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Miles Park Arboricultural Risk Assessment and Tree Management Review
303 Germantown Pike, Lafayette Hill, PA 19444

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Executive Summary

Those who operate a municipal park understand how the inventory impacts operations and budgeting. One must know what there, how much or how many is, and where everything is. But the task doesn't end there. To obtain the greatest benefit from an inventory, managers or their designees must manage it. A good management plan will address these issues and keep the inventory current, in good condition, and functioning for the benefit and safety of those involved.

Managing trees in a park setting can seem like an overwhelming task, but the same principles of inventory management apply. The inventory and management plan should provide managers the data they need to develop realistic budgets for their tree maintenance needs. This inventory will assist in creating a safe environment and maintain the aesthetics throughout Miles Park.

Miles Park, with a large collection of trees, has exhibited over the last 20 years, below average care in maintaining their tree stand. To lead the community into not only maintaining their assets, but they have also decided to establish and set guidelines as they pertain to park safety by cataloging the risk related trees within their urban forest.

My firm was chosen to perform a level 1 inspection of the trees. Visitors and the infrastructure influence our decisions as we review these targets. The property at any given day, season and time occupies both humans and property. This makes for a distinctive inspection since we have both moveable and static targets.

GOALS & OBJECTIVES

A strategic management plan communicates clear goals and the specific objectives designed to carry out those goals. Our goal is to assist in the management of your urban forest.

Assignment

I was retained by Whitemarsh Township to provide a risk assessment and tree management plan of the trees that exist within the park. This assignment was to include:

- Level one assessment
- Mapping
- Furnished report of my findings

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The following categories of information were obtained for each tree. Separate detailed tree survey sheets are attached in the Urban Forest Metrix.

1. Tree reference number
2. Species
3. Stem diameter
4. Physiological condition
5. Category grading / Structural condition
6. Management recommendations

Limits of the Assignment or Scope

I was not provided with past management or care practices that have been employed to the trees.

Documents / Site Reviewed

Only trees within the property

Testing and Analysis

We utilized the TRAQ risk assessment guidelines along with experience and specialized targets. Hazardous trees regularly lead to injury or death of pedestrians, visitors and property owners at private and public locations. To address this issue, the ISA (International Society of Arboriculture) has created the Tree Risk Assessment Qualification (TRAQ). TRAQ promotes the safety of people and property by providing a standardized and systematic process for assessing tree risk. The results of a tree risk assessment can provide tree owners and risk managers with information to make informed decisions regarding their trees.

Level 1: Limited Visual Assessment

The Level 1 assessment is a visual assessment from a specified perspective of an individual tree or a population of trees near specified targets to identify obvious defects or specified conditions.

A limited visual assessment typically focuses on identifying trees with an imminent and/or probable likelihood of failure.

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Level 1 assessments do not always meet the criteria for a "risk Assessment" if they do not include analysis and evaluation of individual trees. Limited visual assessments are the fastest but least thorough means of assessment and are intended primarily for large populations of trees.

The assessment is often done on a specified schedule, and/or immediately after storms to rapidly assess a tree population. Tree inventories are usually considered Level 1 assessments unless a risk assessment is specifically included in the inventory.

The assessor performs a visual assessment by looking for obvious defects, such as dead trees, large cavity openings, large dead or broken branches, fungal fruiting structures, large cracks, and severe leans.

The scope of work may, in some cases, specify the assessor to walk around certain trees to gain a more complete perspective. Drive-by ("windshield") is a limited visual inspection of one side of the tree performed from a slow-moving vehicle. The scope of work may also specify that the inspector walk around certain trees or record images to verify or document observations. This type of inspection is often performed by landowners who have large populations of trees to inspect with specific budget.

When a tree of concern is identified, certain specified information about that tree is recorded. The level 1 assessment will include the tree location and recommended remedial action.
A higher level of inspection may also be recommended when needed, if that option is included in the scope of work.

A constraint of limited visual inspections is that some conditions may not be visible from a one-sided inspection of a tree, nor are all conditions visible on a year-round basis.

Level 2 or Basic Assessment

A level 2 or basic assessment is a detailed visual inspection of a tree and surrounding site, and a synthesis of the information collected. It requires that a tree risk assessor walk completely around the tree, looking at the site, buttress roots, trunk, and branches. A basic assessment may include the use of simple tools to gain additional information about the tree or defects. Basic is the standard assessment that is performed by arborists in response to a client's request for tree risk assessment. Simple tools may be used for measuring the tree and acquiring more information about the tree or defects. However, the use of these tools is not mandatory unless specified in the scope of work.

