2022

Canyon Road Tree Evaluation

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Summary

Logan City in partnership with J-U-B Engineers, Inc. is in the planning phases of a proposed water line which will be installed on the north side of Canyon Road in Logan, Utah. Of particular concern is the impact of construction on 20 mature green ash (*Fraxinus pennsylvanica*) trees that border the north side of Canyon Road from approximately 623 East to 717 East. Partway through the planning phase three of the ash trees were removed and other trees were pruned. This report will analyze the current condition of the remaining 17 trees and make recommendations regarding tree removal or retention as well as recommendations to mitigate construction impacts and root cutting for those trees that remain.

Introduction

Background and History

The ash trees that line the north side of Canyon Road have been in place for approximately 105 years (growth rings were counted on one of the stumps of a removed tree). They are a landmark for those who live on the road as well as those who travel through the area. They serve as a buffer to the residents from the busy traffic along the road as well as providing shade and contributing to the charm of the area on the north side of the road. Logan City has a need to install the water line but is cognizant of the fact that the trees are historic in nature, provide benefits to the immediate residents, and provide community benefits of shade and beauty. Due to the size of the trees, their historic nature, and residents sometimes emotional attachment to the trees, the city would like to assess the feasibility of keeping the trees; balanced with the inevitable impact construction can have on their health and stability.

Figure 1 Canyon Road looking east

Assignment

This report will include a diameter measurement (**diameter breast height- DBH**), distance from limits of excavation will be noted for each tree, current health/condition of each tree, estimate of the useful life of each tree, existing/potential disease or insect problems, future concerns for the trees, potential impact to trenching on the trees, and mitigation recommendations during construction to reduce impact to trees. A **Level 1 Limited Visual Assessment** (Dunster 2017)

will be given on the trees with recommendations if more extensive recommendations are warranted.

Limits of the Assignment

The trees only received a Level 1 Limited Visual Assessment so internal decay, root structure, and defects high in the tree may not be noted. The trees have also been pruned in 2022 to remove deadwood and broken/defective branches. This is useful to improve the appearance and safety of the trees but it makes it more difficult to properly assess the true condition and vigor of the trees. The trees were also assessed while mostly dormant so an accurate accounting of deadwood-especially high in the tree is more difficult to accurately assess.

Purpose and Use of the Report

The purpose of the report is to determine the process and methods to mitigate construction impacts to the trees that will remain and make recommendations regarding removal for trees not worth preserving due to decline or trenching limits.

Observations

Site Description

The location of the trees is on the north side of Canyon Road in Logan, Utah between approximately 623 East and 717 East. All of the trees are relatively close to the asphalt on the road and between .71 feet and 7.16 feet from the limits of construction. The trees border residential properties and driveways. There are no sidewalks or curb and gutter. Many of the trees have wounds on the trunks, some presumably by vehicle collisions.

Testing and Analysis

The diameter of each tree was measured at 4.5’ above ground-diameter breast height (DBH). The distance from the tree trunk to the limits of construction was also noted (Tree Investigation Exhibit). The general condition of each tree was estimated. The trees or stumps were numbered from 1-20 starting on the west end of the study.

