POTENTIAL TREE PLANTING ANALYSIS

Supplemental Map Series

SUMMARY

This document summarizes a high-level GIS analysis to identify where there may be potential locations for new tree plantings throughout the city. The locations identified in this map book represent hypothetical planting locations that can serve as a strategic planning tool as Charlottesville continues to enhance its urban forest.

Prepared for the City of Charlottesville by the Green Infrastructure Center Inc.

January 2017

The information shown in this map book is intended to be used as a high-level, city-wide planning tool. A citywide screening of where there may be potential to plant trees is a useful first step in understanding not only where and how many trees might be planted, but also what benefits might be associated with planting in a given location. This map book is part of a supplemental map series that provides an overview of potential tree planting locations at a neighborhood level. The supplemental map series was created to summarize five metrics that provide insight into potential benefits of tree planting. The five metrics are:

1. Potential tree planting location density
2. Relative temperature
3. Household income
4. Sub-catchment imperviousness
5. Population density

Each metric is summarized in two forms, citywide and right-of-way-specific, for a total of ten map books in the supplemental map series. This map book shows ***the impervious surface coverage of stormwater sub-catchments at each potential tree planting location.*** This map book shows locations within the Right-of-Way only. One of the major benefits provided by trees is reducing stormwater runoff. These maps show the potential planting locations in relation to imperviousness throughout the city. Impervious surfaces do not allow water to pass through, thereby creating runoff that must be managed by the city's stormwater infrastructure). Imperviousness is represented on the map using three categories, each category representing one third of sub-catchments in the city. In other words, the sub-catchments in the city were sorted from highest imperviousness to lowest imperviousness (as a percentage of total sub-catchment area), and separated into three equally sized groups. For example, one third of the sub-catchments in the city fall into the least impervious category (less than 25 percent impervious).

Stormwater sub-catchments are defined by the city's stormwater system, and function similarly to a watershed (i.e. all area within a sub-catchment drains to the same location). The stormwater sub-catchments were delineated as part of the development of the Storm Water Management Model, Charlottesville Stormwater Master Plan (URS, January 2008), a drainage study of the City that utilized the PCSWMM computer program. For this study, the three main Charlottesville watersheds, Meadow Creek, Moores Creek, and the Rivanna River were delineated into approximately 360 sub-catchments, utilizing existing data sources and ESRI ArcMap GIS software. Subsequently, these sub-catchments were refined and added to as part of the Storm Water Management Model, Charlottesville Stormwater Services (URS, November 2010), a continuation of the previous study.

<u>Methodology:</u>

The basic outline of this process was to first update the provided "possible planting area" (PPA), create tree points within the final PPA, calculate a variety of metrics to attach to each point, and finally create map books to help guide future tree plantings.

A variety of datasets were used to complete this analysis. The primary data source for this analysis was created for the City of Charlottesville by Plan-It Geo. They developed a full land cover classification, as well as deriving the PPA from the created land cover dataset. Their product was derived from 2014 aerial imagery, which is one of the major limitations of the analysis because trees planted after 2014 are not accounted for, unless their specific location has been tracked by the City. Many of the datasets used as both exclusion factors and point metrics are updated on a regular basis by City of Charlottesville staff. This will allow the City of Charlottesville to update this analysis in the future when it becomes outdated.

The potential tree planting locations are semi-random points that have been placed to maximize the number of trees that can be planted in the PPA. The PPA was created by mapping several types of land cover, including turf grass and bare soil, while excluding land cover types where trees cannot be planted, like buildings and roads. This analysis only considers pervious PPA. This does not include impervious PPA, such as parking lots, even though it may be possible to plant trees in these areas. Additional exclusion factors (places where trees cannot be planted) were applied to refine the PPA:

- The Meadow Creek Restoration area (the area was replanted, but not captured in the land cover dataset)
- Railroad right-of-way
- A 10-foot buffer around existing trees
- A 10-foot buffer around existing buildings
- A 15-foot buffer around recent tree plantings
- A 10-foot buffer around underground utilities
- Sidewalks
- Private alleyways (alleyways that do not receive public maintenance, but must remain clear for vehicles)
- Un-addressable buildings – ranging from sheds to parking decks

Additionally, points were given a 40-foot separation distance. A 15-foot buffer was used around the available dataset of overhead utilities, but points that fell within this buffer were not removed, only flagged as constrained. Trees can still be planted in these locations, they are simply not ideal for larger trees. These final two constraints were chosen because they are consistent with codes and best practices for tree planting and maintenance in Charlottesville.

