Superior NW Enterprises

September 10, 2020

Project: Pre-construction assessment for lot re-development at 8110 SE 70th Street, Mercer Island, WA. Parcel number 5452800465.

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Objectives: Evaluate health of existing trees and establish criteria for the preservation of those to be retained.

Description: The main layout of the 8110 property has been mostly undisturbed for more than forty years. The original home was built in 1964. All of the trees currently onsite have grown up in place since the existing home was built. The surrounding houses were all built in the same timeframes and few if any changes have taken place on those lots since their construction.

The property was purchased by the current owner in 2011 and they are proposing tearing down the existing house and replacing it with one having a somewhat different footprint as shown in Figures 1 and 2. Superior NW Enterprise was contacted and asked to assess all the trees present on the lot, and near the property lines, as to their health, stability, and overall suitability for retention.

The following itemized tree list begins in the SW corner of the property and their numerical designations are reflected in Figure 3. Diameters were measured at the standard height of 54" above grade (DSH) during the July 2019 site visits. Caliper measurements were made at 6" above grade. Heights were estimated. There are no Exceptional Trees on the site.

1) Flowering Plum (*Prunus xxx*) 18" Cal, 14' tall, 7' spread standing 5' W of the property line near the SW corner of the property (Figure 4). The tree separates into 7 leaders 12" above grade all less than 6" diameter. It is in weak condition with limited new growth and poor color.

2) English Oak (*Quercus robur*) standing 55'SW of the current house's foundation and 30' NW of the edge of the asphalt on 70th. The tree separates into two main stems 6.5" and 8" DSH at the 12" mark. There are five smaller stems which come off low on the south side of the stem. Their diameters are between 1.5" and 2.5". The tree is in excellent condition with great color and abundant new growth. It reaches 28' tall and has a 9' radial spread.

3) Tanyosho Pine (*Pinus densiflora* 'Umbraculifera') 16" Cal, 18' tall, 9' spread to the SW standing 10' NW of the edge of the asphalt and 39' SSW of the SE corner of the existing house. It is part of a three tree clump which forms a single continuous canopy. It exhibits average new growth and color and is in fair condition. There is an 8" caliper subordinated pine between it and the #4 tree standing slightly to the street side of both. Likely within the City of Mercer Island ROW.

4) Tanyosho Pine 13.5" Cal, 14' tall, 8' spread mainly in the NE quadrant. It is over shadowed by the #3 tree which is only 7' to its SW. Its base is 8' back from the edge of the asphalt on 70th. The tree exhibits average new growth and color. May be within the ROW.

5) Tanyosho Pine 10" DSH, 10' tall, 6.5' spread standing 15' SW of the back left corner of the 8110 home. It is in good condition.

6) Red Alder (*Alnus rubra*) 16.5" DSH, 35' tall, 12' spread standing 25' W of the back left corner of the home. The upper half of the tree's canopy is dead as shown in Figure 5. There are multiple epicormics coming off the lower stem.

7) Douglas Fir (*Pseudotsuga menziesii*) 22" DSH, 65' tall standing 20' WNW of the back left corner of the house. The tree bifurcates at the 25' mark (Figure 6) with the stems oriented broadside to the prevailing wind pattern. It does not exhibit a fracture plane and has average new growth and color. The fir has uplifted the existing patio all around its base which is approximately 18" above grade.

8) Pine (*Pinus sp*) standing 16' NNW of the #7 fir. It has an 8" DSH and is close to 30' tall. It has foliar blight with little to no new growth limited to the uppermost canopy.

9) Red Alder 15" DSH, 40' tall, 10' spread almost entirely to the west. The tree broke out at the 14' level and has advanced decay extending down from this point on the west face of the main stem (Figure 7). There is some retrenchment low on the column. The tree leans to the west and into the green space on the neighboring property. It is standing 16' WSW of the #8 pine at the top edge of a small slope.