Figure 2 Old wounds on lower trunk

Table 1. General Condition Matrix

Tree #	DBH	Distance	General Condition of Tree- notes
1	31.8”	7.16’	Previous branch failures. Good condition. Bordered on two sides by asphalt driveways. At 633 Canyon Road.
2	39”	6.26’	Very tall tree. Previous branch failures. Good condition. Mushrooms at base of tree (***Armillaria***)
3	20.3”	4.8’	Dieback on north lead. Deadwood in tree. Fair condition. Long useful life not likely.
4	27.6”	5.44’	Dead branches recently removed in upper crown. At 647. **Self-corrected lean**. Fair condition.
5	28”	4.40’	Good condition. Some deadwood and stubs.
6	21.2”	3.92’	At 649 ½ and 651. Damage at base of tree. Some internal decay suspected. Good.
7	31.2”	3.03’	Previous branch failures. Fair/Good condition. Some horizontal cracks.
8	N/A	3.05’	Tree removed. Directly across from Preston Ave. *Armillaria* present at base of stump.
9	25.5”	3.3’	Fair condition. Co-dominant leader.
10	42.1”	1.88’	At 655. Transverse axis fracture in large branch above road. Large low branch has been removed due to conflicts with garbage trucks. Large overextended branch over road. Good/fair condition- some structural issues.
11	29.1”	1.36’	At 661. Fair condition. A lot of dieback throughout tree. Dead branches and wound in upper trunk.
12	N/A	4.47’	Tree removed.
13	N/A	1.18	Tree removed.
14	24.1”	3.3’	Fair condition. Dieback and large branches have been removed. Minor decay in trunk.
15	28.2”	4.59’	Entire tree leans over road. Early stages of decay opposite of lean. Fair condition.
16	33.8”	2.49’	Prominent root flare. Good condition. Minor deadwood. Previous removal of branches over road.
17	26.3”	4.54’	Stubs along trunk. *Armillaria* detected at ground. Trunk damaged likely from vehicle collisions. Borer exit holes on trunk. Many branches have been removed. Moderate root flair and possible girdling roots. Fair condition.
18	31.2”	3.33’	Crown raised excessively- branch stubs remain from branch removals or broken branches. Large leader over road has been **lions tailed.** Fair condition.
19	29.3”	2.56’	Fair condition- many branches have been removed.
20	35”	.71	Major lead over road. Serious decline in tree. Tree condition is poor. A lot of deadwood and branch stubs. Major trunk wound and *Armillaria* at base of tree.

Figure 3 Armillaria at base of tree

General Characteristics of all Trees in Report

All of the ash trees have been lions tailed and over raised. Lions tailing is the inappropriate pruning practice of removing lateral branches along the lower and middle sections of major leaders or the trunk and concentrating growth at the tips of the branches. Lions tailing is problematic because it removes live branches that make food for the trees when leaves photosynthesize sunlight. This deprives the trees of energy needed for optimal health and vigor. It also creates wounds that the tree needs to expend energy to **compartmentalize**. When trees are lions tailed with most of the growth concentrated at the end of the branch forces from branch weight, wind, or snow load are concentrated at the tips rather than throughout the branch. This practice can lead to branch failure and tree stress resulting in **epicormic growth**. Excessive end weight, whether it occurs naturally or through improper pruning, is a significant structural defect. (Matheny and Clark 1998)

The crown class of the trees is **dominant** or **co-dominant**. Crown class is influenced by the proximity of the tree to other trees.

All of the trees are **mature** or **overmature**. When trees are young, they have a high ratio of leaf surface for photosynthesis compared to biomass. With this high ratio they generate a surplus of energy which can be allocated towards rapid growth. This surplus of energy also is also helpful to tolerate stress and change.

As trees mature the ratio of leaf area compared to biomass decreases. Most of the annual energy generated in leaves is allocated to the maintenance of existing tissues, defense and reproduction. This means that less energy is available for growth and defense from pathogens or environmental stress. (Fraedrich)

Figure 4 Lions tailing and over raising

When the mature or overmature ash trees along Canyon Road are stressed by root cutting during construction they will have less energy reserves to compartmentalize root pruning wounds and regrow the

roots have been pruned out. Large cuts in the root system are also more susceptible to decay pathogens such as *Armillaria*.

Discussion

The primary impact of the waterline installation is damage to or cutting of tree roots. This is compounded by the distance from the tree trunks to the limits of construction which varies between each tree, the size of the trees, the age of the trees, and the condition of the trees. Because the trees are growing close to a road that was built with a highly compacted base it is likely that as the trees grew the roots encountered poor growing conditions near the road and grew parallel to the road rather than under the road. The most well-developed roots are on the north side of the trees away from the road usually in a grass park strip. The trees have adapted to poor growing conditions on the road side and have been able to survive for over 100 years and some have reached impressive size.

Effects of Root Cutting

Cutting tree roots will affect the trees in a number of ways. The first and most obvious is the loss of structural support. The second is having less functional roots that can absorb water and nutrients. The third issue is making large cuts which can be entry points for decay organisms.

