer's 5. Stroke	1. Stroke 2. Heart disease 3. Dementia 4. (tied) Congestive heart failure; COPD

(VDH, Vital Statistics, 2011 & 2012)

2C. Impact Analysis

Access to goods and healthy foods

The addition of the RHTC is expected to have a positive impact on access to goods, services and healthy foods to people living in and near the study area. This is expected due to potential increases in the number of local bus routes, enhanced route availability and transit center accessibility. Access to healthy foods reduces the risk of obesity and some chronic diseases. Both sites have a supercenter or supermarket within a 0.5 mile radius. Site B has more fast food restaurants, but also has a farmer's market.

Access to needed resources is increased in areas where there is enhanced transit (Kawabata, 2003). This tends to be more significant in large urban areas and for those with low-wage jobs. Bader et al. also report that people with access to public transit have expanded potential to access retail, food and other services (2010). In a case study, Clifton found that although access to a car is helpful, public transit and walkability are important factors to successful food shopping for low income residents (2004). The efficiency and convenience of public transit schedules become more important to those living without a car or to those who wish to use alternative forms of transportation, as these have the potential to increase access to healthy foods.

There is some evidence that people with limited access to fast-food restaurants have healthier diets and lower levels of obesity (Larson, et al. 2009). The authors found that the number of fast food restaurants tends of be greater in low-income and minority neighborhoods. Morland & Evenson found that obesity rates were lower in neighborhoods with supermarkets and higher in areas with mostly small grocery stores and fast food restaurants (2008). Inagami et al., found that a higher concentration of fast food restaurants is associated with higher BMIs in Los Angeles (2009). This is more significant for people without access to a car. The RHTC may help people who use public transit to expand the area in which they shop for healthier food.

In a simulation study, Boone-Heinonen et al. found that improvements in the retail food environment, such as more grocery stores and less fast food restaurants, could have a positive impact on BMI (2013). In a similar study, Zick et al. found that in low income neighborhoods, having a healthy grocery store in the area was associated with a lower BMI (2009). In addition, having access to a variety of food options was associated with reduced risk of BMI/obesity. In the Morland & Everson study, the authors found that having a supermarket within a census tract increases the fruit and vegetable consumption of adults (2008). Site B already has three supermarkets while Site C has one.

Access to healthcare and community services

Lack of reliable transportation has been found to be a barrier to receiving heath care (Shier et al., 2013; Yang et al., 2006). Transportation can be the difference between accessing needed care for chronic and other diseases. For some populations, transportation issues are the most common reason that people are unable to keep medical appointments. Public transit does not always remove the barrier, but can offer an alternative resource to those who can access it.

Type, quality and safety of transit centers were cited as important factors to consider in addition to simply adding more transit services. In addition, safety devices, such as traffic lights and crossing aids, and street amenities, such as benches, all increased use of public spaces in neighborhoods (Lee, et al. 2012). In a study looking at accessibility of transit, Chandra et al. stress the importance of transportation system upgrades to improve travel options for residents, including access and mobility to more destinations (2013). In a review article, Giuliano stresses the importance of servicing the transit dependent population (2005). She reports that as opposed to trying to focus on new transit markets, planners need to make sure the needs of those using the service are getting the best, most efficient and reliable service possible.

Welch found that connectivity needs to be incorporated in planning, not just distance. Transit centers can be close to residential areas but perhaps not as connected as they could be. This is an important issue

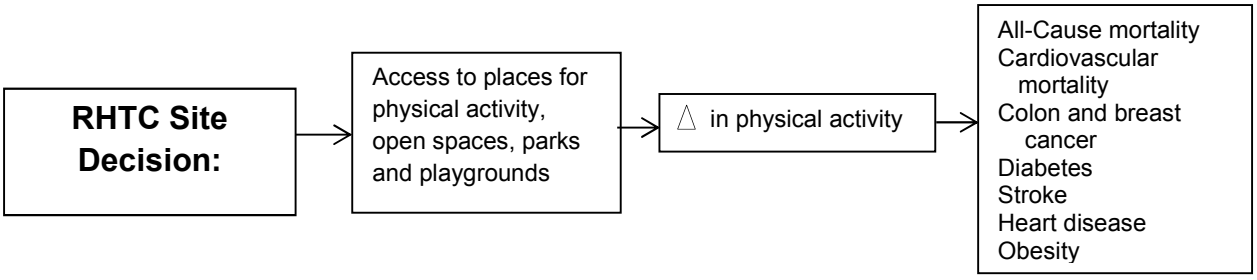
when considering equity of transit, as well (2013). In a review article focused on older adults, Rosso et al. found that higher mobility resulted from increased street connectivity, street safety measures and proximity to retail, parks and green spaces (2011). These factors can also improve access to healthcare and other services needed by this and other populations.

2D. Equity Considerations

When looking at access to healthy food sources, healthcare and other services, transportation becomes an important factor to consider. Other, SDOH also affect access, such as access to safe parks and sidewalks, appropriate social services, programs for those in poverty, public safety and the built environment. Fairfax County residents who live within a 0.5 mile radius of both potential transit center sites are living at a lower socioeconomic status than the majority of the county. The RHTC will not by itself improve the socioeconomic status of area residents; however, planners' considerations in various SDOH can improve and expand opportunities to make healthy choices. Planners need to consider route configuration, including proximity of routes to area supermarkets, grocery stores and healthcare centers. Planners and developers need to make sure the needs of those actually using the services are getting the best, most efficient and reliable service possible.

Focus Area 3: Access to Places for Physical Activity, Open Spaces, Parks and Playgrounds

Pathway Diagram



Recommendation

A new transit center at either site will likely improve access to places for physical activity, open spaces, parks and playgrounds if the following are considered by decision makers and planners:

- Maintain the addition of a new soccer field for the community if Site B is chosen. Ensure that the field will be maintained, safe and accessible to area residents.
- Include safety features and amenities, such as traffic lights, cross walks, bicycle racks, lighting, benches, trees and other greenery in the design of the RHTC to improve the safety and aesthetics of the center.
- Ensure good street connectivity between the RHTC and neighborhoods within a 0.5 mile radius.
- Develop and implement a marketing plan for current and potential riders focusing on the use of the RHTC as a way to be more physically active (active transport and commuting) and to save on household transportation costs.

Summary

Health Considerations

- Regular physical activity is related to numerous health benefits, including lower risks of many chronic diseases including hypertension, cardiovascular disease, stroke, type 2 diabetes and some cancers. Additional benefits may include improved quality of life and mental health, healthy weight maintenance, reduced obesity and increased muscle mass and bone density.
- People who use public transportation typically get an average 19 minutes per day of transit-oriented physical activity. Twenty-nine percent of these people get the recommended amount of daily physical activity just from walking to and from transit.
- By encouraging more active travel, including commuting to work, enhanced transportation services can have positive impacts on health.

Existing Conditions

- Currently, there are many open, accessible and free spaces, parks and playgrounds in the surrounding communities (within the 0.5 mile radius of both Sites B and C). Using GIS maps, Site B has approximately seven open play spaces including recreational facilities and access to two parks for a total of 9 recreational areas. Site C has approximately nine open play spaces and access to six parks for a total of 15 recreational areas.
- For this project, each zip code and four addresses in each 0.5 mile radius area were analyzed with Walk Score. Although the walkability is higher (better) for zip code 22309, the average for 4 selected addresses within the 0.5 mile radius was higher for Site B.
- Site C has better average connectivity and therefore would be the site with the most direct routes to access the transit center. However, Site C also has the least connected site, with the lowest connectivity score.
- The RHTC is part of a broader, ongoing Richmond Highway Public Transportation Initiative started by Fairfax County in 2004. One goal is to improve transit service along the corridor, including pedestrian access improvements. This would benefit either site.

Impact Analysis

- Both proposed sites have the potential to increase levels of physical activity as the opportunity for public transit use and active travel will increase. People who use public transit spend a median of 19 minutes per day walking to and from transit.
- Both proposed sites have the potential to increase pedestrian and bicycle access as well as general walkability of the affected neighborhoods. Safety features and amenities need to be incorporated into final designs.
- Site B has an advantage in that it includes the addition of a community soccer field, which will increase the number of places for physical activity within the 0.5 mile radius.

3A. Health Considerations

The short and long term health benefits of regular physical activity are well documented (Blair and Morris, 2009). People who engage in regular, moderate-intensity physical activity typically enjoy lower risks of many chronic diseases including hypertension, high cholesterol, cardiovascular disease, stroke, type 2 diabetes and some cancers. Additional benefits may include improved quality of life and mental health, healthy weight maintenance, reduced obesity and increased muscle mass and bone density. This type of physical activity does not need to be strenuous and can include activities such as walking, participating in a fitness class, house work, gardening and bicycling. These health benefits are also possible with less vigorous and shorter bouts of regular physical activity. Walking and bicycling are excellent forms of physical activity that are relatively inexpensive and accessible.

Current recommendations from the Centers for Disease Control and Prevention (CDC) for adults ages 18-64 are 30 minutes of moderate-intensity exercise most days of the week (at least five for a total of 150 minutes per week) or vigorous physical activity for at least 20 minutes three days per week (CDC, Physical, 2014). For children 17 and under, the recommendation is 60 minutes of physical activity every day. For those over 65, the same 150 minutes per week is recommended. However, across the US, only about 25% of adults get this recommended amount of physical activity.

The SDOH that are directly related to this focus area are:

- **Education**
  - School Policies that Support Health Promotion
- **Social and Community Context**
  - Perceptions of Discrimination and Equity
- **Neighborhood and Built Environment**
  - Access to Healthy Foods and Active Living

3B. Existing Conditions

Access to places for physical activity

Access to exercise opportunities refers to the number of places for physical activity located near people's homes. Locations for physical activity are defined as parks or recreational facilities. Parks include local, state, and national parks. Recreational facilities include businesses such as gyms, community centers, YMCAs, dance studios and pools. Individuals who reside in a census block within a half mile of a park or within one mile of a recreational facility in urban areas are considered to have adequate access to opportunities for physical activity (University, 2014). Both sites have access to fitness centers within the 0.5 mile radius.

Currently, there are many open, accessible and free spaces, parks and playgrounds in the surrounding communities (within the 0.5 mile radius of both Sites B and C). Using GIS maps, Site B has approximately seven open play spaces including recreational facilities and access to two parks for a total of 9 recreational areas. Site C has approximately nine open play spaces and access to six parks for a total of 15 recreational areas.

Physical activity, obesity and chronic disease rates

There is limited data at the zip code and census tract level for amount of daily physical activity and rates of obesity and chronic diseases. Almost 16% of adults in Fairfax County do not get any physical activity. Almost 19% of high school students in Site C reported getting the recommended amount of daily physical activity compared to 23% at Site B (see Appendix I for Fairfax County Public Schools High School Attendance Areas). Table 11 shows the data accessed and used for this project.

Table 11: Physical Activity and Obesity

	United States	Virginia	Fairfax County	Site B	Site C
Percent of adults getting the recommended amount of physical activity	64.5% (1)	67.1% (1)	N/A	N/A	N/A
Percent adults reporting no leisure time physical activity in past 30 days	25.4% (1)	23.6% (1)	17.0% (2)	N/A	N/A
Percent of high school students getting the recommended amount of physical activity	17.1% (1)	N/A	43.3% (3)	22.8% (3)	18.6% (3)
Adult obesity rate	27.6% (4)	27.4% (4)	22.0% (2)	N/A	N/A
High school student obesity rate	13.0% (4)	N/A	N/A	N/A	N/A
Percent of youth with parks, community centers and sidewalks in neighborhoods	50.0% (1)	46.3 % (1)	N/A	N/A	N/A
Percent of census blocks with park within 0.5 mile boundary	20.3% (1)	19.4% (1)	N/A	100%	100%
Percent of census block with family-friendly fitness center within 0.5 mile boundary	16.6% (1)	18.3% (1)	N/A	100%	100%

((1) CDC, 2010; (2) University, 2014; (3) FC Youth, 2012; (4) CDC, Prevention, 2014)

Walkability and connectivity

At both proposed sites, there is moderate pedestrian and bicycle access. There are about 170 linear feet of finished sidewalk along Richmond Highway at Site B and about 815 linear feet of finished sidewalk along Richmond Highway at Site C. The RHTC is part of a broader, ongoing Richmond Highway Public Transportation Initiative started by Fairfax County in 2004. One goal is to improve transit service along the corridor, including pedestrian access improvements. This would benefit either site. There are no proposed changes to sidewalks or trails as a result of the RHTC being built. However, there are multiple sidewalk projects in progress near Sites B and C as well as along the Route 1 corridor.

Walkability scores for each site vary by neighborhood. A Walkability Score measures the walkability of any address using a patent-pending system. For each address, Walk Score analyzes hundreds of walking routes to nearby amenities. Points are awarded based on the distance to amenities in each category. Amenities within a 5 minute walk (.25 miles) are given maximum points. Walk Score also measures pedestrian friendliness by analyzing population density and road metrics such as block length and intersection density. Data sources include Google, Education.com, Open Street Map, the U.S. Census, Localeze, and places added by the Walk Score user community (walkscore.com). The better the walkability, the closer the score is to 100. Both sites (per zip code) are below 50, indicating relatively low walkability. Locations scoring between 50 and 69 are considered somewhat walkable.

Table 12: Walkability

	Walkability Score
Site B: All 22306	**43**
Site B: Lindberg Dr.	46
Site B: Pace Ln.	57
Site B: Joseph Makell Ct.	63
Site B: Janna Lee Ave.	51
Average for addresses	**54.25**
Site C: All 22309	**49**
Site C: Keswick Rd.	38
Site C: Byers Dr.	62
Site C: Laurel Rd.	43
Site C: Maury Pl.	51
Average for addresses	**48.50**

(www.Walkscore.com/score)

For this project each zip code and four addresses in each 0.5 mile radius were analyzed with Walk Score. Although the walkability is higher for zip code 22309, the average for four selected addresses within the 0.5 mile radius was higher for Site B. Addresses were chosen at both quarter mile and half mile distances to the north and south.

In terms of measuring connectivity, the pedestrian route directness calculation best measures connectivity and reflects minimizing trip distance and route directness. Pedestrian route directness is a ratio of route distance to straight line distance for two points. The calculation is simple: distance of the most direct route/straight-line distance. The measurement for ideal connectivity would be 1. In other words, the closer the connectivity measurement is to 1, the better the connectivity.

For this project, classic Google Maps was used because it has a built in measurement tool. The most direct route distance was the distance calculated by classic Google Maps. For the straight-line distance, classic Google Maps has a Map Labs distance measurement tool. The tool was used to measure distances from Site B and Site C to points east and west within the quarter mile and half mile buffer.

Site C has a lower average connectivity measurement and therefore would be the site with the most direct routes to access the transit center. However, Site C also has the highest individual connectivity measurement for the west half mile location.

Table 13: Connectivity

	Site B	**Site C**
East half mile	2.03	1.19
East quarter mile	1.5	1.25
West half mile	1.8	2.61
West quarter mile	2.27	1.16
Average	**1.9**	**1.55**

(Green, 2014)

3C. Impact Analysis

Access to places for physical activity

The addition of the RHTC will likely increase access to daily physical activity for area residents. This is due to potential increased use of transit and to the potential for a community soccer field at Site B, which would provide an additional place for physical activity at that site. Cohen et al. found that close proximity to parks and open spaces in an urban setting increased the likelihood that minority groups were physically active (2007). Public parks are a valuable resource to those who do not have resources to use private fitness facilities. Parks within walking or biking distance were used more often than parks farther away.

People who have access to and use public transit typically get more physical activity on a daily basis than those who do not. Besser reports that Americans who use public transit spend a median of 19 minutes per day walking to and from transit (2005). Twenty-nine percent of these people get the recommended amount of daily physical activity just from walking to and from transit. In addition, rail users, minorities, people in low-income households and in urban areas were more likely to spend 30 or more minutes walking to and from transit.