Additionally, for planning and analysis purposes, a number of metrics were collected for each identified point. These were:

- Census Data (by block group)
    - Population Density (Persons/Acre)
    - Median Household Income
- Proximity (up to 328 feet (100 meters)) to Major Roads (including ADT numbers)
- Proximity (up to 33 feet (10 meters)) to Trails (Existing and Proposed)
- Proximity (up to 49 feet (15 meters)) to Bike Lanes (Existing and Proposed)
- Proximity (up to 656 feet (200 meters)) to Streams
- Near Forest Cores (100 Feet)

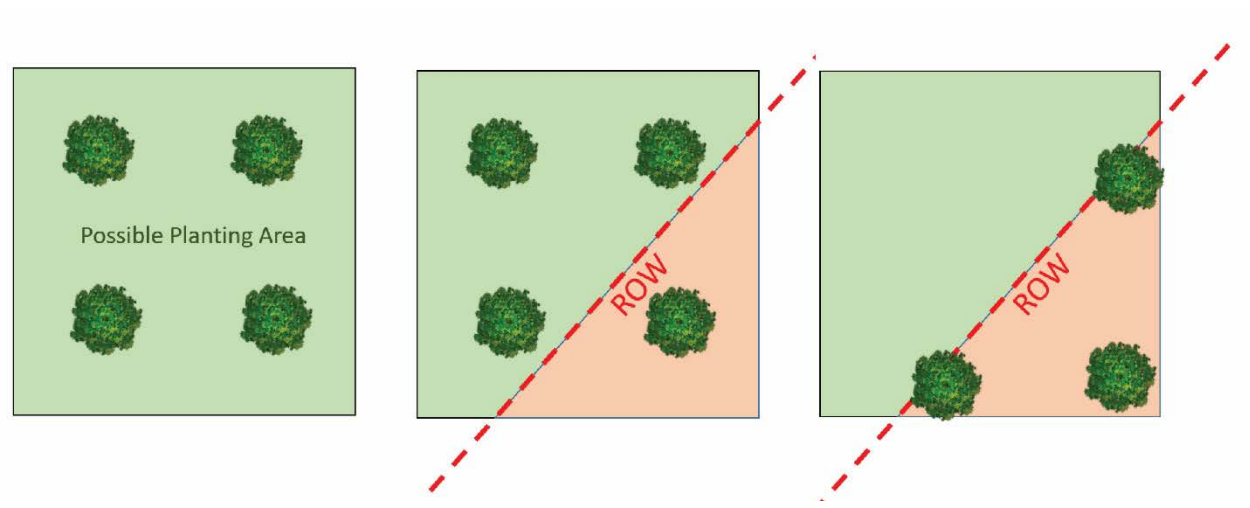
- Sub-catchment Imperviousness Percentage
- Relative Temperature
- Type of Framework Street (50 Feet)
- Zoning
- Steep Slopes
- Floodplain
- Underneath overhead power lines (Dominion Data)
- Entrance Corridor
- State Owned Property
- City/County Owned Property
- School Property
- UVa Property
- Walking Distance to Schools (1/4 Mile)

If a metric does not have a discrete value, such as population density, it was given a value of 0 if it does not meet the metric, and a 1 if it does. Metrics that include “Proximity” have distances included. For the metrics that include proximity, a distance of -1 indicates that the point falls outside of the maximum range to be considered for that metric.

Trees can provide many benefits, from stormwater mitigation to reducing urban heat island, and this supplemental information helps identify where these benefits can be realized. While all of the metrics are embedded in each point, these map books help visualize this information spatially. This map book can identify potential tree planting projects, but the exact location of trees should be adjusted based on the realities of the specific site.

