CHAPTER 4

DESIGN CONSIDERATIONS





Fig. 4-01 - Penstemon digitalis, Foxglove Beardtongue

4. DESIGN CONSIDERATIONS

This section is intended to serve as a resource for PRT project managers and planning and design consultants, providing a starting point for future capital improvement projects. Considerations such as how to select the right plants, materials, and finding the right partners are outlined here. Additionally, resources are provided in order to support impactful design, such as PRT's Equity Index, the American Forest Service Tree Equity Score, and public health indicators like air quality, particle matter, canopy coverage, impervious surfaces, and ridership.

GENERAL DESIGN PRINCIPLES

All projects should be designed to compliance with local codes, including IBC, ADA, and local zoning codes. Planning and design consultants should reference the LRT Design Guidelines for general design principles that include:

- Shade
- ADA
- Open Space
- Clear Path
- Visibility
- Lighting

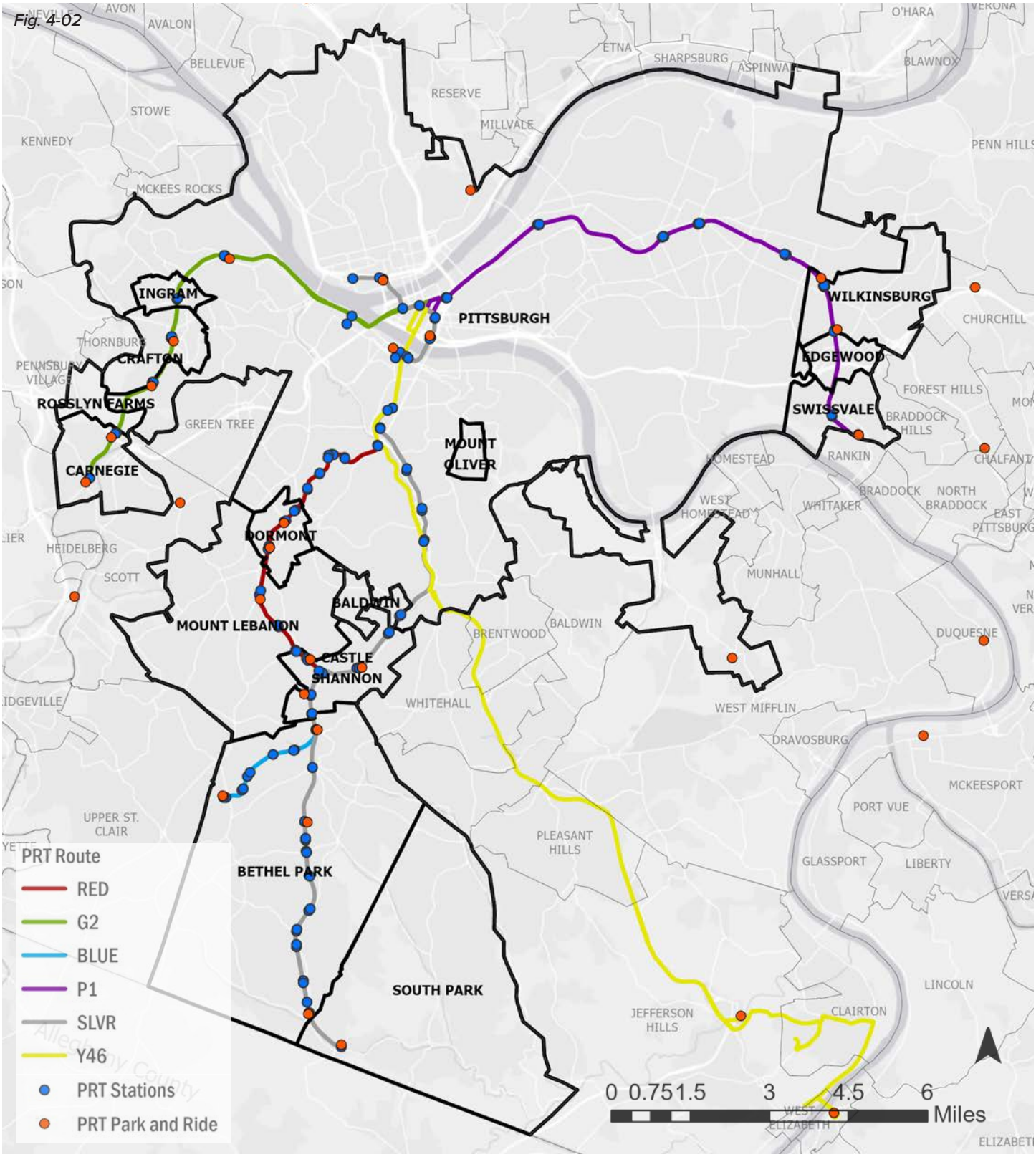
For landscape design, these principles should further emphasize a low impact design approach that uses durable pervious surface and low maintenance native plantings when possible. Adhering to these principles will enhance the environment throughout the PRT system while contributing to a recognizable brand identity for PRT. The specific environmental benefits of these design principles are described within each Landscape Design Strategy in Chapter 3; however, they generally include improvements to air quality, biodiversity, nutrient cycling, stormwater management and flood reduction, and the mitigation of urban heat island effects.

The potential for these principles to contribute the recognizable PRT brand identity are based on the understanding that through promoting transformational landscape design practices, riders, employees, and others within PRT communities will associate their public transit infrastructure with high quality, socially and environmentally responsible design that stands out from typical landscapes that are more commonly seen. These benefits are expected to increase overtime as PRT and their consultants build institutional knowledge about the specific place-based design decisions that perform best.

MUNICIPALITIES

PRT's properties span multiple municipalities. While local codes must guide planning for compliance, adopting a consistent set of zoning standards—modeled after the City of Pittsburgh's more stringent regulations—is recommended county and system-wide. While some codes may not be required outside of Pittsburgh, it should be considered best practice to promote uniformity and reduce risk across jurisdictions.

Fig. 4-02



Data Source: Routes, Park & Rides, Stations & Stops - PRT Open Data; Municipal Boundaries: Allegheny County GIS Open Data

SELECTING THE RIGHT PLANTS

Choosing the right plants is critical to a successful planting design. The “right” plants are the plants that are best suited to the specific local conditions where they will be installed. If plants are provided the conditions that are needed to thrive, they will perform well; however, if these conditions are not met they will perform poorly, exhibit signs of stress, increase maintenance requirements, and be more susceptible to mortality, requiring replacement. Some of the most significant requirements that should be considered first when selecting plants for a landscape design are described below:

Sun Exposure

The amount of sun or shade that a proposed plant is expected to receive is based on surrounding features as well as the solar aspect of the planting location. Generally southern facing plants receive more light than northern facing plants. Orientation to the East or West determines whether a plant will receive morning or afternoon light. Adjacent conditions that impact light availability should be notes such as tall shade trees, buildings, and other structures such as bridges and retaining walls.

Soil

Planting soil is a complex consideration that can significantly affect plant performance. Planting soil characteristics that must be addressed include soil texture, structure, nutrient availability, pH, and percentage of organic matter. It is important to consider both the composition of any planting soil that is being specified to be brought to a project site and the existing soils and subsoils that are present within the planting area. Existing soils can also be amended to meet specified requirements, which reduces the cost associated with offsite disposal and bringing in new material.

Consultants should have a base understanding of soil conditions and identify any erosion prone areas. Maps are provided in this section as reference, but the data should be utilized at the site scale.

Sight Lines

Proposed planting designs must confirm that the mature height of the proposed species will not conflict with vehicular site lines. The vehicular site lines are defined by triangle extending from the drive lines at intersections and must be maintained to allow safe turning. Vegetation within these areas should not exceed 30” at mature height.