Morabia et al. found that using public transit for commuting to work increased individual energy expenditure and could allow for increased daily physical activity (2010). In a review article, Rissel et al. found that if inactive adults were to switch to using public transportation, more people would get the recommended amount of daily physical activity (2012). They report a range of 8-33 additional minutes of physical activity associated with public transit use on a daily basis. In a study of working adults, Bopp et al. found that those who participated in active commuting (e.g., walking, biking, public transit) enjoyed multiple health related benefits and that poorer health outcomes were associated with more passive forms of commuting (2013). In addition, active travel can help adults meet the recommended amount of daily physical activity.

In considering the design of the RHTC, safety, cleanliness, lighting and other factors need to be considered to increase ridership and physical activity. Frank et al. found that the built environment, including transit accessibility, residential density and intersection density have positive impacts on both physical activity and reducing greenhouse emissions (2010). The authors point out that reducing the distance between homes and common destinations can decrease the amount of active travel due to the shorter distances. Decreased car use accounts for these differences. Type, quality and safety of green spaces were cited as important factors to consider in addition to simply providing more green space. In addition, safety devices, such as traffic lights and crossing aids and street amenities, such as benches, all increased physical activity in neighborhoods (Lee, et al. 2012).

Physical activity, obesity and chronic disease rates

There is also evidence that active travel can help with managing some chronic conditions, such as diabetes. In a review article, Xia et al. looked at many benefits of increasing active and public transportation, including air quality, physical activity and economic factors (2013). The authors discuss that this area of research is still emerging but that several studies show promising results. This includes decreasing the risk of chronic diseases.

Samimi et al. found that a 1% decrease in car use can reduce obesity by 0.4% (2009). The authors looked at the effects of transportation and the built environment on general health and obesity. In another study, Grabow et al. estimated the benefits of reduced car travel and suggested that decreasing the number of short trips made in cars can have a positive impact on both air quality and physical activity (2012). They also suggest a benefit to the economy from fewer related deaths and lower healthcare costs.

Walkability and connectivity

At both proposed sites, there is moderate pedestrian and bicycle access. There are about 170 linear feet of finished sidewalk along Richmond Highway at Site B, and about 815 linear feet of finished sidewalk along Richmond Highway at Site C. The RHTC is part of a broader, ongoing Richmond Highway Public Transportation Initiative started by the Fairfax County in 2004. One goal is to improve transit service along the corridor, including pedestrian access improvements.

Ethnic and minority groups tend to be more likely to not meet daily physical activity guidelines. Building infrastructure in lower income neighborhoods has the potential to positively influence physical activity for these populations (Whitt-Glover et al., 2009). Strategies include complete sidewalks, walking and bicycle trails, and increased access to public transportation.

Walkability scores for each specific neighborhood may increase slightly due to the addition of a transit center. Sallis et al. found that neighborhoods with higher walkability scores had higher levels of regular physical activity and lower rates of overweight and obesity (2009). This includes walking for both transportation and leisure. They found this to be true regardless of income, although lower income adults had less favorable weight status. In looking at affordable housing and access to transit, Welch found that connectivity needs to be incorporated in planning, not just distance. Transit centers can be close to residential areas but perhaps not as connected as they could be. This is an important issue when considering equity of transit (2013). In a review article looking at older adults, Rosso et al. found that higher mobility resulted from increased street connectivity, street safety measures and proximity to retail, parks and green spaces (2011). These factors can also improve access to healthcare and other services needed by this population.

Increased physical activity and lower BMIs are associated with neighborhood attractiveness, such as sidewalk cafes and trees in New York City (Lovasi, et al. 2012). This suggests that people are more inclined to be outside and be more active if neighborhood amenities are included in planned design. Social and environmental supports for physical activity are important. Addy et al. found that safe sidewalks, good lighting and trusted neighbors increased the likelihood of increased physical activity (2004).

Aytur et al. (2008) found that people in North Carolina living in higher income areas had more physical activity supports, including non-automobile land improvements, in current development plans than those living in lower income areas. These types of plans and polices were associated with increased physical activity for people of all income levels. This suggests that inequities exist in land use planning that incorporates support for physical activity. The RHTC will help to address this as it will positively impact a lower income area of the county.

3D. Equity Considerations

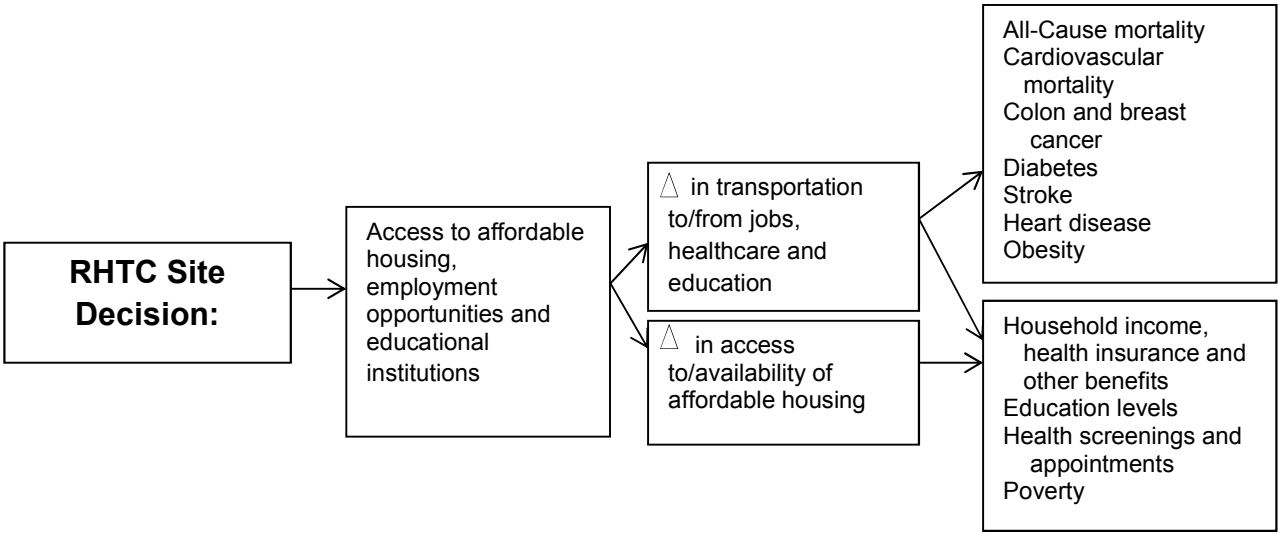
Residents in the areas around both potential transit center sites have a lower socioeconomic status than the majority of Fairfax County. Research shows that those with lower socioeconomic status experience health disparities when compared to higher income and education groups (CDC, Social, 2014). This includes access to places for physical activity. Ethnic and minority groups tend to be more likely to not meet daily physical activity guidelines. Building infrastructure in lower income neighborhoods has the potential to positively influence physical activity for these populations (Whitt-Glover et al., 2009). Strategies include complete sidewalks, walking and bicycle trails, and increased access to public transportation.

For low-income adolescents, Popkin et al. suggest that inequality in access to physical activity resources (e.g., parks, playgrounds) contributes to decreased participation in regular physical activity (2005). The authors assert that the inequitable distribution of such facilities contributes to increased obesity rates in racial and ethnic minority groups. In low-income neighborhoods, Wilson et al. found that increased trails support increased physical activity (2004). Other areas of concern for barriers to physical activity for this group included perceptions of crime, unattended dogs, unpleasant neighborhoods, untrustworthy neighbors and decreased access to public recreation facilities. Another study found that people in

deprived areas who did have access to green spaces were less likely to use them, despite the access (Jones, et al. 2009). From an equity standpoint, planners need to keep these concerns in mind when developing a new transit center. Access to places and spaces for physical activity should be available to all, regardless of socioeconomic status.

Focus Area 4: Access to Affordable Housing, Employment Opportunities and Educational Institutions

Pathway Diagram



Recommendation

A new transit center at either site has the potential to maintain access to affordable housing and improve access to employment opportunities and educational advancement if the following are considered by decision makers and planners:

- Configure routes to maximize access of area residents to the Metro, centers of employment, and colleges and universities, especially during peak times of the day.
- Develop and implement a marketing plan to increase awareness of the RHTC for area employers, colleges and universities.
- Minimize the cost of using the new transit lines to individuals, with respect to current income and household and transportation cost estimates.
- Preserve existing affordable housing along the corridor as well as near the RHTC site.

Summary

Health Considerations

- Access to quality housing, employment opportunities and education is associated with improved health.
- Enhanced access to public transportation has the potential to improve socioeconomic status and health by increasing access to affordable housing, better employment (which will impact income and access to health insurance) and educational advancement opportunities.

Existing Conditions

- Income and education data are mixed between the two sites. When comparing the sites by zip code to the county as a whole, Site B and Site C have a higher unemployment rate, a lower median income, a higher percent of people living in poverty, a higher percent of people without a high school education and a lower percentage of persons with an Associate's degree or higher. Overall, residents at both sites are living at a lower socioeconomic status than the rest of the county.
- Affordable housing opportunities exist at both sites. However, Site B has more mobile homes, housing units and more subsidized units than Site C. Site B also has more renter occupied units than Site C.
- The number of homeless people in Fairfax County has been on the decline since at least 2008. On January 29, 2014, the number identified as in emergency shelter and transitional housing along the Richmond Highway Corridor was 243 individuals (out of 1,225 countywide). During FY13, there were 2,440 unduplicated entries into various homeless programs throughout the county. Of those, 203 people listed 22309 (Site C) and 186 listed 22306 (Site B) as the zip code of their last permanent housing.

Impact Analysis

- The addition of the RHTC could have a positive impact on the employment rate due to a potential increase in the number of local jobs (i.e., the construction project in addition to increased economic development near the site), as well as improved access to jobs throughout the region. When compared to the county, both sites have higher unemployment rates, higher poverty rates and lower household income. Both sites would potentially see a benefit from the addition of the RHTC.
- The RHTC would be expected to have a positive impact on access to educational opportunities due to a potential increase in the number of bus lines and transfer points that the center will provide. When compared to the county, both sites have lower rates for Associate's degree or higher. Both sites would potentially see a benefit from the addition of the RHTC.
- Affordable housing opportunities exist at both sites. However, Site B has more housing units and more subsidized units than Site C. Site B also has more renter occupied units than Site C. The RHTC will likely not impact the amount of affordable housing at either site.
- Research shows that properties near transit maintain and sometimes increase their value better than properties in other locations. Improved property values can increase money available for home improvements. However, increased property value may also cause increased rent, which can have an unintended consequence of displacing low-income residents. The RHTC has the potential to increase property values at both sites and cause an increase in rent.
- There is no evidence that shows that the numbers of homeless people in an area will be affected by the construction of a transit center. The RHTC could become an additional place for homeless people to use as a shelter.

4A. Health Considerations

Access to quality housing, employment and education is associated with improved health. These factors, along with others such as access to parks and sidewalks, social support, poverty, public safety and the built environment are examples of social and physical determinants of health (CDC, Social, 2014). These determinants are linked to a wide range of health and quality of life risks and outcomes. They also partially explain why some people are healthier than others. By improving access to public transportation, it is expected that an improvement in access to affordable housing, employment opportunities and education will follow (Kawabata, 2003; Blumenberg & Shiki, 2003; Hess, 2005; Kenyon, 2011).

Housing

Housing is a basic human need. Several factors such as the location, quality, security and affordability of housing play an important role in accessing and maintaining shelter. Housing is affected by economic stability, the neighborhood and the local environment. Lack of safe and stable housing can adversely affect physical and mental health, including stress, anxiety, substance abuse, aggressive behavior, heart disease, obesity and hypertension (Srinivasan, et al., 2003). In addition, transportation and housing together comprise the two largest expenses faced by individuals and families. Having access to affordable housing and reasonable transportation costs allows for more income to be used for healthy food purchases, preventive healthcare and leisure activities. These can then in turn improve health.

Employment

Improved opportunities for higher paying jobs can have positive impacts on health. Research shows that people with higher socioeconomic status typically have better health than others (Evans & Kantrowitz, 2002). Improved employment can positively affect income, ability to provide housing and food, access to health insurance, decrease stress levels and increase feelings of self-worth. Investment in public transportation services allows for increased ability for workers to travel to and from home to places of employment, especially for low-skilled workers.

Education

Education is closely tied to employment and income. Education level attained is also highly correlated with health (CDC, Social, 2014). Higher levels of education are associated with a longer life expectancy, improved overall health and quality of life, health-promoting behaviors such as being physically active, not smoking and seeing a healthcare provider on a regular basis (CDC, Social, 2014). Generally, the more education one has, the better paying job one can secure. With better jobs come better benefits, including options for health insurance. This can directly affect one's ability to access regular healthcare, preventive services and screenings.

The SDOH areas that directly relate to this focus area are:

- **Economic Stability**
  - Poverty
  - Employment Status
  - Access to Employment
  - Housing Stability (e.g., homelessness, foreclosure)
- **Education**
  - High School Graduation Rates
  - School Policies that Support Health Promotion
  - School Environments that are Safe and Conducive to Learning
  - Enrollment in Higher Education
- **Neighborhood and Built Environment**
  - Quality of Housing

4B. Existing Conditions

Socioeconomic Status

The southeast portion of Fairfax County has a higher percentage of people living in poverty than the rest of the county. Income and education data are mixed between the two sites. When comparing the sites by zip code to the county as a whole, Site B and Site C have a higher unemployment rate, a lower median income, a higher percent of people living in poverty, a higher percent of people without a high school education and a lower percentage of persons with an Associate's degree or higher. Overall, residents at both sites are living at a lower socioeconomic status than the rest of the county.

The following table depicts the data on these socioeconomic factors, including comparisons to the state of Virginia as well as the U.S.:

Table 14: Socioeconomic Status

	United States	Virginia	Fairfax Co.	Site B By Zip (22306)	Mean Site B by Census Tracts	Site C By Zip (22309)	Mean Site C by Census Tracts
Unemployment rate	9.3%	6.9%	5.0%	6.2%	3.5%	5.4%	6.3%
Median household income	$53,046	$63,636	$109,383	$59,243	$77,242	$83,092	$71,312
Living in poverty	10.9%	7.8%	3.6%	9.0%	N/A	5.8%	N/A
Less than high school (all persons over 25)	14.2%	13.1%	8.4%	20.5%	16.9%	14.2%	20.2%
High school graduate only	28.2%	25.2%	13.3%	20.7%	18.0%	22.5%	27.7%
Some college	21.3%	20.2%	14.9%	19.0%	17.4%	18.1%	18.1%
Associate's degree or higher	36.2%	41.6%	63.3%	39.8%	47.6%	45.2%	33.9%

(US Census, 2014)

In addition, when looking at income by housing type and individual census tracts, median household income is lower than the county for residents near the two sites for some owners and renters. There is a large range, with the lowest owners' income of $59,784 in tract 4217.01 in Site C and the lowest renters' income of $59,784 in tract 4154.02 in Site B.

Table 15: Housing Data

Area	Census Tract	Total Income	Compared to County	Owners Income	Compared to County	Renters Income	Compared to County
Site B	4154.02	$107,545	102.0%	$125,833	99.8%	$15,987	24.7%
	4155	$97,309	92.3%	$141,439	112.2%	$30,867	47.7%
	4215	$45,943	43.6%	$65,938	52.3%	$34,307	53.0%
Site C	4160	$71,217	67.6%	$109,004	86.5%	$43,547	67.2%
	4216	$52,652	49.9%	$68,722	54.5%	$43,879	67.7%
	4217.01	$53,495	50.7%	$59,784	47.4%	$31,458	48.6%
Fairfax County Total		$105,416	N/A	$126,075	N/A	$64,767	N/A

(US Census, 2104)

Affordable Housing

Generally, affordable housing is defined as housing that costs less than 30% of income (US Department of Housing, Affordable, 2014). Households are considered burdened if paying more than 30 percent of income for housing. These families may have difficulty paying for necessities such as food, clothing, transportation and medical care. Mixed income housing is publically subsidized multifamily rental housing with a deliberate mix of income levels. A portion of these housing units must be affordable to households whose incomes are at least 60% below the median income for that area (Community, 2014).

