Draft Mason Gulch Landscape Management Plan

Environmental Services Department
City of Tacoma

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Supporting analysis and expertise provided by:

EXECUTIVE SUMMARY

Environmental Science Associates (ESA) prepared this draft Landscape Management Plan (LMP) to assist the City of Tacoma Environmental Services Department with management of vegetation in the vicinity of Mason Gulch. This LMP was prepared in a similar structure to an earlier plan developed for steep ravines along Schuster Parkway. Robinson-Noble, a geotechnical firm, provided expertise to this plan related to steep slopes and landslide hazard.

Mason Gulch is a steeply sloped, 36-acre open space area near the west shore of Commencement Bay in Tacoma (hereafter referred to as “project area”). The City’s North End Wastewater Treatment Plant is located at the lower portion of the gulch. About 60% of Mason Gulch is comprised of slopes greater than 40 percent. Twenty-eight percent of the acreage in the gulch is slopes at 68 percent or steeper which have the potential for, and show evidence of, past soil creep, surficial sloughing, and land sliding. In 2014, the property management authority changed within the City of Tacoma (City) to the Environmental Services Department (ES). This change was also reflected in new rate-based funding that will enable ES to more effectively manage the vegetation in Mason Gulch.

The goal of this 20-year LMP is to create a plant community composition over the long term that maximizes the ecosystem services that this site can provide. ES’s vegetative management goals for Mason Gulch are:

- achieving a sustainable target ecosystem,
- improving slope stability,
- maximizing stormwater benefits, and;
- working to protect public infrastructure and public safety.

Presently, the dominant tree species which are in Mason Gulch are early successional species. Under naturally occurring forest successional processes, shade tolerant conifers and other longer lived woody species would have established; however, urban development, the presence of invasive species, and past alterations have precluded this opportunity.

Restoring the ecosystem of Mason Gulch will require focusing on developing a forest composition that improves age diversity, species diversity, and overall forest health in order to achieve the management goals. For each management goal, both objectives and performance measures are presented in this report. The LMP includes a prioritized list of areas where ES will focus their efforts as time and resources allow.

High quality scenic views are possible from the streets and residential areas at the top of Mason Gulch – primarily along N. Stevens Street and Mason Avenue. Currently, the view potential is significantly diminished by trees. City Comprehensive Plan policies recognize public views as an asset to the community. Further project area planning and public outreach identified public and private views from nearby and/or adjacent properties as a desired vegetative management consideration.

The City receives many requests from nearby neighbors to prune or remove vegetation on City owned properties for the purposes of improving private views. Although Washington State law is clear that property owners have no common law right to a view across neighboring properties (Asche v Bloomquist, 2006), this LMP will provide a process for adjacent property owners to prune for private views on City property, pending approval from the City (see section 6.2 below).

Essentially all of Mason Gulch is classified as a Critical Area under the Tacoma Municipal Code (TMC) due to the presence of steep slopes, wetlands, streams, and Washington State Department of Wildlife (WDFW) designated priority habitat. A long-term programmatic permit under TMC 13.11 Critical Areas Preservation code will be obtained for this LMP.

On behalf of the City, ESA and Robinson Noble were retained to provide the best management practices and engineering expertise to develop this LMP. The firms analyzed geologic hazards (slope stability), as well as vegetation best management practices within the context of applicable regulations. The structure of this LMP is based on the Schuster Slope LMP prepared by Landau Associates and GeoEngineers (2014).

The LMP should be updated regularly to incorporate lessons learned from implementation and best management practices. This plan should be viewed as a dynamic document to be updated as needed, with an in-depth analysis and reevaluation around year ten. Timelines and methods for plant pruning and specifications for planting are included as appendices.

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1.0 INTRODUCTION

Environmental Science Associates (ESA) prepared this draft Landscape Management Plan (LMP) to assist the City of Tacoma Environmental Services Department with management of trees and vegetation in the vicinity of Mason Gulch. This LMP was prepared in a similar structure to an earlier plan developed for steep ravines along Schuster Parkway. Robinson-Noble, a geotechnical firm, provided expertise to this plan related to steep slopes and landslide hazard.

Mason Gulch is a 36 acre open space area under City of Tacoma (City) Environmental Services (ES) ownership and management located near Commencement Bay in Tacoma, Washington (Figure 1). The city-owned gulch property lies adjacent to private residences to the north and south; N. Stevens Street and N. Mason Avenue to the west; and the City's North End Wastewater Treatment Plant to the east (Figures 2A-2C). This Mason Gulch LMP was developed in collaboration between the City's ES Department, ESA, and Robinson Noble and public comment during X public meetings. The LMP's purpose is to provide responsible direction and a transparent process for Mason Gulch stewardship and to address these management elements:

- stormwater benefits such as managing the amount and quality of stormwater,
- slope stability and geologic hazard mitigation,
- overall forest health,
- public safety and infrastructure protection, and;
- Scenic view management.

2.0 SITE HISTORY

Throughout geologic history, the Puget Sound basin was covered several times by the Cordilleran Ice Sheet that advanced south from what is now Canada. The periods in between the glaciations had a climate similar to what we have now. During the most recent glaciation (the Vashon glaciation) the ice over Tacoma was about 2,000 feet thick. That ice melted as the ice sheet retreated about 12,000 years ago.

The upland portions of Mason Gulch historically contained what is known as the North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest (WDNR 2011). This ecological system develops through succession in which climax species, such as Douglas-fir, western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*), replace earlier successional species such as red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*). More information on this ecosystem type is presented in the Target Ecosystem, Section 4.1 of this document.

