

TREE INVENTORY

SUMMARY AND RECOMMENDATIONS

WEST VIRGINIA STATE UNIVERSITY,
WEST VIRGINIA
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TREE INVENTORY

SUMMARY AND RECOMMENDATIONS

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PREPARED BY

PlanIT Geo, LLC, Arvada, Colorado

PREPARED FOR

West Virginia State University, West Virginia

INVENTORY PERFORMED

January 2019



TREE INVENTORY SUMMARY



719

CAMPUS TREES

INVENTORIED, TAGGED,

AND ANALYZED

Having a healthy, diverse urban forest on campus can provide many benefits to students, staff, and the ecosystem. In addition to being aesthetically pleasing, trees also scrub the air of pollutants, slow the release of stormwater runoff into the watershed, filter stormwater, provide oxygen, reduce energy costs, provide shade, and offer habitat and food for wildlife.

Trees on university campuses are particularly valuable due to their therapeutic effects on attentional capacity. In fact, many studies have shown that students “are happier, experience significantly greater well-being, and show significantly lower mental distress when they live [and study] in areas with greater amounts of green space” (Wolf, K.L., et al. *Outside Our Doors, The Nature Conservancy*, 2016).

The key to maintaining a sustainable and healthy urban forest on campus is species and age diversity, proper tree maintenance, risk management, and faculty support, which can be accomplished with an urban forest management plan. The information in this report is provided to guide future maintenance and management and to better plan for the health and longevity of the University’s urban forest.

The inventory data were analyzed in Microsoft Excel, Access, and the West Virginia State University’s TreePlotter app (<https://pg-cloud.com/WVSU/>) to determine the state, characteristics, and trends of WVSU’s urban forest. Analyses and summaries were completed for the inventoried campus trees to determine the health and diversity of all trees managed by the University.

The data include 719 trees that were inventoried by Certified Arborists accredited by the International Society of Arboriculture and tagged with aluminum tree tags. Trees with a four-inch DBH, (or “diameter at breast height,” measured at 4.5 feet above grade) or greater were tagged using nails, while trees that were smaller or had a trunk that was covered by low lying branches received hanging tags on a branch near eye level.

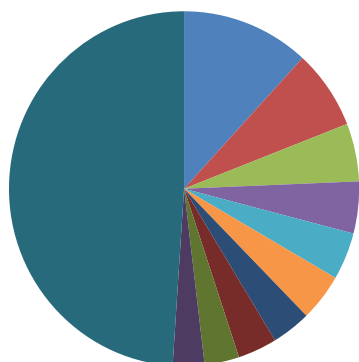
Lastly, it is important to note that the maintenance practices and species selection for planting are different for trees in a confined space compared to open grown trees. Open grown trees tend to have a better growing environment leading to larger statured trees, which could skew the data when included with trees grown in a confined area.

INVENTORY RESULTS AT-A-GLANCE

The following report sections provide the results and recommendations based on the University's tree characteristics and organized by Structure, Management and Risks. The summary results presented below will be discussed in greater detail in the following sections.

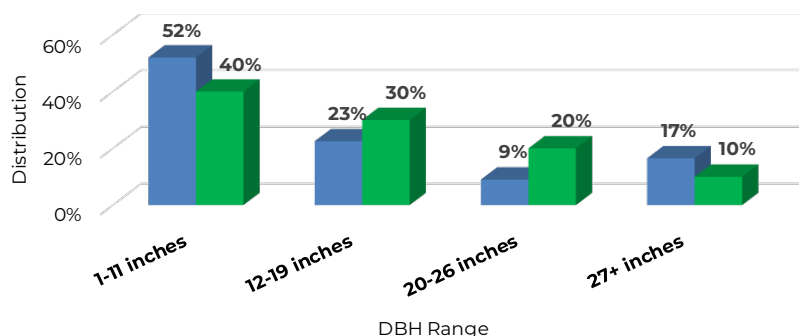
SPECIES DIVERSITY

A total of 72 species were identified. The top ten species comprise 51% of the inventory, with pin oak being the most prevalent at 12%.



