Murray Run Greenway Extension Feasibility Study 2010

Prepared for City of Roanoke Parks and Recreation Department on September 3rd, 2010.

MURRAY RUN GREENWAY

ROANOKE PARKS AND RECREATION

Commission for Accreditation of Park and Recreation Agencies — CAPRA ACCREDITED

The Office of Parks and Greenway Planning

"Support provided by the Urban and Community Forestry Program of the USDA Forest Service and the Virginia Department of Forestry."

TABLE OF CONTENTS

PROJECT TEAM

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Liz Belcher, Roanoke Valley Greenway Coordinator

Special thanks goes out to:

Virginia Department of Forestry
and
USDA Forest Service

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INTRODUCTION

Murray Run Greenway is a one of a kind greenway within the city limits of Roanoke. This 2.5 mile, gravel and mulch paved, greenway trail meanders through dense forest, open fields, and along residential streets. Murray Run Greenway is one of the most used greenways in the City of Roanoke's greenway system due to its proximity to residential neighborhoods and its rustic front country appeal. Currently the greenway connects Shrine Hill Park, Patrick Henry High School, Woodland Park, Fishburn Park, Fishburn Elementary and Virginia Western Community College. The greenway is a vital element in the linkage between some of the City of Roanoke's principal pieces of green infrastructure and will remain so.

As part of the City's Comprehensive Plan, the Murray Run Greenway is "important at the local level for enhancement of neighborhood values, economic development and public health." In the plan, the Mudlick Creek Greenway will meet the Murray Run Greenway by a route in the vicinity of Grandin Road from Shine Hill Park toward the Roanoke City Limits. The map shows Murray Run going northeast from Fishburn Park, through a residential area to Lakewood Park, running adjacent to Brandon Avenue, and to the Roanoke River. In the other direction the greenway would run south from Fishburn Park, through a residential area and the Jefferson Hills Golf Course property, crossing Ogden Road and ending at Green Valley School in Roanoke County. A side loop would go from Virginia Western Community College, behind the Jefferson Hills neighborhood near the railroad tracks, and to Tanglewood Mall and down Ogden Road to the intersection with Circle Brook Drive.

The City of Roanoke's Greenway Policy states that "greenway trails constitute a public trail system for recreational and non-motorized transportation, often linking special parts of the City." It is the aim of this project to continue to link "special" pieces of green infrastructure throughout the study area as well as provide linkage from Tanglewood Mall to the Roanoke River Greenway utilizing the existing trail as the middle section of a phased greenway.

DESIGN PROCESS

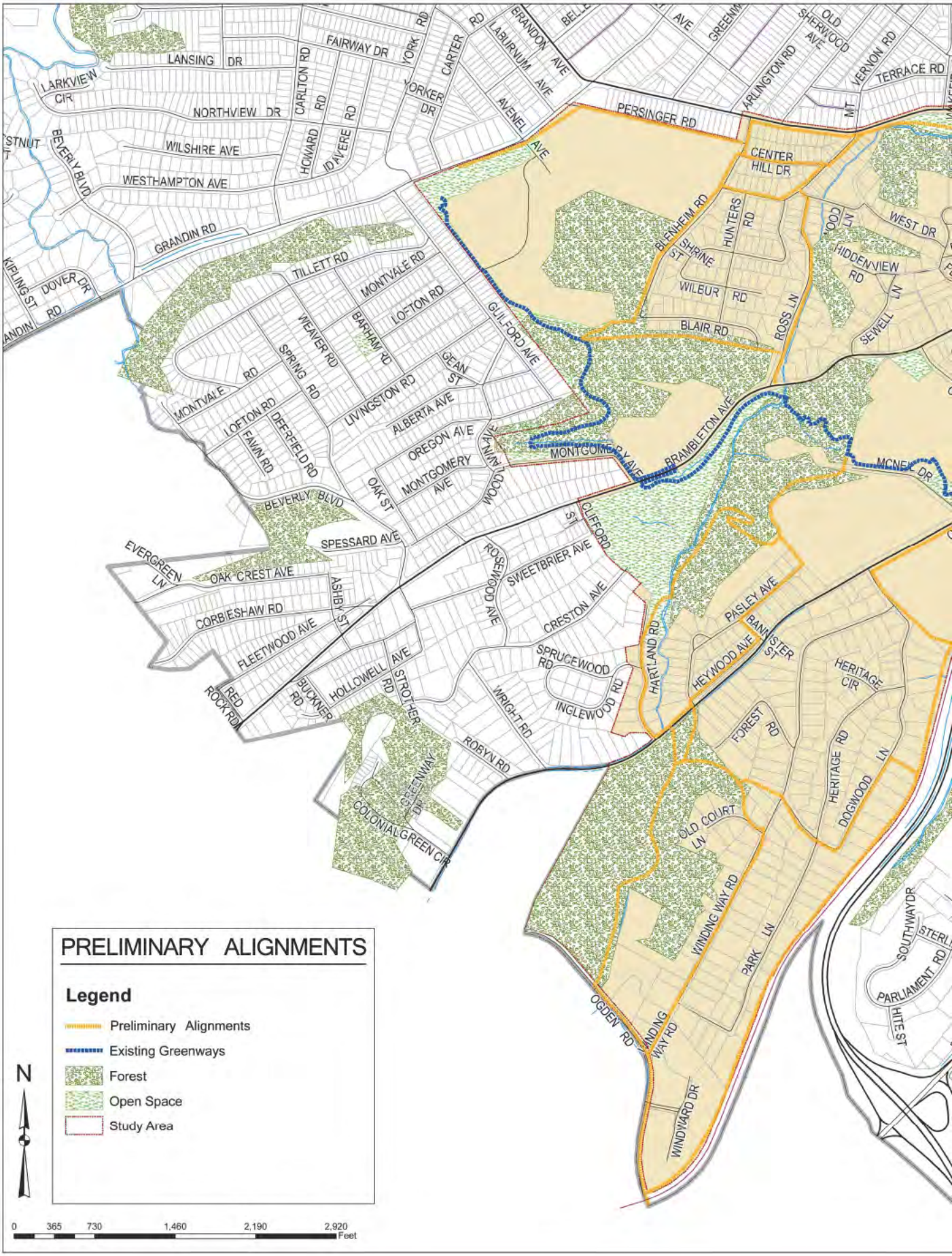
During the initial stages of the design process an area of study was agreed upon and aerial photography was compiled with various layers of GIS data to establish a base map for preliminary alignments. These preliminary alignments were plotted based solely on the data at hand and served only as a starting point for future discussions.

Three exploratory excursions were scheduled during December 2009 to assess the quality of potential corridors and to map significant opportunities and constraints. On December 11th, 2009 the southern portion of the study area was walked, pictures were taken, notable features were marked and preliminary ideas were developed. On December 17th and 18th the eastern and western sections of the area were walked respectively. Upon the conclusion of the field analysis portion of the design process alignments were added to and subtracted from the list of possible corridors as on-ground analysis yielded either negative experiences or were all together impractical. Based on user experience alone three alignments were refined from the aforementioned field notes.

At this point in the design process the three potential alignments were analyzed in regards to slope, connectivity, proximity, property ownership, along with user experience. The suitability analysis produced three potential alignments which were then weighted and ranked comparatively to create alignments "A," "B," and "C." "A" being the most preferred to "C" being the least preferred but all of which are feasible and accomplish, to varying degrees, the goals for this section of Murray Run Greenway. Design standards were created to illustrate the desired characteristics of certain sections of the trail alignments and a trail action plan was devised.

PRELIMINARY ALIGNMENTS

At the outset of this project several preliminary alignments were developed to define greenway corridors within the study area that could have potential as an alignment. These preliminary alignments were loosely based on property lines, topography and green infrastructure connectivity. Field analysis and user experience were not taken into account as this was simply a measure to reduce the feasible corridors within the study area. (Refer to Preliminary Alignments Map)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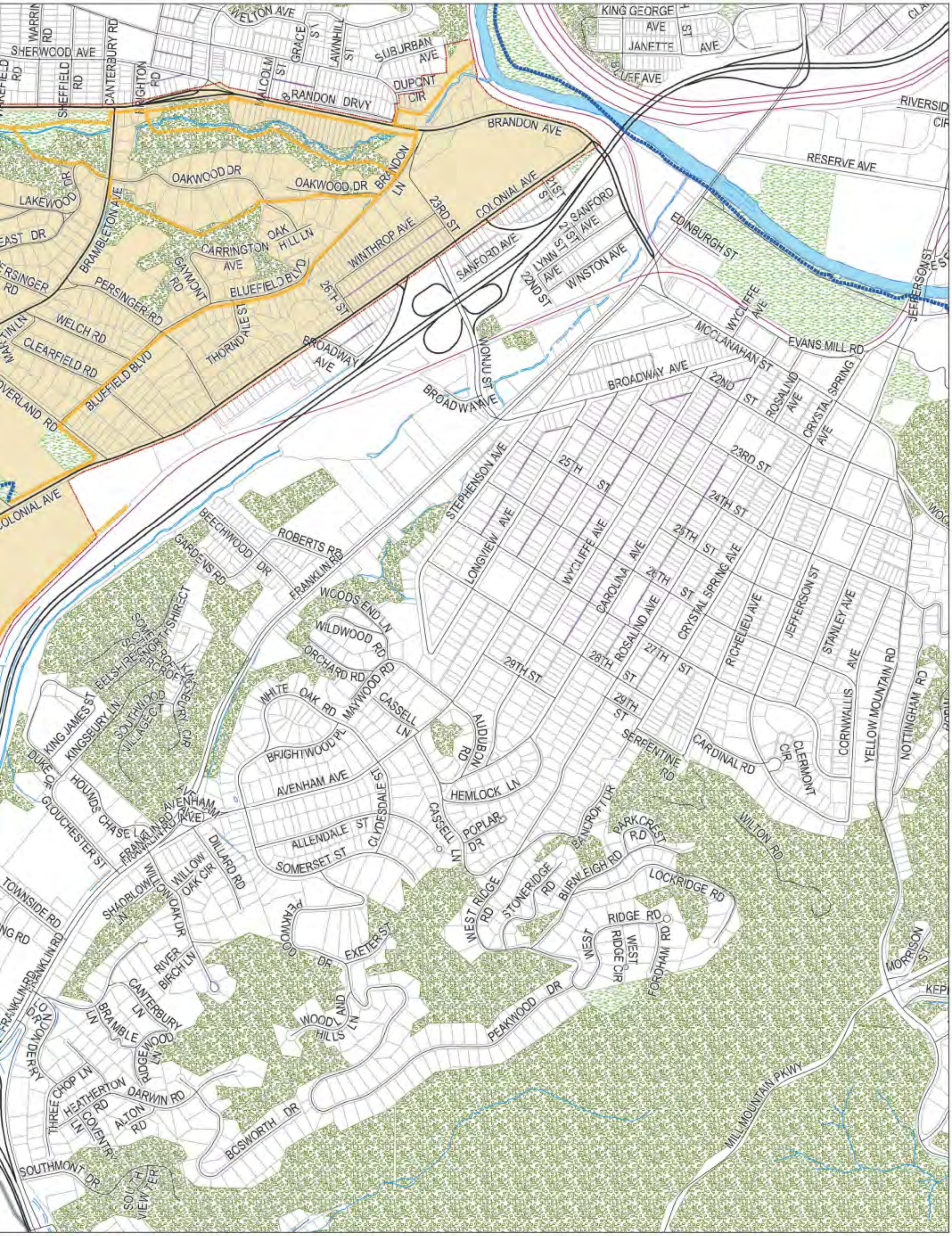
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DARWIN RD
COVENTRY LN
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MILL MOUNTAIN PKWY
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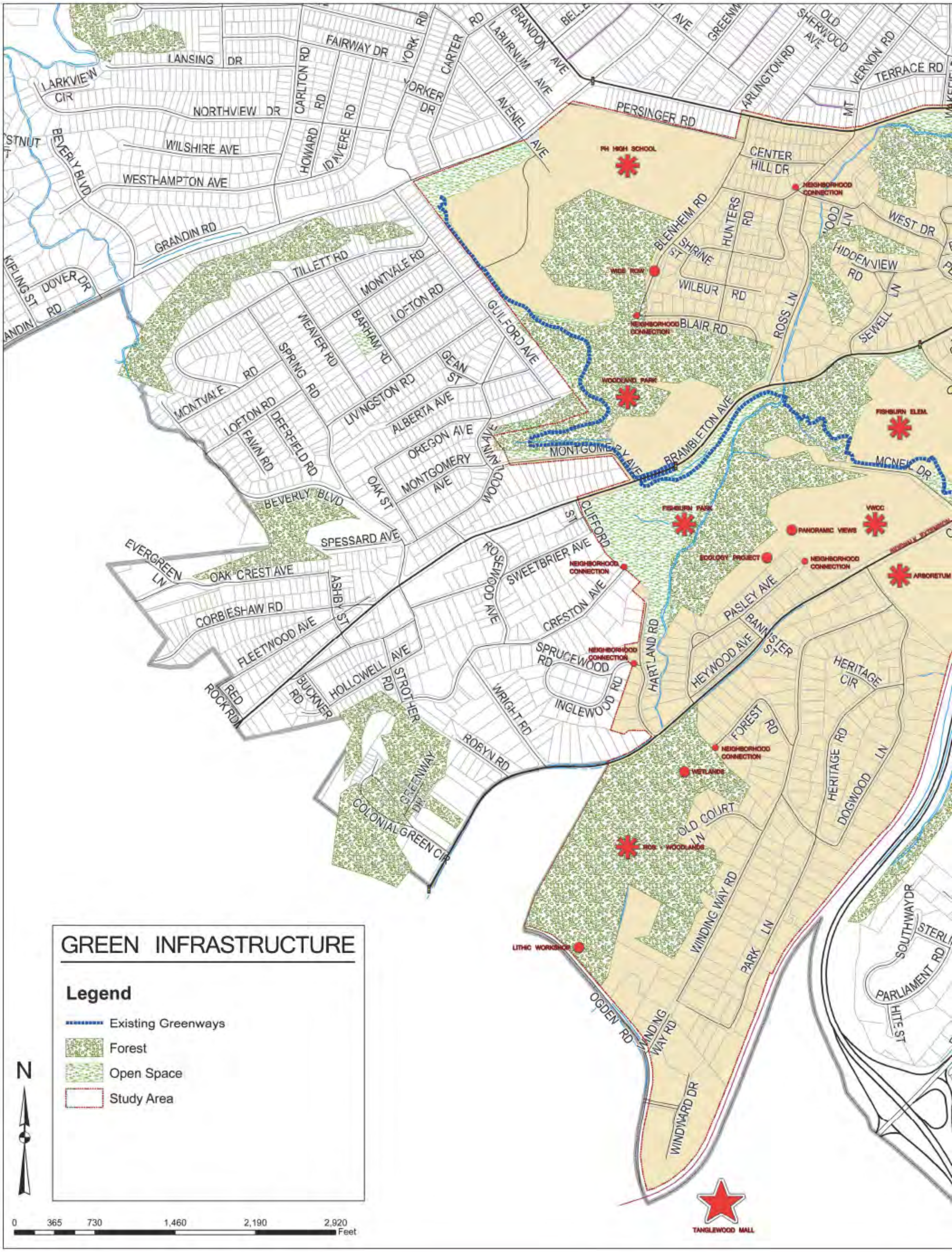
EXISTING CONDITIONS

On December 11-18th 2009 field analysis was conducted to clarify on ground conditions throughout the study area (Refer to Green Infrastructure/Existing Conditions Map). Starting on Ogden Road at Tanglewood Mall it was noted that this would be the only feasible crossing to connect greenway users to Tanglewood as the bridge at Ogden Road is the only span across the Railway (Refer to Picture Map 1). Ogden Road is a shared road with Roanoke County. It is noted by minimal right-of-way and several residential apartment complexes that have established vegetative buffers. Through the duration of Ogden Road minimal right-of-way was present. The field analysis continued through the Jefferson Hills Golf Course parcel along Murray Run to Colonial Avenue (Refer to Picture Map 2). This portion of the study area is highlighted by riparian vegetation, wetlands, and a meandering creek bed. It is likely that a stream crossing will be necessary if the trail is sited here. Once at Colonial Avenue two corridors were walked: Hartland Rd and Pasley Avenue. Both corridors are similar with Hartland Rd consisting of lower slopes and greater connectivity to Fishburn Park. Vital to note is that both Hartland and Pasley had wide enough ROW to contain a greenway corridor. At the peak of Pasley Avenue, near Virginia Western Community College, a significant overlook was present as well as a unique ecology experiment overseen by VWCC staff and students. At the end of Hartland Road the city owned Fishburn Park property is accessible through dense vegetation (Refer to Picture Map 3). Existing foot trails lead back to Murray Run where a wooden bridge stream crossing is present. More foot trails litter the hillside along the west side of Murray Run connecting eventually to the existing portion of the Murray Run Greenway. The north section of the study area is quite expansive and is generally characterized as small residential streets lined with older, well kept houses (Refer to Picture Map 4). The majority of the residential section between Patrick Henry High School and Lakewood Park contains sidewalks and areas without sidewalks are home to significant right-of-way. One exception is Ross Lane, which parallels Murray Run. Ross Lane is without sidewalks and in most areas has only minimal vacant right-of-way.