Other site lines that need to be maintained include signage and signals as well as site lines required to maintain pedestrian safety (i.e.; avoid plantings that could potentially conceal a person). Local rules and regulations dictate the appropriate planting proximity to various elements in the public streetscape.

Topography / Slope

Topographic position can have a big effect on plant performance. Steep slopes can cause planting soils to become very dry and also risk erosion during rainfalls while isolated low points may not drain causing soils to be very wet and potentially fill with sediment runoff from adjacent areas. It is important to note the topography and choose plant species accordingly. Some plant species are known for having particularly fibrous or rhizomatic root systems which are well adapted to steep slopes; however wherever possible proposed slopes should not be greater than 1H:3V. Slopes steeper than this may also prevent the installation of plant material with large root balls which will need to be heeled in to prevent over-topping.

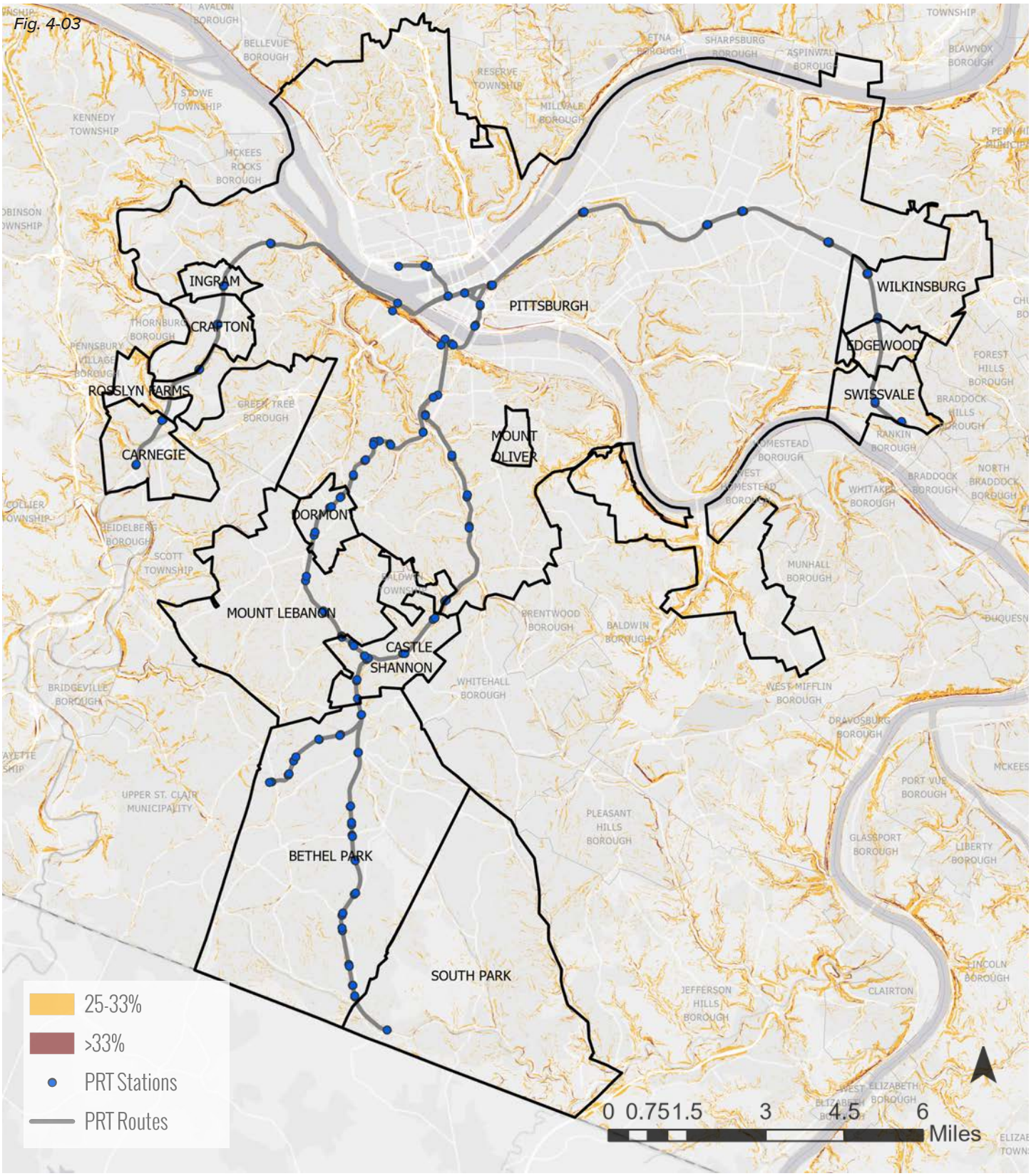
Salt Tolerance

Due to road salt applications, salt tolerance is an important characteristic to consider when developing planting plans for urban conditions. Plant species have varying degrees of salt tolerance and also there is often a distinction between a plant species' tolerance of soil salts (salts that are washed into a planting area with runoff) and aerosol salts (salts that are carried in the air to a plants leaves).

TOPOGRAPHY - STEEP SLOPES

Steep slopes require specific considerations for plant communities, as well as stormwater management, erosion control, and runoff considerations. Many PRT properties include steep slopes, as shown in the map below, which illustrates slopes greater than 25%.