- Pin oak, 12%
- Red maple, 7%
- Boxelder, 5%
- Eastern redbud, 5%
- Crabapple, 4%
- Honeylocust, 4%
- American basswood, 4%
- Eastern white pine, 4%
- Sugar maple, 3%
- Kousa dogwood, 3%

SIZE DISTRIBUTION



In accordance with the "ideal" distribution of urban forest tree size classes, small trees with a diameter of 1-11 inches made up the majority of the inventory with 52% of all trees.

- WVSU Distribution
- Ideal Distribution

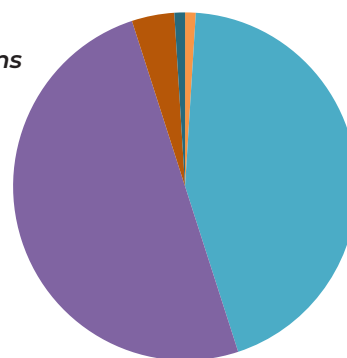
MAINTENANCE NEEDS

Most trees inventoried had a condition of "good" (44%) or "fair" (50%). 47% of all trees surveyed had some type of primary maintenance need, and 10% were at imminent risk of failure.

Most Common Primary Maintenance Needs	Percent of Trees
Crown Cleaning	20.3%
Prune-Clearance	10.7%
Prune-Structural	8.3%

Tree Conditions

- Excellent, 1%
- Good, 44%
- Fair, 50%
- Poor, 4%
- Dead, 1%



TREE INVENTORY STRUCTURE

Urban forest structure describes the tree population on campus in terms of its species composition, number of trees, age classes, and tree distribution. These summaries assist campus tree managers in proper tree management and planting to ensure long-lasting canopy and benefits distributed equally throughout the University.

TREE DIVERSITY AND COMPOSITION

Species composition data are essential since the types of trees present on campus greatly affect the amount of benefits produced, tree maintenance activities, and budgets.

The 719 trees inventoried are comprised of 72 different species classifications (accounts for the following generalized common names: “elm,” “holly,” “juniper,” “pine,” “oak,” “spruce,” “dogwood,” “cherry,” “ash,” “maple,” “magnolia,” “linden,” and “apple”). The top species comprise 50.9% of the tree population. The highest percent consists of pin oak with 11.8% (85 trees) of the total tree population.