According to the Fairfax County Comprehensive Plan (Fairfax County, Comprehensive, 2013) here are no current plans to add more mixed income housing at either site. Site B is in the Hybla Valley/Gum Springs Community Business Center, Land Units D-2, 3 and 4 and E. The Plan for Land Unit E says it may be redeveloped at 16-20 units per acre with 12.5% of the units as affordable housing. Current county policy defines "affordable" as for households with 70% of the area median income. The minimum requirement is for 12% of new multifamily units to be classified as affordable. Site C is in the South County Community Business Center, Land Units A and B-1, 2 and 3. Both Sites B and C have more renter-occupied housing than the rest of the county; Site B has more by zip code and by census tracts.

Table 16: Housing Type

Per household	United States	Virginia	Fairfax County	Site B By Zip (22306)	Mean Site B by Census Tracts	Site C By Zip (22309)	Mean Site C by Census Tracts
Percent owner occupied	65.5%	67.8%	69.7%	45.9%	52.1%	66.1%	56.9%
Percent renter occupied	34.5%	32.2%	30.3%	54.1%	47.9%	33.9%	43.1%

(US Census, 2014)

Currently, Site B has 3,100 housing units including 791 mobile homes and 1,207 subsidized apartment units Site C has 2,927 housing units, including 120 mobile homes (Fairfax County, Comprehensive, 2013). Forecasts for 2043 are 3,820 and 3,625 for Sites B and C respectively (Fairfax County, Integrated, 2013). Per the Fairfax County Comprehensive Plan, maximum housing potential for the two sites is 3,993 and 3,917, respectively. Collectively, Sites B and C have less than 3% of the housing units in the county, but over half of the mobile homes (911 out of 1,761).

Homelessness

The number of homeless people in Fairfax County has been on the decline since 2008. A point-in-time survey is conducted annually to capture the number of individuals and in families who are homeless on a given date. In 2008, the number was 1,835. In 2014, it was 1,225, a 33% decrease. The number decreased from 2013 to 2014 by 9%, from 1,350 to 1,225. As of January 29, 2014, the number of homeless people identified as in emergency shelter and transitional housing along the Richmond Highway Corridor totaled 243 (19.8% of the total homeless in the county).

- Single adults in emergency shelter, including hypothermia programs = 128
- Families in emergency shelter = 59 people in 21 families
- Families in transitional housing = 56 people in 21 families

This compares to the total number of 1,225 homeless countywide, with the breakdown as follows:

- Single adults in emergency shelter including hypothermia programs = 402
- Single adults in transitional housing programs = 54
- Single adults – unsheltered (some might be living along the Richmond Highway Corridor) = 66
- Single adults in Safe Haven = 8
- Families in emergency and overflow shelter = 265 people in 82 families
- Families in transitional housing = 430 people in 134 families

During FY13, there were 2,440 unduplicated entries into various homeless programs throughout the county. Of those, 203 people listed 22309 (includes Site C) and 186 listed 22306 (includes Site B) as the zip code of their last permanent housing (Fairfax County, Highlights, 2014).

4C. Impact Analysis

Employment and Education

The addition of the RHTC is projected to have a positive impact on employment and education opportunities due to potential increases in the number of local jobs, better access to jobs in the region, more bus routes, enhanced route availability and transit center accessibility.

In areas where there is enhanced transit, more people and especially people without access to a car are more likely to be employed (Kawabata, 2003; Blumenberg & Shiki, 2003; Hess, 2005). This tends to be more significant in large urban areas and for those with low-wage jobs. In addition, in areas where transit

is well connected and routes are well planned, enhanced job opportunities are typical for all levels of workers. When considering job access for lower income workers, proximity of residence to job-rich areas is a key to transit planning success. Communities along the Richmond Highway Corridor are near job-rich areas as part of the Metropolitan Washington DC region. For inner-city workers without access to cars, public transit service supports employment opportunities. If increased job accessibility along a specific corridor is the goal, then increased public transit along that corridor is a necessity (Tilahun & Fan, 2014). This is also key if job growth along the corridor is planned. The evidence shows that the RHTC alone may not be enough to decrease unemployment rates for all groups, but the enhanced transit access will allow for more opportunities for nearby residents.

A few studies have looked specifically at people on welfare programs, access to transportation, and employment. Ong and Houston (2014) found that for women on welfare, increased transit options near their homes increased employment and transit use for work. Other factors noted by the authors include overcrowding of buses and frequency of transit service (route scheduling). Another study found that policies that improved access to public transportation can positively affect employment in urban areas (Sanchez, 1999). However, it should be noted that other factors, such as racial discrimination, job training opportunities, and access to child care and other social service programs, also play a role in levels of employment (Sanchez et al., 2004). Planners need to consider route configuration, employment locations, level of service and overall cost to use transit to individuals who need or desire to use public transit.

Regarding education, Kenyon (2011) found lack of transportation to be a barrier to access and achievement to college. This was found to be true for traditional and non-traditional students. Transportation, including public transit, is a means to assist in successful participation in higher education. Suggestions to improve this access include increasing walkability to and from campuses, expanding public transit infrastructure and offering subsidies as needed. The addition of the RHTC will give residents more options for commuting to both jobs and places of higher education.

Housing

Affordable housing opportunities exist at both sites. However, Site B has more housing units and more subsidized units than Site C. Site B also has more renter occupied units than Site C. According to the Fairfax County Comprehensive Plan, there are no current plans to add more mixed income housing at either site. Currently, Site B has 3,100 housing units and Site C has 2,927 (Fairfax County, Comprehensive, 2013). Forecasts for 2043 are 3,820 and 3,625 for Sites B and C respectively. As per the county's comprehensive plan, maximum housing potential for the two sites is 3,993 and 3,917, respectively.

Research shows that property values near transit maintain their value better than other locations. When looking at TOD (transit-oriented development), one study found that homes closer to TOD sites sell for higher prices than those farther away, at least in San Francisco (Mathur & Ferrell, 2013). TODs are medium-high density mixed-use developments within a walking distance to a major transit station. The authors also cite several studies that show that homes that are closer to rail stations and transit lines, and that allow greater access to transportation, have an increased resale value.

A major report, The New Real Estate Mantra: Location Near Public Transportation, shows that homes near transit lost less value during the housing recession (2006-2011) and were more price-resilient (American Public Transportation, 2013). This was found to be true across all housing types and was more significant for homes near stations that had high transit access. Households near transit also saw lower transportation costs. The study examined 6 major metropolitan areas: Boston, Chicago, Minneapolis/St. Paul, Phoenix and San Francisco. High location efficiency (walkable and close to public transit and neighborhoods that have connected streets and good access to jobs and services also positively contribute to home values. An unintended consequence of increased home values could be increased rent and subsequent decreases in affordable housing. People in unaffordable housing are at increased risk of poor health, including hypertension and arthritis. Increased costs for housing and transportation can mean less money for healthcare, preventive services and other healthy behaviors (Pollack, et al. 2010). Planners and developers of the RHTC need to consider overall housing and transportation costs in the area when determining the cost to use the transit.

Overall, there is little evidence that shows that the number of homeless people in an area will be affected by the construction of a transit center. One concern is that buses and bus terminals are sometimes used by homeless people for day or overnight shelter (Nichols & Cazares, 2011). If this becomes an issue, those in need can be referred to appropriate social services and local homeless shelters.

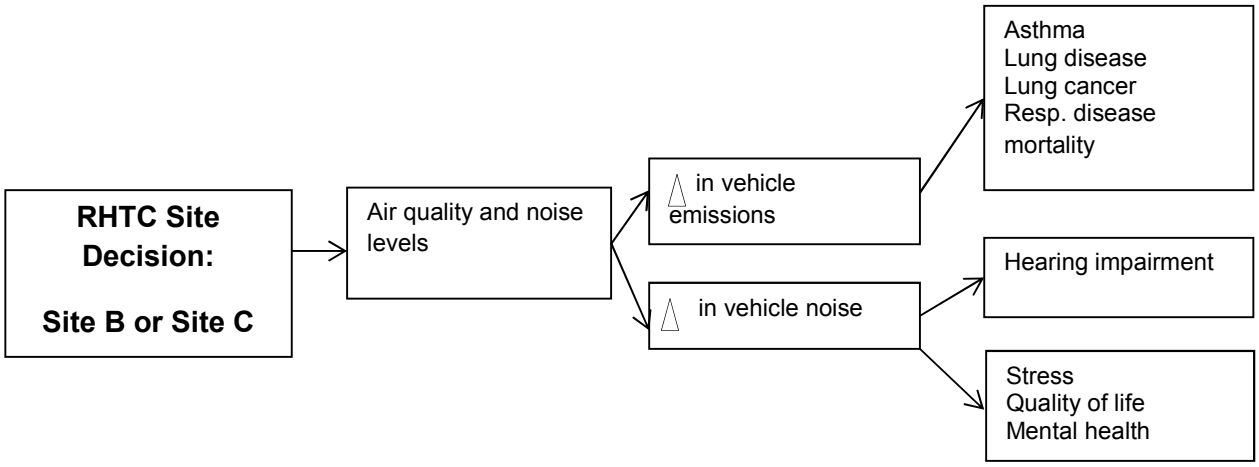
4D. Equity Considerations

Every aspect of the economy has the potential to affect health and health equity, including finance, education, housing, employment and transportation. While health may not be a prominent focus of policies in these sectors, they have strong impact on health and health equity. When looking at affordable housing, employment opportunities and access to educational institutions, there are many factors to consider. These include, but are not limited to, the social determinants of health (access to safe parks and sidewalks, appropriate social services, programs for those in poverty, public safety and the built environment).

Fairfax County residents who live within a 0.5 mile radius of both potential transit center sites are living at a lower socioeconomic status than the majority of the county. They have lower employment, lower income, lower education levels and more subsidized housing. The addition of the RHTC will not automatically improve these factors among all area residents. Planners need to consider route configuration, including proximity of routes to areas of greater employment need and educational opportunities when designing the transit schedules. These need to be designed to accommodate all levels of employment, including low wage jobs (Sanchez, 1999). The cost of public transit needs to be considered as well.

Focus Area 5: Air Quality and Noise Levels

Pathway Diagram



Recommendation

A new transit center at either site will likely maintain current air quality and noise levels. However, it is recommended that the following are considered by decision makers and planners:

- Monitor the air quality during construction as well as post-construction so federal standards are met. Use Clean Construction models from the EPA.
- Use clean diesel combustion engines and follow EPA guidelines for heavy-duty engines and vehicle standards.
- Monitor bus noise levels so as not to exceed 80 decibels.

Summary

Health Considerations

- Poor air quality contributes to respiratory disease, cancers, stroke, cardiovascular disease, premature death, asthma and other illnesses. Populations at higher risk for these conditions include children, older adults and those who are immunosuppressed. Common air pollutants include hydrocarbons, carbon monoxide, nitrogen oxides, sulfur oxides, mobile source air toxins and particulate matter.
- Noise pollution is also a health hazard. Hearing loss has negative effects on interpersonal communication, quality of life, and work-life balance as it disrupts speech and sleep, increases stresses, and reduces productivity in the workplace and in school. Excessive exposure to noise is often associated with adverse effects on mental health and the cardiovascular system. Noise can adversely affect short and long-term memory and sleep patterns, decreasing productivity in the workplace and school.

Existing Conditions

- Current air quality near the Richmond Highway Corridor is measured on a daily basis at a station on Franconia Road approximately 2 miles from the potential sites. Data was obtained for the daily maximum 8-hour average ozone for concentrations for the year 2013. Based on this data, the value for Franconia was 0.079 ppm, which does not meet the current EPA ozone standard of 0.075 ppm.
- For 2010-2012, Fairfax County ranked last in the state of Virginia for the health factor of physical environment, largely due to air pollution measures.
- For the chief complaint of asthma, the two zip codes that include the two transit center sites have a higher number of cases than any other zip code in Fairfax County (128 in 22306, Site B; 113 in 22309, Site C).
- There is no local data for lower respiratory disease and/or lung cancer for the two sites.
- Noise levels at the two sites are not currently monitored.

Impact Analysis

- The RHTC may increase air pollution if additional bus routes are added. However, the FCDOT is not projecting an increase in bus routes at this time. FCDOT reports that current buses meet air quality standards. In addition, FCDOT also reports that increased transit use generally reduces air pollution.
- If bus ridership increases and personal vehicle use decreases significantly, this could improve air quality at the site.
- Noise levels will not likely be impacted as buses in the current fleet meet noise standard levels.
- Asthma, respiratory disease and lung cancer rates will likely not change as a result of the RHTC.

5A. Health Considerations

Poor air quality contributes to respiratory disease, cancers, stroke, cardiovascular disease, premature death, asthma and other illnesses (Srinivasan et al., 2003). Populations at higher risk for these impacts include children, older adults and those who are immunosuppressed (US EPA, 2000). Transportation-related pollutants are one of the largest contributors to unhealthy air quality. Exposure to traffic emissions has been linked to many adverse health effects including exacerbation of asthma symptoms, diminished lung function, adverse birth outcomes and childhood cancer. Common transportation-related air pollutants include carbon monoxide, nitrogen dioxide and particulate matter. Ozone, formed when nitrogen dioxide and sunlight react, is also a common pollutant. Particulate matter and ozone are known respiratory irritants that can aggravate asthma alone or when combined with other environmental factors, such as pollen, smoke, temperature and humidity. Recent studies also suggest that particulate matter is a risk factor for cardiovascular disease (CDC, 2009).

The built environment (such as schools, parks, businesses, greenways and transportation systems) affects both individual health and environmental quality. For example, supporting bicycling as a primary mode of transportation increases physical activity and reduces pollution and accidents from motor vehicles (CDC, Healthy, 2014). In addition, Healthy People 2020 has specific objectives for air quality. These are to reduce the number of days the Air Quality Index exceeds 100 to increase the use of alternative modes of transportation to work (other than personal vehicles) and to reduce air toxic emissions. HP 2020 also lists several objectives for asthma. These include reducing asthma related deaths, asthma related hospitalizations and the number of missed days of work or school due to asthma.

In general, air pollution is reduced by strategies that decrease commute times and promote alternative modes of transportation other than automobiles and trucks (UCLA, Air, 2014). Public policy may be especially effective in reducing air pollution. Examples of this include smoke-free legislation, converting to less polluting fuels, improved vehicle efficiency and improved mass transit systems. Mass transit can improve service coverage, ease-of-use and provide an attractive, time-efficient alternative to automobile use for all community members, especially those with limited mobility options (e.g., the young and the elderly). Mass transit has the potential to provide stress-free travel and create opportunities for positive social interaction. Travel time to/from work, school, shopping and recreational opportunities can contribute to hazardous levels of air pollution. Travel time can be lessened through transit-oriented development and improvements in the effectiveness of public transportation systems.

A major source of urban noise is frequently attributed to mass transit as well as other motor vehicles (engine acceleration, horns, alarms, etc.) (UCLA, Noise, 2014). Noise from motor vehicles includes engine acceleration, tire and road contact, horns and alarms. The associated health outcomes from noise are considerable. Noise-induced hearing loss is a significant problem in urban areas. In addition to auditory damage, increasing attention is being paid to the non-auditory health effects of noise. Hearing loss has negative effects on interpersonal communication, quality of life and work-life balance as it disrupts speech and sleep, increases stresses, and reduces productivity in the workplace and in school. Excessive exposure to noise is often associated with adverse effects on mental health and the cardiovascular system. Noise can adversely affect short and long-term memory and sleep patterns, affecting productivity in the workplace and school.

The SDOH area that directly relates to this focus area is:

- **Neighborhood and Built Environment**
  - Environmental Conditions

5B. Existing Conditions

Fairfax County is located in Northern Virginia and falls within the greater Washington D.C Metropolitan Area. Some air quality data is available for the state or region and some is available at the local level. Air quality near the Richmond Highway Corridor is measured on a daily basis at a station on Franconia Road. Data was obtained for the daily maximum 8-hour average ozone for concentrations for the year 2013. The data represents the ozone monitoring period (April through October, 2013). The daily 8-hour max ozone is compared to the ozone standard (0.075 ppm) to evaluate any exceedance of the standard on a daily basis. There was only one exceedance in Franconia, on July 17. Another air quality parameter is called Design Value, which is a three-year average of the 4th highest daily 8-hour max ozone concentrations. If this value is above the current ozone standard of 0.075 ppm at any monitor, then the area represented by that monitor is said to be in non-attainment for the standard. Currently, based on draft 2011-2013 data, the design value for Franconia is 0.079 ppm, which is above the 0.075 ppm. Therefore, the Franconia Road area was not meeting the current ozone standard of 0.075 ppm (MWCOG, 2014).