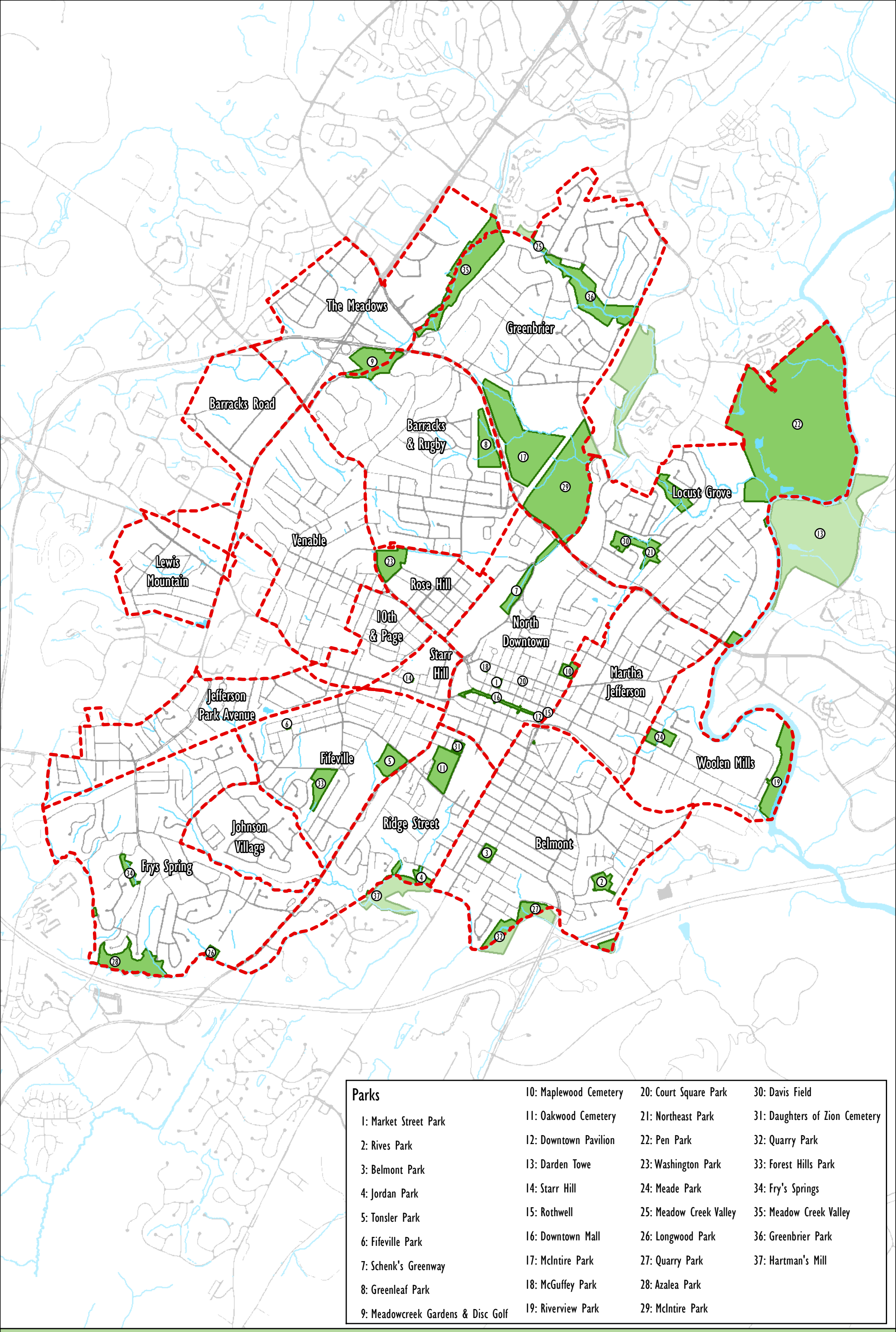
Right-of-Way Analysis:

Right-of-way possible planting area points are calculated from their own analysis, not a selection from all potential tree planting locations. This is because the points were placed randomly to maximize the number of points. The random points did not take into account the right-of-way, leading to an under-estimation of points that could fit into the right-of-way. A second, identical calculation was done on just the PPA within the right-of-way so that the number of points were not under-represented. The total points and the points in the right-of-way should be treated as separate analysis.



This series of images demonstrates the difference between the possible planting points generated specifically inside the right-of-way. The image at left shows where possible planting points would be located by ArcGIS to maximize the number of points in a given possible planting area (green square) and a specified minimum spacing between points. The middle image demonstrates what would happen assuming the portion of the PPA shown in orange was in the ROW. Under this scenario, only one point would be found to be in the ROW. The image at right shows what would happen if the same analysis is run ***only considering the ROW***. Under this scenario, three points can be located in the ROW, using the same assumptions.

Thus, if one is interested in only what can be done in the ROW, the ROW-specific analysis should be used, as it looks at how planting sites can be maximized in only the ROW.