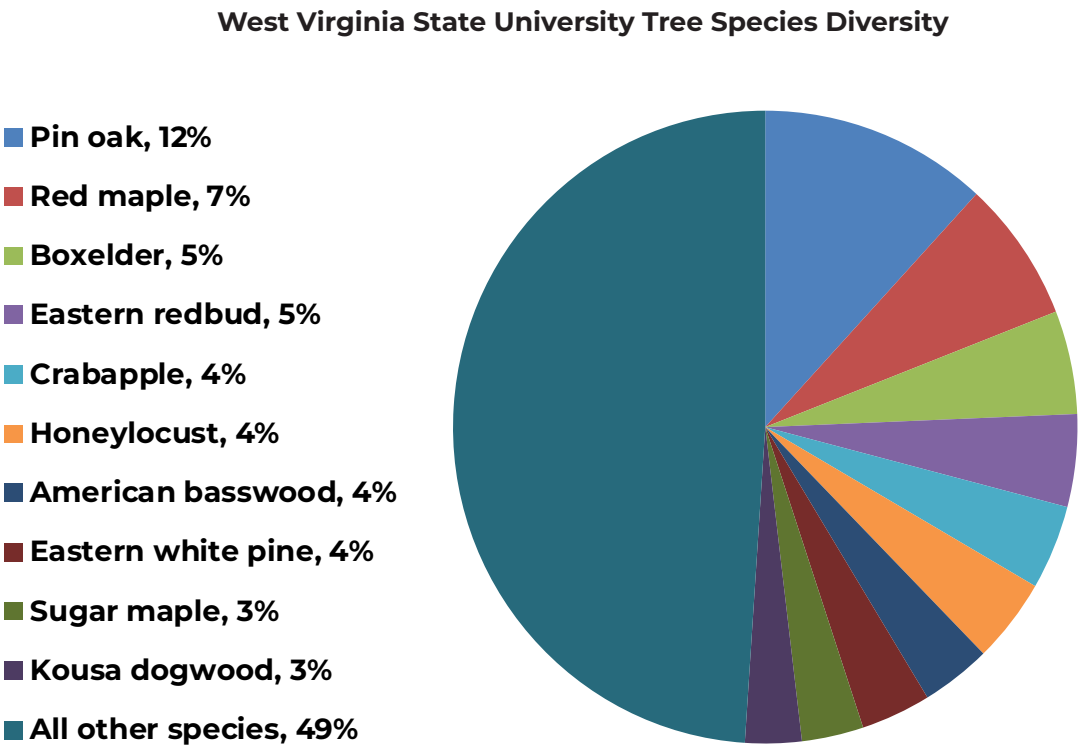


Figure 1. | West Virginia State University tree species composition.

SIZE AND AGE DISTRIBUTION

The distribution of tree ages influences the structure of the urban forest as well as the present and future costs. An unevenly-aged urban forest offers continued flow of ecological benefits and a more uniform work flow allowing managers to more accurately allocate annual maintenance schedules and budgets.

To optimize the value and benefits of the campus trees, the urban forest on campus should have a high percentage of large canopy trees which provide greater ecosystem benefits. On the other hand, there must be a suitable number of younger, smaller trees in the urban forest to account for the loss of large and mature trees in decline. Having a healthy percentage of young trees in the urban forest will ensure a sustainable tree population as well as age distribution in future years.

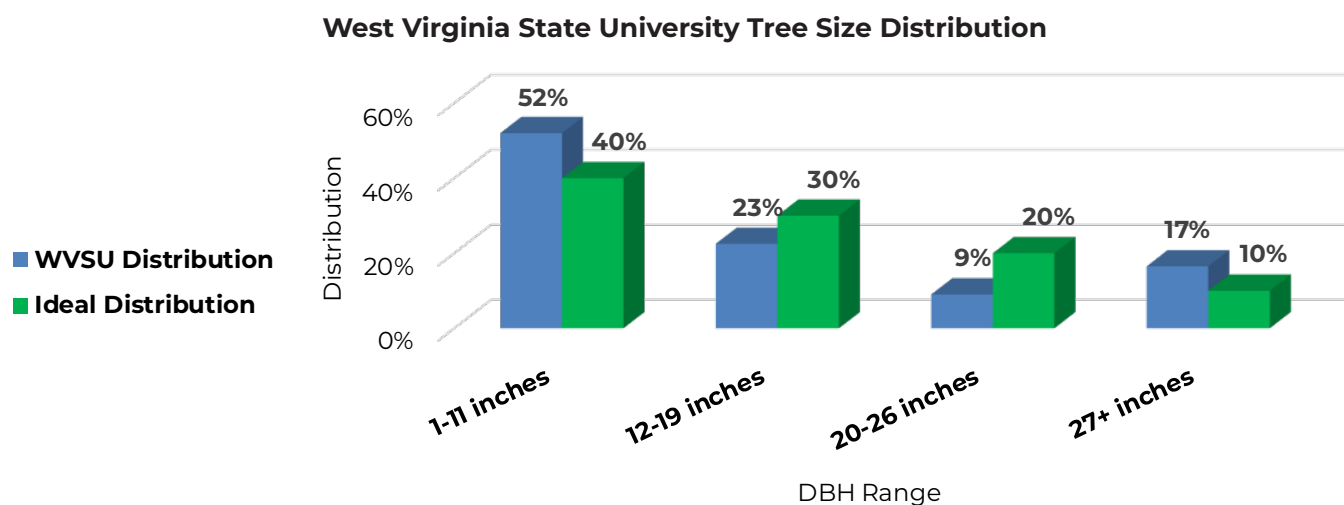


Figure 2. | Comparison of West Virginia State University's tree size distribution to an ideal distribution.