Fig. 4-03

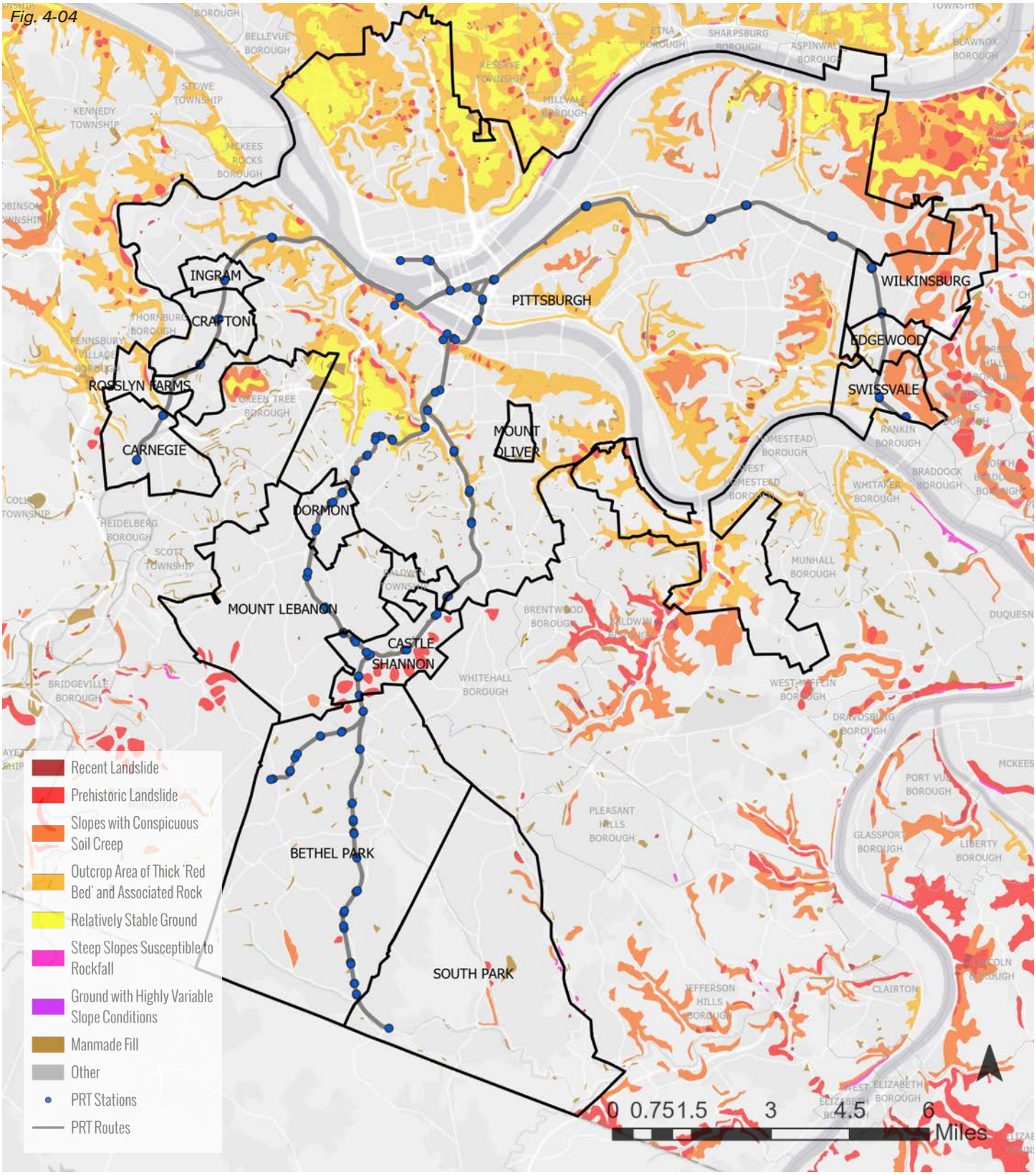


Data Source: City of Pittsburgh GIS Data Hub

LANDSLIDE PRONE AREAS

The regional topography means some areas are susceptible to landslides during heavy rainfall. The map below identifies slopes that have either recently experienced landslides (darkest red), or those at risk from landslide or slope failure (orange).

Fig. 4-04

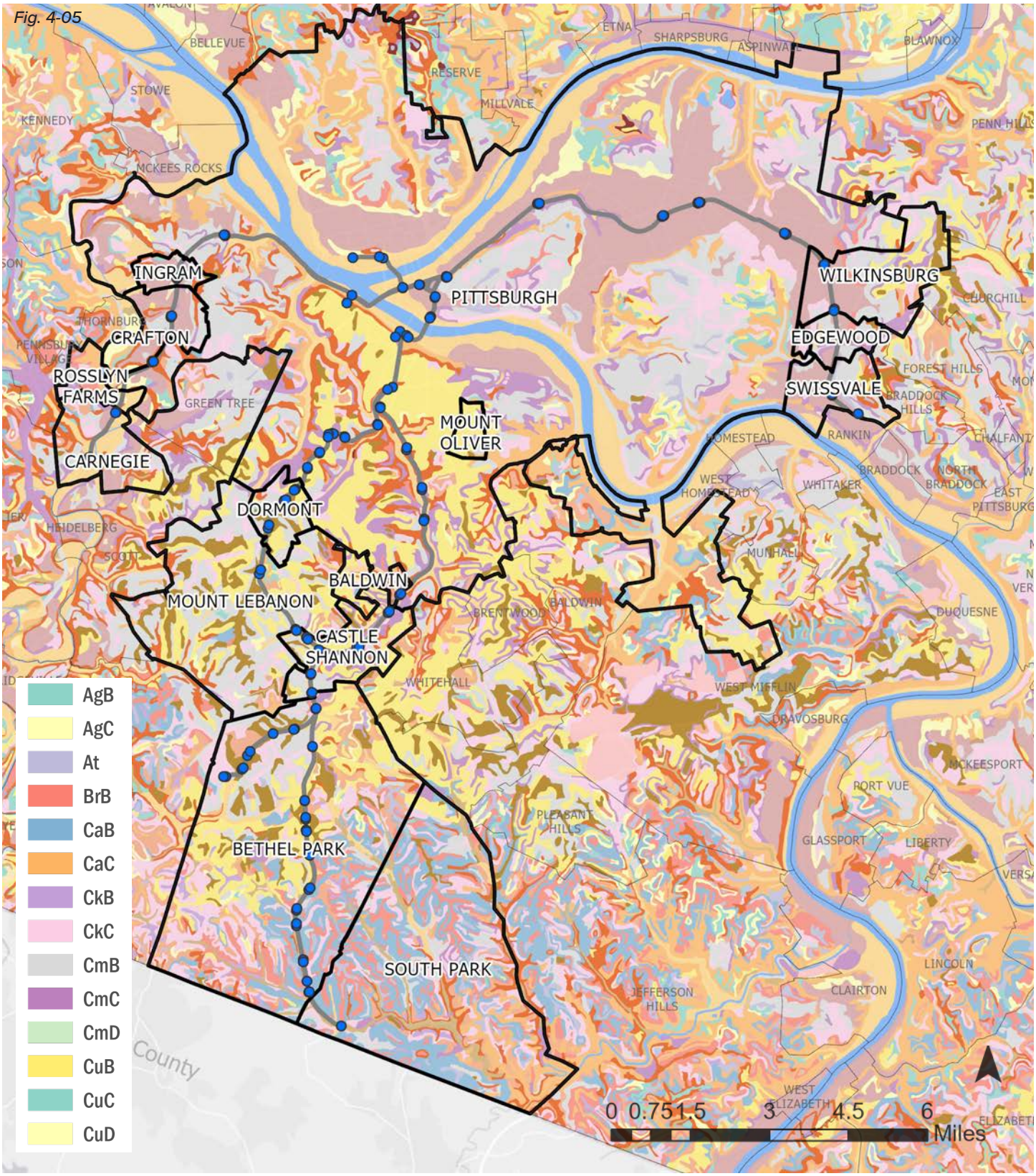


Data Source: Landslide Pomeroy Study - Allegheny County GIS Open Data, Published 2019

SOIL MAP

When designing and planning station areas, consultants should review soil maps at the scale of the site. The map below gives a visual reference of soil data, which provides useful information about landform or surface features, such as slope percentage, as well as physical characteristics like sand / clay / loam, which is important for identifying plants that will thrive in the particular soil conditions.