It is highly likely that any trail segments through this area will be on residential sidewalks. Once in Lakewood Park potential trail alignments can revert back to a front country nature. There are no notable constraints present. On the backside of the Lakewood Park property exists an access road bed that leads to Lakewood Drive (Refer to Picture Map 5). At the top of Lakewood Drive is a noteworthy overlook. From this point onward to Towers shopping center the field analysis team walked several different paths most of which can be characterized as riparian corridor and forested hillsides, all of high quality. If you follow the banks of Murray Run, the south side consists of steep hillside with dense vegetation and the north side is relatively flat riparian corridor. Upon reaching the intersection of Brandon Lane, the entrance to Towers, and Brandon Avenue an existing pedestrian crossing is present. This is the most likely place to cross Brandon Avenue. After crossing Brandon Avenue the team accessed what appears to be a paper street behind Little Caesar's Pizza. This existing corridor traverses several private properties and leads directly to the railway line on the south side of the Roanoke River. From this point on a possible connection can be made via a deserted rail line.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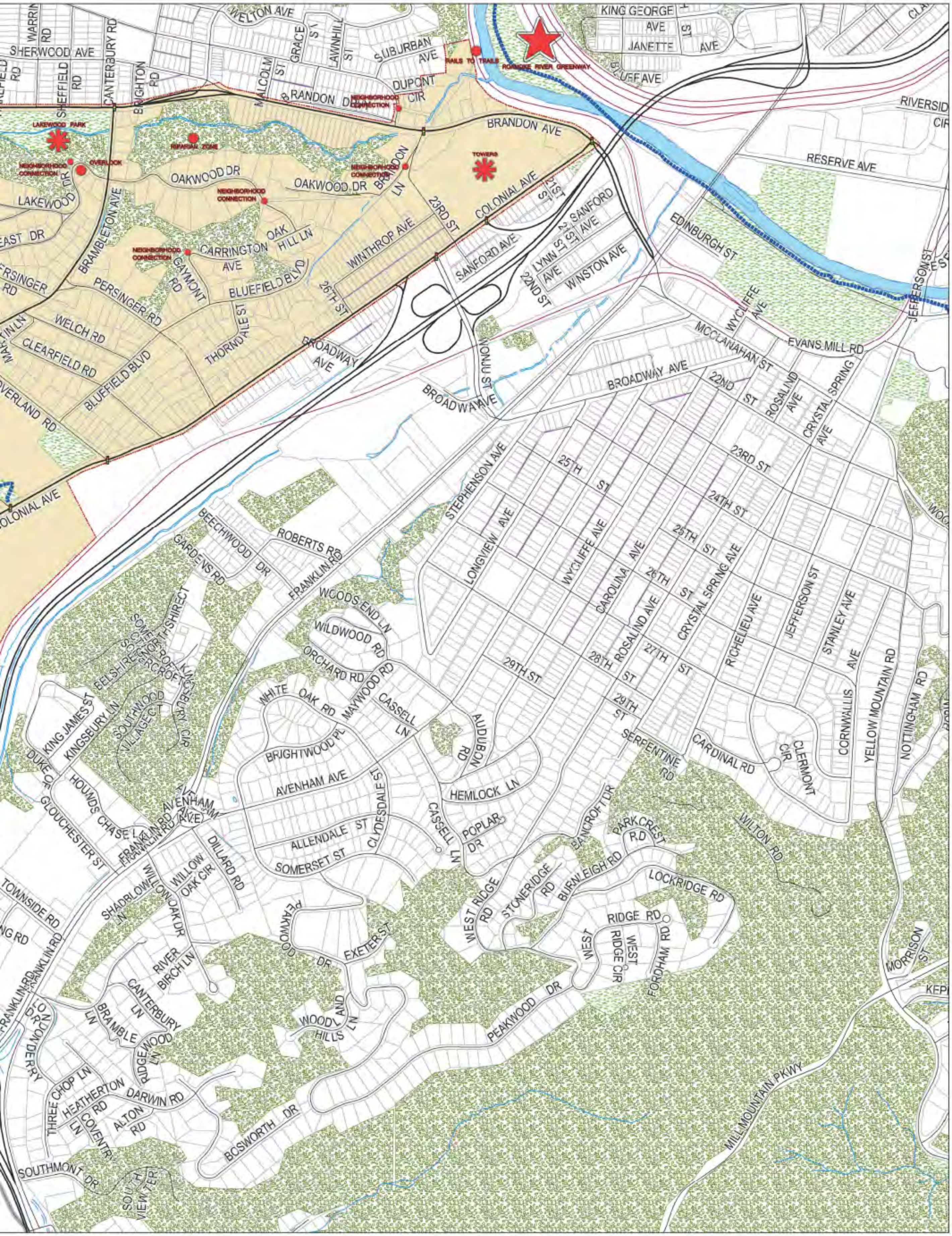
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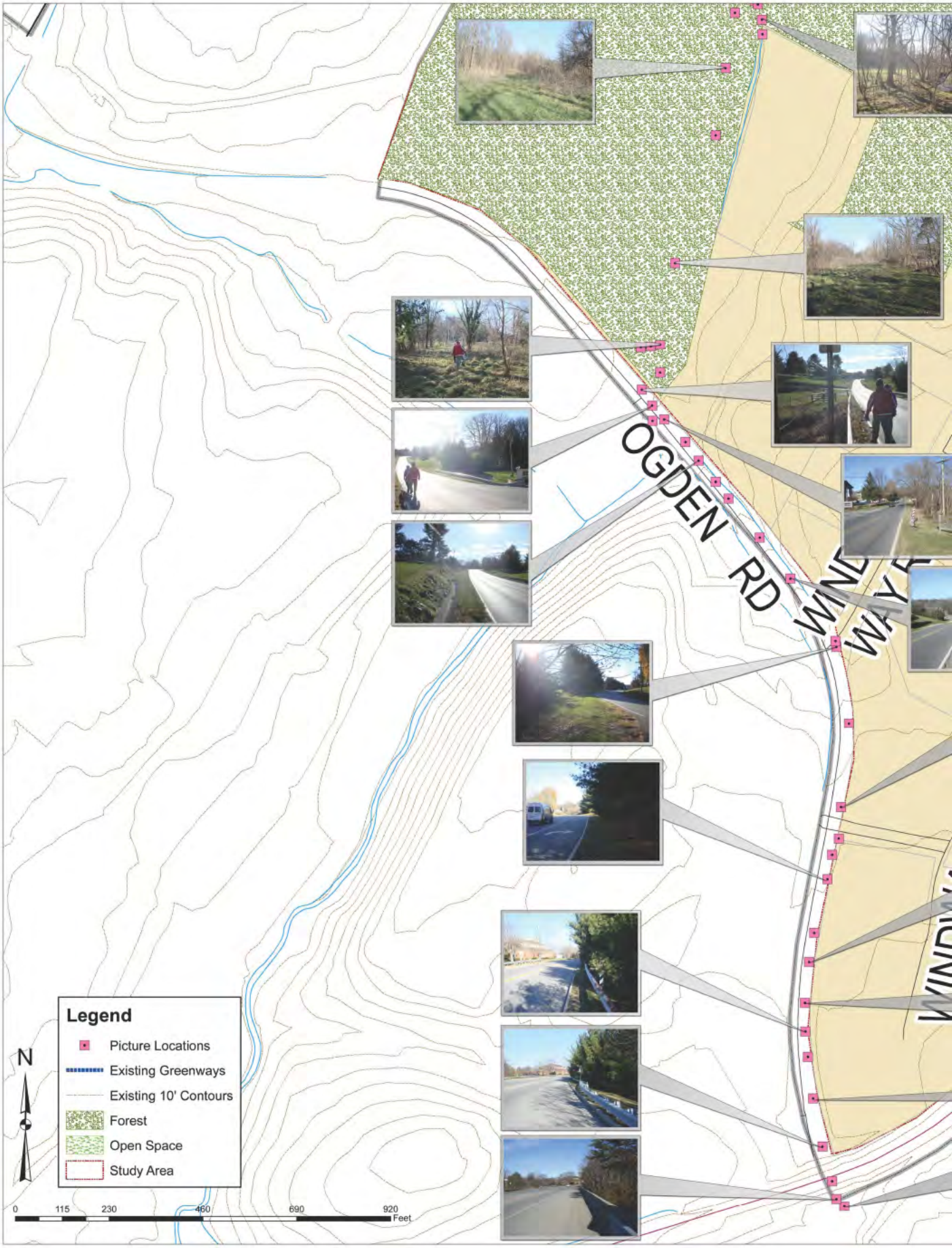
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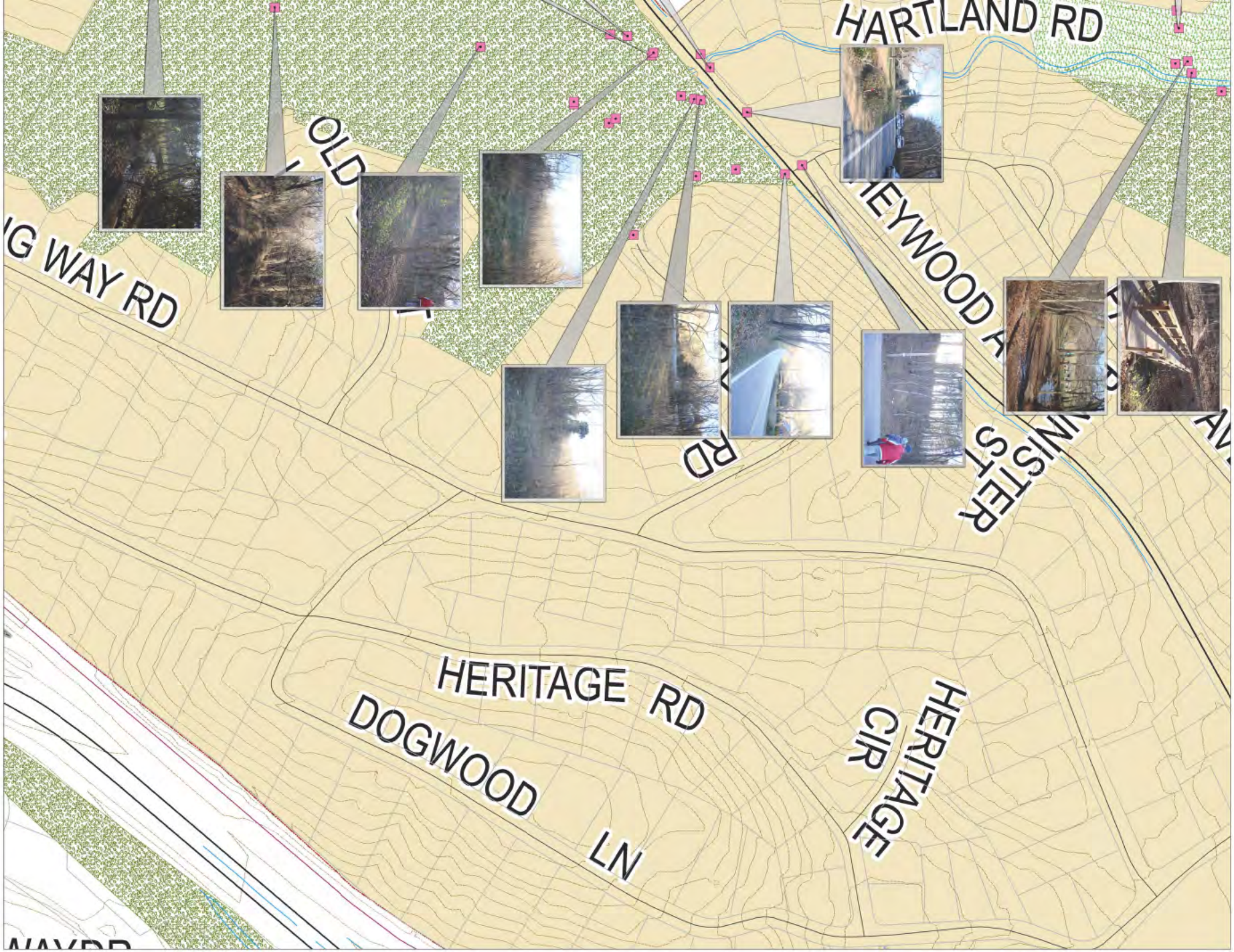
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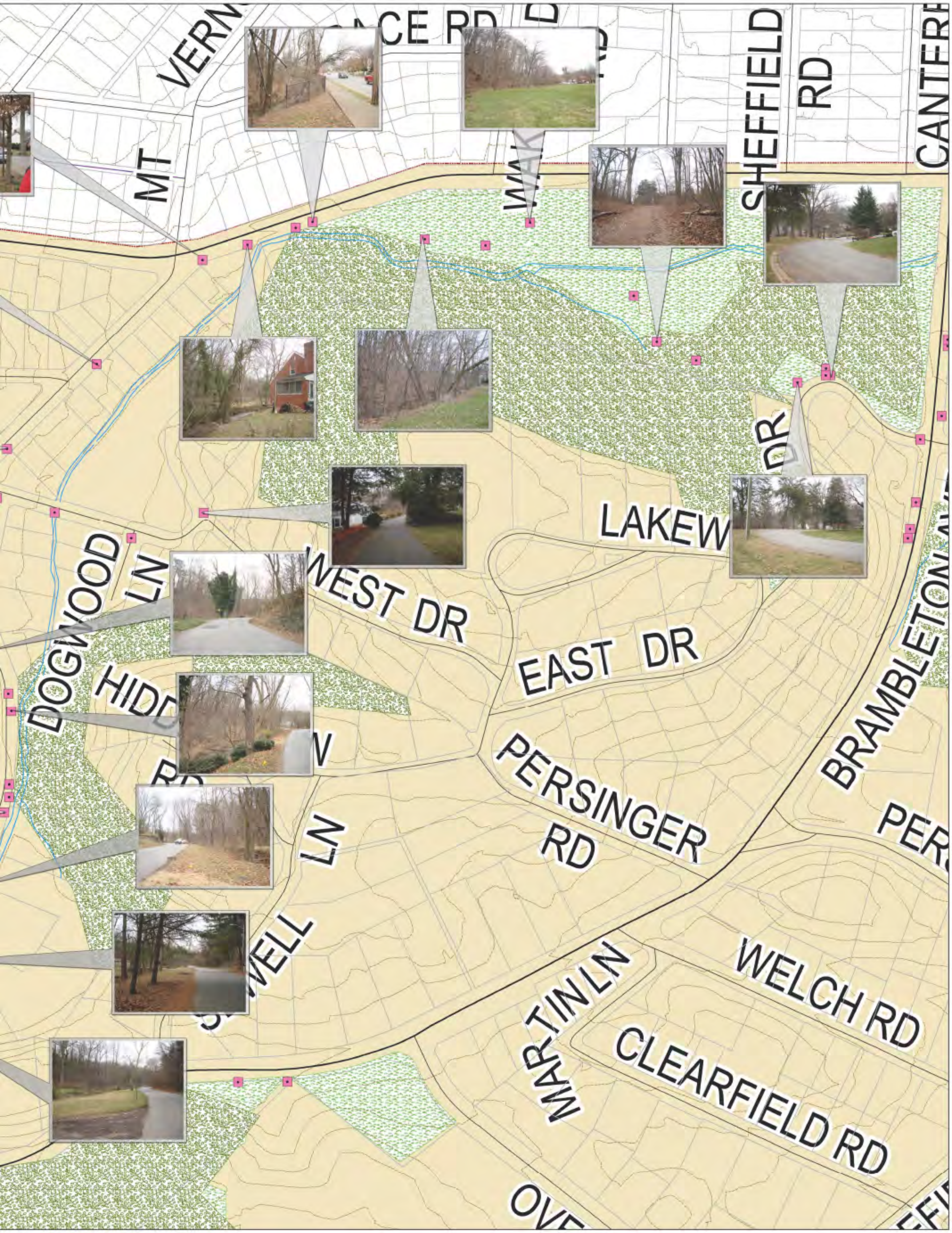
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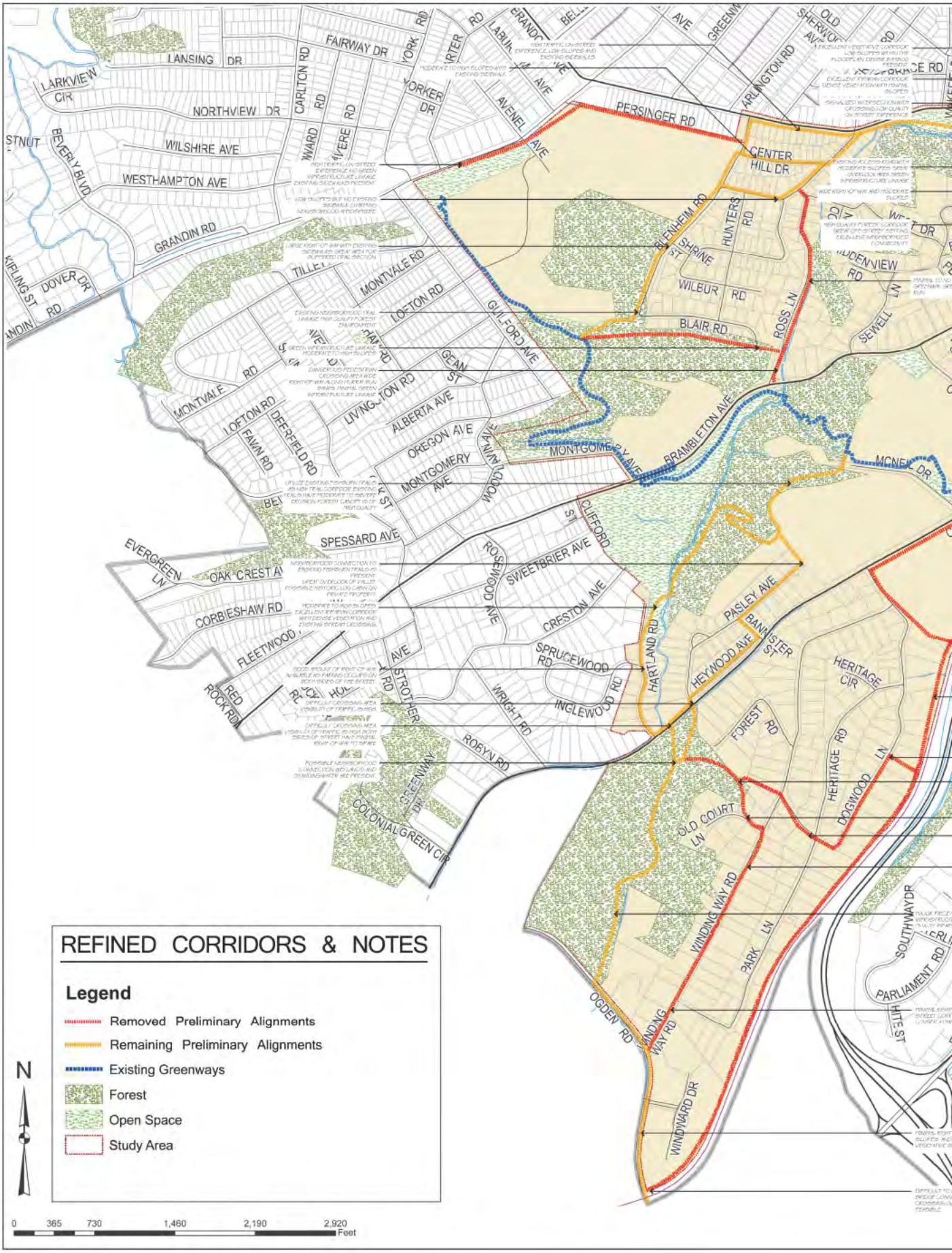
REFINED ALIGNMENTS

At this point in the design process preliminary alignments were adjusted, removed, or left unaltered based on field analysis, the user experience, and overall on-ground feasibility. Three preferred alignments were created and suitability analysis was undertaken to see if one or any of the alignments were feasible. (Refer to Refined Alignments Map)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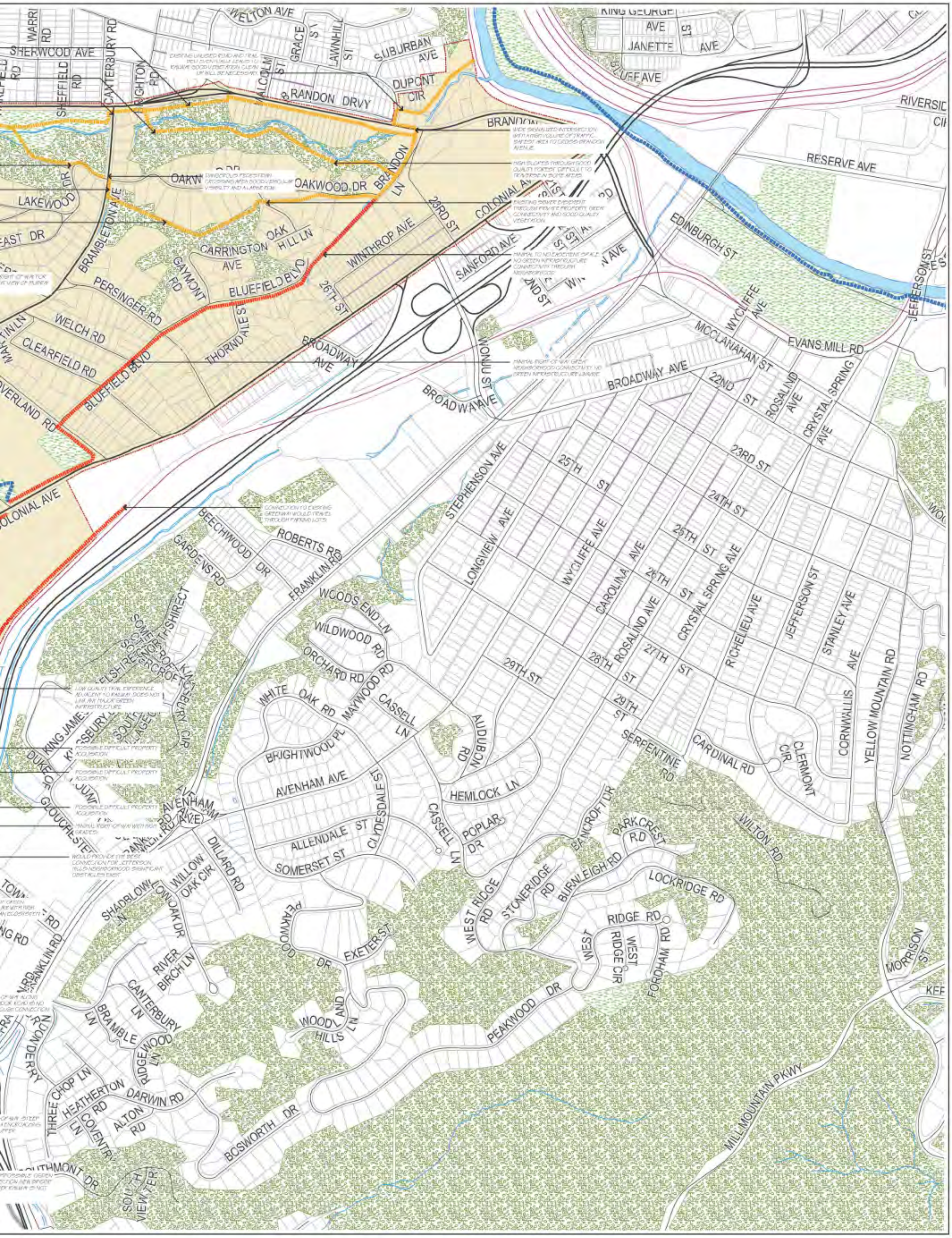
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SUITABILITY ANALYSIS

Of utmost importance to this feasibility study was to evaluate the physical characteristics of the study area in order to develop trail alignments that are technically feasible and environmentally sensitive. This is also intended to minimize maintenance costs and negative impacts of inappropriate development within the floodplain and other developmentally sensitive areas. Layering pertinent data such as green infrastructure, soils, wetlands, slopes, property ownership, area destinations, transportation and alignment proximity coupled with field analysis lead to the development of a series of suitability analysis maps that aim to reveal those technically feasible and environmentally sensitive trail alignments within the study area.

The progression of the analysis process was initiated by composing a decision matrix with weighted aspects that would lead to a hierarchal categorization of proposed trail alignments. Weights were derived, on a one to five scale, based on the aspect's preferred influence on proposed alignments.

User Experience

It is paramount to feature user experience as the highest weighted aspect throughout the trail corridor. As such the proposed alignments aimed to incorporate a variety of ecological habitats, scenic views, area attraction connections, and a contiguous link between city green infrastructure to the furthest extent possible. Since a potential greenway corridor's experience is too ambiguous to define on a single map several days were spent combing the study area in search of significant features that could be highlighted through potential alignments. These features along with other opportunities and constraints were then referenced and depicted on five picture maps and a composite green infrastructure map. These six maps only serve as a means of conveying a general level of exposure as to what the study area has to offer.

Proximity

Second to trail experience, by a small margin, is trail proximity in comparison to potential users. As is always the goal in large public projects, a need was established to provide as many citizens as possible a logical and safe route to access the greenway corridor. For the purposes of this analysis it was assumed that access to the alignments is accomplished on foot, as to establish a minimum proximity area. If other modes of transportation are considered the proximity area will grow proportionally. It is also assumed that a reasonable walking distance of 1/4th a mile (1320ft) will be the base distance from a trail node. If a property falls outside the 1/4th mile distance it is still very much walk able as the average maximum walking distance is ½ a mile (2640ft) for a fit adult. In certain situations obstacles were taken into account such as the lack of sidewalk, topographic incline, and the crossing of major roadways (Brandon Ave., Colonial Ave., and Brambleton Ave.) that would prevent a property's owner from safely accessing a trail node. The following are descriptions of the various levels of proximity depicted in the same order as on

SUITABILITY ANALYSIS CONT.

the maps: (Please refer to Proximity Maps "A")(Proximity Map "B")(Proximity Map "C")

1) The property is either bisected by the proposed alignment or is located immediately adjacent to the proposed corridor.
2) The property is not immediately adjacent to the proposed corridor yet still a maximum distance of 1/4th a mile. These properties can still safely access the trail via neighborhood level streets that may or may not have sidewalk. In some cases a small footpath would be needed to make the connection (depicted in a red dashed line) to the main alignment.
3) The property is still connected by neighborhood streets but falls outside of the preferred walking distance of 1/4th a mile. Citizens can still access the alignment safely, however the further the property the more likely an alternate transportation method will be used. In some instances this area is actually located within the intersection of two nodes. One node being a distance greater than 1/4th mile yet still accessible via neighborhood streets and the other node within a 1/4th mile yet only accessed via future sidewalk. In these instances it is assumed access via neighborhood streets would be preferable at this time.
4) The property is within 1/4th a mile of a node; however sidewalks must be created along major roadways to establish a safe and logical connection.
5) The property is located more than 1/4th a mile from a node and will need sidewalks to access a trail alignment. In some instances a property is, in reality, within a 1/4th a mile from a node, however significant obstacles exist preventing potential users from reaching a trail alignment.

Green Infrastructure Linkage

Green infrastructure connectivity is one of the more important aspects of greenway planning. With dwindling green resources in most urban areas a greenway corridor can quickly become a saving grace for areas rich in wildlife resources and an educational tool for an adjacent population. It is imperative that the potential trail alignments incorporate as much of the City of Roanoke's green spaces as possible. Green infrastructure maps were created to illuminate areas of significant tree cover as well as open fields and property designated ROS (Recreation Open Space) zoning. Field Analysis was also taken into account to highlight opportunistic points along potential corridors. These points can be described as overlooks, vistas, riparian corridors and wetlands, significant vegetation and any other interesting topographic features. Coupled with the aforementioned analysis maps, several alignments began to plot themselves. It should be noted that the character of the existing Murray Run Greenway is described as a front country trail that sweeps with the landscape, instead of through it, with various ecological habitats along its borders. It is undoubtedly best to extend these characteristics through out the entire length of the corridor to the highest extent plausible.

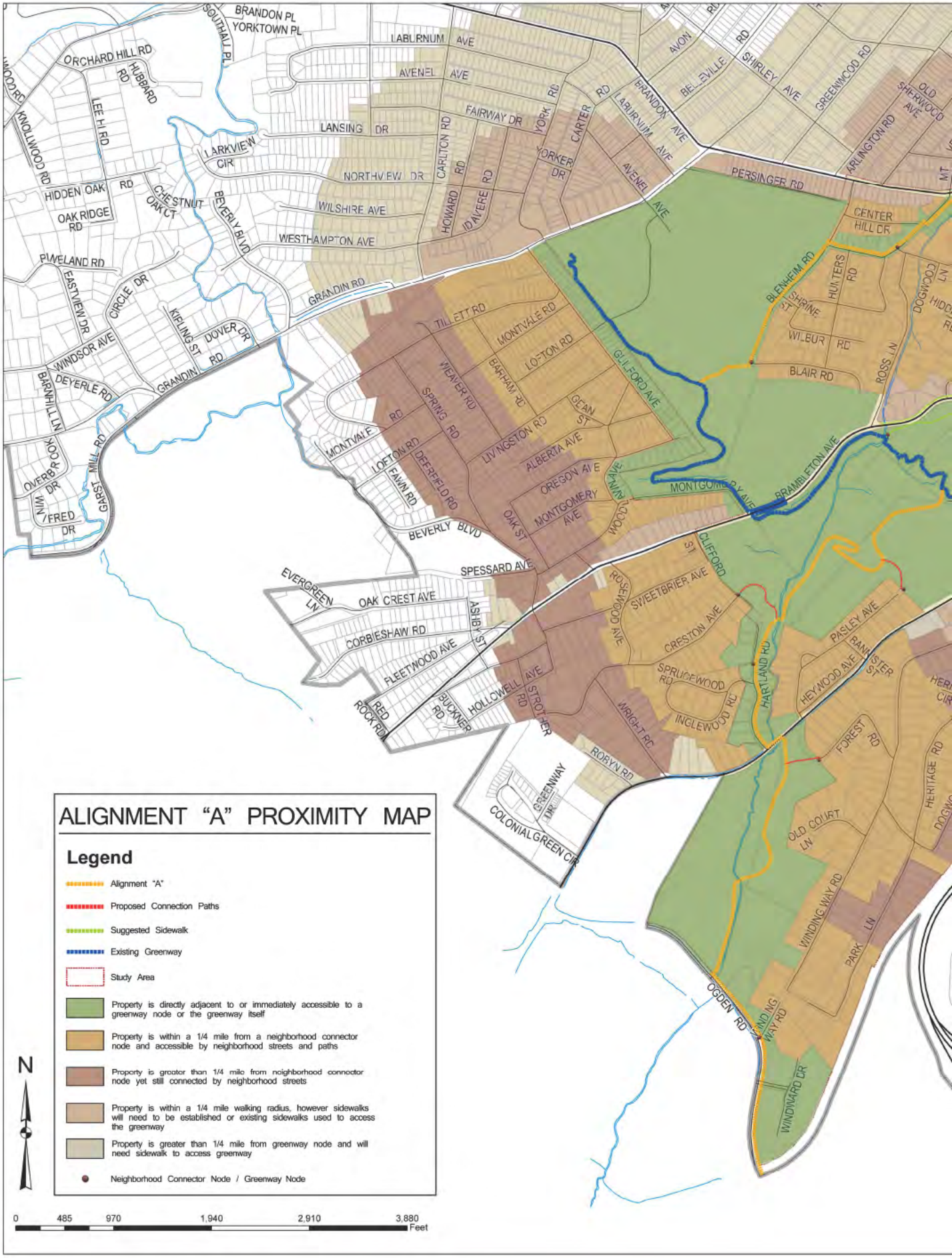
SUITABILITY ANALYSIS CONT.