Overall, the age distribution of WVSU's urban forest (blue bars) is similar to the ideal age distribution (green bars). As Figure 2 shows, 52% of the University's urban forest (374 trees) is comprised of trees with a DBH (or "diameter at breast height," measured at 4.5 feet above grade) ranging from 1 to 11 inches. This indicates that the majority of the campus trees are young or small-statured, which is desirable for a healthy urban forest on campus. However, trees with a DBH of 27 inches or greater make up 16.5% (119 trees) of WVSU's campus trees. Campus trees in this DBH range can offer larger ecological benefits if the tree is properly maintained and remains healthy, but trees of this size should be monitored frequently to determine maintenance needs, potential risks, and signs of decline. The DBH range with the least number of trees is 20 to 26 inches, which makes up 9% of the tree population (or 64 trees). The average DBH for the whole population is 14 inches, and the largest recorded DBH is 56 inches.

An ideal age distribution in the tree population allows managers to allocate and project annual maintenance costs uniformly. This ensures continuity in overall tree canopy coverage and associated benefits which are often dependent on the growing space of individual trees (e.g. open grown versus restricted growing areas). It is recommended to monitor and strategically manage large trees throughout the University, considering the risks that are associated with large, mature trees.

TREE INVENTORY MANAGEMENT

Tree characteristics and outside forces affect the management needs for urban trees. An analysis of the condition and maintenance requirements assists managers in planning the University's urban forest.

Tree condition indicates how well trees are managed and how well they perform given site-specific conditions. Tree maintenance needs are assigned for public safety reasons and for the health and longevity of the trees. Understanding the maintenance needs assists tree managers in establishing daily work plans and maintaining public safety.

URBAN FOREST CONDITION

The inventory data were analyzed to identify potential trends in tree condition and management needs. Information on the condition of trees plays an important role in campus planning, University budgeting, and use of resources. Each inventoried tree's health was evaluated by ISA Certified Arborists based on the condition of the wood and the foliage.

Figure 3 on the right, summarizes the 719 trees that were assigned a condition rating and shows the detailed information for each condition class.

The data show that a majority of the trees inventoried are classified as being in "Fair" condition, comprising 50% or 359 trees, followed by those in "Good" condition comprising 44% (313 trees).

Note that 5 trees are classified as dead / removal required, and 31 are noted as poor condition. The dead trees or trees noted for removal should be addressed and planned for immediately.

West Virginia State University Tree Health Conditions

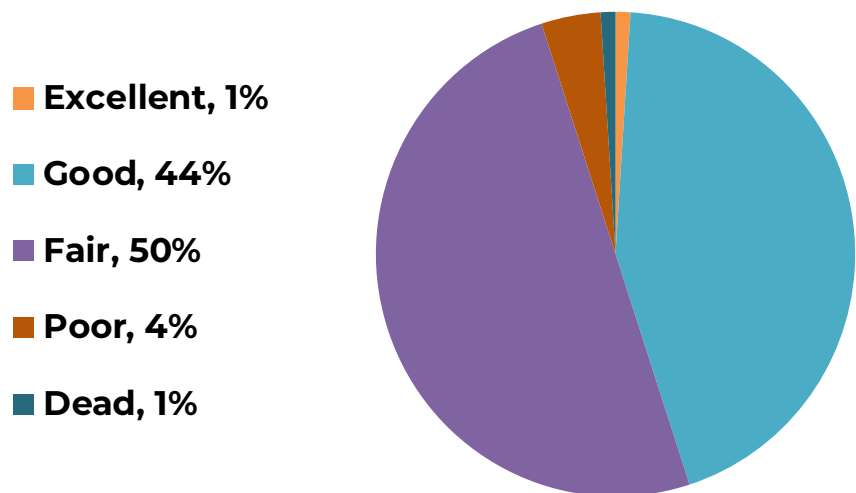


Figure 3. | West Virginia State University tree health conditions.