Fig. 4-05

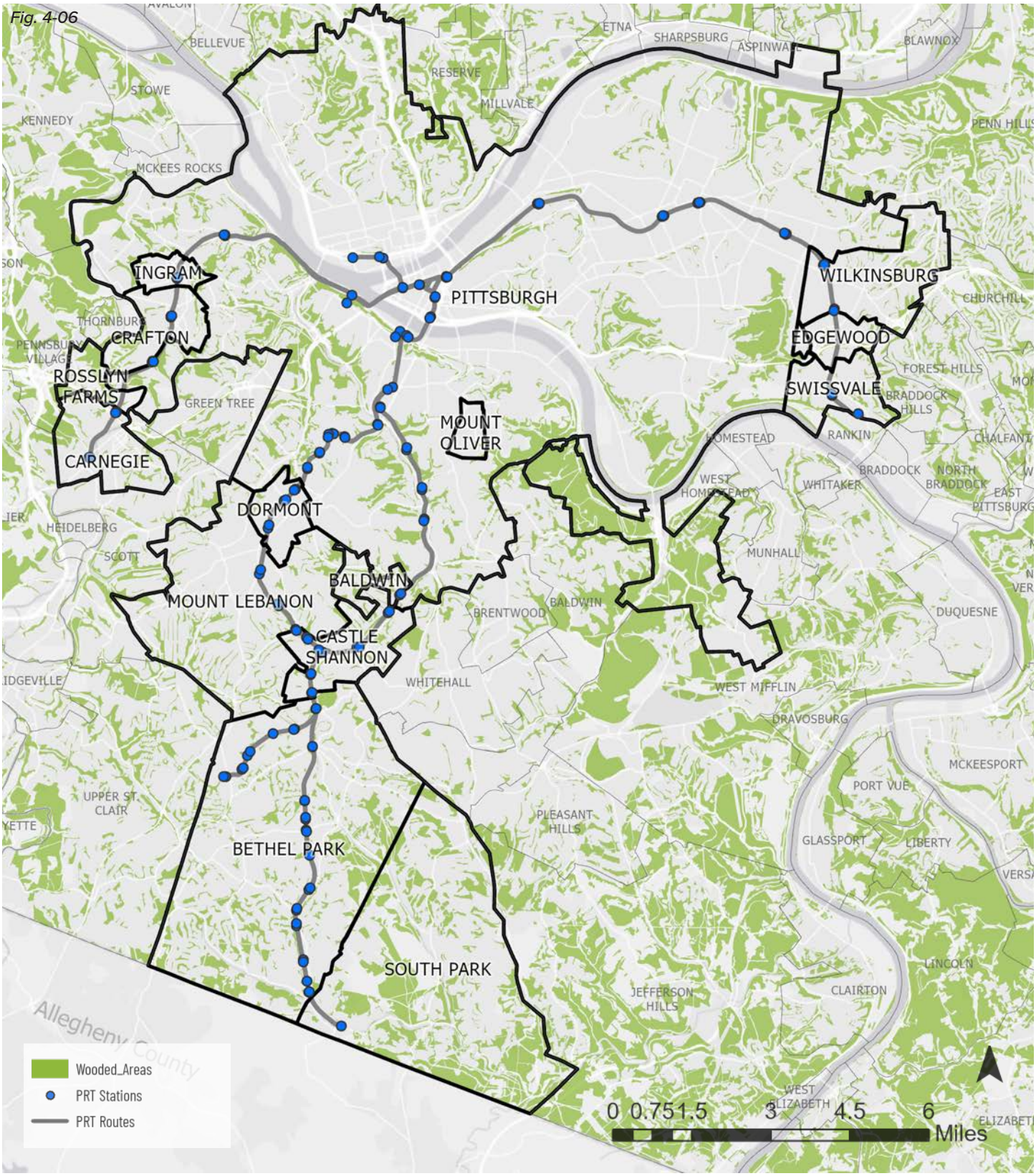


Data Source: Allegheny County Soil Types - Allegheny County GIS Open Data, Published 2015

TREE CANOPY COVERAGE

As of 2020, Allegheny County has a canopy coverage of 51.7%. Across PRT properties, canopy coverage is about 31% - indicating considerable need for an increase in tree canopy to mitigate impacts of heat island and improve air quality. While Allegheny County's Climate Action Plan is currently underway, Pittsburgh's Climate Action Plan set a target of 60% tree canopy coverage by 2030.

Fig. 4-06

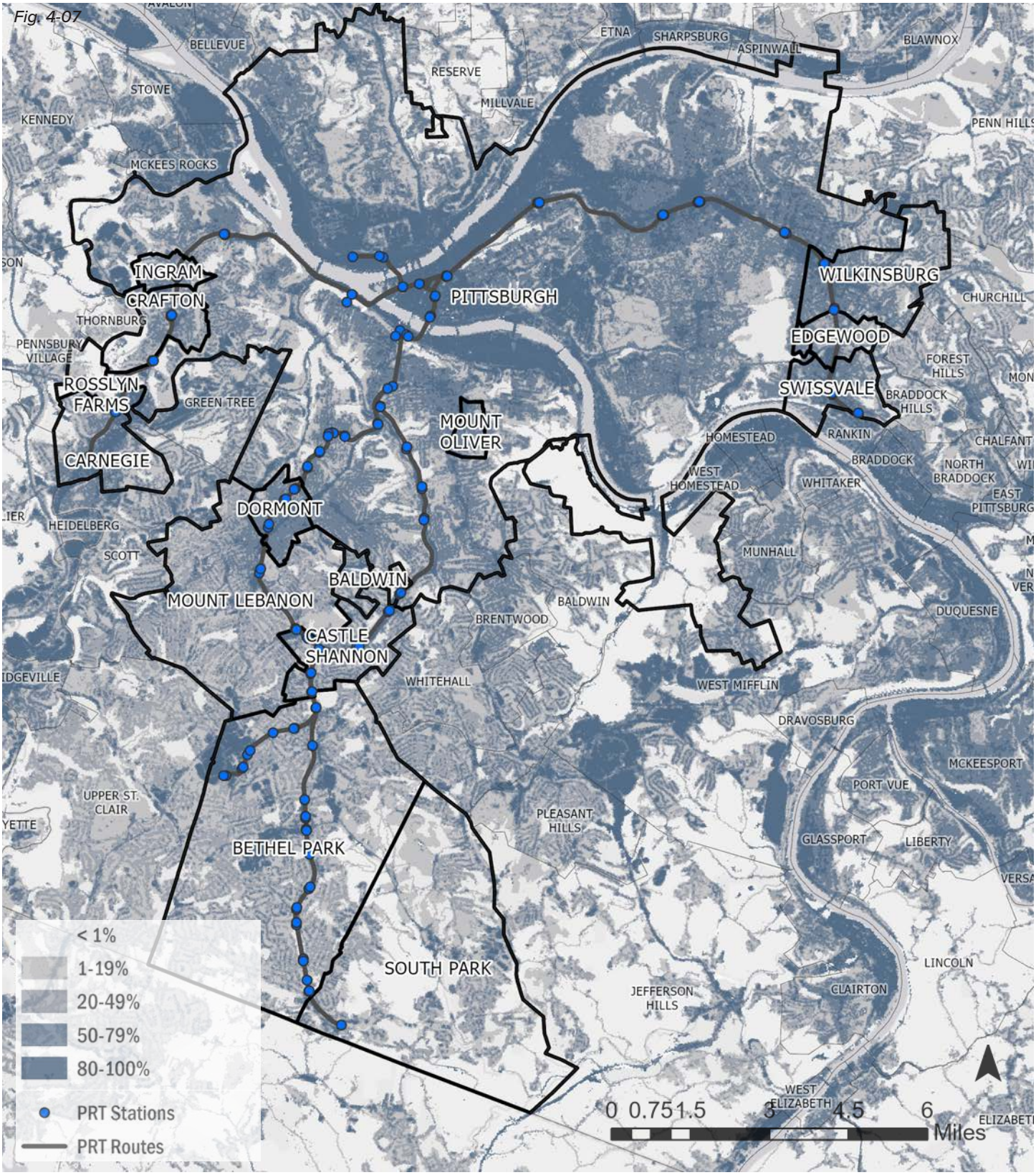


Data Source: Allegheny County Wooded Areas Boundaries - Allegheny County GIS Open Data, Published 2015

IMPERVIOUS SURFACES

Impervious surfaces refer to any man-made material that prevents or limits the infiltration of water into the ground, such as roofs, and asphalt or concrete roadways and parking lots. In the map below, darker blue areas indicate a higher percentage of imperviousness, whereas lighter gray areas indicate some perviousness, or infiltration, despite being a highly built-up, urban area.

Fig. 4-07



Data Source: Impervious Surface Time Series - National Land Cover Database (NLCD) Database, Updated 2025

DESIGNING FOR IMPACT

Transit infrastructure provides more than a means of transportation—it's an opportunity to promote public health, environmental resilience, and social equity. Each PRT station holds the potential to positively shape its context by addressing broader communities needs. In order to determine where landscape improvements can have the greatest impact, designers should reference **PRT's Index of Mobility Need**, alongside external data sources, some of which are highlighted here.