Property Ownership

Property ownership maps were developed in order to produce, to the highest extent possible, a set of trail alignments that would provide the lowest amount of obstacle as it pertains to right-of-way or easement acquisition. By and large, as is depicted on the map, there are only a few areas that potential trail alignments will need to cross private property. In some cases sewer easements already exist in these areas which may aid the cause. Nevertheless, the majority of alignments that are produced will be located on either city-owned land, land zoned as ROS, or vacant land. Three areas are to be noted as a cause for concern. The section of trail along Ogden road will be cumbersome as plantings, limited right-of-way and adjacent properties will prove difficult, but not impossible, to overcome. A second area of concern is a 100ft section along Colonial Avenue. This section is bound on both sides, on one side by Murray Run and by Colonial Avenue on the other. A small strip of land exists between the two however any potential trail will be narrow. Nevertheless, this section remains the only plausible crossing area in regards to traversing Colonial Avenue. The third and final area of concern is the section between Brambleton Avenue and Towers shopping center. This area is the only region in the study area with no city-owned property, with the exception of right-of-way along Brandon Avenue. If the characteristics of a front country trail are to be present through the extent of the corridor, cooperation of private property owners will be paramount. (Please refer to City Owned/Vacant Map)

Slope

The fifth and final analysis map is slope analysis. The current characteristics of the existing section of the Murray Run Greenway consist of high slopes, dirt and mulch pathways, and rock outcroppings. For the reasons listed above this greenway is implicitly not ADA compliant and therefore slopes were not a top priority. However, any new trail segment should be subjected to slope analysis to propose sections of lesser topographic difficulty. Additionally, sections of trail that are proposed in areas of high slopes require a greater deal of maintenance and planning thereby decreasing the likelihood the trail will be environmentally sensitive and economically sustainable. Two areas of concern arose during this portion of the analysis process. The first section is the area within Fishburn Park. The area is home to many spur trails that have noticeable erosion issues which will need to be dealt with if a section of trail is sited here. The second section of concern is again the area between Brambleton Ave. and Towers shopping center. Within this area along the borders of Murray Run are several areas of significant slope. This portion is also one of the larger forested tracts in the study area and its inclusion may be necessary to achieve a front country trail appeal. (Please refer to Slope Map)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YORKTOWN PL
SOUTHALL PL
ORCHARD HILL RD
HUBBARD RD
LEE HI RD
KNOLLWOOD RD
LABURNUM AVE
AVENEL AVE
FAIRWAY DR
LANSING DR
LARKVIEW CIR
NORTHVIEW DR
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WINFRED DR
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GRANDIN RD
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HOWARD RD
IDAVERE RD
YORK RD
CARTER RD
YORKER DR
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GREENWOOD RD
ARLINGTON RD
OLD SHERWOOD AVE
PERSINGER RD
CENTER HILL DR
BLENHEIM RD
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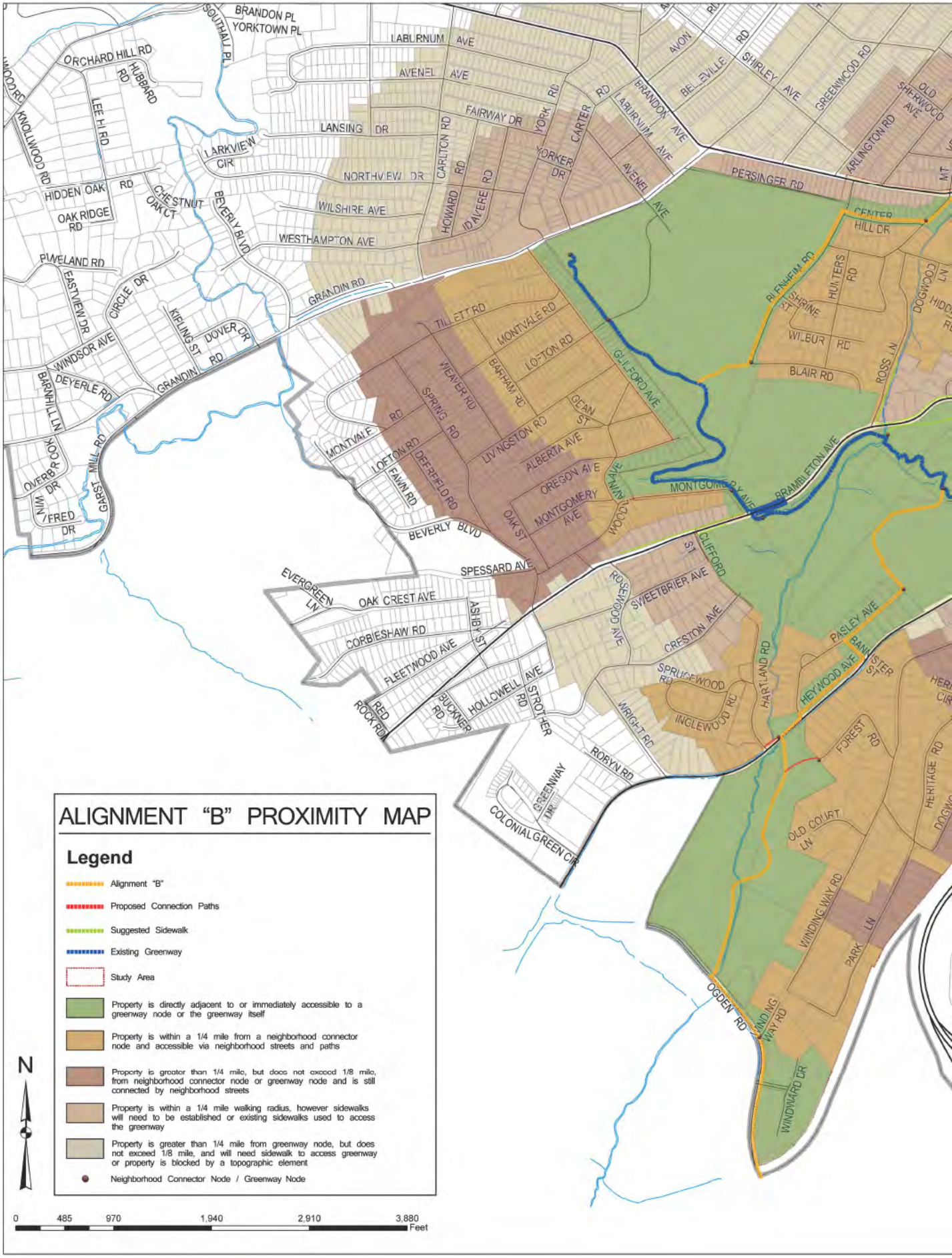
COLONIAL GREEN CIR
FOREST RD
OLD COURT LN
WINDING WAY RD
PARK LN
HERITAGE RD
OGDEN RD
WINDWARD DR
ALIGNMENT "A" PROXIMITY MAP
Legend
Alignment "A"
Proposed Connection Paths
Suggested Sidewalk
Existing Greenway
Study Area
Property is directly adjacent to or immediately accessible to a greenway node or the greenway itself
Property is within a 1/4 mile from a neighborhood connector node and accessible by neighborhood streets and paths
Property is greater than 1/4 mile from neighborhood connector node yet still connected by neighborhood streets
Property is within a 1/4 mile walking radius, however sidewalks will need to be established or existing sidewalks used to access the greenway
Property is greater than 1/4 mile from greenway node and will need sidewalk to access greenway
Neighborhood Connector Node / Greenway Node
N
0
485
970
1,940
2,910
3,880
Feet

PROXIMITY MAP "A"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FAIRWAY DR
YORK RD
CARTER RD
LARKVIEW CIR
NORTHVIEW DR
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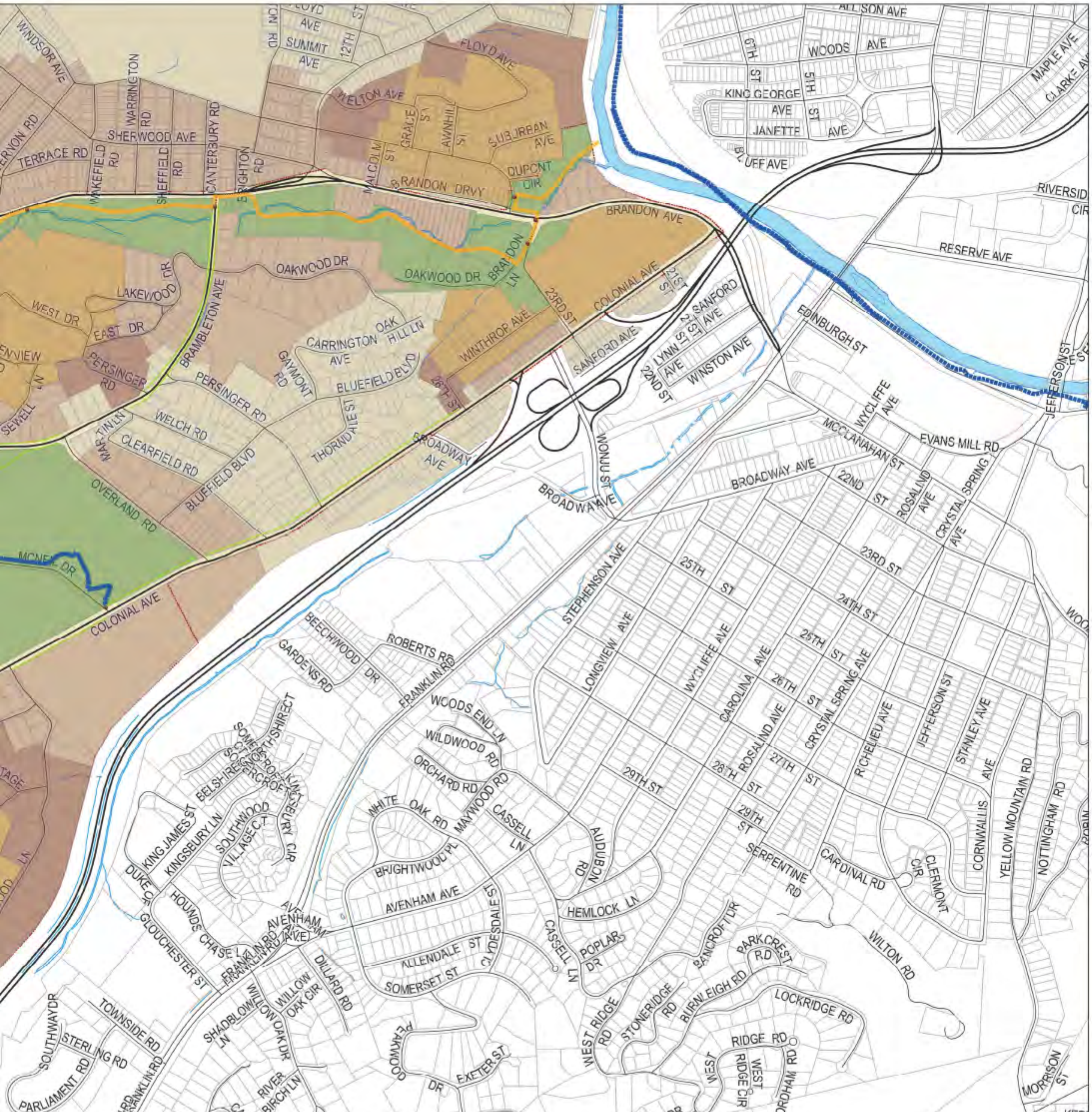
STROTHER RD
BUCKNER RD
RED ROCK RD
ROSSCOMMON AVE
SWEETBRIER AVE
CRESTON AVE
CLIFFORD ST
PASLEY AVE
BANISTER ST
HEYWOOD AVE
SPRUCEWOOD RD
INGLEWOOD RD
HARTLAND RD
WRIGHT RD
RORYN RD
GREENWAY DR
COLONIAL GREEN CIR
FOREST RD
HERITAGE RD
OLD COURT LN
WINDING WAY RD
PARK LN
OGDEN RD
WINDWARD DR
ALIGNMENT "B" PROXIMITY MAP
Legend
Alignment "B"
Proposed Connection Paths
Suggested Sidewalk
Existing Greenway
Study Area
Property is directly adjacent to or immediately accessible to a greenway node or the greenway itself
Property is within a 1/4 mile from a neighborhood connector node and accessible via neighborhood streets and paths
Property is greater than 1/4 mile, but does not exceed 1/8 mile, from neighborhood connector node or greenway node and is still connected by neighborhood streets
Property is within a 1/4 mile walking radius, however sidewalks will need to be established or existing sidewalks used to access the greenway
Property is greater than 1/4 mile from greenway node, but does not exceed 1/8 mile, and will need sidewalk to access greenway or property is blocked by a topographic element
Neighborhood Connector Node / Greenway Node
N
0
485
970
1,940
2,910
3,880
Feet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BRIGHTON RD
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FLOYD AVE
WELTON AVE
GRACE ST
AVENHILL ST
SUBURBAN AVE
MALCOLM ST
BRANDON DRVY
DUPONT CIR
BRANDON AVE
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LAKEWOOD DR
WEST DR
EAST DR
BRAMBLETON AVE
PERSINGER RD
CARRINGTON AVE
OAK HILL LN
GAYMONT RD
BLUEFIELD BLVD
WINTHROP AVE
23RD ST
COLONIAL AVE
21ST ST
SANFORD AVE
LYNN AVE
22ND ST
WINSTON AVE
SEWELL LN
WELCH RD
MARTIN LN
CLEARFIELD RD
THORNDALE ST
26TH ST
BROADWAY AVE
OVERLAND RD
MCNEIL DR
WONJU ST
ALLISON AVE
6TH ST
WOODS AVE
5TH ST
KING GEORGE AVE
JANETTE AVE
BLUFF AVE
MAPLE AVE
CLARKE AVE
RIVERSIDE CIR
RESERVE AVE
EDINBURGH ST
WYCLIFFE AVE
MCCLANAHAN ST
EVANS MILL RD
JEFFERSON ST
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ROSALIND AVE
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FRANKLIN RD
WOODS END LN
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ORCHARD RD
MAYWOOD RD
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KINGSBURY LN
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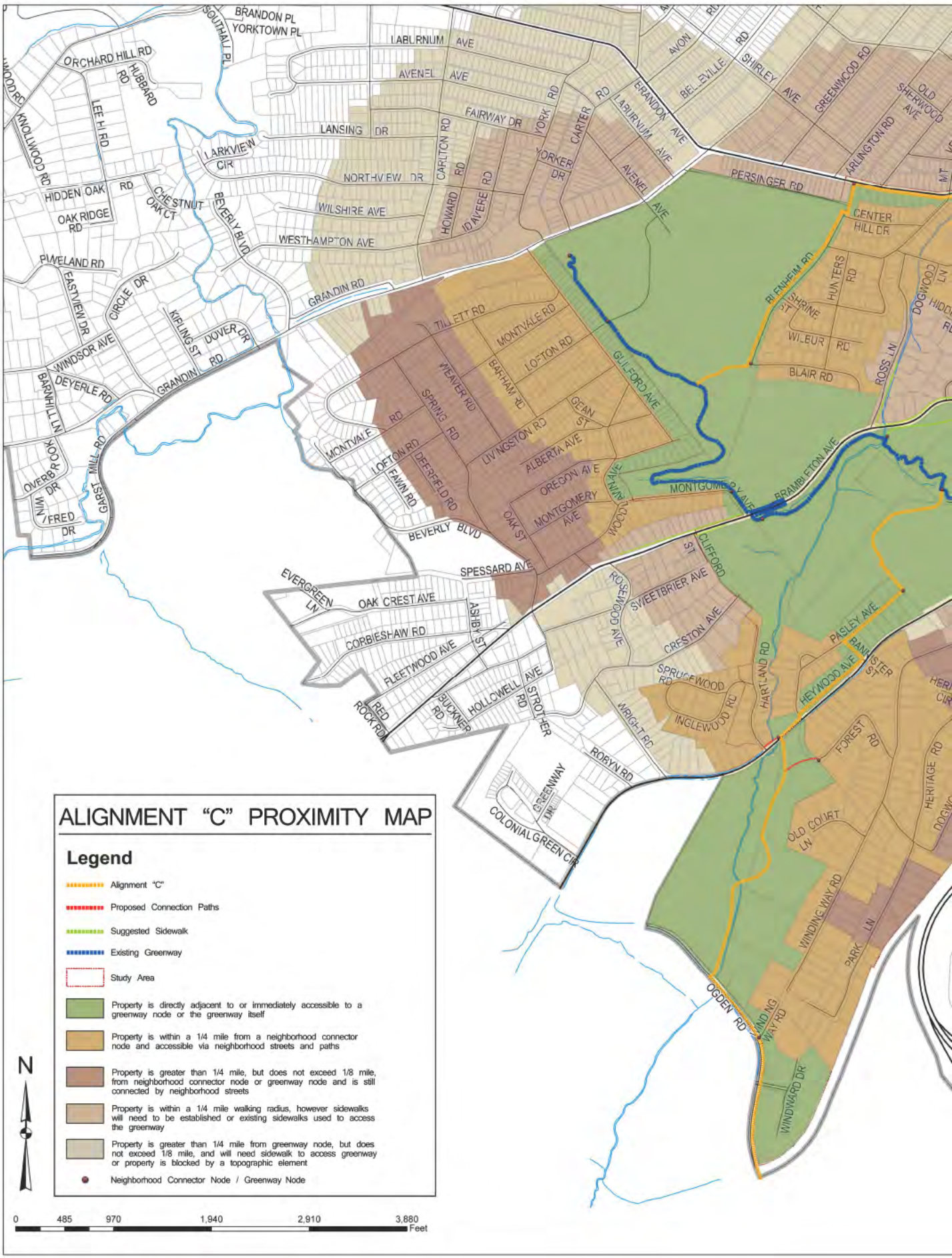
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RED ROCK RD
WRIGHT RD
ROBYN RD
GREENWAY DR
COLONIAL GREEN CIR
FOREST RD
HERITAGE RD
OLD COURT LN
WINDING WAY RD
PARK LN
OGDEN RD
WINDWARD DR
ALIGNMENT "C" PROXIMITY MAP
Legend
Alignment "C"
Proposed Connection Paths
Suggested Sidewalk
Existing Greenway
Study Area
Property is directly adjacent to or immediately accessible to a greenway node or the greenway itself
Property is within a 1/4 mile from a neighborhood connector node and accessible via neighborhood streets and paths
Property is greater than 1/4 mile, but does not exceed 1/8 mile, from neighborhood connector node or greenway node and is still connected by neighborhood streets
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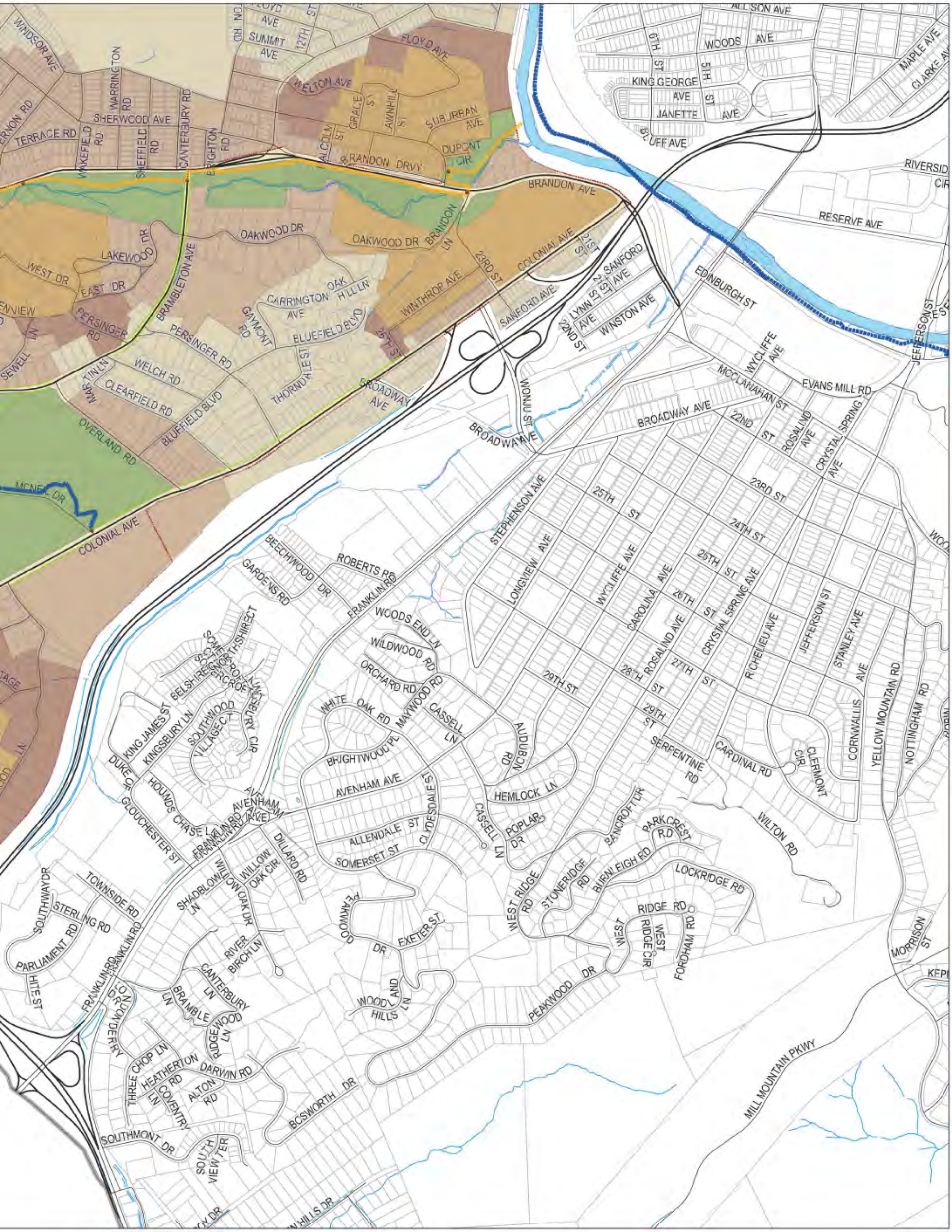
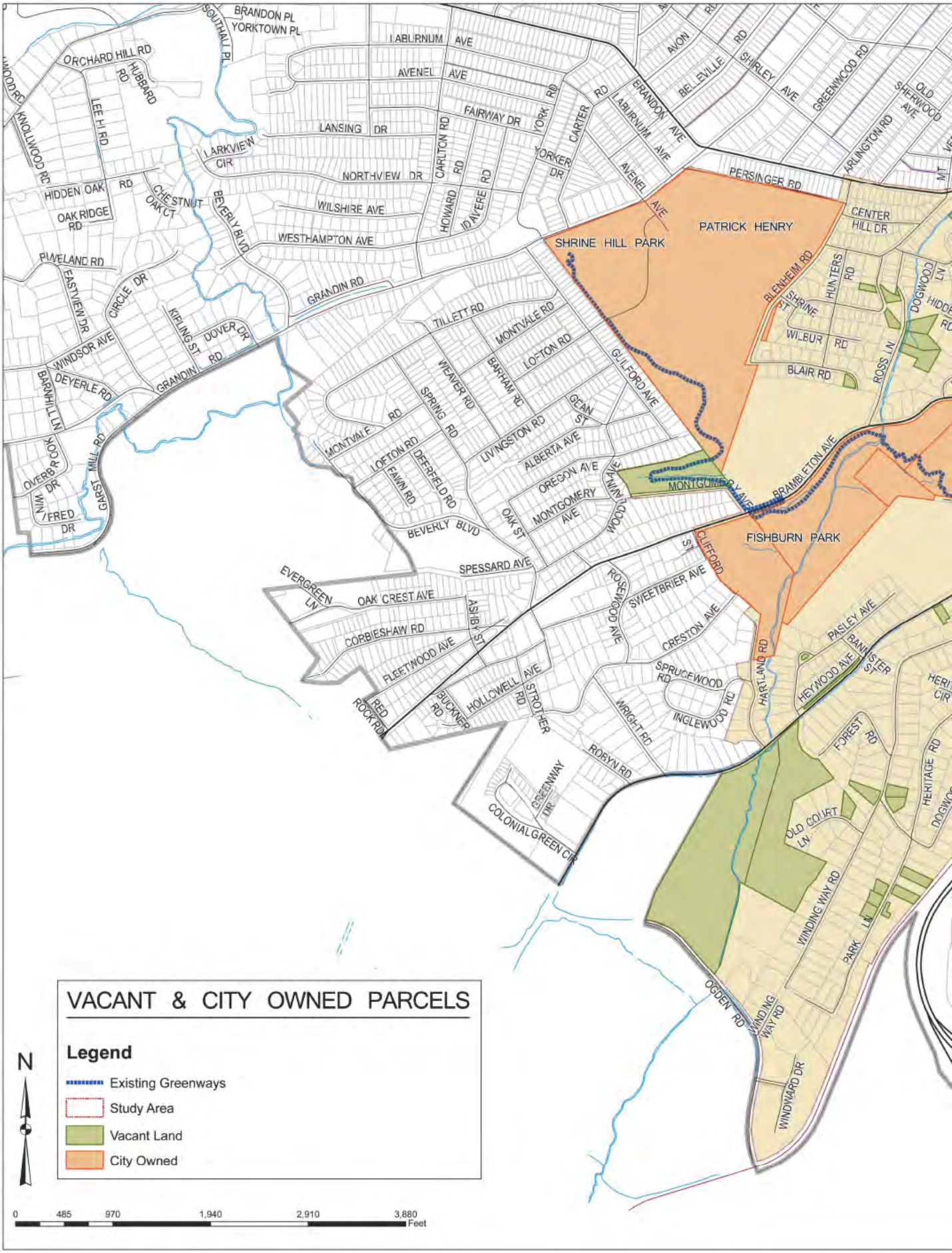
Property is greater than 1/4 mile from greenway node, but does not exceed 1/8 mile, and will need sidewalk to access greenway or property is blocked by a topographic element
Neighborhood Connector Node / Greenway Node
N
0
485
970
1,940
2,910
3,880
Feet



