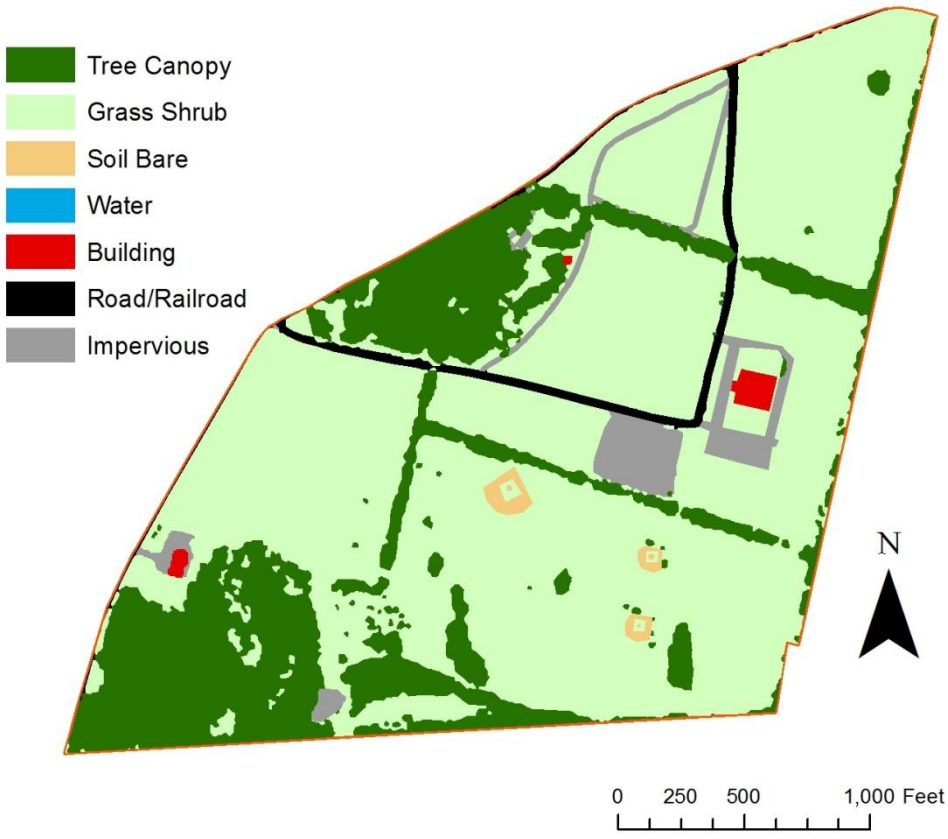
Jefferson County Parks & Recreation

Urban Tree Canopy Analysis



Report Prepared By:

Cacapon Institute
Protecting rivers and watersheds since 1985

Contributors:

FOREST SERVICE U.S. DEPARTMENT AGRICULTURE

dep

WEST VIRGINIA DIVISION OF FORESTRY

Contents

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From the Cacapon River to the Potomac to the Chesapeake Bay we protect rivers and watersheds using science and education.

Founded in 1985, CI has grown from a local watershed research and protection group to an organization reaching a broad audience across the Mid-Atlantic.

Our vision is a future where polluted watersheds are history. As educators we teach students first and then, through them, we reach the larger community. As problem solvers we find solutions and build partnerships to address environmental problems. As fact finders we research watershed issues of importance. As foresters we are creating healthy communities alive with trees.

We coordinate the Potomac Watershed Partnership, working to protecting the lands and waters of the Potomac River Basin. CI is an active participant in the WV DEP Chesapeake Bay Program and contributes to the EPA Chesapeake Bay Program's Education and Forestry work groups in Annapolis.

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Introduction

Cacapon Institute (CI), in partnership with the USDA Forest Service (USFS), WV Division of Forestry (DOF), WV Department of Environmental Protection (DEP), and Jefferson County Parks & Recreation (JCPRC), has completed an Urban Tree Canopy (UTC) analysis for all ten (10) of JCPRC's parks.

This analysis found that JCPRC's ten parks occupy .3% of Jefferson County, WV (409 of 135,377 acres). A map showing locations of JCPRC's ten parks is provided in the Appendix. Although this is a small percent of the county's total acreage, it plays a very large role in providing safe, healthy, and fun outdoor experiences for Jefferson County residents. It is JCPRC's responsibility to provide as many opportunities at these ten parks for Jefferson County, WV residents as possible. Uses include sports fields and recreation, wildlife habitat and viewing, hiking trails, parking for annual events, indoor recreation and events space, and more. Successful management of JCPRC's landscape should include a plan for managing forested landscapes, increasing tree canopy where possible, and transferring greenspace and other open areas that are currently mowed 25x per year into more sustainable land management practices that decrease mowing costs, increase tree canopy, and provide valuable opportunities for the citizens of Jefferson County, WV. This analysis provides that information and is intended to be incorporated as part of a larger, more comprehensive plan for JCPRC parks that is currently underway.

Volunteers plant trees at Morgan Grove Park

Under the recommendations of JCPRC staff, CI proposed areas for planting landscape trees, creating no-mow reforestation areas, and fostering low-mow grasslands that will help to increase tree canopy and reduce mowing costs. In addition, CI utilized USFS tools to estimate the environmental benefits of JCPRC's existing tree canopy. The Existing Tree Canopy was determined by the University of Vermont based on 2009 data.

This report is a snapshot in time and changes have occurred since the original landcover assessment was completed. The analysis should be used as a guideline for understanding UTC and setting UTC goals. It is not intended as a definitive conclusion or as a discussion of the current condition of UTC or landcover because changes in the landscape including construction, development, tree growth, and plantings have altered the landcover since 2011.

Background

Urban Tree Canopy (UTC)

UTC is a measure of the leaves, stems, and branches of trees covering the ground when viewed from above. UTC is a valuable measurement when studying the urban forest. The urban forest is the trees we live with, the trees that grace our neighborhoods, towns, parks, schools, and roadsides. CI, in partnership with the USDA Forest Service and West Virginia Division of Forestry, is assisting government agencies and volunteers to assess and enhance UTC in the Potomac Basin of WV. Assistance includes analyzing UTC to determine high priority planting sites, setting UTC goals, fostering tree planting initiatives, and developing long-term plans to expand UTC. Our goal is to increase the public benefits of UTC including clean air, shade, and reduced stormwater runoff pollution. Investigating and defining UTC are first steps for city officials, decision makers, managers and the public in efforts to enhance Tree Canopy. Trees' benefits can be measured and quantified. The "2012 Martinsburg WV i-Tree Street Survey," for example, found the street tree population's benefit is estimated to provide a 9:1 return on investment. For every $1.00 Martinsburg spends on tree maintenance i-Tree estimates $9.00 in benefits is returned by the street tree population.

UTC Landcover Assessment

In 2009, with financial support from the USDA Forest Service and WV Division of Forestry, CI engaged the Spatial Analysis Laboratory at the University of Vermont's (UVM) Rubenstein School of Environmental & Natural Resources. UVM applied high-resolution National Agriculture Inventory Program[1] color infrared and U.S. Geological Survey Light Detection and Ranging (LiDAR) data to complete a landcover assessment of Jefferson County. The color infrared indicates the composition of the land surface so asphalt, concrete, bare soil, water, plants and other surfaces can be identified. LiDAR data indicates the height of objects on the ground. By combining LiDAR and color infrared, UVM can differentiate Tree Canopy from plants under 8' in height. UVM also uses the LiDAR height information to define building footprints to distinguish buildings from other impervious surfaces. This unique and complex process produces a 97% accurate landcover assessment. UVM distinguishes seven landcover types: Tree Canopy, Greenspace (fields, grass, and vegetation <8 feet), Bare Soil, Water, Building, Road-Railroad (asphalt, concrete, dirt-gravel roads and other surfaces connected to transportation arteries), and Impervious (parking lots, sidewalks, driveways, etc.). "A Report on Jefferson County's Existing and Possible Tree Canopy" is available at the Publication Tab at CacaponInstitute.Org. Jefferson County used the UVM assessment as the basis for their 2011 "Urban Tree Canopy Plan and Goals." The UTC and Landcover Map of Jefferson County, as it

[1] "High-resolution" in this case is <1 meter accuracy National Agriculture Inventory Program (NAIP) data.

was in 2011, is available online. These and other reports and studies, and stories on how citizens are volunteering to plant trees through the WV Project CommuniTree are all available on CI's Forestry Tab.

Cacapon Institute UTC Analysis for JCPRC Parks

CI parsed out the landcover for JCPRC's ten (10) parks using data from the county-wide UTC assessment. Under the recommendations of JCPRC staff, CI proposed areas for planting landscape trees, creating no-mow reforestation areas, and fostering low-mow grasslands. In the case of reforestation and grasslands, these land management practices will reduce mowing costs. In the case of landscape trees and reforested areas, these land management practices will increase Tree Canopy (Table 1). All of these proposed land management practices include varying degrees of costs and maintenance needs, both in the short- and the long-term.

Existing greenspace and open areas that are, in most cases, currently mowed on a weekly basis were targeted for changes in land management practices. The Proposed Land Management Practices in this analysis and their associated benefits, costs, and maintenance needs are in part based off of the Landscape Regimes in "Trees or Turf? Best Value in Managing Urban Green Space".

Specifically, Landscape Trees was modeled off of Woodland in Managed Green Space, Reforestation was modeled off of Naturally Colonizing Woodland, and Grasslands was modeled off of Rough Grasslands, as described in the referenced report above. For this analysis, Landscape Trees are any tree or grove of trees that were planted for shade, aesthetics, or other beautification purposes and which will be mowed around into perpetuity. Reforestation is any area which will be left to reestablish through natural regeneration, or in specific cases, through targeted tree plantings. Grasslands are any area which will be mowed 1-2x per year to keep down woody vegetation and to provide habitat for wildlife, especially birds.

Proposed Land Management Practices	Increase Tree Canopy	Decrease Mowing Cost	Short-term Cost	Long-term Cost	Short-term Maintenance	Long-term Maintenance
Landscape Trees	Yes	No	High	Medium	High	Medium
Reforestation	Yes	Yes	Low	Medium	Low	Medium
Grasslands	No	Yes	Low	Low	Low	Low

Table 1 – Proposed Land Management Practices and their associated benefits, costs, and maintenance.

In addition to analyzing existing landcover and proposing new land management practices, CI utilized i-Tree tools software developed by the USFS, specifically i-Tree Vue (Vue) to estimate the environmental benefits of JCPRC's existing tree canopy. Vue "provides a broad estimate of

tree canopy, air pollution removal, carbon storage and annual carbon sequestration[2]" and an additional benefit is that no field data collected is required. However, a major limitation of Vue is that it utilizes low-resolution data that has been found to underestimate tree canopy by 10-28%. Canopy Cover, Impervious Surfaces, and Landcover from the National Land Cover Database (NLCD) 2006 were used for the Vue analysis.

[2] More information about i-Tree Vue can be found at http://www.itreetools.org/vue/.

Findings

Existing Landcover

JCPRC's ten (10) parks occupy .3% of Jefferson County, WV (409 of 135,377 acres). Tree Canopy is 24% (97 of 409 acres) and Greenspace, Open is 72% (295 of 409 acres) of the existing landcover (Figure 1). The majority of the landcover is greenspace and open areas that in most cases are currently being mowed.

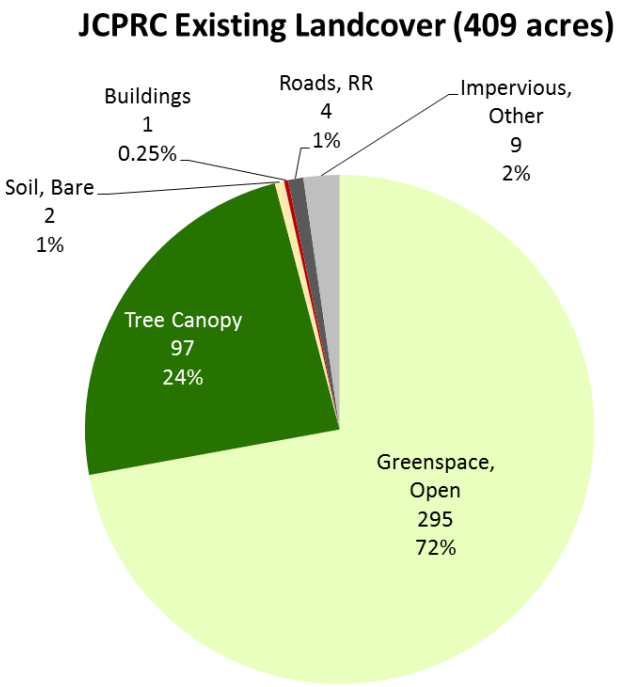


Figure 1 – Existing Landcover at JCPRC parks

The three largest parks – Sam Michaels, South Jefferson, and James Hite – contain the majority of Tree Canopy (66 of 97 acres) and the majority of Greenspace, Open (249 of 295 acres)(Figure 2, top). When viewed as a percentage, the parks with the highest percentage of Tree Canopy are Heather Marriott Park and Bolivar Nature Park, although the total acreage of tree canopy within those parks is much less significant (11 and 6, respectively) (Figure 2, bottom).

Figure 3 shows existing landcover (outer circle) by each park (inner circle) in the top image. For example, James Hite Park has 93 acres of Greenspace, Open and 24 acres of Tree Canopy. The bottom image displays each park (outer circle) by existing landcover (inner circle). For example, the majority of the 97 acres of Tree Canopy is located in Sam Michaels, Morgan Grove, James Hite, and Heather Marriott Parks. Additionally, the majority of Impervious, Other surfaces like sidewalks, parking lots, etc. are at Sam Michaels Park.

Parks	Tree Canopy %
Boise, ID	16%
St. Louis, MO	22%
Jefferson County, WV	**24%**
Vancouver, WA	25%
Salem, OR	30%
Tukwila, WA	38%
Virginia Beach, VA	47%
Shoreline, WA	54%
Nashville, TN	57%
Washington, DC	59%

Table 2 – Tree Canopy percentages of parks across the United States

Compared to other UTC analyses conducted at parks across the United States, JCPRC has a relatively low percentage of Tree Canopy in their ten parks (Table 2).

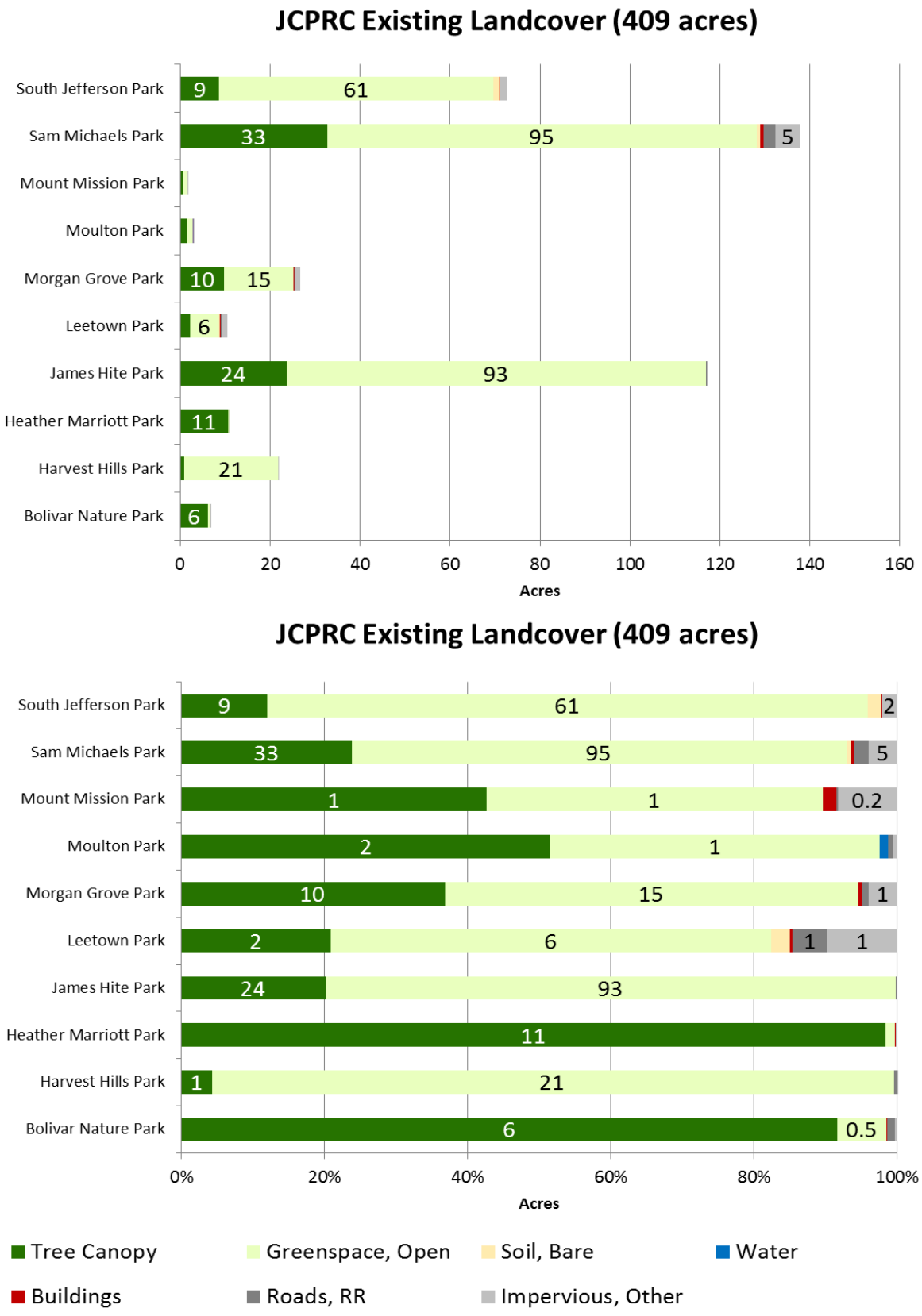


Figure 2 – Existing Landcover at JCPRC parks by acres (top) and percentage (bottom).

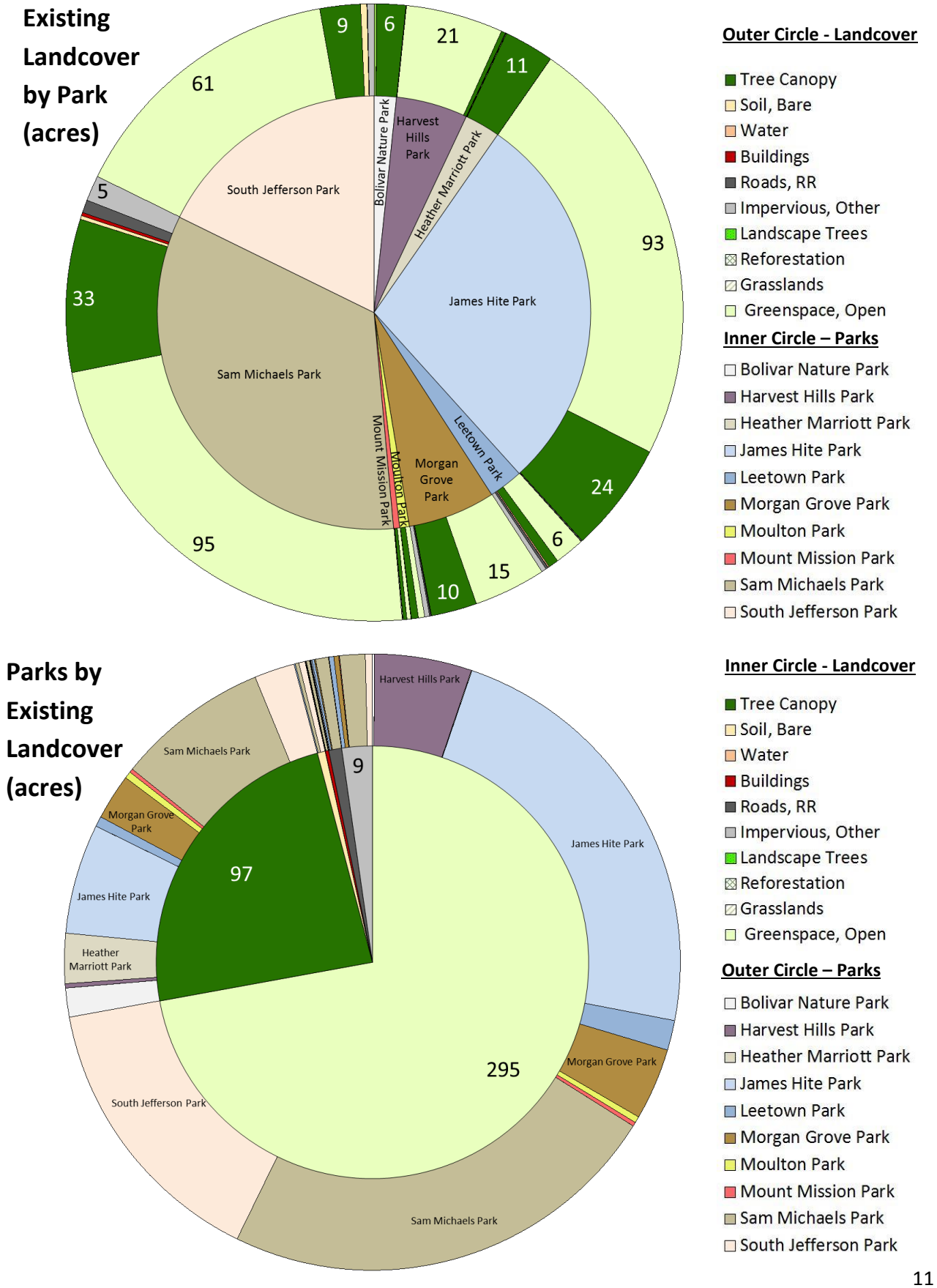


Figure 3– Existing landcover by parks (top) and parks by existing landcover (bottom)

Proposed Landcover

Cacapon Institute, under the direction of JCPRC staff, created three new landcover classes – Landscape Trees, Reforestation, and Grasslands – as described in the Background section on Page 7 and in Table 1.