10) Red Alder 11" DSH, 45' tall, 8' spread mainly to the west. It is standing 6' N of the #9 tree. The uppermost branches of the alder are dying back. There is some epicormic growth along the mid-column. The tree leans slightly to the north.

11) Red Alder 17.5" DSH, 50' tall, 18' spread only to the NW quadrant. The tree stands 3' N of the #10 tree and 10' W of the #8 pine. It leans noticeably to the NW and has a large decay point at the 9' level (see Figure 7).

12) Red Alder standing close to the NW corner of the property, 18-20' below the top of the bank (edge of the backyard proper). Not measured or tagged. It appears to be about 50' tall with a 14' spread and is in below average condition (Figure 8). It was estimated as having a 14" DSH.

13a) Pacific Willow (*Salix lucida*) with four main stems between 6" and 10" DSH as shown in Figure 9. It stands near the west side of the parcel. The tree reaches 45' tall and, together with the #13b tree, has a 30' wide overarching canopy. It is in good condition for the species.

13b) Other half of the Pacific Willow stand. It contains at least one 10" stem and a handful of others in the 6-8" range. Good condition in native form (see Figure 9).

14) Douglas Fir 30.5" DSH, 75' tall standing in the City ROW 7' NE of the NE corner marker. The tree was topped or damaged near the 60' mark and now has one dominant and multiple subordinate tops (Figure 10). It has abundant new growth and good color.

There are a number of other smaller trees and shrubs scattered about the lot. A large English Laurel hedge which has gone feral runs along the NW corner of the property and into the neighboring ones (see Figure 8). It reaches 20' tall and 25' wide in places. None of the stems are greater than 9" in diameter at the standard height.

A set of three small Black Pines stand near the center of the curve along 70th. Two of them are in the City ROW, one stands fully on the subject property. The three function as a set unit. None of them are larger than 7" DSH and the tallest rises to 10'. They are in good condition and it appears from the proposed plans that they can be retained as a functional part of the landscape.

Methods: Tree assessment is both an art and a science. To properly perform, an arborist must have an extensive background in biology, tree mechanics, and tree structure that is equal parts academic and field knowledge. It takes years of study to recognize and correctly diagnose the subtle signs trees exhibit before their failure, whether it be partial or total. The process begins with a visual inspection (visual tree assessment, VTA) which is followed up as necessary with soundings, core testing, and/or other detection means. Each tree is examined and evaluated according to several factors including species type, size, vigor, injuries present, root and grade disturbance, deadwood, location and extent of decay, stem taper, exposure, and targets that are at risk.

The International Society of Arboriculture (ISA) has recently published a Best Management Practices bulletin to aid in their tree risk assessment program. This methodology for risk matter assessment will take the place of the standard ISA model currently in use. While focusing on a qualitative analysis the program is still based on three aspects of tree risk; failure potential, size of part failing (potential of damage from impact), and target rating. The aspects are scaled as follows. Failure potential (FP) can be imminent, probable, possible, or improbable. Target rating (T) is based on frequency of occupancy and is listed as very low, low, medium, or high. Selections are made in each of the first two categories and a likelihood of target impact found. It can be rated as unlikely, somewhat likely, likely, or very likely (Figure 11). Obviously a level of null risk does not exist if a tree is present. For practical purposes however, arborists assume that if there is no target, the tree poses little or no risk.

The consequences of the failure, usually a function of size of the failed part, are listed as negligible, minor, significant, or severe. Combining the likelihood of a tree failure event with the consequences of that event allows a trained arborist to assign a level of risk to a given tree's situation. There are four acceptable categories within the model; Low, Moderate, High, or Extreme. The highest level, extreme, can only be assigned when the likelihood of failure and impact is high (very likely) and the consequences are severe (Figure 12).

Discussion: According to the provided plan sets there will be no primary impact from the house construction to the trees on the lot. The primary area includes the environs immediately within the boundaries of the proposed new construction and the regions within ten feet of those boundaries. The new layout calls for terraces to be built along the west side of the parcel and their construction will intersect with the #6, #9, #10, and #11 alders.