MURRAY RUN GREENWAY EXTENSION FEASIBILITY STUDY


VACANT & CITY OWNED PARCELS
Legend
Existing Greenways
Study Area
Vacant Land
City Owned
N
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485
970
1,940
2,910
3,880
Feet
SHRINE HILL PARK
PATRICK HENRY
FISHBURN PARK
BRANDON PL
YORKTOWN PL
SOUTHALL PL
ORCHARD HILL RD
HUBBARD RD
LEE H I RD
KNOLLWOOD RD
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ASHBY ST
ROSEMARY AVE
SWEETBRIER AVE
CRESTON AVE
PASLEY AVE
RANNISTER ST
HEYWOOD AVE
HARTLAND RD
SPRUCEWOOD RD
INGLEWOOD RD
HOLLOWELL AVE
STROTHER RD
BUCKNER RD
RED ROCK RD
WRIGHT RD
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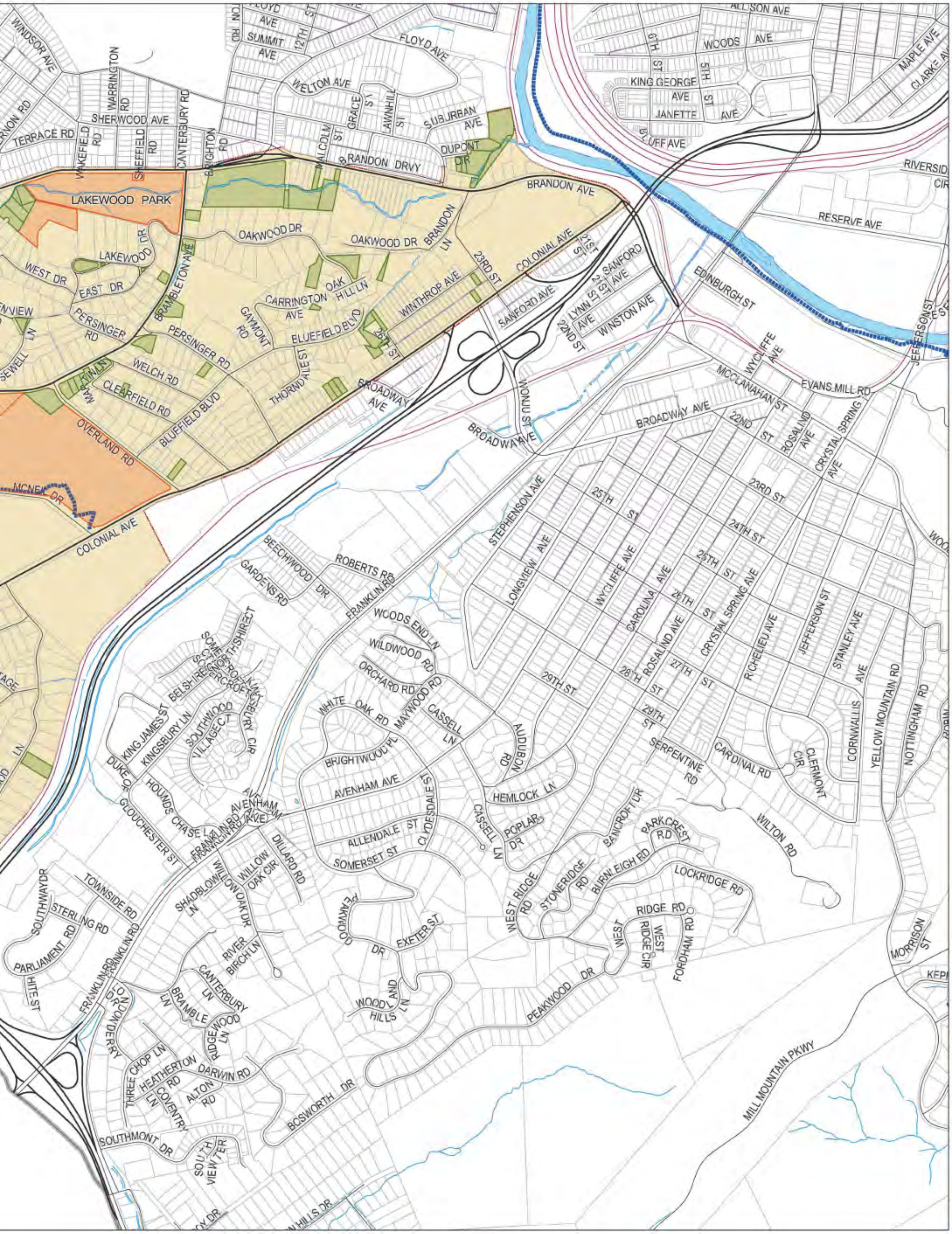
LAKEWOOD PARK
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PARLIAMENT RD
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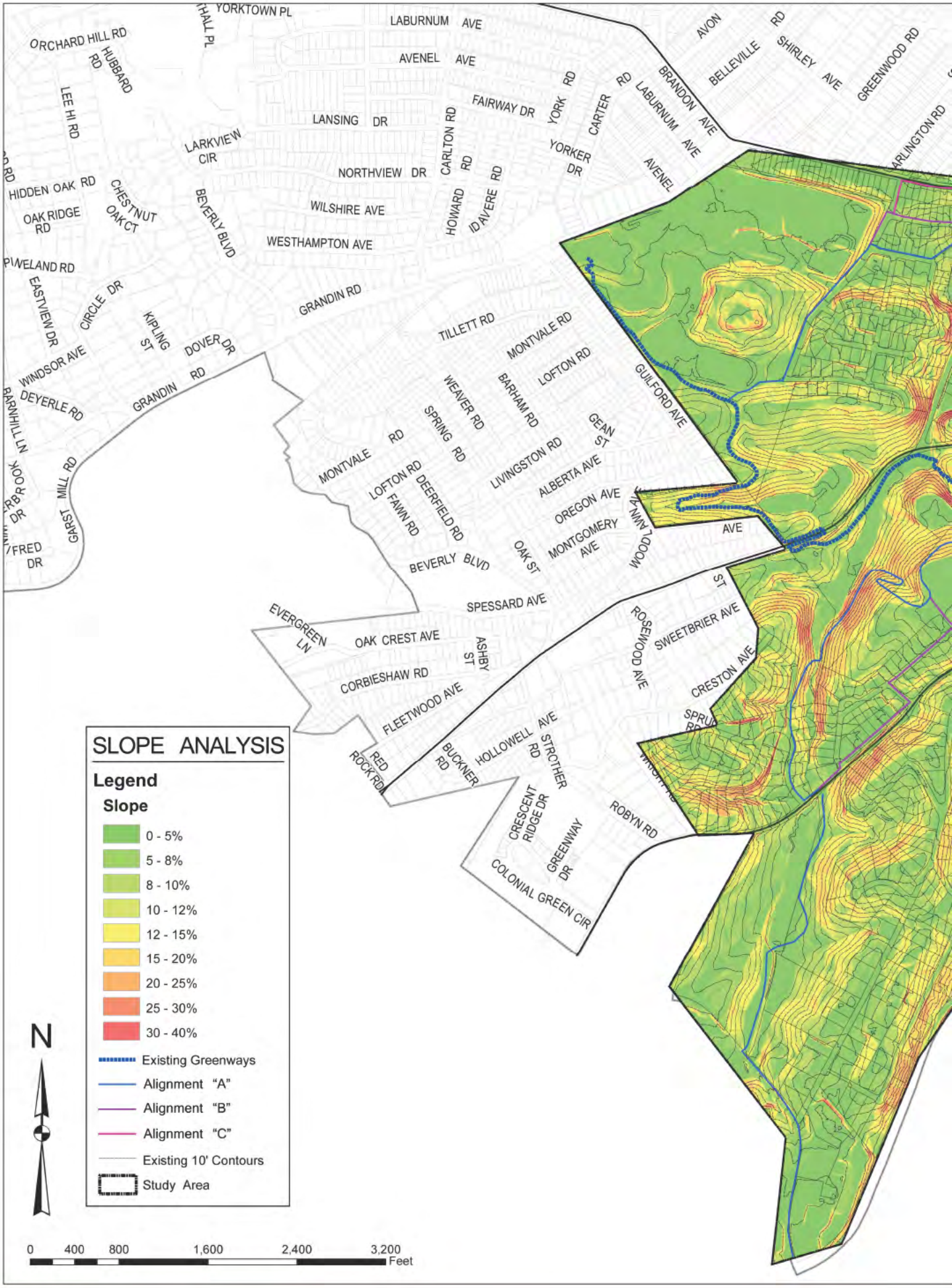
WOODS AVE
ALLISON AVE


SLOPE ANALYSIS
Legend
Slope
0 - 5%
5 - 8%
8 - 10%
10 - 12%
12 - 15%
15 - 20%
20 - 25%
25 - 30%
30 - 40%
Existing Greenways
Alignment "A"
Alignment "B"
Alignment "C"
Existing 10' Contours
Study Area
N
0 400 800 1,600 2,400 3,200
Feet
YORKTOWN PL
LABURNUM AVE
AVENEL AVE
ORCHARD HILL RD
HUBBARD RD
LEE HI RD
LANSING DR
FAIRWAY DR
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CARTER RD
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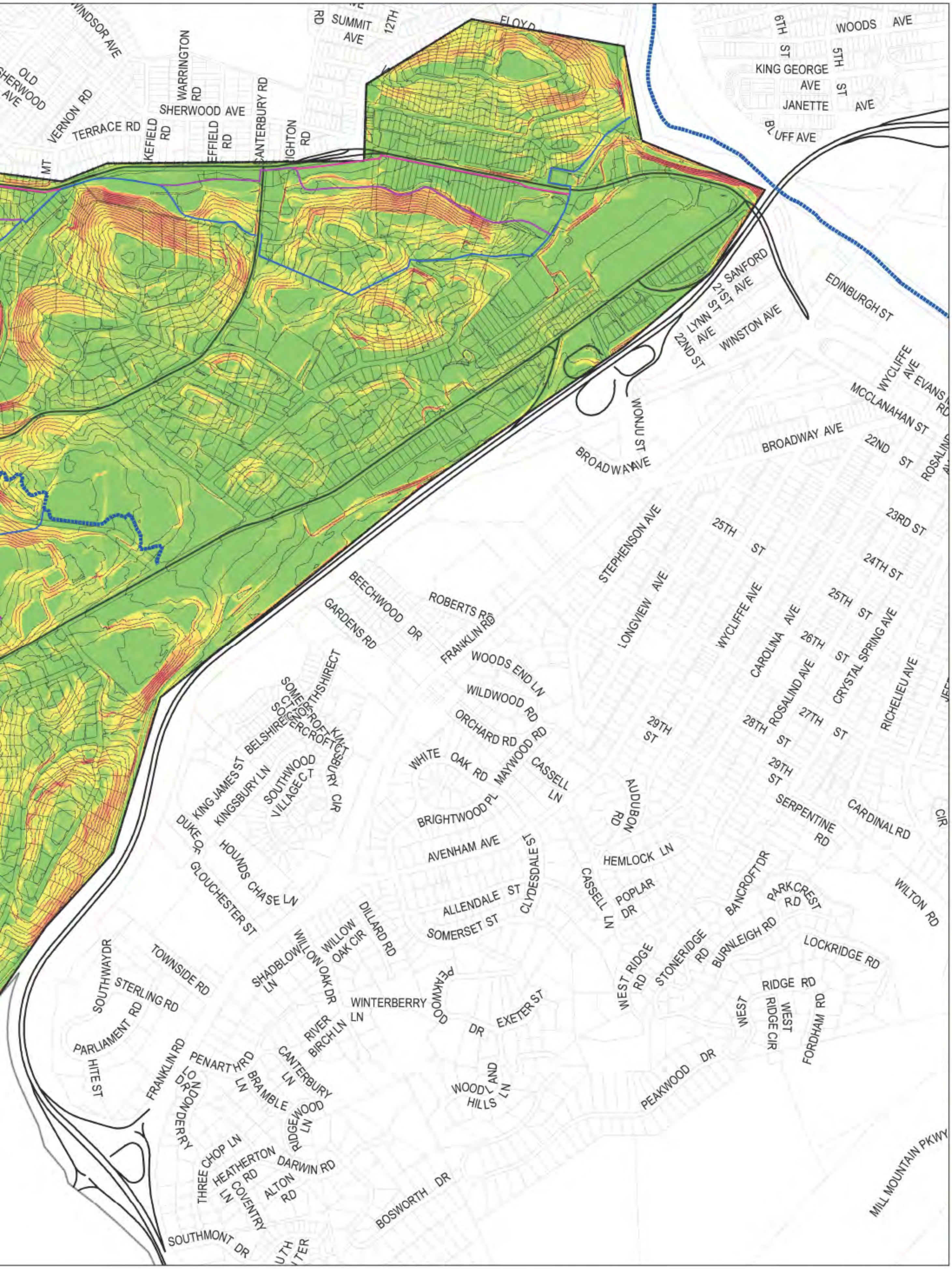
BELLEVILLE RD
SHIRLEY AVE
GREENWOOD RD
LARKVIEW CIR
CARLTON RD
YORKER DR
AVENEL
NORTHVIEW DR
HIDDEN OAK RD
OAK RIDGE RD
CHESTNUT OAK CT
BEVERLY BLVD
WILSHIRE AVE
HOWARD RD
IDAVERE RD
WESTHAMPTON AVE
PIVELAND RD
EASTVIEW DR
CIRCLE DR
KIPLING ST
DOVER DR
GRANDIN RD
TILLETT RD
MONTVALE RD
LOFTON RD
GUILFORD AVE
WINDSOR AVE
DEYERLE RD
GRANDIN RD
WEAVER RD
BARHAM RD
SPRING RD
GEAN ST
LIVINGSTON RD
ALBERTA AVE
OREGON AVE
MONTGOMERY AVE
MONTVALE RD
LOFTON RD
DEERFIELD RD
FAWN RD
BEVERLY BLVD
OAK ST
WOODLAWN AVE
BARNHILL LN
GARST MILL RD
SPESSARD AVE
EVERGREEN LN
OAK CREST AVE
ASHBY ST
ROSEWOOD AVE
SWEETBRIER AVE
CRESTON AVE
CORBIESHAW RD
FLEETWOOD AVE
HOLLOWELL AVE
BUCKNER RD
STROTHER RD
RED ROCK RD
CRESCENT RIDGE DR
GREENWAY DR
ROBYN RD
COLONIAL GREEN CIR



SLOPE

MURRAY RUN GREENWAY EXTENSION FEASIBILITY STUDY

FINAL ALIGNMENTS

Upon completion of the suitability analysis the three aforementioned refined alignments where weighted and classified as Alignment "A," "B," and "C" based on the level in which they achieved desired attributes. Several sections of the three corridors are seen as "the only feasible way" or "the best way" to accomplish the establishment of a greenway. Therefore small adjustments to Alignment "A," in the way of Alignment "B" and "C," were created to provide other alignment possibilities in case of foreseen or unforeseen circumstances.

Alignment "A"

Alignment "A" Section One begins at the northwest corner of the Tanglewood Mall property along Ogden Road (Please refer to Final Alignments Map). It is envisioned that the alignment will run along the east side of Ogden Road crossing the railroad overpass via the bridge on Ogden Road. Although this section of the alignment will tightly hug the road there should be sufficient space for a greenway corridor on the bridge. Proceeding northward along Ogden Road in the section between the bridge and Winding Way Road several obstacles are present. Minimal right-of-way is present as well as encroaching vegetation from adjacent residential units. In several areas an earthen berm has been combined with vegetation to create a formidable buffer. Nevertheless, short of crossing Ogden Road to the county side this is the only viable path for connection to Tanglewood Mall. From Winding Way Road northward to Murray Run right-of-way is present with little to no obstacles. Although along the east side of the road, in a handful of areas, where steep slopes are present runoff will need to be addressed. It is envisioned that this entire section of the alignment, from Tanglewood to Murray Run along Ogden Rd, will be composed of varying width sidewalk. Once crossing Murray Run the alignment proceeds into the Jefferson Hills Golf Course Parcel on the western side of the creek. This portion of the alignment will meander through riparian vegetation, open meadows, and act as a linkage to one of the major pieces of green infrastructure in the city. Halfway through the Jefferson Hills Golf Course Parcel a stream crossing will be necessary to access the eastern side of the stream to proceed northward toward the ROS-zoned parcel adjacent to Murray Run. This section of the alignment is envisioned as an 8-10' paved trail or an 8-10' gravel trail. Now at Colonial Avenue an unmarked crossing will lead to a short section of sidewalk along the north side of Colonial Ave extending in a southwesterly direction to Hartland Road. The alignment will follow Hartland Road northward until the Fishburn Park property is reached. The alignment along Hartland Road is envisioned as an 8' separated sidewalk. From Hartland Road the alignment proceeds into the Fishburn Park property, where steep slopes will need to be addressed in order to reach grade down to Murray Run. where an existing wooden bridge provides a crossing over Murray Run. The alignment proceeds in a northeasterly direction along established front country trails. It is recommended, but not necessary, that the existing footpaths be retrofitted to deal with storm water erosion. The alignment wraps around existing trails and then daylights on the VWCC property where a great view of the valley can be seen. The trail will then run along the property boundary between VWCC and Fishburn Park where it will eventually connect with the existing portion of Murray Run Greenway at McNeil Dr.

Alignment "A" Section Two begins near Woodland Park, near the Patrick Henry High School track, and proceeds in an easterly direction towards Blenheim Road. This section of the alignment

FINAL ALIGNMENTS CONT.

is envisioned as an 8-10' separated trail. Once on Blenheim Road an exceptionally large right-of-way with an existing 5 foot sidewalk will provide a great setting for an 8-10' separated sidewalk segment. This trail type will extend down Blenheim Road to the point where the alignment crosses over to Persinger Road SW. The trail will continue down Persinger Road on proposed residential sidewalks and then head in a northerly direction on Mt. Vernon Road SW. Approximately half way down Mt. Vernon Rd the alignment will utilize existing residential sidewalks. At the intersection of Mt. Vernon Road SW and Center Hill Drive the alignment will cross from the west side of Mt. Vernon Road SW to the eastside. Once on the eastside of Mt. Vernon Road SW the alignment will follow existing residential sidewalks into Lakewood Park. Once the trail enters Lakewood Park the trail will meander along the stream banks and access the existing gravel maintenance road on the backside of the pond. Progressing along the maintenance road the alignment proceeds in an easterly direction toward Lakewood Drive where it will parallel Lakewood Drive until it reaches Brambleton Avenue. The segment of trail through Lakewood Park and along Lakewood Drive is visualized as an 8-10' paved trail or an 8-10' gravel trail. An unmarked crossing over Brambleton Avenue will lead to a section of Brambleton Avenue with a larger than average ROW. The alignment will parallel the street in a southern direction and then cross into the northern part of the Elks Lodge property. The alignment will continue in a south easterly direction along the northern border of the Elks Lodge property until the trail takes a turn northward to Oakwood Drive. Once across Oakwood Drive an existing sewer easement through private property will provide a corridor to reach the eastern section of Oakwood Drive and Brandon Lane. Once along Brandon Lane the trail will continue to the major intersection of Brandon Lane and Brandon Avenue. It is pictured that the entire length of trail, from Brambleton Avenue to Brandon Avenue, will consist of an 8-10' paved trail or an 8-10' gravel trail. This section of the trail will require cooperation between the City of Roanoke and private property owners, but will link large portions of green infrastructure and multiple neighborhoods. Once across Brandon Avenue the alignment will continue, on existing sidewalk, west to Windsor Avenue where it will head north. Directly behind Little Caesar's Pizza the alignment will take a right on what is commonly referred to as a paper street. The existing unpaved street turns into a maintenance/foot trail which traverses several parcels of private property before terminating at an unused railway track on the south side of the Roanoke River. This will be the terminus for the alignment as a possible rail-to-trail project will connect the Murray Run segments to the Roanoke River Greenway approximately a mile to the north.

Alignment "B"

Alignment "B" slightly differs from Alignment "A" in one of three segments: Colonial Avenue to McNeil Drive, Blenheim Road to Mt. Vernon Road, and Lakewood Park to Brandon Lane. All other sections of this alignment are described, in detail, in the Alignment "A" description.

Alignment "B" will deviate from Alignment "A" at the crossing of Colonial Avenue. The alignment will proceed in a northeastern direction paralleling Colonial Avenue until it reaches Pasley Avenue. Once the alignment has reached Pasley Avenue the trail will extend down the southern side of Heywood Avenue and turn right onto Bannister Street. Small, marked residential

FINAL ALIGNMENTS CONT.

pedestrian crossings will be situated at each crossover. The trail will proceed up Bannister Street until it rejoins with Pasley Avenue and heads towards the Virginia Western Community College property where it will reconnect with Alignment "A." It is envisioned that the on-street portion of Alignment "B" through the Pasley Avenue neighborhood will be 5'-8' sidewalk until the trail reaches the community college property where it will revert to an 8-10' paved trail or an 8-10' gravel trail.

Picking up at the intersection of Blenheim Road and Persinger Rd., Alignment "B" will extend down Blenheim Rd. to Center Hill Dr. This small section of trail will consist of an 8-10' separated trail. The alignment will cross over Blenheim Road onto Center Hill Drive and utilize existing sidewalk on the northern side of the street. It will then proceed down Center Hill Dr where it will reconnect with Alignment "A" at Mt. Vernon Rd.

The third and final adjustment of Alignment "B" occurs between Lakewood Park and Brandon Lane. Alignment "B" traverses the entire length of Lakewood Park and utilizes the existing signalized intersection at Brambleton Avenue as a crosswalk. It then progresses eastward parallel to Brandon Avenue and crosses into a vacant, wooded property currently held by Stonebridge Properties LLC. The section of trail within Lakewood Park will most likely be an 8-10' paved trail. Once along the edges of Lakewood Park and along Brandon Avenue the trail will consist of 5'-8' separated sidewalk. The alignment traverses the Stonebridge property where it winds through riparian forest and alongside Murray Run creek before crossing over the creek and traveling along the hillside south of Murray Run until it reaches Brandon Lane. Through the Stonebridge property and along the hillside the trail will be an 8-10' paved trail or an 8-10' gravel trail. This section of the trail will also require cooperation between the City of Roanoke and private property owners. Once at Brandon Lane the trail will reconnect with Alignment "A."

Alignment "C"

Alignment "C" slightly differs from Alignment "A" and "B" in one of two segments: Blenheim Road to Mt. Vernon Road, and Brambleton Avenue to Brandon Lane. All other sections of this alignment are described, in detail, in the Alignment "A" and "B" description.

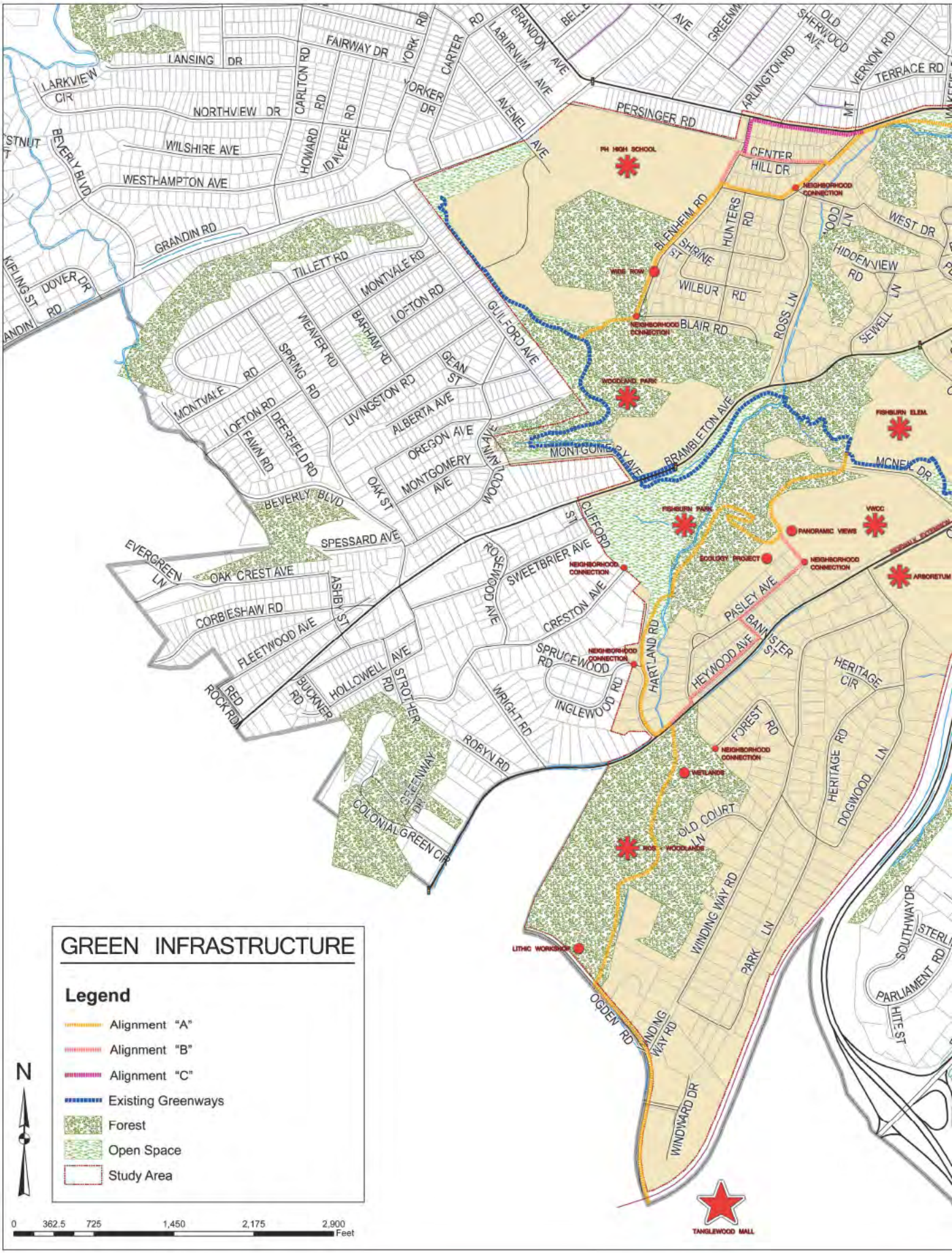
Picking up at the intersection of Blenheim Road and Center Hill Drive Alignment "C" will cross over Blenheim Road at Center Hill Drive and extend down Blenheim Rd. to Brandon Avenue along the east side of the street. This small section of trail will consist of a 5'-8' sidewalk. The alignment will then proceed down Brandon Avenue, on existing sidewalks, where it will reconnect with Alignment "A" at Mt. Vernon Rd. Alignment "C" picks back up on Brandon Avenue in the northwest corner of the Stonebridge property and is a slight modification of Alignment "B." This piece of the trail will travel parallel to Brandon Avenue but will be buffered from the street by approximately 20 feet. This small section of trail will be an 8-10' paved trail or an 8-10' gravel trail. Alignment "B" will then daylight on existing sidewalk and proceed down Brandon Avenue to Brandon Lane at the signalized intersection where it will reconnect with Alignment "A."

