# 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.

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 *potential tree planting location density within city right-of-way.* These maps serve as a visualization, highlighting where many potential tree planting locations are clustered together. The shaded bands on the maps indicate how many potential planting points fall nearby any given location. One of the most obvious reasons for identifying such clusters of potential locations is from a maintenance efficiency standpoint. If 100 trees are planted in close proximity, the maintenance costs for these trees (especially the needs during the first several years after planting such as watering and pruning), is expected to be lower than if the 100 trees were planted in disparate locations throughout the city.

These points were created by the Green Infrastructure Center (GIC) using the best available GIS data, not field surveys. The datasets included in the methodology are under constant revision, and may not be perfectly accurate or current. This analysis is not a suitability study and does not represent recommended tree planning sites. The locations identified may include areas where trees could not be physically planted, and could also include areas that may not be suitable for planting. Further field investigation will be needed to determine if the points identified are suitable for planting and to identify the precise tree planting site.

Methodology:

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.
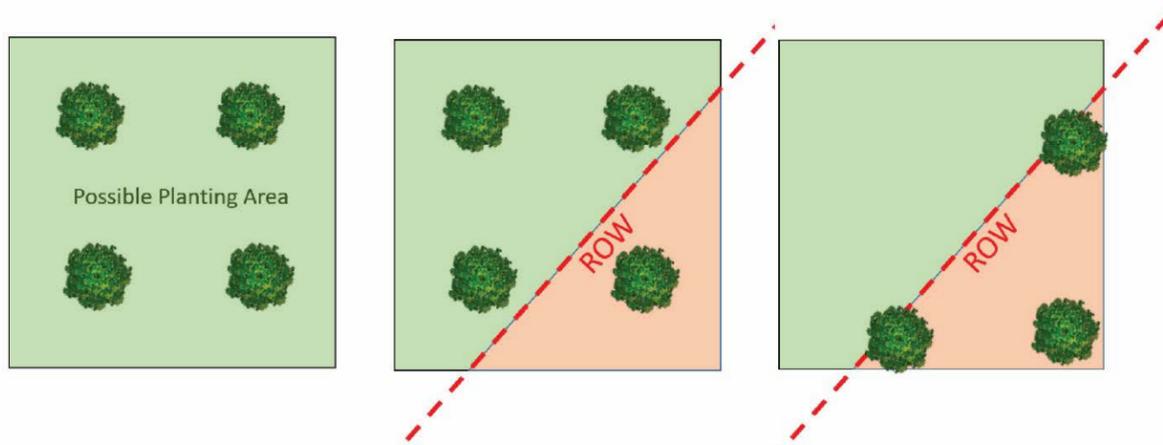


This series of images demonstrates the difference between the possible planting points generated specifically inside the right-of-way. The image at left shows where possible planting points would be located by ArcGIS to maximize the number of points in a given possible planting area (green square) and 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.
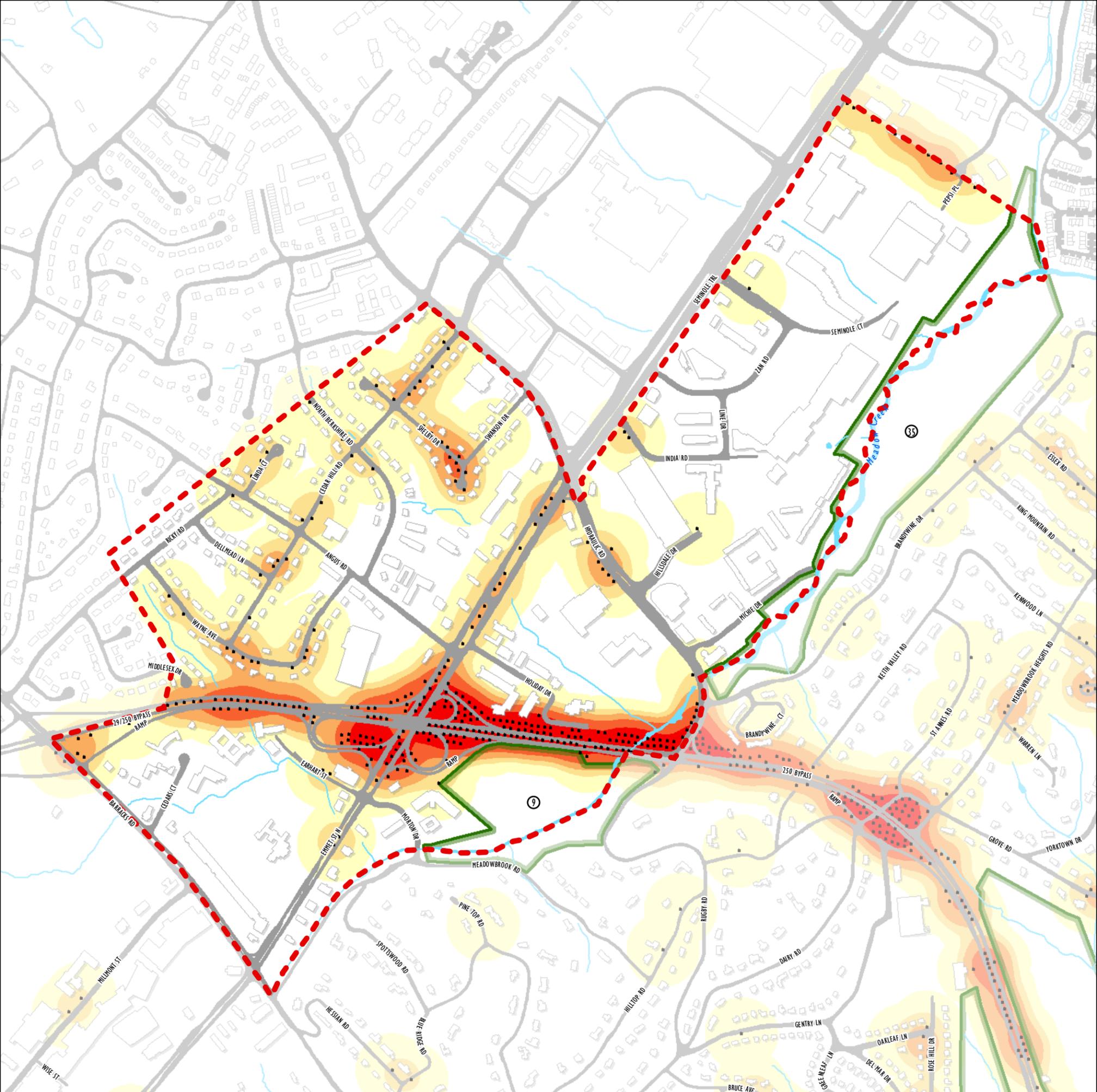
Thus, if one is interested in only what can be done in the ROW, the ROW-specific analysis should be used, as it looks at how planting sites can be maximized in only the ROW.

# Neighborhoods Overview
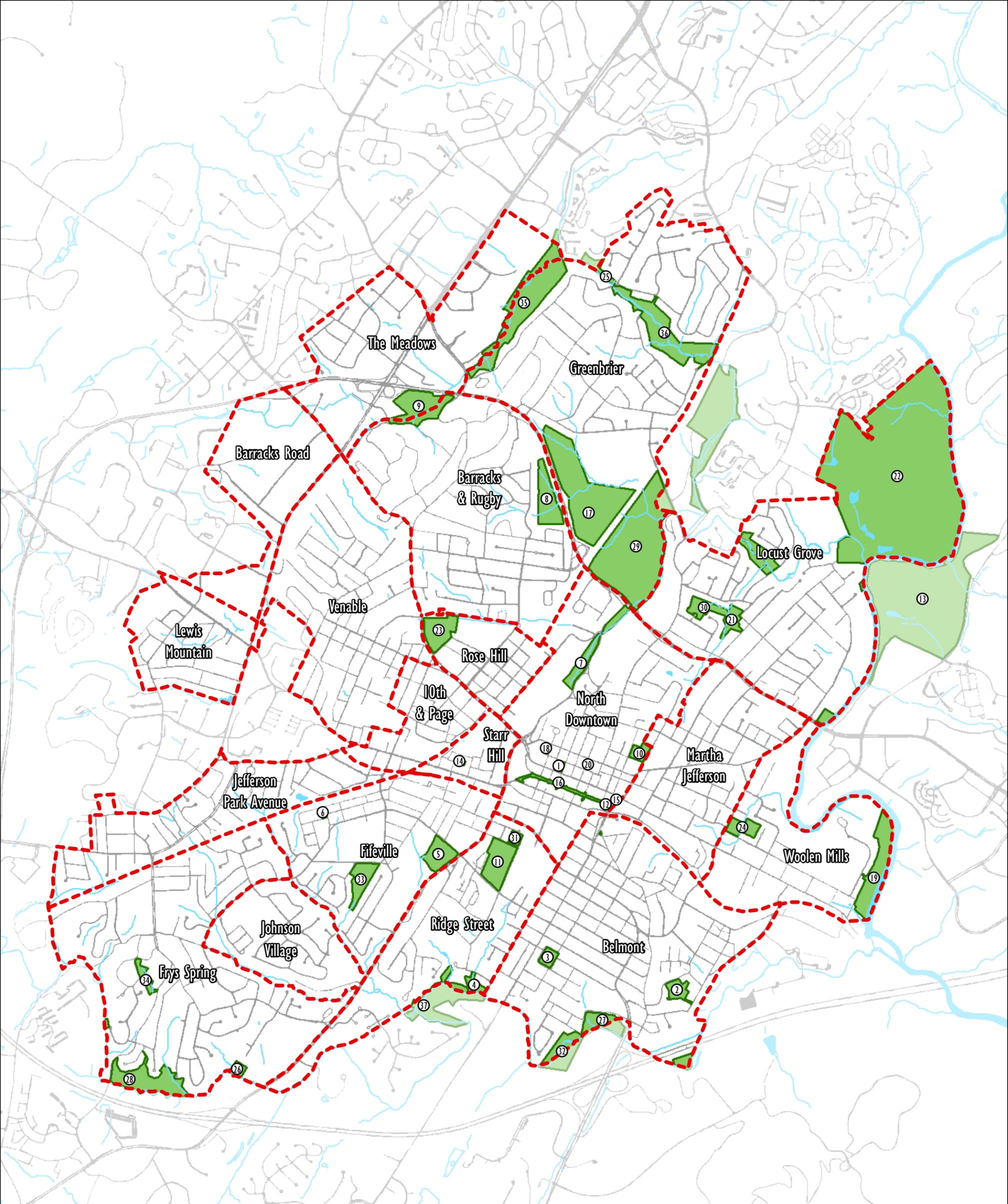
**Parks**

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

0    0.5    1 Mile

# The Meadows

## Legend

- Potential Tree Planting Locations (Right-of-Way)
- Streams
- Neighborhood Boundaries
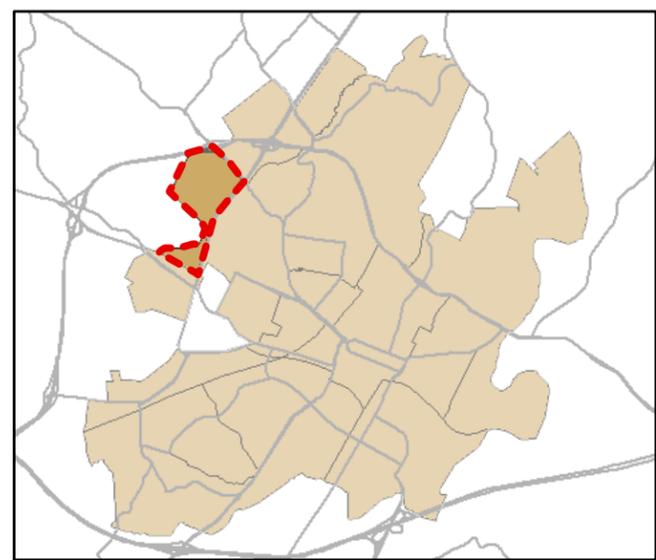- Parks