There will be some intrusion into the secondary impact zone which includes the trees which have root systems extending within the construction area. This region, the Critical Root Zone (CRZ), is a radial area extending out from the tree a distance equal to one foot per inch of diameter. According to the plan shown in Figure 2 only one tree will be affected. The #7 Douglas fir, with a 22" DSH, has a 22' radial CRZ. The excavation for the foundation will come to within 14' of the base of this tree and the grade will be raised around it to level the upper terrace.

Typically intrusion within the Critical Root Zone is strongly discouraged by the tree care industry. However trenching type incursion, that is excavation that will occur along only one sector of a tree's CRZ, can reach significantly into the root growth area without having a detrimental long term effect. What does have to be absolutely protected is a tree's Structural Root Plate (SRP). This radial area is again related to the diameter inches of the tree in question but not quite in a direct proportion as in the CRZ. Figure 13 below illustrates the relationship.

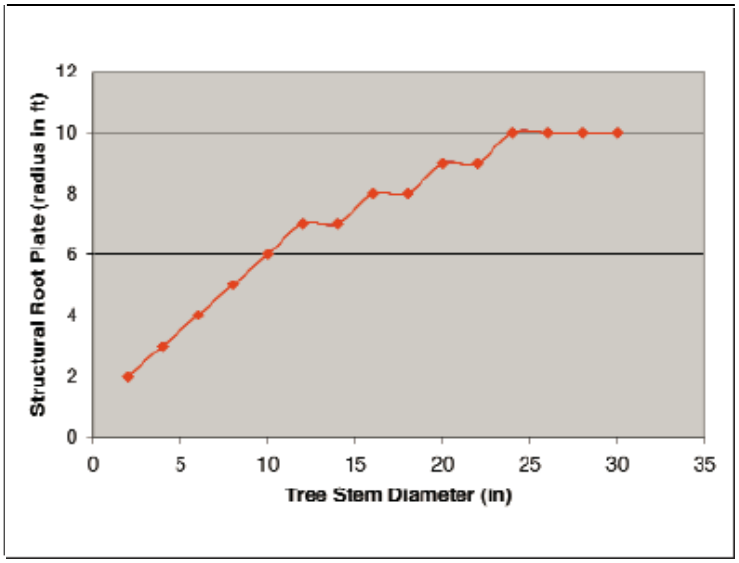

Figure 13. Size of the Structural Root Plate in relation to tree stem diameter. Note that the SRP levels off at 10' for any tree over 24" in diameter.

In the case of the #7 fir mentioned above, the excavation for the proposed foundation could come as near as 14' to the base of the tree. From Figure 13 the Structural Root Plate for a 22" DSH tree is given as 9' so the foundation demolition should be well outside this tree's SRP.

The final grade for the upper terrace is given as 274 and it will stretch about 20' west of the fir. The planter bed area the fir is standing in is shown as being at 273+7. The root crown of the fir is markedly above this level and, as stated earlier, its roots are creating uplift in the patio area. The grade change between the tree and the new house will be between 2 and 5 positive inches. The grade currently drops off rapidly on the tree's west side, nearly 3' at 10' out from its base and then 5' more over the next 10' linear.

Increasing the depth of soil more than 12" above tree roots can result in their demise as surely as severing them does due to suffocation. Either a tree well or some other modification would have to be created in order to protect the SRP of the #7 fir from overfill.

The #5 pine stands within the south side leg of the proposed upper terrace. It is shown as being just shy of the 274 line and about 7' east of the 272 line. This tree's SRP extends 6' radially.

No other trees stand close enough to the work zone for either the demolition or excavation portions of the project to have their SRPs impacted.

The chart shown in Figure 14 below is used to determine what percentage of a tree's Critical Root Zone will be affected by trenching type incursion. In general trees can sustain losses of up to 30% of the overall area within their CRZ without having long term detrimental results.