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Measuring tools may include a diameter tape, clinometers, or tape measure. Other inspection tools include binoculars, magnifying glass, mallet, trowel, shovel, or a probe.

1. Binoculars may be used to inspect the upper portions of a tree's crown to look for cavities, nesting holes, cracks, weak unions, and other conditions and tree responses.

2. A magnifying glass (hand lens) may be used to help identify fungal fruiting bodies or pests that may affect the overall health of the tree.

3. The trunk may be sounded with a non-damaging instrument, such as a broad-headed mallet made of wood, rubber, leather, or resin. The tree risk assessor strikes the tree trunk in multiple places and listens for tone variations that may indicate hollows or dead bark.

4. A probe is a small-diameter, stiff rod, stick, or wire that is inserted into a cavity to estimate its size and extent. Because there may be sections of nonfunctional wood adjacent to a cavity, this type of measurement should be considered only an approximation of the extent of decay.

5. A trowel or shovel can be used to conduct minor excavations to expose roots or the root collar. Care should be taken to not damage roots during the excavation process. More extensive root collar excavations are considered an advanced assessment.

A primary goal of tree risk assessment is to provide information about the level of risk posed by a tree over a specific time. This is accomplished in qualitative tree risk assessment by first determining the categories for likelihood and consequences of tree failure. These factors are determined by:

1. Evaluating the structural conditions that may lead to failure, the potential loads on the tree, and the trees' adaptations to weaknesses—to determine the likelihood of failure.

2. Evaluating the likelihood that a tree or branch could strike people or property or disrupt activities.

3. Assessing the injury, damage or disruption—to estimate the consequences of failure.

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Glossary Tree Risk Assessment has a unique set of terms with specific meanings. Definitions of all specific terms may be found in the International Society of Arboriculture's Best Management Practice for Tree Risk Assessment. Definitions of some of these terms used in this report are as follows:

The likelihood of failure may be categorized as imminent meaning that failure has started or could occur at any time; probable meaning that failure may be expected under normal weather conditions within the next 3 years; possible meaning that failure could occur but is unlikely under normal weather conditions during that time frame; and improbable meaning that failure is not likely under normal weather conditions and may not occur in severe weather conditions during that time frame.

The likelihood of the failed tree part impacting a target may be categorized as high meaning that a failed tree or tree part will most likely impact a target; medium meaning that a failed tree or tree part may or may not impact a target with equal likelihood; low meaning that the failed tree or tree part is not likely to impact a target; and very low meaning that the chance of a failed tree or tree part impacting the target is remote.

The consequences of a known target being struck may be categorized as severe meaning that impact could involve serious personal injury or death, damage to high value property, or disruption to important activities; significant meaning that the impact may involve personal injury, property damage of moderate to high value, or considerable disruption; minor meaning that impact could cause low to moderate property damage, small disruptions to traffic or a communication utility, or minor injury; and negligible meaning that impact may involve low value property damage, disruption that can be replaced or repaired, and do not involve personal injury.

Tree Risk Assessments, Limitations & Glossary

In accordance with industry standards, tree risk ratings are derived from a combination of three factors: the *likelihood of failure*, the *likelihood of the failed tree part impacting a target*, and the *consequences* of the target being struck. The guidelines used to classify each of these factors that are presented in the *ISA's BMP for Tree Risk Assessment* and guidelines. These factors are then used to categorize tree risk as *Extreme, High, Moderate or Low.* The factors used to define your risks ratings are identified in this report. An explanation of terms used in this report appears in the glossary located in the appendix.

The information provided in this report is based on the conditions identified at the time of inspection. Tree conditions do change over time, so reassessment is recommended annually and after major storm events.

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Limitations of Tree Risk Assessments

It is important for the tree owner or manager to know and understand that all trees pose some degree of risk from failure or other conditions. The information and recommendations within this report have been derived from the level of tree risk assessment identified in this report, using the information and practices outlined in the *International Society of Arboriculture's Best Management Practices for Tree Risk Assessment,* as well as the information available at the time of the inspection. However, the overall risk rating, the mitigation recommendations, or any other conclusions do not preclude the possibility of failure from undetected conditions, weather events, or other acts of man or nature. Trees can unpredictably fail even if no defects or other conditions are present. It is responsibility of the tree owner or manager to schedule repeat or advanced assessments, determine actions, and implement follow up recommendations, monitoring and/or mitigation.