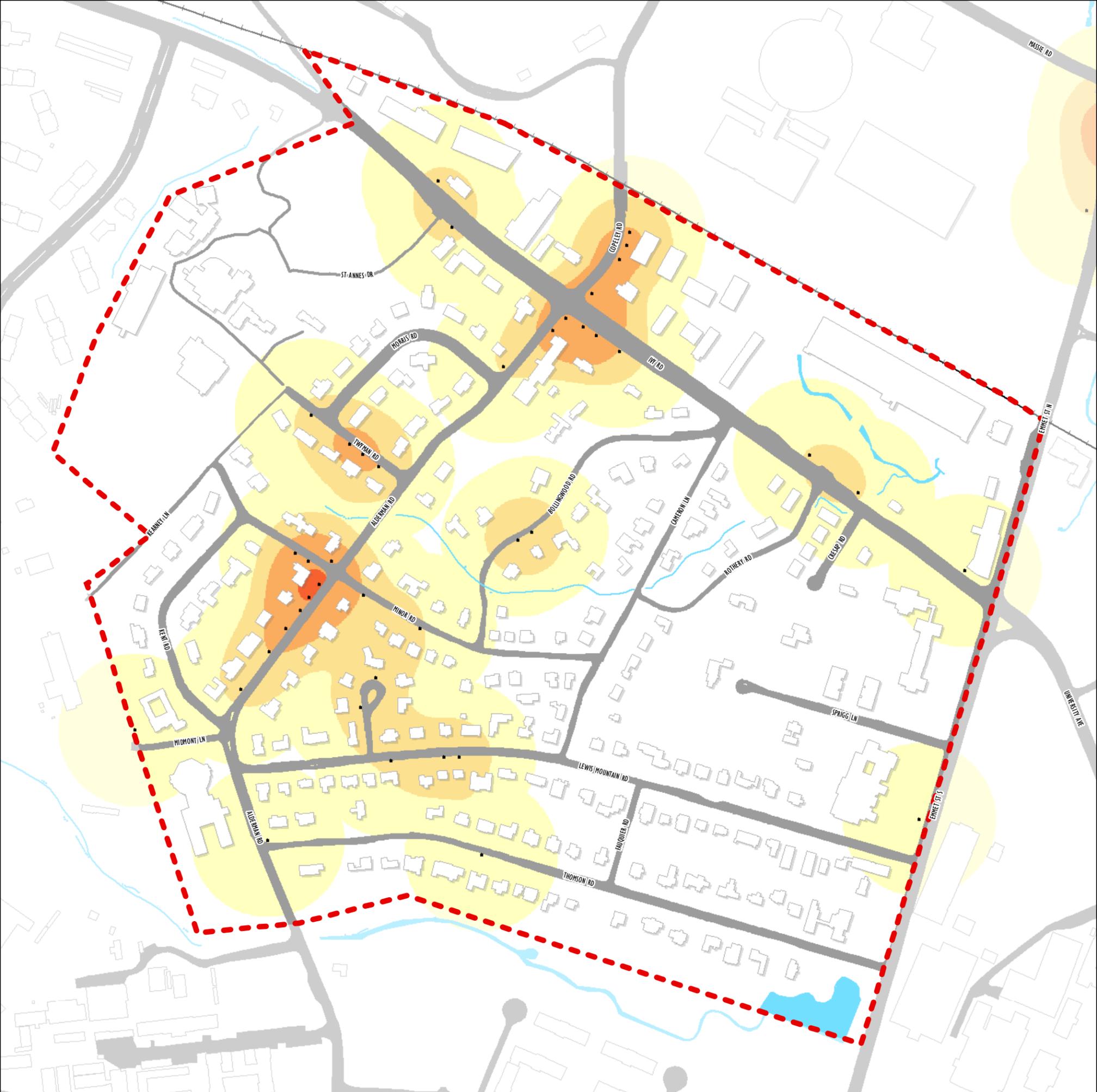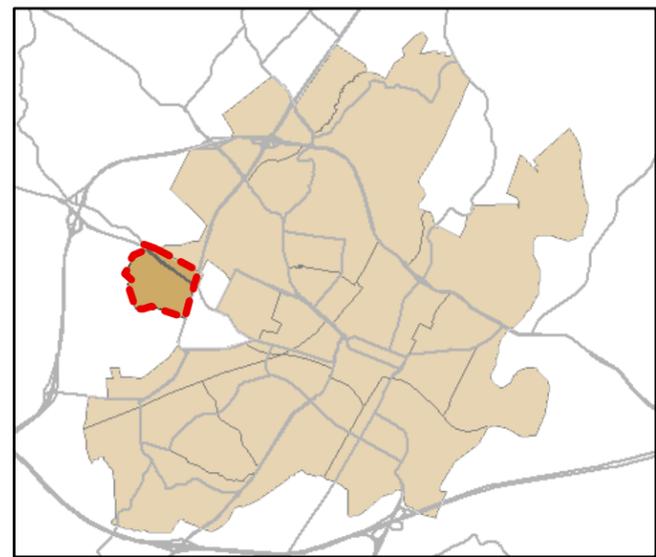### Potential Tree Planting Location Density (Right-of-Way)
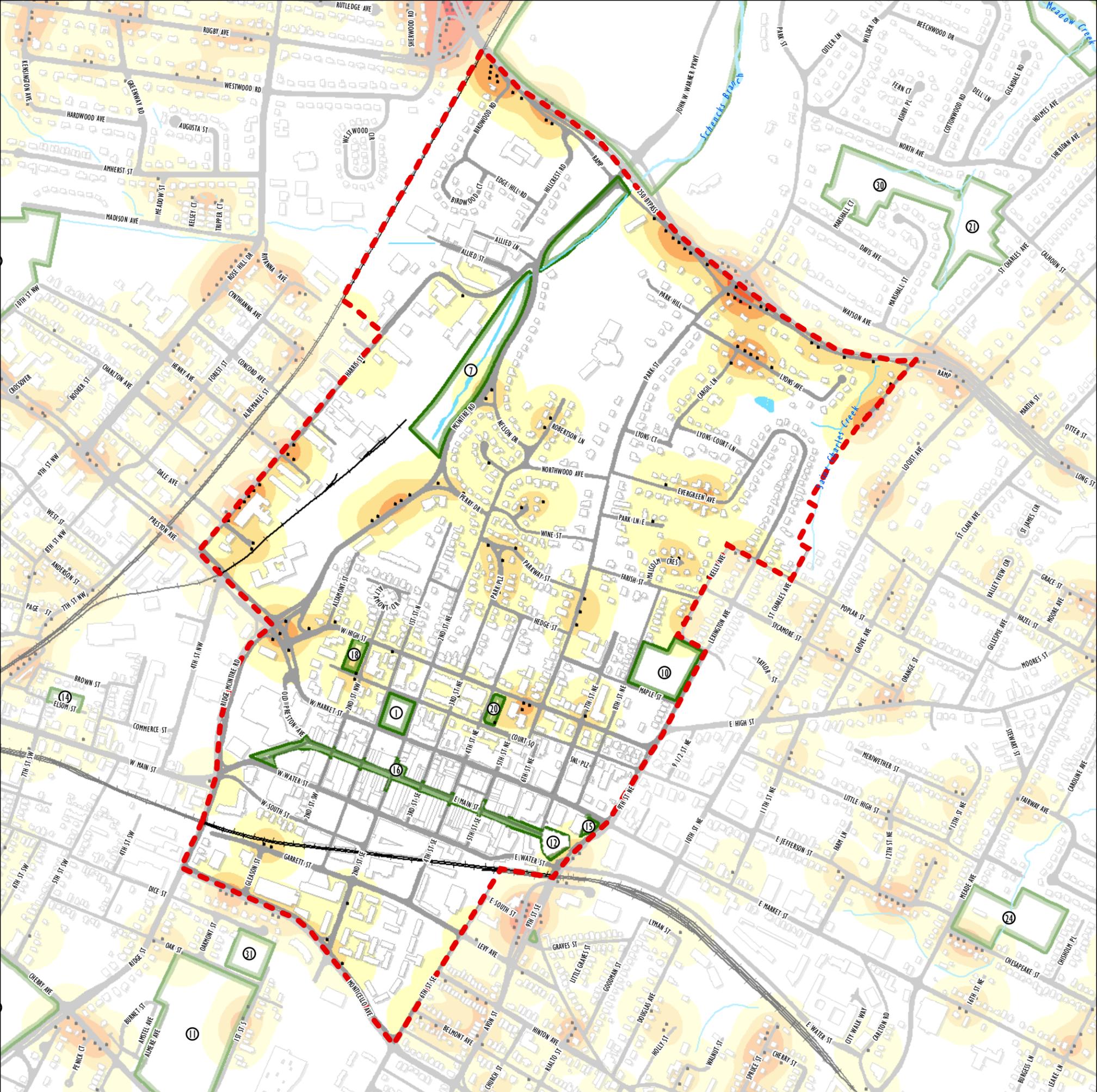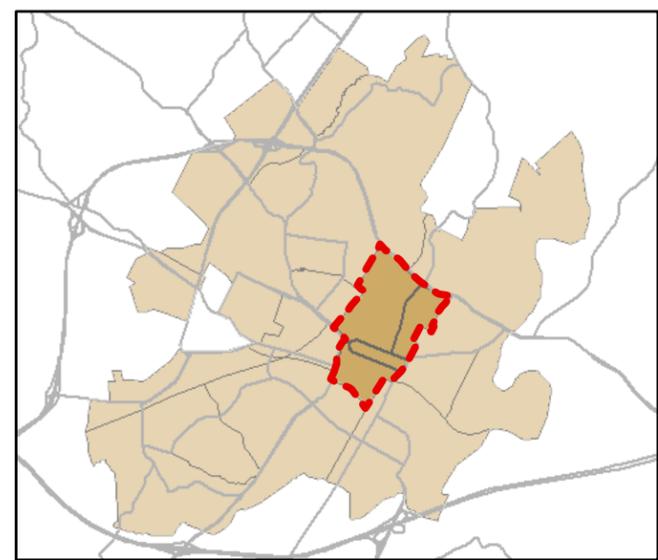
- Higher Planting Location Density
- Lower Planting Location Density