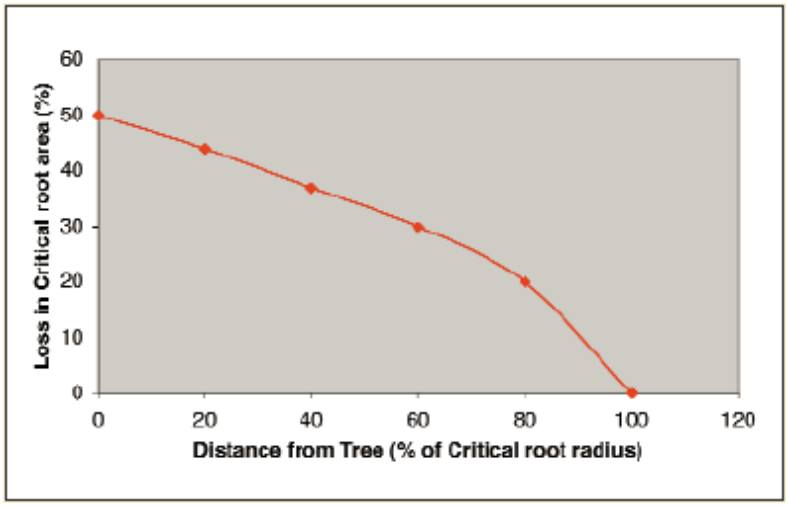

Figure 14. Chart giving the loss in critical root area as a function of the radial distance to the CRZ disturbance.

Using the #7 fir again as the example, with the foundation excavation being 14' from the tree's base and it having a 22" DSH, there will be impact at a linear distance equal to 64% of the fir's CRZ (14'/22'). The chart shows that this roughly equates to a 27% loss of the fir's Critical Root Area (CRA) putting it just within the maximum recommended impact guideline. However, if more than 8" of fill is placed over the fir's roots on its west side it will have an additive impact effect which could result in the tree's early decline.

The area around the #5 pine will also have to be carefully managed to prevent too deep of fill being placed over its roots on the west side.

The NW corners of the west side retaining walls will cross into the CRZ for the #12 alder. From the plan sets it appears that the nearest corner will come no closer than 10' to the base of the tree. This will result, at the extreme, in a 10% loss of rooting material for the alder, well within its tolerance level.

There does not appear to be significant grade changes around the other retained trees on the site. None of the other trees present on the lot have root systems which extend into the proposed work zones.

Risk Assessment: The #7 and #14 Douglas Firs are not so much at risk of falling over but rather of their large codominant spars breaking free. The spars on the # 7 tree have **possible likelihoods of failure** as an apically dominate species such as a fir with a bifurcated main stem becomes less able to dissipate wind loads. As the existing and proposed homes are just 20' from the tree, up wind of it, and the two tops are more than 20' tall, the spars are **somewhat likely to fail and impact.** The spars are less massive than an entire tree but the failure of either one of them could still cause **significant consequences**. Therefor the #7 fir would be characterized as having a **moderate risk** component.

The #14 tree stands far enough from and upwind of both homes in its area. It does however stand at the intersection of 82nd Avenue and 70th Street where auto and pedestrian traffic has to pause before proceeding. The formation of this tree is less strong than that of the #7 tree. Its spars have **probable likelihoods of failure** but only **medium likelihoods of striking** a person or vehicle. This relegates it the **somewhat likely to fail and impact** row in the second matrix. Like the #7 tree failure of a spar could still cause **significant consequences** and it would be characterized as having a **moderate risk** component.

Recommendations: The #6, #9, #10, and #11 alders should be removed during the clearing and grading period for the project. None of these trees are viable long term and due to their quite poor conditions should not be included in the tree calcs for the site.

Whether the #7 fir is suitable for retention is debatable. While it stands far enough from the actual work zone that it will not outright lose too much of its root system it is also in an area which is slated to be filled to raise the grade. If the ground is leveled to the west of the tree it will likely result in atrophy of the roots on that side. So a significantly large section of the upper terrace would have to be left with a large 'divot' to protect the tree's roots. This doesn't make a great deal of sense.