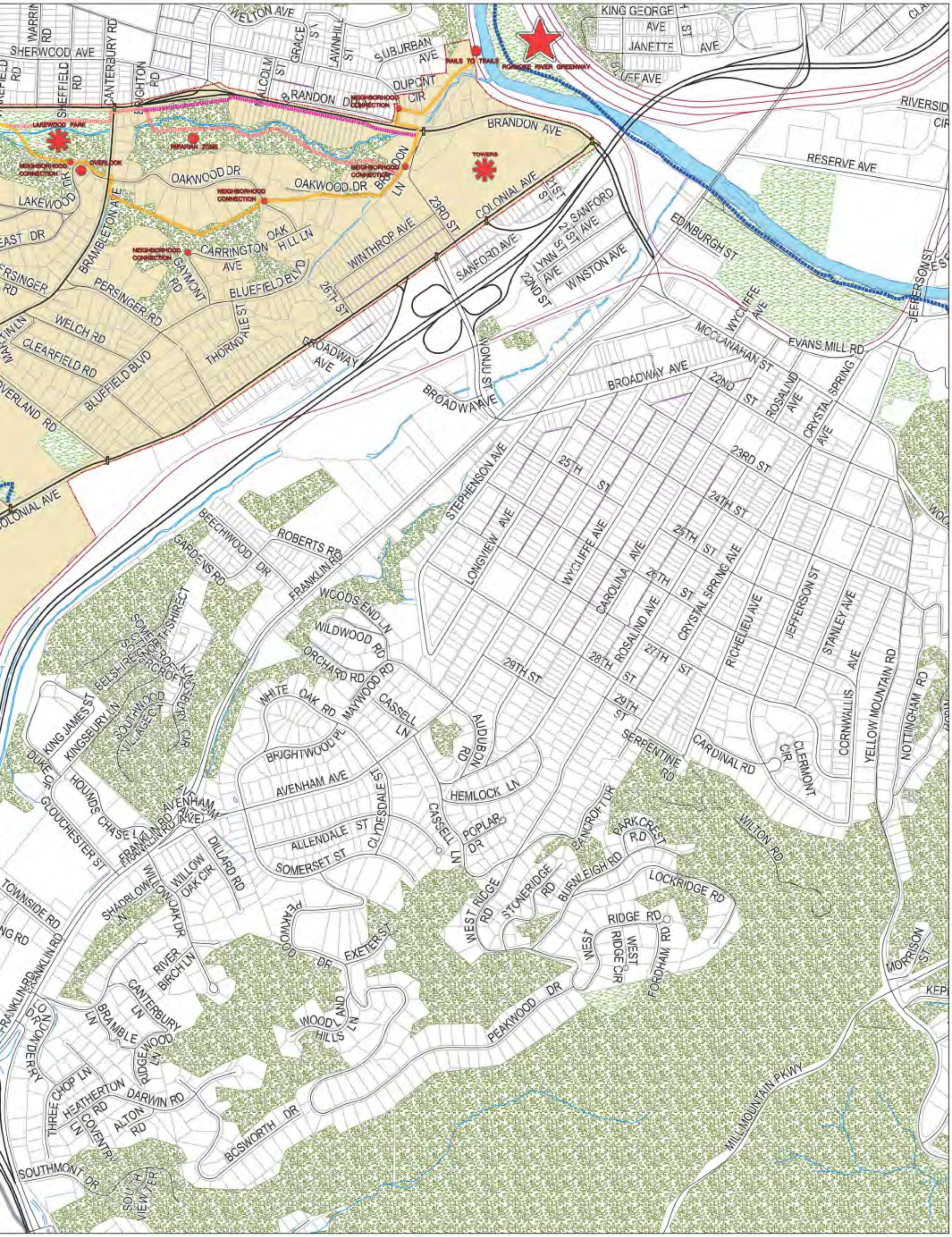
FINAL ALIGNMENTS CONT.

Conclusion

Alignment "A" is the preferred route for Murray Run Greenway as it is a juxtaposition of all the desired goals and objectives for this project. Alignment "A" will link most major green infrastructure in the study area while at the same time maximizing the number of citizens with walking access. Alignment "A" will provide the highest level of front country appeal and create the least amount of vehicle pedestrian interaction. Alignment "A" will also provide trail segments of low to moderate slope without utilizing on-street facilities.

As previously stated the preferred alignment will consist of trail segments of varying width. Although it is desired to keep the trail's front country characteristics it is recommended, in areas of high erosion, that the trail be paved and proper drainage systems be established. To the highest extent possible it is desired to create a vegetative barrier between trail users and vehicular traffic at all times. Although it is recognized that certain areas along the corridor will leave little room for buffers once a trail is established. Crossings at Colonial Avenue and Brambleton Avenue will most likely be unmarked; as no signalized intersections are present in these areas. Any new construction of sidewalks along this alignment, within the right of way, should be designed in conformance with Roanoke's Street Design Guidelines and Complete Streets Policy.


GREEN INFRASTRUCTURE
Legend
Alignment "A"
Alignment "B"
Alignment "C"
Existing Greenways
Forest
Open Space
Study Area
N
0
362.5
725
1,450
2,175
2,900
Feet
PERSINGER RD
FAIRWAY DR
LANSING DR
LARKVIEW CIR
NORTHVIEW DR
WILSHIRE AVE
WESTHAMPTON AVE
GRANDIN RD
BEVERLY BLVD
DOVER DR
KIPLING ST
CARLTON RD
HOWARD RD
IDAVERE RD
YORK RD
YORKER DR
CARTER RD
LABURNUM AVE
BRANDON AVE
AVENEL AVE
ARLINGTON RD
VERNON RD
TERRACE RD
OLD SHERWOOD AVE
GREENWOOD AVE
PH HIGH SCHOOL
CENTER HILL DR
NEIGHBORHOOD CONNECTION
BLENHEIM RD
HUNTERS RD
WEST DR
HIDDEN VIEW RD
SHRINE ST
WILBUR RD
ROSS LN
SEWELL LN
BLAIR RD
WIDE ROW
TILLETT RD
MONTVALE RD
LOFTON RD
BARHAM RD
WEAVER RD
SPRING RD
GUILFORD AVE
GEAN ST
LIVINGSTON RD
ALBERTA AVE
OREGON AVE
MONTGOMERY AVE
DEERFIELD RD
FAVAN RD
OAK ST
WOODLAND PARK
FISHBURN ELEM.
BRAMBLETON AVE
MONTGOMERY AVE
MCNEAL DR
FISHBURN PARK
VWCC
PANORAMIC VIEWS
ECOLOGY PROJECT
ARBORETUM
CLIFFORD ST
SWEETBRIER AVE
ROSEWOOD AVE
CRESTON AVE
SPRUCEWOOD RD
INGLEWOOD RD
HARTLAND RD
PASLEY AVE
BANISTER ST
HEYWOOD AVE
HERITAGE CIR
FOREST RD
HERITAGE RD
DOGWOOD LN
WETLANDS
OLD COURT LN
WINDING WAY RD
PARK LN
SOUTHWAY DR
PARLIAMENT RD
HITE ST
OGDEN RD
WINDWARD DR
LITHIC WORKSHOP
TANGLEWOOD MALL
SPESSARD AVE
BEVERLY BLVD
EVERGREEN LN
OAK CREST AVE
CORBIESHAW RD
FLEETWOOD AVE
ASHBY ST
HOLLOWELL AVE
BUCKNER RD
RED ROCK RD
STROTHER RD
WRIGHT RD
ROBYN RD
GREENWAY DR
COLONIAL GREEN CIR


WELTON AVE
SHERWOOD AVE
CANTERBURY RD
SHEFFIELD RD
BRIGHTON RD
GRACE ST
SUBURBAN AVE
DUPONT CIR
KING GEORGE AVE
JANETTE AVE
BLUFF AVE
RAILS TO TRAILS
ROANOKE RIVER GREENWAY
BRANDON AVE
LAKEWOOD PARK
RIPARIAN ZONE
NEIGHBORHOOD CONNECTION
OVERLOOK
TOWERS
OAKWOOD DR
LAKEWOOD DR
BRAMBLETON AVE
CARRINGTON AVE
OAK HILL LN
GAYMONT RD
BLUEFIELD BLVD
PERSINGER RD
WELCH RD
CLEARFIELD RD
OVERLAND RD
THORNDALE ST
COLONIAL AVE
23RD ST
26TH ST
WINTHROP AVE
SANFORD AVE
WINSTON AVE
22ND ST
EDINBURGH ST
RESERVE AVE
RIVERSIDE CIR
JEFFERSON ST
WYCLIFFE AVE
MCCLANAHAN ST
EVANS MILL RD
BROADWAY AVE
ROSALIND AVE
CRYSTAL SPRING AVE
23RD ST
24TH ST
25TH ST
26TH ST
27TH ST
28TH ST
29TH ST
STEPHENSON AVE
LONGVIEW AVE
WYCLIFFE AVE
CAROLINA AVE
ROSALIND AVE
CRYSTAL SPRING AVE
RICHELIEU AVE
JEFFERSON ST
STANLEY AVE
CORNWALLIS AVE
YELLOW MOUNTAIN RD
NOTTINGHAM RD
BEECHWOOD DR
GARDENS RD
ROBERTS RD
FRANKLIN RD
WOODS END LN
WILDWOOD RD
ORCHARD RD
MAYWOOD RD
WHITE OAK RD
CASSELL LN
AUDUBON RD
BRIGHTWOOD PL
AVENHAM AVE
CLYDESDALE ST
ALLENDALE ST
SOMERSET ST
HEMLOCK LN
POPLAR DR
SERPENTINE RD
CARDINAL RD
CLERMONT CIR
BANCROFT DR
PARKCREST RD
WILTON RD
LOCKRIDGE RD
BURNLEIGH RD
STONERIDGE RD
WEST RIDGE RD
RIDGE RD
WEST RIDGE CIR
FORDHAM RD
PEAKWOOD DR
EXETER ST
WOODLAND HILLS LN
BOSWORTH DR
MILL MOUNTAIN PKWY
MORRISON ST
KING JAMES ST
KINGSBURY LN
DUKE OF GLOUCESTER ST
HOUNDS CHASE
TOWNSIDE RD
DILLARD RD
WILLOW OAK CIR
WILLOW OAK DR
SHADBLOW LN
RIVER BIRCH LN
CANTERBURY LN
BRAMBLE LN
RIDGEWOOD LN
THREE CHOP LN
HEATHERTON RD
COVENTRY LN
DARWIN RD
ALTON RD
SOUTHMONT DR
SOUTH VIEW TER

TRAIL ACTION PLAN

Murray Run Greenway is a vital piece within the City of Roanoke's larger conservation effort. The existing greenway, and its proposed extensions, parallel and traverse the Murray Run stream corridor further exemplifying its ability to preserve and protect a precious riparian environment. By establishing a linkage between fragmented parts of the City of Roanoke's green infrastructure the Murray Run Greenway corridor will act as a linear park serving a large portion of the population in the southern area of the city. Such a large park corridor will only help achieve the City of Roanoke's tree canopy goals and alternative transportation initiatives. The subsequent trail action plan will discuss the benefits of the proposed greenway extensions and recommend suggested design guidelines.

Neighborhood Connections

The existing section of Murray Run Greenway connects Shrine Hill Park, Patrick Henry High School, Woodland Park, Fishburn Park, Fishburn Elementary and Virginia Western Community College. The proposed extensions will look to build on the, already established, connectivity. The proposed alignments will ultimately connect trail users to Tanglewood Mall and the Roanoke River Greenway. However, a hand full of other destinations can be reached: Towers Shopping Center, Lakewood Park, and any number of the apartment complexes adjacent to Tanglewood Mall. For those neighborhoods that are not directly adjacent to the proposed alignments, neighborhood spur trails will provide connectivity. These neighborhood spur trails are smaller, 5-6' gravel trails. As previously stated Alignment "A" will provide the largest number of users foot access, via neighborhood spur trails or direct trail access, to the main greenway.

Environmental, Educational and Economic Benefits

The centerpiece of most greenways is a water feature such as a stream or river. Greenways can inherently connect people with these natural systems and much care must be taken to ensure the overall health of the corridor. Locating the trail alignment within the existing floodplain will not impede the natural systems that accompany a water course and will allow for preservation of riparian attributes. While the trail itself may add a minuet amount of paved surface, it is recommended that all paving be pervious, it will not adversely affect the corridors ability to handle certain flood events. However, great care should be taken during the construction phase of the project. Specific attention must be paid to erosion control measures in and around sensitive natural systems. It is of utmost concern that riparian buffers remain intact as to not compromise its ability to filter runoff and debris from adjacent land uses. Greenway trails by their vary nature will provide an alternative method of transportation thereby lessening the amount of vehicular traffic at any given time. It goes without saying that this will in turn reduce the amount of air pollution and traffic congestion along the corridor.

A picturesque corridor can also generate enthusiasm and promote a healthier lifestyle amongst users. The complex nature of water systems and ecological sciences can provide an opportunity for education and foster a greater connection with the surrounding environment.

TRAIL ACTION PLAN CONT.

Significant research is needed in order to quantify the cost savings that might be realized from decreased flood mitigation and insurance as well as determine the effect of increased vegetation as a result of the greenway. Evidence from other cities indicates that these impacts might be significant. Leaders in Johnson County, Kansas, expected to spend $120 million on storm water control projects Instead, voters passed a $600,000 levy to develop a county wide streamway park system. Development of a greenway network along streambeds addressed some of the county's flooding issues, and provided a valuable recreational resource. In 1999 the county commissioned a twenty year master plan that recommended that even more benefits, in terms of flood control, storm water management, and recreational use, could be realized if a more than ten fold increase in the size of the streamway park system were inacted. A 2002 study of San Antonio Texas by American Forests found that annual positive economic impact of the city's trees was $70 million. This study included many benefits, such as reduced home cooling costs and decreased storm water management costs. The study estimated that trees saved it from adding 678 million cubic feet of storm water handling capacity at an approximate cost of 1.3 billion. Additionally, the study made a high estimate of per tree pollution control benefits, possibly reflecting a recent increase in the value of such services to cities.

As evidenced by the continued use and strong public support of greenways in the Roanoke Valley, the economic benefit of greenways does not go unnoticed. There are both direct benefits of greenway implementation such as increased revenue in surrounding eateries and increasing sales of outdoor equipment such as bikes and rollerblades. Additionally, homeowners adjacent to greenway corridors are seeing an increase in property values when compared to similar houses with no greenway access. In 2001 Dr. John Crompton of Texas A&M University compiled the results of 25 major studies examining the effects of open space on property values. Crompton found that 20 of 25 studies concluded that open space and parks increased proximate property values. Crompton emphasized the difficulty involved in averaging diverse studies but proposed the following guidelines for use by local planners: Properties abutting or fronting a passively used park can be assumed to be worth 20% more than comparable properties without this amenity. In areas where passively used parks are large (over 25 acres), well maintained and attractive, this value may be much lower. Additionally, heavey active use may result in no value increase at all, although a premium of approximately 10% could be anticipated on property 2-3 blocks from such a park. Properties that are within 500 feet of a small park are likely to be positively impacted. For larger community sized parks, properties within 2,000 feet are likely to be positively impacted. While we do not know exactly how the Murray Run Greenway would be used, it seems clear that the park would have a neighborhood scale, causing properties within a wide radius to appreciate.

Greenways have become a catalyst in economic development by attracting commercial businesses that are looking to relocate to areas with a high quality of life. As is often noted businesses in the relocation process often cite the presence of trail and greenway corridors as a key criterion in their decision process. In 1997, a group of researchers conducted a study on the effects of park and open space on corporate location decisions. Researchers interviewed representatives from 73 economic development agencies and 174 businesses in the state of Colorado. All of the businesses had relocated, expanded or been launched in Colorado in the previous five years.

TRAIL ACTION PLAN CONT.

The economic development officals surveyed in the study ranked quality of life second behind operating costs among general categories influencing corporate location decisions. They further ranked recreation, parks, and open space third behind primary/secondary education and cost of living/housing among six quality of life sub-categories. Company respondents, on the other hand, ranked quality of life first among categories and recreation, parks, and open space second among quality of life sub-categories.

Community Health Benefits

The Problem: While it's not the foremost subject matter when one speaks of greenways, the health benefits of developing greenway trails close to residential communities is phenomenal. Chronic diseases such as heart disease, cancer, and diabetes are the leading causes of death and disability in the United States. These diseases account for 7 of every 10 deaths and affect the quality of life of 90 million Americans. The prevalence of obesity among our children aged 6 to 11 has more than doubled in the past 20 years. The 2007 National Survey of Children's Health found that 31 percent of Virginia's 10-to-17 year olds were overweight or obese, an increase since 2003 of 1 percent. This figure puts Virginia just under the national average of 31.6 percent and ranks the state 23rd highest in the country for percentage of overweight or obese children. Our society seems to devote a majority of their time to relatively isolated, private activities. For instance, studies show that a growing number of hours spent watching television, playing video games, surfing the Internet, and other "screen-time" activities have eaten into what was formerly social and active time for both children and adults. These activities could therefore be tied to depression and other diseases related to inactivity and isolation. Moreover, we need to ask ourselves what happens when people do venture outside. The lack of connected trails, unavailable sidewalk development, non-existent safe routes to schools, and the lack of interesting landscapes discourages physical activity.

The Analysis: Originally, the field of Parks and Recreation was created to heal a society, to literally breathe new life into our urban, industrial landscape by bringing greenspace into the toxic urban fabric of the nineteenth century and to give hope and anticipation back to our citizens by implementing fun and enjoyable programming for the tired and depressed American workforce. A high quality environment is essential for both children and adults to achieve optimal health and development. Building and land-use policies, including the quality and design of a child's physical environment, can help to cause or prevent illness, disability and injury, and degrade or preserve natural resources.

In their cost-benefit analysis of Physical Activity of Using Trails, Doctor's Wang, Macera, Schmid, and Buchner of the Center for Disease Control (CDC) found that for every $1 invested in trails yielded a $2.94 direct medical benefit to the community. The CDC found that because of the health and economic burden of physical inactivity, promoting physical activity has become a public health priority. Studies have shown that lifestyle interventions are as effective as structured interventions in increasing physical activity. For activities such as walking and cycling, availability of greenway trails, sidewalks and bicycle routes is an important element needed to incorporate

TRAIL ACTION PLAN CONT.

physical activity into everyday life. Indeed, lack of accessible facilities has been identified as a deterrent to a physically active lifestyle.

The Mission: Our task in Roanoke is to create active neighborhood linkages through a micro-scale greenway and trails planning tool that connects both our greenspaces and great places that can in turn provide the rationale for a range of solutions to foster health and livability. Making our neighborhoods and Village Centers more navigable for strollers, walkers and bikers may promote physical and social activity - but it may not be a fruitful activity unless this accessibility is linked to great places and has a direct impact on our community's chronic health related issues.

A "healthy" Roanoke, is made of places that are valued by and accessible to everyone in their neighborhood: parks for recreation, play, and relaxation; streetscapes and sidewalks where neighbors meet and people can shop, jog and stroll; and downtown or community markets with fresh produce, food, festivals, theatre and other goods. Such places are also the "front porches" of public institutions: city halls, libraries, schools, and post offices. These places must be situated so that people can conveniently reach them on foot or by transit. Psychologically, thriving public spaces give residents a strong sense of community, and promote the kinds of familiarity and social bonds that make neighborhoods safer and healthier. They are critical to livable cities and healthy communities.

Expectations and Interventions: Developing the remaining corridors of the Murray Run Greenway effort, brings another 10,689 people to within a ¼ mile walking distance of a regional greenway trail. Based upon previous unbiased third-party research, performed specifically for Roanoke by Appalachian State University's Department of Health & Human Science, we should also expect to effect the population in the same manner:

1.Since outdoor environments make unique contributions that may not be achieved or replicated in gym, clinical, or home settings. These contributions should include:

- Stress reduction which occurs in natural settings
- Unique site features that motivate physical activity
- Novelty in surroundings
- Potential for intrinsically motivated behavior
- Potential for adherence
- Opportunities for unplanned physical activity

2. Residents living near a greenway are more likely to engage in physical activity.

3.Citizens should demonstrate significant gains once the greenway is developed in walking, moderate activity, vigorous activity, as well as in their frequency of stretching and strength training. Overall, the proportion of respondents who would increase their physical activity should be in the neighborhood of 42.6%.

4.Residents will be more likely to meet CDC/ACSM guidelines following the

TRAIL ACTION PLAN CONT.

development of the Murray Run Greenway near their homes.

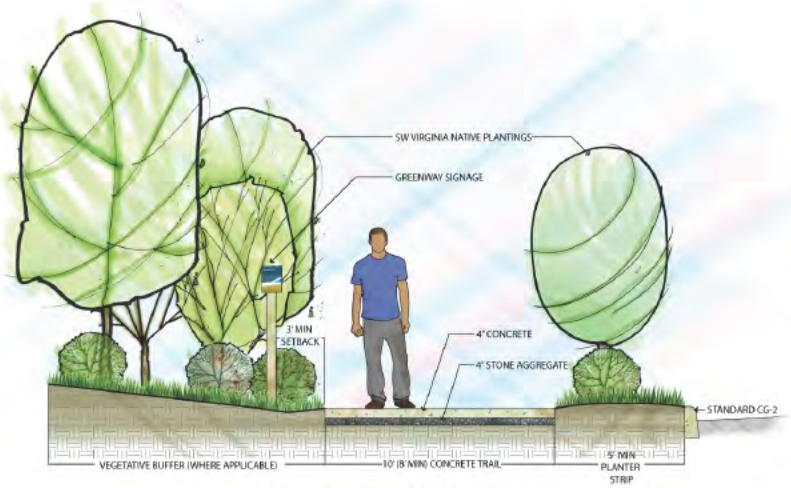
Design Guidelines

The existing section of Murray Run Greenway consists mainly of 4-6' front country trail with a mulched or earthen surface. Small sections of the existing trail are concrete sidewalk and asphalt of varying width. It is recommended that the trail corridor consist of a consistent surface pattern so that certain users do not assume the entire length of the trail is paved. The front country appeal of the existing section is to be carried over to the proposed extensions in terms of vegetation and slope. To minimize future maintenance costs it is recommended that the proposed alignment consist of a 6-10' pervious surface through off-street areas and 5-10' concrete sidewalks in on-street areas. Additionally proper drainage systems should be installed throughout the corridor. Both of the aforementioned design recommendations would reduce erosion and annual maintenance thereby producing a greater amount of sustainability. Throughout the majority of the proposed corridor, on-street sections of the alignment have sparse right-of-way available for trail use and proper buffers. Where applicable, along on-street sections of the alignment a buffer of 5' is recommended. In rare cases, a small buffer or no buffer may be the only plausible solution due to right-of-way constraints. Buffers are recommended to shield the trail from adjacent land uses and to maintain a natural trail setting. (Trail types are illustrated on pg 35)

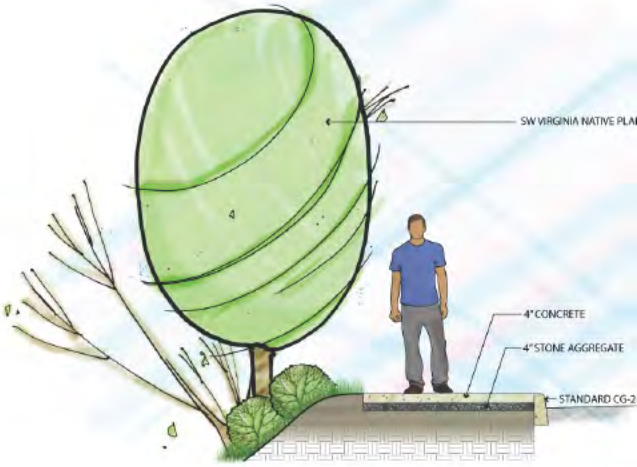
Road and Stream Crossings

The preferred alignment for the Murray Run extensions will have three stream crossings, excluding the existing crossing within Lakewood Park, 3 major street crossings and a few residential street crossings. One stream crossing will occur within the Jefferson Hills Golf Course parcel. It is recommended that a bridge crossing be used to avoid damaging the stream corridor to the furthest extent possible. A culvert may be used in lieu of a bridge as they are less expensive and permits are easily obtainable. However, the environmental impacts of a culvert crossing would be more severe than a bridge crossing. The second stream crossing occurs in the Fishburn Park property as the trail enters from Hartland Avenue. There is an existing footbridge that can be reused although modification may be necessary. The third and final stream crossing is located directly off of Brambleton Avenue along the east side of the road. A small stream crossing will be necessary and either a culvert or bridge will suffice.

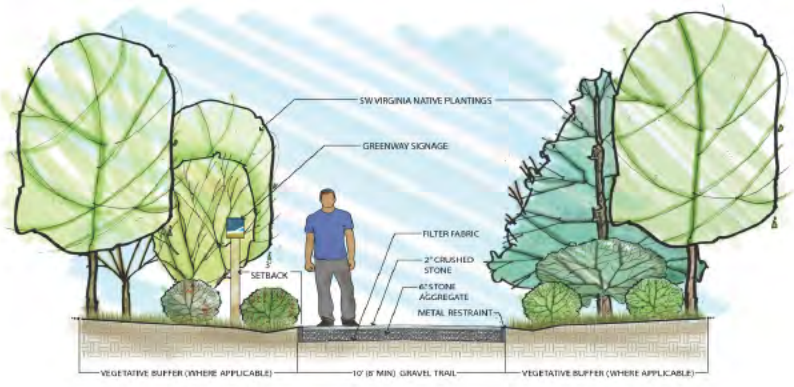
Three major road crossings will occur along the preferred alignment: Colonial Avenue, Brambleton Avenue and Brandon Avenue. Colonial Avenue and Brambleton Avenue crossings are non signalized, unmarked crossings. The crossing at Brandon Avenue is an existing signalized intersection. However, a marked crosswalk may need to be installed and a refuge island is recommended . Sample options of the Brandon Avenue crossing are located on the typicals page. Minor residential crossings occur four times along the preferred alignment.