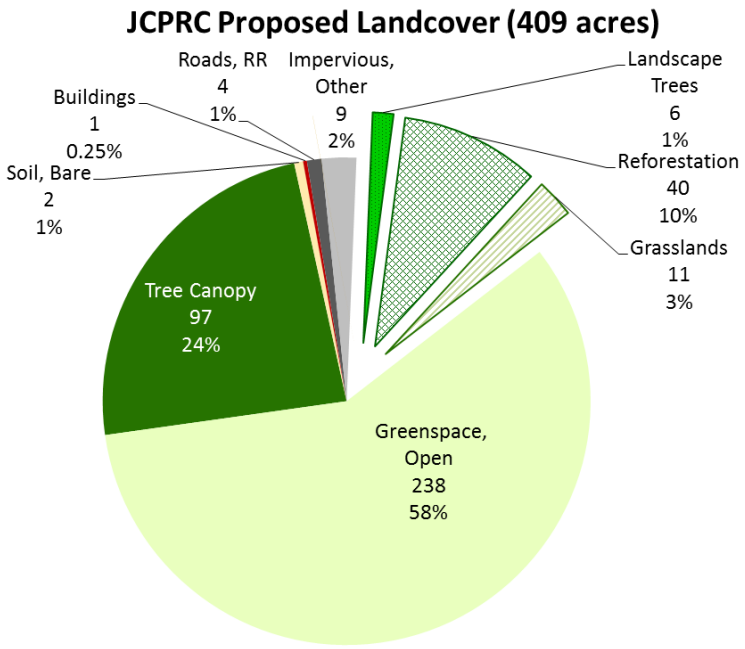


Figure 4 – Proposed Landcover at JCPRC parks

If JCPRC were to make all of the proposed changes to their land management practices, they would decrease the amount of greenspace and open areas on JCPRC parks 14% (295 acres down to 238 acres). Those 57 acres would be converted to Landscape Trees (6 acres, 1%), Reforestation (40 acres, 10%), and Grasslands (11 acres, 3%)(Figure 4).

South Jefferson Park would receive the greatest amount of acreage change in land management practices, with 31 acres of greenspace and open areas being converted to Reforestation. Sam Michaels Park would be the only park to convert greenspace and open areas to Grasslands (11 acres)(Figure 5, top). When viewed as a percentage, making even small changes in land management practices, like reforesting 0.2 acres and planting 0.06 acres of landscape trees at Moulton Park, would increase the park's tree canopy from 51% to 60% (Figure 5, bottom).

Figure 6 shows proposed landcover (outer circle) by each park (inner circle) in the top image. For example, Sam Michaels Park is the only park that would convert land management practices from Greenspace, Open to all three new categories – Landscape Trees, Reforestation, and Grasslands. The bottom image displays each park (outer circle) by proposed landcover (inner circle). For example, the majority of proposed landscape tree plantings would take place at South Jefferson Park and Sam Michaels Park.

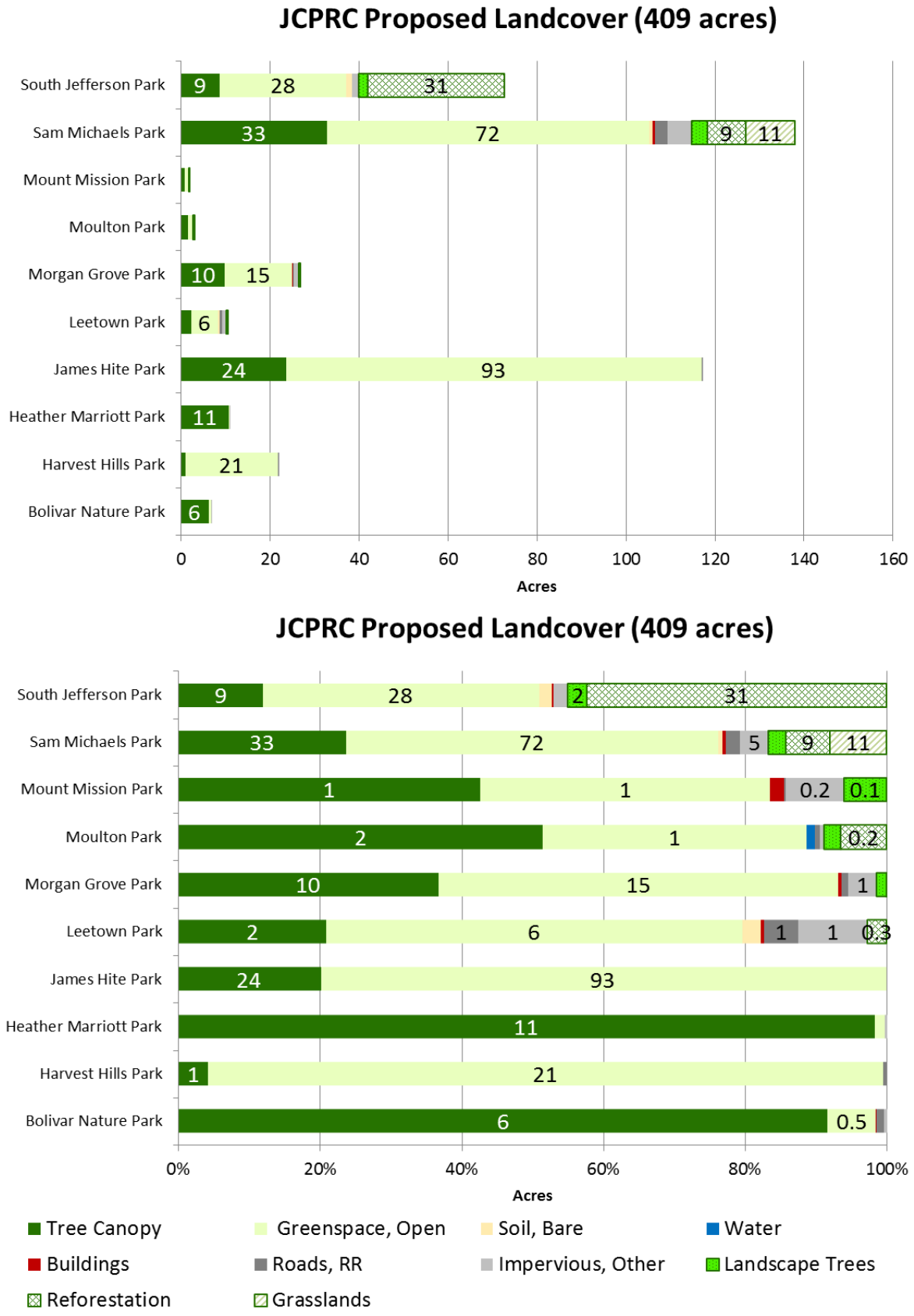
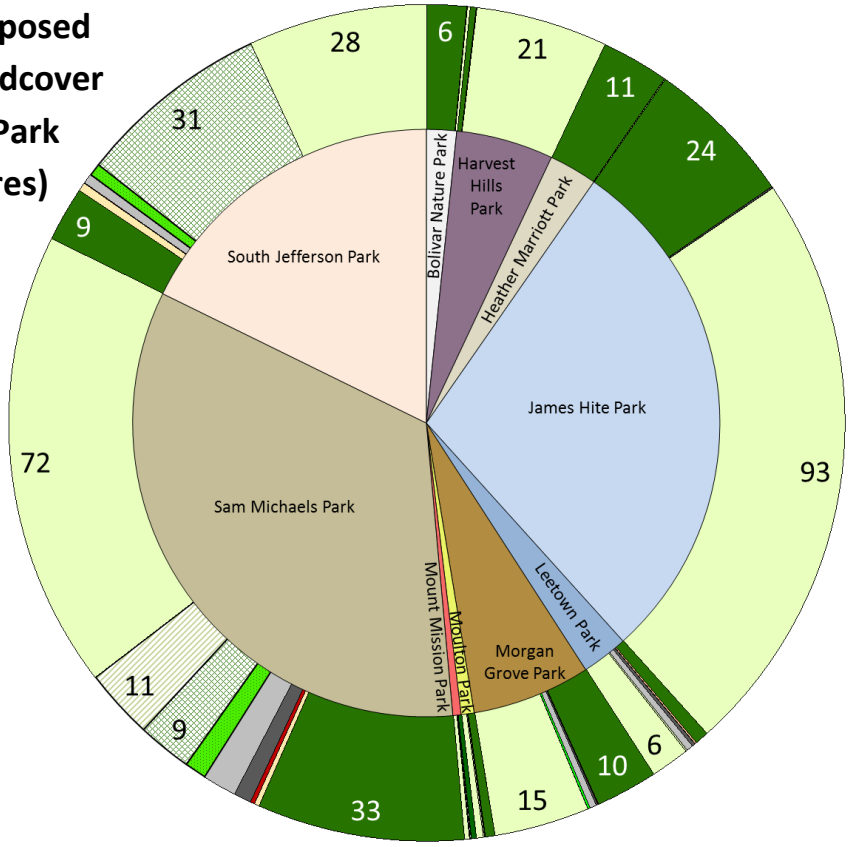


Figure 5 – Proposed Landcover at JCPRC parks by acres (top) and percentage (bottom).

Proposed Landcover by Park (acres)



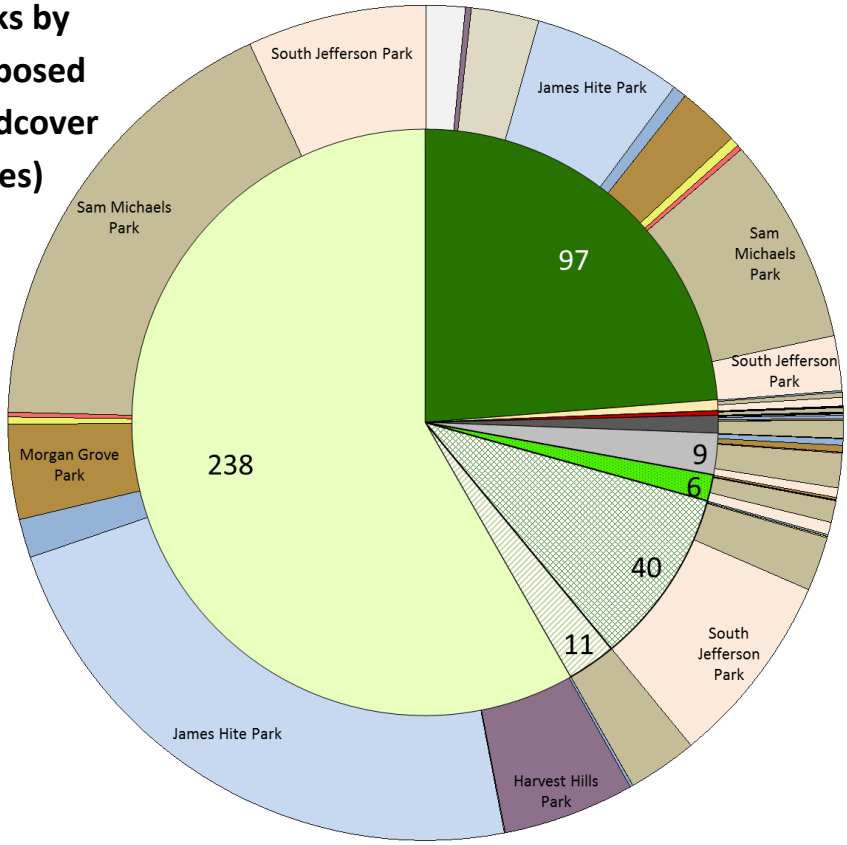
Outer Circle - Landcover

- Tree Canopy
- Soil, Bare
- Water
- Buildings
- Roads, RR
- Impervious, Other
- Landscape Trees
- Reforestation
- Grasslands
- Greenspace, Open

Inner Circle – Parks

- Bolivar Nature Park
- Harvest Hills Park
- Heather Marriott Park
- James Hite Park
- Leetown Park
- Morgan Grove Park
- Moulton Park
- Mount Mission Park
- Sam Michaels Park
- South Jefferson Park

Parks by Proposed Landcover (acres)



Inner Circle - Landcover

- Tree Canopy
- Soil, Bare
- Water
- Buildings
- Roads, RR
- Impervious, Other
- Landscape Trees
- Reforestation
- Grasslands
- Greenspace, Open

Outer Circle – Parks

- Bolivar Nature Park
- Harvest Hills Park
- Heather Marriott Park
- James Hite Park
- Leetown Park
- Morgan Grove Park
- Moulton Park
- Mount Mission Park
- Sam Michaels Park
- South Jefferson Park

Figure 6 – Proposed landcover by parks (top) and parks by proposed landcover (bottom)

Turf-to-Trees Cost-Benefit Analysis

Cacapon Institute proposes converting 56.8 acres of Greenspace, Open to land management practices that increase tree canopy (Landscape Trees), both increase tree canopy and decrease mowing costs (reforestation), or decrease mowing costs (Grasslands)(Figure 7).

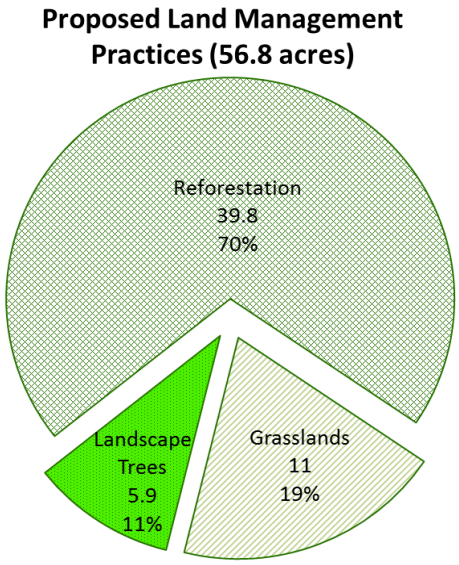


Figure 7 – This plan proposes converting 56.8 acres of Greenspace, Open to Reforestation (39.8 acres), Landscape Trees (5.9 acres), and Grasslands (11 acres).

Currently, JCPRC spends $59,843.00 annually on mowing their ten parks (Table 3). JCPRC calculated these costs based on the 2014 mowing season between April 1st and October 31st. The majority of JCPRC's mowing costs are salary (54%, $32,400). Ancillary costs, such as equipment depreciation, gasoline, repairs, and other minor expenditures make up the rest of JCPRC's mowing budget (46%, $27,443).

It is important to note that while land will be managed in a way that requires less mowing, there will be an equal or greater amount of maintenance needed on the proposed land management practices. WV-DOF and Cacapon Institute are available to offer opportunities for employees to become trained and educated in tree care and maintenance.

Item	Cost
Salaries (2,700 hours at $12.00/hour	$32,400
Equipment Depreciation	$12,000
Gasoline	$7,443
Equipment maintenance and repairs	$5,500
Transportation Costs	$2,500
Total	**$59,843**

Table 3 – JCPRC mowing expenses

On average, JCPRC maintenance crews mow each park 25 times per year. The mowing cost per acre is estimated to be $13.24. By converting 56.8 acres from Greenspace, Open across all 10 of JCPRC's parks, there is potential for transfer of significant costs from mowing to tree management at the majority of the parks. This will move expenses away from mowing, which is polluting and loud, to land management practices that have environmental and human health benefits that increase over time.

However, James Hite Park will soon be developed and 93.3 acres will require weekly mowing estimated at $30,861.17 annually. Even with adopting all of the proposed land management practices, JCPRC will have to produce an additional $12,080.49 of mowing funds to maintain their existing parks and the newly developed James Hite Park with the current mowing regime

of 25 times per year (Table 4). It is expected that James Hite Park will be mowed beginning July 2015 at an average of one per week through September. Beginning Spring 2016 the park will be utilized for soccer games and will be moved on average 1-2 times a week.

Park	Existing Greenspace, Open (acres)	Existing Mowing (Annual $)	Proposed Greenspace, Open (acres)	Proposed Mowing (Annual $)	Change in Costs (Annual $)
Bolivar Nature Park	0.5	$152.99	0.5	$152.99	$-
Harvest Hills Park	20.8	$-	20.8	$-	$-
Heather Marriott Park	0.1	$-	0.1	$-	$-
James Hite Park*	93.3	$-	93.3	$30,861.17	$30,861.17
Leetown Park	6.4	$2,122.17	6.1	$2,028.16	$94.01
Morgan Grove Park	15.4	$5,108.91	15.1	$4,981.60	$127.31
Moulton Park	1.3	$445.50	1.1	$360.45	$85.05
Mount Mission Park	0.9	$288.28	0.8	$251.50	$36.78
Sam Michaels Park	95.4	$31,557.79	72.3	$23,921.70	$7,636.08
South Jefferson Park	60.9	$20,167.37	28.3	$9,365.93	$10,801.44
Total	295.1	59,843.00	238.3	$71,923.49	$12,080.49

Table 4 – Annual existing costs, proposed costs, and savings on mowing costs for adopting 56.8 acres of proposed land management practices. This table assumes all parks will maintain the mowing regime of 25 mows per year. *James Hite Park's development plan for 93.3 acres of existing Greenspace, Open added into JCPRC's mowing costs will offset any benefit from mowing at other parks.

Even small changes in JCPRC's established mowing regime of 25 mows per year can have significant benefits in reducing annual mowing costs. If, for instance, all land management strategies proposed in this report are adopted, reducing mowing to once every 2 weeks (from

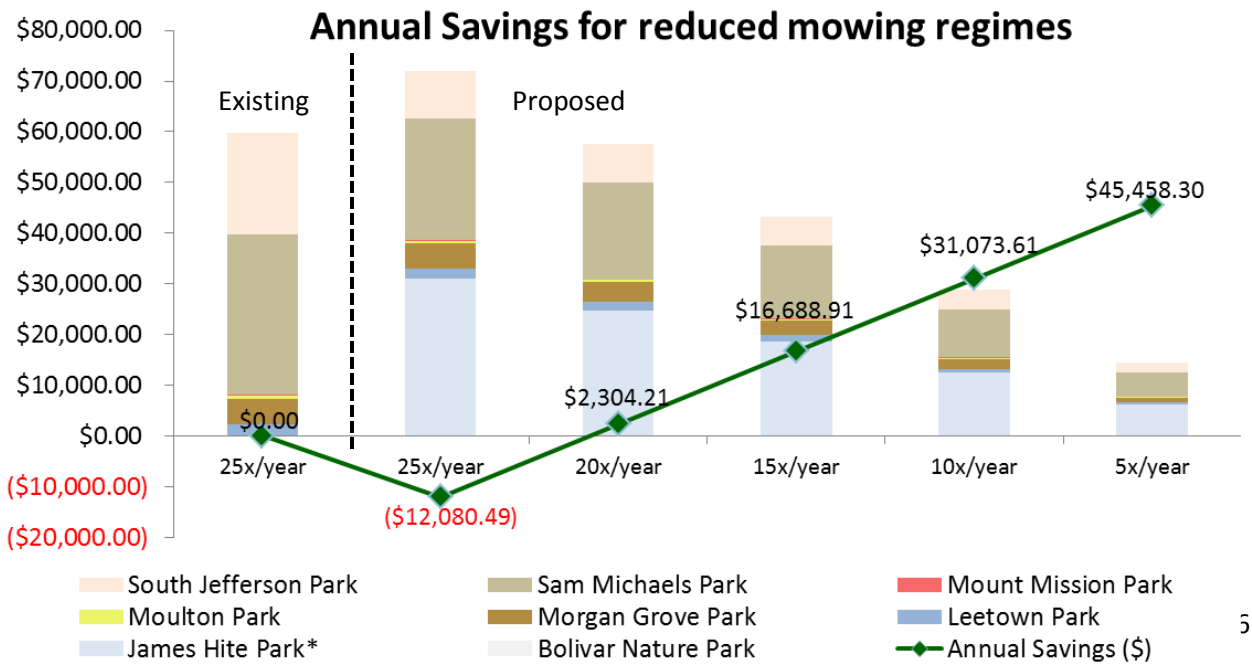


Figure 8 – Annual savings for reducing mowing regimes from 25x/year to lesser frequencies.

25x/year to 15x/year) can save JCPRC an estimated $16,688.91 annually (Figure 8).

It is recommended that JCPRC conduct further analyses of their greenspace and open areas to make priority decisions on which areas of the park can be mowed less frequently. Not every park, and not every greenspace within each park, can be reduced – i.e, recreation sports fields, dog parks, trails, etc. However, taken as a whole, significant savings are possible by reducing the frequency of mowing.

Additional savings that are not discussed in depth in this report may be achieved by building equipment storage sheds at each park to save staff time and gasoline for hauling mowing equipment from park to park. Further investigations into these solutions should be pursued by JCPRC.

Environmental Benefits Analysis

UTC provides many environmental benefits to communities, such as reducing air pollution (reported in this iTree Vue analysis) and decreasing energy demand by providing shade in summer, blocking cold winds in winter, reducing ambient air temperatures, decreasing urban heat island effect, and more. By reducing energy demands, especially in regions that use fossil fuels as the main source of energy, less air pollution is emitted.

The USFS has developed a suite of tools (as discussed in the Background section) that assist municipalities in determining the dollar value for annual environmental benefits provided by UTC. iTree VUE was used for this study.