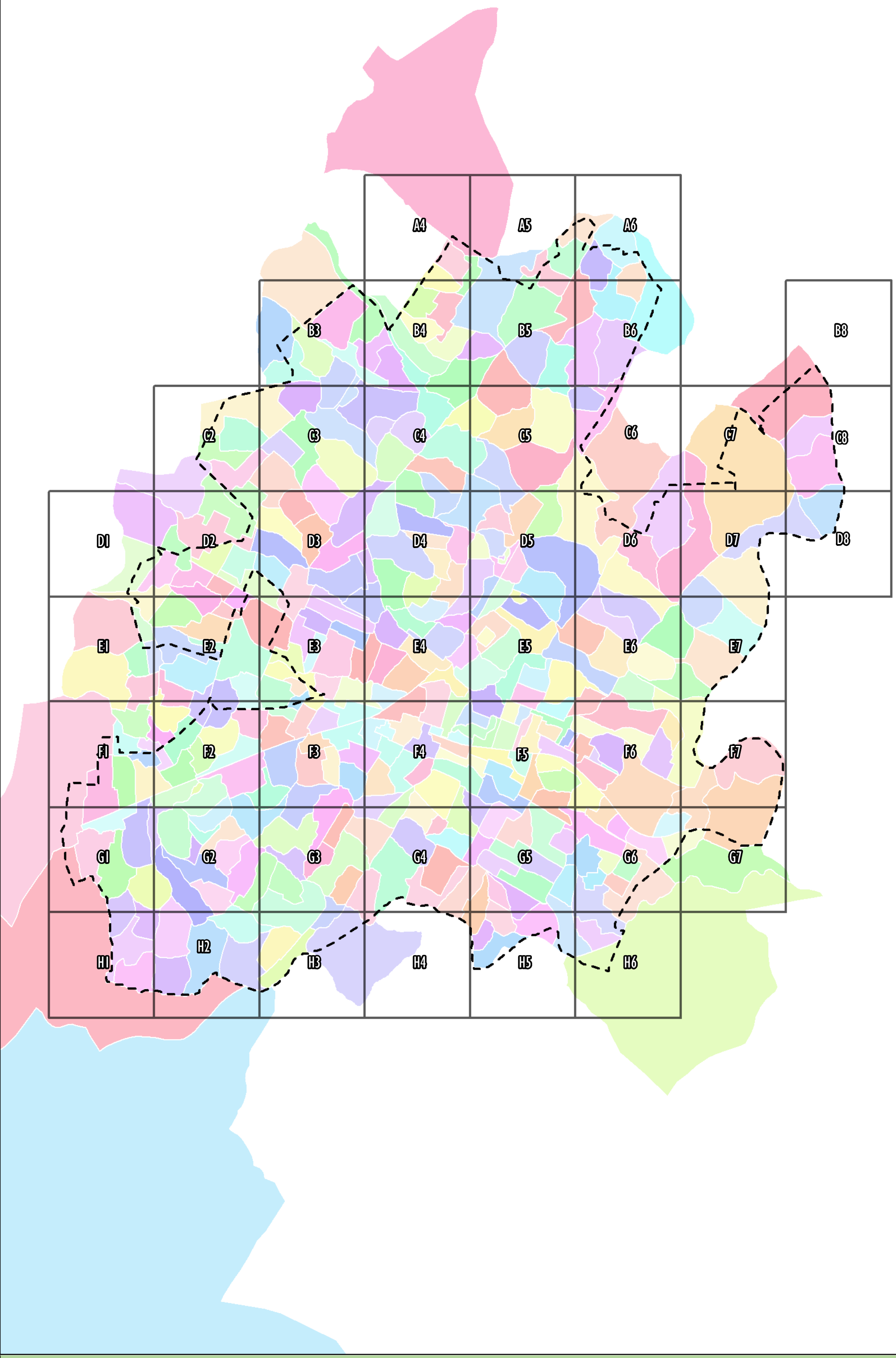


Parks

1: Market Street Park
2: Rives Park
3: Belmont Park
4: Jordan Park
5: Tonsler Park
6: Fifeville Park
7: Schenk's Greenway
8: Greenleaf Park
9: Meadowcreek Gardens & Disc Golf
10: Maplewood Cemetery
11: Oakwood Cemetery
12: Downtown Pavilion
13: Darden Towe
14: Starr Hill
15: Rothwell
16: Downtown Mall
17: McIntire Park
18: McGuffey Park
19: Riverview Park
20: Court Square Park
21: Northeast Park
22: Pen Park
23: Washington Park
24: Meade Park
25: Meadow Creek Valley
26: Longwood Park
27: Quarry Park
28: Azalea Park
29: McIntire Park
30: Davis Field
31: Daughters of Zion Cemetery
32: Quarry Park
33: Forest Hills Park
34: Fry's Springs
35: Meadow Creek Valley
36: Greenbrier Park
37: Hartman's Mill

Neighborhoods Overview

0 0.5 1 Mile



Sub-catchment Boundaries

0 0.5 1 Mile

The Meadows

0 500 1,000 2,000 3,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

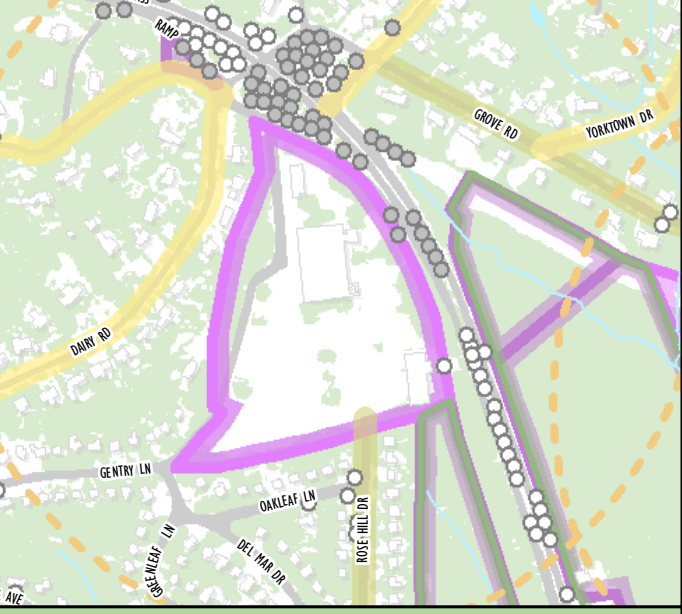
Framework Streets - Typology

Street Typology

- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B
- Neighborhood Boundaries