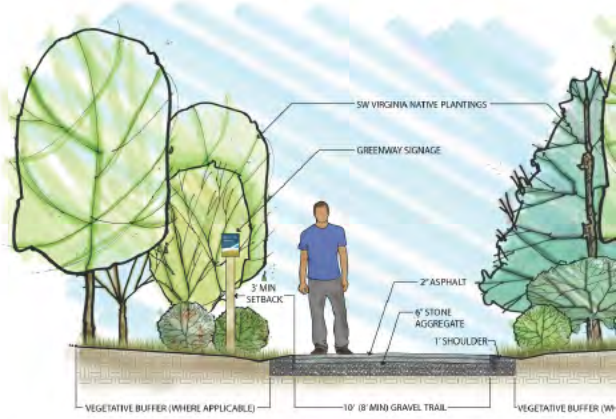
FIVE FOOT SEPERATED SIDEWALK



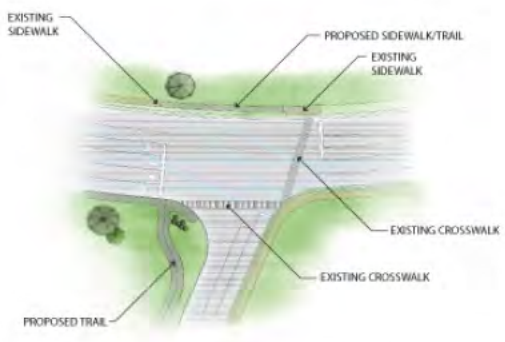
SIDEWALK COLONIAL AVENUE



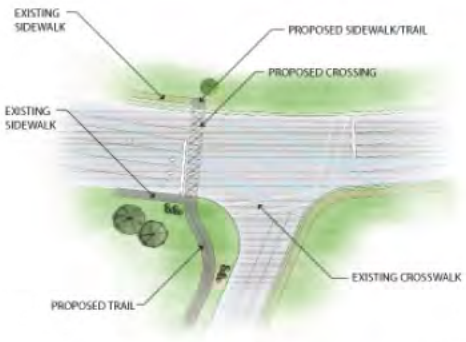
STONE TRAIL



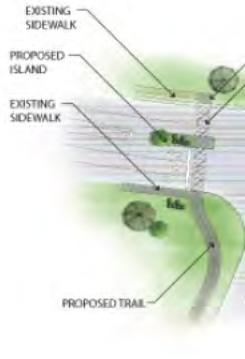
PAVED TRAIL



BRANDON AVE. EXISTING CROSSING (SIDEWALK EXTENSION ON NORTH SIDE)



BRANDON AVE. PROPOSED CROSSWALK (SMALL SECTION OF NEW SIDEWALK/TRAIL ALONG NORTH SIDE)



BRANDON AVE. PR
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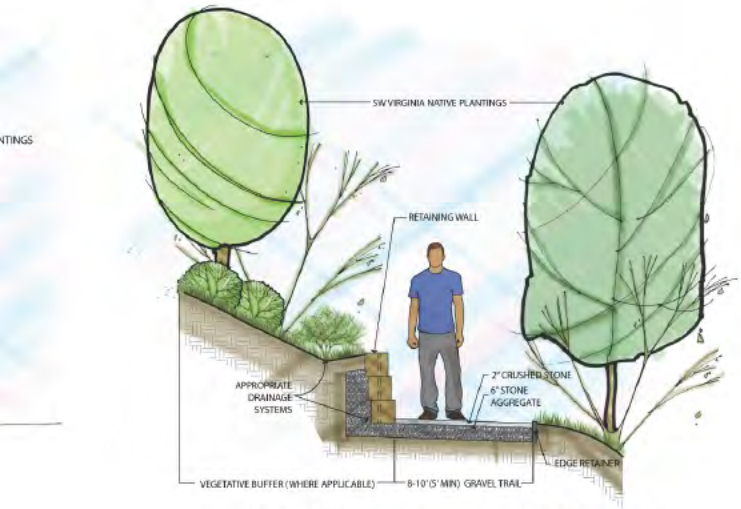
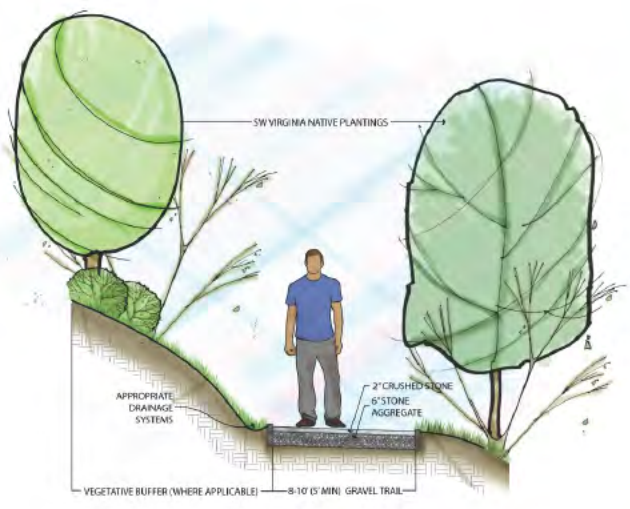
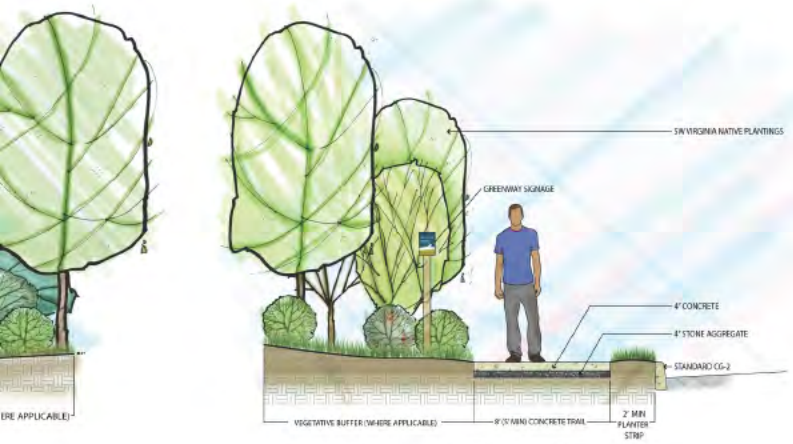


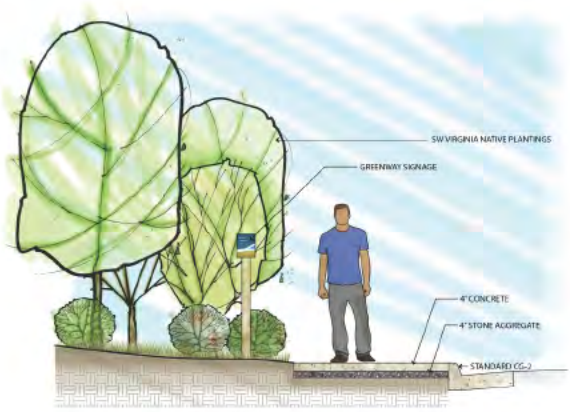
FRONT COUNTRY TRAIL WITH RETAINING WALL



FRONT COUNTRY TRAIL



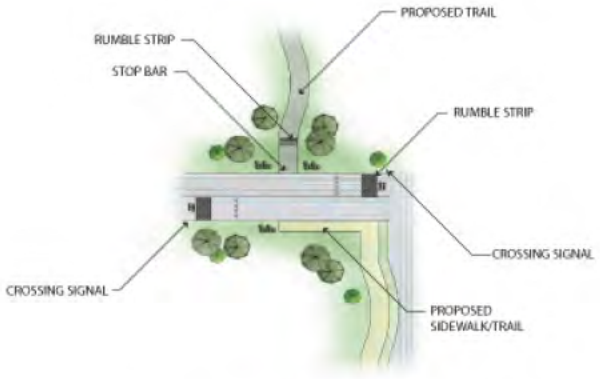
SMALL SEPERATED SIDEWALK/TRAIL



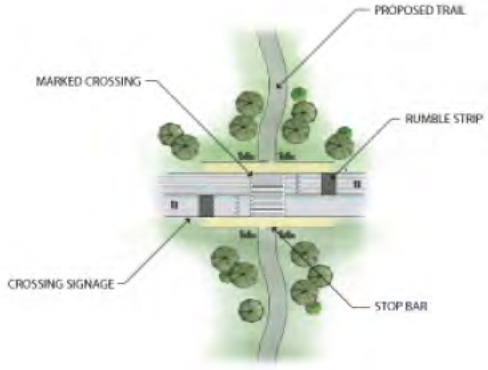
8-10' (5' MIN) CONCRETE SIDEWALK

TYPICAL SIDEWALK/TRAIL

OPOSED CROSSWALK
AN REFUGE ISLAND
NEW SIDEWALK/TRAIL)



COLONIAL AVE. AND BRAMBLETON AVE.
PROPOSED UNMARKED CROSSING



TYPICAL NEIGHBORHOOD CROSSINGS

TRAIL ACTION PLAN CONT.

Conservation Guidelines: Riparian Buffers and Water Quality

The Roanoke Zoning Ordinance has a River and Creek Corridors Overlay District (Section 36.2-335). It states that any development within 50 feet landward of the creek must meet certain standards. The regulations call for the 50 foot buffer to have "vegetation that is effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff." The current vegetation shall be retained and where it does not exist, applicable vegetation "shall be established and maintained upon any land disturbing activity." The Overlay Zone is shown on the Stream Assessment Maps (pages 40 & 41).

The following is allowed within the 50 foot buffer requirement: "public passive recreation uses such as greenways and pervious trails, provided that to the extent possible, such pathways use existing and proposed utility alignments or previously cleared areas and minimize tree cutting to the maximum extent practicable."

Section 36.2-333 of the Roanoke Zoning Ordinance establishes a Floodplain Overlay District. Certain public and private recreation uses are permitted in the floodway "provided they do not employ structures, fill, or storage of materials and equipment within the floodway which may cause any increase in 100-year flood height and velocity."

Stream Health

The Virginia Department of Environmental Quality considers Murray Run to be Impaired (Category 5) for recreation purposes from its headwaters to its mouth at the Roanoke River due to Fecal Coliform. The VA Cooperative Extensions Service defines "recreational purposes" as swimming and boating. The possible sources are listed as wildlife other than waterfowl, urbanization, sanitary sewer overflows and nonpoint source wet weather discharges. "Impaired water" means water that is not meeting one or more state water quality standards as required by the Clean Water Act.

A stream bank assessment looking at erosion and the width of the riparian buffer was done of Murray Run as it passes through Fishburn and Lakewood Parks. The results are found on the Stream Assessment Maps on pages 40 & 41. Photos on the maps show the actual condition at selected spots. The vegetation in the buffer intercepts pollutants in surface runoff, provides food and cover for wildlife, lowers water temperatures by shading the stream, and increases the resistance to erosion.

Sections of the stream bank at Fishburn Park are eroded as shown on the map. The northern tip of the stream (as it leaves Fishburn Park) is protected by riprap. Flooding is not uncommon in the park and has given rise to erosion. As the photos show, the bottoms of some large trees hang over the side of the creek. In the top photo on the left, erosion of the stream bank has resulted in a young tree "slipping" over the edge and growing sideways. The erosion is at its worst at a curve in the creek below the crossing of the existing greenway.

TRAIL ACTION PLAN CONT.

On the eastern side of the creek the land remains in its natural wooded condition (with the exception of a earthen trail), providing a wide buffer. The wooded buffer is found on both sides of the stream near the southern boundary of the park. North of that section, there is only a three to ten foot wide riparian buffer area of trees and shrubs along the west side of the stream. Large expanses of grass and occasional trees fill the remaining 42 to 45 foot width of what should be expanded to a 50 foot buffer. Trees and shrub vegetation are needed, in addition to native grasses, to create an effective riparian buffer that would protect the creek from erosion and water pollutants.

Similar erosion exists along Murray Run's banks as the stream flows through Lakewood Park. In the center of the park, the stream has been channelized. A pond is found just south of that part of the creek. Aside from this center third of the park, there is a wide wooded buffer on the southern side of the stream. On the northern side of the stream, there is a two to ten foot wide buffer along the stream on the western and eastern ends of the park. Only grass and a few trees are found north of that small buffer area. A 50 foot wide buffer is needed along the length of the stream for riparian health. Riprap has been placed on the stream bank as the stream exits the park and crosses under Brambleton Avenue. Currently, the Virginia Tech School of Landscape Architecture and the School of Engineering are developing a master plan for Lakewood Park which includes a bio-engineering component. The bio-engineering component specifically addresses the remediation of Murray Run and the artifical pond within the park boundary.

The Virginia Department of Forestry's Riparian Forest Handbook 1 lists these three categories of action that may be taken to restore a riparian forest:

1. Exclusion: Limiting activity near the stream, using fencing or other methods
2. Planting: Establishing trees and shrubs in the riparian zone
3. Channel Modification: Using knowledge of hydraulic geometry and bio-engineering techniques to change the shape of the channel, restoring its natural meander, width and depth

For the amount of stream bank erosion seen in Fishburn and Lakewood Parks, the second option - planting a buffer zone - would be most applicable. The Virginia Department of Forestry administers the Virginia Water Quality Fund grants on a revolving basis. One of the purposes of the grants is to restore and improve the quality of state waters. The typical riparian buffer grant is $5,000 to $10,000. Trees up to 1.5 inch caliper are reimbursed at $75.00 each and seedlings are reimbursed at $8.00 each. The agency requires a minimum of a 35 foot wide buffer which is usually 3 rows of trees. The seedlings are generally planted at the spacing of 10 -15 foot centers or 190 to 435 per acre. The grant will pay for a maximum of 435 seedlings per acre.

Appendix II shows the Model Three-Zone Riparian Forest Buffer from the 1998 *Commonwealth of Virginia Riparian Buffer Implementation Plan.* Zone One is closest to the water and can vary from 15 to 25 feet. Tree removal is generally not permitted there. Zone Two is immediately landward of Zone One and is typically 50 to 75 feet wide. Periodic harvesting is often

TRAIL ACTION PLAN CONT.

necessary in this zone. Zone Three is immediately landward of Zone Two and varies from 20 to 25 feet. Controlled grazing or haying can be permitted there. The Natural Resources Conservation Service standards for riparian buffers are found in Appendix III. It calls for a 35 foot riparian buffer. The Virginia Department of Conservation and Recreation's *Virginia Stream Restoration and Stabilization Best Management Practices Guide* outlines practices for stream bank restoration other than riparian buffers. It contains detailed information on the best management practices listed in Appendix I.

Urban Tree Canopy

The Urban Tree Canopy Map (please refer to page 42) shows the proposed greenway alignments in relation to land cover. Starting at the Ogden Road end of Alignment A, the proposed route runs across non-building impervious land (pavement) and non-tree vegetation (yards) until it moves onto Jefferson Hill Golf Course property. There, it passes through a significant area of tree canopy until it crosses Colonial Avenue and enters a suburban neighborhood with non-building impervious land and non-tree vegetation. After it exits the neighborhood, it moves across a large stretch of Fishburn Park and Virginia Western Community College properties with tree canopy. It touches an area of non-tree vegetation as it moves toward the existing section of greenway behind James Madison Middle School.

Alignment B takes a different course after it crosses Colonial Avenue. It passes along three streets (non-building impervious land and non-tree vegetation). There it enters a part of the Virginia Western Community College covered with non-tree vegetation until it rejoins Alignment A.

Alignment A picks up again at its union with the existing greenway south of the track at Patrick Henry High School. It then moves east to Blenheim Road where it travels over non-building impervious land and non-tree vegetation until it turns east and north through a similar section of the neighborhood. This is where Alignments B and C differ from Alignment A by moving along streets to the north. From Blenheim Road to the entrance to Lakewood Park, all alignments pass through similar conditions of non-building impervious land and non-tree vegetation.

The alignment passes over non-tree vegetation in the western section of Lakewood Park. Alignment A heads south and runs through an area of tree canopy while Alignment B continues over the non-tree vegetation. Crossing Brambleton Avenue, Alignment A makes its way east through an area of tree canopy and turns north on a private street near 23rd Street, where it hits non-tree vegetation and non-building impervious land. The alignment crosses Brandon Avenue, jogs around Little Caesars Pizza and travels north through tree canopy to the Roanoke River.

Between Brambleton Avenue and 23rd Street, Alignment B crosses through tree canopy north of Alignment A; Alignment C parallels Brandon Avenue, running first through tree canopy, then non-tree vegetation and non-building impervious land.

TRAIL ACTION PLAN CONT.

The Murray Run Study Area is 1.7 square miles (1103 acres). The following table is based on the 2009 *Report on the City of Roanoke's Existing and Possible Urban Tree Canopy* that used 2008 NAIP imagery to categorize land cover. Tree canopy covers 62.9% of the study area (693.1 acres), with non-tree vegetation being the next largest land cover type at 17.9% or 197 acres.

Land Cover - Murray Run Study Area		
Type of Land Cover	**Acres**	**% of Total Area**
Water	0.6	0.1
Non-building Impervious	152.1	13.8
Non-tree vegetation	197.0	17.9
Tree Canopy	693.1	62.9
Building Impervious	59.8	5.4

An analysis of the data was done using CITYgreen software from American Forests. This software is good at highlighting the dollar value of trees. The analysis found that the study area's tree canopy removes 67,475 pounds of pollutants from the air each year, for a dollar value of $162,930. The trees store 29,882.98 tons of carbon, with 232.65 tons sequestered annually. If the trees were removed, it would cost $11,696,297 to build stormwater facilities to manage the increase in runoff. As for water quality, Chromium levels would increase 176.01% without the trees. The Chemical Oxygen Demand would increase 191.98% and the Biological Oxygen Demand would increase 101.64%. The CITYgreen analysis found in Appendix IV provides more information.

For the aforementioned benefits that the vegetation within the Murray Run corridor provides it is recommended that a 50' protection and management zone be established from the centerline of the trail. The management and protection zone will aim to achieve the following goals:

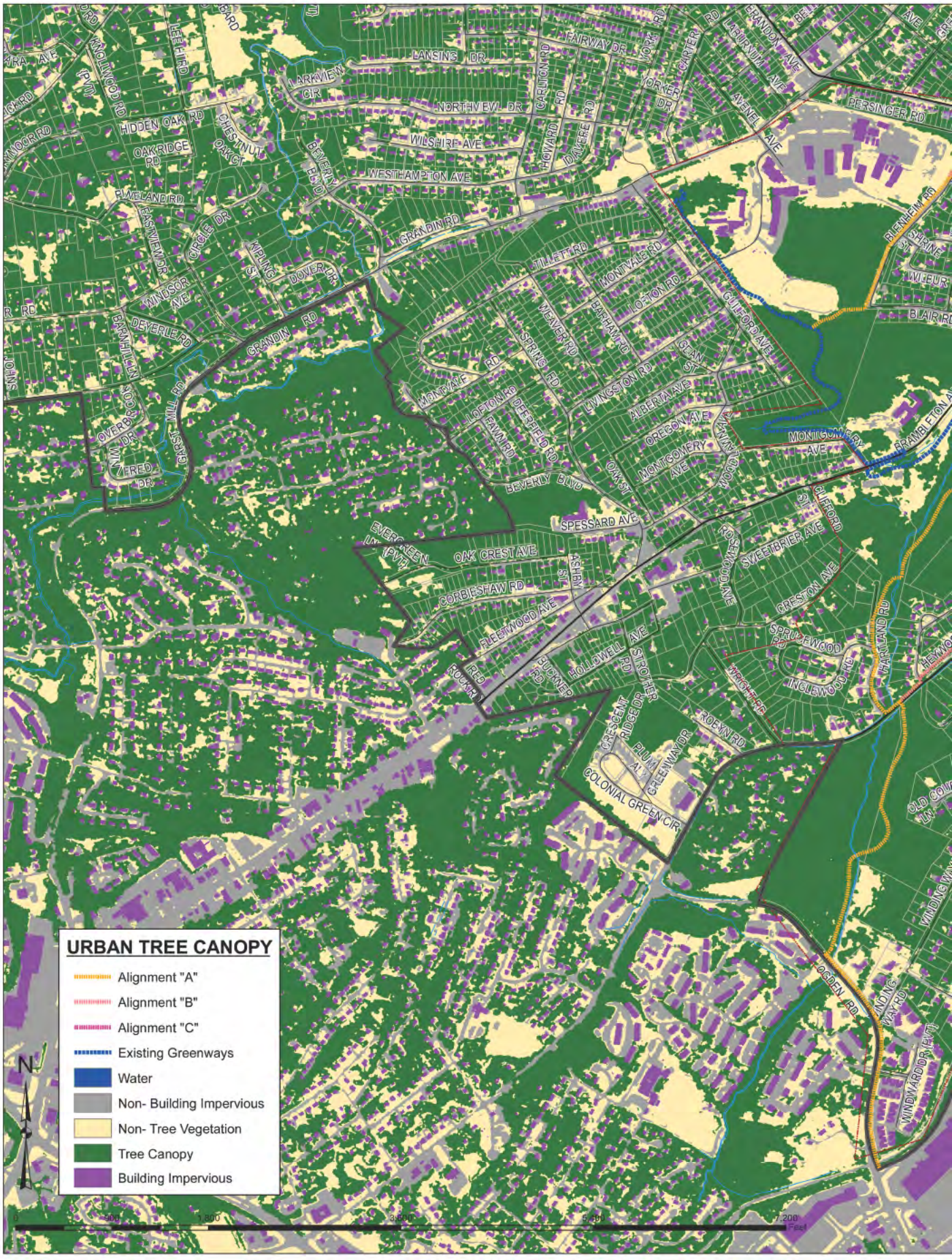
1. Preserve the Murray Run corridor and promote the natural beauty and environmental quality of the area.
2. Enhance the Murray Run corridor by encouraging high quality, sustainable design.
3. Promote water quality protection, bank stability, erosion control, preservation of ecological habitat and a tree root protection zone.
4. Ensure that buildings fit within the context in which they are built.
5. Promote high quality development that is consistent with the City's comprehensive plan.
6. Facilitate transitions from commercial corridors and adjacent neighborhoods to the environmental corridor.


SHRINE HILL PARK
WOODLAND PARK
FISHBURN PARK
GEAN ST
ALBERTA AVE
OREGON AVE
MONTGOMERY AVE
MONTGOMERY AVE
LAWNWOOD
CLIFFORD ST
SWEETBRIER AVE
ROSEMOOD AVE
CRESTON AV
SPRUCE RD
Stream Corridor Assessment
Open Space
Forest
River/Creek Overlay District
Eroded Stream Bank
Existing Greenway
Park Property
N
0
265
530
1,060
Feet


BLAIR RD
ROSS
SEWELL
RAMBLETON AVE
MCNEIL DR
EY AVE
ANNISTER
ST
HERITAG


MT
WEST DR
Stream Corridor Assessment
Open Space
Forest
River/Creek Overlay District
Eroded Stream Bank
Existing Greenway
Park Property
N
0
140
280
840
1,120
Feet


RD
RD
LAKEWOOD PARK
LAKEWOOD DR
RAMBLETON AVE


URBAN TREE CANOPY
Alignment "A"
Alignment "B"
Alignment "C"
Existing Greenways
Water
Non- Building Impervious
Non- Tree Vegetation
Tree Canopy
Building Impervious
N
0
1,800
3,600
5,400
7,200
Feet
LANSING DR
FAIRWAY DR
LARKVIEW CIR
NORTHVIEW DR
WILSHIRE AVE
WESTHAMPTON AVE
GRANDIN RD
HIDDEN OAK RD
OAKRIDGE RD
OAK CT
CHESTNUT
BEVERLY BLVD
FLAMELAND RD
EASTVIEW DR
CIRCLE DR
KIPLING ST
DOVER DR
WINDSOR AVE
DEVERLE RD
BARNHILL RD
KNOLLWOOD RD
OVERBROOK DR
MILL RD
TILLETT RD
MONTVALE RD
LOFTON RD
BARNHAM RD
WEAVER RD
SPRING RD
MONTAVE RD
DEERFIELD RD
FAWN RD
LIVINGSTON RD
GLAN ST
ALBERTA AVE
OREGON AVE
MONTGOMERY AVE
OAK ST
GUILFORD AVE
BLENHEIM RD
BLAIR RD
SPESSARD AVE
OAK CREST AVE
CORBIESHAW RD
FLEETWOOD AVE
ASHBY ST
ROSEMOOR AVE
SWEETBRIER AVE
CRESTON AVE
SPRUCEWOOD RD
HARKLAND RD
INGLEWOOD RD
WRIGHT RD
HOLLOWELL AVE
STROTHER RD
BUCKNER RD
ROCKY RD
ROBYN RD
CRESCENT RIDGE DR
PLUM GREENWAY DR
COLONIAL GREEN CIR
OGDEN RD
WINDING WAY RD
WINDYARDDRIVE CT


SHERWOOD AVE
TERRACE RD
WAKEFIELD RD
SHEFFIELD RD
CANTERBURY RD
BRIGHTON RD
WESTON AVE
GRACE ST
LAWNHILL ST
SUBURBAN AVE
DUPONT CIR
BRANDON DRWY
BRANDON AVE
KING GEORGE AVE
JANETTE AVE
CLIFF AVE
CENTER HILL CR
LAKEWOOD DR
WEST DR
EAST DR
HIDDENVIEW RD
DOGWOOD LN
ROSS LN
SEWELL LN
PERSINGER RD
BRAMBLETON AVE
OAKWOOD DR
CARRINGTON AVE
BLUEFIELD BLVD
THORNDALE ST
WINTHROP AVE
23RD ST
COLONIAL AVE
SANFORD AVE
22ND ST
WINSTON AVE
EDINBURGH ST
MARTIN LN
WELCH RD
CLEARFIELD RD
OVERLAND RD
BROADWAY AVE
MCNEIL DR
STEPHENSON AVE
BEECHWOOD DR
GARDENS RD
ROBERTS RD
FRANKLIN RD
WOODS END LN
WILDWOOD RD
ORCHARD RD
HAYWOOD RD
WHITE OAK RD
BRIGHTWOOD PL
AVENHAM AVE
ALLENDALE ST
SOMERSET ST
CLYDESDALE ST
CASSELL LN
AUDUBON RD
OAK LN
HEMLOCK LN
POPLAR DR
LONGVIEW AVE
WYCLIFFE AVE
CAROLINA AVE
ROSALIND AVE
CRYSTAL SPRING AVE
SERPENTINE RD
CARDINAL RD
BANCROFT DR
PARK CREST RD
LOCKRIDGE RD
RIDGE RD
WEST RIDGE CIR (PVT)
FORDHAM RD
BURLEIGH RD
STONERIDGE RD
WEST RIDGE RD
PEAKWOOD DR
EXETER ST
WOODLAND HILLS LN
WINTERBERRY LN
DILLARD RD
HERITAGE RD
HERITAGE CIR
FOREST RD
DOGWOOD LN
PARK LN
SOUTHWAY DR
STERLING RD
PARLIAMENT RD
WHITE ST
TOWNSIDE RD
GLOUCESTER ST
SOUTHMONT DR (PVT)
DARWIN RD
ALTON RD
COVENTRY LN
HEATHERTON RD
THREE CHOP LN
PENARTH RD
CANTERBURY LN
BRAMBLE LN
BOSWORTH DR
MILL MOUNTAIN

APPENDICIES

Appendix I: Best Management Practices

Appendix II: Model Three-Zone Riparian Buffer

Appendix III: NRCS Riparian Buffer Standards

Appendix IV: CityGreen Report

Appendix V: Virginia Native Riparian Plantings

Appendix VI: Destinations

Appendix VII: Bike Plan for MPO

BEST MANAGEMENT PRACTICES

The following Best Management Practices are from the Virginia Stream Restoration and Stabilization Best Management Practices Guide by the Virginia Department of Conservation and Recreation.