For 2010-2012, Fairfax County ranked last in the state for Physical Environment, largely due to air pollution measures (University of Wisconsin, 2012). For the chief complaint of asthma, the two zip codes that house the potential transit center sites have a higher number of cases than any other zip code in Fairfax County (128 in 22306, Site B; 113 in 22309, Site C).

Table 17: Asthma Data

	United States	Virginia	Fairfax County (all zip codes)	Mt. Vernon Area	Site B 22306	Site C 22309
Mt. Vernon Hospital adults discharged for asthma	N/A	N/A	N/A	78 (in 2010)	N/A	N/A
Mt. Vernon Hospital adult ED visits for asthma	N/A	N/A	N/A	449 (in 2010)	N/A	N/A
Mt. Vernon Hospital children discharged with asthma	N/A	N/A	N/A	0.77% of pediatric cases	N/A	N/A
Asthma as ED chief complaint (in 2013)	N/A	N/A	1,684	N/A	128 cases	113 cases
Adult asthma prevalence (self-reported) (BRFSS, 2012)	13.45%	13.58%	N/A	N/A	N/A	N/A

(Verite, 2013; FCHD, 2014)

The current noise level at both sites is not measured on a regular basis.

5C. Impact Analysis

In a review article, Xia et al. looked at many benefits of increasing active and public transportation, including air quality, physical activity and economic factors (2013). The authors discuss that this area of research is still emerging, but that several studies show promising results; this includes decreasing the risk of chronic diseases. Morabia et al. found that using public transit for commuting to work increased individual energy expenditure (2010). They also found that depending on transit type, exposure to particulate matter may or may not be improved with a switch from car to public transit. Frank et al. found that the built environment, including transit accessibility, residential density and intersection density have positive impacts on both physical activity and reducing greenhouse emissions (2010). The authors point

out that reducing the distance between homes and common destinations can also decrease the amount of active travel due to the shorter distances. Decreased car use accounts for these differences.

In a study estimating the benefits of reduced car travel, Grabow et al. suggest that decreasing the number of short trips made in cars can have positive impact on both air quality and physical activity (2012). They also suggest a benefit to the economy from fewer related deaths and lower healthcare costs. Similar results were found by Maizlish, et al., 2013 and Dennekamp & Carey, 2010. These authors found reductions in cardiovascular disease, cardiorespiratory disease and diabetes from changing to walking or biking from driving cars and high-emission vehicles. They also found a reduction in greenhouse gas emissions with increased low-emission driving.

In a study that looked at several health variables related to increasing transit use and decreasing car use, Samimi & Mohammadian found significant improvements in general health, obesity, high blood pressure, high blood cholesterol and heart attack, but not on asthma due to increased transit use (2010). They also suggest that increased walkability can also help motivate people to be more active and maintain overall healthier lifestyles.

The RHTC has the potential to improve air quality if low-emission buses are used and the center creates enough increased ridership to reduce the number of vehicles on the road. However, other factors, such as overall traffic volume, wind patterns, and travel patterns can also have impacts on air quality. As stated previously, FCDOT reports that at Site B, there are no projections on a change in ridership specifically due to the proposed transit center. The most likely source of new riders would be the residential area adjacent to the north end of the site. For Site C, there are also no projections on a change in ridership specifically due to the proposed transit center, although ridership will likely increase if commuter parking is included as part of the project.

Current EPA guidelines on heavy duty engines and vehicles aim to reduce annual emissions of toxic air pollutants (US EPA, 2000). Expected health benefits due to the reduction include reduced coughing, chest pain, shortness of breath, emergency room visits for asthma and other respiratory problems. Modifications such as smoke-free legislation, converting from “dirtier” fuels (e.g., coal or diesel) to less polluting fuels (e.g., natural gas), improved vehicle fuel efficiency, improved mass transit systems to decrease automobile use, and making cargo logistics systems more efficient could all significantly reduce air pollution. Motor vehicles contribute to more than 50% of air pollution in urban areas. The design of communities and transportation systems impacts how often automobiles are used, how many automobile trips are taken and the length of those trips. Reducing automobile trips by increasing mass transit use, carpooling, walking and bicycling can help reduce air pollution, especially in urban areas.

Gouge, et al. found that operational control strategies, such as idling restrictions and route and bus scheduling, can impact health outcomes with regard to air quality (2013). This includes considering which buses are being used, at what times of the day and in what areas. In Fairfax County, current bus idling policy is that a bus may not idle for more than five minutes. If a bus has down time of more than five minutes, its engine must be turned off.

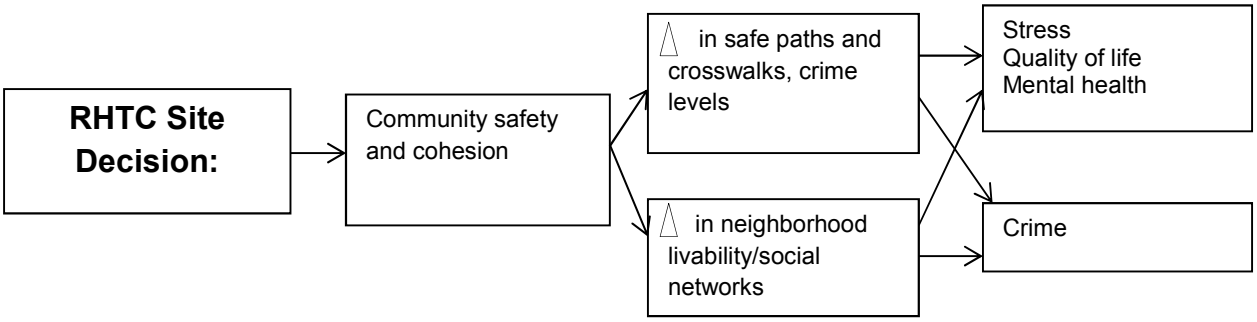
In a study of noise levels associated with New York City’s mass transit systems, Neitzel et al. found that noise levels were highest for subways and platforms than for buses (2009). They found that regular exposure to transit noise is associated with some hearing loss. A study by Tabacchi et al. in Madrid found similar results (2011). Recommended actions include regular transit maintenance and the use of quieter equipment. Bus noise was found to average between 70 and 80 decibels. This is the safe noise level that the guidelines specify for 24 hours of noise exposure (Berglund, et al. 1999). However, Xia et al. note that research in the area of noise reduction as a result of reduction in the number of vehicles on the road is lacking (2013).

5D. Equity Considerations

Fairfax County residents who live within a 0.5 mile radius of both potential transit center sites are living at a lower socioeconomic status than the majority of the county. They also bear higher burdens of some chronic diseases. Marshall et al. discuss the need to monitor lower income areas for unequal burdens of exposure to air pollution (2009). As changes to the built environment attempt to improve areas for walkability and mass transit, health outcomes for all groups affected need to be researched and documented. Disparities in asthma ED visits exist in the potential transit site areas. Additional data on other health disparities would have been beneficial to this study. The RHTC as it is currently planned will likely not impact the air and noise pollution around the areas at the two potential sites. Planners need to consider route configuration and timing, types of vehicles in use and the potential increase in ridership for future study. As stated earlier, attention must be paid to research and evaluation of how transportation projects benefit or disadvantage those at the lower end of the socioeconomic scale (Sanchez, 2008).

Focus Area 6: Community Safety and Cohesion

Pathway Diagram



Recommendation

A new transit center at either site will likely improve community safety and cohesion if the following are considered by decision makers and planners:

- Include safety features, such as lighting, security cameras, complete sidewalks and trails, crosswalks, crossing signals, police presence, bike racks and secure parking in the design of the RHTC.
- Solicit comments, suggestions and feedback from area residents before, during and after the site selection process and construction of the transit center.
- Develop and implement a marketing plan to inform area residents about the RHTC including information about safety features, access, cost and amenities.

Summary

Health Considerations

- Community safety (real and perceived) and community cohesion are directly related to health. Stress, hypertension, anxiety, depression and overall mental health are related to neighborhood factors such as poor building conditions, perceptions of crime, litter, overcrowding, vandalism and lack of green space.
- Involving community members in the planning, design and building phases of a development project increases community cohesion, feelings of neighborhood identity, and a sense of belonging.

Existing Conditions

- A key informant interview revealed the following:
  - Community members feel safe and secure (adults and youth). However, at Site B, there is some concern about the parking lot adjacent to the Walmart. This is an undeveloped lot that has the perception of attracting crime.
  - Children and seniors utilize existing community resources and services, such as after school programs, meals on wheels, board and civic associations and various spaces for neighborhood events.
  - On a scale of 1 to 10, 10 being the highest, community cohesion ranks between 8 and 10
  - There are 15 to 20 locally owned businesses around Site B. Information for Site C was not available. There are 11 businesses at Site B which would be have to be demolished/relocated to make room for the RHTC.
  - While it is difficult to know how many people walk to local stores, it is estimated to be at least 50%.
  - It is estimated that 10% to 30% of residents participate in community organizations but that only 2 to 3% are involved in planning and development activities.
- Forty-six percent of survey respondents in the Fairfax Health District identified low crime and/or safe neighborhoods as strengths of the community, as compared to only 33% of respondents in 22306, and 29% of respondents in 22309.
- Twenty-two percent of survey respondents in the Fairfax Health District identified programs, activities, and support for youth, teens and seniors as a strength of the community, as compared to 27% of respondents in 22306 and 30% of respondents in 22309.
- The Mount Vernon area is characterized by higher crime than other areas of the county. In 2010 and 2011, the Mt. Vernon District Station reported 6,098 and 6,382 criminal offenses. It was one of only two stations in Fairfax County with an increase from 2010 to 2011. Mt.Vernon District Station had a 4.7% increase and the Sully District Station had a 2% increase. The Franconia District Station had similar numbers to Mt. Vernon District Station, with 6,230 in 2010 and 5,988 in 2011.
- For crimes against persons, the Mt. Vernon District Station has more assaults than any other station (there are eight stations in the county). There are not significant differences in homicides, kidnapping/abductions and sex offenses between Mt. Vernon District Station and the next highest station(s).
- Total crimes against property were highest in the Mt. Vernon District Station, as compared to the other stations.
- Site C has a lower (better) average connectivity measurement and therefore would be the site with the most direct routes to access the transit center. However, Site C also has the highest individual connectivity measurement for the one of the analyzed sites.

Summary
Impact Analysis
• There is little evidence that building the transit center will impact community safety or cohesion. Safety features that encourage the use of the facility, such as lighting, security cameras, complete sidewalks and trails, crosswalks, crossing signals, bike racks and secure parking, may have more of an impact if residents are made aware of such features. • The building of the RHTC will likely improve community cohesion if residents are engaged and active participants in the process.

6A. Health Considerations

Community safety (real and perceived) and community cohesion are directly related to health. Stress, hypertension, anxiety, depression and overall mental health are related to neighborhood factors such as perceptions of crime, litter, overcrowding, vandalism and lack of green space (Hill et al., 2012; Chandola, 2001; Ziersch, et al., 2007). People who feel safe report less psychological distress (Booth et al., 2012). These factors, along with others, such as access to parks and sidewalks, social support, poverty, public safety and the built environment are examples of social and physical determinants of health (CDC, Social, 2014). These determinants are linked to a wide range of health and quality of life outcomes and risks. They also partially explain why some people are healthier than others.

The SDOH areas that directly relate to this focus area are:

- **Economic Stability**
  - Housing Stability (e.g., homelessness, foreclosure)
- **Education**
  - School Environments that are Safe and Conducive to Learning
- **Social and Community Context**
  - Social Cohesion
  - Perceptions of Discrimination and Equity
  - Civic Participation
- **Neighborhood and Built Environment**
  - Crime and Violence
  - Environmental Conditions

6B. Existing Conditions

A key informant interview (Lloyd Tucker) was utilized to gather information about community safety and cohesion. The Region 1 Manager with the Fairfax County Department of Neighborhood and Community Services is responsible for coordinating a range of human services for residents of southeastern Fairfax County. Regional Managers facilitate the development of programs, including enhancements to existing offerings and addressing gaps in services. They are experts in engaging the community about environmental changes and infrastructure development along the Richmond Highway Corridor. The Region 1 Manager reported:

- Generally, community members feel safe and secure (adults and youth). However, at Site B, there is some concern about the parking lot adjacent to the Walmart. This is an undeveloped lot that has the perception of attracting crime. Most people feel like they have a good relationship with local police.
- Many children and seniors utilize existing community resources and services, such as after school programs, meals on wheels, board and civic associations and various spaces for neighborhood events.
- On a scale of 1-10, 10 being the highest, community cohesion ranks between 8 and 10. People feel connected to their family and friends, and even neighbors they do not know very well.

- Of the many businesses in the area, 15 to 20 are locally owned around Site B. Information for Site C was not available. There are 11 businesses at Site B which would be relocated to make room for the RHTC. Members of the West African community and the Murraygate neighborhood feel very connected to these businesses.
- While it is difficult to know how many people walk to access local stores, it is estimated to be at least 50%.
- It is estimated that 10 to 30% of residents participate in community organizations but that only 2-3% are involved in planning and development activities.

As a part of the Mobilizing for Action through Planning and Partnerships (MAPP) process, a Community Health Survey was conducted in 2010 to gather opinions about community strengths, health-related issues and areas for improvement (Fairfax County, Community, 2010). Data from the survey suggest that residents in Site B (22306) feel less safe than those in Site C (22309). Residents from both of these areas felt less safe compared to the county at large. However, more residents in both areas felt that programs, activities and support services were a strength of their community compared to the county overall.

- Safety: 46% of respondents in the Fairfax Health District identified low crime or safe neighborhoods as a strength of the community, compared to only 33% of respondents in 22306,and 29% of respondents in 22309.
- Programs: Only 22% of respondents in the Fairfax Health District identified programs, activities, and support for youth, teens and seniors as a strength of the community, as compared to 27% of respondents in 22306 and 30% of respondents in 22309.

Crime data from the Fairfax County Police Department was utilized to assess current crime levels. The Mount Vernon area is characterized by higher crime than other areas of the county. In 2010 and 2011, the Mt. Vernon District Station reported 6,098 and 6,382 criminal offenses, respectively. It was one of only two stations in Fairfax County with an increase from 2010 to 2011. Mt. Vernon District Station had a 4.7% increase and the Sully District Station had a 2% increase. The Franconia District Station had similar numbers to Mt. Vernon District Station, with 6,230 in 2010 and 5,988 in 2011 (Fairfax County, Police, 2012).

Table 18: Crimes Against Persons and Property

Crimes against persons and property, 2011 and 2012		All Fairfax County	Mt. Vernon Station District	Highest (or next highest) Station	Lowest Station
Homicides	2011	11	2	2 (3 others stations)	0 (1 station)
	2012	16	1	2 (4 stations)	0 (1 station)
Assaults	2011	7,819	1,407	1,266	678
	2012	7,786	1,527	1,158	624
Kidnapping/Abduction	2011	129	22	28	7
	2012	142	24	33	9
Sex offenses	2011	302	52	48	24
	2012	304	50	54	20
Crimes against property	2011	26,983	4,176	4,051	2,304
	2012	26,334	3,999	3,946	2,085

(Fairfax County, Police, 2014)

There are eight Fairfax County Police Department District Stations. For crimes against persons, Mt. Vernon District Station has more assaults than any other station. There are not substantial differences in homicides, kidnapping/abductions and sex offenses between Mt. Vernon District Station and the next

highest station(s). Total crimes against property were highest in the Mt. Vernon District Station compared to the other stations.