**Parks** 9: Meadowcreek Gardens & Disc Golf

0   500   1,000   2,000   3,000 Feet
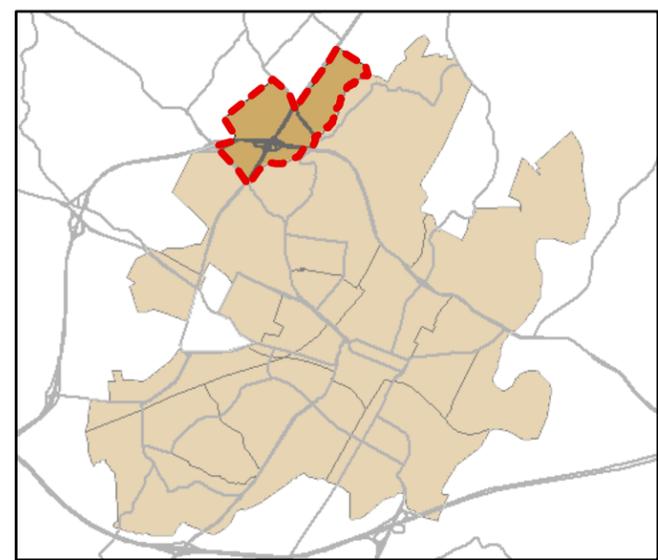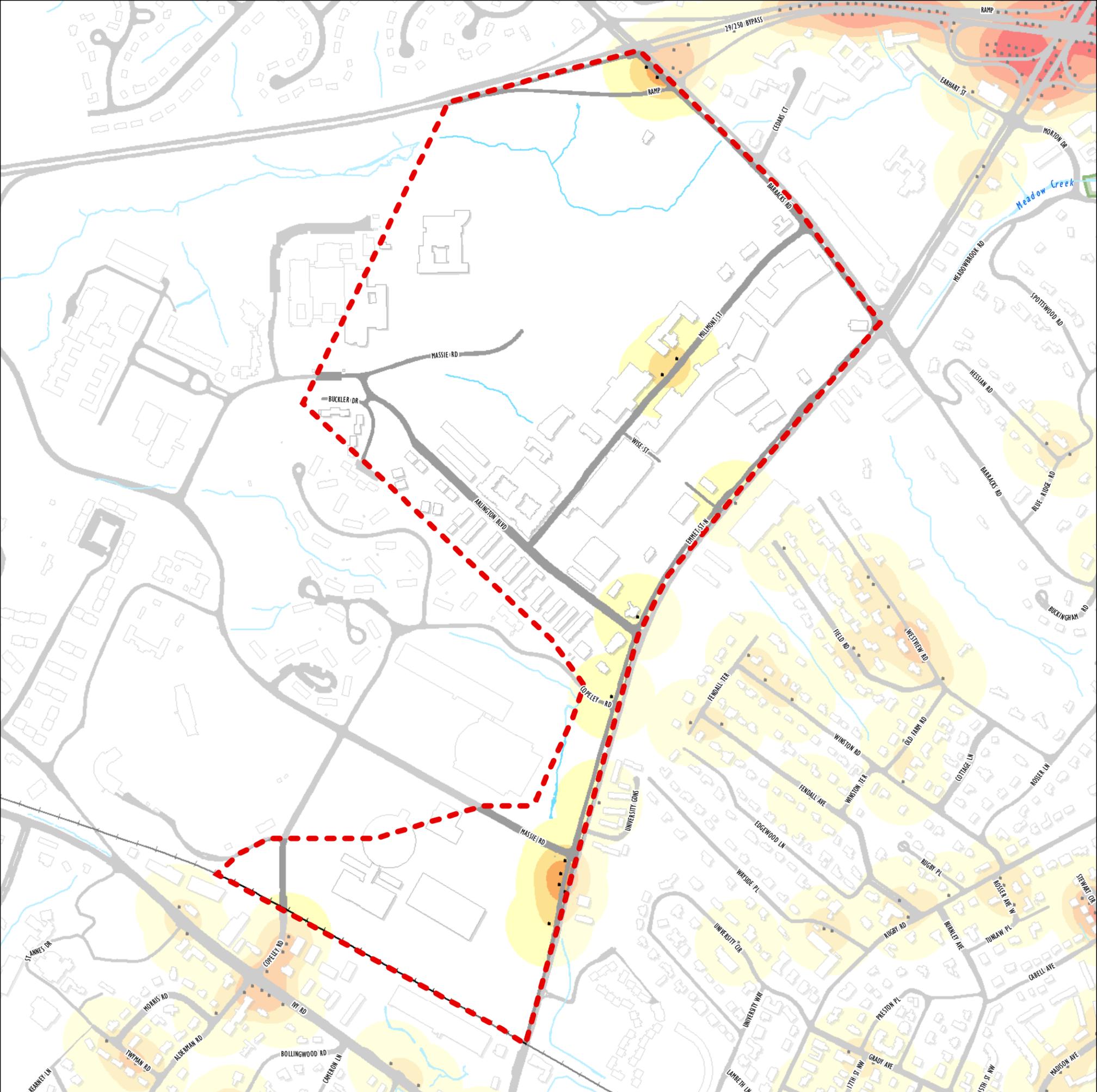
# Barracks Road

Legend

- Potential Tree Planting Locations (Right-of-Way)
- Streams
- Neighborhood Boundaries
- Parks

Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
- Lower Planting Location Density

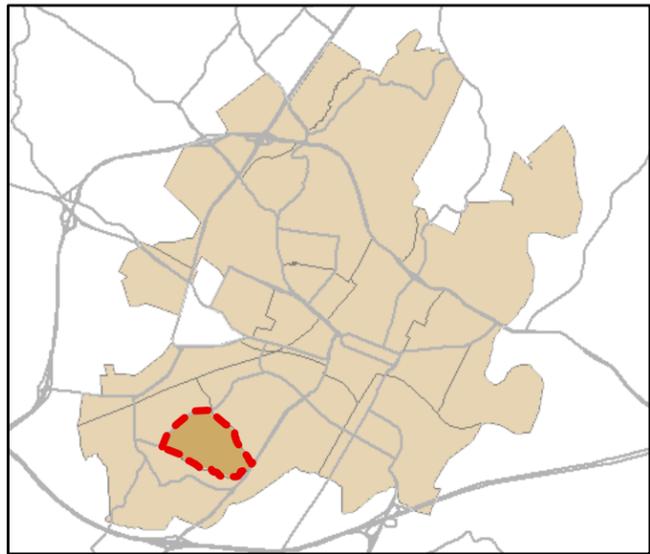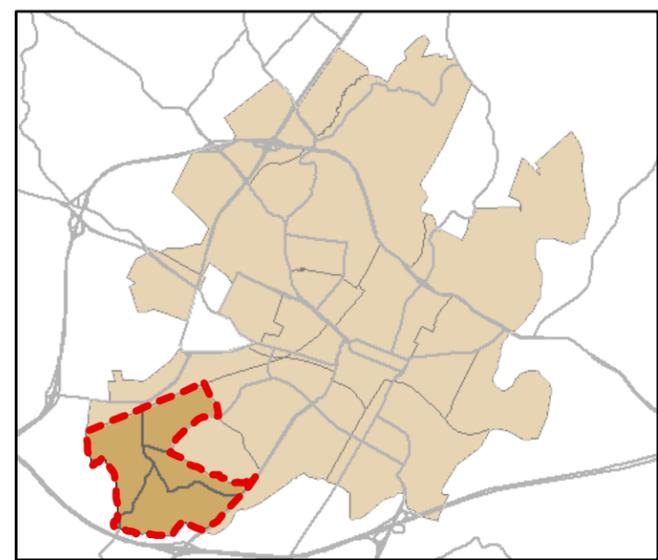# Lewis Mountain

Scale: 0 — 500 — 1,000 Feet

## Legend

- **·** Potential Tree Planting Locations (Right-of-Way)
- —— Streams
- ▬ ▬ Neighborhood Boundaries
- ☐ Parks

### Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
- Lower Planting Location Density

Street labels visible on map: MASSIE RD, ST. ANNES DR, COPELEY RD, IVY RD, MORRIS RD, TWYMAN RD, ALDERMAN RD, ROLLINGWOOD RD, CAMERON LN, CREST RD, ROTHERY RD, EMMET ST N, SPRIGG LN, EMMET ST S, UNIVERSITY AVE, BENNETT LN, KEENE RD, MINOR RD, MIDMONT LN, ALDERMAN RD, LEWIS MOUNTAIN RD, FAUQUIER RD, THOMSON RD

# North Downtown



## Legend

- **·** Potential Tree Planting Locations (Right-of-Way)
- —— Streams
- --- Neighborhood Boundaries
- ▭ Parks

### Potential Tree Planting Location Density (Right-of-Way)
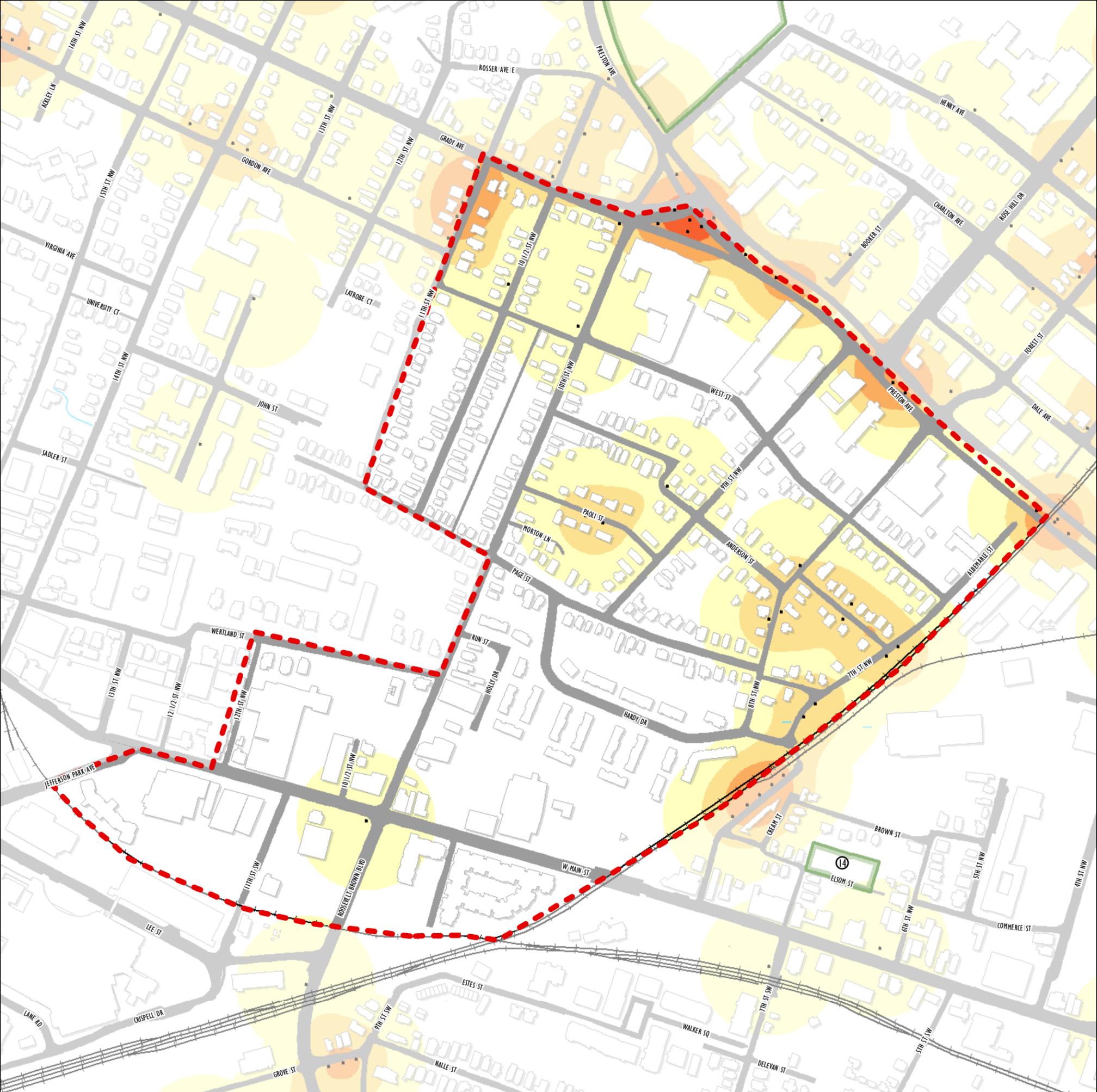
- Higher Planting Location Density
- Lower Planting Location Density