Currently the fir only has a Moderate Risk level but as it grows the force loads on the two stems will increase exponentially. It could have reduction pruning completed with a mindset to maintain the tree near its current height but that will force lateral growth and, as the tree will end up just 5-8' off the back deck of the new house, continued branch encroachment will be an issue for the life of the tree.

Because of its proximity to the new home, the #7 fir's lower canopy will have to be pruned back and some limbs removed entirely. This will change the dynamics of the tree, shifting its center of gravity higher on the column (destabilizing it) and significantly reducing the ballast/harmonic dampening effect these limbs provide.

The tree will provide good shade in the summer and break the storm winds in the winter. But it will also rain needles on the roof and decks year round and will likely drop pitch on the decks from pruning cuts. There may also be uphill neighbors which have view issues with the tree.

This arborist feels, on a balance of the issues, that the tree is best removed and a more suitable one installed at a proper distance from the home. A pair of Weeping Alaska Cedars would be good choices.

The #4 Tanyosho should be pruned to clear the street sign and create proper clearance at the curb line for vehicular traffic.

Some attention will have to be paid to the areas around the #12 and #13 trees as it was not possible to determine their exact placement in relation to the proposed work. Once the blackberries are removed and the layout for the west retaining walls fully determined the degree of impact and mitigation required for them can be better resolved.

All the trees which are to be retained will have to be protected by laying down layers of mulch to cushion any impact to their roots and to prevent soil compaction. A rough rule of thumb would be 8-12" of mulch laid down out to 3' past the existing driplines as possible. Typically 6' chain link fencing is installed to designate no impact zones and is placed at the distance proscribed by the City of Mercer Island for non-incursion which is one linear foot per linear inch of tree diameter.

Any work which has to occur within the protection fencing will require arborist oversite. Roots which are discovered in these areas should be severed cleanly rather than torn out by machinery. The exact depth of fill required and its placement will have to be determined by the arborist in real time as the project proceeds.

Waiver of Liability Because the science of tree risk assessment is constantly broadening its understanding, it cannot be said to be an exact science. Every tree is different and performing tree risk assessment is a continual learning process. Many variables beyond the control, or immediate knowledge, of the arborist involved may adversely affect a tree and cause its premature failure. Internal cracks and faults, undetectable root rot, unexposed construction damage, interior decay, and even nutrient deficiencies can be debilitating factors. Changes in circumstance and condition can also lead to a tree's rapid deterioration and resulting instability. All trees have a risk of failure. As they increase in stature and mass their risk of breakdown also increases, eventual failure is inevitable.

While every effort has been taken to provide the most thorough and accurate snapshot of the trees' health, it is just that, a snapshot, a frozen moment in time. These findings do not guarantee future safety nor are they predictions of imminent events. It is the responsibility of the property owner to adequately care for the tree(s) in question by utilizing the proper professionals and to schedule future assessments in a timely fashion.