Root failures comprise a significant percentage of all tree failures. They are difficult to predict due to the limited visibility of the root system and soil anchoring factors. Root failures are associated with root cutting, root decay, and other factors which weaken the root system such as high winds or heavy snow loads. If more than one-third of the **buttress roots** are decayed or severed, the tree is at high risk of failure. (Fraedrich and Smiley 2001)

When a fully mature or overmature tree looses even five to ten percent of the root system dieback in the crown is likely as well as increased susceptibility to attack by disease and insects. (Matheny and Clark 1998)

Decay

Root decay can be difficult to diagnose or recognize because it initiates underground. When trees fail and root systems and trunks are broken apart the decay is often easy to see and identify. Trees that fail under non storm conditions will have extensive decay in the buttress roots. This decay often will extend into the heartwood of the lower trunk or coalesce with decay originating in the trunk. Root decay occurs most often in overmature trees and on sites that have been disturbed by construction or in high use areas. Decay can sometimes be associated with fungal fruiting structures often found at the base of a tree, in tree **cavities**, or along the trunk. When

fungal fruiting structures (**conks, bracts**, or **mushrooms**) are identified they indicate that decay is present. (Fraedrich and Smiley 2001)

Armillaria

Armillaria mella is a pathogenic fungus that can colonize healthy tissues but typically works as a secondary colonizer of already weakened trees. Uprooting or occasionally stem fracture, can occur either before of after the death of the tree. (Watson and Green 2011)

Some of the trees have *Armillaria* at their base. In addition to already being present on the site *Armillaria* can enter into large diameter roots that have been damaged by excavation. This decay fungi can continue to grow into the heartwood at the base of the tree. (Dunster 2017)

Figure 5 Armillaria at base of tree

Calculating Extent of Root Pruning

Literature varies somewhat in regards to acceptable distances from the tree where roots can be cut. A general rule is six inches to one foot from the trunk per inch diameter (DBH) on one side of the tree. The distance given by Smiley, Fraedrich, and Henderson (2002) is: preferred distance 5 times DBH; minimum distance: 3 times DBH. As has been discussed, the majority of the root system will be on the north side of the trees and to a lesser extent ½ of the east and west side of the trees. Other factors to consider are: age of the tree(s), condition of the tree(s), and relative species tolerance to construction impacts or root pruning. A table is listed below listing each tree number, DBH, distance from tree trunk to edge of excavation, and the ratio between DBH and distance from trunk and edge of excavation. Measurements from trunk base to edge of excavation provided by JUB Engineers with Tree Investigation Exhibit.

Table 2. Distance Ratio between DBH and Distance to Excavation

Tree #	DBH	Distance	Distance ratio to DBH
1	31.8”	7.16’	2.7
2	39”	6.26’	1.92
3	20.3”	4.8’	2.83
4	27.6”	5.44’	2.36
5	28”	4.40’	1.88
6	21.2”	3.92’	2.21
7	31.2”	3.03’	1.17
8	N/A	3.05’	N/A

9	25.5”	3.3’	1.55
10	42.1”	1.88’	.54
11	29.1”	1.36’	.56
12	N/A	4.47’	N/A
13	N/A	1.18	N/A
14	24.1”	3.3’	1.64
15	28.2”	4.59’	1.95
16	33.8”	2.49’	.88
17	26.3”	4.54’	2.07
18	31.2”	3.33’	1.28
19	29.3”	2.56’	1.04
20	35”	.71	.24

If we are to strictly follow the guidelines recommended by Smiley, Fraedrich, and Henderson all of the trees are below the threshold of no root pruning closer than three times the tree diameter and only tree 1 and 3 are close.

Species Tolerance to Construction Impacts

Coder (2014) gives green ash good relative tolerance to development impacts and notes good tolerance of root pruning and loss. Ash will benefit from supplemental irrigation following injury. Tolerant of saturated soils and fill. Ash trees in general are tough and tolerant of stressful conditions when they are in good health and vigor.