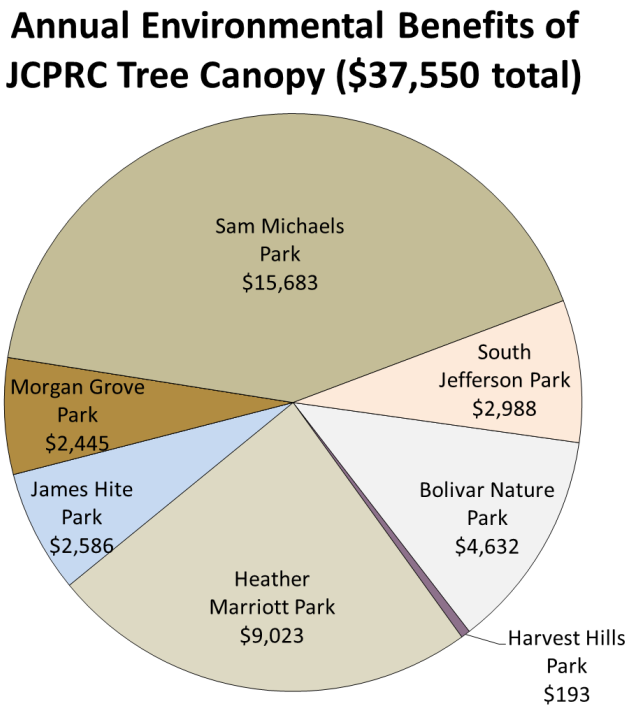


Figure 9 – Annual environmental benefits of JCPRC's existing tree canopy

VUE uses 3 types of imagery from the National Land Cover Database (NLCD) – Landcover (Figure 10, A), Percent Tree Canopy (Figure 10, B), and Percent Impervious Surfaces (Figure 10, C). Maps can be generated to display the output (Figure 10, D).

Pollution Reduction	Rate per pound
Carbon Storage	$0.003
Carbon Sequestration	$0.003
CO Removal	$0.64
NO2	$4.49
O3	$4.49
SO2	$1.10
PM10	$3.00

Table 5 – Rates used in i-Tree VUE for pollution reduction

This report found that JCPRC's existing tree canopy generates $37,550 worth of environmental benefits, in the form of air pollution reduction, to Jefferson County residents (Figure 9). Rates for air pollution reduction can be found in Table 5.

VUE analyses could not be run for Moulton Park and Mount Mission Park because they were too small (2.9 and 1.8 acres, respectively). The low-resolution (30m) aerial imagery is not statistically accurate at this scale. Additionally, although Leetown Park is large enough for

statistical accuracy in VUE (10.4 acres), it was not found to have any Tree Canopy in VUE so the analysis of environmental benefits provided by the park's Tree Canopy could not be analyzed.

A major consideration when reviewing this analysis is to understand the limitations of VUE, particularly the underestimation of tree canopy as an artifact of using low-resolution (30m) aerial imagery. The high-resolution (1m) UTC assessment conducted by the University of Vermont for Jefferson County, WV that found 93 acres of Tree Canopy for the 7 parks. VUE analysis found 35 acres of Tree Canopy for these 7 parks (62% lower than UVM).

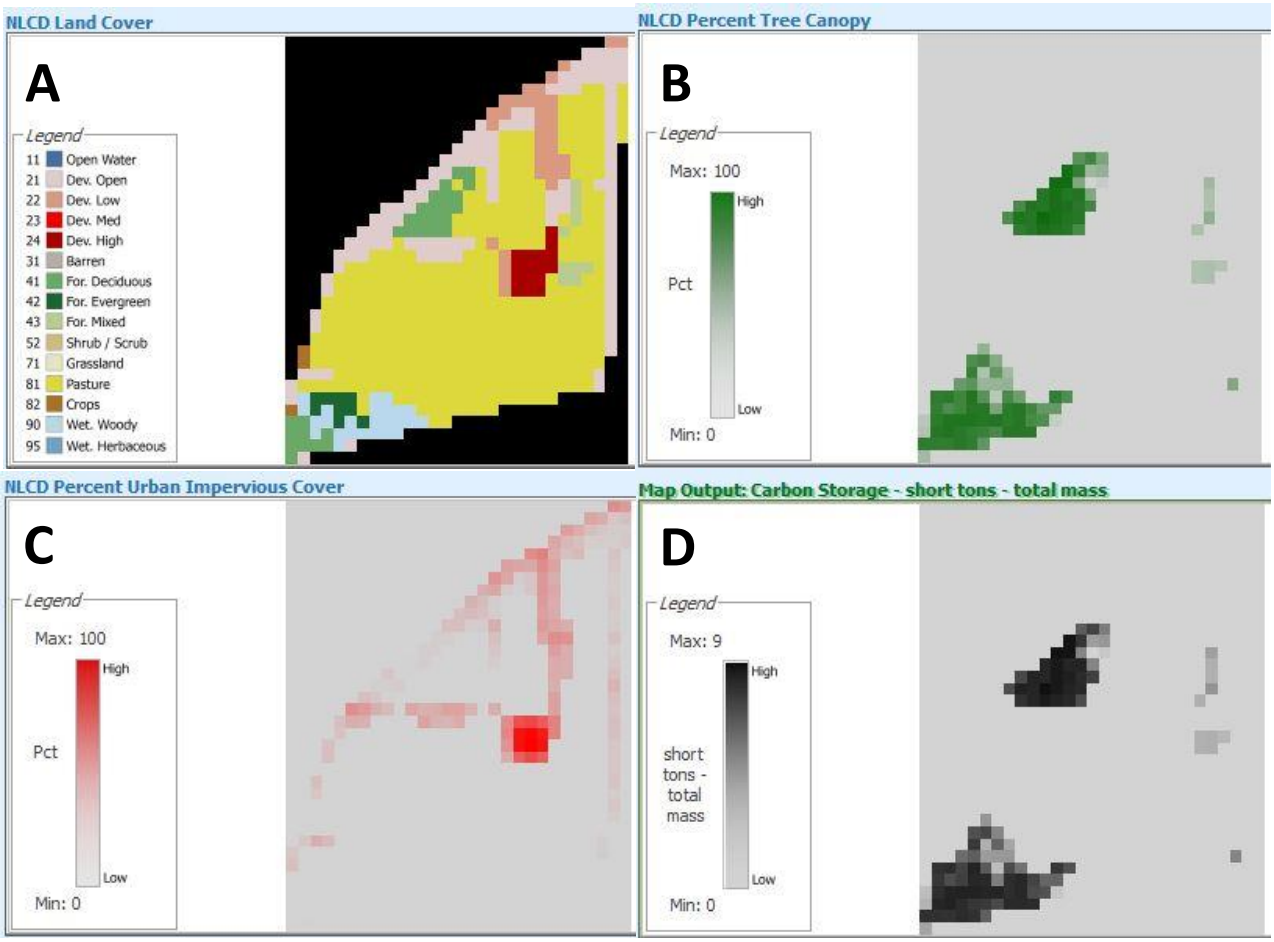


Figure 10 – Example iTree VUE program screen for Sam Michaels Park. A = Landcover, B = Tree Canopy, C = Urban Impervious Cover, and D = Sample Map Output

Individual Parks Analysis

Following is an analysis of each individual park's existing and proposed landcover. Figure 11 shows each park's existing tree canopy. The estimated cost benefits for reducing mowing at each park, as well as the environmental benefits of each park's tree canopy, is provided on the following pages. The parks are listed in alphabetical order.

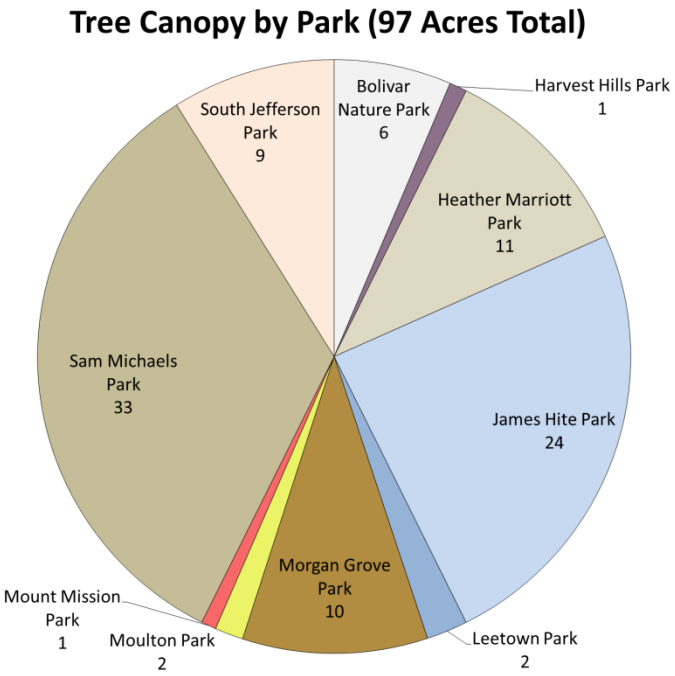


Figure 11 – Existing Tree Canopy by park (97 acres total)

Summary of Conclusions

Bolivar Nature Park ranks 8th in size (6.7 acres) and has the 2nd largest percentage of Tree Canopy (96%, 6.2 acres). Existing annual mowing costs are estimated to be $152.99. VUE estimates $4,632 in annual environmental benefits provided by the park's tree canopy. No changes in land management practices are proposed for this park and general recommendations include management of existing tree canopy for long-term survivability of existing trees.

Harvest Hills Park ranks 5th in size (21.8 acres) and has the smallest percentage of Tree Canopy (4%, 0.9 acres). There are no mowing costs associated with this park because it is not developed. JCPRC does not currently have a long-term development and management plan, so no changes in land management practices were proposed. VUE estimates $193 in annual environmental benefits provided by the park's tree canopy. General recommendations include inventorying existing trees before development and creating long-term management plans for the park's natural resources.

Heather Marriott Park ranks 6th in size (10.8 acres) and has the largest percentage of Tree Canopy (98%, 10.7 acres). There are no mowing costs associated with this park because it is not developed. JCPRC does not currently have a long-term development and management plan, so no changes in land management practices were proposed. VUE estimates $9,023 in annual environmental benefits provided by the park's tree canopy. General recommendations include inventorying existing trees before development and creating long-term management plans for the park's natural resources.

James Hite Park ranks 2nd in size (117.2 acres) and has the 8th largest percentage of Tree Canopy (20%, 23.6 acres). There are no mowing costs associated with this park which is currently not developed, so no changes in land management practices were proposed. However, this park is slated to be developed in 2015-2016. Future development will significantly increase JCPRC's mowing costs by an estimated $30,861 annually. VUE estimates $2,586 in annual environmental benefits provided by the park's tree canopy. General recommendations include inventorying existing trees before development and creating long-term management plans for the park's natural resources.

Leetown Park ranks 7th in size (10.4 acres) and has the 7th largest percentage of Tree Canopy (21%, 2.2 acres). Existing annual mowing costs are estimated to be $2,122. Cacapon Institute proposes 0.3 acres of reforestation that would increase Tree Canopy to 24% (2.5 acres) and decrease the mowing costs by an estimated $65.98 annually ($1,423.43). Leetown Park is above size threshold requirement, but Tree Canopy values were analyzed as 0 in VUE, so VUE analysis could not be applied. General recommendations include management of existing tree canopy for long-term survivability of existing trees and development of recommendations for reforesting 0.3 acres. Additionally, steps should be taken to maintain landscape trees that have been planted at this park through WV Project CommuniTree.

Morgan Grove Park ranks 4th in size (26.7 acres) and has the 5th largest percentage of Tree Canopy (37%, 9.8 acres). Existing annual mowing costs are estimated to be $5,109. Cacapon Institute proposes planting 0.35 acres of landscape trees that would increase Tree Canopy to 38% (10.2 acres) and decrease the mowing costs by an estimated $89.35 annually ($3,496.27). VUE estimates $2,455 in annual environmental benefits provided by the park's tree canopy. General recommendations include management of existing tree canopy for long-term survivability of existing trees and development of recommendations for planting 0.35 acres of landscape trees. Tree planting projects with community volunteers have begun to address some of the planting areas for landscape trees as described in this plan. The park's owner, the Shepherdstown Community Club, in partnership with JCPRC and local tree care companies, have taken steps to save the park's Ash *(Fraxinus sp*.) from Emerald Ash Borer. Additionally, steps should be taken to maintain landscape trees that have been planted at this park through WV Project CommuniTree and other community volunteer tree planting projects.

Moulton Park ranks 9th in size (2.9 acres) and has the 3rd largest percentage of Tree Canopy (51%, 1.5 acres). Existing annual mowing costs are estimated to be $446. Cacapon Institute proposes planting 0.07 acres of landscape trees and 0.19 acres of reforestation that would increase Tree Canopy to 60% (1.8 acres) and decrease the mowing costs by an estimated $59.69 annually ($252.98). Moulton Park is below size threshold requirement so VUE analysis could not be

applied. General recommendations include management of existing tree canopy for long-term survivability of existing trees and development of recommendations for planting 0.07 acres of landscape trees and reforesting 0.19 acres. Due to the park's proximity to the Shenandoah River and the high probability of soil erosion and loss of park safety from high waters, actions should be taken immediately to address the proposed land management practices as described in this report. Additionally, steps should be taken to maintain landscape trees that have been planted at this park through WV Project CommuniTree.

Mount Mission Park is JCPRC's smallest park (1.9 acres) with the 4th largest percentage of Tree Canopy (43%, 0.8 acres). Existing annual mowing costs are estimated to be $228. Cacapon Institute proposes planting 0.1 acres of landscape trees that would increase Tree Canopy to 49% (0.9 acres) and decrease the mowing costs by an estimated $25.81 annually ($176.51). Mount Mission Park is below size threshold requirement so VUE analysis could not be applied. General recommendations include management of existing tree canopy for long-term survivability of existing trees and development of recommendations for planting 0.1 acres of landscape trees.

Sam Michaels Park is JCPRC's largest park (137.9 acres) with the 6th largest percentage of Tree Canopy (24%, 32.8 acres). Existing annual mowing costs are the highest for Sam Michaels Park and are estimated to be $31,558. Cacapon Institute proposes planting 3.4 acres of landscape trees, reforesting 8.5 acres, and fostering 11 acres of grasslands that would increase Tree Canopy to 33% (44.8 acres) and decrease the mowing costs by an estimated $5,359.28 annually ($16,789.12). VUE estimates $15,683 in annual environmental benefits provided by the park's tree canopy. General recommendations include management of existing tree canopy for long-term survivability of existing trees and development of recommendations for planting 3.4 acres of landscape trees, reforesting 8.5 acres, and fostering 11 acres of grasslands. As the headquarters for JCPRC administration and the largest, most diverse park in terms of opportunities it provides to the residents of Jefferson County, extra consideration should be given to any changes made to this park, especially in the light of future development within the park. As an extremely valuable community resource (see Environmental Benefits section below), it is critical that JCPRC protect, maintain, and when possible, enhance tree canopy at Sam Michaels Park. Additionally, steps should be taken to maintain landscape trees that have been planted at this park through WV Project CommuniTree and other community volunteer tree planting projects.

South Jefferson Park ranks 3rd in size (72.6 acres) and has the 9th largest percentage of Tree Canopy (12%, 8.7 acres). Existing annual mowing costs are the highest for South Jefferson Park and are estimated to be $20,167. Cacapon Institute proposes planting 1.9 acres of landscape

trees and reforesting 30.6 acres that would increase Tree Canopy to 57% (41.3 acres) and decrease the mowing costs by an estimated $7,580.85 annually ($6,573.35). VUE estimates $2,898 in annual environmental benefits provided by the park's tree canopy. General recommendations include management of existing tree canopy for long-term survivability of existing trees and development of recommendations for planting 1.9 acres of landscape trees and reforesting 30.6 acres. South Jefferson Park has the greatest potential for changing land management strategies from cost-intensive weekly mowing of greenspace and open areas to a more sustainable and cost-friendly forest ecosystem that provides quality recreational and other opportunities for Jefferson County residents. Additionally, steps should be taken to maintain landscape trees that have been planted at this park through WV Project CommuniTree.

Bolivar Nature Park

Bolivar Nature Park (6.8 acres) is located at 294 Jefferson Street, Harpers Ferry, WV 25425.

> *"This park is filled with plenty of botanical delights. A walking trail allows you to stroll through the park where you can relax on a bench and watch the deer graze. The newly updated gazebo and picnic tables are available for your convenience at the parks entrance."* – JCPRC website

A brochure has been developed for Bolivar Nature Park titled "Bolivar Nature Park: Bird Gardens & Nature Trails" that discusses the purpose of the park, forest succession, and the benefits of having forested parks in urban communities.

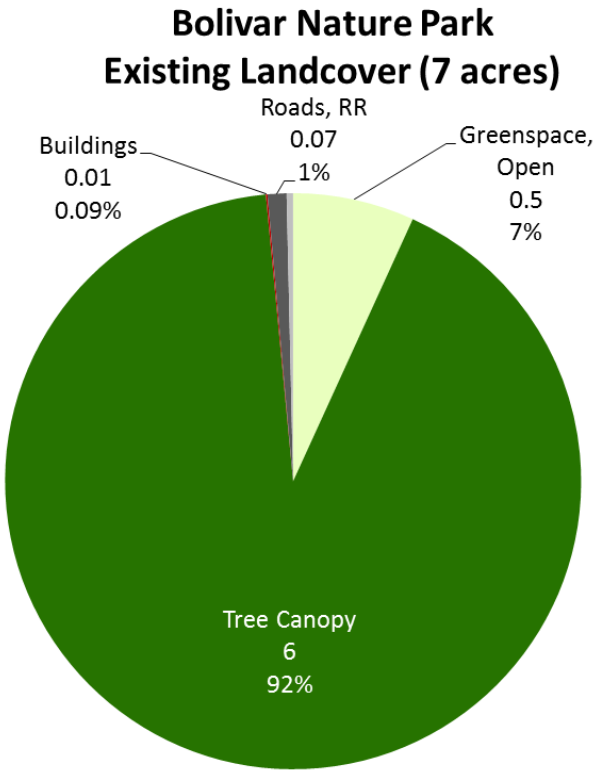


Figure 12 – Existing Landcover at Bolivar Nature Park

Bolivar Nature Park currently has a high percentage of Tree Canopy (92%, 6 acres) and only a very small percentage of Greenspace, Open (7%, 0.5 acres)(Figure 12). A map of existing landcover at Bolivar Nature Park is provided in the Appendix. No changes in land management practices were proposed for this park.

JCPRC currently mows 0.5 acres at Bolivar Nature Park 25x/year, at an estimated cost of $152.99 annually. No changes in the mowing costs are expected for this park.

VUE analysis estimates Bolivar Nature Park's existing tree canopy provides $4,632 in environmental benefits annually. Compared to the UVM analysis, VUE underestimated the Tree Canopy by 1.8 acres (29.2%).

JCPRC has been successful in allowing this park to grow its tree canopy and now they must focus on maintaining that tree canopy as it ages and begins to decline. This cycle of establishment, growth, decline, and eventual mortality is natural in forest ecosystems but must be carefully managed in urban and community settings. JCPRC should focus their efforts at Bolivar Nature Park on inventorying the trees directly around structures, parking areas, walking trails, and other high-traffic areas to identify beneficial tree species in need of protection and

maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree.

Harvest Hills Park

Harvest Hills Park (22 acres) is an undeveloped park near Duffields Train Station on Flowing Springs Road in Shenandoah Junction, WV.

The majority of the park is Greenspace, Open (95%, 21 acres) and only a very small percentage (4%, 1 acre) is Tree Canopy (Figure 13). A map of existing landcover at Harvest Hills Park is provided in the Appendix. No changes are proposed in the land management practices of Harvest Hills Park until JCPRC decides the future use for this park.

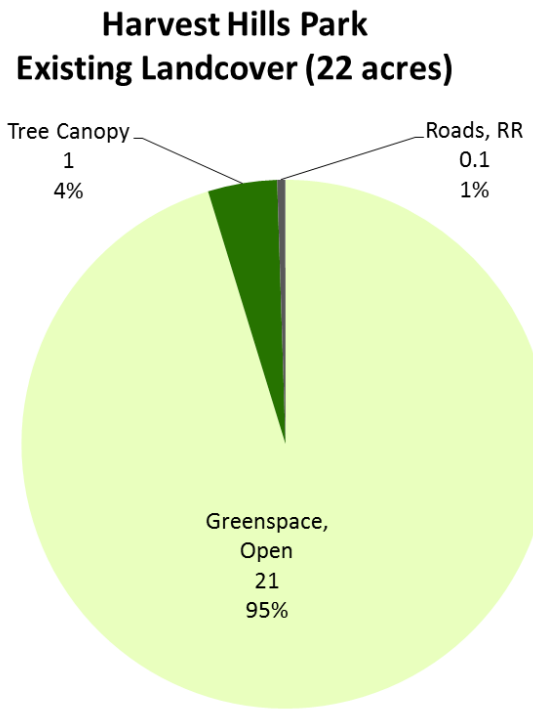


Figure 13 – Existing Landcover at Harvest Hills Park

JCPRC does not currently mow the 20.8 acres of greenspace and open areas at Harvest Hills Park. No changes in the mowing costs are expected for this park.

VUE analysis estimates Harvest Hills Park's existing tree canopy provides $193 in environmental benefits annually. Compared to the UVM analysis, VUE underestimated the Tree Canopy by 0.7 acres (78.4%).

It is recommended that JCPRC inventory the existing 1 acres of tree canopy before developing long-term plans for Harvest Hills Park. JCPRC should focus their efforts at Harvest Hills Park on inventorying the trees directly around sites where there may be future structures, parking areas, walking trails, and other potential high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree. If and when the park develops, particular care should be given to protecting the existing trees both during construction (physical damage of trunk, compression of roots from heavy equipment, etc.) as well as after construction as the natural surface and sub-surface flow of water changes from potential increases in impervious landcover like buildings, roads, sidewalks, etc. Additionally, Harvest Hills Park is in close proximity to Elks Branch, one of the tributaries to Elks Run that flows into the Potomac River.