Parks

9: Meadowcreek Gardens & Disc Golf



Barracks Road

0 500 1,000 2,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

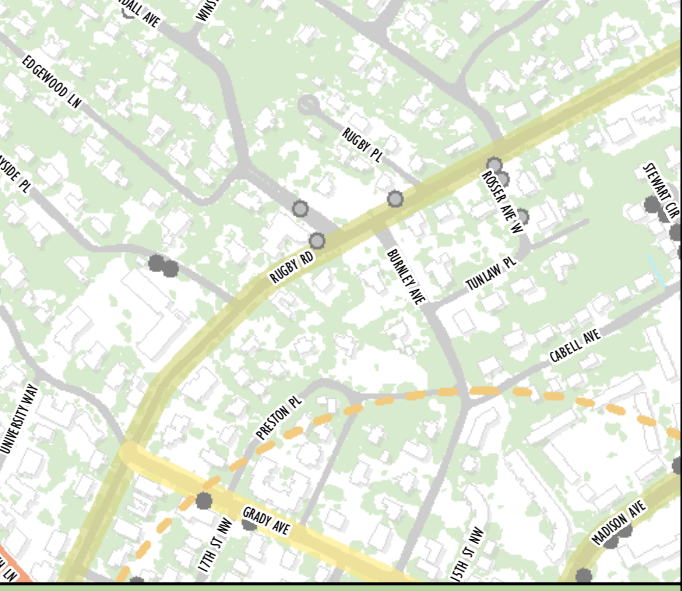
Mixed Use A

Mixed Use B

Neighborhood A

Neighborhood B

Neighborhood Boundaries



Lewis Mountain

0 500 1,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

Mixed Use A

Mixed Use B

Neighborhood B

Neighborhood Boundaries

5 Minute School Walkzones

North Downtown

0 500 1,000 2,000 3,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Framework Streets - Typology