Rockwell Associates can make no warranty or guarantee whatsoever regarding the safety of any tree, trees, or parts of trees, regardless of the level of tree risk assessment provided, the risk rating, or the residual risk rating after mitigation. The information in this report should not be considered as making safety, legal, architectural, engineering, landscape architectural, land surveying advice or other professional advice. This information is solely for the use of the tree owner and manager to assist in the decision-making process regarding the management of their tree or trees. Tree risk assessments are simply tools which should be used in conjunction with the owner or tree manager's knowledge, other information and observations related to the specific tree or trees discussed, and sound decision making.

Glossary

Tree risk assessment has a unique set of terms with specific meanings. Definitions of all specific terms may be found in the International Society of Arboriculture's Best Management Practice for Tree Risk Assessment. Definitions of some of these terms used in this report are as follows:

The likelihood of failure may be categorized as imminent meaning that failure has started or could occur at any time, probable meaning that failure may be expected under normal weather conditions within the next 3 years; possible meaning that failure could occur but is unlikely under normal weather conditions during that time frame; and improbable meaning that failure is not likely under weather conditions and may not occur in severe weather conditions during that time frame.

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The likelihood of the filed tree part impacting a target may be categorized as high meaning that a failed tree or tree part will most likely impact a target; medium meaning the failed tree or tree part could impact the target but is not expected to do so; low meaning that the failed tree or tree part is not likely to impact a target; and very low meaning that the chance of a failed tree part impacting the target is remote.

The *likelihood of failure and impact* is defined by Likelihood Matrix below.

LIKELIHOOD OF FAILURE AND IMPACT

Likelihood of impacting Target				
Likelihood of Failure	**Very Low**	**Low**	**Medium**	**High**
Imminent	Unlikely	Somewhat likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

The consequences of a known target being struck may be categorized as sever meaning that impact could involve serious personal injury or death, damage to high value property, or disruption to important activities; significant meaning that the impact may involve personal injury, property damage of moderate to high value, or considerable disruption; minor meaning that impact could cause low to moderate property damage, small disruptions to traffic or a communication utility, or minor injury; and negligible meaning that impact may involve low value property damage, disruption that can be replaced or repaired, and do not involve personal injury.

Targets are people, property, or activities that could be injured, damaged or disrupted by a tree failure.

Levels of assessment 1) Limited visual assessments are conducted to identify obvious defects. 2) Basic assessments are visual inspections done by walking around the tree looking at the site, buttress roots, trunk and branches. It may include the use of simple tools to gain information about specific tree parts, defects, targets of site conditions. Drilling to detect decay is an advanced assessment technique. Tree Risk Ratings are terms used to communicate the level of risk rating. They are defined in defined in defined in the Risk Matrix below as a combination of Likelihood and Consequences:

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ISA RISK MATRIX

Consequences of the Tree Failure

Likelihood of Failure & Impact	**Negligible**	**Minor**	**Significant**	**Severe**
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Overall tree risk rating is the highest individual risk identified for the tree. The *residual risk* is the level of risk the tree should pose after the recommended mitigation.

Observations Summary

Average condition of the trees	Below average
Generalized care of trees	Below Average
Cultural practices implemented (soil management, mulching, fertilization)	Below average

Strategic Safety Plan

The management must adopt an ongoing safety plan which is to include the following:

- Post storm inspections – this inspection should be broken into grids with target ratings.
- Prone failures, storms predictions and rerouting. Rockwell to assist.

Future Best Management Practices at Miles Park

Specific Arboricultural Tasks

Trees provide a variety of benefits such as environmental, social, community and economic. Therefore, to allow these benefits to offer the maximum results, it is important to properly care for our trees. Below you will find detailed descriptions of the work tasks referred to in this report.

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Vertical Mulching

Vertical mulching is performed to open compacted soils to allow air and water to reach the roots and assist with aeration of the soil. Soil compaction is harmful because it reduces the amount of space in the soil that would normally be filled with oxygen and water. A high-pressure air gun is used for the process, so we can expose the roots 14-18 inches below ground without damage.

After removing the compacted soil, it is necessary to back fill the holes with an organic mixture which will add an organic source of nutrients to the trees and plants and to the structure of the soil profile.