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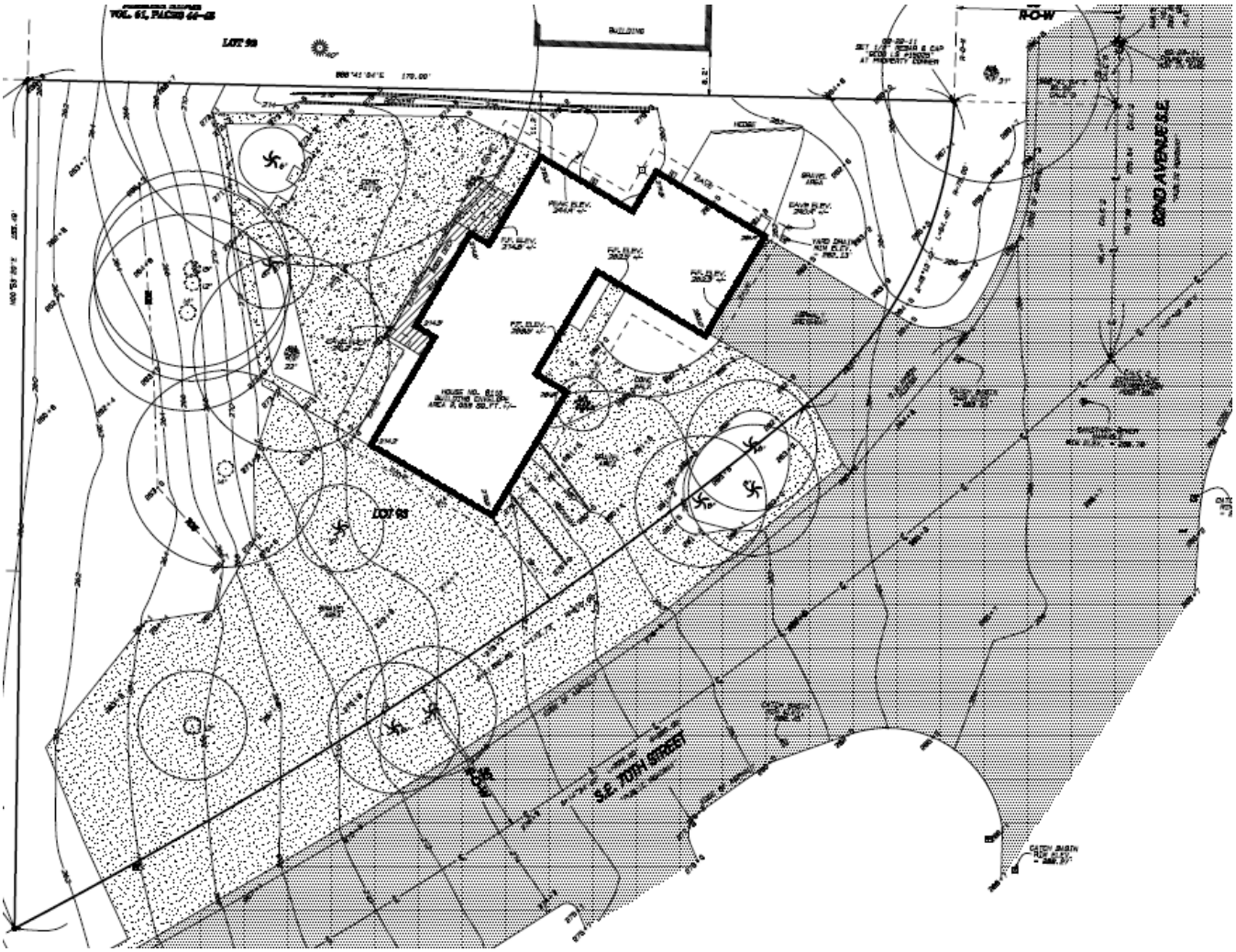

Figure 1. Excerpt from the survey plans showing footprint of existing house.