Street Typology

- Downtown
- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Parks

1: Market Street Park

7: Schenk's Greenway

10: Maplewood Cemetery

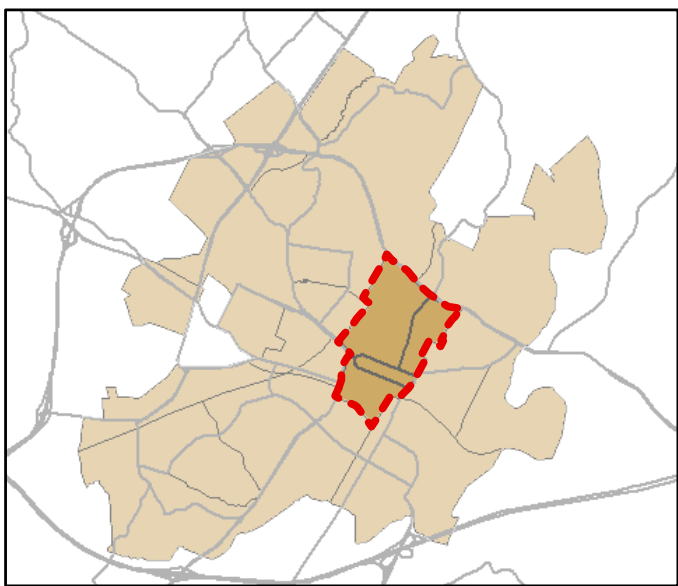
12: Downtown Pavilion

15: Rothwell

16: Downtown Mall

18: McGuffey Park

20: Court Square Park



Johnson Village

0 500 1,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

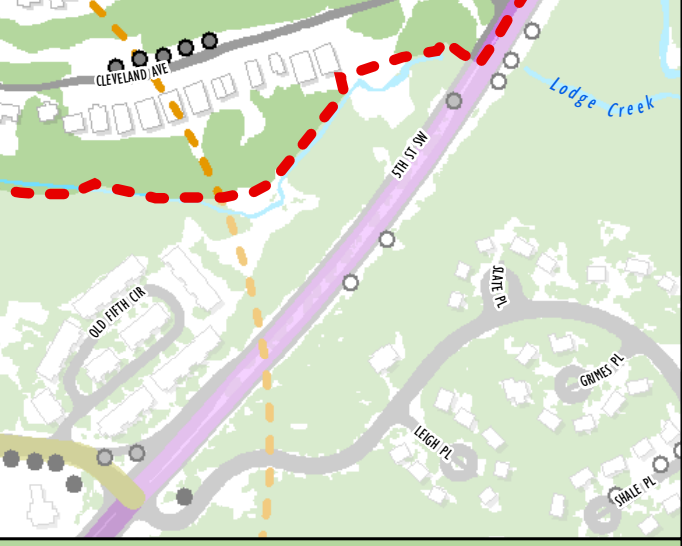
Mixed Use A

Mixed Use B

Neighborhood A

Neighborhood B

Neighborhood Boundaries



Frys Spring

0 500 1,000 2,000 3,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

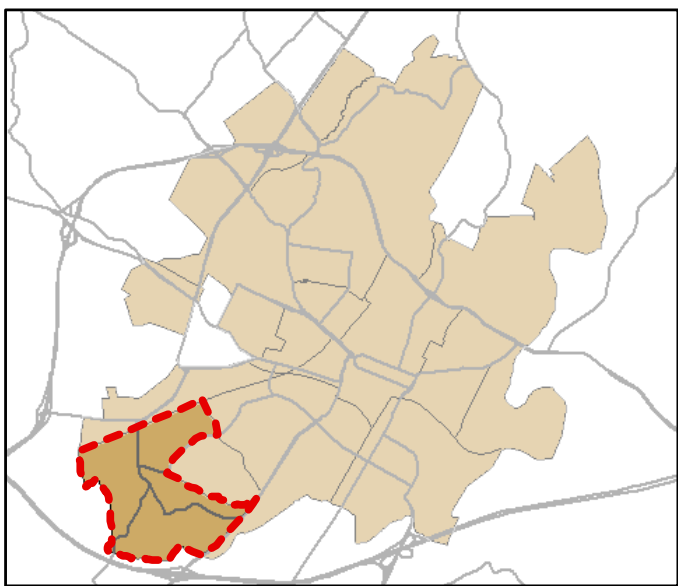
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B
- Neighborhood Boundaries

Parks

26: Longwood Park

28: Azalea Park

34: Fry's Springs



10th & Page

0 500 1,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

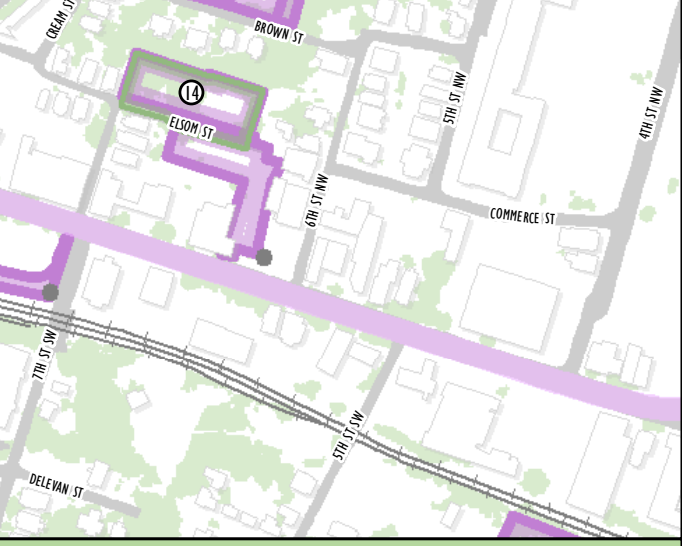
UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B
- Neighborhood Boundaries



Jefferson Park Avenue

0 500 1,000 2,000 3,000 4,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

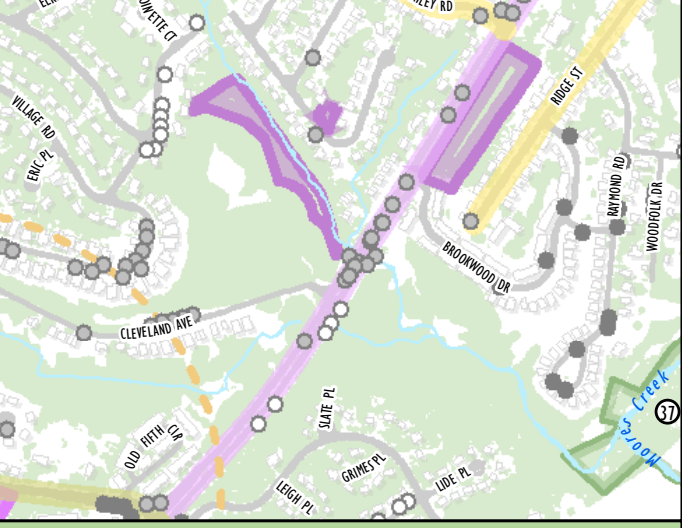
UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B
- Neighborhood Boundaries



Starr Hill

0 500 1,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Framework Streets - Typology