Evaluating a station's connection to parks, trails, and open space, as well as understanding where there are disadvantaged populations with greater mobility needs—such as minority populations, low income households, or cost burdened renters—helps to identify where landscape improvements can be most effective, and direct investments where they can do the most *good*.

Tools like American Forests' **Tree Equity Score** provide actionable insights by revealing where gaps in urban tree canopy coverage align with social vulnerability, identifying communities disproportionately affected by extreme heat, pollution and other environmental hazards.

The Trust for Public Land's **ParkServ** online tool considers regional access to parks and open space, reinforcing the link between quality green space and community health, resilience, and justice. Understanding where there are existing open spaces, trail connections, or institutional anchors will also help to identify where public amenities might be most impactful.

Environmental data further strengthens the case for impactful landscape investments. Many PRT routes experience elevated levels of particulate matter (PM2.5) and poor air quality, underscoring the need for targeted landscape interventions and green infrastructure that not only improves air quality, but also create safer, cooler, and more resilient communities.

These values are further supported through PRT's NEXTransit 2025 Long Range Plan where the general public, community stakeholders, PRT staff, and the PRT Boards identified sustainable transit as a key values of transit.

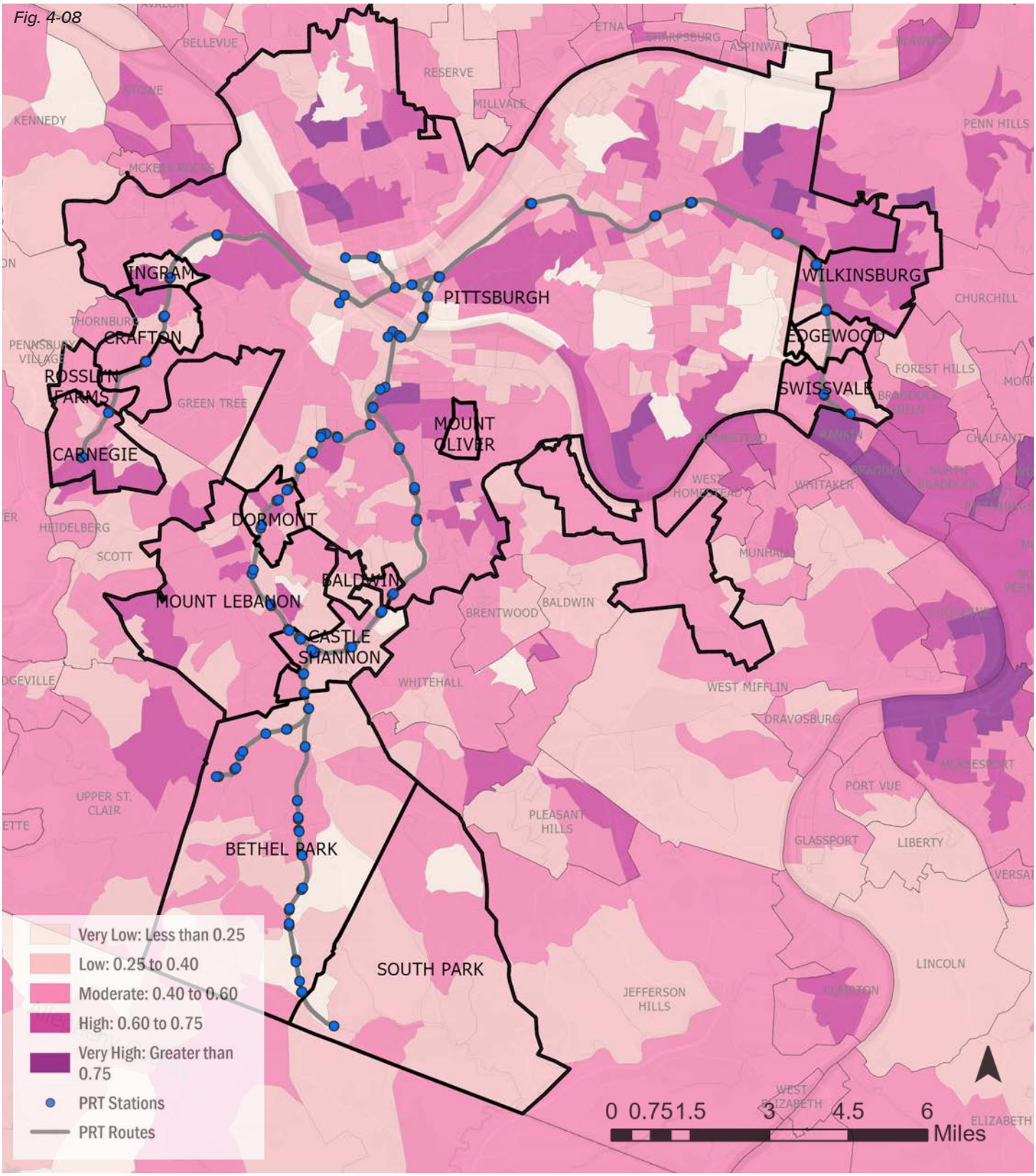
> *"I value a transit system that enhances the health of communities and the natural environment via its operations with regard to energy use, water use, raw material use, land use, and waste production."*[1]

[1] Pittsburgh Regional Transit. (2021, September 16). NEXTransit: Long-range transportation plan [PDF]. Port Authority of Allegheny County. Page 16.

PRT INDEX OF TRANSIT NEED

This evaluation identifies areas with a higher portion of disadvantaged populations (low income households, minority race or ethnicity populations) or those who have greater mobility needs (households with older adults, persons with disabilities, or households without access to a vehicle). The analysis overlays these different factors to create an index score where darker shades indicate greater need.