Care should be taken to protect existing Tree Canopy, and enhance tree canopy when possible on the 21 acres of greenspace and open areas, to reduce stormwater runoff pollution from entering Elks Branch.

Heather Marriott Park

Heather Marriott Park (11 acres) is an undeveloped park near the St. Andrew's Mountain Community Center on Mission Road in Harpers Ferry, WV.

The majority of the park is Tree Canopy (99%, 11 acres) and only a very small percentage is Greenspace, Open (1%, 0.1 acres)(Figure 14). A map of existing landcover at Heather Marriott Park is provided in the Appendix. No changes are proposed in the land management practices of Heather Marriott Park until JCPRC decides the future use for this park.

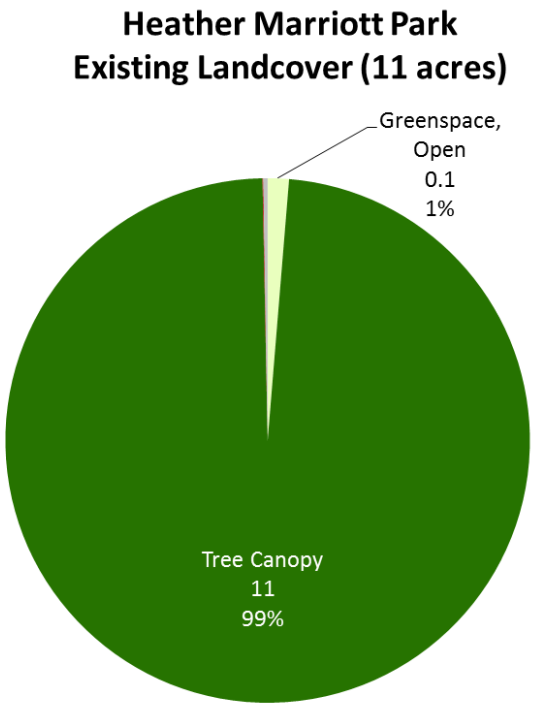


Figure 14 – Existing Landcover at Heather Marriott Park

JCPRC does not currently mow the 0.1 acres of greenspace and open areas at Heather Marriott Park. No changes in the mowing costs are expected for this park.

VUE analysis estimates Heather Marriott Park's existing tree canopy provides $9,023 in environmental benefits annually. Compared to the UVM analysis, VUE underestimated the Tree Canopy Park by 2.2 acres (20.6%).

It is recommended that JCPRC inventory the existing 11 acres of tree canopy before developing long-term plans for Heather Marriot Park. JCPRC should focus their efforts at Heather Marriott Park on inventorying the trees directly around structures, parking areas, walking trails, and other high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree. If and when the park develops, particular care should be given to protecting the existing trees both during construction (physical damage of trunk, compression of roots from heavy equipment, etc.) as well as after construction as the natural surface and sub-surface flow of water changes from potential increases in impervious landcover like buildings, roads, sidewalks, etc. The high percentage of existing Tree Canopy at Heather Marriott Park offers JCPRC the possibility of creating wooded walking trails for Jefferson County

residents that provide safe and healthy outdoor recreation opportunities, wildlife habitat and viewing, and other benefits.

James Hite Park

James Hite Park (117 acres) is an undeveloped park located at 1425 Hite Road, Kearneysville, WV 25430.

The majority of the park is Greenspace, Open (80%, 93 acres) and a small percentage is Tree Canopy (20%, 24 acres)(Figure 15). A map of existing landcover at James Hite Park is provided in the Appendix. No changes are proposed in the land management practices of James Hite Park until JCPRC begins development in 2015-2016, as described in the paragraph below from the JCPRC website:

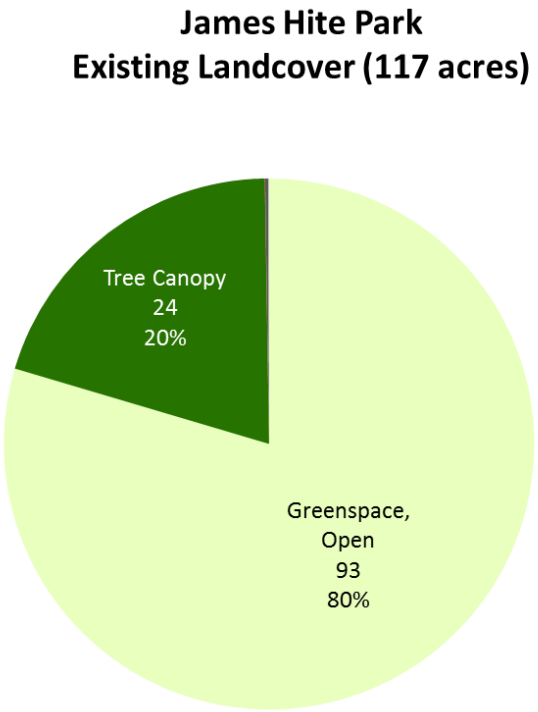


Figure 15 – Existing Landcover at James Hite Park

> *"The [Jefferson County] Commission has secured the services of LPDA, Inc. a Sterling Virginia based Landscape Architecture firm to develop the Master Plan. LPDA and the Commission have worked with Stakeholders representing several groups, as well as taken input from the general public since the first public meeting to develop a program and preliminary design for Hite Road Park to facilitate the needs of the active and passive recreation user in the County which include: fitness and walking trails, baseball, softball, soccer, and football fields, basketball and tennis courts, tot lots and playgrounds, a skate park, a dosh park, a mini golf course, and supporting facilities.* – JCPRC website
>
> *The Master Plan also incorporates a high emphasis on passive recreation opportunities and includes a series of picnic pavilions and shelters and outdoor games to take advantage of the 119 acre site's natural amenities and treed areas."*

A "Conceptual Map of James Hite Park" has been developed by LPDA as part of the Master Plan. Included in that plan is a "James Hite Park Brochure" that discusses the history of the parks and the goals and objectives for development. Both are available for download online at www.JCPRC.org.

JCPRC does not currently mow the 93.3 acres of greenspace and open areas at James Hite Park. However, once this park is developed, that will add an estimated $30,861 to JCPRC's mowing.

The JCPRC will begin mowing approximately 40 acres summer 2015 as the initial phase of development is completed. Additional acreage will be mowed/maintained as the park continues to develop over the next 5-10 years. Once development is complete, further analyses should be conducted for identifying sites for planting landscaping trees, reforesting unused fields and open areas, and creating grasslands that reduce mowing.

VUE analysis estimates James Hite Park's existing tree canopy provides $2,586 in environmental benefits annually. Compared to the UVM analysis, VUE underestimated the Tree Canopy by 21.2 acres (89.8%).

It is recommended that JCPRC inventory the existing 20 acres of tree canopy before implementing the James Hite Park Master Plan as produced by LPDA, Inc. JCPRC should focus their efforts at James Hite Park on inventorying the trees directly around structures, parking areas, walking trails, and other high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree. Additionally, large patches of tree canopy should be preserved for the benefits they provide for human recreation, wildlife habitat and viewing opportunities, and reducing stormwater runoff pollution and maintaining tree canopy as described in "Jefferson County, WV's Urban Tree Canopy Plan & Goals".

If and when the park develops, particular care should be given to protecting the existing trees both during construction (physical damage of trunk, compression of roots from heavy equipment, etc.) as well as after construction as the natural surface and sub-surface flow of water changes from potential increases in impervious landcover like buildings, roads, sidewalks, etc.

Leetown Park

Leetown Park (10 acres) is located at 56 Jefferson Orchard Road, Kearneysville, WV 25430.

> *"Located four miles East of Leetown, this ten-acre park has been a gathering for softball games since the 1970's. On the park grounds are lighted softball fields, tennis courts, a playground, picnic pavilion, horse shoe pits, concession stand and restroom facility. This park offers a great place to host your company's softball league or to simply relax and just play a pick-up game of baseball."* – JCPRC website

The majority of the park is Greenspace, Open (61%, 6 acres) and a smaller percentage is Tree Canopy (21%, 2 acres)(Figure 16). Cacapon Institute proposes converting 3% of the landcover (0.3 acres) to Reforestation. This would increase Tree Canopy from 21% to 24% (2.2 to 2.5 acres). Maps of existing landcover and proposed landcover at Leetown Park are provided in the Appendix.

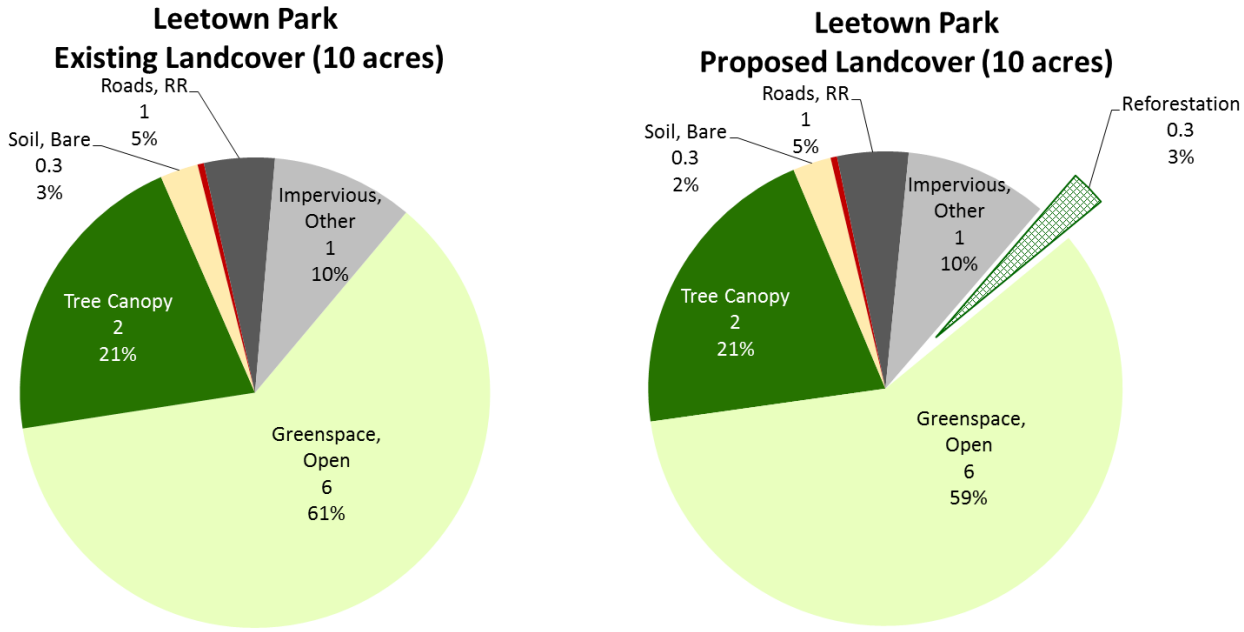


Figure 16 – Existing Landcover at Leetown Park (left) and Proposed landcover (right)

It is recommended that JCPRC inventory the existing 2 acres of tree canopy, particularly trees directly around structures, parking areas, walking trails, and other high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree.

JCPRC currently mows 6.4 acres of greenspace and opens areas at Leetown Park at an estimated cost of $2,122 annually. By converting 0.3 acres to more sustainable land management practices, JCPRC could save $94 annually.

VUE analysis was not applied for Leetown Park because VUE did not find any Tree Canopy due to programmatic limitations from utilizing low-resolution (30m) aerial imagery.

Specific site recommendations for converting 0.3 acres of Greenspace, Open to reforestation should be created before making those land management practice changes.

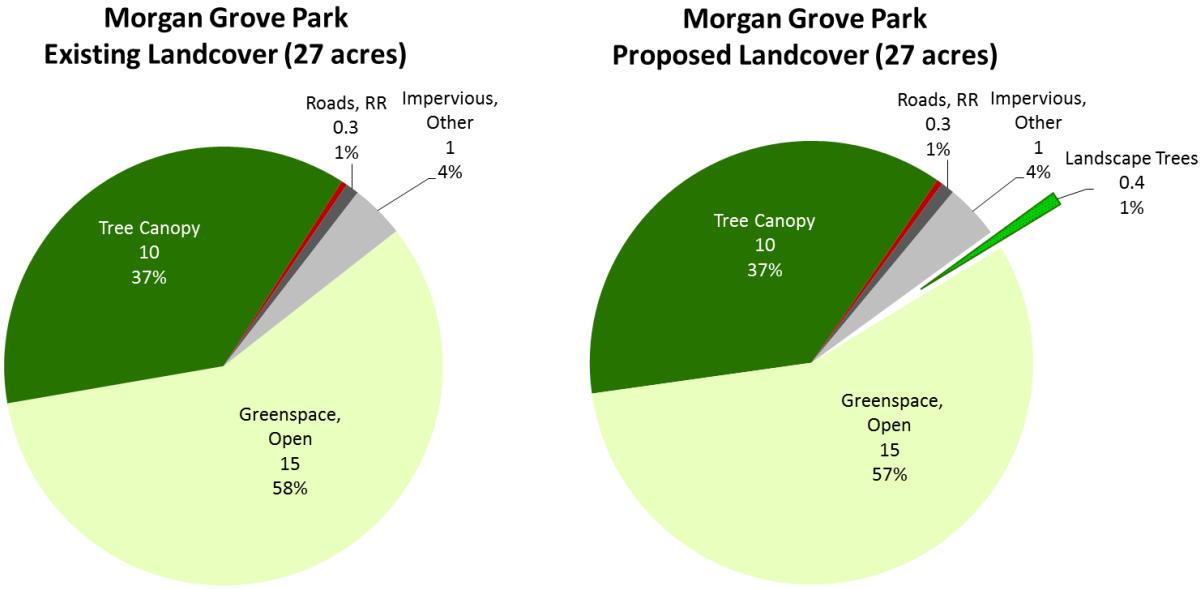
Additionally, JCPRC should continue to maintain the twelve mixed species shade trees planted through WV Project CommuniTree in spring 2013 at Leetown Park. Specific maintenance tasks, based off of Cacapon Institute's 2014 inventory of conservation projects, include mulching the trees to reduce competition with weeds and foster good root growth, pruning the trees to maintain healthy structure and growth, and re-planting 1 white oak tree that is in severe stages of decline due to physical injuries. In all cases, extreme diligence should be given to watering newly planted trees until they are well established.

Morgan Grove Park

Morgan Grove Park (27 acres) is located at 4198 Kearneysville Pike, Shepherdstown, WV 25443.

> *"With over twenty acres of shade trees, meadows, playgrounds, and spring-fed streams, this popular park serves as an idyllic site for community gatherings and events. A 1500 square foot covered picnic pavilion with a full kitchen and restroom facility offers the perfect place to host family events as well as corporate functions. Other features of the park include playground equipment, soccer fields, sand volleyball, horseshoe pits, and a 3/4 mile walking trail."* – JCPRC website

The majority of Morgan Grove Park is Greenspace, Open (58%, 15 acres) and a significant percentage of the park is Tree Canopy (37%, 10 acres)(Figure 17). Cacapon Institute proposes converting 1% of the landcover (0.4 acres) from Greenspace, Open. This would increase Tree Canopy from 37% to 38% (9.8 to 10.2 acres). Maps of existing landcover and proposed landcover at Morgan Grove Park are provided in the Appendix.



It is recommended that JCPRC inventory the existing 10 acres of tree canopy, particularly trees directly around structures, parking areas, walking trails, and other high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree. Work is currently being conducted by the park's owner, Shepherdstown Community Club, to "Help Save the Ash Trees at Morgan's Grove Park". More information about what the Shepherdstown Community Club is

Figure 17 – Existing Landcover at Morgan Grove Park (left) and Proposed landcover (right)

doing to protect its ash trees on their website, www.shepherdstowncc.org. JCPRC currently mows 15.4 acres of greenspace and opens areas at Morgan Grove Park at an estimated cost of $5,109 annually. By converting 0.4 acres to different land management practices, JCPRC could save $127.31 annually. It is important to note that mowing costs are most likely higher at Morgan Grove Park than this estimate because the maintenance department mows under the majority of the existing Tree Canopy, particularly in the northern and eastern sections of the park.

VUE analysis estimates Morgan Grove Park's existing tree canopy provides $2,445 in environmental benefits annually. Compared to the UVM analysis, VUE underestimated the Tree Canopy by 7.5 acres (76.6%).

Specific site recommendations for converting 0.43 acres of Greenspace, Open to Landscape Trees should be created before making those land management practice changes.

Additionally, JCPRC should continue to maintain the trees planted through WV Project CommuniTree over the past several years including 24 flowering trees planted in Fall 2013, 24 mixed species planted in Spring 2014, and 16 mixed species planted in Fall 2014. Specific maintenance tasks, based off of Cacapon Institute's 2014 inventory of conservation projects, include mulching the trees to reduce competition with weeds and foster good root growth, removing stakes and arbor straps to allow for natural tree stabilization, weeding to reduce competition, and re-planting 1 eastern redbud tree that has died. Additional volunteer tree planting projects at Morgan Grove Park should also be inventoried and maintained. In all cases, extreme diligence should be given to watering newly planted trees until they are well established.

Moulton Park

Moulton Park (3 acres) is located at 716 Bloomery Road, Charles Town, WV 25414.

> *"On the shore of the Shenandoah River, just north of the Bloomery Bridge, this half-mile of river frontage features camping and other recreational opportunities. The well-shaded, quiet hammock of foliage creates inviting habitat for squirrels, birds, and waterfowl. Come check out the new boat, camp sites, picnic tables, fire its, parking access & more!"* – JCPRC website

The majority of Moulton Park is Tree Canopy (51%, 1.5 acres) and a significant percentage of the park is Greenspace, Open (37%, 1.1 acres)(Figure 18). Cacapon Institute proposes converting 2% of the landcover (0.07 acres) from Greenspace, Open to Landscape Trees and converting 7% of the landcover (0.19 acres) from Greenspace, Open to Reforestation. This would increase Tree Canopy from 51% to 60% (1.5 to 1.8 acres). Maps of existing landcover and proposed landcover at Moulton Park are provided in the Appendix.

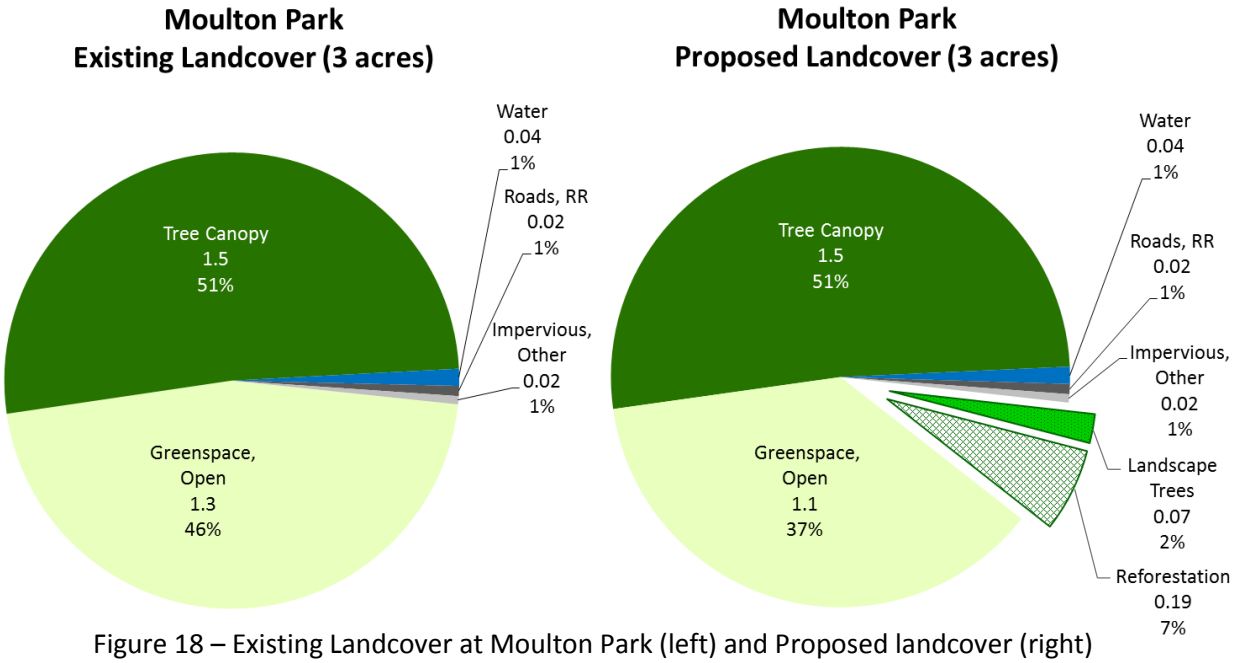


Figure 18 – Existing Landcover at Moulton Park (left) and Proposed landcover (right)

JCPRC currently mows 1.3 acres of greenspace and opens areas at Moulton Park at an estimated cost of $446 annually. By converting 0.3 acres to more sustainable land management practices, JCPRC could save $85 annually.

VUE analysis was not run for Moulton Park because the park acreage is too small for statistical accuracy.

It is recommended that JCPRC inventory the existing 1.5 acres of tree canopy, particularly trees directly around structures, parking areas, walking trails, Bloomery Road, and other high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree.

Actions have already been taken for converting 0.3 acres of Greenspace, Open to 0.07 acres of Landscape Trees and 0.19 acres of reforestation at Moulton Park through WV Project CommuniTree volunteer community tree plantings. Steps should be taken for cultivating those trees and maintaining them in good health.