Over time this material will break down providing the tree with a good source of nutrients while achieving a loftier soil median for tree roots to flourish.

Root Crown Excavation

The importance of a tree's root crown, where the stem transitions into the root system, cannot be overestimated. When excess soil or mulch is piled against the stem of a tree, it can lead to a host of problems. The result ranges from chronic poor performance to complete failure of the tree.

Root Crown Excavation is the process of removing the dirt from around the trunk to inspect the base of the tree. This can be done to investigate the extent of decay that is present or to view the structure of the roots to see if there may be a girdling root issue. Many trees (nearly all), that have been planted in the last 6-10 years have been planted too deeply.
This allows the stem to be girdled by circling roots. This is very common in lindens, and maples, but can happen to any tree that is planted too deeply.

Pruning Techniques

When pruning, each cut has the potential to change the growth of the tree therefore no branch should be removed without reason. The most common reasons for pruning include removing dead branches, improving form, and reducing risk. Trees may also be pruned to increase light and air penetration to the inside of the tree’s crown or to the landscape below. Mature trees are usually pruned for corrective or preventative measures.

Routine thinning does not necessarily improve the health of a tree. Trees produce a dense crown of leaves to manufacture the sugar used as energy for growth and development.

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Removal of foliage through pruning can reduce growth and stored energy reserves. Heavy pruning can be a significant health stress for the tree.

Most routine pruning to remove weak, diseased, or dead limbs can be accomplished at any time during the year with little effect on the tree. As a rule, growth and wound closure are maximized if pruning takes place before the spring growth flush.

Heavy pruning of live tissue just after the spring growth flush should be avoided, especially on weak trees. At that time, trees have just expended a great deal of energy to produce foliage and early shoot growth. Removal of a large percentage of foliage at that time can stress the tree.

There are several different types of pruning to perform on your trees to maintain healthy, safe and attractive conditions.

Clean Prune - is the removal of dead, dying, diseased, weakly attached, and low-vigor branches from the crown of a tree.

Thinning - is selective branch removal to improve structure and to increase light penetration and air movement through the crown. Proper thinning opens the foliage of a tree, reduces weight on heavy limbs, and helps retain the tree's natural shape.

Raise Prune - removes the lower branches from a tree to provide clearance for buildings, vehicles, pedestrians, and vistas.

Reduction Prune - reduces the size of a tree, often for utility line clearance. Reducing a tree's height or spread is best accomplished by pruning back the leaders and branch terminals to secondary branches that are large enough to assume the terminal roles (at least one-third the diameter of the cut stem). Compared to topping, reduction helps maintain the form and structural integrity of the tree.

Hazard Prune – Pruning to reduce hazard to people or property includes removal of dead and decaying branches; branches that interfere with sight lines or travel along streets, driveways, or sidewalks; branches that rub against structures; thorny or spiny branches that might cause injury and pruning for utility line clearance. Healthy, strong, properly attached branches that overhang a building do not usually pose an unreasonable safety risk and do not necessarily need to be removed.

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Structural Prune - a good long-lasting branch and crown form is created from the beginning and future storm damage is reduced. The useful life of the tree and its multiple benefits over time are increased and more expensive tree care practices that may be needed later in the life of the tree such as cabling, and bracing are avoided.

Shape - Pruning for tree form or shape involves removal of certain branches and leaving others to direct growth toward and away from certain areas. Pollarding, crown raising, and topiary all are examples of pruning for form.

Removal – Tree removal will consist of removing the entire tree including the existing root system. All stumps are to be removed in their entirety. We will be replanting in the same vicinity during the re-introduction period. All laterals, core stump area, rocks, and foreign debris must be removed.

A soil blend consisting of one-third topsoil, one-third leaf mold and one-third sand will aid in restoring the soil quality and alleviate compaction. All stump areas must be filled with this soil blend prior to planting the new trees.

Trees that are not to be replaced will require mitigation and turf establishment. The desired seed should consist of 60% Fescue. Penn mulch or a similar product is recommended.

Cabling systems – To be designed with Rockwell and Contractor selected to perform the work. Cabling shall be followed using the ANSI A300 Standard / Best Management Practices - Tree Support Systems, Third Edition.