Timing of Root Pruning

The best time to prune roots is before active root growth which is in late summer and fall. (Hagen 2001) It can also include late winter and very early spring. Root pruning should be avoided before bud break, through leaf expansion, and times of years when heavy winds are not expected. Summer should be avoided when water demand is greatest for the tree. Recovery may be quicker if root disturbance occurs between late summer and late winter when carbohydrate reserves are at their highest (Svihra 1997)

Methods of Exposing Roots and Root Pruning

There are three main methods to expose and prune roots.

1) Excavate the soil to expose roots using **supersonic air tool**s, pressurized water (such as a vacuum truck- hydro vac), or hand tools and selective root pruning.
2) Cutting through the soil along a predetermined line on the surface using a tool specifically designed to cut tree roots.
3) Excavating with a trenching machine or excavator to expose and prune the roots.

(Fite and Smiley 2008)

Figure 6 Root excavation with air tool

Air and water excavation are desirable because if done properly little damage occurs to the roots and they can be cut cleanly after they are exposed. During hydro excavation a vacuum system is needed to remove excess water and soil from a site. Pruning after a trencher or excavator has torn or crushed roots is the least desirable and will damage root systems beyond the excavation because the roots are pulled until they break. If an excavator is used, a careful operator can dig shallowly until resistance is felt and then the excavation can continue with hand digging so the roots can be cut.

Exposed roots can be pruned with loppers, hand saws, chain saws, or diamond bladed construction saws. It is important to make clean cuts and to not cut indiscriminately at a predetermined line but rather prune the roots back to lateral roots if possible. Roots should be cut with equipment that minimizes cracking the wood and tearing the bark.

The ANSI A300 (Part 5)- 2012 gives specific guidelines for root pruning:

> 54.12.5 Roots should not be ripped or torn during excavation
>
> 54.12.5.1 Roots should be pruned or cut prior to excavation to minimize the damage from ripping.
>
> 54.12.5.2 Ripped or damaged roots shall be exposed using the least injurious method and the damaged section cut cleanly and relatively perpendicular to the length of the root.

Assessment of Tree Condition

Tree condition is a major factor is deciding to retain trees during and after the construction process. If the trees are declining, deemed problematic, or hazardous; there is no value in keeping them unless you consider public relations; but that should override the reasons of viability and safety. The Council of Tree and Landscape Appraisers have guidelines to assess the general condition of trees which is a useful tool in making decisions regarding tree preservation vs removal.