PRIMARY MAINTENANCE REQUIREMENTS

The inventory required an assessment of the maintenance needs, if any, for each tree. This information along with risk assessment ratings, location, and the TreePlotter application were used to guide the maintenance recommendations.

Table 3. | Primary maintenance needs of West Virginia State University trees.

Tree Work	Count	%
Crown Cleaning	146	20.3%
Prune-Clearance	77	10.7%
Prune-Structural	60	8.3%
Remove	15	2.1%
Monitor	14	1.9%
Remove-Girdling Root	9	1.3%
Remove-Hanger	5	0.7%
Thin	5	0.7%
Remove Hardware	3	0.4%
Sidewalk Damage	2	0.3%
Reduce	2	0.3%
Total	338	47.0%

Table 3 provides a summary of the primary removals required as well as pruning recommendations for WV SU's trees. Of the 338 trees assigned a maintenance task, the majority (146, Or 20% of campus trees) are recommended for crown cleaning. This involves the removal of dead, dying, diseased, broken, poor structured, or attached limbs. Clearance pruning involves the removal of branches for clearance of buildings, pedestrians, vehicles, light poles, utility lines, etc. and is recommended for 77 trees (11% of the campus trees). Structural pruning to train immature trees is recommended for 60 trees (8.3%), and complete removal of the tree is recommended for 15 trees (2.1%).

"Remove-hanger" was prescribed for 5 trees on campus. These trees have dead and/or detached branches that could potentially cause serious injury or property damage if not addressed in a timely manner. "Remove-girdling root" was prescribed for 9 trees. These trees have a structural root(s) that is encircling the trunk of the tree. If these roots are not ammended, they will eventually prevent the flow of water and nutrients through the cambium and kill the tree. 381 trees were identified as not needing any maintenance, although all trees should be routinely observed to assess for any new maintenance issues.

The map on the following page shows the location of trees recommended for removal. This map can be viewed at <https://pg-cloud.com/WVSU/>. Use the advance filter feature to search for "Remove" under "Tree Work." The inventory of campus trees shows that there is a need to remove certain trees in order to lower the risk and maintain public safety. It is recommended that these trees be prioritized by risk, size, condition, and location and remove the largest, poorest quality trees as soon as possible. Trees with the highest Target Risk and Probability of Failure should take top priority over other trees.

A total of 15 trees have been recommended for removal. This indicates that the tree is dead or dying and will not recover. Note that these trees may be an imminent threat based on the Risk Rating produced by assessing the part of the tree most likely to fail, Likelihood of Failure, Likelihood of Impacting Target, and Consequence of Failure.

TREE INVENTORY RISK ASSESSMENT

This section summarizes the potential risks identified during the campus tree inventory. The International Society of Arboriculture's tree risk rating criteria was used to determine risk, and included a rating of the Likelihood of Failure, Likelihood of Impacting a Target, Timeframe for Possible Failure, and Consequence of Failure. This assessment assigns a Risk Rating to each tree in the inventory if a defect is observed.

The table below provides a count of each Risk Rating category, as well as the percentage of trees most likely to fail in each risk category. The criteria "Probability of Failure" with a rating of "Imminent" highlights the trees that need to be addressed immediately. Trees with these criteria should be considered to have an extremely high potential for failure that could cause the most damage and/or harm within a year or during a wind/storm event.

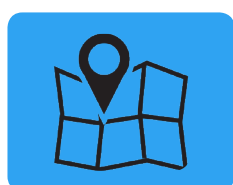
Table 4. | Risk ratings of West Virginia State University trees.

Risk Rating	Count	Imminent Probability of Failure
High	0	0
Moderate	10	4
Low	337	6
Total	347	10

As seen in Table 4, no trees have a "High" Risk Rating but 10 trees on campus have a "Moderate" Risk Rating and 337 have a "Low" Risk Rating. Among those 347 trees, 10 of them have an assessed tree part with an Imminent Probability of Failure.