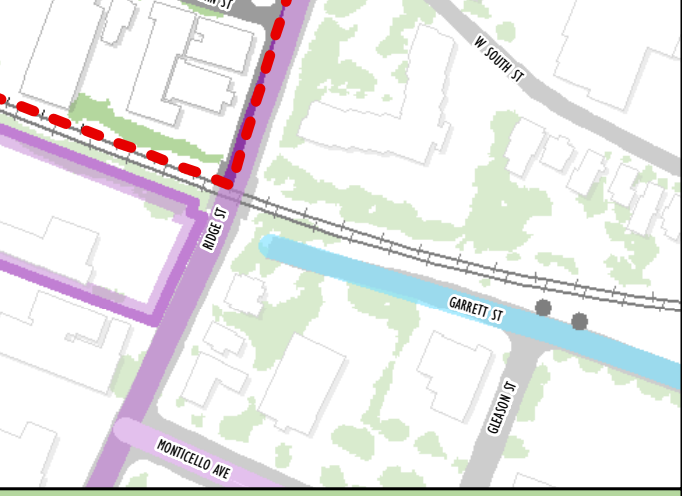
Street Typology

- Downtown
- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A

- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks

14: Starr Hill



Fifeville

0 500 1,000 2,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

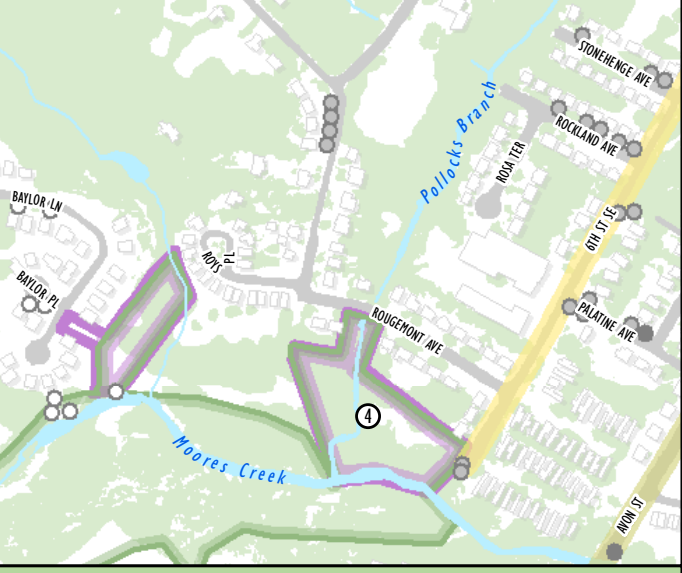
- Downtown
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

Parks

5: Tonsler Park

6: Fifeville Park

33: Forest Hills Park



Ridge Street

0 500 1,000 2,000 3,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Framework Streets - Typology

Street Typology

- Downtown
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks

4: Jordan Park

11: Oakwood Cemetery

31: Daughters of Zion Cemetery

Belmont

0 500 1,000 2,000 3,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Framework Streets - Typology

Street Typology

- Downtown
- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

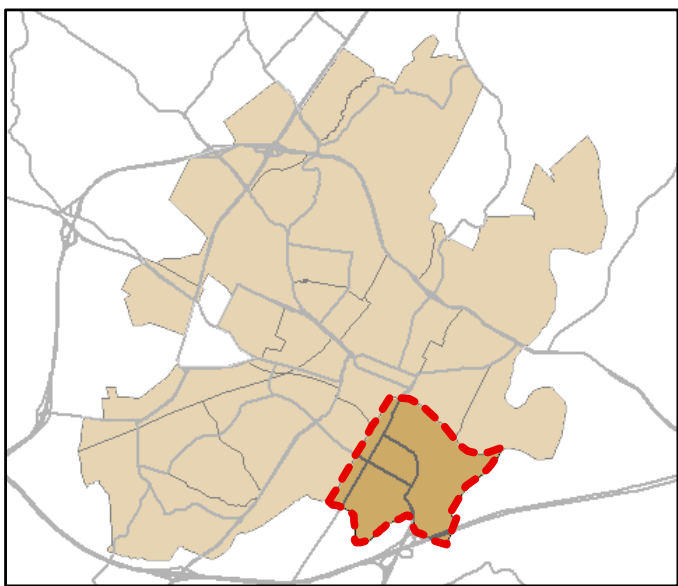
Parks

2: Rives Park

3: Belmont Park

27: Quarry Park

32: Quarry Park



Woolen Mills

0 500 1,000 2,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Downtown
- Industrial
- Mixed Use B
- Neighborhood A
- Neighborhood B