Tree Replacement Sizes

Shade Trees	**3.0" caliper**
Ornamental Trees	**8-10'**
Evergreen Trees	**8-10'**

Warranty of Inspection

Warranty is based only at the time of inspection and is limited to the visual inspection of a level one and two risk assessment. At no time can we predict saturated soils, winds exceeding 15MPH, snow and ice load, microburst, human damage, mechanical damage, soil erosion, soil failure, excessive leaf/fruit/nut/acorn or any other weight bearing item, tornados, hurricane, excessive rain and moisture. This is a risk assessment to limit liability. In no fashion can we or anyone eradicate risk unless we remove every single tree on the property.

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Tree Risk Assessments, Limitations & Glossary in accordance with industry standards, tree risk ratings are derived from a combination of three factors: the likelihood of failure, the likelihood of the failed tree part impacting a target, and the consequences of the target being struck. The guidelines used to classify each of these factors are presented in the ISA's BMP for Tree Risk Assessment and Guidelines. These factors are then used to categorize tree risk as Extreme, High, Moderate or Low.

The factors used to define your risk ratings are identified in this report. The information provided in this report is based on the conditions identified at the time of inspection. Tree conditions do change over time, so reassessment is recommended annually and after major storm events.

Limitations of Tree Risk Assessments

It is important for the tree owner or manager to know and understand that all trees pose some degree of risk from failure or other conditions. The information and recommendations within this report have been derived from the level of tree risk assessment identified in this report, using the information and practices outlined in the International Society of Arboriculture's Best Management Practices for Tree Risk Assessment, as well as the information available at the time of the inspection. However, the overall risk rating, the mitigation recommendations, or any other conclusions do not preclude the possibility of failure from undetected conditions, weather events, or other acts of man or nature.
Trees can unpredictably fail even if no defects or other conditions are present. It is the responsibility of the tree owner or manager to schedule repeat or advanced assessments, determine actions, and implement follow up recommendations, monitoring and/or mitigation.

https://wwv.isaarbor.com/education/resources/BasicTreeRiskAssessmentForm_Print_2017.pdf

Urban Forest Composition

Species Diversity and Tree Type Composition - A diverse tree population in terms of species, age, form, and function maximizes urban forest benefits through time while minimizing costs and risk. Maintaining a diverse species mix is a critical way to promote a healthy and resilient urban forest. The conventional metric for evaluating urban forest species diversity is the 10-20-30 rule (Santamour 1990), according to which the urban forest population consists of no more than 10% of one species, 20% of one genus, or 30% of one family. However, this guideline has been found to be inadequate in some cases, leaving cities vulnerable to catastrophic forest loss due to pests and pathogens (Raupp et. al 2006). The community, as seen with the attached inventory, is below average for the required diversity.

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Tree Condition

Trees were rated as good, fair, poor, or dead. These general ratings reflect whether a tree is likely to continue contributing to the urban forest (good and fair trees) or whether the tree is at or near the end of its life (poor and dead trees). The following guidelines were used:

Good: The tree has strong structure and is healthy and vigorous with no apparent problems. Trunks are solid with no bark damage and the crown is full. Roots show no signs of heaving or visible crossing, and there are no major wounds, decay, conks, or cavities.

Fair: The tree is in average condition. Structural problems may be present, including results of pruning for general care. Tree may have dead branches and some canopy loss. Wounds are minimal and there is no major decay.

Poor: The tree is in a general state of decline as indicated by major wounds, root heaving, dead limbs resulting in major canopy loss, and/or visible signs of decay indicated by major rot or fungal growth.

Dead: The tree is dead with no live leaves. Dead trees were excluded from data analysis, except for tree condition statistics and total number of trees inventoried.

Recommendations for Priorities

Priority class recommendations are based on a 5-year management plan that takes into consideration tree species, condition, location, age, and proximity to infrastructure. We intend that this rating system assist decision makers in prioritizing tree pruning, cabling and bracing, and tree lightning protection recommendations. Trees with a priority of 1 and an Overall Risk Rating of Extreme or High (see definitions in the next section) should be addressed immediately. Prioritization does consider any budgetary or financial considerations.

1, 2, 3, 4 and 5 are all based on observations by the inventory arborist. The following additional information clarifies each priority class:

I. Priority 1 To be addressed in year 1 of the management cycle. Priority 1 may include trees with large dead wood, structural defects, located in exposed sites, high aesthetic value, and/or parts that are currently negatively interacting with infrastructure, such as branches that touch buildings, interfere with signage or lighting, or obstruct pathways.