## 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

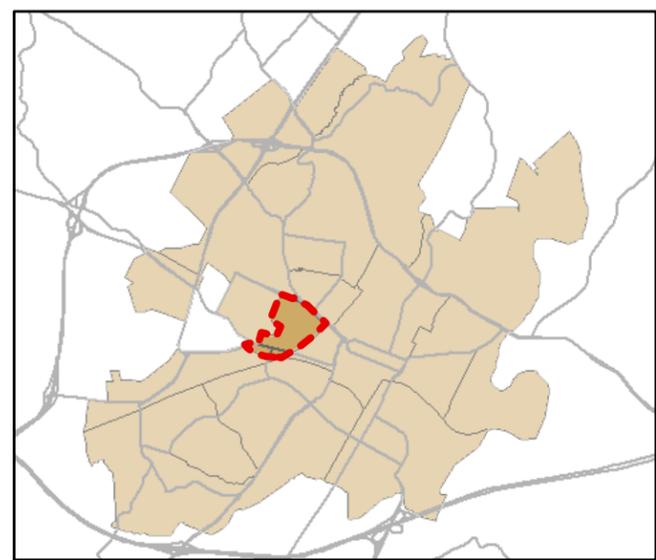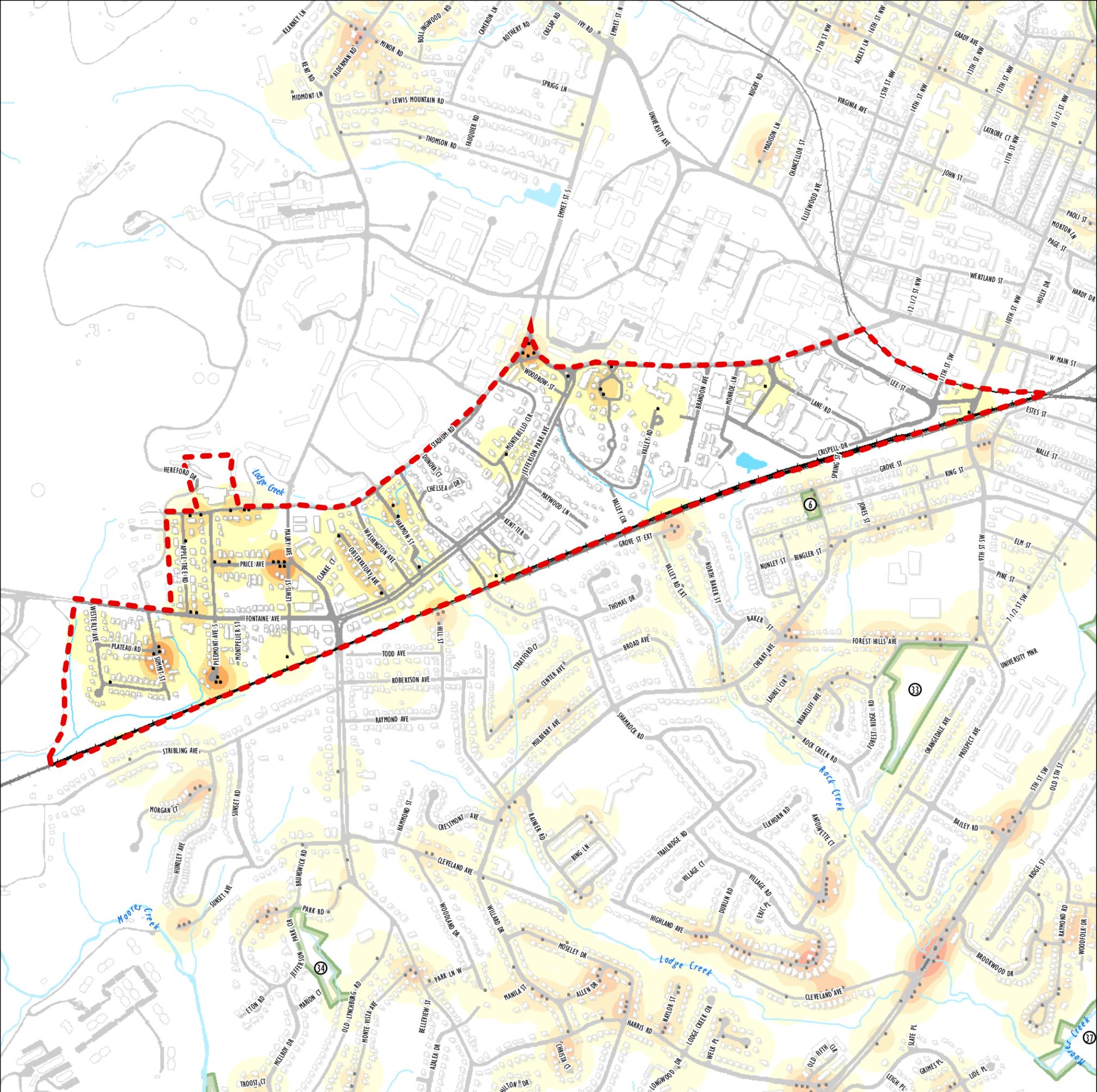Scale: 0 — 500 — 1,000 — 2,000 — 3,000 Feet

# Johnson Village

Legend

- Potential Tree Planting Locations (Right-of-Way)
- Streams
- Neighborhood Boundaries
- Parks

Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
- Lower Planting Location Density

0    500    1,000 Feet

# Frys Spring

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

## Legend

• Potential Tree Planting Locations (Right-of-Way)

— Streams

- - - Neighborhood Boundaries

▭ Parks

## Potential Tree Planting Location Density (Right-of-Way)
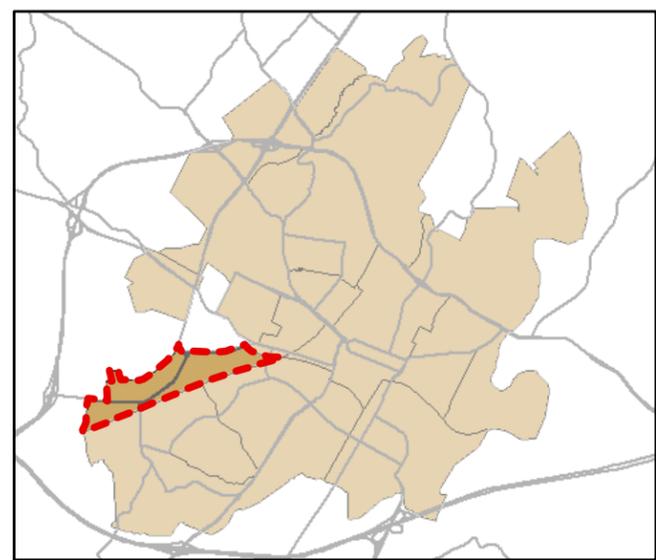
■ Higher Planting Location Density

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■ Lower Planting Location Density

## Parks

28: Azalea Park

34: Fry's Springs

26: Longwood Park

# 10th & Page



Legend

- · Potential Tree Planting Locations (Right-of-Way)
- — Streams
- Neighborhood Boundaries
- Parks

Potential Tree Planting Location Density (Right-of-Way)
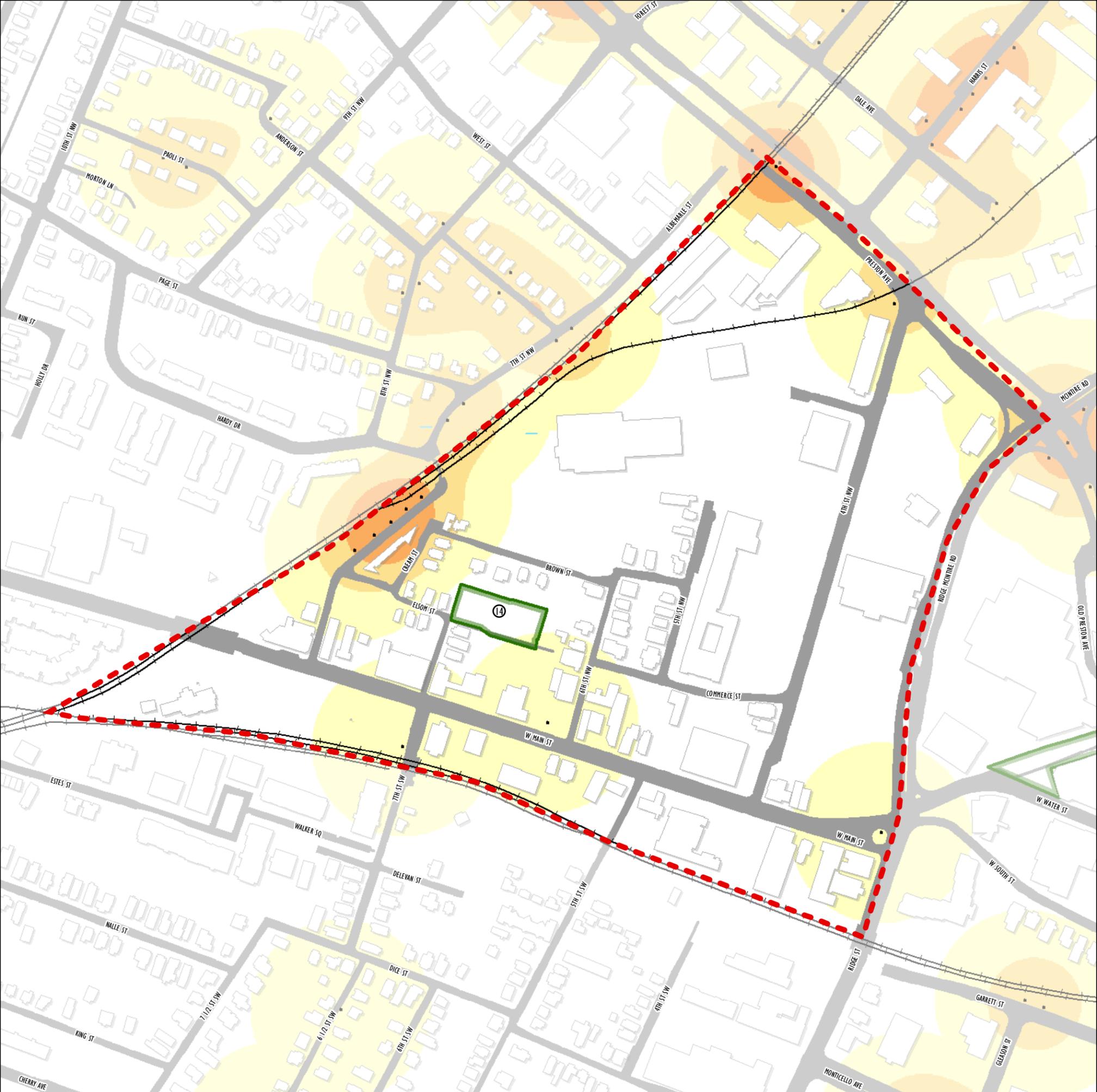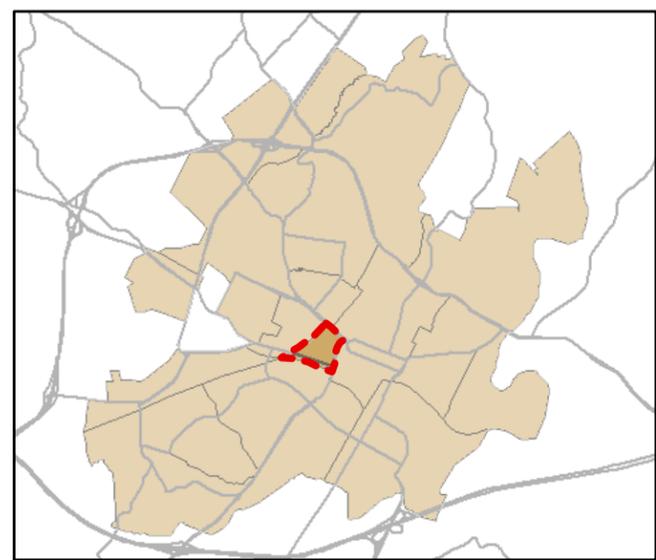
- Higher Planting Location Density
- Lower Planting Location Density