Fig. 4-08

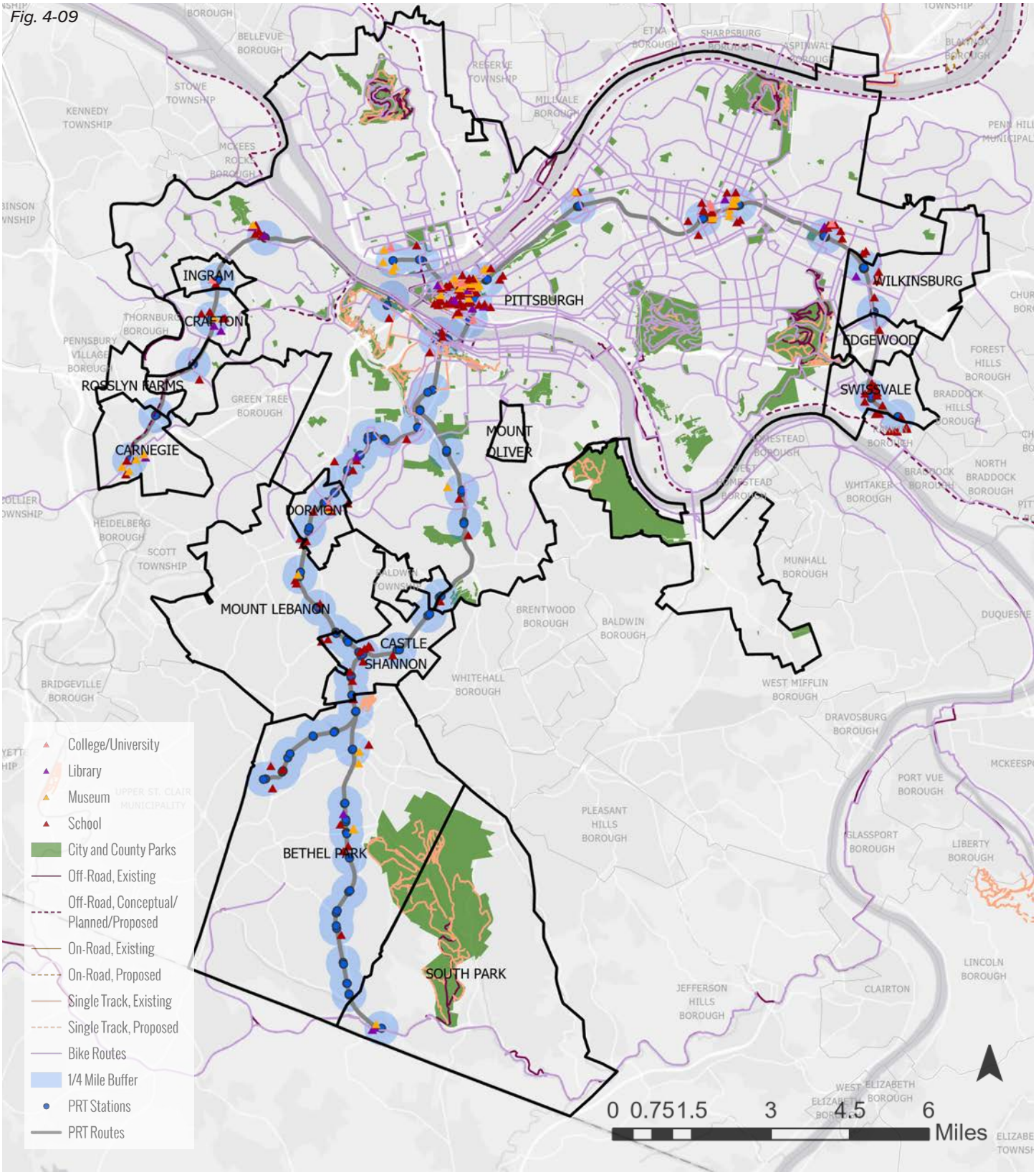


Data Source: PRT Open Data, Updated 2024

INSTITUTIONAL ANCHORS + PARK, NATURE, AND TRAIL ACCESS

Identifying nearby parks, trails, schools, and cultural institutions will help to determine where public landscape amenities might be most impactful. The map highlights these features, and when analyzed at the station level, such context can guide the type of landscape improvements and their programmatic offerings.

Fig. 4-09

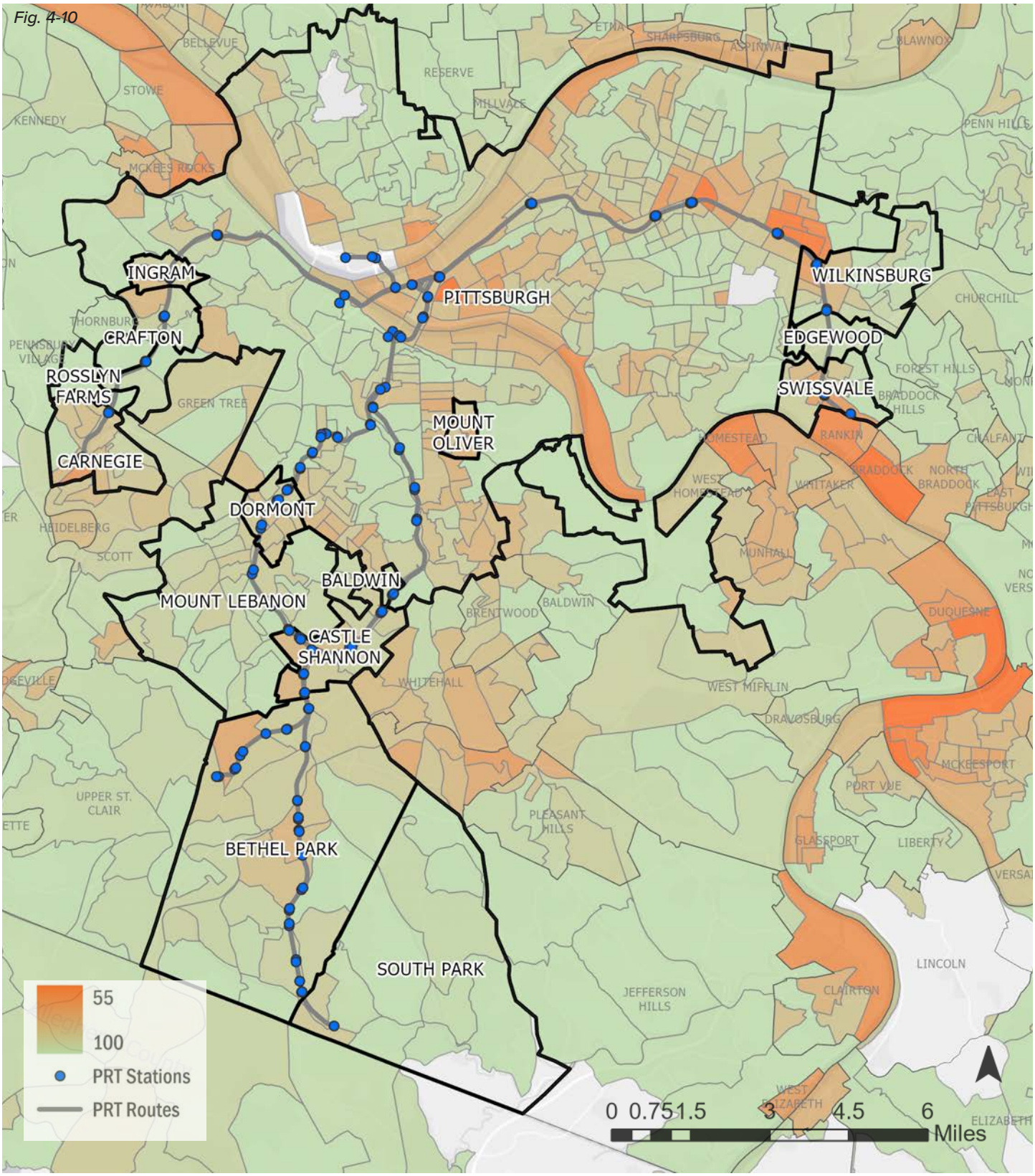


Data Source: Allegheny County Parks - Allegheny County Open Data, Pittsburgh Parks - City of Pittsburgh GIS Data Hub.

AMERICAN FORESTS' TREE EQUITY SCORE

The Tree Equity Score is a useful tool for determining where to plant trees–by integrating data such as tree canopy, building density, income, employment, race, health, and age–giving priority to areas where trees would create the greatest impact. Darker orange indicates a low Tree Equity Score, correlating to a higher need for additional tree canopy coverage.