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II. Priority 2 To be addressed in year 2 of the management cycle. Priority 2 may include trees with small dead wood, developing structural defects, located in semi-exposed sites, moderate esthetic value, and/or parts that are anticipated to negatively interact with infrastructure, such as branches that touch buildings, interfere with signage or lighting, or obstruct pathways.

III. Priority 3 To be addressed in year 3 of the management cycle. Priority 3 may include trees with small dead wood, developing structural defects, located in lesser used sites, and/or parts that are anticipated to negatively interact with infrastructure, such as branches.

IV. 4 years - to be completed within four years or sooner.

V. 5 years - to be completed within five years or sooner.

Soil Compaction/Soil Management

Soil Compaction is the greatest problem observed at the park. Soil compaction occurs when soil particles are pressed together, reducing pore space between them.
Heavily compacted soils contain few large pores and have a reduced rate of both water infiltration and drainage from the compacted layer. This occurs because large pores are the most effective in moving water through the soil when it is saturated.

In addition, the exchange of gases slows down in compacted soils, causing an increase in the likelihood of aeration-related problems. Finally, while soil compaction increases soil strength-the ability of soil to resist being moved by an applied force-a compacted soil also means that roots must exert greater force to penetrate the compacted layer.

Soil compaction changes pore space size, distribution, and soil strength. One way to quantify the change is by measuring the bulk density. As the pore space is decreased within a soil, the bulk density is increased. Soils with a higher percentage of clay and silt, which naturally have more pore space, have a lower bulk density than sandier soils.

Due to compaction, we need to relieve the soil compaction through vertical mulching and aerification. The testing average throughout the various areas of the grounds showed the psi to be around 420 where optimal levels should be at 200-250 psi. Vertical mulching will correct this problem going forward.

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Organic matter is important in the soil to improve soil structure, nutrient holding capacity, water holding capacity, and infiltration. Fertility amendments such as animal manure, compost, and green manure cover crops increase the organic matter level.

The organic material level was below average in some areas for a healthy urban forest. The vertical mulching task will aid in correcting this problem. Organic compost will be incorporated into the process. I have stated in a few tree's that compaction relief should occur. However, this should be implemented on every tree within the lawn, landscape bed and streetscape.

Mulching

Mulching is one of the most important ways to maintain healthy landscape trees. Mulch is any material applied to the soil surface for protection or improvement of the area covered.
The trees are lacking best management practices as it pertains to mulching. All trees should be mulched at least out to 2/3 of the dripline if not greater. Only for trees in landscape areas (not the wooded/natural zones)

When applied correctly, mulch has the following beneficial effects on plants and soil:

- Mulch prevents loss of water from the soil by evaporation.
- Mulch reduces the growth of weeds, when the mulch material itself is weed-free and applied deeply enough to prevent weed germination or to smother existing weeds.
- Mulch keeps the soil cooler in the summer and warmer in the winter, thus maintaining a more even soil temperature.
- Mulch prevents soil splashing, which not only stops erosion but keeps soil-borne diseases from splashing up onto the plants.
- Organic mulch can improve the soil structure. As the mulch decays, the material becomes topsoil. Decaying mulch also adds nutrients to the soil.
- Mulch prevents crusting of the soil surface, thus improving the absorption and movement of water into the soil.
- Mulch prevents the trunks of trees and shrubs from damage by lawn equipment.
- Mulch helps prevent soil compaction.
- Mulch can add to the beauty of the landscape by providing a cover of uniform color and interesting texture to the surface.
- Mulched plants have more roots than plants that are not mulched, because mulched plants will produce additional roots in the mulch that surrounds them.

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Shredded Hardwood Mulch

This mulch is good at suppressing weeds. It does not wash away easily. It decomposes relatively slowly, and it is very attractive.

This material contains bark and pieces of wood of various sizes and makes attractive mulch. A 2- to 3- inch layer of wood chips provides good weed control. Small wood chips decompose very rapidly using nitrogen from the soil, which needs to be replaced by nitrogen fertilizer.

The best time to mulch new plantings is right after you plant them. Around established plants mulch is best applied in early spring. This is when plants are beginning to grow and before weed seeds start to germinate. How often mulch needs to be replenished depends on the mulching material.

Before applying any type of mulch to an area, it is best to weed the area. Spread a layer of mulching materials over the entire plant bed. Keep mulch 2 to 3 inches away from the stems of woody plants. This will prevent decay caused by wet mulch and rodent damage during the winter. Keep mulch 6 to 12 inches away from the walls of buildings.