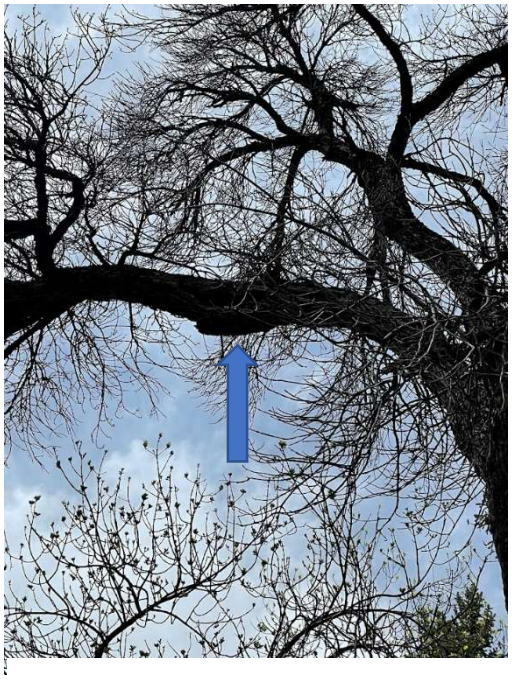

Figure 7 Transverse fracture tree # 10

Table 3. Condition Component Matrix

Rating category		Condition components		Percent rating
	Health	Structure	Form	
Excellent	High vigor and nearly perfect health with little or no twig dieback, discoloration or defoliation	Nearly ideal and free of defects	Nearly ideal for the species. Generally symmetric. Consistent with the intended use	81% to 100%
Good	Vigor is normal for the species. No significant damage due to diseases or pests. Any twig dieback, defoliation, or discoloration is minor.	Well-developed structure. Defects are minor and can be corrected.	Minor asymmetric/deviations from species norm. Mostly consistent with the intended use. Function and/or aesthetics are not compromised	61% to 80%
Fair	Reduced vigor. Damage due to insects and diseases may be significant and associated with defoliation but is not likely to be fatal. Twig dieback, defoliation, discoloration, and/or dead branches may compromise up to 50% of the crown.	A single defect of significant nature or multiple moderate defects. Defects are not practical to correct or would require multiple treatments over several years.	Major asymmetries/deviations from species norm and/or aesthetics are compromised	41% to 60%
Poor	Unhealthy and declining in appearance. Poor vigor. Low foliage density and poor foliage color are present. Potentially fatal pest infestation. Extensive twig and/or branch dieback.	A single serious defect or multiple significant defects. Recent change in tree orientation. Observed structural problems cannot be corrected. Failure may occur at any time.	Large asymmetric/abnormal. Detracts from intended use and/or aesthetics to a significant degree.	21% to 40%
Very poor	Poor vigor. Appears to be dying and in the last stages of life. Little live foliage.	Single or multiple severe defects. Failure is probable or imminent.	Visually unappealing. Provides little or no function in the landscape.	6% to 20%
Dead				0%-5%

(Council of Tree and Landscape Appraisers 2019) All of the trees are evaluated from the mid end of good to the low end of fair.

Conclusion

Removal of trees relating to construction can be a difficult decision when weighing the desires of all stakeholders. Many people have an emotional and even historical connection to trees- especially those that are large, old, unique specimens, or provide a benefit such as shade, screening, noise abatement, wildlife habitat, or desirable aesthetics. This must be balanced with practical considerations of safety, long term tree health and viability, budget restraints relating to tree preservation, current condition of trees, and practical construction methods. Long term viability, the condition of the trees, the need to trench close to the trees, and safety issues have been evaluated in order to make the most practical and realistic recommendations while trying to strike a balance between desirability, practicality, and safety.

Recommendations

Based on my investigation, analysis, and conclusions, I am recommending the following course of action regarding the remaining 17 ash trees. As outlined in the table below.

Table 4. Retention Decision Matrix

Tree #	DBH	Distance	Distance Ratio	Condition	*Armillaria* noted?	Remove/Keep?
1	31.8”	7.16’	2.7	Good	No	Keep
2	39”	6.26’	1.92	Good	Yes	Remove
3	20.3”	4.8’	2.83	Fair	No	Remove
4	27.6”	5.44’	2.36	Fair	No	Remove
5	28”	4.40’	1.88	Good	No	Keep
6	21.2”	3.92’	2.21	Good	No	Keep
7	31.2”	3.03’	1.17	Fair/Good	No	Remove
8	N/A	3.05’	N/A	N/A	Yes	N/A
9	25.5”	3.3’	1.55	Fair	No	Remove
10	42.1”	1.88’	.54	Fair/Good	No	Remove
11	29.1”	1.36’	.56	Fair	No	Remove
12	N/A	4.47’	N/A	N/A	No	N/A
13	N/A	1.18	N/A	N/A	No	N/A
14	24.1”	3.3’	1.64	Fair	No	Remove
15	28.2”	4.59’	1.95	Fair	No	Remove
16	33.8”	2.49’	.88	Good	No	Remove
17	26.3”	4.54’	2.07	Fair	Yes	Remove
18	31.2”	3.33’	1.28	Fair	No	Remove
19	29.3”	2.56’	1.04	Fair	No	Remove
20	35”	.71	.24	Poor	Yes	Remove

The biggest factor in recommending the removal of specific trees is related to the distance from the tree trunk and the edge of excavation. This can have a significant impact on the health and stability of the trees. This is compounded by the age and condition of the trees and the presence of armillaria detected on three existing trees.

It is important to mitigate the effects of root pruning/removal and construction impacts on the three trees recommended for preservation.

Figure 8 Tree #15 leaning over road

Tree Preservation

The three trees recommended for preservation are all listed as “good” condition, are at the closest just under 4’ from excavation limits and do not show signs of *Armillaria*. They are all mature or over mature trees and there will be an impact from root removal. Ash trees are listed as having good relative tolerance to construction impacts but this needs to be balanced with the close limits of trenching and the age and condition of the trees.