Fig. 4-10

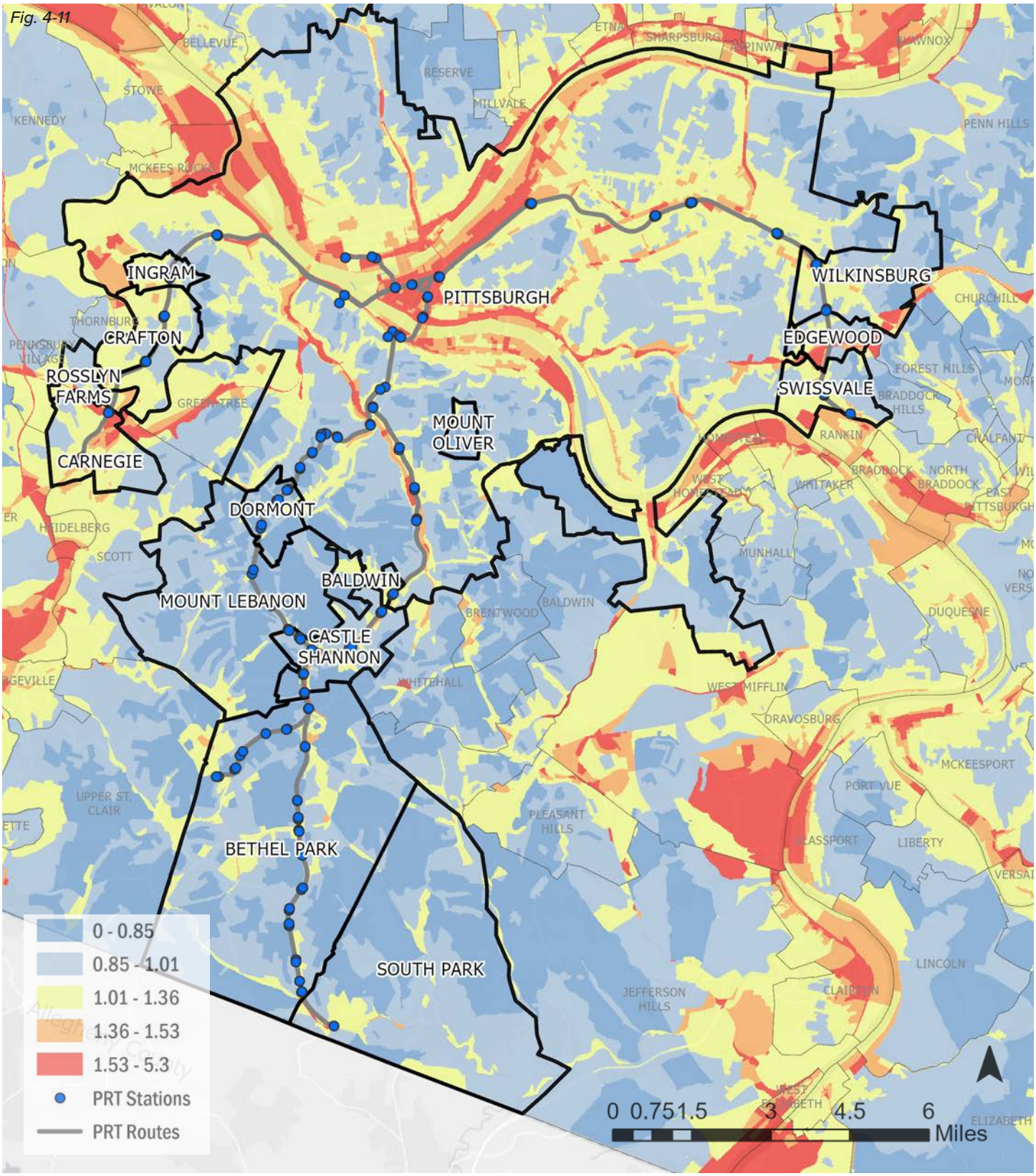


Data Source: www.treeequityscore.org

BLACK CARBON / AIR QUALITY

This analysis focuses on areas that have highest levels of air pollution, which can lead to negative health impacts and increased risk of health conditions like asthma, heart attacks, or lung cancer. Pollutants like black carbon - which is emitted from gasoline and diesel engines are found along many of PRT's transit lines.

Fig. 4-11

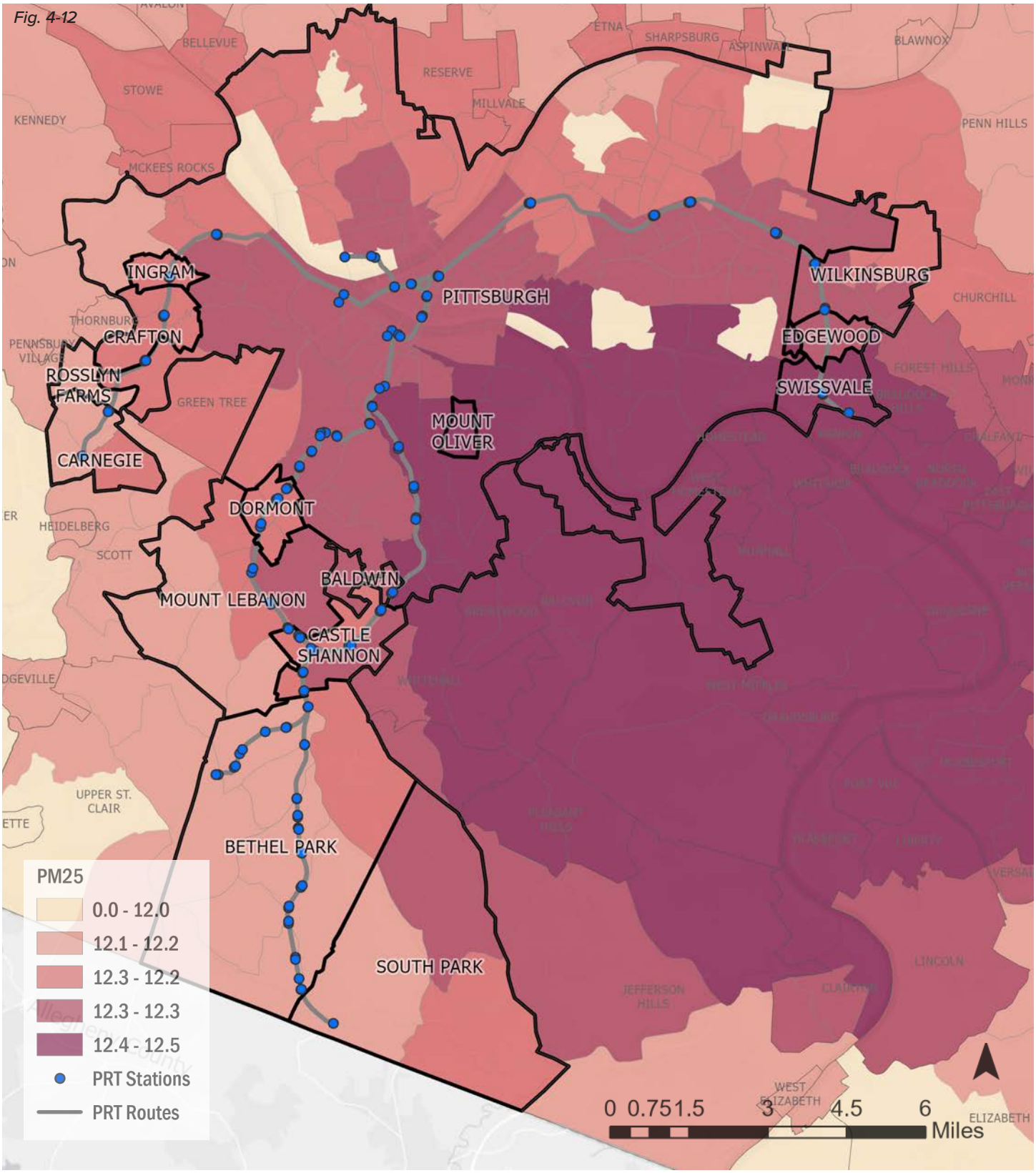


Data Source: Data provided by The Breathe Project, an organization working to improve air quality and eliminate carbon pollution in Pittsburgh, Southwestern PA, and beyond.