WV Project CommuniTree plantings in need of maintenance at Moulton Park include 24 flowering trees planted in spring 2014 and 100 mixed riparian species planted in fall 2014. Specific maintenance tasks, based off of Cacapon Institute's 2014 inventory of conservation projects, include mulching the trees to reduce competition with weeds and foster good root growth and re-planting 4 eastern redbud trees that have died. In all cases, extreme diligence should be given to watering newly planted trees until they are well established.

Mount Mission Park

Mount Mission Park (2 acres) is located at 4210 Mission Road, Harpers Ferry, WV 25425.

> *"This picturesque three and one-half acre park is located on Mission Road, near Shannondale. Shaded by oak and maple trees, the picnic pavilion, complete with restroom and kitchen facilities has played host to family reunions, weddings, receptions, and birthday parties. An old church on site, a playground, horseshoe pits, sand volleyball and a baseball diamond make this park a convenient site for neighborhood get-togethers."*
>
> – JCPRC website

The two major types of landcover at Mount Mission Park are Greenspace, Open (47%, 0.87 acres) and Tree Canopy (43%, 0.79 acres)(Figure 19). Cacapon Institute proposes converting 6% of the landcover (0.1 acres) from Greenspace, Open to Landscape Trees to provide a visual buffer between the park and nearby roads. This would increase Tree Canopy from 43% to 49% (0.79 to 0.89 acres). Maps of existing landcover and proposed landcover at Mount Mission Park are provided in the Appendix.

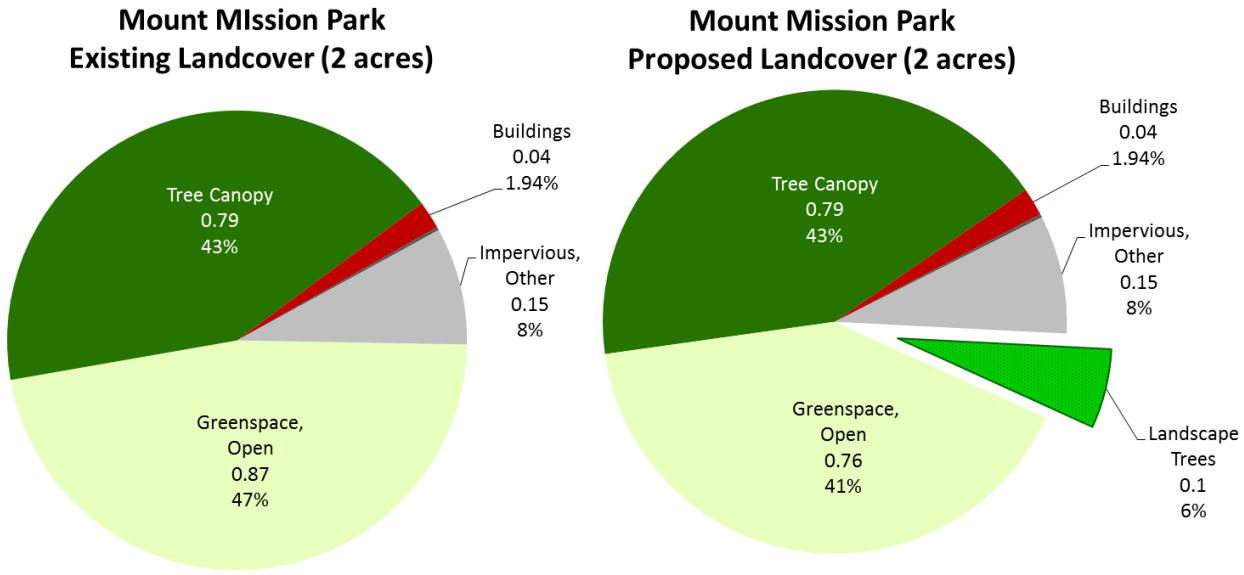


Figure 19 – Existing Landcover at Mount Mission Park (left) and Proposed landcover (right)

JCPRC currently mows 0.87 acres of greenspace and opens areas at Mount Mission Park at an estimated cost of $288 annually. By converting 0.1 acres to more sustainable land management practices, JCPRC could save $37 annually.

VUE analysis was not run for Mount Mission Park because the park acreage is too small for statistical accuracy.

It is recommended that JCPRC inventory the existing .79 acres of tree canopy, particularly trees directly around structures, parking areas, walking trails, and other high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree.

Sam Michaels Park

Sam Michaels Park (138 acres) is located at 235 Sam Michael's Lane, Shenandoah Junction, WV 25442.

> *"The private setting of this park offers the perfect place to host weddings, wedding receptions, and reunions and other family events. The well shaded picnic pavilion offers an adjacent kitchen and restroom facility. The sparse acreage lends well to community events such as concerts, dog shows, festivals, and more. Nestled within the park are little league fields, home of Jefferson County Parks and Recreation; Community Center, athletic fields, playgrounds, horseshoe pits, and a sand volleyball court. Our special event field is used as a dog park throughout the year, with the exception of scheduled special events such as the Mountain Heritage Arts & Crafts Festival, Fireworks, and other periodic events."* – JCPRC website

The majority landcover at Sam Michaels Park is Greenspace, Open (69%, 95 acres) and there is a significant amount of Tree Canopy (24%, 33 acres)(Figure 20). Cacapon Institute proposes converting 2% of the landcover (3 acres) from Greenspace, Open to Landscape Trees and 6% of the landcover (9 acres) from Greenspace, Open to Reforestation. This would increase Tree Canopy from 24% to 33% (33 to 45 acres). Additionally, Cacapon Institute proposes that 8% of the landcover (11 acres) should be converted from Greenspace, Open to Grasslands. Maps of existing landcover and proposed landcover at Sam Michaels Park are provided in the Appendix.

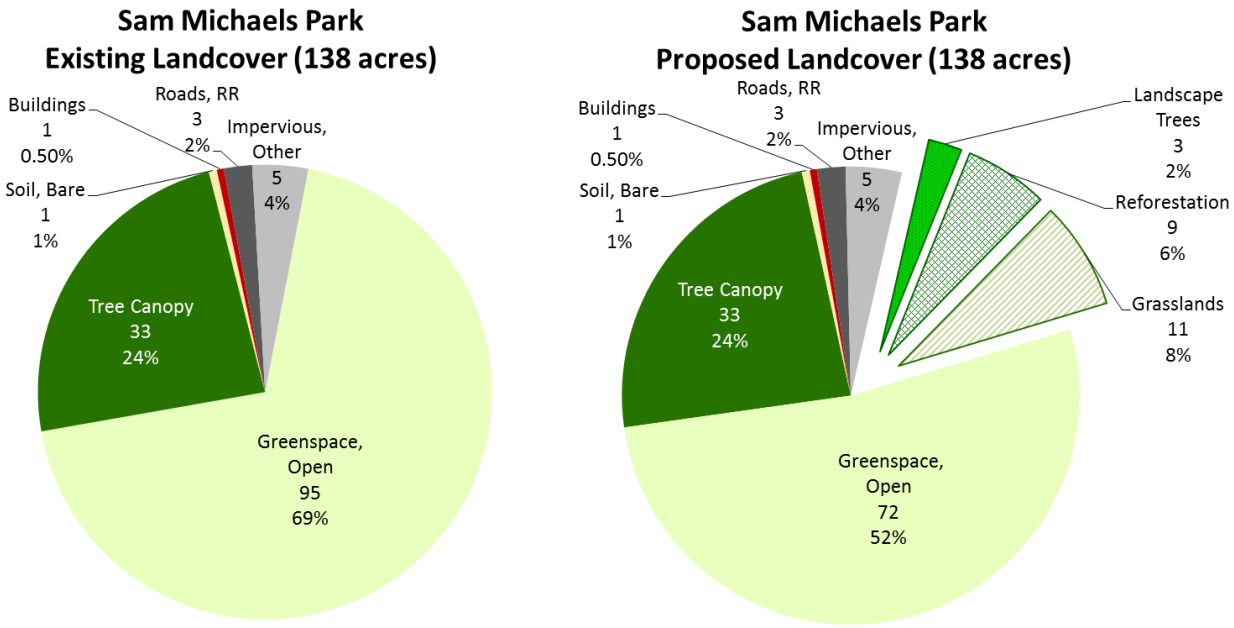


Figure 20 – Existing Landcover at Sam Michaels Park (left) and Proposed landcover (right)

JCPRC currently mows 95.4 acres of greenspace and opens areas at Sam Michaels Park at an estimated cost of $31,558 annually. By converting 23 acres to different land management practices, JCPRC could save $7,636 annually.

VUE analysis estimates Sam Michaels Park's existing tree canopy provides $15,683 in environmental benefits annually. Compared to the UVM analysis, VUE underestimated the Tree Canopy by 18 acres (54.9%).

It is recommended that JCPRC inventory the existing 33 acres of tree canopy, particularly trees directly around structures, parking areas, walking trails, and other high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree.

Actions have already been taken for converting 12 acres of Greenspace, Open to 3 acres of Landscape Trees and 9 acres of reforestation at Sam Michaels Park through WV Project CommuniTree volunteer community tree plantings and other community tree planting events. Steps should be taken for cultivating those trees and maintaining them in good health.

WV Project CommuniTree plantings in need of maintenance at Moulton Park include 12 shade trees planting in fall 2012 and 24 mixed trees species planted in spring 2014. Specific maintenance tasks, based off of Cacapon Institute's 2014 inventory of conservation projects, include mulching the trees to reduce competition with weeds and foster good root growth, removing stakes and arbor straps to allow for natural tree stabilization, weeding to reduce competition, and re-planting 3 flowering trees from the 2014 planting that have died. In all cases, extreme diligence should be given to watering newly planted trees until they are well established. Additional volunteer tree planting projects at Morgan Grove Park should also be inventoried and maintained.

Starting in summer 2014, JCPRC maintenance crews began to create the Grasslands areas described in this report by reducing mowing in those areas from 25 times per year to 1-2 times per year to remove woody vegetation (i.e., trees and shrubs). These areas should be monitored so as to keep invasive species from colonizing and outcompeting native flowers and grasses for resources.

South Jefferson Park

South Jefferson Park (73 acres) is located at 4095 Leetown Road, Summit Point, WV 25446.

> *"Located on Route 1, between Summit Point and Middleway, this park accommodates six baseball fields, tennis courts, concession stand, a playground, and basketball court. It's a great place to relax and spend a day in the park."* – JCPRC website

The majority landcover at South Jefferson Park is Greenspace, Open (84%, 61 acres) and there is a small amount of Tree Canopy (12%, 9 acres)(Figure 21). Cacapon Institute proposes converting 3% of the landcover (2 acres) from Greenspace, Open to Landscape Trees and 42% of the landcover (31 acres) from Greenspace, Open to Reforestation. This would significantly increase Tree Canopy from 12% to 57% (9 to 41 acres). Maps of existing landcover and proposed landcover at South Jefferson Park are provided in the Appendix.

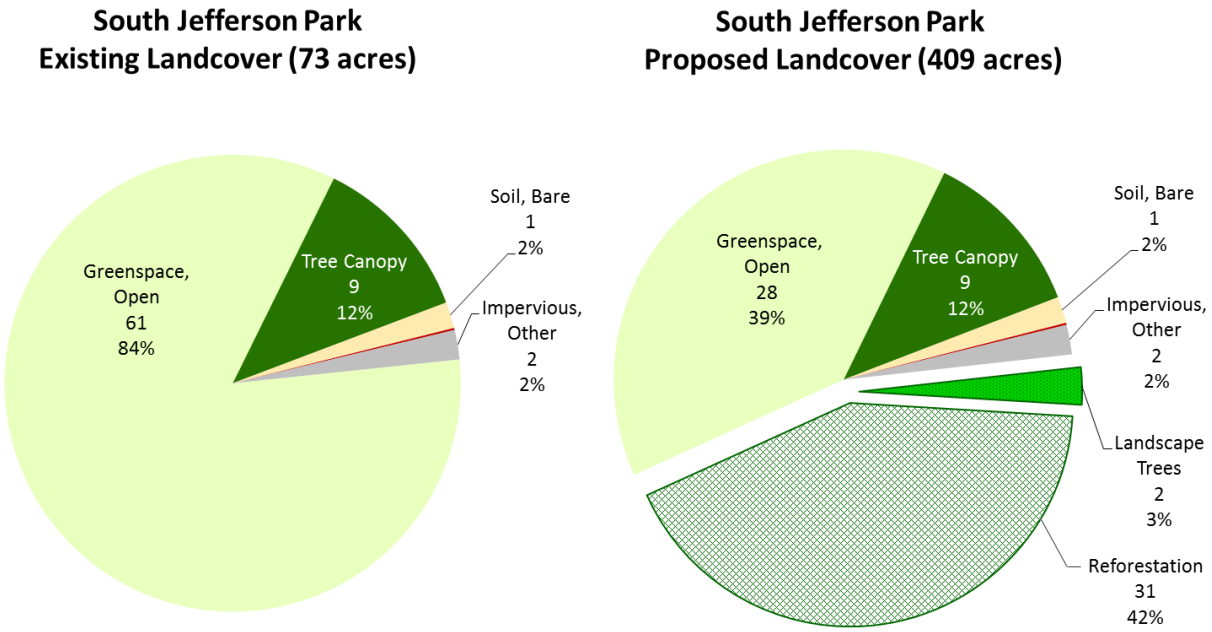


Figure 21 – Existing Landcover at South Jefferson Park (left) and Proposed landcover (right)

JCPRC currently mows 60.9 acres of greenspace and opens areas at South Jefferson Park at an estimated cost of $20,167 annually. By converting 33 acres to more sustainable land management practices, JCPRC could save $10,801 annually.

VUE analysis estimates South Jefferson Park's existing tree canopy provides $2,989 in environmental benefits annually. Compared to the UVM analysis, VUE underestimated the Tree Canopy by 5.9 acres (67.7%).

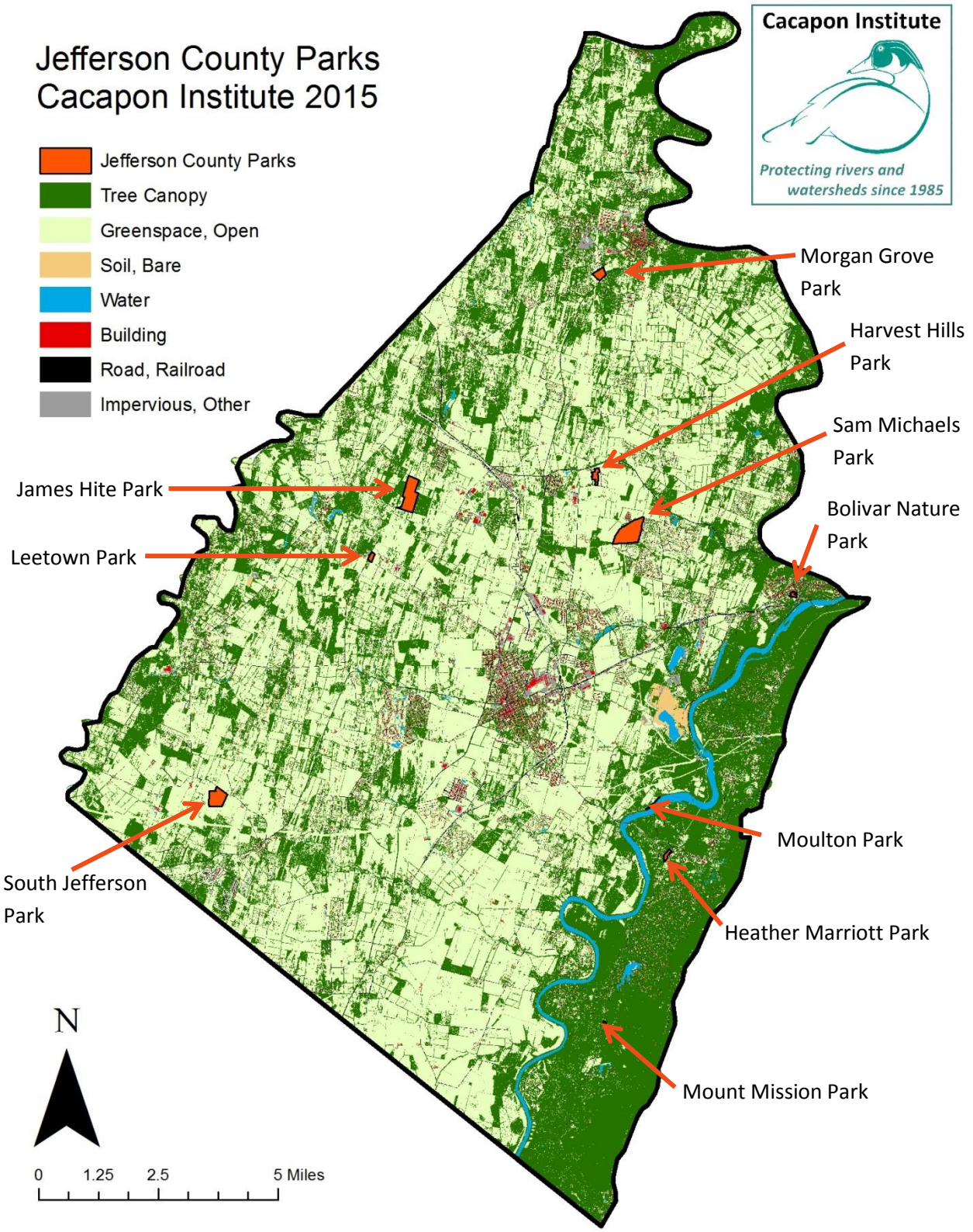
It is recommended that JCPRC inventory the existing 9 acres of tree canopy, particularly trees directly around structures, parking areas, walking trails, and other high-traffic areas to identify beneficial tree species in need of protection and maintenance and invasive species for removal. Particular care should be given to trees that are declining in health and tree care professionals should be consulted on best management practices for protecting and maintaining those trees, and when no other options are available, safe removal of the tree.

Actions have already been taken for converting 2 acres of Greenspace, Open to Landscape Trees at South Jefferson Park through a WV Project CommuniTree volunteer community tree planting. Steps should be taken for cultivating those trees and maintaining them in good health.

The WV Project CommuniTree planting in need of maintenance at Moulton Park is 16 shade trees planted in spring 2014. Specific maintenance tasks, based off of Cacapon Institute's 2014 inventory of conservation projects, include mulching the trees to reduce competition with weeds and foster good root growth, weeding to reduce competition, and re-planting 2 shade trees that have died. In all cases, extreme diligence should be given to watering newly planted trees until they are well established.

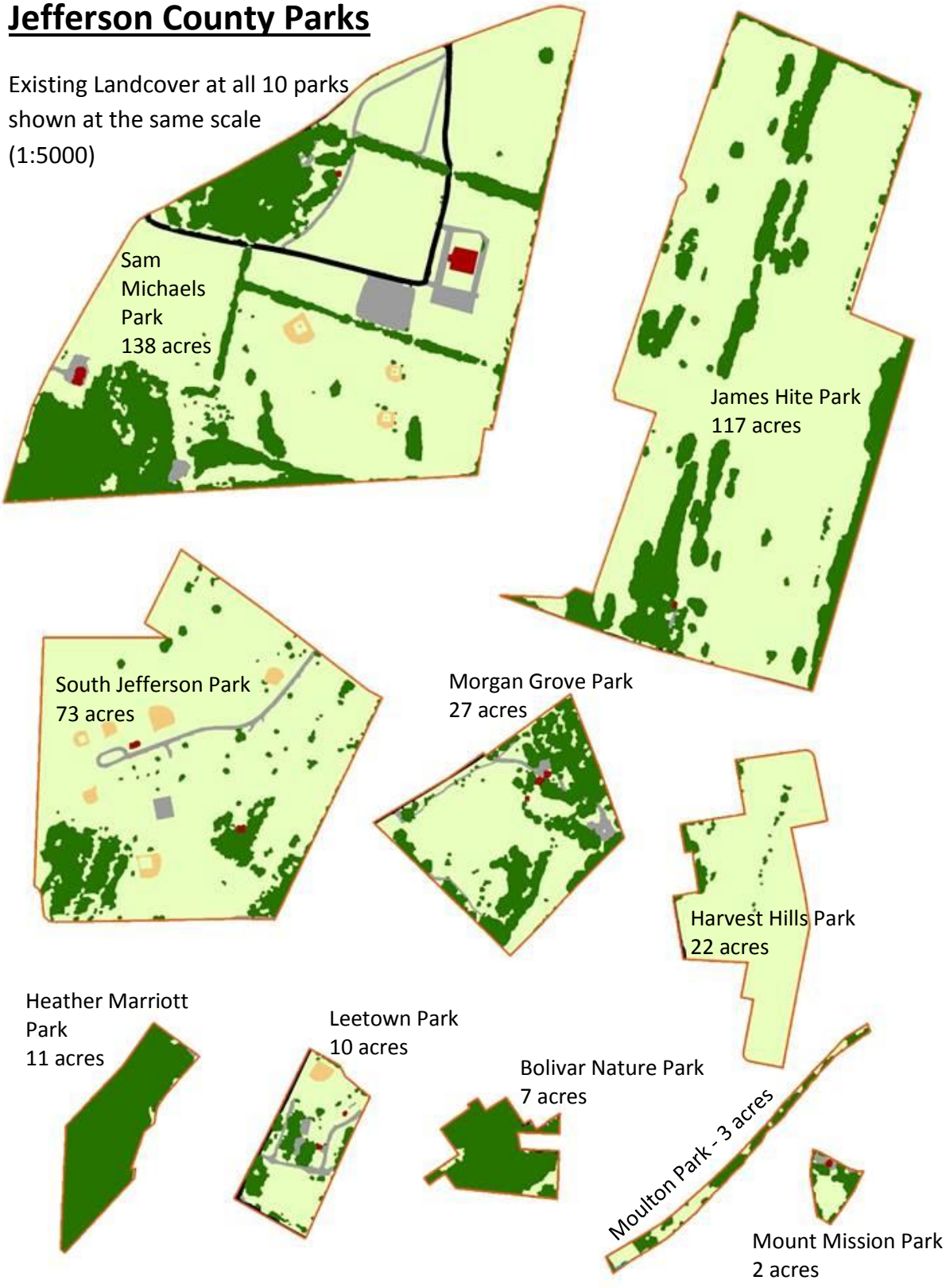
Additionally, for the past several years, JCPRC maintenance crews have begun to allow some of the 31 acres proposed to become reforestation areas in this report to naturally regenerate. These areas should be monitored so as to keep invasive species from colonizing and outcompeting native trees and shrubs for resources.