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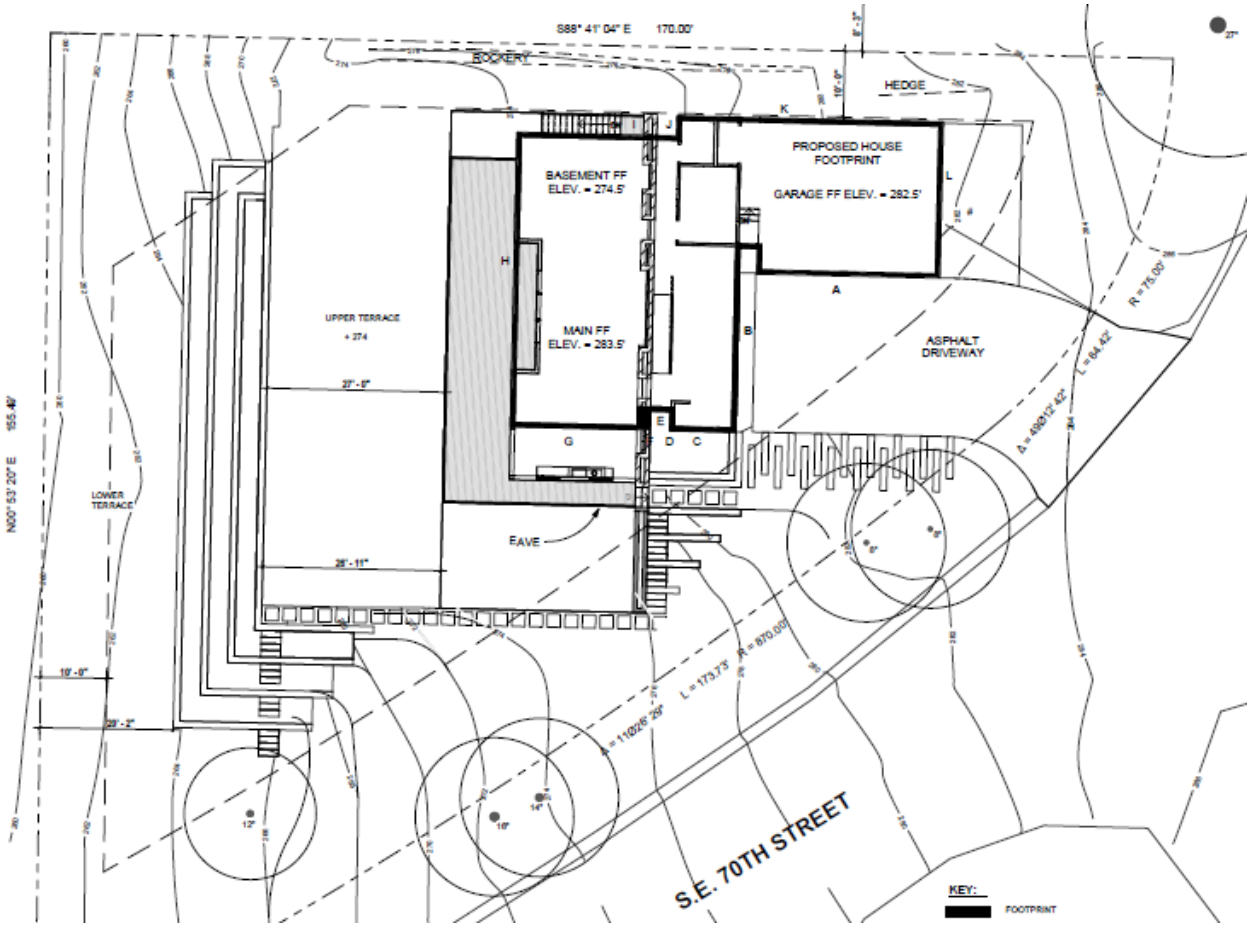

Figure 2. Excerpt from proposed plans showing new layout of home. Note retaining walls on the west side.

Figure 3. Aerial view of the subject property showing the approximate location of the trees listed in the description section (white numerals).

Figure 4. Photo showing the #1 Flowering plum and the SW corner marker.

Figure 5. Photo showing the #6 alder's canopy.

Figure 6. Photo showing bifurcation of #7 Douglas Fir.

Figure 7. Photo showing the #9-11 alders. Note their poor conditions.

Figure 8. Photo showing the upper canopy of the #12 tree and the large laurel hedge in front of it.

Figure 9. Photo of the #13a and #13b willows looking WNW across the blackberry patch.

Figure 10. Photo taken of the #14 fir damage point looking up from the street.

Figure 11. The matrix used to estimate the likelihood of a tree failure impacting a specific target.

Likelihood of Failure	**Likelihood of Impacting Target**			
	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

Figure 12. Risk rating matrix showing the level of risk as the combination of likelihood of a tree failing and impacting a specific target, and severity of the associated consequences.

Likelihood of Failure and Impact	**Consequences**			
	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