PARTICULATE MATTER

Fine particulate matter, or PM2.5 is an air pollutant that can be highly dangerous for animals and humans, as the finer particles can be absorbed into the bloodstream upon inhalation. This pollutant poses the greatest health threat, particularly for people over 65 or children with lung and cardiovascular diseases.

Fig. 4-12



Data Source: Data provided by The Breathe Project, an organization working to improve air quality and eliminate carbon pollution in Pittsburgh, Southwestern PA, and beyond.

FINDING THE RIGHT PARTNERS

PRT need not act alone in transforming its landscape portfolio into sustainable landscapes that are more resilient, more attractive, and easier to maintain at scale. The physical challenges that are present in PRT's portfolio are present throughout the region and have led to the creation of mission-driven non-profits that discretely address specific needs. PRT should actively build relationships with these organizations to understand how their capabilities and missions align with the specific challenges that PRT faces.

Watershed Partners

There are watershed organizations throughout the region with the capacity to either advocate for, implement, or maintain green stormwater infrastructure to improve water quality and reduce flooding impacts. Two of the largest watershed organizations are **Upstream**, which is focused primarily on watersheds in communities served by PRT's Martin Luther King Jr. East Busway, and **Watersheds of South Pittsburgh**, which is focused primarily on watersheds in communities served by PRT's Red and Blue light rail lines.

At a minimum, partnerships with these organizations can enable PRT to better coordinate with institutional and local stakeholders by tapping into their networks. Additionally, watershed organizations can help PRT to identify supporting sources for funding and financing which can enable PRT to implement higher-quality landscaping strategies that support stormwater management goals.

Ecological and Stewardship Partners

Organizations focused on the quality of local ecology or carbon reduction progress, like **Sustainable Pittsburgh,** can support PRT by providing technical assistance or could implement their own projects on PRT-owned land. **Tree Pittsburgh** is a non-profit that has a reforestation program to plant trees in areas impacted by invasive species, illegal dumping, or disruption from development activity. Outside of PRT's station areas, an organization like Tree Pittsburgh could reforest non-occupiable areas that are currently mowed by PRT staff.

Other organizations, such as a neighborhood group, may have an interest in the implementation of pilot projects or providing stewardship of specific sites. In Bethel Park, local organizations have implemented the **Trolley Beautification Project** at sites along PRT's Silver Line. In the future, similar initiatives could consult PRT's *Landscape Design Guidelines* for the appropriate strategies and plant lists.

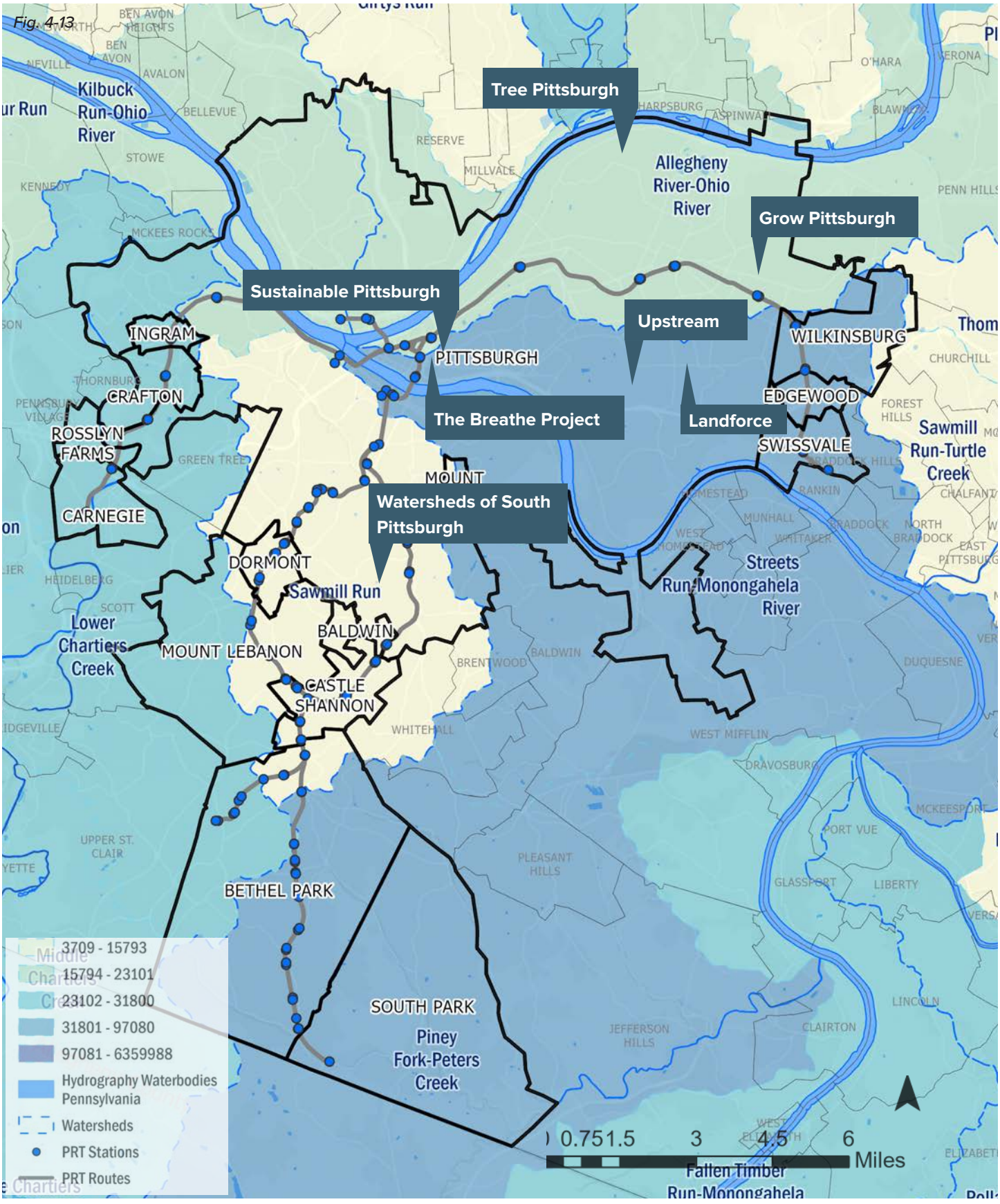
Land-Owning Partners

Throughout PRT's real estate portfolio are parcels on steep slopes, often wooded, that are unlikely to be developed or serve a future transit use. Those sites are exposed to risks such as illegal dumping and ecological disruption due to invasive species. PRT could identify appropriate organizations to divest these parcels to, such as a municipality or land trust. Parcels adjoining a municipal or county park could be appended as part of those parks, transferring the maintenance responsibilities and risks to the park owner. Within the **City of Pittsburgh**, parcels proximal to a city-designated greenway could be transferred to the City and appended to the greenway, similarly transferring maintenance responsibilities and risks to the City and enabling a local neighborhood organization to steward that land through the City's **Greenways for Pittsburgh** program.

An example could be some of the steep slopes that PRT owns near Herron Station, which could be appended to the City of Pittsburgh's Bigelow Greenway. Land trusts such as the **Western Pennsylvania Conservancy**, **Allegheny Land Trust**, and others could be interested in permanently conserving excess land from PRT's portfolio, allowing it to be a regional ecological asset in perpetuity. Land trusts can also assist in the transfer of property from one entity to another, supporting the transaction with their technical assistance and capacity.

WATERSHEDS AND REGIONAL PARTNERS

Fig. 4-13



Data Source: Hydrography Waterbodies, Watersheds - Allegheny County GIS Open Data