Regarding connectivity, the pedestrian route directness calculation best measures connectivity and reflects minimizing trip distance and route directness. Pedestrian route directness is a ratio of route distance to straight line distance for two points. The calculation is simple: distance of the most direct route/straight-line distance. The resulting connectivity measurement for ideal connectivity would be 1. In other words, the closer the connectivity measurement is to 1, the better the connectivity. For this project, classic Google Maps was used because it has a Map Labs distance measurement tool for straight-line distance. The tool was used to measure distances from Site B and Site C to points to the east and west within the quarter mile and half mile buffer.

Table 19: Neighborhood Connectivity

	Site B	**Site C**
East half mile	2.03	1.19
East quarter mile	1.5	1.25
West half mile	1.8	2.61
West quarter mile	2.27	1.16
Average	**1.9**	**1.55**

(Green, 2014)

Site C has a lower average connectivity measurement and therefore has the most direct routes to access the transit center. However, Site C also has the highest individual connectivity measurement for the west half mile location. Therefore, Site C is considered to have the overall best pedestrian directness within the 0.5 mile radius.

6C. Impact Analysis

Foster et al. found that residents feel safer in neighborhoods with more walkability (2010). The authors discuss several factors that can address safety concerns, including planning and land-use policies that encourage walking and social contact. In a study looking at quality of housing and local conditions, Austin et al. found that deteriorating neighborhood conditions negatively affected perceptions of safety. Recommendations for planners to help increase perceptions of safety included increasing efforts to maintain and rehabilitate neighborhoods, including safety features such as lighting and open areas (2002).

In a review article, Loukaitou-Sideris emphasized the importance of safety and security on walking (2006). She discusses how neighborhood surroundings and the built environment are related to safety, crime and traffic danger. These are important considerations when trying to encourage more walking and public transit use. Datar et al. found a weak association between parental perceptions of safety and physical activity levels of children (2013). Children of parents who had higher levels of perceived fear of safety were less active and watched more television that others. Social and environmental supports for physical activity are important, as well. Addy et al. found that safe sidewalks, good lighting and trusted neighbors increased the likelihood of feelings of safety within a community and thus increased levels of physical activity (2004).

In a study looking at social networks and their relationship to perceived safety, males reported feeling more safe with smaller social networks (DeJesus et al., 2010). The authors looked at low income housing and found that social networks did not contribute to the feeling of safety as much for women. Additional factors influencing perceived safety include education level, birth country and first languages other than English. There is little evidence that building the transit center will impact community safety or cohesion. Safety features that encourage the use of the facility, such as lighting, security cameras, complete sidewalks and trails, crosswalks, crossing signals, bike racks and secure parking, may have more of an impact if residents are made aware of such features. Another safety consideration is that buses and bus terminals are sometimes used by homeless people for day or overnight shelter (Nichols & Cazares,

2011). If this becomes an issue, those in need can be referred to appropriate social services and local homeless shelters.

Welch found that connectivity needs to be incorporated in planning, not just distance. Transit centers can be close to residential areas, but perhaps not as connected as they could be. This is an important issue when considering equity of transit as well (2013). In a review article looking at older adults, Rosso et al. found that higher mobility resulted from increased street connectivity, street safety measures and proximity to retail, parks and green spaces (2011). Although RHTC is not full scale TOD, there is some research that shows that transit development in an area often leads to increased levels of trust and connections with neighbors (Kamruzzaman et al., 2014). In an article looking at "good" neighborhoods, features such as walkability, proximity to a variety of places, safe intersections, complete sidewalks and access to transit were all listed as desirable (Miles & Song, 2009). Specifically, safety and walkability were cited as key components to enhancing feelings of neighborhood identity and a sense of belonging. Forsyth et al. found that by involving community members in planning and decision making, neighborhood values as well as government goals can be honored (2010). The study describes a collaborative process used during planning, designing and developing increased affordable housing. The collaborative process helped to give voice to community members, which in turn increased feelings of community cohesion. The building of the RHTC will likely improve community cohesion if residents are engaged and active participants in the process.

6D. Equity Considerations

The Mt. Vernon Station has more crime than other areas of Fairfax County. Fairfax County residents who live within a 0.5 mile radius of both potential transit center sites are living at a lower socioeconomic status than the majority of the county. Because of this, residents are at increased risk for continued disparities in many areas, including housing, crime levels, real and perceived safety, social cohesion and other environmental factors. The RHTC will not, by itself, improve the socioeconomic status of area residents. Planners need to consider safety features, access issues and community engagement as essential to the project process.

IX. Methodology and Limitations

For Census data (American Fact Finder), the data is presented by zip code and census tract areas. For census tracts, raw numbers were used to calculate overall percentages. Using the raw numbers, the mean (average) was calculated for the two sets of census tracts for Sites B and C as listed below.

- Site B: Zip code 22306; Census tracts 4154.01, 4154.02, 4155, 4215(census tract 4216 was excluded from Site B because only one street from that census tract falls in the 0.5 mile radius of Site B).
- Site C: Zip code 22309 ; Census tracts 4160, 4216, 4217.01, 4217.02, 4218.

For the measure of neighborhood connectivity, a calculation was used based on the idea that long blocks and few intersections may cut down on the destinations that can be reached via foot or bicycle (http://activelivingresearch.org). The study, by Dr. Jennifer Dill of Portland State University, found that the pedestrian route directness calculation best measures connectivity and reflects minimizing trip distance and route directness. Pedestrian route directness is a ratio of route distance to straight line distance for two points. The calculation is distance of the most direct route/straight-line distance. The resulting connectivity measurement for ideal connectivity would be 1. However, this will rarely occur. The closer the connectivity measurement is to 1, the better the connectivity.

To measure connectivity, Google Maps was used because it has a built in measurement tool in the classic version. The most direct route distance was the distance calculated by classic Google Maps. For the straight-line distance, classic Google Maps has a Map Labs distance measurement tool. The tool was used to measure distances from Site B and Site C to points to the east and west within the quarter mile and half mile buffer. This tool requires clicking on the two points to calculate the distance; therefore, some variability is to be expected due to human error.

Site B Calculations: For Site B, the designated address was 7842 Richmond Highway, Alexandria, VA 22306. To the east, the designated half mile buffer intersection was Silverado Place and Pantano Place. 1.3 mile direct route/0.64 mile straight line route = 2.03. To the east, the designated quarter mile buffer intersection was Stork Road and Pelican. 0.6 mile direct route/0.4 mile straight line route = 1.5. To the west, the designated half mile buffer intersection was Holland Road and Hinson Farm Road. 0.9 mile direct route/0.5 mile straight line route = 1.8. To the west, the designated quarter mile buffer intersection was Fordson Court and Fordson Road.0.5 mile direct route/0.22 mile straight line route = 2.27.

Site C Calculations: For Site C, the designated intersection was Gregory Drive and Richmond Highway. To the east, the designated half mile buffer intersection was Wyres Street and Glen Street.0.5 mile direct route/0.42 mile straight line route = 1.19. To the east, the designated quarter mile buffer intersection was Cedar Lake Court and Lake Park Drive. 0.6 mile direct route/0.48 mile straight line route = 1.25. To the west, the designated half mile buffer intersection was Mt. Zephyr Street and Mt. Zephyr Drive. 0.6 mile direct route/0.23 mile straight line route = 1.25. To the west, the designated quarter mile buffer intersection was Gateshead Drive and Radford Avenue. 0.8 mile direct route/0.69 mile straight line route = 1.16.

Calculations: Neighborhood Connectivity

	Site B	**Site C**
East half mile	2.03	1.19
East quarter mile	1.5	1.25
West half mile	1.8	2.61
West quarter mile	2.27	1.16
Average	**1.9**	**1.55**

(Green, 2014)

There are some limitations to the HIA. The most significant limitation was the compressed timeframe in which the HIA was conducted. Use of the rapid HIA model and the grantor's project period required that all steps of the HIA process be completed between January 2014 and June 2014. This timeframe did not allow for the level community engagement and data collection as would have been ideal. There were also some challenges in obtaining quantitative data at the community and census tract levels. For some focus areas, data at this community level was available and utilized. However, in other cases, zip code data, county or state level data as well as some qualitative data were used. This caused some analysis to be based more strongly on the literature review as opposed to quantifiable existing conditions in the areas of study.

Another limitation to conducting this HIA was the challenge faced in the evolving site design and selection process. One of the sites identified for analysis was deferred from consideration near the end of the HIA project period. At the time of this report, FCDOT was no longer pursuing Site B as a potential alternative for the RHTC. However, they were continuing to consider Site C, as well as researching additional site alternatives more centrally located near Site B. The HIA team believed that the data, impact analysis, and recommendations identified through the HIA project could still be useful to help inform the final site location decision. However, the study will likely need to be updated depending on the location of alternative sites under consideration.

X. Conclusions

The goals of the RHTC project are to support revitalization and transportation objectives for the Richmond Highway Corridor, enhance existing bus services, allow more flexibility to transit users, reduce single occupancy vehicle traffic, encourage public transportation, and foster economic development along the corridor. The RHTC HIA was conducted in an effort to inform the site selection process for the center and discuss the health impacts of the site location on local community residents. The RHTC HIA process followed national standards, frameworks and practices in the HIA field. The findings and recommendations were based on literature review, best practices, stakeholder input, key informant knowledge and existing health, demographic and built environment data in the 0.5 mile radius areas of both potential sites.

Overall, the HIA findings show the RHTC has the potential to positively impact the health of residents living near both potential transit sites. Considerations, such as improvements to pedestrian and bicycle facilities, could serve to greatly advance the new transit center's impact on health through improving walkability; increasing access to opportunities for physical activity; improving access to employment and educational opportunities; reducing vehicle, pedestrian and bicycle traffic fatalities and injuries; and improving neighborhood safety and security. Recommendations for the RHTC were developed to advance health outcomes and mitigate negative impacts for communities along the Richmond Highway Corridor.

The RHTC HIA is an example of a Health in All Policies (HiAP) approach to policy and decision making. Health in All Policies is a collaborative approach to improving the health of all people by incorporating health considerations into decision-making across sectors and policy areas. The goal of HiAP is to ensure that decision-makers are informed about the health, equity and sustainability consequences of various policy options during the policy development process. A HiAP approach identifies the ways in which decisions in multiple sectors affect health, and how better health outcomes can support the goals of these multiple sectors. It engages diverse governmental partners and stakeholders to work together to promote health, equity and sustainability, and simultaneously advance other goals, such as promoting job creation and economic stability, transportation access and mobility, a strong food system, and educational attainment. There is no one "right" way to implement a HiAP approach, and there is substantial flexibility in process, structure, scope and membership.

The HIA process was very educational for all team members and demonstrates collaboration across agencies to benefit the Fairfax community. The Health Department and the Department of Transportation came together on a project to study how a transit center would potentially affect the health of a community. This was the first time for such a process in Fairfax County. Staff from both agencies look forward to continued collaboration on this project and future projects.

XI. References

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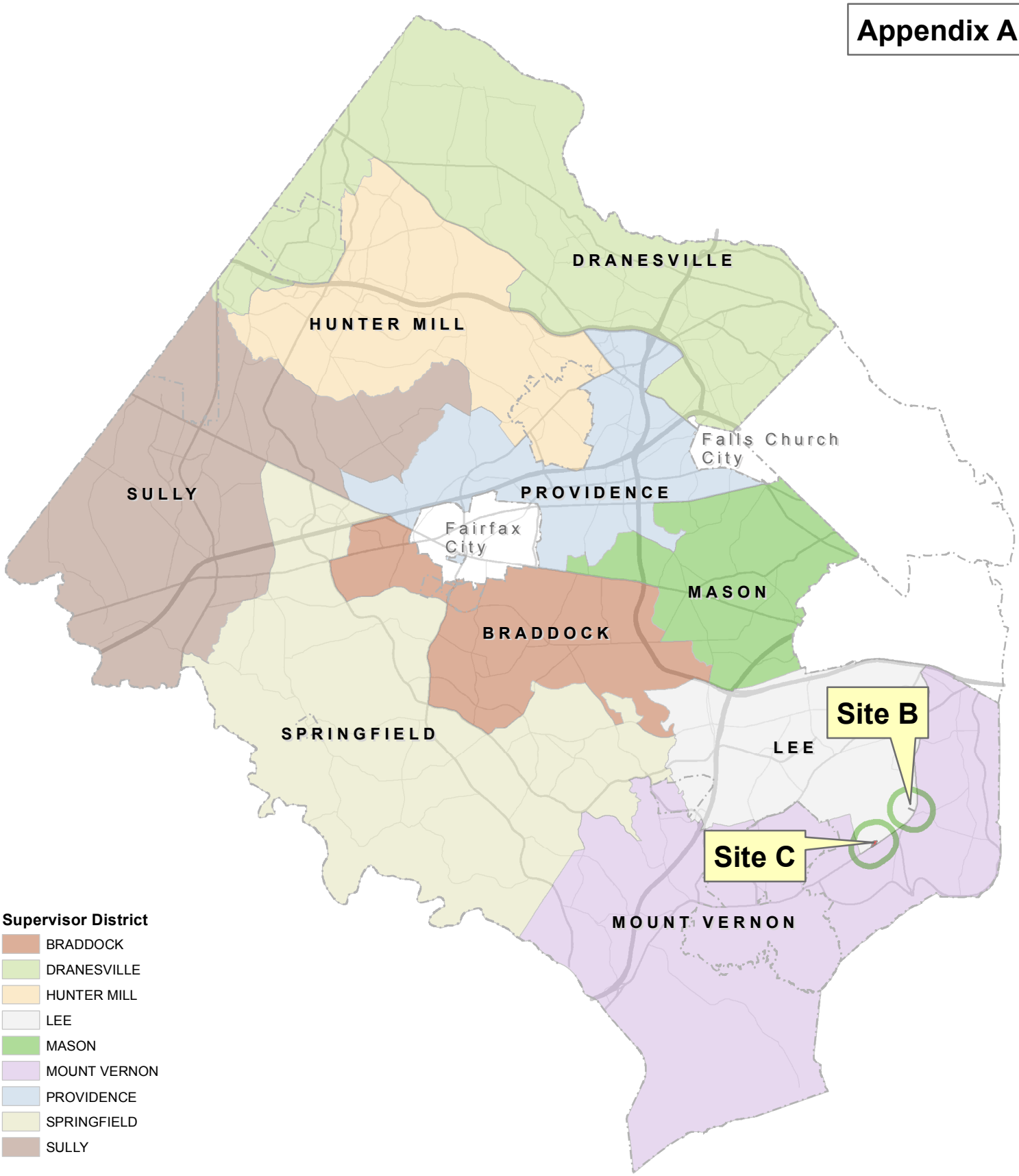
XII. Appendices

A. Map: Fairfax County Supervisor Districts
B. Project Charter
C. Pathway Diagram
D. Scoping Worksheet
E. Map: Site B Area of Study
F. Map: Site C Area of Study
G. Map: Zip Codes
H. Map: Human Services Regions
I. Map: Fairfax County Public Schools High School Attendance Areas
J. Map: Census Tracts
K. Map: Fairfax County Police Department Mount Vernon District Station Service Area

Appendix A



FAIRFAX COUNTY SUPERVISOR DISTRICTS
Richmond Highway Transit Center
Health Impact Assessment

N

0 2.5 5 Miles

Legend

- Potential Transit Center Site
- 0.5 mile radius

Richmond Highway Transit Center
Health Impact Assessment
Project Charter

Appendix B

I. Purpose

A Health Impact Assessment (HIA) is a six-step method that incorporates data, research, and stakeholder input to determine a policy or project's impact on the health of a population. This process proactively takes into account the health implications of decisions to avoid harmful health impacts, support positive health outcomes, and promote health equity. An HIA can guide policy makers, governmental partners, and community stakeholders in the decision-making process by examining the health impacts of a project and offering recommendations to monitor and manage potential health effects.

II. Background

Encouraging economic revitalization of the Richmond Highway Corridor has been a goal of the Fairfax County Board of Supervisors (BOS) for many years. Richmond Highway is an important artery that connects major commercial, residential, and recreational points in Northern Virginia. The proposed Richmond Highway Transit Center (RHTC) would enhance existing bus services currently provided by the Fairfax County Department of Transportation (FCDOT) and Washington Metropolitan Area Transit Authority along the Richmond Highway Corridor. Since 2011, FCDOT has analyzed 30 potential transit center sites, and a conceptual design study is currently underway on the top sites. A stakeholder design charrette, public informational meeting, and subsequent stakeholder coordination has helped to identify the two most viable alternatives for further study.