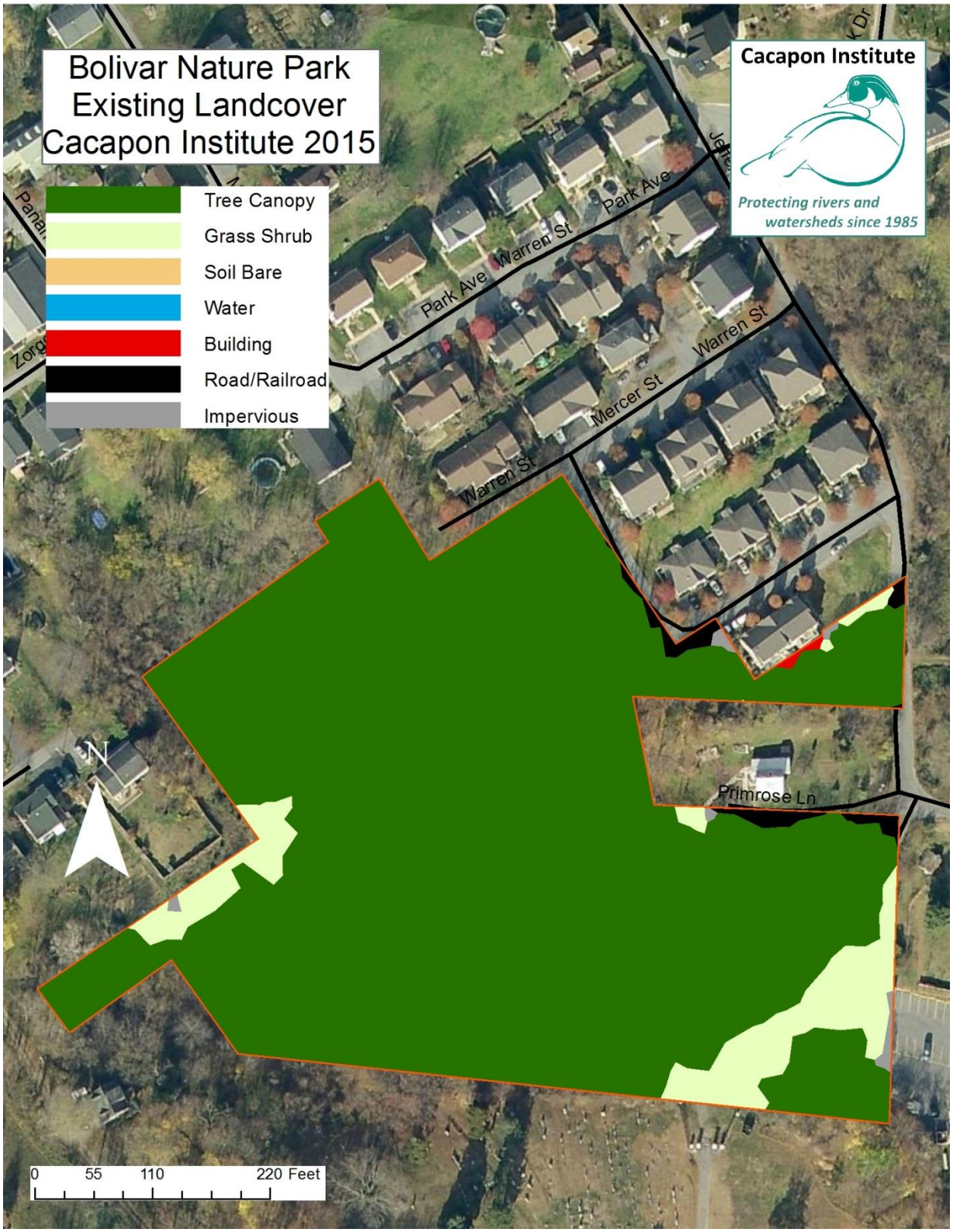
Appendix

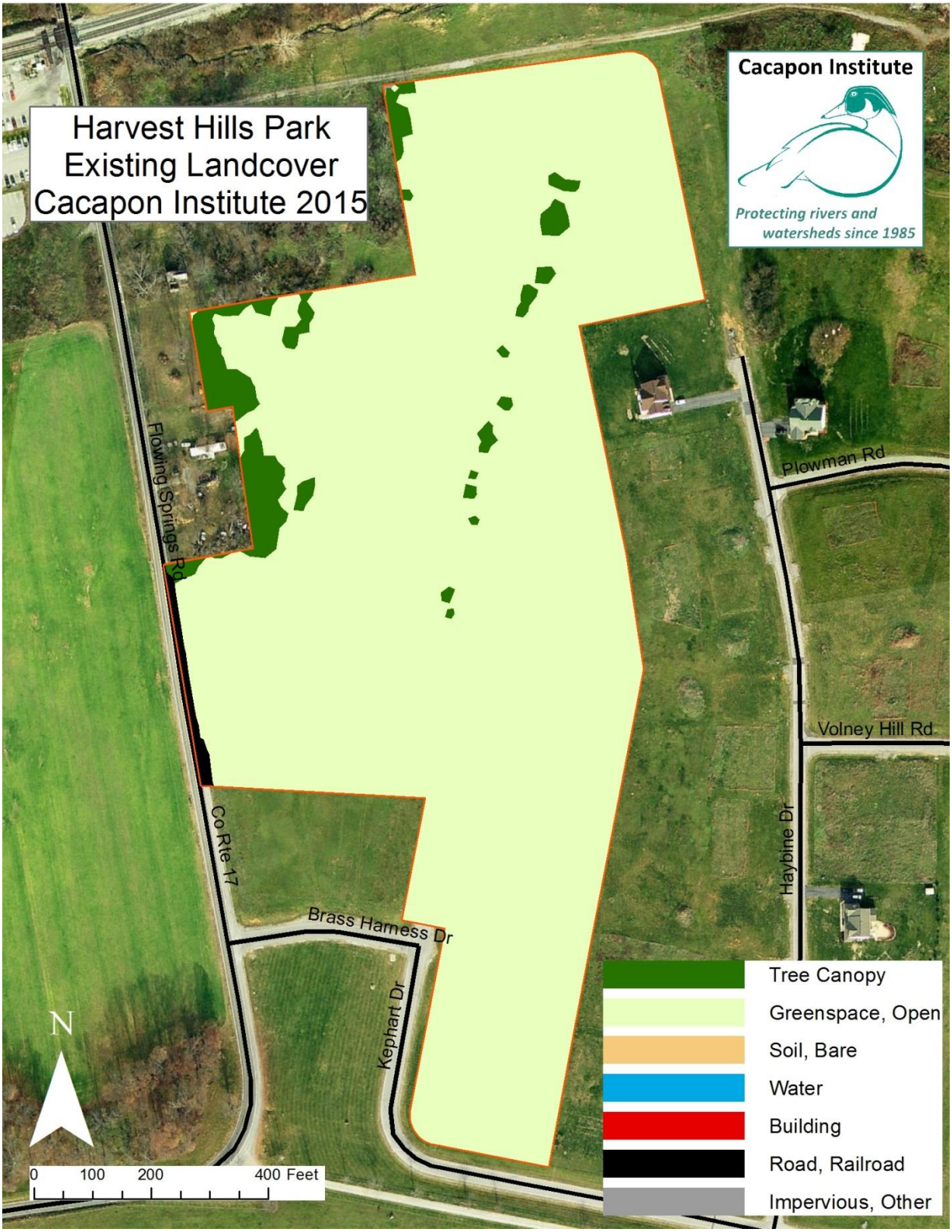

Jefferson County Parks
Cacapon Institute 2015
Jefferson County Parks
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Cacapon Institute
Protecting rivers and watersheds since 1985
Morgan Grove Park
Harvest Hills Park
Sam Michaels Park
James Hite Park
Bolivar Nature Park
Leetown Park
Moulton Park
South Jefferson Park
Heather Marriott Park
Mount Mission Park
N
0
1.25
2.5
5 Miles

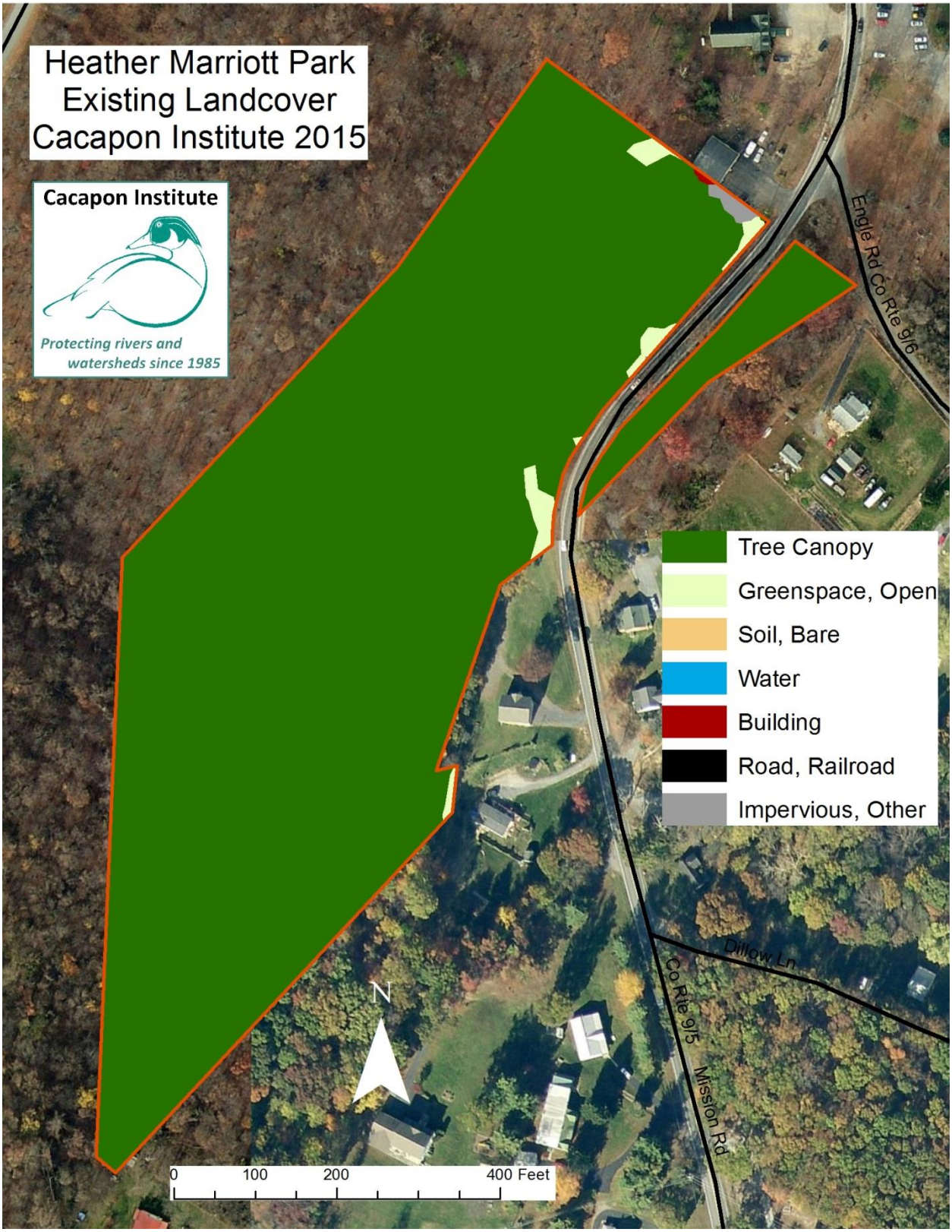
Jefferson County Parks

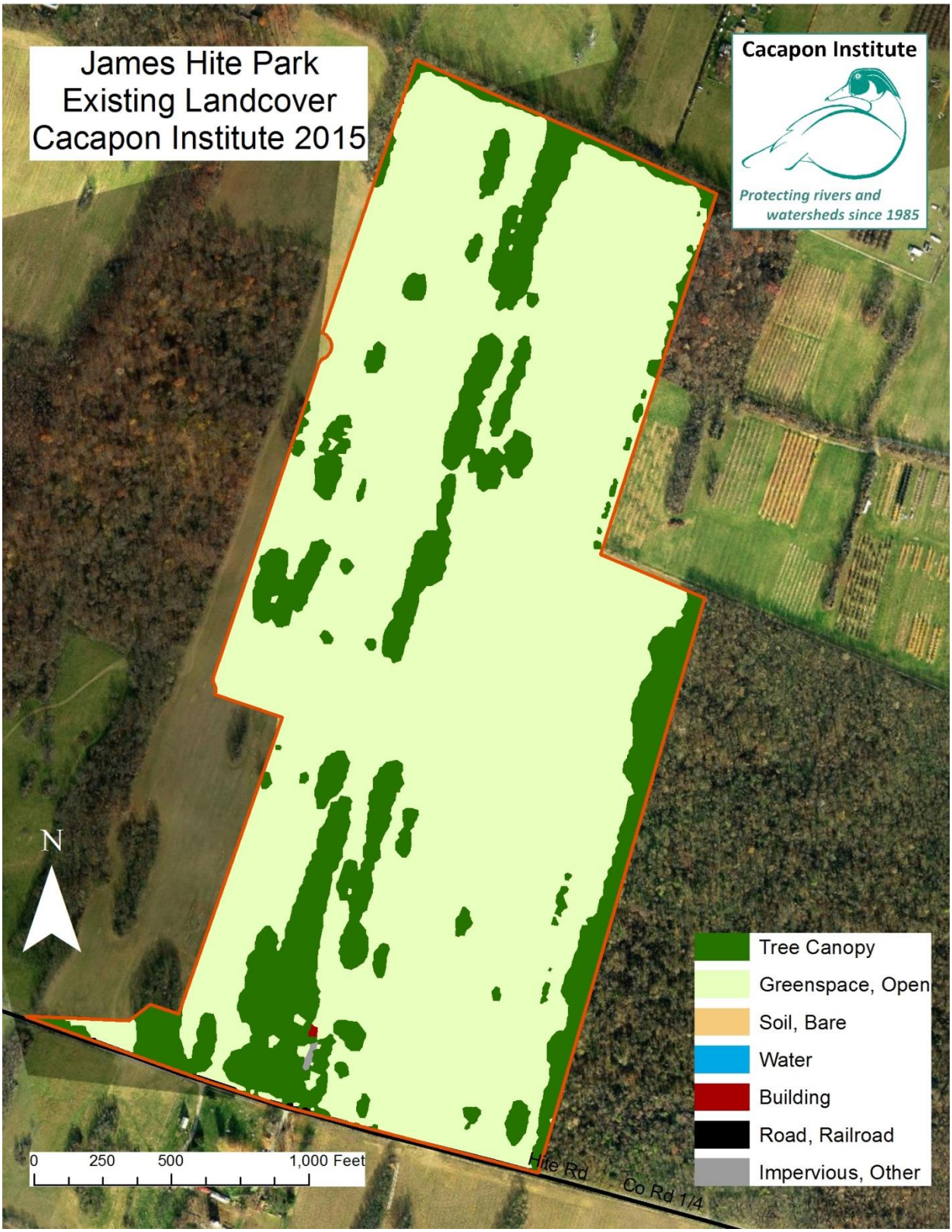
Existing Landcover at all 10 parks shown at the same scale (1:5000)

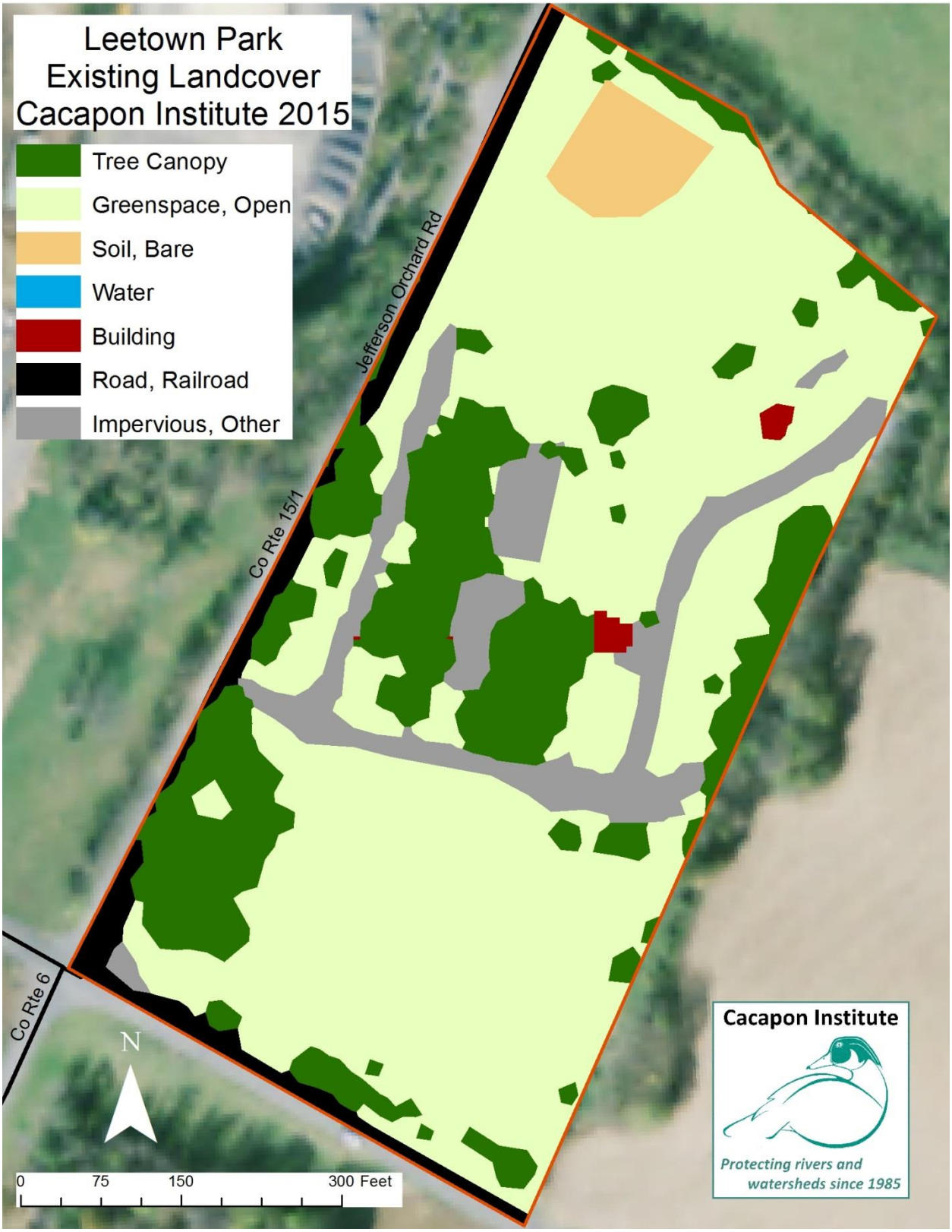


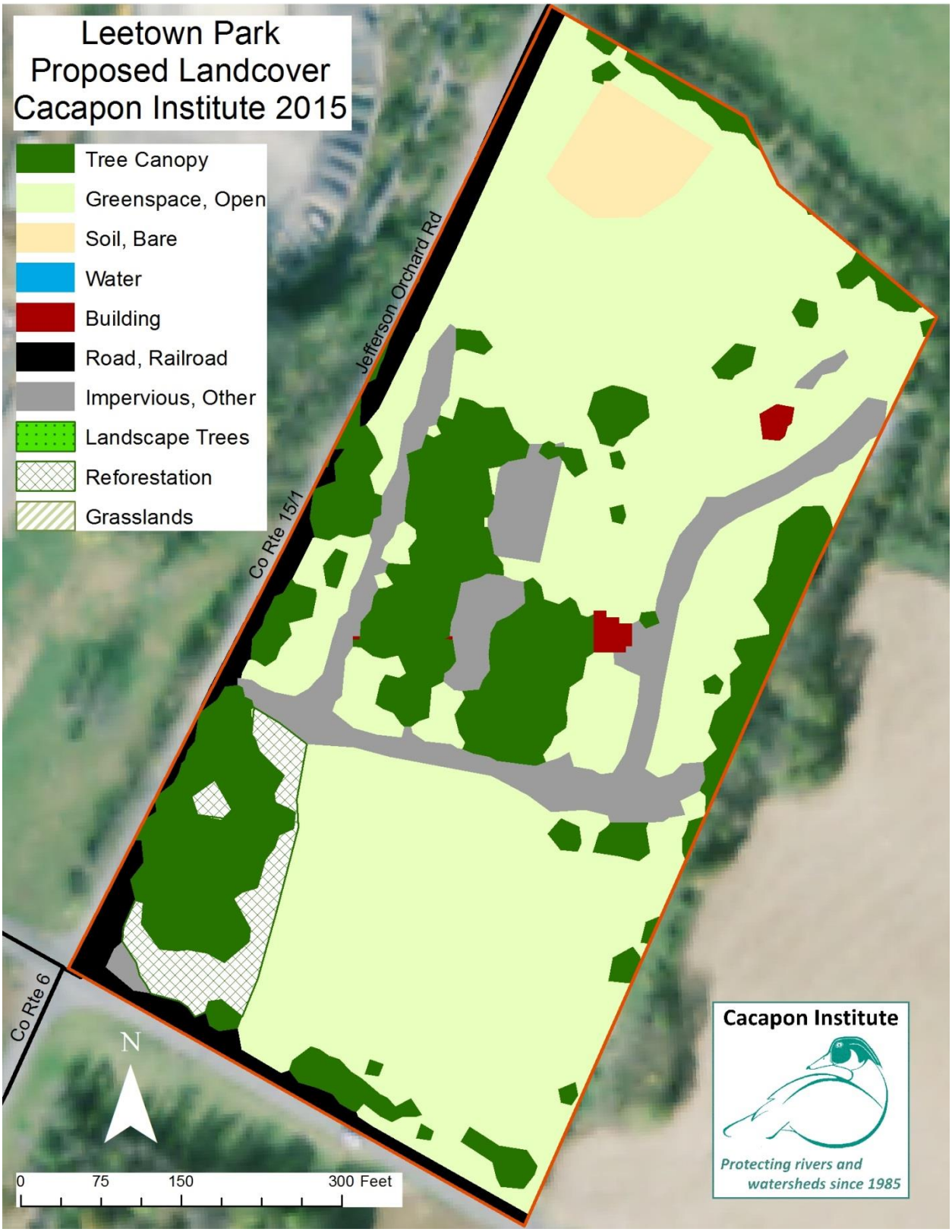

Bolivar Nature Park
Existing Landcover
Cacapon Institute 2015
Tree Canopy
Grass Shrub
Soil Bare
Water
Building
Road/Railroad
Impervious
Cacapon Institute
Protecting rivers and watersheds since 1985
Park Ave
Warren St
Park Ave
Warren St
Mercer St
Warren St
Primrose Ln
N
0 55 110 220 Feet