1. Bank Protection Guidelines
   - Cedar Tree Revetments
   - Rootwad Revetments
   - Stacked Stone
   - Boulder Revetments
   - Rock Toe Revetments
   - Live Crib Wall
   - Interlocking Concrete Jacks
2. Bank Stabilization Guidelines
   - Natural Fiber Rolls
   - Live Soil Lifts
   - Natural Fiber Matting
   - Live Fascines
   - Brush Mattresses
   - Live Stakes
   - Branch Layering
3. Grade Control Structures Guidelines
   - Rock Cross Vanes
   - Rock W-Weirs
   - Rock Vortex Weirs
   - Step Pools
   - Log Drops and V Log Drops
4. Flow Deflection/Concentration Guidelines
   - Rock Vanes
   - J-Hook Vanes
   - Wing Deflectors
   - Log Vanes
   - Cut-Off Sills
5. Temporary Flow Diversion Guidelines
   - Pump Around Diversion
   - Sandbag/Stone Diversion
   - Diversion Pipes
   - Portable Dams/Barriers
   - Temporary Flow Diversion

MODEL THREE-ZONE RIPARIAN BUFFER

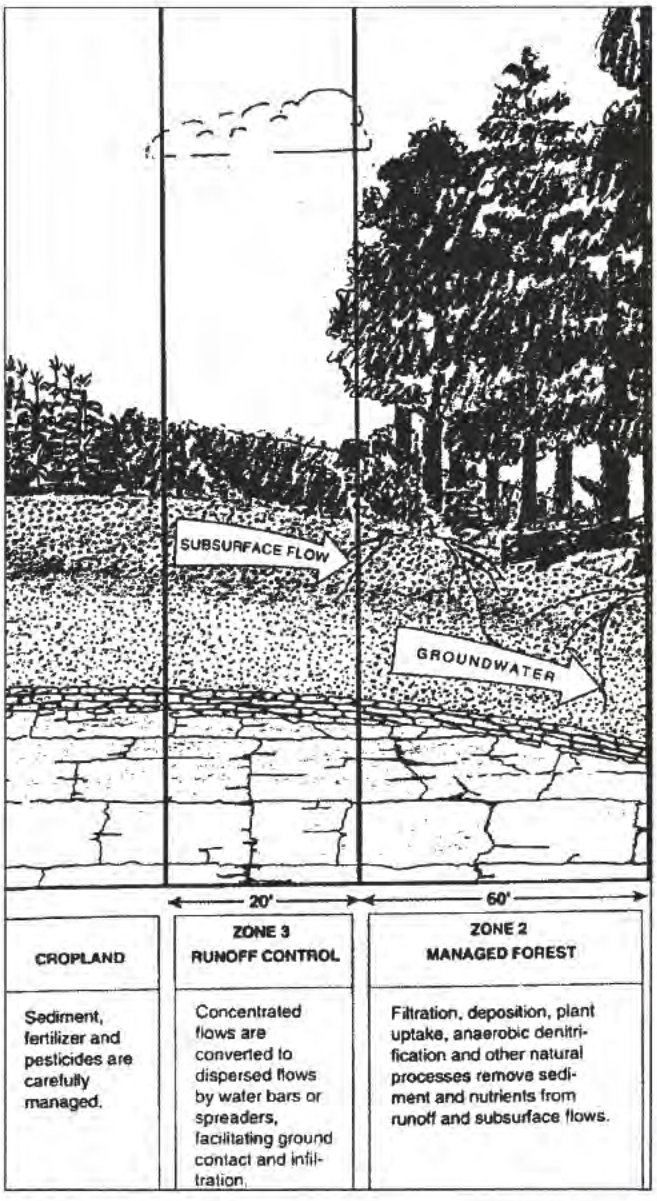
WHAT IS A MODEL THREE-ZONE RIPARIAN FOREST BUFFER?

A three-zone buffer system is a model to help plan riparian forest buffers. This highly flexible system is designed to achieve better water quality and other landowner objectives. A three-zone riparian forest buffer may not be necessary or even achievable in every setting, but the model is included in this plan as an example of the best case riparian buffer. The three zones are described below and depicted in the accompanying graphic.

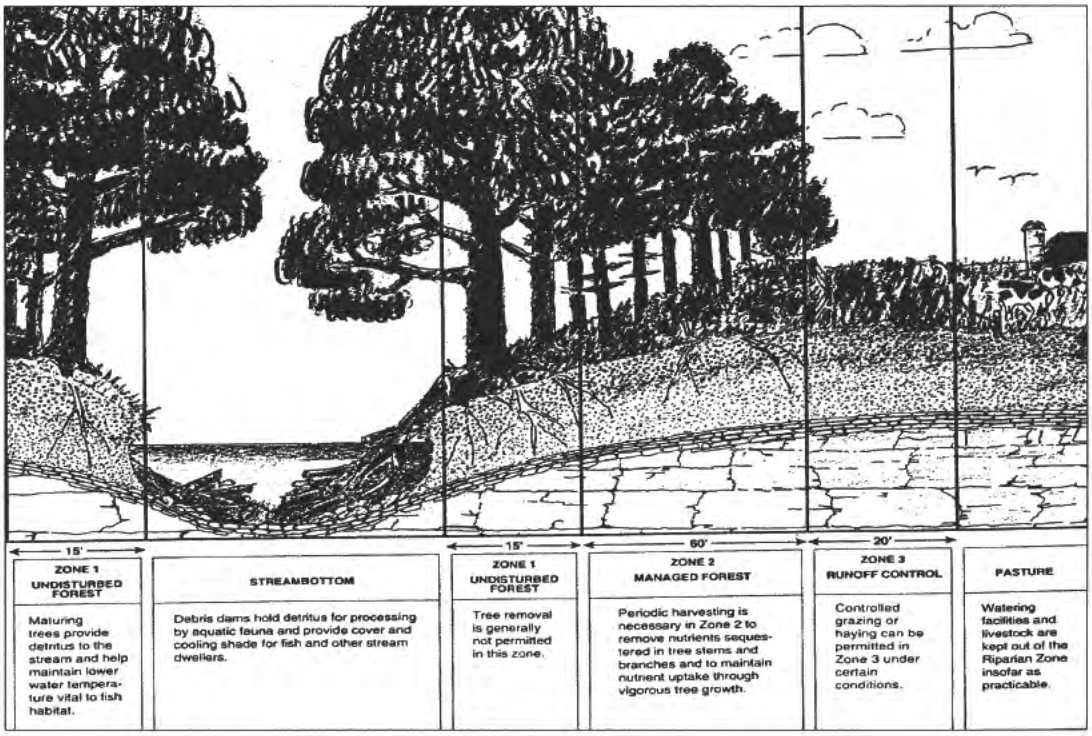
Zone 1- This zone, the inner core of the buffer closest to the water, extends upland from the stream's edge, stabilizing the streambank and providing habitat for aquatic organisms. Here, the tree roots reduce soil erosion by flowing water, and keep sediment and any nutrients bound to it out of the stream. This zone will improve habitat along all streams, with its greatest impact being along smaller streams where the canopy shades the water, providing maximum control over light and temperature. The width of Zone 1 can vary from 15 - 25 feet.

Zone 2- Located immediately landward of Zone 1, this zone protects water quality by removing, transforming, or storing nutrients, sediments and other pollutants. Also, Zone 2 provides food and shelter for hundreds of wildlife species. The width of this zone is typically 50-75 feet. However, it can vary depending on stream order, topography and soil type

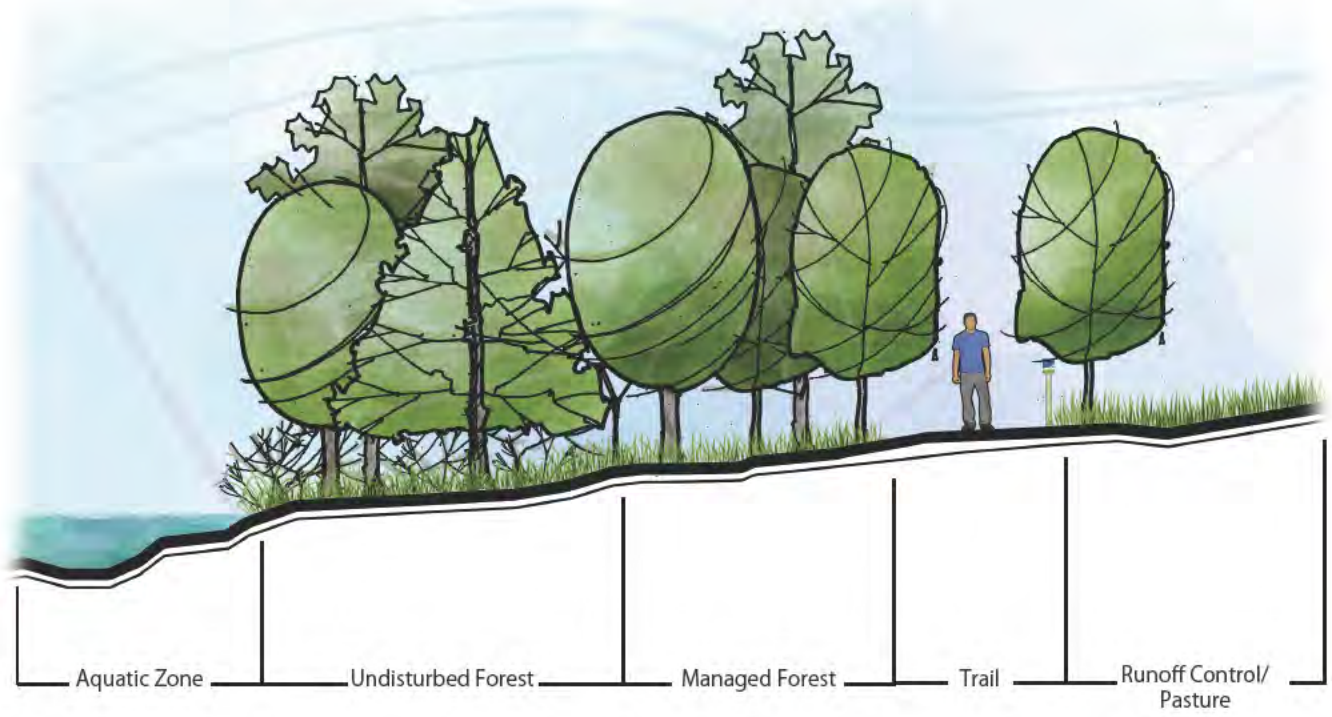
Zone 3- Immediately landward of Zone 2, this zone contains grass filter strips or other control measures to slow runoff, filter sediment and related chemicals, and allow water to infiltrate the ground. Grass filter strips help protect the wooded areas and set the stage so the riparian forest buffer can perform at its peak. Zone 3 spreads out the water flow and prevents adjacent land use runoff from eroding channels through the buffer. This enables Zone 2 to effectively trap sediment because the runoff is in the form of sheet flow. The width of this zone generally varies from 20-25 feet.



MODEL THREE-ZONE RIPARIAN BUFFER



15'	15'	60'	20'	
ZONE 1 UNDISTURBED FOREST	STREAMBOTTOM	ZONE 1 UNDISTURBED FOREST	ZONE 2 MANAGED FOREST	ZONE 3 RUNOFF CONTROL	PASTURE
Maturing trees provide detritus to the stream and help maintain lower water temperature vital to fish habitat.	Debris dams hold detritus for processing by aquatic fauna and provide cover and cooling shade for fish and other stream dwellers.	Tree removal is generally not permitted in this zone.	Periodic harvesting is necessary in Zone 2 to remove nutrients sequestered in tree stems and branches and to maintain nutrient uptake through vigorous tree growth.	Controlled grazing or haying can be permitted in Zone 3 under certain conditions.	Watering facilities and livestock are kept out of the Riparian Zone insofar as practicable.



NRCS RIPARIAN BUFFER STANDARDS

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

RIPARIAN FOREST BUFFER

(Ac.)

CODE 391

DEFINITION

An area predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

PURPOSE

- Create shade to lower or maintain water temperatures to improve habitat for aquatic organisms.
- Create or improve riparian habitat and provide a source of detritus and large woody debris.
- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Reduce pesticide drift entering the water body.
- Restore riparian plant communities.
- Increase carbon storage in plant biomass and soils.

CONDITIONS WHERE PRACTICE APPLIES

Riparian forest buffers are applied on areas adjacent to permanent or intermittent streams, lakes, ponds, and wetlands. They are not applied to stabilize stream banks or shorelines.

CRITERIA

General Criteria Applicable to All Purposes

The riparian forest buffer shall be positioned appropriately and designed to achieve sufficient width, length, vertical structure/density and connectivity to accomplish the intended purpose(s).

Dominant vegetation will consist of existing, naturally regenerated, or seeded/planted trees and shrubs suited to the soil and hydrology of the site and the intended purpose(s).

The vegetation will extend a minimum width to achieve the purpose(s). Measurement shall begin at and perpendicular to the normal water line, bank-full elevation, or the top of the bank as determined locally.

Overland flow through the riparian area will be maintained as sheet flow.

For sites to be regenerated or planted, excessive sheet-rill and concentrated-flow erosion will be controlled.

Excessive sheet-rill and concentrated-flow erosion will be controlled in the areas immediately adjacent and up-gradient of the buffer site.

Use tree and shrub species that are native and non-invasive. Substitution with improved and locally accepted cultivars or purpose-specific species is allowed. For plantings and seeding, only viable, high-quality and adapted plant materials will be used.

Favor tree and shrub species that have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides.

Periodic removal of some forest products such as high value trees, medicinal herbs, nuts, and fruits is permitted provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the electronic Field Office Technical Guide.

NRCS, NHCP

January 2006

NRCS RIPARIAN BUFFER STANDARDS

Necessary site preparation and planting shall be done at a time and manner to insure survival and growth of selected species for achieving the intended purpose(s).

Livestock shall be controlled or excluded as necessary to achieve the intended purpose. Refer to the standards Prescribed Grazing, 528, and/or Use Exclusion, 472, as applicable.

Harmful plant and animal pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose. If pesticides are used, refer to the standard Pest Management, 595.

Additional Criteria to Reduce Excess Amounts of Sediment, Organic Material, Nutrients and Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow

The minimum width shall be at least 35 feet measured horizontally on a line perpendicular to the water body beginning at the normal water line, bank-full elevation, or the top of the bank as determined locally.

The width will be extended in high nutrient, sediment, and animal waste application areas, where the contributing area is not adequately treated or where an additional level of protection is needed.

Existing, functional underground drains through the riparian area will pass pollutants directly to the outlet. To filter such pollutants, drains can be plugged, removed or replaced with perforated pipe/end plugs to allow passage and filtration of drain water through the riparian forest root zone. Caution is advised that saturated conditions in the riparian and adjacent areas may limit existing land use and management.

Additional Criteria to Create or improve riparian habitat and provide a source of detritus and large woody debris.

The width will be extended to meet the minimum habitat requirements of the wildlife or aquatic species of concern.

Existing functional underground drains shall be replaced with non-perforated pipe under the buffer area to alleviate root intrusion and to sustain the drains functionality. Alternatively, a regulating valve or structure may be installed on the drain to control drain outflow.

Establish plant communities that address the target aquatic and terrestrial wildlife needs and have multiple values such as habitat, nutrient uptake and shading.

Additional Criteria for Increasing Carbon Storage in Biomass and Soils

Maximize width and length of the riparian forest buffer.

Select plants that have higher rates of carbon sequestration in soils and plant biomass and are adapted to the site to assure strong health and vigor. Plant the appropriate stocking rate for the site.

CONSIDERATIONS

Tree and shrub species, which may be alternate hosts to undesirable pests, should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

Allelopathic impacts of plants should be considered.

The location, layout and density of the buffer should complement natural features, and mimic natural riparian forests.

For sites where continued function of drains is desired, woody root penetration may eventually plug the underground structure. In these cases, a setback of woody vegetation planted over the drain maintained in herbaceous cover or using rigid, non-perforated pipe will minimize woody root penetration.

Maximize widths, lengths, and connectivity of riparian forest buffers.

The species and plant communities that attain biomass more quickly will sequester carbon faster. The rate of carbon sequestration is enhanced as riparian plants mature and soil organic matter increases.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets,

NRCS, NHCP

January 2006

NRCS RIPARIAN BUFFER STANDARDS

technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The riparian forest buffer will be inspected periodically and protected from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, concentrated flows, pesticides, livestock or wildlife damage and fire.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

Any manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation shall sustain the intended purpose(s). Refer to the standard Forest Stand Improvement, 666.

Control or exclusion of livestock and harmful wildlife shall continue. Refer to the standards Prescribed Grazing, 528, and/or Use Exclusion, 472, as applicable.

Fertilizers, pesticides and other chemicals used to maintain buffer function shall not impact water quality.

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January 2006

CITY GREEN REPORT

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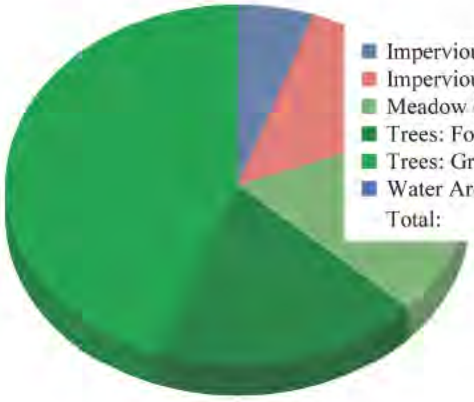
Analysis Report
for
Murray Run Study Area

CITYgreen

Land cover areas are in acres.



Impervious Surfaces: Buildings/ structures	59.6	5.4%
Impervious Surfaces: Paved: Drain to sewer	152.1	13.8%
Meadow (Continuous grass, generally mowed, not grazed)	195.8	17.8%
Trees: Forest litter understory	203.6	18.5%
Trees: Grass/turf understory	490.8	44.5%
Water Area	0.6	0.1%
Total:	1,102.5	100.0%

Total Tree Canopy: 694.4 acres (63.0%)

Air Pollution Removal

By absorbing and filtering out nitrogen dioxide (NO2), sulfur dioxide (SO2), ozone (O3), carbon monoxide (CO), and particulate matter less than 10 microns (PM10) in their leaves, urban trees perform a vital air cleaning service that directly affects the well-being of urban dwellers. CITYgreen estimates the annual air pollution removal rate of trees within a defined study area for the pollutants listed below. To calculate the dollar value of these pollutants, economists use "externality" costs, or indirect costs borne by society such as rising health care expenditures and reduced tourism revenue. The actual externality costs used in CITYgreen of each air pollutant is set by the each state, Public Services Commission.

Nearest Air Quality Reference City: **Roanoke**

	Lbs. Removed/yr	Dollar Value
Carbon Monoxide:	1,238	$528
Ozone:	28,476	$87,483
Nitrogen Dioxide:	6,190	$19,018
Particulate Matter:	24,761	$50,790
Sulfur Dioxide:	6,809	$5,110
Totals:	**67,475**	**$162,930**

Carbon Storage and Sequestration

Trees remove carbon dioxide from the air through their leaves and store carbon in their biomass. Approximately half of a tree's dry weight, in fact, is carbon. For this reason, large-scale tree planting projects are recognized as a legitimate tool in many national carbon-reduction programs. CITYgreen estimates the carbon storage capacity and carbon sequestration rates of trees within a defined study area.

Total Tons Stored: 29,882.98

Total Tons Sequestered (Annually): 232.65

CITY GREEN REPORT

AMERICAN FORESTS
americanforests.org

CITYgreen
calculating the value of nature

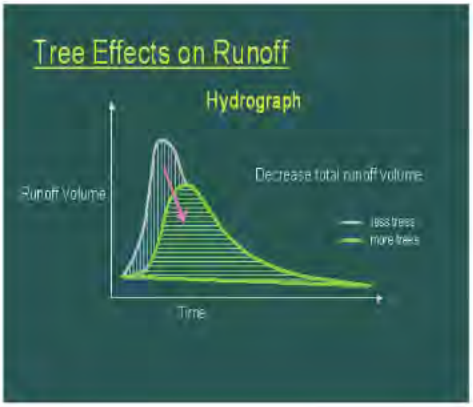
Analysis Report
for
Murray Run Study Area

Stormwater

Trees decrease total stormwater volume helping cities to manage their stormwater and decrease detention costs. CITYgreen assesses how land cover, soil type, and precipitation affect stormwater runoff volume. It calculates the volume of runoff in a 2-year 24-hour storm event that would need to be contained by stormwater facilities if the trees were removed. This volume multiplied by local construction costs calculate the dollars saved by the tree canopy. CITYgreen uses the TR-55 model developed by the Natural Resource Conservation Service (NRCS) which is very effective in evaluating the effects of land cover/land use changes and conservation practices on stormwater runoff. The TR-55 calculations are based on curve number which is an index developed by the NRCS, to represent the potential for storm water runoff within a drainage area. Curve numbers range from 30 to 100. The higher the curve number the more runoff will occur. CITYgreen determines a curve number for the existing landcover conditions and generates a curve number for the conditions if the trees are removed and replaced with the user-defined replacement landcover specified in the CITYgreen Preferences. The change in curve number reflects the increase in the volume of stormwater runoff.

Water Quantity (Runoff)

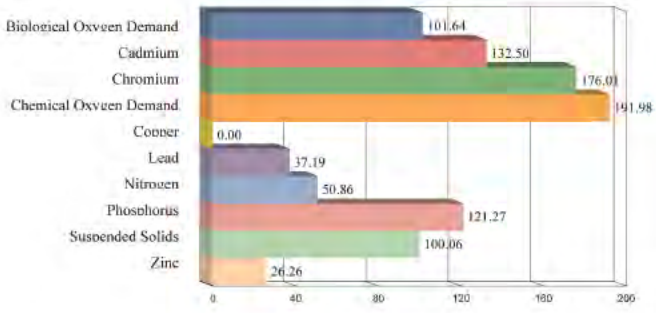
2-yr, 24-hr Rainfall:	3.75 in.
Curve Number reflecting existing conditions:	74
Curve Number using default replacement landcover:	92
Additional stormwater storage volume needed:	5,848,149 cu. ft.
Construction cost per cu. ft.:	$2.00
Total Stormwater Savings:	**$11,696,297**
Annual costs based on payments over 20 years at 6% Interest:	**$1,019,736 per year**



Water Quality (Contaminant Loading)

Cities must comply with Federal clean water regulations and develop plans to improve the quality of their streams and rivers. Trees filter surface water and prevent erosion, both of which maintain or improve water quality. Using values from the US Environmental Protection Agency (EPA) and Purdue University's L-thia spreadsheet water quality model, American Forests developed the CITYgreen water quality model. This model estimates the change in the concentration of the pollutants in runoff during a typical storm event given the change in the land cover. This model estimates the Event Mean Concentrations of Nitrogen, Phosphorus, Suspended Solids, Zinc, Lead, Copper, Cadmium, Chromium, Chemical Oxygen Demand(COD), and Biological Oxygen Demand (BOD). Pollutant values are shown as a percentage of change.