III. Focus Areas

Through collaboration with governmental partners and community stakeholders, the HIA will examine the health benefits and impacts of locating the transit station at each of the two sites to inform the decision-making process. Although the potential benefits of a new transit center are numerous, stakeholders need more information about the potential effects of the transit center in the following areas:

1. Mobility along the corridor, including public transit options and opportunities for safe active travel;
2. Access to goods and services, including healthy food options, healthcare, and community services;
3. Access to places for physical activity, including open space, playgrounds, parks, and recreational facilities;
4. Availability of affordable housing, employment opportunities, and educational institutions;
5. Environmental conditions, including air quality and noise levels;
6. Community safety and cohesion, specifically as it relates to the relocation of businesses.

IV. Work Plan

Due to challenges with regard to the evolving site design and selection process, some start and finish dates were modified during the project period; original planned dates are in black and revised actual dates are in red.

#	WORK PLAN	START	FINISH
1.	**Screening:** Identifying the need and value of HIA. Discussions were held between FCHD and FCDOT and the grant application was developed.	Nov 2013	Dec 2013
2.	**Scoping:** Determining which health impacts to evaluate, analysis methods, and a work plan. Scoping will take place through engagement with governmental partners and community stakeholders. During this phase, stakeholders will identify health issues, research questions and methods, and process evaluation questions for the HIA. Pathway diagrams agreed upon by stakeholders will show the anticipated outcomes of the RHTC Project and aid in the prioritization of areas for analyses.	Jan 2014 Feb 2014	Feb 2014 March 2014
3.	**Assessment:** Gathering data to develop a profile of existing health conditions and an evaluation of potential health impacts. Assessment will involve data collection to describe the health outcomes and populations affected by the proposed transit center sites and revised design proposals. An impact analysis will be conducted based on empirical research and literature review.	Feb 2014 March 2014	March 2014 May 2014
4.	**Recommendations:** Identifying strategies to mitigate negative and maximize positive health impacts. In collaboration with governmental partners and community stakeholders, evidence-based recommendations will be developed to address the identified impacts. Additional revisions to site designs will be incorporated.	March 2014 June 2014	March 2014 June 2014

#	WORK PLAN	START	FINISH
5.	**Reporting:** Developing and communicating findings and recommendations.	Apr 2014 May 2014	July 2014 Aug 2014
	• Initial HIA findings shared with FCDOT, DHCD, FCPA, and other stakeholders.	April 2014 Jun 2014	April 2014 Jun 2014
	• Community engagement activities to share HIA results and gather community input on the alternatives for the transit center.	May 2014 Post Grant	May 2014 Post Grant
	• FCDOT will make a recommendation for site selection to the BOS for their approval.	June 2014 Post Grant	July 2014 Post Grant
	• Finalize a publicly-accessible written report to include the HIA participants, the process, the data analyses, the impacts, and the corresponding recommended actions to be taken.	Jun 2014	Jul 2014 Aug 2014
6.	**Monitoring and Evaluation:** Tracking the progress and effects of the HIA.		
	• Process outcomes: How was the HIA conducted?	Jan 2014	Jul 2014 Aug 2014
	• Short term outcomes: Did the HIA influence the decision-making and the site selection process?	May 2014 Post Grant	July 2014 Post Grant
	• Intermediate outcomes: Were the recommendations implemented?	Jul 2014 Post Grant	Project completion
	• Long Term outcomes: Did the project affect health outcomes?	Post project completion	Post project completion

V. Resources

Organization	Resources
National Association of County and City Health Officials (NACCHO)	A NACCHO Health Impact Assessment Project Grant was awarded for the period of January through June 2014. The grant provides technical assistance, and $14,487 for a FCHD part-time staff position to conduct an HIA. The grant aims to increase local expertise in HIA, and improve community design and built environment decisions by including health considerations in the process.
Partnership for a Healthier Fairfax (PFHF)	PFHF has developed a Community Health Improvement Plan to enhance the health of the community. One of the priority issues outlined in the plan is to promote healthy and safe physical environments. Conducting an HIA was one of the strategies discussed as a component of their Health in All Policies (HiAP) efforts. This project has the support of the PFHF members who will participate and mobilize resources as needed.
Virginia Department of Health (VDH)	A VDH Healthy Eating and Active Living Grant was awarded to increase knowledge of and support for the HiAP approach among government leaders in Fairfax County. The project period for the grant is January through September 2014, which aligns with the timing of the HIA. The RHTC HIA will be used as a relevant local example of how health considerations can inform policy making.

VI. Roles and Responsibilities

Project Sponsors	Role
Dr. Gloria Addo-Ayensu, Director, FCHD	Project guidance and oversight
Tom Biesiadny, Director, FCDOT	Project guidance and oversight

Project Team	Responsibilities
Fairfax County Health Department	
Marie Custode, Strategic Planner	HIA project management
Sara Pappa, HIA Project Coordinator	HIA project coordination, including gathering data and research, convening stakeholders, analyzing the findings, developing recommendations, and writing the report
Sherryn Craig, Health Planner	Data analysis, research, and writing
Adrian Joye, Environmental Health Specialist	Geographic information system analysis

Project Team	Responsibilities
Shawn Kiernan, District Epidemiologist	Data analysis
David Lawrence, Environmental Health Specialist	Data analysis, research, and writing
Pieter Sheehan, Director, Environmental Health	Technical assistance and review
Robin Wilson, Public Health Analyst	Data analysis, research, and writing
Fairfax County Department of Transportation	
Arpita Chatterjee, Transportation Planner II	Traffic analysis, long range planning, technical assistance and review
Michael Guarino, Transportation Planner IV	RHTC project oversight and management
Caijun Luo, Transportation Planner III	RHTC project management and coordination
Douglas C. Miller, Environmental Program Coordinator	Technical assistance and review
Randall White, Transportation Planner III	Transit data and projections, transit (including bus) facility needs, oversight and review
Additional Members	
Sharon Arndt, Project Director, Community Transformation Grant, Neighborhood and Community Services	Cross-system integration of Health in All Policies
Christine Green, Co-Chair, Healthy and Safe Physical Environment Priority Team, PFHF	Technical assistance and review
Linda Hollis, Co-Chair, Healthy and Safe Physical Environment Priority Team, PFHF	Technical assistance and review
John Payne, Deputy Director, Housing and Community Development	Technical assistance and review
Patricia S. Rosend, Engineer II, Park Authority	Technical assistance and review

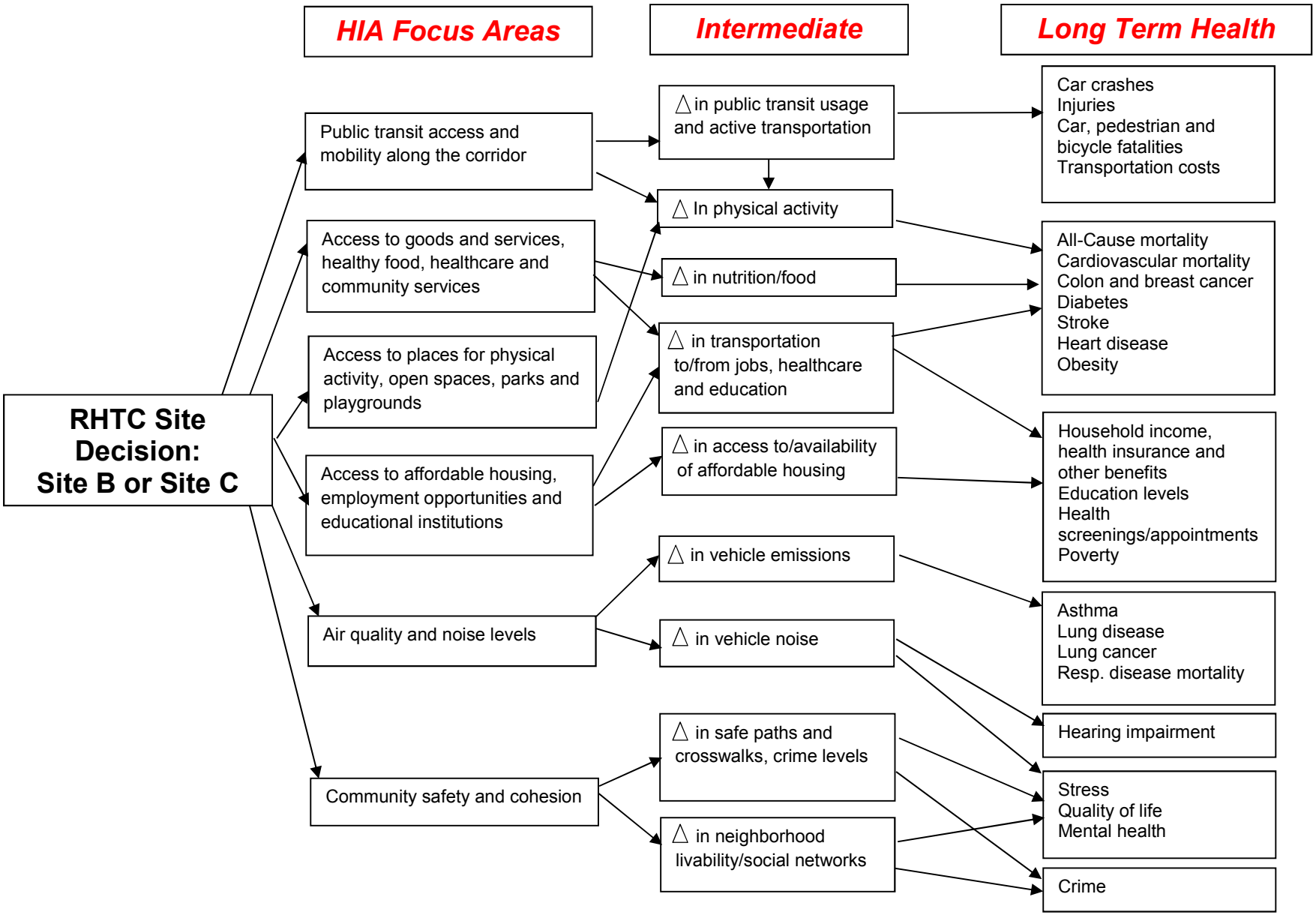
Technical Assistance
David R. Bowden, Director, Planning and Development, FCPA
Victoria Cardoza, CTG Project Analyst, NCS
Stuart Freudberg, Senior Director, Environment, Public Safety and Health, MWCOG
Elizabeth A. Hagg, Deputy Director, Office of Community Revitalization
Andrew M. Kolaitis, Right of Way Project Coordinator, FCDOT
Karyn L. Moreland, Chief, Capital Projects, FCDOT

Technical Assistance
Kimberly M. Rybold, Planning and Zoning
Charlie Strunk, Bicycle Coordinator, FCDOT
Eric Teitelman, Chief, Capital Projects and Operations, FCDOT
Lloyd Tucker, Region 1 Manager, Regional Services and Center Operations, FCDNCS
Chris Wells, Pedestrian Coordinator, FCDOT

Additional Stakeholders
Supervisor Jeff McKay, Fairfax County Board of Supervisors, Lee District
Supervisor Gerald Hyland, Fairfax County Board of Supervisors, Mt. Vernon District
Joan Clark, Supervisor McKay's office
Latrice Wallace, Supervisor Hyland's office
Pat Harrison, Deputy County Executive, Fairfax County
Rob Stalzer, Deputy County Executive, Fairfax County
Fairfax County Redevelopment and Housing Authority
Lee District Association of Civic Associations
Lee District Land Use Committee
Mount Vernon Council of Citizens' Associations
Mount Vernon-Lee Chamber of Commerce
South County Task Force for Human Services
Southeast Fairfax Development Corporation
VOICE (Virginians Organized for Interfaith Community Engagement) for Justice
Housing/apartment communities including (but not limited to): Audubon Community, Penbrook Village, Pinewood South, Murraygate, Gum Springs Village

RHTC Site Decision Draft Pathway

Appendix C



Appendix D

Project: Richmond Highway Transit Center; Site Decision Scoping Worksheet		
HIA Focus Area	**Mobility along the corridor, including public transit options and opportunities for safe active travel**	
Existing Conditions Research Questions	**Impact Research Questions**	**Indicators**
What is the baseline public transit ridership in the community?	How will the RHTC affect public transit ridership in the community?	Current ridership Current car ownership Personal vehicle miles traveled
What is the baseline time spent in traffic? Avg. commute time?	How will the RHTC affect the number of hours spent in traffic?	Traffic volume Number of trips during peak hours
What is the baseline data on car crashes and related injuries and fatalities?	How will the RHTC affect the number of car crashes and related injuries and fatalities?	Number of car crashes within .5 mile radius Number of car crash related injuries and fatalities within .5 mile radius
What is the baseline data on pedestrian and bicycle crashes and related injuries and fatalities?	How will the RHTC affect the number of pedestrian and bicycle crashes and related injuries and fatalities?	Number of pedestrian and bicycle crashes within .5 mile radius Number of pedestrian and bicycle crash related injuries and fatalities within .5 mile radius
What are household transportation costs?	How will the RHTC affect average household transportation costs?	Transportation cost per household type
What percent of households do not have a car?	How will the RHTC affect the percent of households do not have a car?	Percent of households without a car
What percent of households are within .5 miles of a transportation hub?	How will the RHTC affect the number of households that are within a .5 mile radius of a transportation hub (transit or Metro station)?	Number of households in the area
What is the current number and type of calls made to Coordinated Services Planning for transportation assistance from the area?	How will the RHTC affect the number and type of calls made to Coordinated Services Planning for transportation assistance from households in the area?	Number of requests for transportation assistance of community members

HIA Focus Area	Access to goods and services, including healthy food options, healthcare, and community services	
Existing Conditions Research Questions	**Impact Research Questions**	**Indicators**
What healthy food sources currently exist in the community?	How will the RHTC affect the number of healthy food sources available to the community?	# food deserts # grocery stores with fresh fruits and vegetables # farmers markets
What healthcare resources currently exist in the community?	How will the RHTC affect access to healthcare resources in the community?	ED use Preventive services use (i.e. Mammograms) # Dr. offices # hospitals within a 30 minute walk or commute # public health facilities within a 30 minute walk or commute
What community services currently exist in the community?	How will the RHTC affect access to community services sources in the community?	Location and type of community services
How many bus routes are currently available within a .5 mile radius?	How will the RHTC affect the number of bus routes are currently available within a .5 mile radius?	Current number of bus routes Projected number of bus routes
What is the percentage of adults who report getting the recommended number of servings of fruits and vegetables each day?	How will the RHTC affect the percentage of adults who report getting the recommended number of servings of fruits and vegetables each day?	Percentage of adults who report getting the recommended number of servings of fruits and vegetables each day?
What is the percentage of children who report getting the recommended number of servings of fruits and vegetables each day?	How will the RHTC affect the percentage of children who report getting the recommended number of servings of fruits and vegetables each day?	Percentage of children who report getting the recommended number of servings of fruits and vegetables each day?
What are current health	How will the RHTC affect the health	Asthma rates

disparities in the community?	disparities in the area?	Obesity rates ED visits by chief complaint Leading causes of death Access to primary care Need for services population index Registered Medicaid providers Ambulatory Sensitive Conditions