The map on the next page shows the location of these 10 trees, as well as the 15 trees recommended for removal. The data can also be viewed at <https://pg-cloud.com/WVSU/>. Use the advance filter feature to filter for trees with a "Moderate" Risk Rating and an "Imminent" Likelihood of Failure.

In total, 347 trees were given a Risk Rating. Of those trees, 10 have an assessed tree part with an Imminent Probability of Failure, but 6 are "Low" risk. Along with the trees identified for removal, these are trees that should be evaluated and be considered for immediate maintenance. No trees were assigned an "Extreme" Risk Rating.



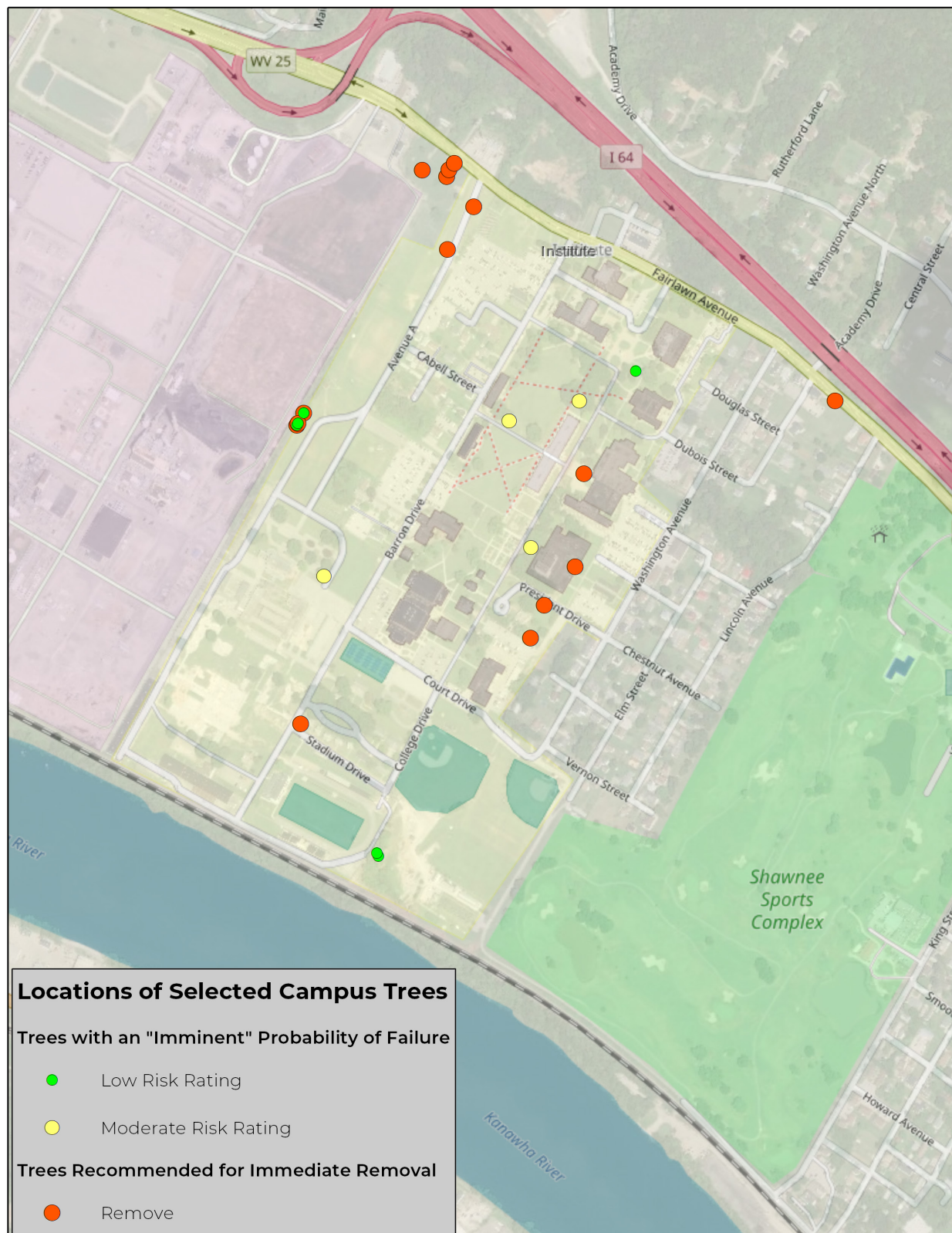


Figure 4. | Locations of trees that have an "Imminent" probability of failure and trees recommended for removal.

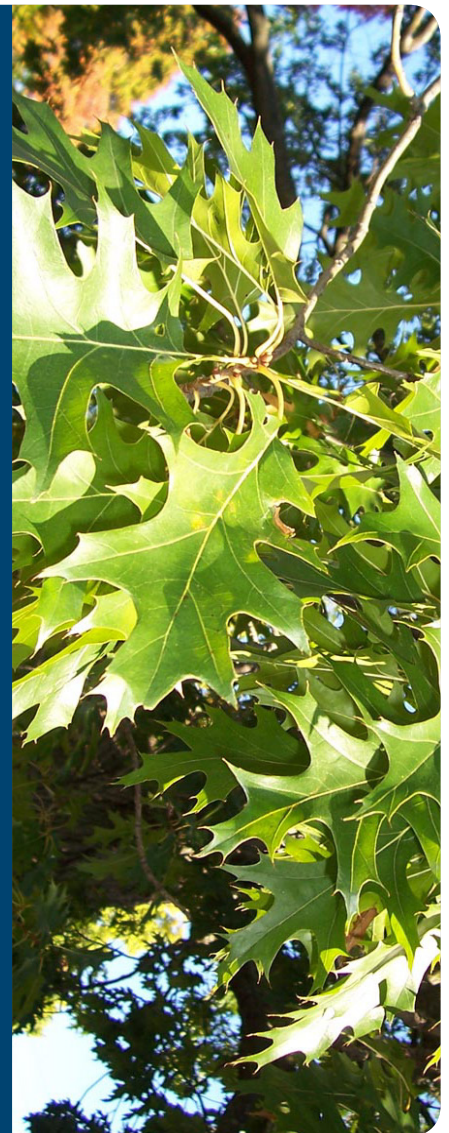
SUMMARY OF RECOMMENDATIONS

The campus trees are a defining and valued characteristic of West Virginia State University making the University a desirable place to live, work and pursue higher education. It is a resource that has a history and legacy of care and management; however, certain trees require immediate removal or maintenance.

The University should strive to achieve a routine monitoring and maintenance schedule of all trees and continue to plant trees, especially after removal, to enhance the beauty of the campus and the benefits that trees provide. While it will take work and additional resources to address the maintenance needs, its implementation will help ensure that West Virginia State University's campus trees will continue to be valued by its constituents.

CAMPUS TREE INVENTORY RECOMMENDATIONS

- Address the **high risk** trees accordingly
- Evaluate lower risk trees and address accordingly
- Monitor trees less than **fair** condition
- Conduct **routine tree maintenance** as described
- Maintain or establish a cyclical, routine tree **monitoring and maintenance schedule**
- **Plant** trees after removal
- Ensure industry standards and **best management practices** are followed during the planting and care of trees
- **Educate** the students, faculty, and community about the tree inventory population, the associated benefits, and the tree management program
- Continue to track maintenance, plantings, and removals in the **TreePlotter application**
- Consider adding the TreePlotter application and its data to an appropriate course **curriculum** such as an environmental studies, urban forestry, or GIS class.
- Consider **engaging the student population** in the care of young trees (watering, structural pruning, mulching, etc.) under supervision and instruction by trained staff.
- Conduct a complete inventory of the campus tree population **5-10 years** from the 2019 inventory.



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