Percent Change in Contaminant Loadings



NATIVE RIPARIAN PLANTINGS

Native Plants: Riparian Plants

Recommended Uses	Native Regions	Minimum Light Requirements	Riparian Vegetation Zones
W = Wildlife	M = Mountains	S = Full Shade	1 = Emergent
H = Horticulture and Landscaping	P = Piedmont	P = Partial Sun	2 = Riverside Thicket
C = Conservation and Restoration	C = Coastal Plain	F = Full Sun	3 = Saturated Thicket
D = Domestic Livestock Forage			4 = Well-drained Forest

Native Riparian Plants

Scientific Name	Common Name	Uses				Region			Light			Zone			
		W	H	C	D	M	P	C	S	P	F	1	2	3	4
Herbaceous plants															
Acorus americanus (A. calamus)	sweet flag		x	x		x	x	x		x	x	x			
Amsonia tabernaemontana	blue star		x				x	x	x	x				x	x
Arisaema triphyllum	Jack-in-the-pulpit		x			x	x	x	x					x	x
Asarum canadense+	wild ginger		x	x		x	x	x	x						x
Asclepias incarnata	swamp milkweed	x	x	x		x	x	x		x	x	x	x		
Aster novae-angliae	New England aster		x	x		x				x	x			x	
Aster novi-belgii	New York aster	x	x	x				x		x	x	x	x		
Aster umbellatus	flat-top white aster		x	x		x	x			x	x			x	
Bidens cernua+	nodding beggar-ticks	x	x	x		x	x	x		x	x	x	x		
*Boltonia asteroides**	aster-like boltonia		x					x			x	x	x	x	
Caltha palustris	marsh marigold		x	x		x		x		x	x			x	
Chamaecrista fasciculata+	partridge pea			x		x	x	x			x				x
Chelone glabra	white turtlehead		x	x		x	x	x	x	x			x	x	
Chrysogonum virginianum	green and gold		x	x		x	x	x	x						x
Coreopsis tripteris	tall coreopsis		x	x		x	x	x		x	x		x	x	x
Delphinium tricorne	dwarf larkspur		x			x	x		x	x					x
Dicentra cucullaria	Dutchman's breeches		x			x	x		x						x
Equisetum hyemale	horsetail, scouring rush			x		x	x	x	x	x	x		x	x	x
Eupatorium coelestinum	mistflower	x	x	x		x	x	x	x	x	x			x	x

NATIVE RIPARIAN PLANTINGS

Eupatorium fistulosum	Joe Pye weed	x	x	x		x	x	x		x	x		x	x	x
Eupatorium perfoliatum	common boneset			x		x	x	x		x	x	x	x	x	
Helenium autumnale	sneezeweed	x	x	x		x	x	x		x	x	x	x	x	
Helianthus decapetalus	ten-petaled sunflower	x	x	x		x	x	x		x	x			x	x
Heliopsis helianthoides	oxeye sunflower	x	x	x		x	x	x		x	x			x	x
Hibiscus moscheutos	Eastern rosemallow	x	x	x		x	x	x			x	x	x		
Iris virginica	Virginia blue flag		x	x			x	x		x	x	x	x		
Kosteletskya virginica	seashore mallow	x		x				x			x	x	x		
Lilium superbum	Turk's cap lily		x			x	x	x		x	x			x	x
Lobelia cardinalis	cardinal flower	x	x	x		x	x	x		x	x	x	x	x	
Lobelia siphilitica	great blue lobelia	x	x	x		x	x	x	x	x				x	x
Maianthemum racemosa	false Solomon's seal		x	x		x	x	x	x	x				x	x
Mertensia virginica	Virginia bluebells		x	x		x	x		x	x				x	x
Mimulus ringens	monkeyflower		x	x		x	x	x			x	x	x	x	
Monarda didyma	bee balm	x	x	x		x			x	x				x	x
Nymphaea odorata	American water lily	x	x	x		x	x	x			x	x			
Oenothera fruticosa	sundrops	x	x	x		x	x	x			x	x	x	x	x
Peltandra virginica	arrow arum	x	x	x			x	x		x	x	x	x		
Phlox divaricata	woodland phlox		x	x		x	x			x				x	x
Phlox paniculata	summer phlox		x	x		x	x	x		x	x			x	x
Podophyllum peltatum+	mayapple	x	x	x		x	x	x		x	x				x
Polemonium reptans	Jacob's ladder		x			x	x	x	x	x					x
Pontederia cordata	pickerel weed	x	x	x			x	x			x	x			
Rhexia virginica	Virginia meadow-beauty	x		x		x	x	x			x			x	
Rudbeckia laciniata	cut-leaved coneflower	x	x	x		x	x	x		x	x		x	x	x
Sagittaria latifolia	broadleaf arrowhead	x	x	x		x	x	x			x	x	x		
Saururus cernuus	lizard's tail		x	x		x	x	x		x	x	x	x		
Senecio aureus+	golden ragwort	x		x		x	x	x	x	x			x	x	x
Solidago rugosa+	rough-stemmed goldenrod	x		x		x	x	x		x	x		x	x	x
Verbena hastata	blue vervain	x		x		x	x			x	x		x	x	
Vernonia noveboracensis	New York ironweed	x	x	x		x	x	x		x	x		x	x	x
Viola cucullata	marsh blue violet	x	x	x		x	x	x		x	x			x	
Viola pubescens	yellow violet	x	x	x		x	x		x	x					x
Zephranthes atamasco	Atamasco lily		x	x				x		x	x		x	x	x
Ferns and fern allies															

NATIVE RIPARIAN PLANTINGS

Athyrium asplenioides	Southern ladyfern		x	x		x	x	x	x					x	x
Botrychium virginianum	Rattlesnake fern		x			x	x	x	x	x					x
Onoclea sensibilis+	sensitive fern		x	x		x	x	x		x	x			x	x
Osmunda cinnamomea	cinnamon fern		x	x		x	x	x	x	x			x	x	
Osmunda regalis	royal fern		x	x		x	x	x		x				x	x
Polystichium acrostichoides	Christmas fern		x	x		x	x	x	x						x
Thelypteris palustris	marsh fern		x			x	x	x		x	x	x	x	x	
Woodwardia virginica+	Virginia chain fern		x	x				x	x	x	x	x	x		
Grasses, sedges, reeds															
Agrostis perennans	autumn bentgrass			x		x	x	x	x	x	x	x	x	x	x
Andropogon gerardii	big bluestem	x	x	x	x	x	x			x	x		x	x	
Andropogon glomeratus	bushy bluestem		x	x		x	x	x		x	x			x	
Arundinaria gigantea	wild cane, river cane	x		x		x			x	x	x		x	x	x
Carex crinita var. crinita	long hair sedge	x	x	x		x	x	x		x	x	x	x	x	
Carex lurida	sallow sedge	x		x		x	x	x		x	x	x	x	x	
Carex stricta	tussock sedge	x		x		x	x	x		x	x	x	x	x	
Chasmanthium latifolium	river oats, spanglegrass		x	x		x	x	x	x	x	x		x	x	x
Dichanthelium clandestinum	deer-tongue	x		x	x	x	x	x		x	x	x	x	x	x
Dichanthelium commutatum	variable panicgrass	x	x	x	x	x	x	x	x	x					x
Dulichium arundinaceum	dwarf bamboo	x		x	x	x	x	x		x	x	x	x	x	
Elymus hystrix (Hystrix patula)	bottlebrush grass	x	x			x	x	x	x	x	x				x
Elymus virginicus	Virginia wild rye	x		x		x	x	x	x	x			x	x	x
Juncus canadensis	Canada rush	x		x			x	x		x	x	x	x	x	
Juncus effusus	soft rush	x		x		x	x	x		x	x	x	x	x	
Leersia oryzoides	rice cutgrass	x		x		x	x	x		x	x	x	x	x	
Panicum virgatum	switch grass	x	x	x		x	x	x		x	x	x	x	x	
Saccharum giganteum	giant plumegrass	x	x	x			x	x		x	x	x	x	x	
Scirpus cyperinus	woolgrass bulrush	x	x	x		x	x	x		x	x	x	x	x	
Sparganium americanum	American bur-reed	x		x		x	x	x		x	x	x			
Tripsacum dactyloides	gama grass	x	x	x	x	x	x	x		x	x	x	x	x	x
Typha latifolia	broad-leaved cattail	x		x		x	x	x			x	x			
Zizania aquatica	wild rice	x	x	x				x			x	x			
Vines															
Bignonia capreolata	crossvine	x	x			x	x	x	x	x			x	x	x
Celastrus scandens	climbing bittersweet	x	x			x	x	x	x	x	x				x

NATIVE RIPARIAN PLANTINGS

Clematis virginiana	virgin's bower		x			x	x	x		x	x	x	x	x	x
Parthenocissus quinquefolia	Virginia creeper	x	x	x		x	x	x		x	x		x	x	x
Shrubs															
Alnus serrulata	common alder	x	x	x		x	x	x	x	x	x	x	x	x	
Aronia arbutifolia	red chokeberry		x	x		x	x	x	x	x			x	x	x
Aronia melanocarpa	black chokeberry		x	x		x	x	x		x	x		x	x	x
Callicarpa americana	American beautyberry	x	x					x	x	x				x	x
Cephalanthus occidentalis	buttonbush		x	x		x	x	x		x	x	x	x		
Clethra alnifolia	sweet pepper-bush	x	x	x				x	x	x				x	
Cornus amomum	silky dogwood	x		x		x	x	x	x	x			x	x	
Hydrangea arborescens	wild hydrangea		x			x	x	x	x	x					x
Ilex decidua	possumhaw	x	x	x			x	x	x	x			x	x	x
Ilex verticillata	winterberry	x	x	x		x	x	x		x	x		x	x	x
Itea virginica	Virginia willow	x	x	x				x	x	x			x	x	
Leucothoe racemosa	fetterbush, sweetbells		x	x		x	x	x		x	x		x	x	
Lindera benzoin	spicebush	x	x	x		x	x	x	x					x	x
Myrica cerifera	Southern wax myrtle	x	x	x				x	x	x		x	x	x	x
Rhododendron viscosum	swamp azalea		x	x		x	x	x		x	x		x	x	
Rubus allegheniensis	Alleghany blackberry	x	x	x		x	x				x		x	x	x
Salix sericea	silky willow		x	x		x	x	x		x	x		x	x	
Sambucus canadensis	common elderberry	x	x	x		x	x	x			x		x	x	x
Spiraea alba	narrow-lvd. meadowsweet	x	x	x		x					x		x	x	
Spiraea latifolia	broad-lvd. meadowsweet	x	x	x		x					x		x	x	x
Vaccinium corymbosum	highbush blueberry	x	x	x		x	x	x	x	x	x		x	x	x
Viburnum dentatum	So. arrow-wood viburnum	x	x	x		x	x	x		x	x				
Viburnum prunifolium	black-haw viburnum	x	x	x		x	x	x		x	x				
Small trees															
Amelanchier arborea	downy serviceberry	x	x	x		x	x	x		x	x				x
Amelanchier canadensis	Canada serviceberry	x	x	x		x	x	x			x		x	x	x
Amelanchier laevis	smooth serviceberry	x	x	x		x				x	x				x
Asimina triloba	paw paw	x	x	x		x	x	x	x	x				x	x
Cornus alternifolia	alternate-leaf dogwood	x	x	x		x	x		x	x					x
Crateagus flava	October haw	x	x			x	x	x		x	x			x	
Morus rubra	red mulberry	x	x	x		x	x	x	x	x				x	x
Ostrya virginiana	Eastern hop-hornbeam		x			x	x	x	x	x					x

NATIVE RIPARIAN PLANTINGS

Persea borbonia	redbay, sweet bay		x	x				x	x	x				x	
Rhus glabra	smooth sumac	x	x	x		x	x	x			x			x	x
Salix nigra	black willow			x		x	x	x		x	x	x	x	x	
Medium to Large Trees															
Acer rubrum	red maple		x	x		x	x	x			x	x	x	x	x
Betula lenta	sweet birch, black birch	x	x	x		x	x			x	x			x	x
Betula nigra	river birch	x	x	x		x	x	x			x		x	x	
Diospyros virginiana	persimmon	x	x	x		x	x	x	x	x	x		x	x	x
Fraxinus americana	white ash	x	x			x	x	x		x	x		x	x	x
Fraxinus pensylvanica	green ash	x	x	x		x	x	x		x	x		x	x	
Juglans nigra	black walnut	x		x		x	x	x		x	x		x	x	x
Liquidambar styraciflua	sweetgum		x	x		x	x	x	x	x	x		x	x	x
Liriodendron tulipifera	tulip-tree, tulip poplar	x	x	x		x	x	x			x			x	x
Nyssa aquatica	water tupelo	x	x	x				x		x	x	x			
Nyssa sylvatica	black gum	x	x	x		x	x	x		x	x		x	x	x
Oxydendrum arboreum	sourwood		x			x	x	x		x				x	x
Pinus taeda	loblolly pine	x	x	x			x	x			x		x	x	x
Platanus occidentalis	sycamore			x		x	x	x		x	x		x	x	x
Quercus bicolor	swamp white oak	x		x		x	x	x	x	x			x	x	
Quercus laurifolia	swamp laurel oak	x		x				x		x	x		x	x	
Quercus michauxii	swamp chestnut oak	x	x				x	x		x	x		x	x	x
Quercus nigra	water oak	x		x				x	x	x			x	x	x
Quercus palustris	pin oak	x	x	x		x	x	x	x	x			x	x	
Quercus phellos	willow oak	x	x	x			x	x		x	x		x	x	x
Taxodium distichum	bald cypress		x	x				x			x	x			

+May be aggressive in garden setting.

*Due to the rarity and sensitivity of habitat in Virginia, these species are recommended for horticultural use only.

Planting these species in natural areas could be detrimental to the survival of native populations.

DESTINATIONS

Destinations, Connections and Attractions

Schools

Patrick Henry High School
Fishburn Elementary
Virginia Western Community College

Shopping

Tanglewood Mall
Towers Shopping Center

Park, Greenways and Open Space

Roanoke River Greenway
Woodland Park
Shrine Hill Park
Fishburn Park
Lakewood Park
Old Jefferson Golf Course

Neighborhoods and Communities

Franklin Colonial Neighborhood
Grandin Court Neighborhood
Raleigh Court Neighborhood
Wasena Neighborhood
Roanoke County

Honeywood Apartments
Pebble Creek Apartments
Winding Way Road
Hartland Road
Pasley Avenue
Blenheim Road
Persinger Road
Mount Vernon Road
Oakwood Drive

MPO BIKEWAY PLAN

Pathways Bicycle Plan

While it is the aim of this feasibility study to identify potential greenway corridors for the Murray Run Greenway separate from on road bicycle facilities the area of coverage for potential greenway users would be greatly enhanced from a joint greenway/bicycle facility venture. The following map is a depiction of the 2005 Bikeway Plan for the Roanoke Valley Area Metropolitan Planning Organization (MPO) proposed bike lane facilities in and around the proposed alignments. There are numerous areas of overlap which would only serve to strengthen pedestrian facilities in the Roanoke Valley.

When compared in conjunction with the proximity maps, the Bike Path Map can begin to reveal the possible extents of the serviceable area for each greenway alignment. (Please refer to Bikeways Plan)

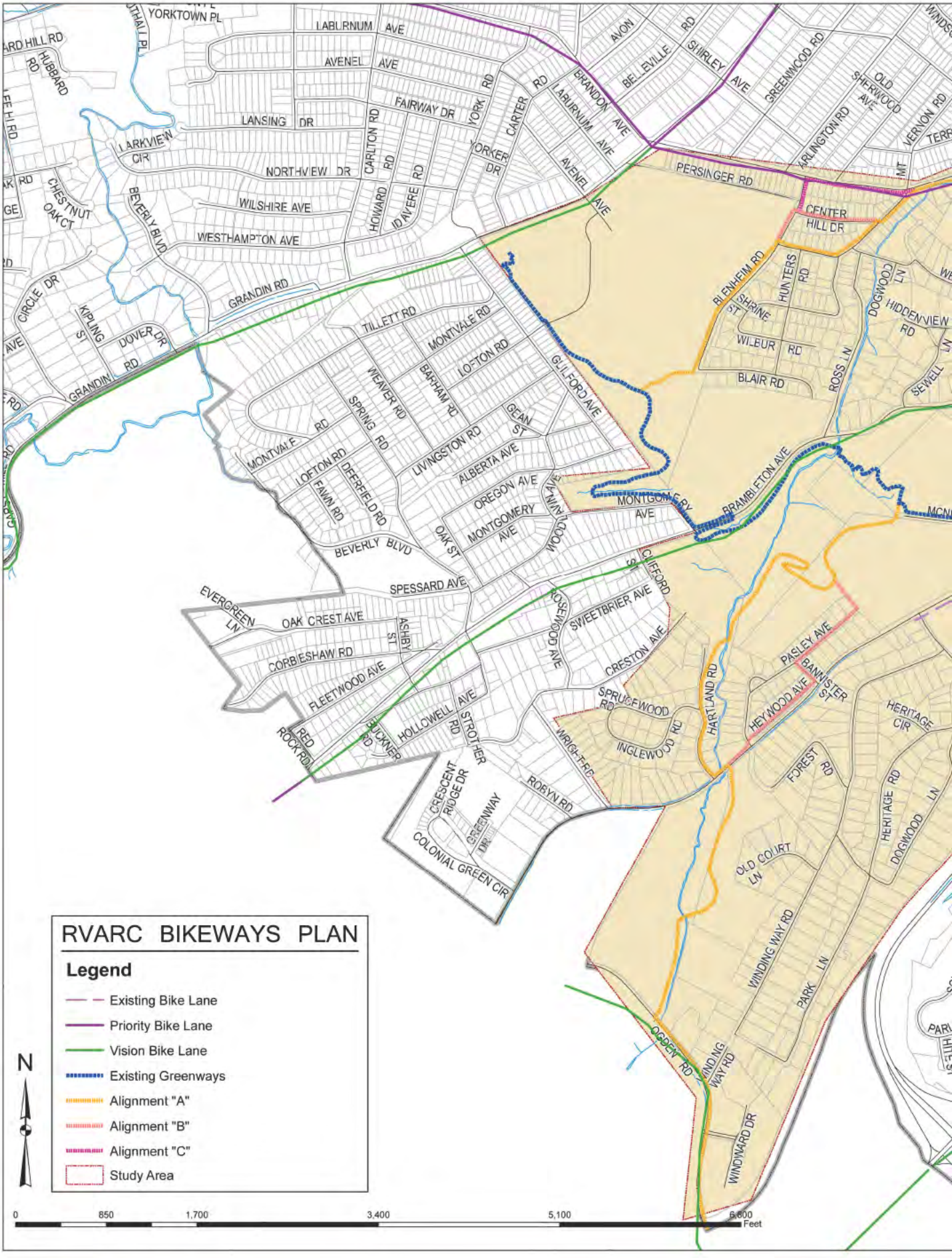
For the Murray Run study area, the MPO plan includes the following in the "Priority List of Corridors for Bicycle Accommodations." These routes are highest priority and should receive funding for bicycle improvements as it becomes available. They link greenways, areas of interest and transit systems.

- Brandon Avenue from Franklin Road to City of Salem
- Colonial Avenue from Dogwood Road (beside Virginia Western Community College Arboretum) to Brandon Avenue
- Grandin Road from Brandon Avenue to Memorial Avenue
- Memorial Avenue from Campbell Avenue to Grandin Road
- Route 419 from Roanoke County Line to Route 311
- Murray Run Greenway

The plan includes the following in the "Vision List of Corridors for Bicycle Accommodations." These areas are of medium priority and will fill in gaps in connectivity. They may be moved to the Priority List during the annual review process.

- Colonial Avenue from Route 419 to Roanoke City Line
- Ogden Road from Colonial Avenue to Route 419
- Brambleton Avenue from Garst Mill Road to Brandon Avenue
- Grandin Road from Garst Mill Road to Brandon Avenue
- Route 419 from Roanoke City Limits to Brambleton Avenue
- Starkey Road from Route 419 to Buck Mountain Road

The bicycle accommodations could be on-street facilities (shared roadway, paved shoulder, wide outside lane or bike lane) or off-road facilities (shared use path).


RVARC BIKEWAYS PLAN
Legend
Existing Bike Lane
Priority Bike Lane
Vision Bike Lane
Existing Greenways
Alignment "A"
Alignment "B"
Alignment "C"
Study Area
N
0
850
1,700
3,400
5,100
6,800
Feet
YORKTOWN PL
LABURNUM AVE
AVENEL AVE
FAIRWAY DR
LANSING DR
LARKVIEW CIR
NORTHVIEW DR
WILSHIRE AVE
WESTHAMPTON AVE
GRANDIN RD
TILLETT RD
MONTVALE RD
LOFTON RD
WEAVER RD
SPRING RD
BARHAM RD
GILFORD AVE
GEAN ST
LIVINGSTON RD
ALBERTA AVE
OREGON AVE
MONTGOMERY AVE
BEVERLY BLVD
SPESSARD AVE
EVERGREEN LN
OAK CREST AVE
CORBLESHAW RD
FLEETWOOD AVE
HOLLOWELL AVE
STROTHER RD
ROSEWOOD AVE
SWEETBRIER AVE
CRESTON AVE
SPRUCEWOOD RD
INGLEWOOD RD
HARTLAND RD
HEYWOOD AVE
PASLEY AVE
BANNISTER ST
HERITAGE CIR
FOREST RD
HERITAGE RD
DOGWOOD LN
OLD COURT LN
WINDING WAY RD
PARK LN
OGDEN RD
WINDWARD DR
ROBYN RD
WRIGHTFRD
CRESCENT RIDGE DR
GREENWAY DR
COLONIAL GREEN CIR
RED ROCK RD
BUCKNER RD
PERSINGER RD
CENTER HILL DR
BLENHEIM RD
HUNTERS RD
SHRINE ST
WILBUR RD
BLAIR RD
ROSS LN
DOGWOOD LN
HIDDENVIEW RD
SEWELL LN
BRAMBLETON AVE
MONTGOMERY AVE
AVON RD
BELLEVILLE RD
SHIRLEY AVE
GREENWOOD RD
OLD SHERWOOD AVE
ARLINGTON RD
VERNON RD
BRANDON AVE
LABURNUM AVE
AVENEL AVE
YORK RD
CARTER RD
YORKER DR
CARLTON RD
HOWARD RD
IDAVERE RD
HUBBARD RD
LARKVIEW CIR
CHESTNUT OAK CT
BEVERLY BLVD
CIRCLE DR
KIPLING ST
DOVER DR
GRANDIN RD
MONTVALE RD
FAWN RD
DEERFIELD RD
OAK ST
GOODWIN AVE
GILFORD ST


SUMMIT AVE
FLOYD AVE
WOODS AVE
KING GEORGE AVE
JANETTE AVE
BLUFF AVE
MAPLE AVE
WARRINGTON RD
SHERWOOD AVE
WAKEFIELD RD
SHEFFIELD RD
CANTERBURY RD
BRIGHTON RD
ELTON AVE
MALCOLM ST
GRACE ST
AWNHILL ST
SUBURBAN AVE
DUPONT CIR
BRANDON DRVY
BRANDON AVE
RIVER
RESERVE AVE
OAKWOOD DR
BRANDON LN
LAKEWOOD DR
EAST DR
BRAMBLETON AVE
CARRINGTON AVE
OAK HILL LN
COLONIAL AVE
23RD ST
21ST ST
SANFORD AVE
EDINBURGH ST
PERSINGER RD
GAYMONT ST
BLUEFIELD BLVD
WINTHROP AVE
26TH ST
LYNN AVE
WINSTON AVE
22ND ST
WYCLIFFE AVE
EVANS MILL RD
MCCLANAHAN ST
MARTIN LN
WELCH RD
CLEARFIELD RD
THORNDALE ST
BROADWAY AVE
WONJU ST
22ND ST
ROSALIND AVE
CRYSTAL SPRING AVE
OVERLAND RD
STEPHENSON AVE
25TH ST
23RD ST
24TH ST
BEECHWOOD DR
GARDENS RD
ROBERTS RD
FRANKLIN RD
LONGVIEW AVE
CAROLINA AVE
26TH ST
JEFFERSON ST
STANLEY AVE
WOODS END LN
WILDWOOD RD
ORCHARD RD
MAYWOOD RD
29TH ST
28TH ST
27TH ST
RICHELIEU AVE
YELLOW MOUNTAIN RD
NOTTINGHAM RD
CORNWALLIS AVE
KING JAMES ST
KINGSBURY LN
SOUTHWOOD VILLAGE CT
WHITE OAK RD
CASSELL LN
AUDUBON RD
SERPENTINE RD
CARDINAL RD
CLERMONT CIR
DUKE OF GLOUCESTER ST
HOUNDS CHASE LN
BRIGHTWOOD PL
AVENHAM AVE
HEMLOCK LN
BANCROFT DR
PARKCREST RD
WILTON RD
ALLENDALE ST
SOMERSET ST
CLYDESDALE ST
POPLAR DR
BURNLEIGH RD
LOCKRIDGE RD
TOWNSIDE RD
WILLOW OAK CIR
DILLARD RD
SHADBLOW LN
WILLOW OAK DR
WEST RIDGE RD
STONERIDGE RD
RIDGE RD
WEST RIDGE CIR
FORDHAM RD
STERLING RD
WINTERBERRY LN
RIVER BIRCH LN
PEAKWOOD DR
EXETER ST
MORRISON ST
FRANKLIN RD
PENARTH RD
CANTERBURY LN
BRAMBLE LN
RIDGEWOOD LN
WOODLAND HILLS LN
LONDONDERRY DR
THREE CHOP LN
HEATHERTON RD
COVENTRY LN
DARWIN RD
ALTON RD
BOSWORTH DR
MILL MOUNTAIN PKWY
SOUTHMONT DR