Parks

19: Riverview Park

24: Meade Park

Martha Jefferson

0 500 1,000 2,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

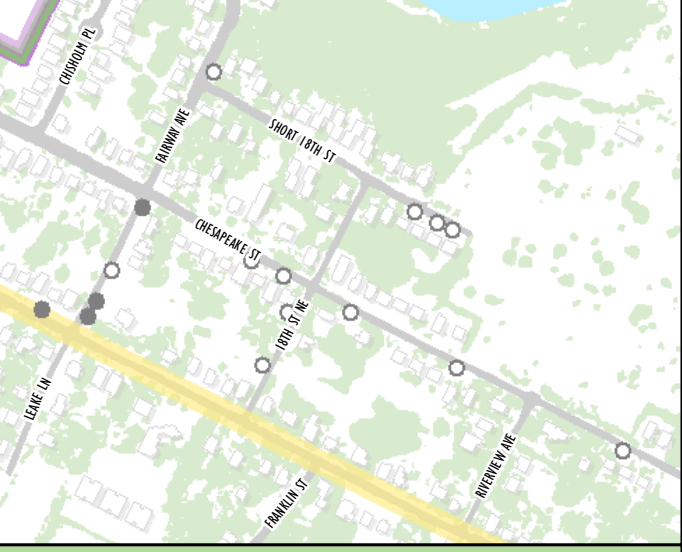
UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Downtown
- Industrial
- Mixed Use B
- Neighborhood A
- Neighborhood B



Locust Grove

0 500 1,000 2,000 3,000 4,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Industrial
- Mixed Use B
- Neighborhood A
- Neighborhood B
- Neighborhood Boundaries

Parks

22: Pen Park

30: Davis Field

21: Northeast Park

Greenbrier

0 500 1,000 2,000 3,000 4,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

Parks

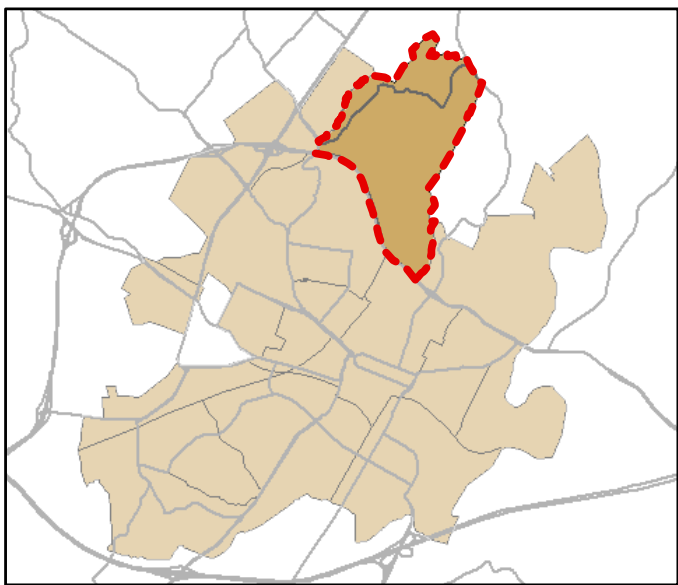
17: McIntire Park

25: Meadow Creek Valley

29: McIntire Park

35: Meadow Creek Valley

36: Greenbrier Park



Venable

0 500 1,000 2,000 3,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

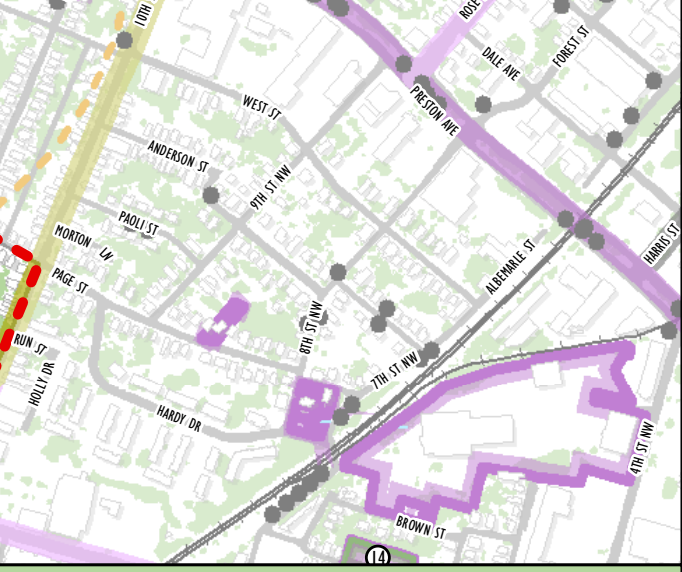
UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B



Rose Hill

0 500 1,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

Parks

23: Washington Park

Barracks & Rugby

0 500 1,000 2,000 Feet

Legend

Potential Tree Planting Locations (Right-of-Way)

Subcatchment Imperviousness

- 38% - 93%
- 25% - 37%
- 0% - 24%

Streams

Neighborhood Boundaries

5 Minute School Walkzones

Tree Canopy

Parks

School Parcels

State-Owned Parcels

UVa Parcels

City Parcels

Framework Streets - Typology

Street Typology

- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

Parks

8: Greenleaf Park