The amount of mulch to apply depends on the texture and density of the mulch material. Many wood and bark mulches are composed of fine particles and should not be more than 2 to 3 inches deep.

To determine how many cubic feet of mulch is needed, you need to calculate the surface area and the desired depth of coverage. There are 27 cubic feet in a cubic yard. One cubic yard will cover a 324-square-foot area with an inch of mulch. Figure out the square footage of your bed, that is the width times the length for square or rectangular shaped beds.

The square footage of a circular bed is the distance from the middle of the circle to the outside, multiplied by itself and then multiplied by 3.14 (which is pi). Multiply your square footage by the depth desired (in inches) and divide by 324 square feet. This will tell you how many cubic yards you will need.

Annual Inspections

The township should conduct annual inspections to review the trees stated in this inventory to decrease the changes of tree failure or to review any changes that has occurred from the past inspection. Rockwell can assist in this process.

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Mapping

Please see the attached map. The mapping was conducted using color codes for easy priority/timing of the work product.

Stump Removal

All stumps are to be removed unless they are on a severe slope, natural area, trail system or an area where equipment is to0 dangerous to perform this work product.

Risk vs. Storms

1. Evidence of past tree failures (branch, trunk, root, and soil) and possible cause (windthrow, snapping, crown failure, root disease, and waterlogged ground)
2. Wind exposure, including changes to wind patterns or exposure.
3. Recent exposure of forest trees from clearing for new development or storm damage that has opened a new edge.
4. Site changes that may have altered wind and/or sunlight exposure.
5. Evidence of flooding, drought, or standing water.
6. Indicators of changes in soil hydrology (lowering or raising of the water table)
7. Evidence of disturbances such as trenching, excavation, filling (placement of fill materials or alteration of native soil grades), compaction, and any other construction damage that might have caused injury to root systems.
8. Soil conditions and factors affecting the trees, such as frequency of saturation, compaction, erosion, textural gradients, restrictions to root growth from shallow, impermeable layers, and restrictions by roads, rock, urban infrastructure, or building foundations.

Urban Forest Metrix

See attached urban forest metrix inventory.

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Budget

To ensure that the collection is maintained, the following estimated budgets should be reviewed and inserted into the annual projections.

Rockwell inventory and practices implementation	$60,000.00 - $90,00.00
Annual general maintenance (raise pruning, storm damage, dead branch removal, general pruning)	$15,000.00
Annual cultural practices (watering, fertilization, mulching, vertical mulching, cable inspections, retagging/label management)	$10,000.00
5/6-year cycling of Rockwell plan	$20,000.00
Planting – annual	$4500.00

Arboricultural Practices

All tree care practices should be implemented using the following.

- ANSI A300 pruning standard.
- ANSI A300 (Part 3) -2013 Supplemental Support Systems (includes Cabling, Bracing, Guying, and Propping)
- ANSI A300 Soil Management Standard (Part 2)

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Glossary of Terms

arborist: 1. An individual engaged in the profession of arboriculture who, through experience, education and related training, possesses the competence to provide for, or supervise the management of, trees and other woody ornamentals. 2. An individual engaged in the profession of arboriculture.

branch: An outgrowing shoot, stem or twig that grows from the main stem or trunk.

cable: 1) Zinc coated strand per ASTM A-475 for dead-end grip applications. 2) Wire rope or strand for general applications. 3) Synthetic-fiber rope or synthetic fiber webbing for general applications.

cabling: The installation of a steel wire rope, steel strand, or synthetic-fiber system within a tree between limbs or leaders to limit movement and provide supplemental support.

canopy: collective branches and foliage of a tree or group of trees' crowns

cavity: An open wound characterized by the presence of decay and resulting in a hollow.

cleaning: Selective pruning to remove one or more of the following parts: dead, diseased, and/or broken branches (6.6.1)

co-dominant branches: Equal in size and importance, usually associated with either the trunks, stems, or scaffold limbs.

conk: fruiting body or nonfruiting body of a fungus. Often associated with decay. Critical root zone (CRZ): area of soil around a tree trunk where roots are located that provide stability and uptake of water and minerals required for tree survival.

Crown: 1. The leaves and branches of a tree measured from the lowest branch on the trunk to the top of the tree. 2. The portion of a tree comprising the branches.