To minimize this impact, fencing should be placed at the limits of excavation so that the trench does not extend further than absolutely necessary and so that construction equipment does not compact soil or disturb the trees or root system beyond the fencing. Posts should be placed in the ground to support fencing so that it is not easily moved and it should remain in place until construction is complete. Fencing should extend for at least 20' and preferably more to reduce impacts to roots.

The trees will be losing the water and nutrient uptake due to root loss and supplemental irrigation should occur on the remaining root system. A deep soaking from May-September every two weeks can be the difference between survival and decline/death.

The plant growth regulator Paclobutrazol -trade name Cambistat is used on trees suffering from stress or construction impacts. It can be beneficial to stressed trees by allocating growth resources into defense or survival rather than growth. Some benefits are:

- Increase the longevity of trees growing in stressful conditions
- Increase fine root density
- Improve drought and heat resistance
- Increase disease resistance
- Reduce the effects of urban tree stress.

This product should be applied to the trees that are preserved at least two months prior to construction. Well in advance is best. This product can be applied as a basal drench anytime the ground is not frozen.

Exception to Preservation

If during the course of root excavation, it is determined that roots needing to be cut are significant enough to affect the stability or long-term health of the tree a decision will need to be made to reevaluate the situation and consider removal of the tree.

Root Excavation and Pruning

Since only three trees are listed for preservation supersonic air tools such as an Air-Spade (https://www.airspade.com/collections/all#/) or Hydro Vac should be used to expose the roots for cutting. Once the roots have been exposed, they can be cut cleanly with a chainsaw or a diamond concrete blade. If a chainsaw is used it is important to clean soil from the roots as much as possible to avoid rapid dulling of the chainsaw chain.

Replanting

In urban areas trees are often removed for various reasons. It is a disservice to the community to not replant trees where feasible so that their benefits can eventually be replaced by the new plantings. Along Canyon Road the ash trees have been a landmark and focal point for generations. As part of the project, I recommend replacing the trees, but planting them further back from the road to help avoid/limit the clearance and collision issues that have occurred in the

past. The replacement trees should be tolerant of urban conditions, not weedy, **naturalized**, or invasive, grow tall enough that the canopy can grow over the road without vehicle conflict, and not susceptible to current or projected insect or disease issues. As list of recommended trees follows:

- Bur oak *Quercus macrocarpa*
- American linden *Tilia americana*
- Silver linden *Tilia tomentosa*
- Kentucky coffee-tree *Gymnocladus dioicus*
- American elm *Ulmus americana*
- White oak *Quercus alba*
- London Planetree *Platanus x acerifolia*

All of these trees are successfully grown in Logan.

Recommendation Summary

Remove 14 trees. Retain three trees, place construction fencing against the limits of excavation for approximately 20' (Consideration will have to be given for driveway access). Deep irrigate the trees every two weeks from the months of May- September. Apply Paclobutrazol to base of retained trees at least two months prior to construction. Excavate root with Air-Spade or Hydro Vac. Replant 14 trees using recommended species. Recommendations are subject to change if the numbers in the Tree Investigation Survey are revised regarding distance from trunk to limits of excavation.

Glossary

Armillaria mellea: A pathogenic fungus that typically works as a secondary colonizer of already weakened trees. Uprooting, or occasionally stem fracture, can occur either before or after the death of the tree. The fungus can spread from colonized stumps and roots to surrounding trees. It is a white rot.

Bracts: Fruiting body or nonfruiting body of a fungus. Often associated with decay.

Buttress roots: Roots at the tree base that help support the tree and equalize mechanical stress.

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

Co-dominant: trees slightly smaller than dominant trees whose crowns define the upper surface of the canopy.

Compartmentalize: physiological process which creates the chemical and mechanical boundaries that act to limit the spread of disease and decay organisms.

Conks: Fruiting or spore producing body of wood decay fungi, forming on the external surface of the stem or trunk.

Diameter Breast Height (DBH): Diameter of the trunk, measured at breast height- 54 inches above the ground.

Dominant: Trees whose crowns extend above the general stand canopy and are not restricted by adjacent trees.

Epicormic growth: Shoots which result from adventitious or latent buds. Often occur in trees that are stressed by poor pruning practices, insect attack, or general decline.