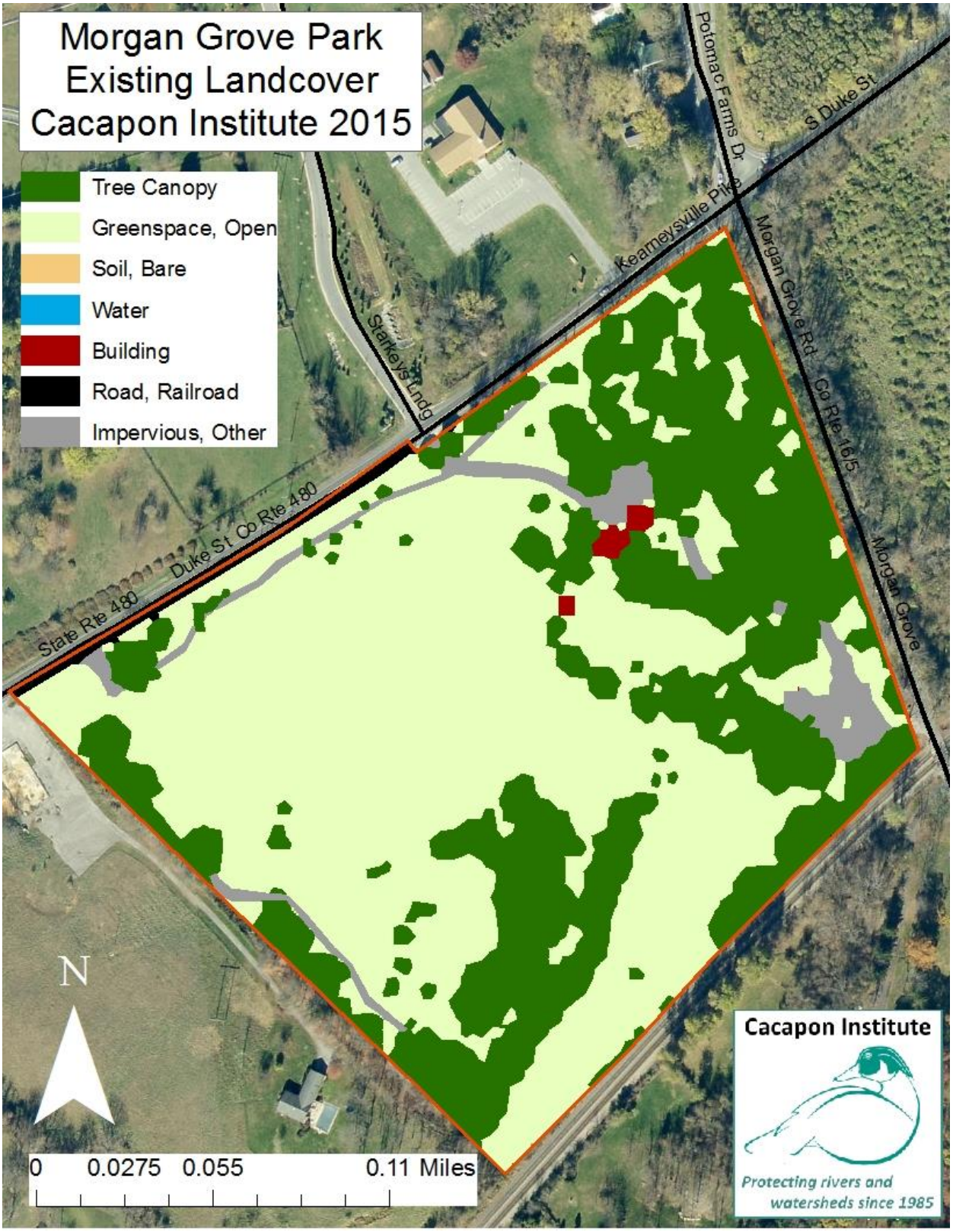

Harvest Hills Park
Existing Landcover
Cacapon Institute 2015
Cacapon Institute
Protecting rivers and watersheds since 1985
Flowing Springs Rd
Plowman Rd
Volney Hill Rd
Haybine Dr
Co Rte 17
Brass Harness Dr
Kephart Dr
N
0 100 200 400 Feet
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other

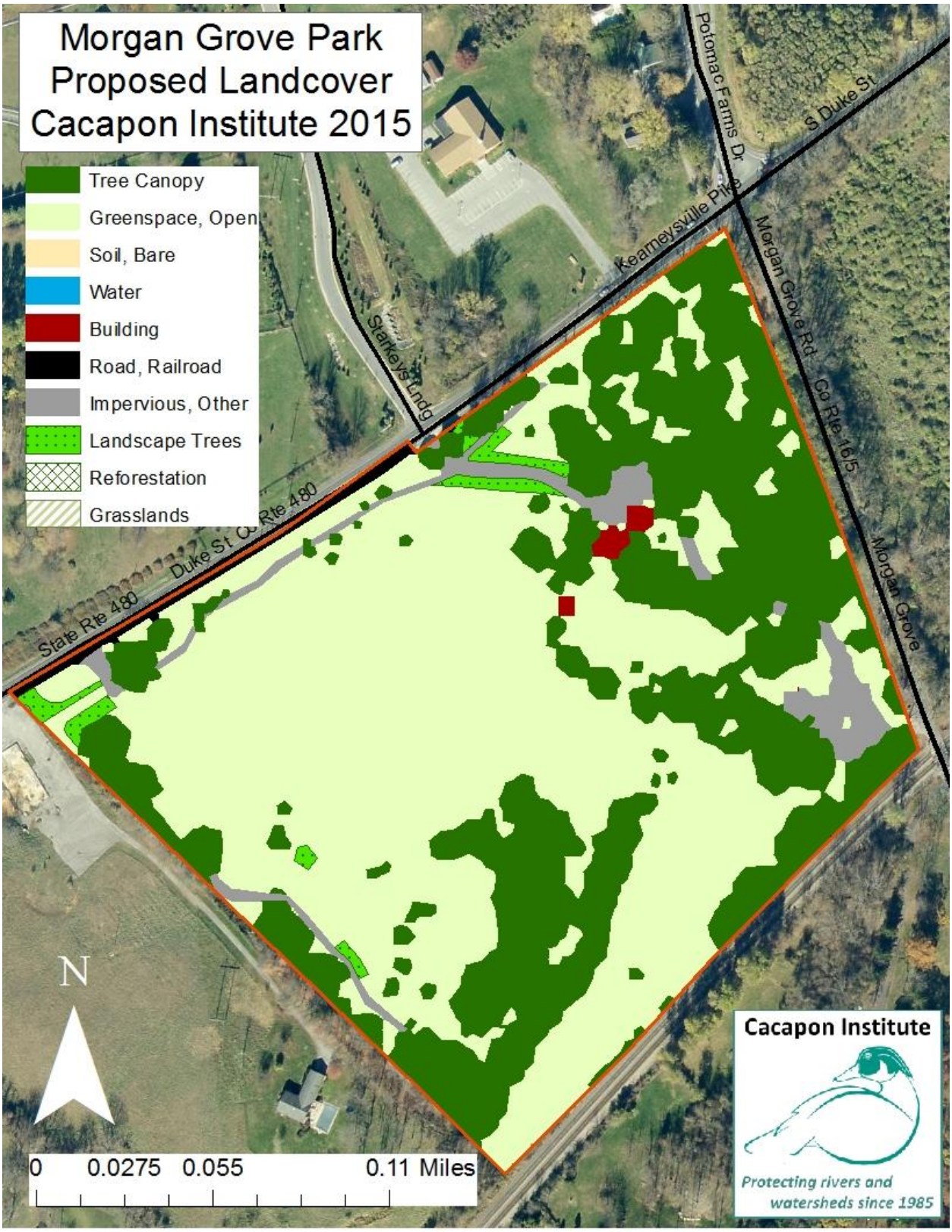

Heather Marriott Park
Existing Landcover
Cacapon Institute 2015
Cacapon Institute
Protecting rivers and watersheds since 1985
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Engle Rd Co Rte 9/6
Dillow Ln
Co Rte 9/5
Mission Rd
N
0
100
200
400 Feet

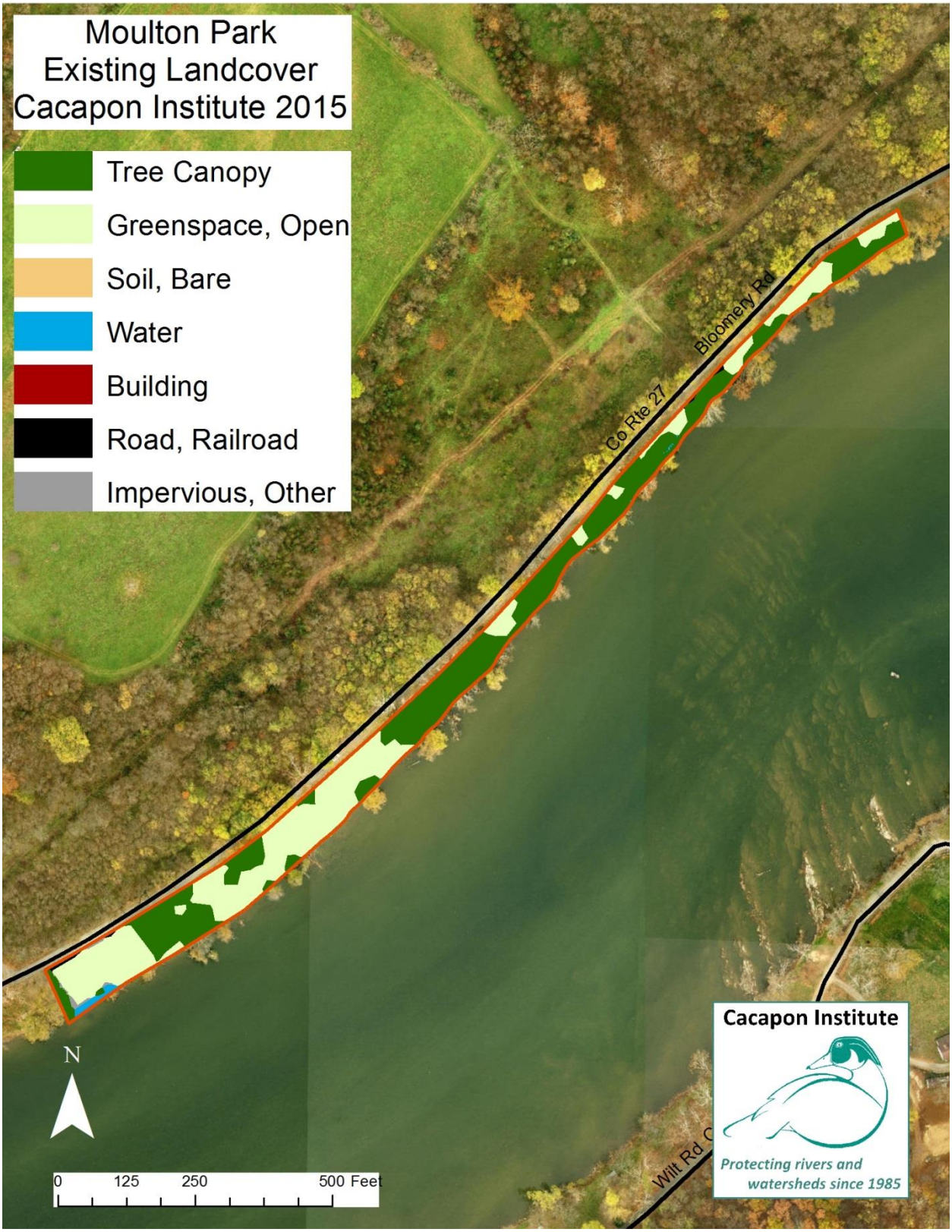

James Hite Park
Existing Landcover
Cacapon Institute 2015
Cacapon Institute
Protecting rivers and watersheds since 1985
N
0 250 500 1,000 Feet
Hite Rd
Co Rd 1/4
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other

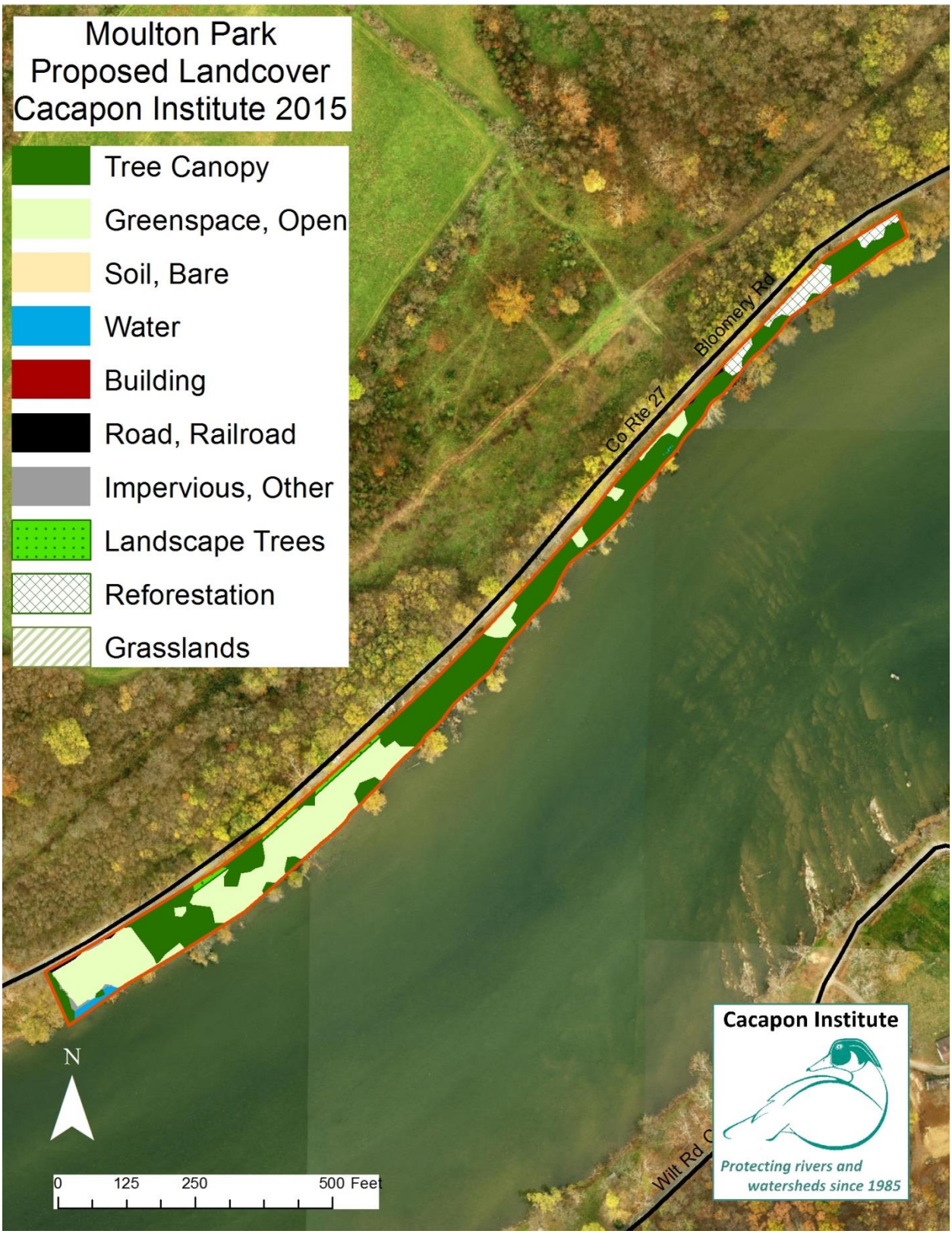

Leetown Park
Existing Landcover
Cacapon Institute 2015
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Jefferson Orchard Rd
Co Rte 15/1
Co Rte 6
N
0
75
150
300 Feet
Cacapon Institute
Protecting rivers and watersheds since 1985

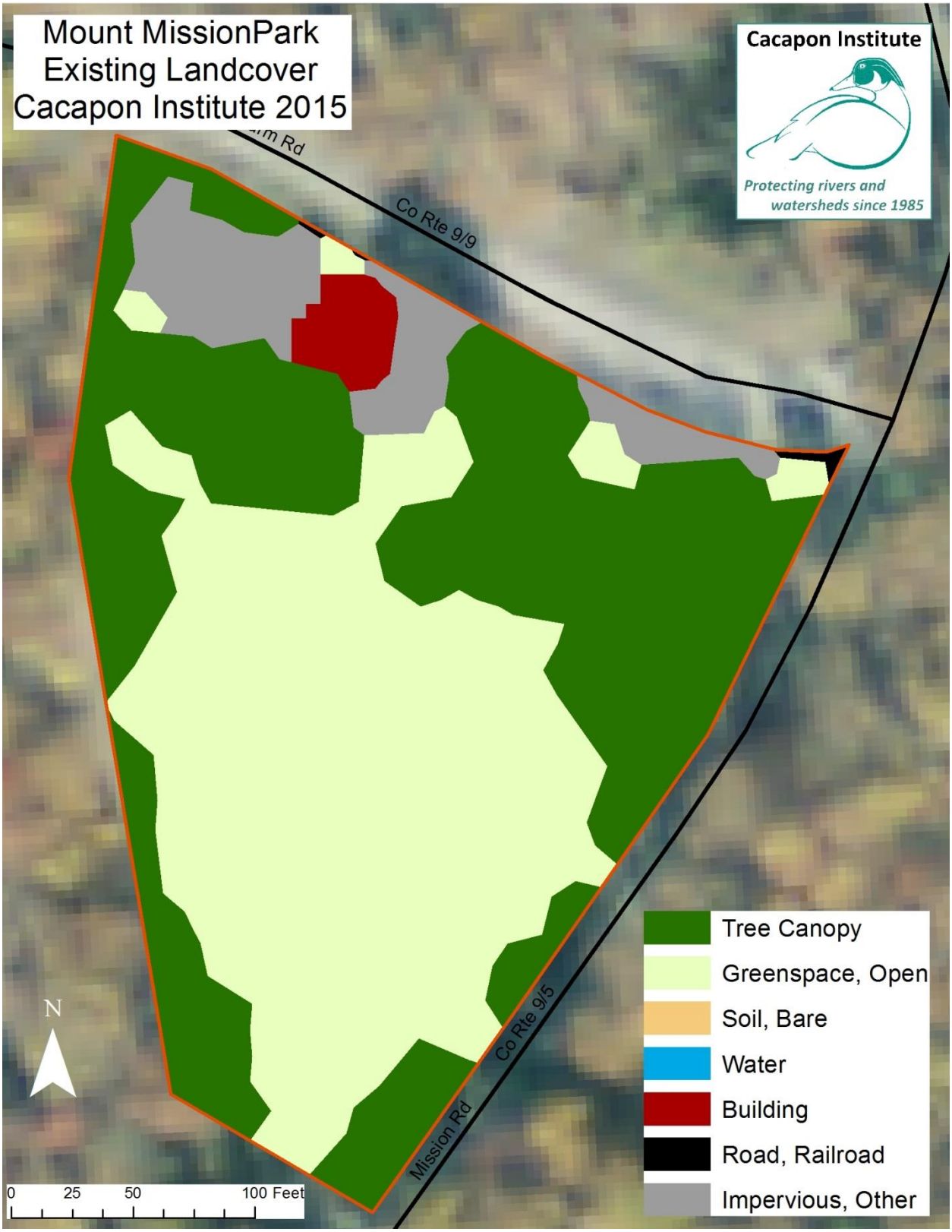

Leetown Park
Proposed Landcover
Cacapon Institute 2015
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Landscape Trees
Reforestation
Grasslands
Jefferson Orchard Rd
Co Rte 15/1
Co Rte 6
N
0
75
150
300 Feet
Cacapon Institute
Protecting rivers and watersheds since 1985