D.B.H. (diameter at breast height): Measurement of trunk diameter taken at 4.5 feet (1.4 m) off the ground.

decay: The degradation of woody tissue caused by microorganisms.

girdling root: A root that may impede proper development of other roots, trunk flare, and/or trunk.

lateral branch: A shoot or stem growing from a parent branch or stem.

leader: A dominant or co-dominant, upright stem.

lean: Departure from vertical of the stem, beginning at or near the base of the trunk.

limb: A large, prominent branch. Lion's tailing: The removal of an excessive number of inner, lateral branches from parent branches. Lion's tailing is not an acceptable pruning practice.

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organic matter: material derived from the growth (and death) of living organisms. The organic components of soil.

pH: unit of measurement that describes the alkalinity or acidity of a solution. Measured on a scale of 0 to 14. Greater than 7 is alkaline, less than 7 is acid, and 7 is neutral (pure water).

pruning: The selective removal of plat parts to meet specific goals and objectives.

raising: Selective pruning to provide vertical clearance.

reduction: Selective pruning to decrease height and/or spread.

Risk assessment: process of evaluating what unexpected things could happen, how likely it is, and what the likely outcomes are. In tree management, the systematic process to determine the level of risk posed by a tree, tree part, or group of trees.

root collar: The transition zone between the trunk and the root system.

root flare or trunk flare: The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

root zone: The volume of soil containing the roots of a plant.

soil amendment: Any material added to soil to alter its composition and structure, such as sand, fertilizer, or organic matter.

Soil Ph: A measure of the acidity or alkalinity of the soil.

structural support system: hardware installed in tree, may be cables, braces, or guys, to provide supplemental support.

thinning: Selective pruning to reduce density of live branches.

tree risk assessment: Closer inspection of visibly damaged, dead, defected, diseased, leaning or dying tree to determine management.

tree inventory: A comprehensive list of individual trees providing descriptive information on all or a portion of the project area. Management during site planning, site development, and construction.

tree protection zone: A space above and belowground within which trees ae to be retained and protected. Management during site planning, site development, and construction.

trunk: That portion of a stem or stems of a tree before branching occurs.

wound: An opening that is created when the bark of a living branch or stem is penetrated, cut, or removed.

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ARBORIST DISCLOSURE STATEMENT

If requested by you, Rockwell Associates will obtain bids from various contractors to perform the work. Should you elect to engage our services to oversight this phase of work, all associated time and cost will be billed as an additional per the rate schedule $105.00 per hour.

Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. Clients may choose to accept or disregard the recommendations of the arborist, or to seek additional advice.

Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period of time. Likewise, remedial treatments, like any medicine, cannot be guaranteed.

Treatment, pruning, and removal of trees may involve considerations beyond the scope of the arborist's services such as property boundaries, property ownership, site lines, disputes between neighbors, and other issues. Arborists cannot take such considerations into account unless complete and accurate information is disclosed to the arborist. An arborist should then be expected to reasonably rely upon the completeness and accuracy of the information provided.

You have retained our firm for this report and review, you will for perpetuity hold us harmless, pay all fees associated with a lawsuit and defend Rockwell associates in all legal matters.

Trees can be managed, but they cannot be controlled. To live near trees is to accept some degree of risk. The only way to eliminate all risk associated with trees is to eliminate all trees.

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CERTIFICATION OF PERFORMANCE

I, John Rockwell Hosbach, Jr., certify that:

•I have personally inspected the tree(s) and/or the property referred to in this report and have stated my findings accurately. The extent of the evaluation or appraisal is stated in the attached report and the Terms of Assignment.

•I have no current or prospective interest in the vegetation or the property that is the subject of this report and have no personal interest or bias with respect to the parties involved.

•The analysis, opinions and conclusions stated herein are my own and are based on current scientific procedures and facts.

•My analysis, opinions and conclusions were developed, and this report has been prepared according to commonly accepted arboricultural practices.

•My compensation is not contingent upon the reporting of a predetermined conclusion that favors the cause of the client or any other party nor upon the results of the assessment, the attainment of stipulated results, or the occurrence of any subsequent events.

I further certify that I am a member in good standing of the American Society of Consulting Arborists and the International Society of Arboriculture. I have been involved in the field of Arboriculture in a full-time capacity for a period of more than 25 years.

Signed: John Rockwell Hosbach Jr. Date: 4/21

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