0    500    1,000 Feet

# Jefferson Park Avenue

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

## Legend

• Potential Tree Planting Locations (Right-of-Way)

— Streams

╍╍ Neighborhood Boundaries

▭ Parks

### Potential Tree Planting Location Density (Right-of-Way)

■ Higher Planting Location Density

■

■

■

■ Lower Planting Location Density

# Starr Hill

Parks    14: Starr Hill

0    500    1,000 Feet

## Legend

- Potential Tree Planting Locations (Right-of-Way)
- Streams
- Neighborhood Boundaries
- Parks

## Potential Tree Planting Location Density (Right-of-Way)

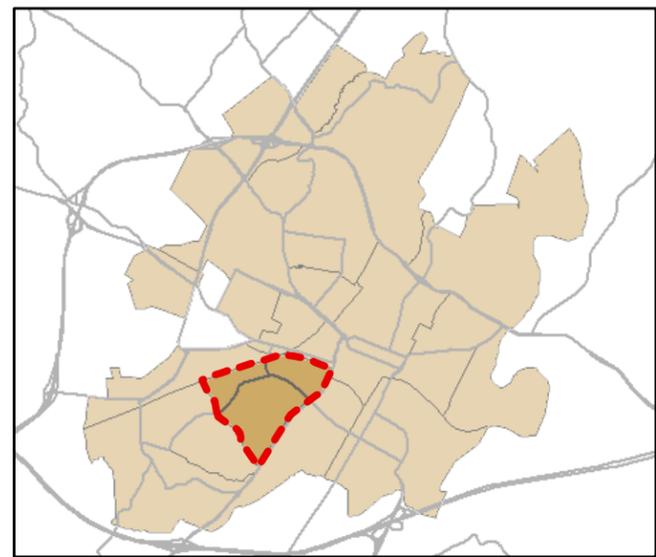- Higher Planting Location Density
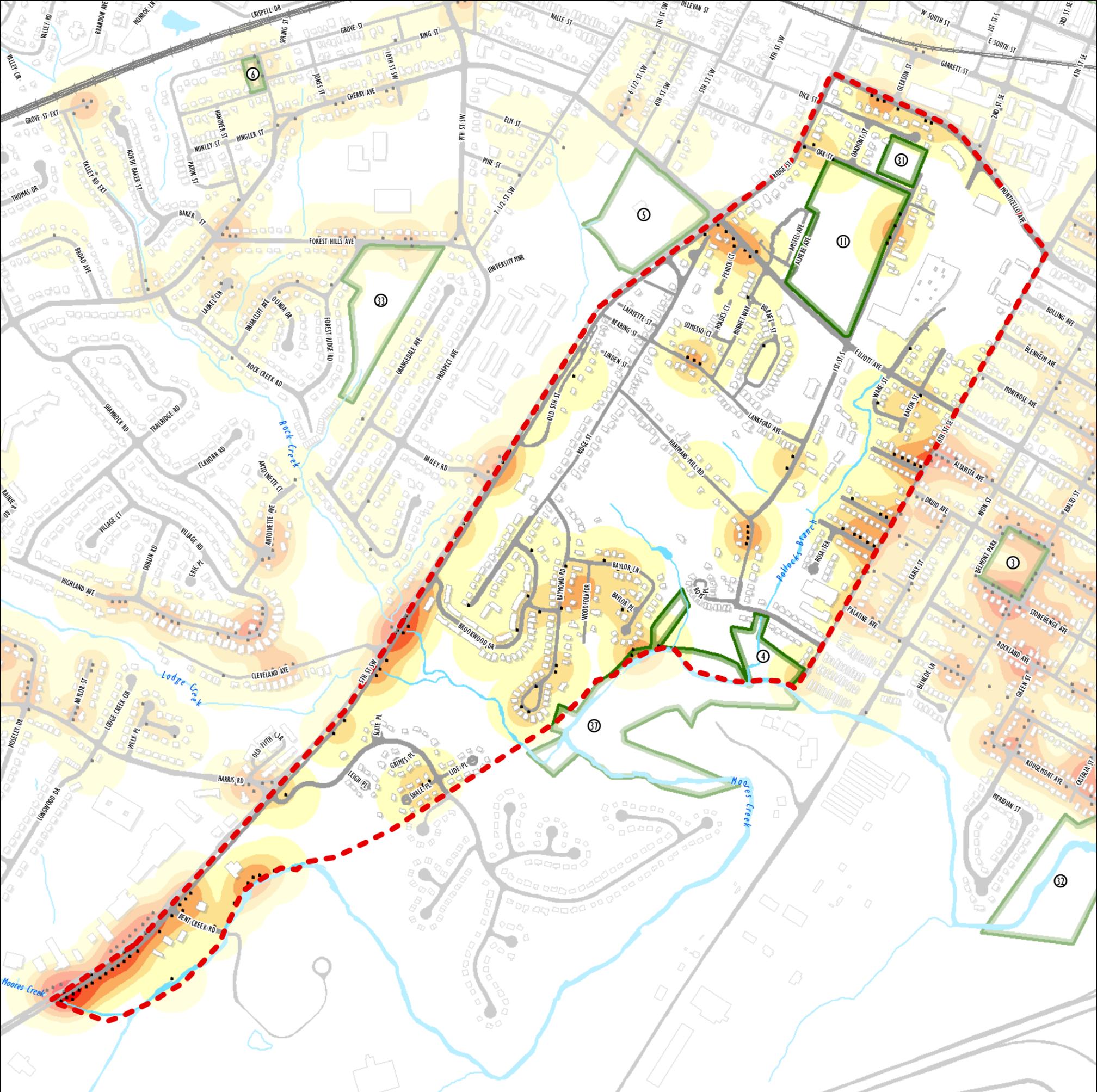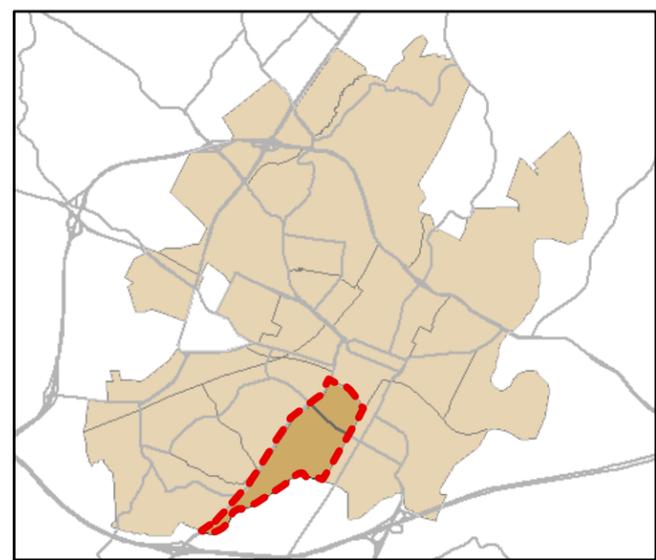- Lower Planting Location Density

### Map Labels

FOREST ST, HARRIS ST, DALE AVE, PRESTON AVE, MCINTIRE RD, OLD PRESTON AVE, LOIS ST NW, MORTON LN, PAOLI ST, 9TH ST NW, ANDERSON ST, WEST ST, ALBEMARLE ST, PAGE ST, RUN ST, HOLLY DR, HARDY DR, 8TH ST NW, 7TH ST NW, 10TH ST NW, RIDGE MCINTIRE RD, BROWN ST, CREAM ST, ELSON ST, 5TH ST NW, 6TH ST NW, COMMERCE ST, W MAIN ST, W WATER ST, ESTES ST, WALKER SQ, 7TH ST W, DELEVAN ST, 5TH ST W, W SOUTH ST, W MAIN ST, RIDGE ST, GARRETT ST, NALLE ST, 7 1/2 ST W, DICE ST, 6 1/2 ST W, 6TH ST W, GLEASON ST, KING ST, CHERRY AVE, MONTICELLO AVE

# Fifeville

Scale: 0 — 500 — 1,000 — 2,000 Feet

## Legend

- •  Potential Tree Planting Locations (Right-of-Way)
- —  Streams
- - - -  Neighborhood Boundaries
- ▭  Parks

### Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
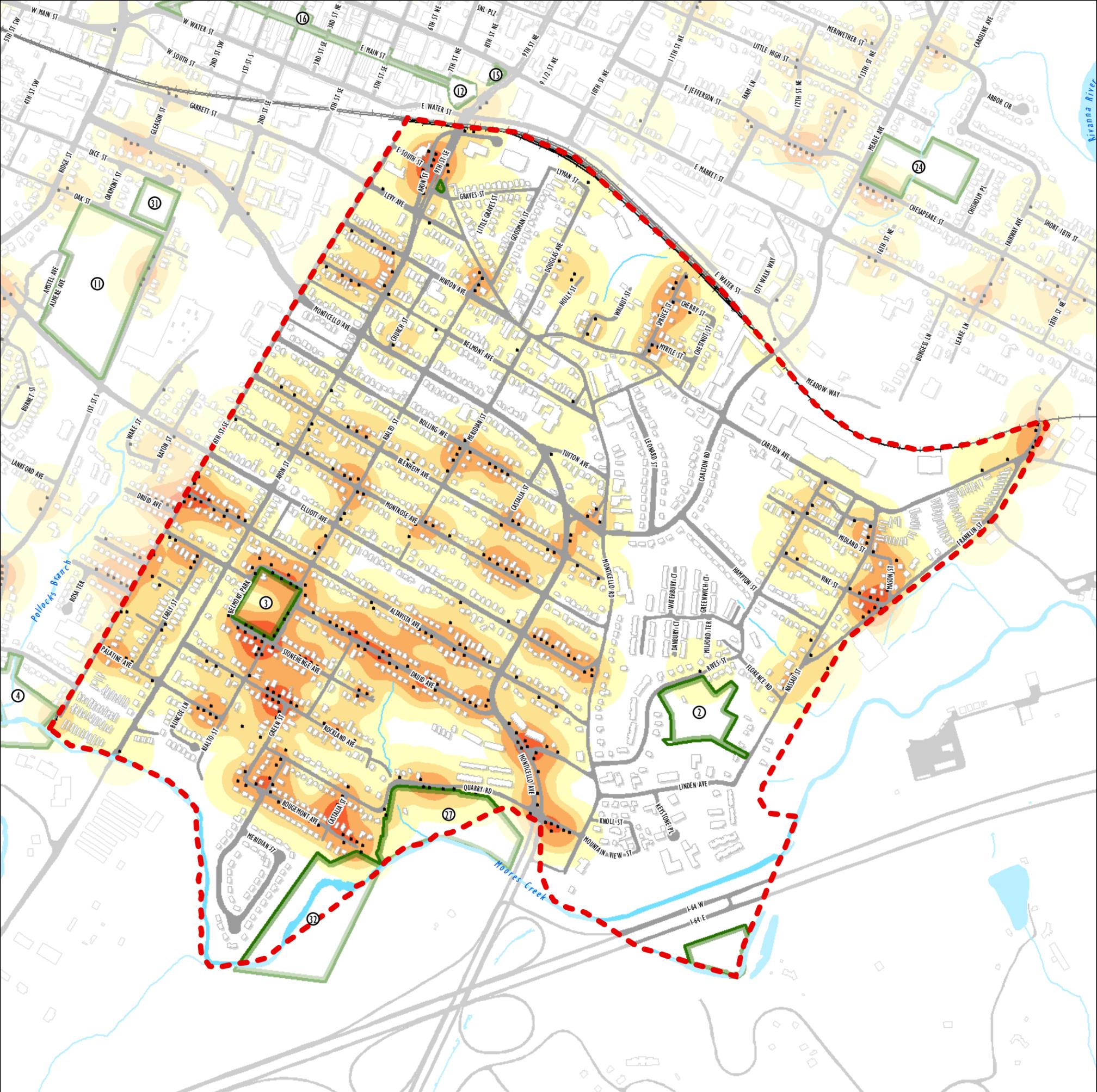- Lower Planting Location Density

### Parks

6: Fifeville Park
5: Tonsler Park
33: Forest Hills Park

# Ridge Street

## Legend

- • Potential Tree Planting Locations (Right-of-Way)
- — Streams
- --- Neighborhood Boundaries
- ▭ Parks

## Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
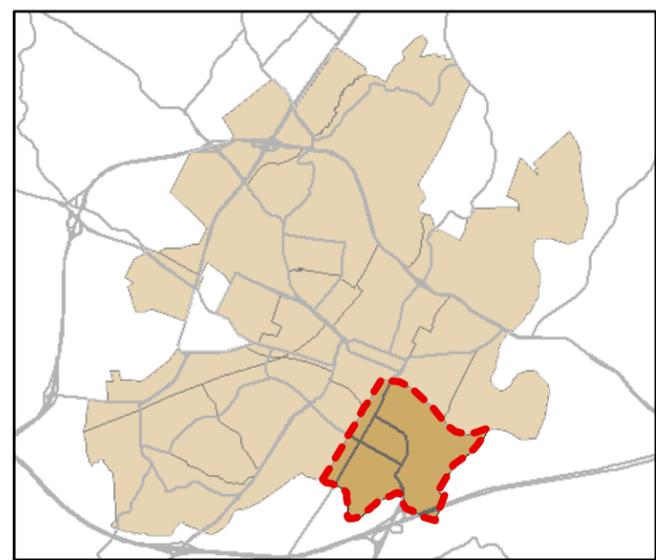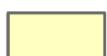- Lower Planting Location Density

## Parks

11: Oakwood Cemetery
31: Daughters of Zion Cemetery
4: Jordan Park

# Belmont

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

## Legend

- Potential Tree Planting Locations (Right-of-Way)
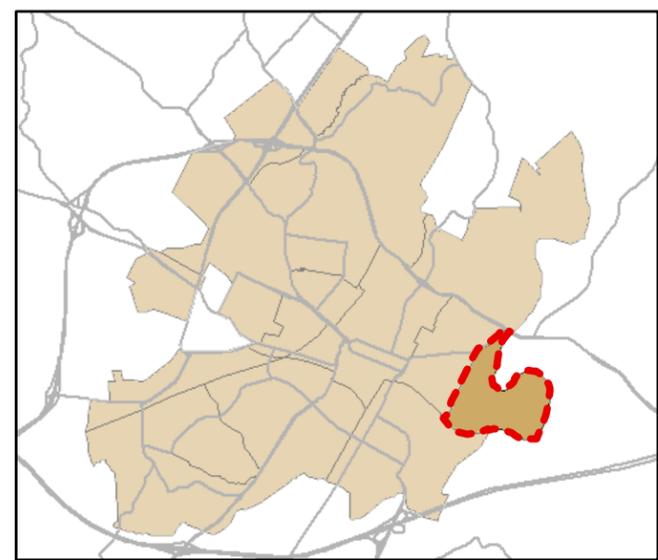- Streams
- Neighborhood Boundaries
- Parks

## Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
- Lower Planting Location Density

## 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)

— Streams

- - - Neighborhood Boundaries

☐ Parks

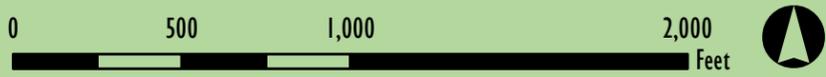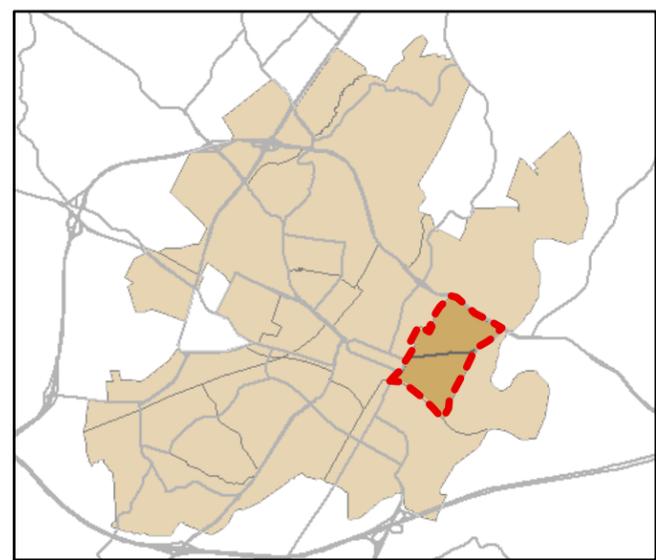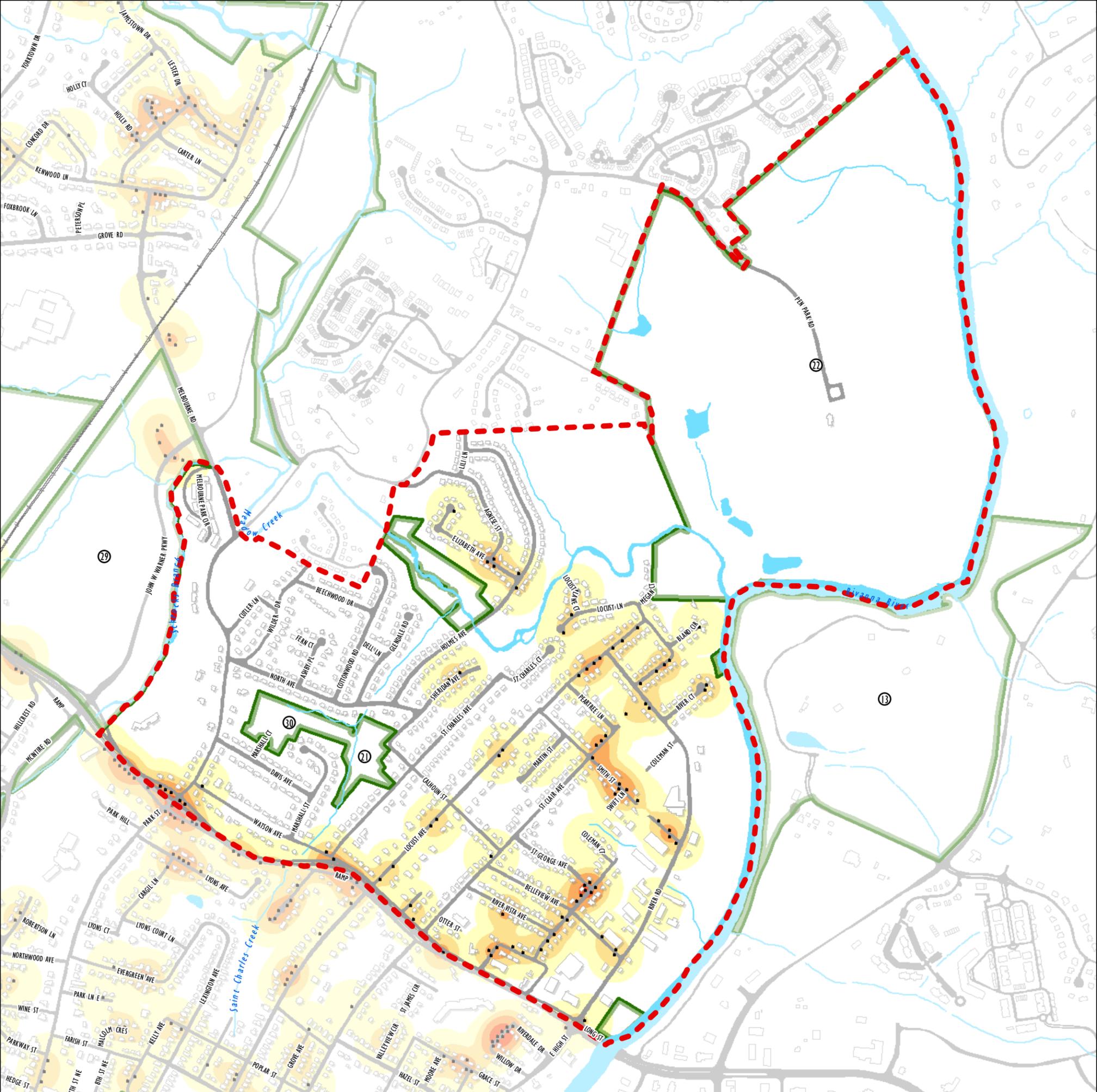## Potential Tree Planting Location Density (Right-of-Way)