Level 1 Limited Visual Assessment: Typically focus on identifying trees with imminent and/or probable likelihood of failure.

Lions tailed: Improper pruning technique where internal foliage and branches are removed, leaving the growth concentrated at branch ends.

Mature: Tree close to their full height and crown size, these dimensions are determined by species and site factors.

Mushrooms: Fungal fruiting body found in decaying areas of trees, around base of trees, or where root systems occur or on decaying organic matter.

Overmature: A tree having reached a developmental stage at which growth has slowed down or virtually ceased.

Naturalized: A non-native plant that does not need human help to reproduce and maintain itself over time in an area where it is not native.

Reaction Wood: Specialized wood which develops in response to a lean or similar mechanical stress, attempting to restore the stem to the vertical.

Tree Protection Zone: is an area where construction activities are prohibited or restricted to prevent injury to preserved trees, especially during pre- construction and construction.

Self-corrected Lean: Portion of a tree that leans. Tree is attempting to straighten through new growth (**reaction wood**).

Supersonic Air Tools: A tool that uses compressed air to remove and break up soil without damaging roots or underground utilities.

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Appendix A: Sample Construction Specifications

The following specifications may be used on all construction plans.

- Before beginning work, the contractor is required to meet with the consultant at the site to review all work procedures, storage areas, and tree protection measures.
- Fences shall be erected to protect trees to be preserved. Fences are to remain until all site work is completed. Fences may not be relocated or removed without the written permission of the consultant.
- Fences should extend 30’ in each direction away from preserved trees where practical.
- Construction trailers and traffic storage areas must remain outside fenced areas at all times.
- No materials, equipment, spoil, or waste or washout water may be deposited, stored, or parked within the **tree protection zone** (fenced area).
- If injury should occur to any preserved tree during construction, it should be evaluated as soon as possible by the consultant so that appropriate treatments can be applied.
- Any grading, construction, demolition, or other work that is expected to encounter tree roots must be monitored by the consulting arborist.
- All preserved trees shall be irrigated on a schedule of every two weeks from May-September. Each irrigation shall wet the soil within the tree protection zone to a depth of 24”.
- Before excavation, trees shall be root pruned near the edge of the tree protection zone by cutting all roots cleanly to a depth of 24”. Roots shall be exposed with high pressure air or hydro vac and cut with a chainsaw, hand saw, or diamond concrete cutting blade.
- Any roots damaged during construction shall be exposed to sound tissue and cut cleanly with a saw.

Appendix B: Assumptions and Limiting Conditions

- No responsibility is assumed for matters legal in character.
- Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the consultant can neither guarantee nor be responsible for the accuracy of information provided by others.
- The consultant shall not be required to give testimony or attend court by reason of this report unless subsequent contractual arrangements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.
- Loss or alteration of any part of this report invalidates the entire report.
- Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the written consent of the consultant.
- Neither all nor any part of the contents of this report, nor copy thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales, or other media, without the prior expressed written or verbal consent of the consultant particularly as to value conclusions, identity of the consultant, or any reference to any professional society or institute or to any initialed designation conferred upon the consultant as stated in his qualification.
- This report and values expressed herein represent the opinion of the consultant, and the consultant's fee is in no way contingent upon the reporting of a specified value, a stipulated result, the occurrence of a subsequent event, nor upon any finding to be reported.

Unless expressed otherwise: (1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and (2) the inspection is limited to a visual examination of accessible items without dissection, excavation, probing, or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plants or properties in question may not arise in the future.

Appendix C- Certification of Performance

I Mark Malmstrom, certify that:

- I have personally inspected the trees and 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 the assignment
- I have no personal interest or bias with respect to the parties involved
- The analysis, opinions, and conclusions were developed and this report has been prepared accordingly to commonly accepted arboricultural practices.
- No one provided significant professional assistance to me.
- 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 of the International Society of Arboriculture (ISA), a Certified Arborist (RM0460AT) since 1994, Tree Risk Assessment Qualified, and a member of the Utah Community Forestry Council and Arboretum Committee at Utah State University.

Signed: Mark Malmstrom

Date: May 20, 2022