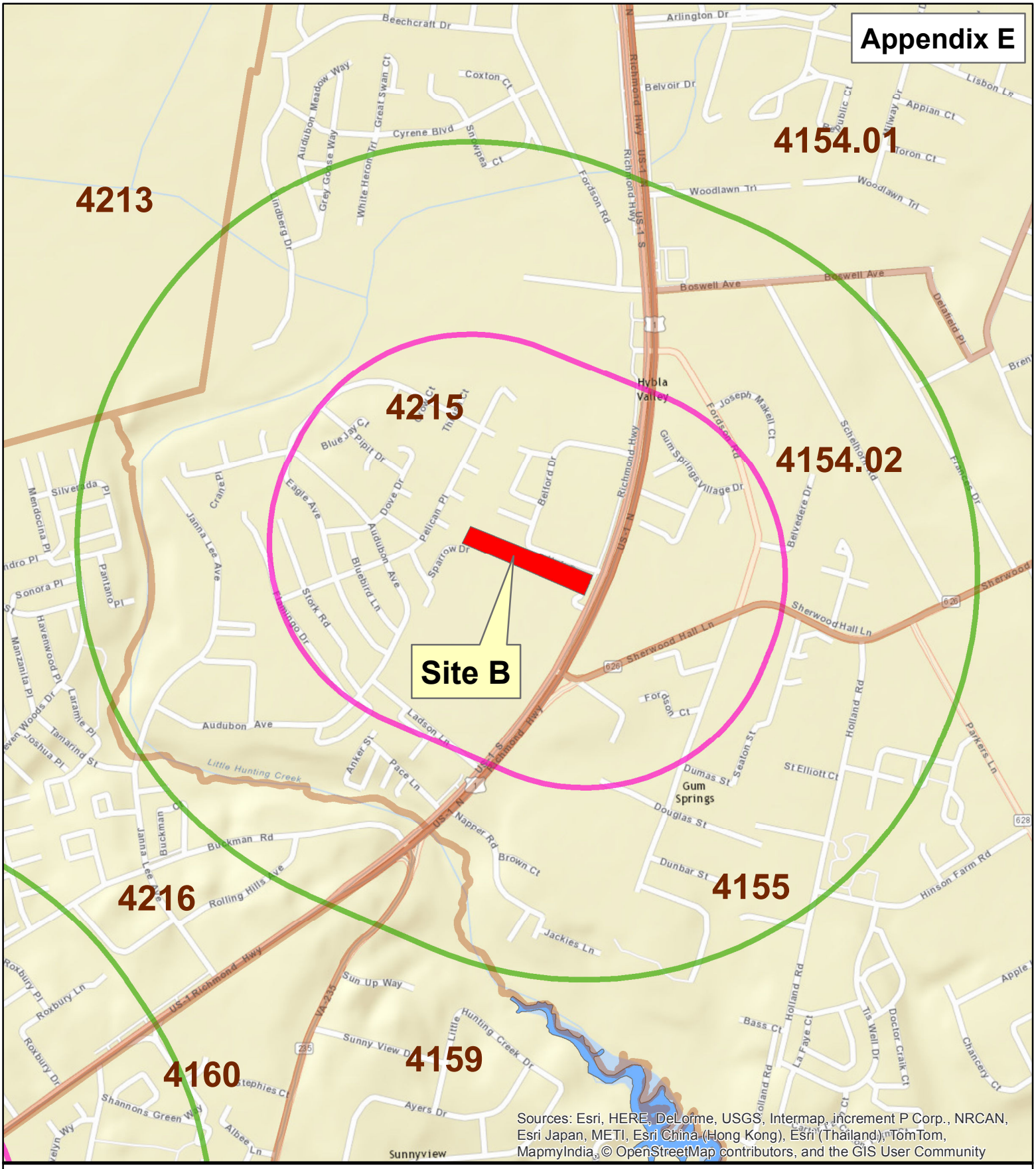
HIA Focus Area	Access to physical activity, including open space, playgrounds, parks, and recreational facilities	
Existing Conditions Research Questions	**Impact Research Questions**	**Indicators**
How many accessible parks, playgrounds and recreational facilities exist within .5 miles of the proposed RHTC?	How will the RHTC change the number of accessible parks, playgrounds and recreational facilities within .5 miles of the area?	Location and type of physical activity facilities
What is the percentage of adults who report getting the recommended amount of daily physical activity?	How will the RHTC affect the percentage of adults who report getting the recommended amount of daily physical activity?	Percentage of adults who report getting the recommended amount of daily physical activity?
What is the percentage of children who report getting the recommended amount of physical activity?	How will the RHTC affect the percentage of children who report getting the recommended amount of daily physical activity?	Percentage of children who report getting the recommended amount of physical activity?
What are the current obesity rates?	How will the RHTC affect obesity rates?	Obesity rates
What are current chronic disease rates?	How will the RHTC affect current chronic disease rates?	Rates of chronic diseases: cancer, diabetes, heart disease, respiratory diseases
What is the current pedestrian and bicycle access in the area?	How will the RHTC affect pedestrian and bicycle access in the area?	Linear feet of finished trails and sidewalks Proposed changes to linear feet of finished trails and sidewalks
What are current walkability scores of households in the community?	How will the RHTC affect walkability scores of households in the community?	Average walkability score of households in the community
How connected are	How will the RHTC affect the	Linear feet of finished trails and sidewalks

neighborhoods to the proposed sites?	connectivity of neighborhoods to the proposed sites?	Proposed changes to linear feet of finished trails and sidewalks

HIA Focus Area	Availability of affordable housing, employment opportunities and educational institutions	
Existing Conditions Research Questions	**Impact Research Questions**	**Indicators**
What is the current unemployment rate?	How will the RHTC impact the unemployment rate?	Unemployment rate
What affordable housing is available in the area?	How will the RHTC affect the amount of affordable housing in the area? Will it affect property value?	Number and type of housing options available
What is the current SES of community residents?	How will the RHTC affect the SES of community residents?	Income, education level
What is the current HS graduation rate? Some college?	How will the RHTC affect the education level of community residents?	Education levels
What are current plans for mixed income housing?	How will the RHTC affect plans for mixed income housing?	Number and type of housing options planned for in the future
What is the level of homelessness in the area?	How will the RHTC affect the homeless population in the area?	Number of homeless individuals and families in the area

HIA Focus Area	Environmental issues including air and noise pollution	
Existing Conditions Research Questions	**Impact Research Questions**	**Indicators**
What is the current air quality in the community?	How will the RHTC affect the air quality in the community?	Ozone quality Clean Air Standards Act Vehicle emissions
What is the current noise level in the community?	How will the RHTC affect the noise level in the community?	Noise levels
What is the current rate of asthma in the community?	How will the RHTC affect the asthma rate in the community?	Asthma rates
What is the current rate of lower respiratory disease in the community?	How will the RHTC affect the lower respiratory rate in the community?	Respiratory disease rates
What is the current rate of lung disease/cancer in the community?	How will the RHTC affect the lung disease/cancer rate in the community?	Lung disease/cancer rates

HIA Focus Area	Community safety and cohesion	
Existing Conditions Research Questions	**Impact Research Questions**	**Indicators**
Does the community currently feel safe and secure in the neighborhood?	How will the RHTC affect community safety?	Perceptions of safety Current crime statistics
How are residents currently connected to the site?	How will the RHTC affect how residents are connected to the site?	#Fences # paved walkways; #/type other barriers
What is the current level of community cohesion?	How will the RHTC affect community cohesion?	Sense of community cohesion
Current # of businesses in the area? Locally owned?	How will the RHTC affect the number of local businesses in the area and the number of locally owned businesses?	Actual count
What percent of community residents currently walk to area businesses to shop?	How will the RHTC affect the percent of community residents who walk to area businesses to shop?	Number of customers on foot
What percent of people are involved in community organizations? Need to define this.	How will the RHTC affect percent of people are involved in community organizations?	Number of residents participating in community organizations
What percent of people are involved in community planning and development?	How will the RHTC affect percent of people are involved in community planning and development?	Number of residents participating in community planning and development



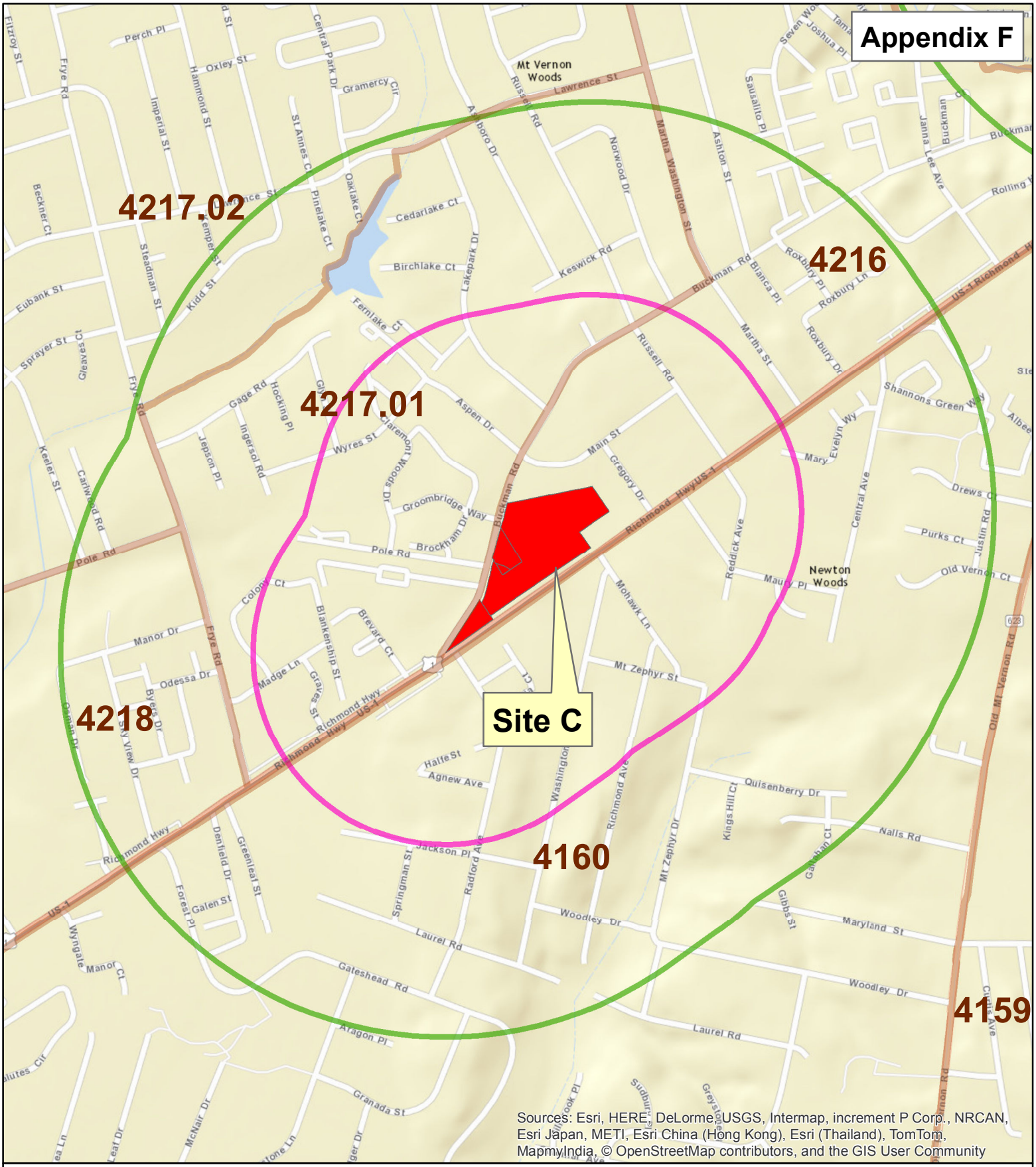
N

0 0.1 0.2 Miles

SITE B AREA OF STUDY
Richmond Highway Transit Center
Health Impact Assessment

Legend

- 0.25 mile radius
- 0.5 mile radius


Appendix F
4217.02
4216
4217.01
4218
4160
4159
Site C
Mt Vernon Woods
Newton Woods
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
N
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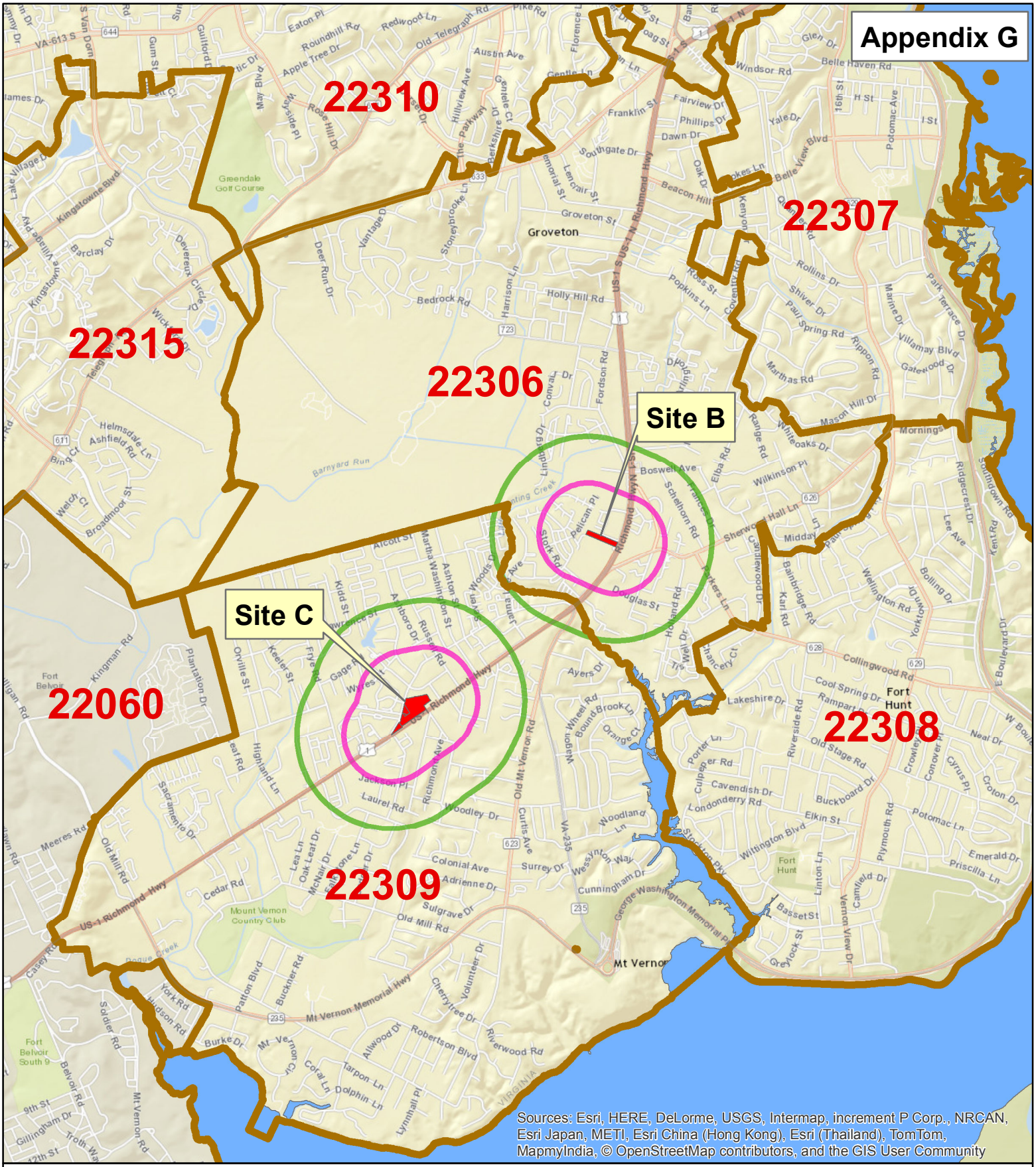
0.1
0.2 Miles
SITE C AREA OF STUDY
Richmond Highway Transit Center
Health Impact Assessment
Legend
0.25 mile radius
0.5 mile radius