■ Higher Planting Location Density

■
■
■
■ Lower Planting Location Density

Rivanna River

LOCUST AVE
ST JAMES CIR
RIVER RD
LONG ST
VALLEY VIEW DR
ST CLARK AVE
GRACE ST
RIVERDALE DR
MOORE AVE
WILLOW DR
GROVE AVE
POPLAR ST
HAZEL ST
WARD AVE
GILLESPIE AVE
ORANGE ST
SYCAMORE ST
MOORES ST
E HIGH ST
DUKE ST
STEWART ST
CAROLINE AVE
MERIWETHER ST
CHISHOLM PL
ARBOR DR
13TH ST NE
LITTLE HIGH ST
FARM LN
12TH ST NE
E JEFFERSON ST
MEADE AVE
RIVERBLUFF DR
14TH ST NE
MARKET AVE
SHORT/18TH ST
CITY WALK WAY
E WATER ST
BURGESS LN
LEAKE LN
10TH ST NE
RIVERSIDE AVE
E MARKET ST
CHESAPEAKE ST
RIVERVIEW AVE
CARLTON RD
MEADOW WAY
DEEPHILL ST
FRANKLIN ST
MERCHANT ST
CARLTON AVE
MIDLAND ST
RIVES ST

24

19

# Martha Jefferson

0    500    1,000    2,000
Feet

## Legend

• Potential Tree Planting Locations (Right-of-Way)

— Streams

▦ Neighborhood Boundaries

▢ Parks

## Potential Tree Planting Location Density (Right-of-Way)
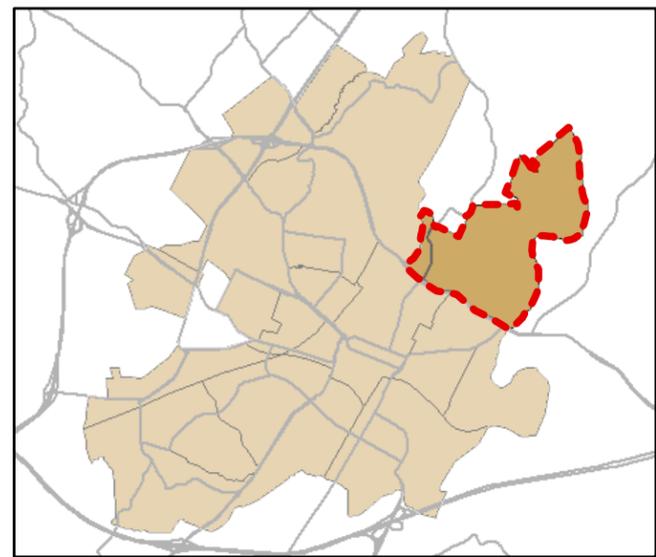
■ Higher Planting Location Density

■
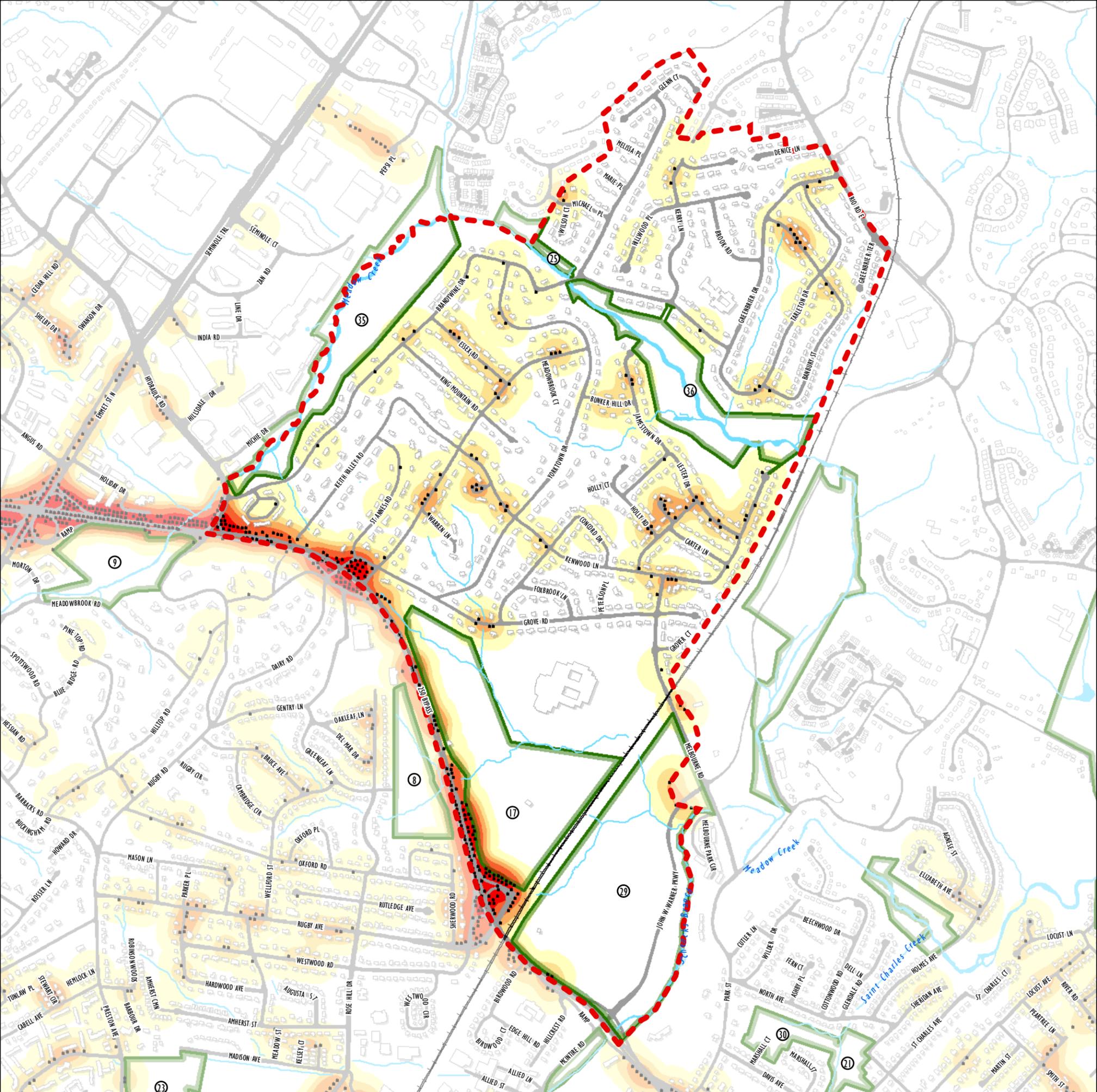■
■
■ Lower Planting Location Density

# Locust Grove

Scale: 0 — 500 — 1,000 — 2,000 — 3,000 — 4,000 Feet
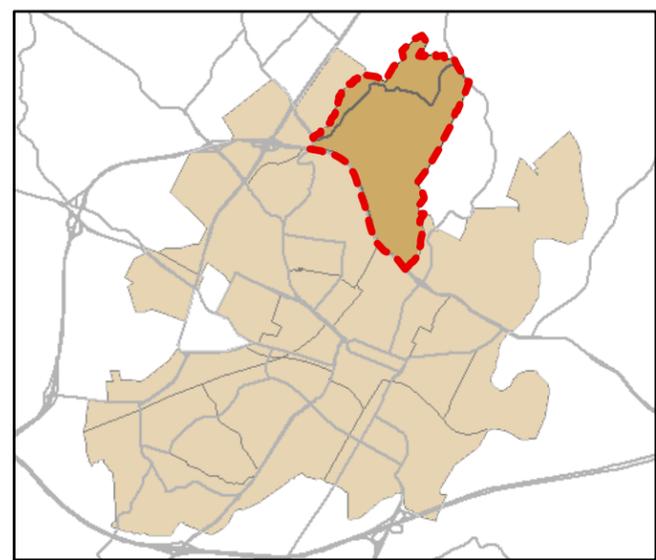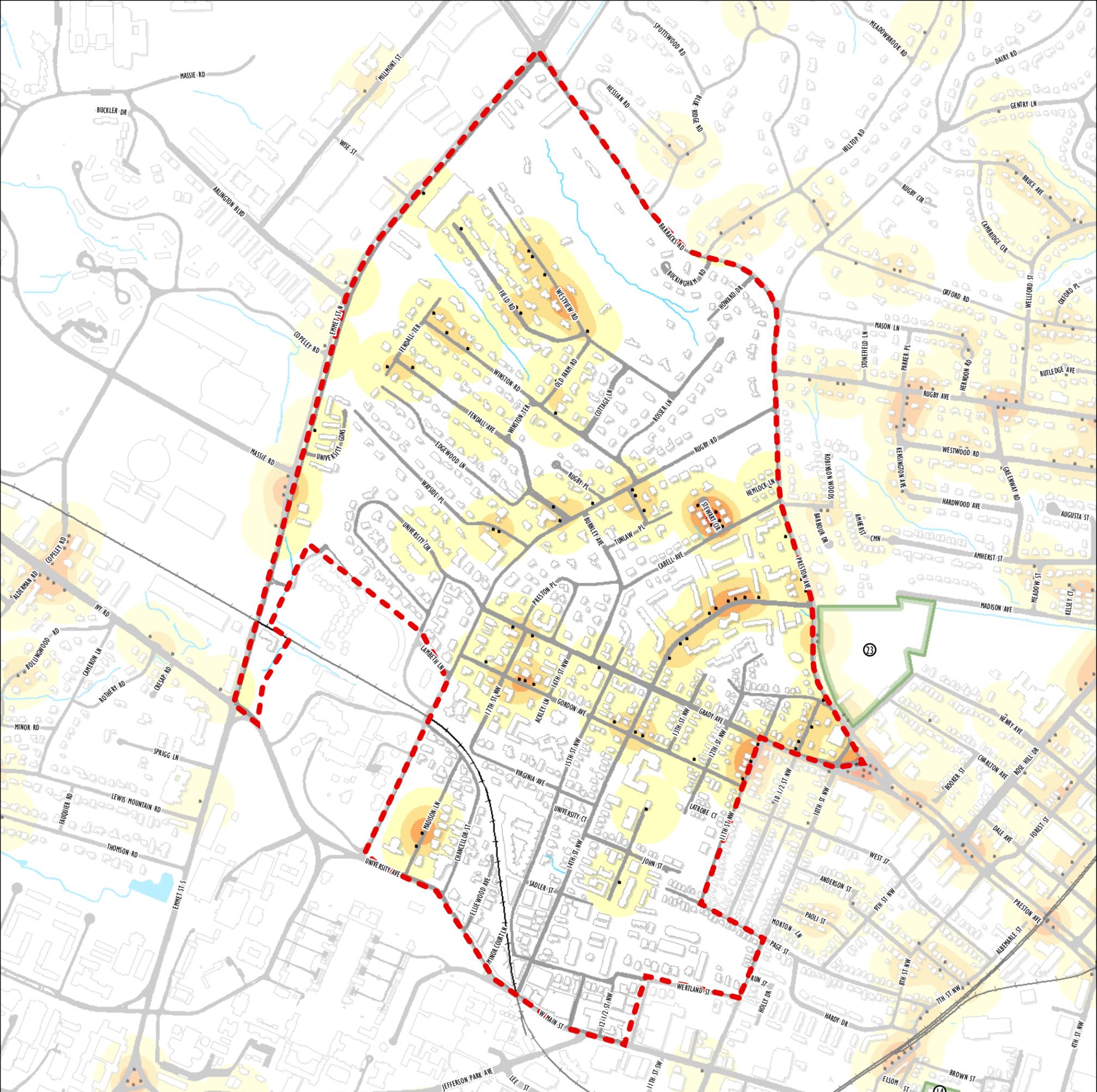
## Legend

- • Potential Tree Planting Locations (Right-of-Way)
- — Streams
- ▪▪▪ Neighborhood Boundaries
- ▭ Parks

### Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
- Lower Planting Location Density