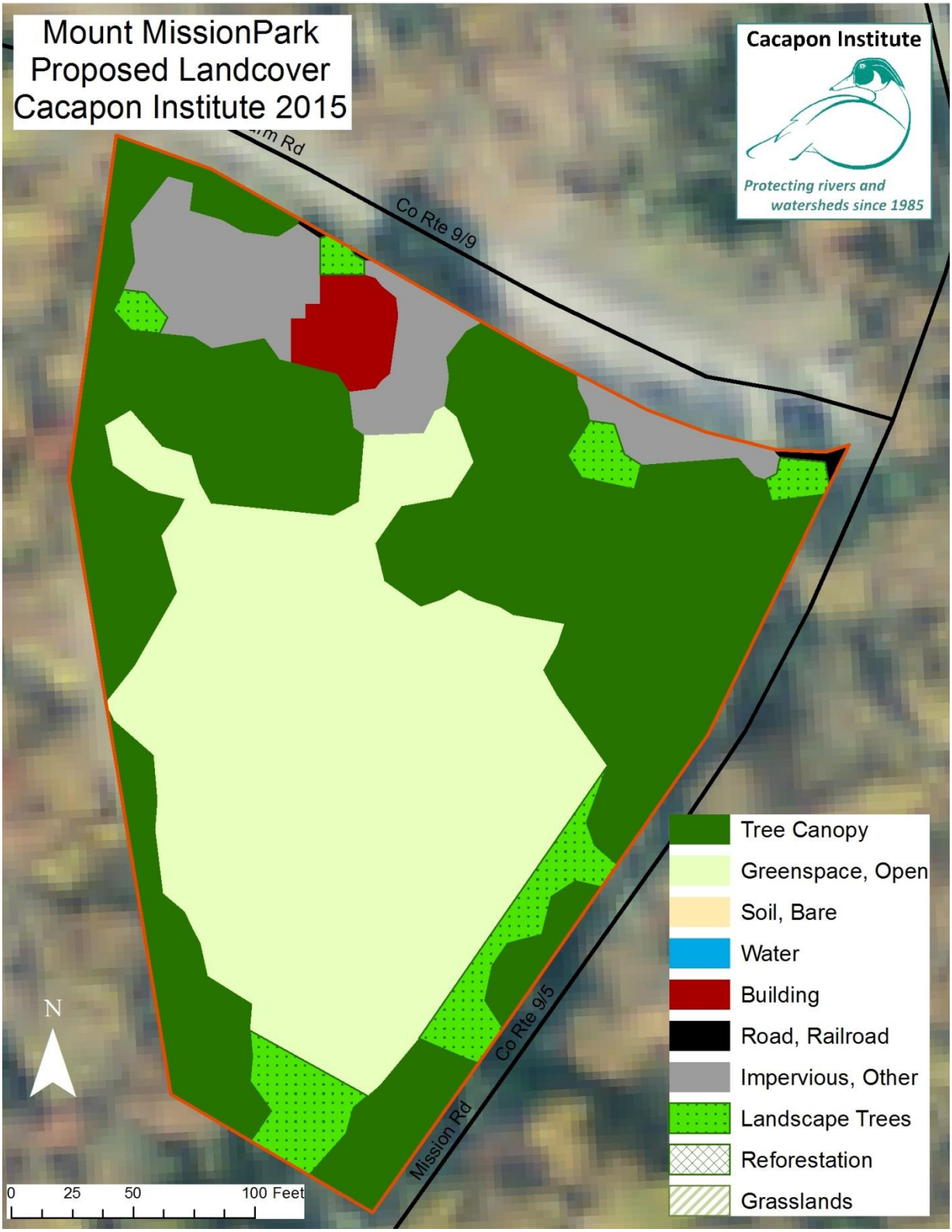

Morgan Grove Park
Existing Landcover
Cacapon Institute 2015
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Potomac Farms Dr
S Duke St
Kearneysville Pike
Morgan Grove Rd Co Rte 16/5
Morgan Grove
Starkeys Lndg
Duke St Co Rte 480
State Rte 480
N
0 0.0275 0.055 0.11 Miles
Cacapon Institute
Protecting rivers and watersheds since 1985

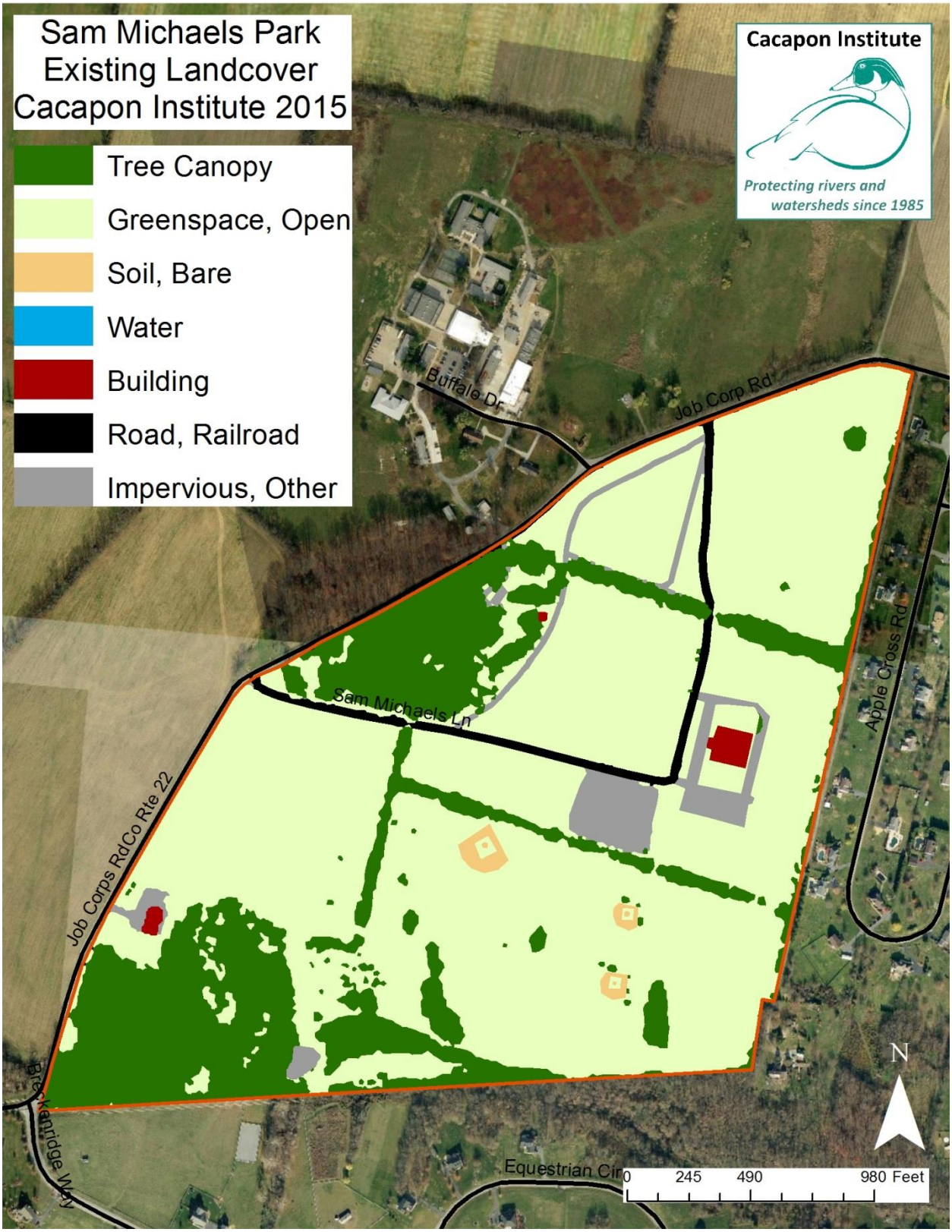

Morgan Grove Park
Proposed Landcover
Cacapon Institute 2015
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Landscape Trees
Reforestation
Grasslands
Potomac Farms Dr
S Duke St
Kearneysville Pike
Morgan Grove Rd
Co Rte 16/5
Morgan Grove
Starkeys Lndg
Duke St Co Rte 480
State Rte 480
N
0
0.0275
0.055
0.11 Miles
Cacapon Institute
Protecting rivers and watersheds since 1985

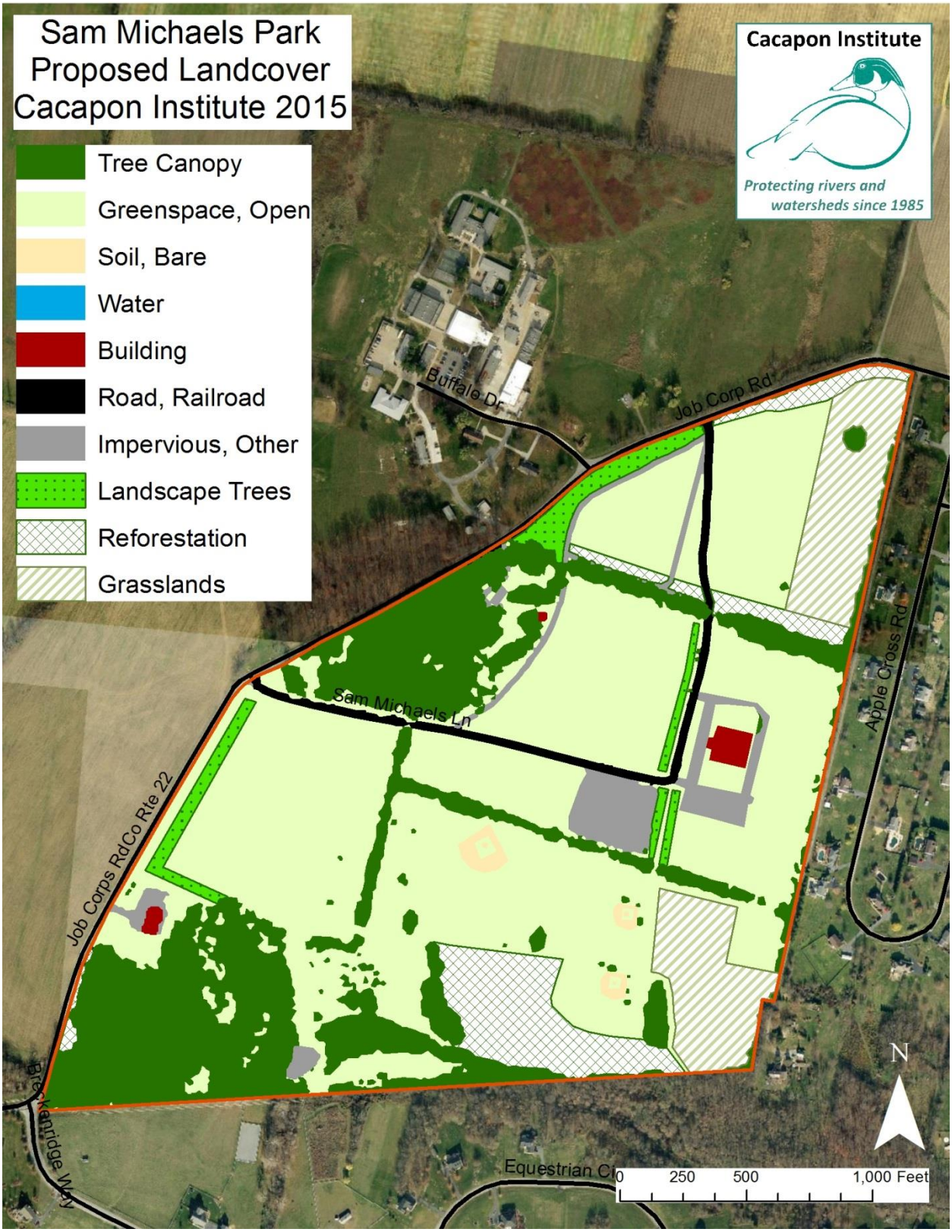

Moulton Park
Existing Landcover
Cacapon Institute 2015
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Bloomery Rd
Co Rte 27
N
0
125
250
500 Feet
Cacapon Institute
Protecting rivers and watersheds since 1985

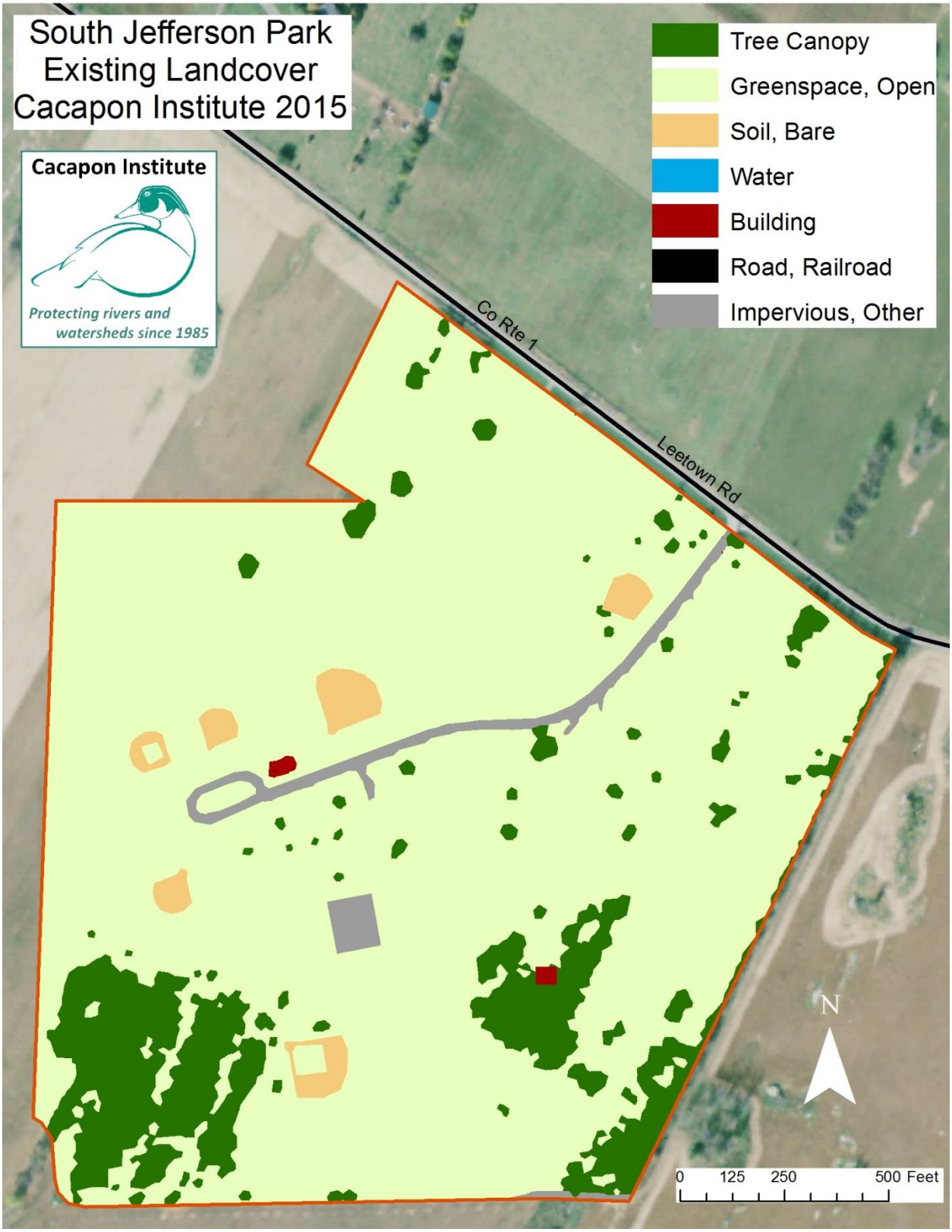

Moulton Park
Proposed Landcover
Cacapon Institute 2015
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Landscape Trees
Reforestation
Grasslands
Bloomery Rd
Co Rte 27
N
0
125
250
500 Feet
Cacapon Institute
Protecting rivers and watersheds since 1985

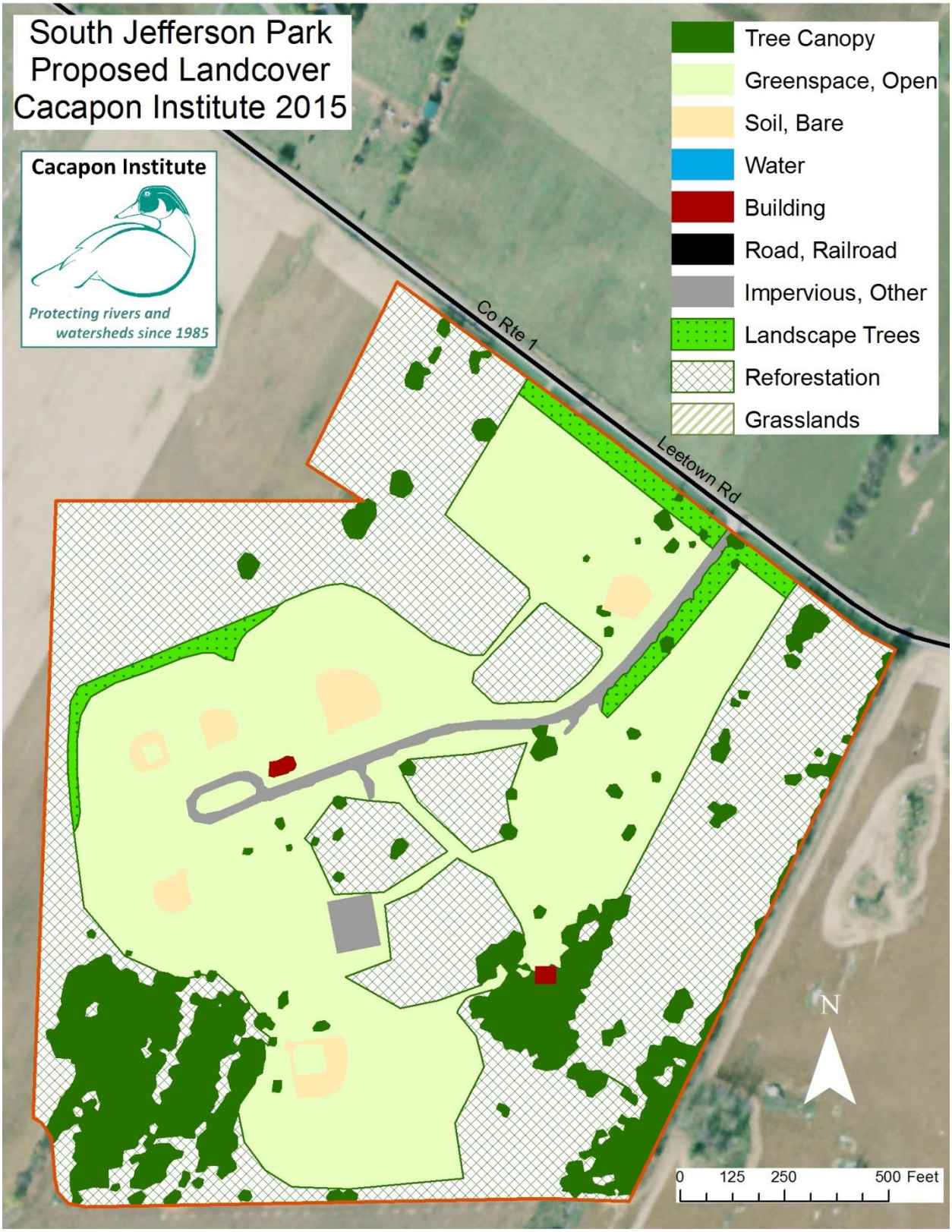

Mount MissionPark
Existing Landcover
Cacapon Institute 2015
Cacapon Institute
Protecting rivers and watersheds since 1985
Co Rte 9/9
Co Rte 9/5
Mission Rd
N
0 25 50 100 Feet
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other


Mount MissionPark
Proposed Landcover
Cacapon Institute 2015
Cacapon Institute
Protecting rivers and watersheds since 1985
Co Rte 9/9
Co Rte 9/5
Mission Rd
N
0 25 50 100 Feet
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Landscape Trees
Reforestation
Grasslands


Sam Michaels Park
Existing Landcover
Cacapon Institute 2015
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Cacapon Institute
Protecting rivers and watersheds since 1985
Buffalo Dr
Job Corp Rd
Sam Michaels Ln
Apple Cross Rd
Job Corps RdCo Rte 22
Breckenridge Way
Equestrian Cir
N
0 245 490 980 Feet


Sam Michaels Park
Proposed Landcover
Cacapon Institute 2015
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Landscape Trees
Reforestation
Grasslands
Cacapon Institute
Protecting rivers and watersheds since 1985
Buffalo Dr
Job Corp Rd
Sam Michaels Ln
Apple Cross Rd
Job Corps RdCo Rte 22
Breckenridge Way
Equestrian Ct
N
0 250 500 1,000 Feet


South Jefferson Park
Existing Landcover
Cacapon Institute 2015
Cacapon Institute
Protecting rivers and watersheds since 1985
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Co Rte 1
Leetown Rd
N
0 125 250 500 Feet


South Jefferson Park
Proposed Landcover
Cacapon Institute 2015
Cacapon Institute
Protecting rivers and watersheds since 1985
Tree Canopy
Greenspace, Open
Soil, Bare
Water
Building
Road, Railroad
Impervious, Other
Landscape Trees
Reforestation
Grasslands
Co Rte 1
Leetown Rd
N
0 125 250 500 Feet