N

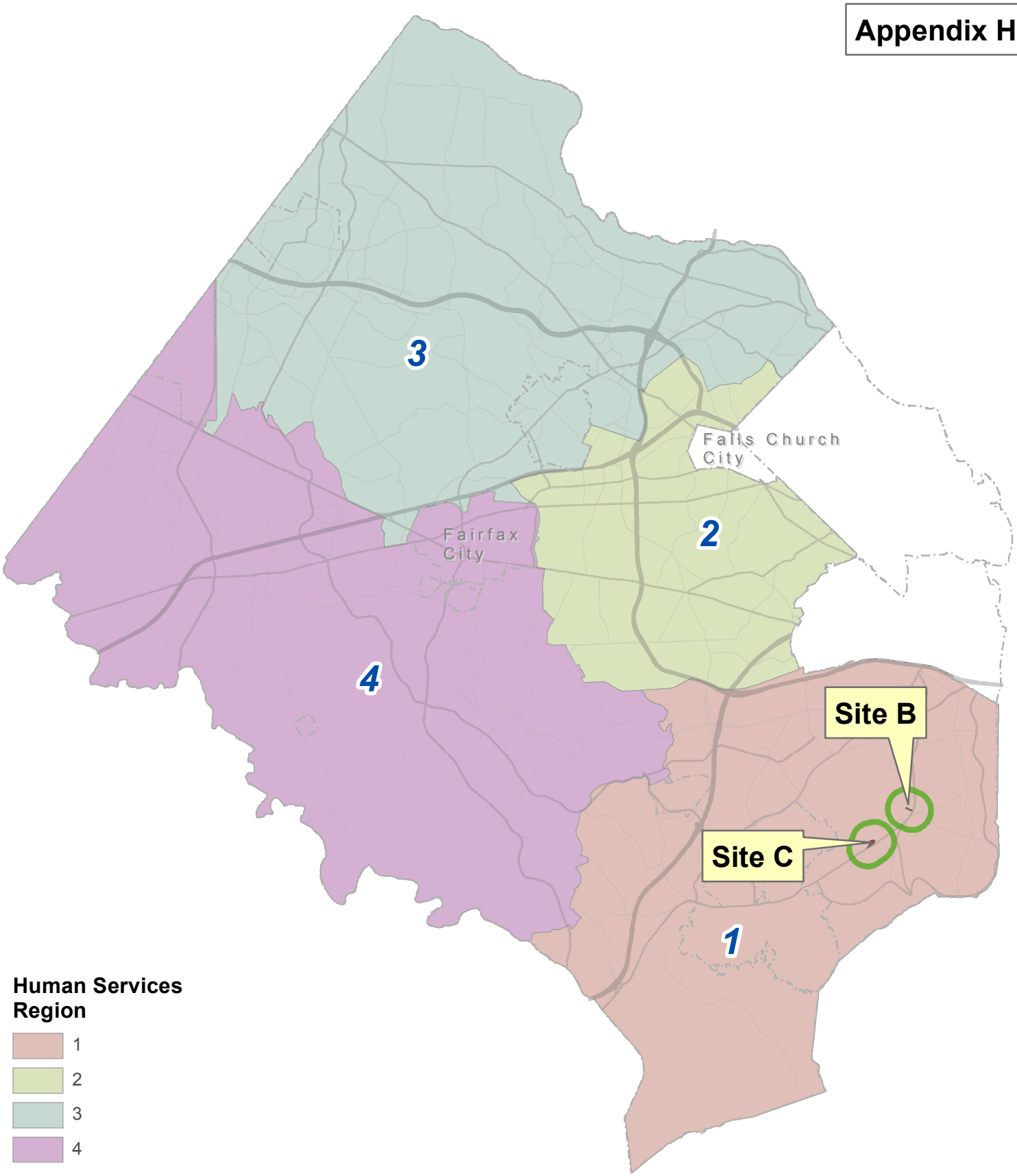
0 0.55 1.1 Miles

ZIP CODES
Richmond Highway Transit Center
Health Impact Assessment

Legend

- 0.25 mile radius
- 0.5 mile radius
- Zip Code Boundary

Appendix H



HUMAN SERVICES REGIONS
Richmond Highway Transit Center
Health Impact Assessment

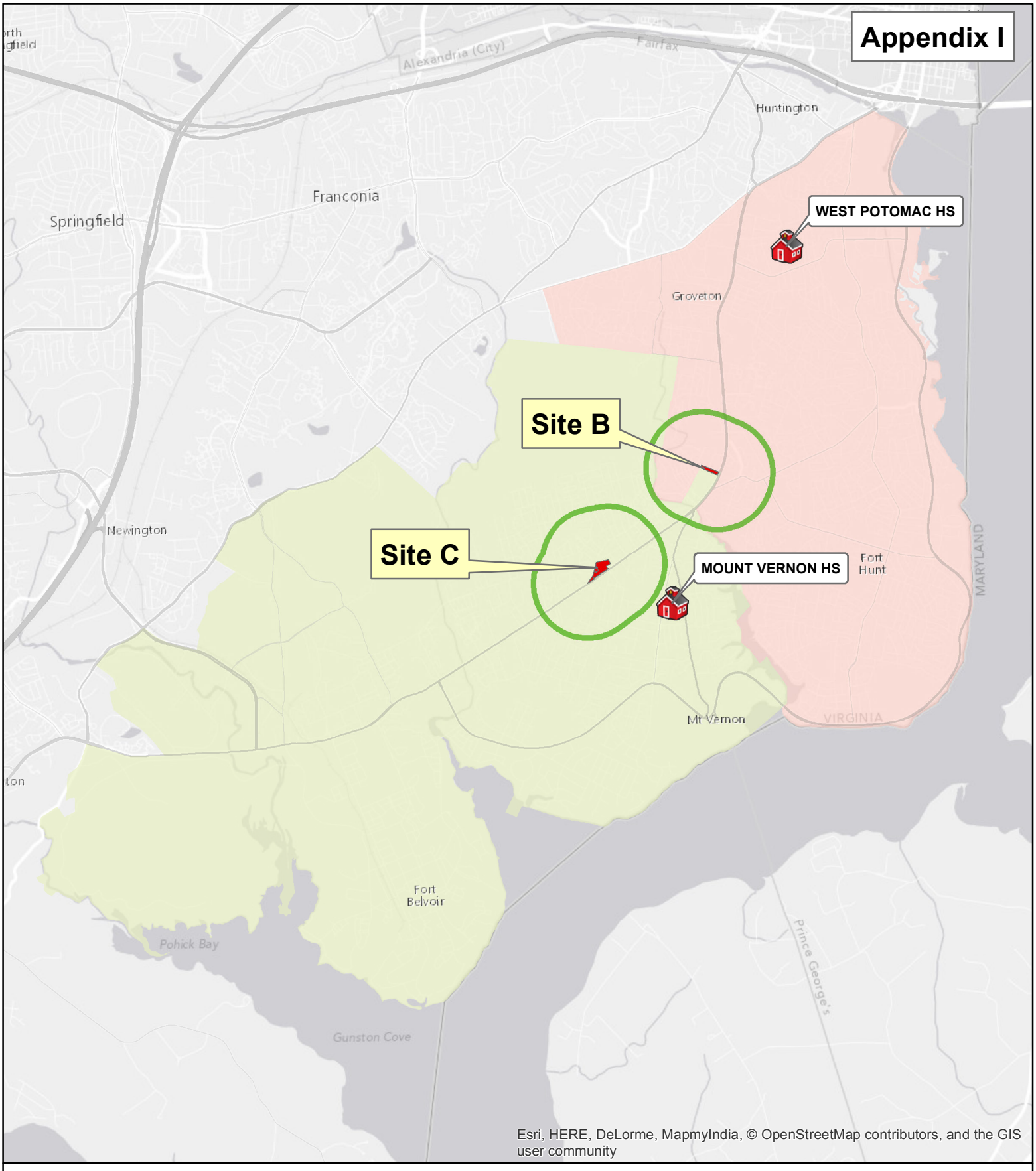
N

0 2.5 5 Miles

Legend

Potential Transit Center Site

0.5 mile radius



N

0 0.8 1.6 Miles

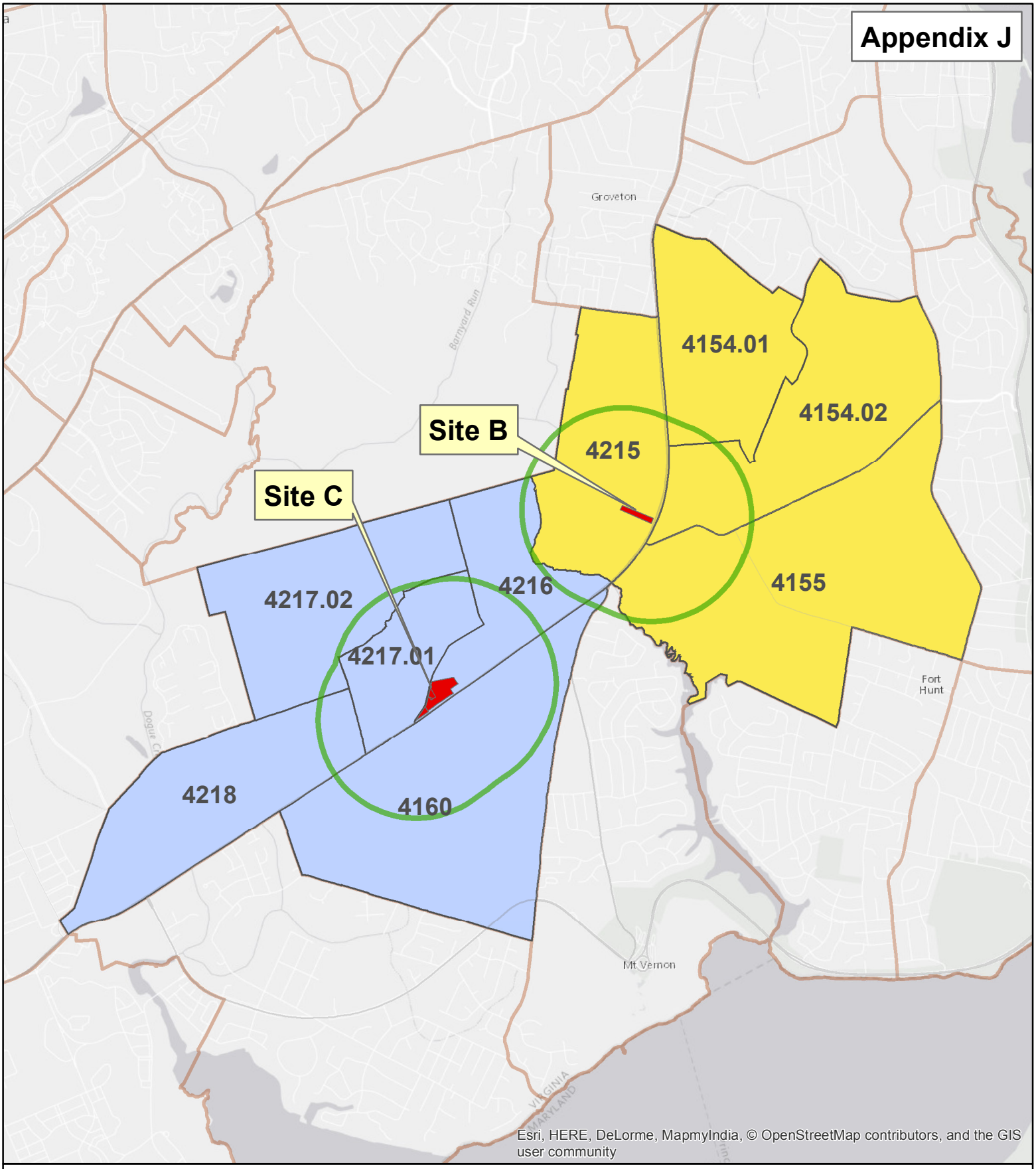
FAIRFAX COUNTY PUBLIC SCHOOLS
HIGH SCHOOL ATTENDANCE AREAS
Richmond Highway Transit Center
Health Impact Assessment

Legend

- Potential Transit Center Site
- 0.5 mile radius

High School Attendance Area

- MOUNT VERNON
- WEST POTOMAC



N

0 0.4 0.8 Miles

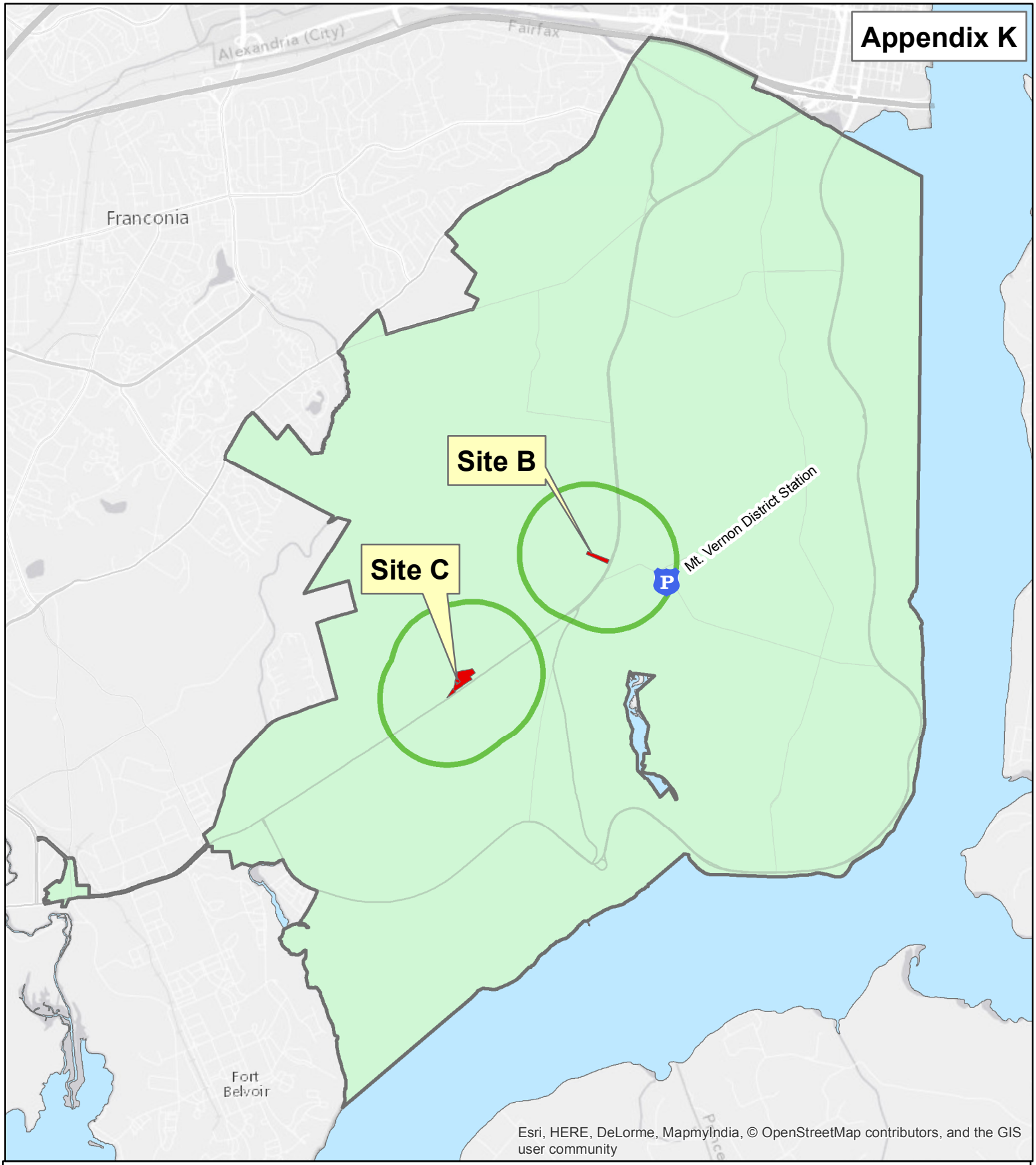
CENSUS TRACTS
Richmond Highway Transit Center
Health Impact Assessment

Legend

- Potential Transit Center Site
- 0.5 mile radius

Census Tracts

- Site B Area of Analysis
- Site C Area of Analysis


Appendix K
Alexandria (City)
Fairfax
Franconia
Site B
Site C
Mt. Vernon District Station
Fort Belvoir
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
N
0
0.6
1.2 Miles
FAIRFAX COUNTY POLICE DEPARTMENT
MOUNT VERNON DISTRICT STATION
SERVICE AREA
Richmond Highway Transit Center
Health Impact Assessment
Legend
Potential Transit Center Site
0.5 mile radius
Mount Vernon Police Service Area
Mount Vernon District Station

Fairfax County
Health Department

August 2014