## Parks

21: Northeast Park
22: Pen Park
30: Davis Field

# Greenbrier

## Legend

- **•** Potential Tree Planting Locations (Right-of-Way)
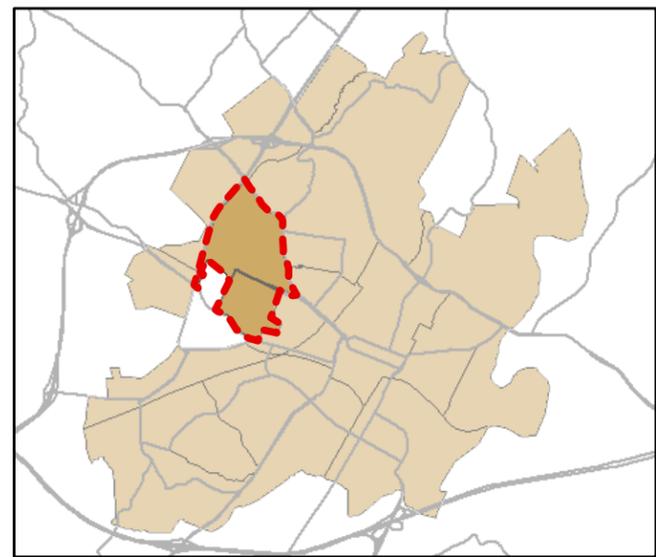- ⎯ Streams
- ▬▬ Neighborhood Boundaries
- ▭ Parks

### Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
- Lower Planting Location Density

## Parks

17: McIntire Park
25: Meadow Creek Valley
29: McIntire Park
35: Meadow Creek Valley
36: Greenbrier Park

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

# Venable

## Legend

- Potential Tree Planting Locations (Right-of-Way)
- Streams
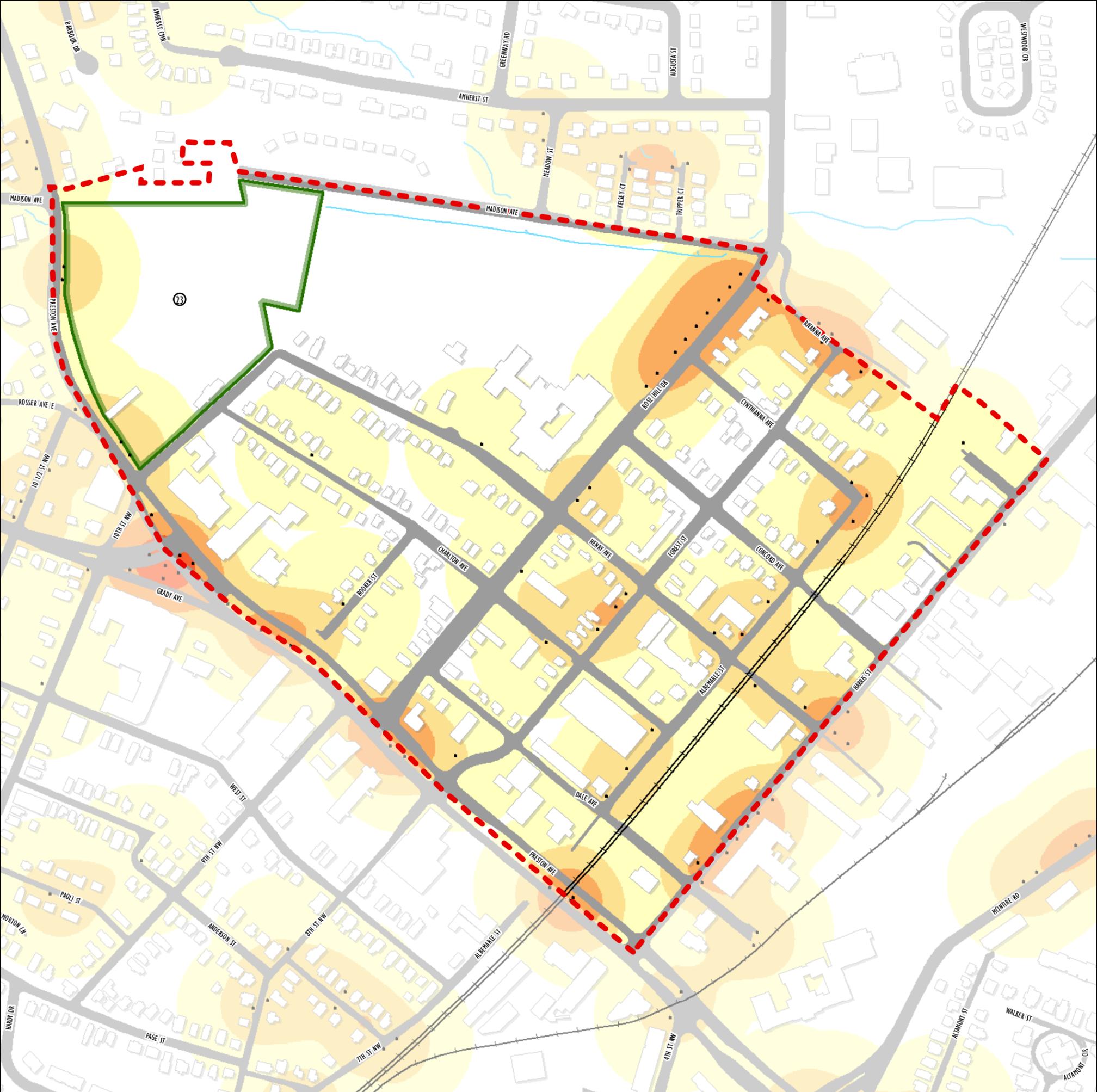- Neighborhood Boundaries
- Parks

## Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
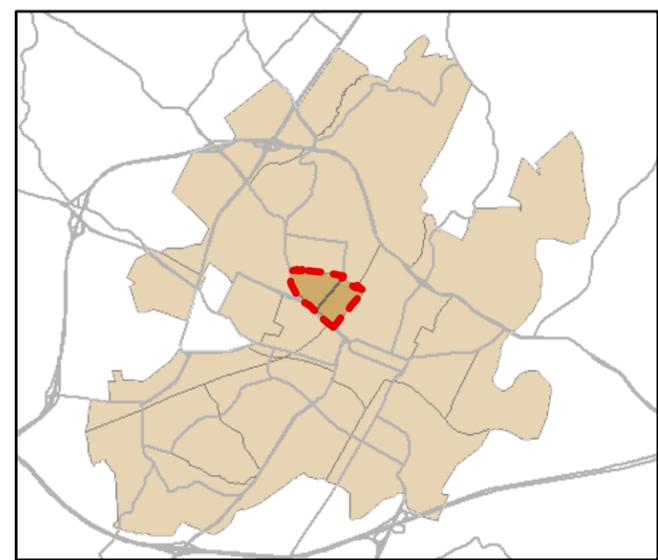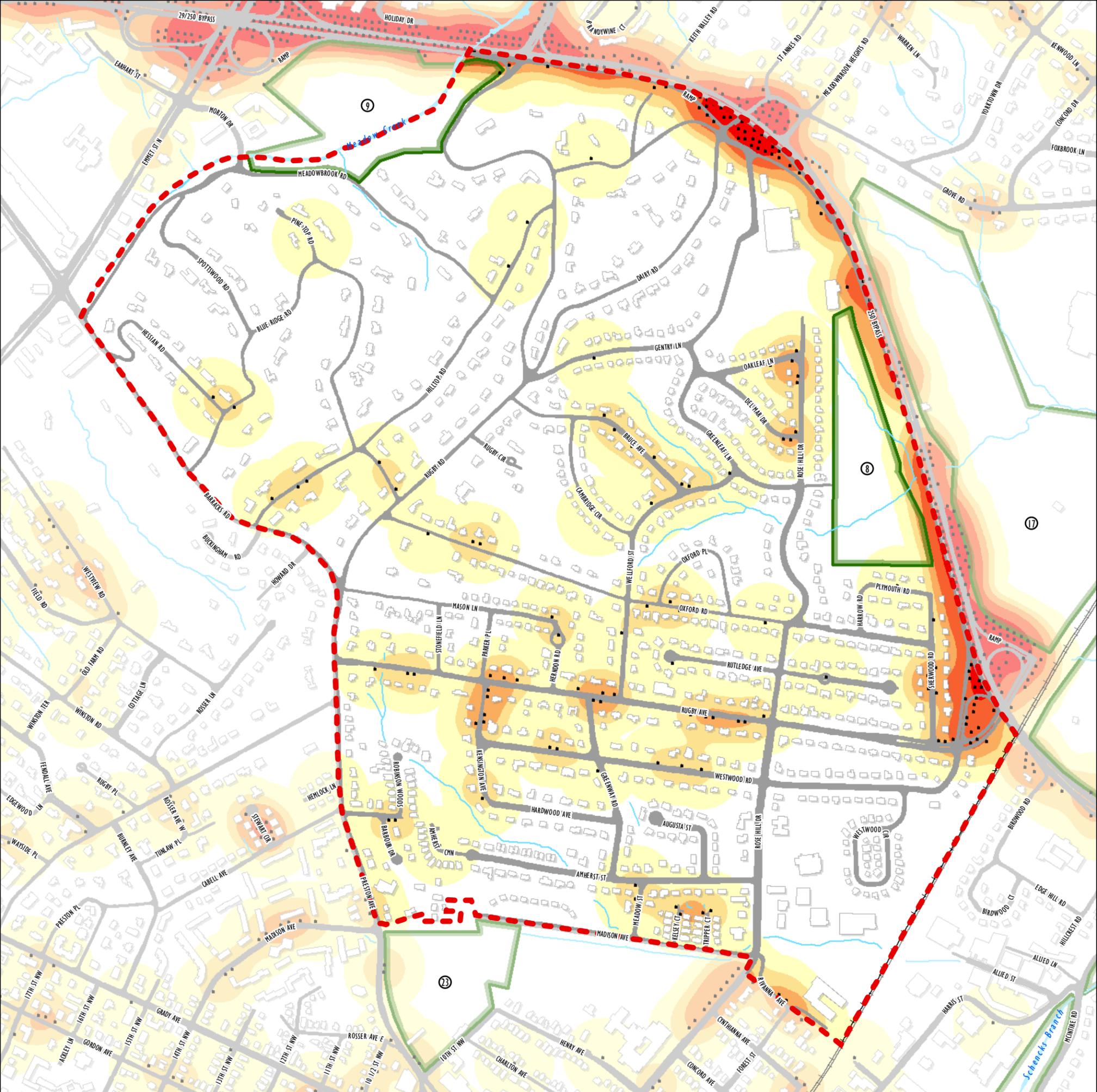- Lower Planting Location Density

# Rose Hill

## Legend

- Potential Tree Planting Locations (Right-of-Way)
- Streams
- Neighborhood Boundaries
- Parks

### Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
- Lower Planting Location Density

Parks  23: Washington Park

0    500    1,000 Feet

# Barracks & Rugby

## Legend

- • Potential Tree Planting Locations (Right-of-Way)
- —— Streams
- ▌▌▌ Neighborhood Boundaries
- ▭ Parks

### Potential Tree Planting Location Density (Right-of-Way)

- Higher Planting Location Density
- Lower Planting Location Density

Parks  8: Greenleaf Park

0   500   1,000   2,000 Feet