As Tacoma has settled, established, and urbanized, the once natural state of Mason Gulch was altered by development. The larger conifers were logged out of Mason Gulch and other species such as bigleaf maple became dominant. The gulch was not replanted to replace those conifers. As the area around Mason Gulch developed into residential neighborhoods, fewer native conifers were remaining nearby that could provide a source of seed that would have put Mason Gulch back on a more natural path of ecological succession. With settlement of the area also came the non-native invasive plant species which are dominant on some of the upper slopes and also found throughout the gulch. The lack of a parent seed source and competition with invasive plants is contributing to the current condition within the vegetation community found in Mason Gulch today.

3.0 EXISTING CONDITIONS

3.1 GEOLOGY/SLOPE STABILITY

Most of the Puget Sound Region was affected by past intrusion of continental glaciation. The last period of glaciation, the Vashon Stade of the Fraser Glaciation, ended around 14,000 years ago. Many of the geomorphic features seen today are a result of scouring and overriding by glacial ice. During the Vashon Stade, areas of the Puget Sound region were overridden by a significant depth of ice estimated at around 2,000 feet thick! Soil layers overridden by the ice sheet were compacted to a much greater extent than those soils which were not overridden. Part of typical glacial sequence within Mason Gulch includes the following soil deposits from newest to oldest:

Artificial Fill – Fill material is mostly placed by human activities – typically during grading for road construction.

Colluvium – Colluvium consists of loose, unconsolidated sediment that was deposited on hillslopes or at the base of slopes by rainwater washing the material or by continuous downslope creep by gravity.

Recessional Outwash – These deposits were derived from the stagnating and receding Vashon glacier and consist mostly of sand and gravel. Recessional deposits were not compacted by the glacier.

Vashon Till – is a mixture of clay, sand, pebbles, cobbles and boulders, all in variable amounts. The till was deposited directly by the ice as it advanced over and eroded irregular surfaces on previously deposited formation and sediments. The till was well compacted by the glacier and exhibits high strength and stability however drainage through the material is poor.

Advance Outwash – is typically a thick section of mostly clean, pebbly sand win increasing amounts of gravel higher in the section. The advance outwash was placed by the advancing glaciers and was overridden and well compacted by the glacier.

Pre-Vashon Continental Glacial Drift – is a composite geologic unit that includes combinations from among all the continental glacial and non-glacial deposits and are common in bluffs near Puget Sound.

Mason Gulch exists with a general southwest to northeast alignment. Elevations along the rim of the gulch are at approximately elevation 310. At the bottom of the gulch, in the northeast region of the site, elevations are approximately elevation 30 – a difference of about 280 feet. Mason Gulch is bordered by

N Mason Ave, N Stevens Street and 37th Streets in the western to southwestern region of the site. The remainder of the gulch is bordered by residential properties and the wastewater treatment plant at the east side.

Steep slopes exist near the rim of the gulch and grades appear to decrease toward the roughly 130 to 170 foot elevation in the gulch valley. Steep slopes were measured up to approximately 100% near the rim of the gulch however those slope areas were limited in size. Slope inclinations in the range of 60 to 70 percent are more prominent.

Several surface springs occur in the gulch. The springs occur mostly in the 140 to 190 foot elevation range. Horizontal water wells were installed at the site at the base of the steep slope in the southwestern region of the gulch. At least two well pipes are not visible due to soil creep. Some of the well pipes are degraded or broken off.

3.2 VEGETATION

Forest health is evaluated by considering forest age, structure, composition, function, presence of unusual levels of disease, and resilience to disturbance based on land management objectives. Although mature native trees are present in Mason Gulch, the overall forest health is considered poor to moderate in regards to its structure, status, lack of species diversity (both in age and class), and ability to provide stormwater benefit.

Mason Gulch vegetation conditions vary widely with elevation change. The upper elevations consist of a forest dominated by bigleaf maple with a sparsely vegetated understory. These slopes have few layers of native understory plants, with very few understory trees or large shrubs and limited groundcover. The slopes lack of vegetation layering, which has left the surface soil under the canopy exposed and susceptible to erosion and intrusion from invasive plant species. Observed vegetative conditions on the slopes include: invasive species, tree disease, lack of native species diversity, lack of evergreen species, lack of successional progress, and diminished soil binding root mass. The lower elevations in Mason Gulch are more gently sloping and tend to be much wetter from groundwater expressing from places near the toe of the slopes. The lower elevations are dominated by deciduous trees but have a much more robust shrub understory. As with the slopes, however, the lower elevation areas have few mature conifers and essentially no conifer seedlings or small trees.

3.2.1 Native Species

The native vegetation on the project site is dominated by a mature bigleaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra*), with bigleaf maple dominating in monocultural stands over much of the slopes on the western portion of the gulch. Less dominant native tree species include western red cedar, Douglas fir (*Pseudotsuga menziesii*), salmonberry (*Rubus spectabilis*), salal (*Gaultheria shallon*) and sword fern (*Polystichum munitum*). Big leaf maple identified in Mason Gulch are generally multi- stemmed , with individual stems averaging around 10 inches in diameter at breast height (dbh).

The typical lifespan of bigleaf maple trees is 50 to 200 years (Fryer 2011). Bigleaf maple trees observed within the project area are potentially midway through their lifespan. Most of the red alders within the project area are mature (dbh of xxx inces) and assumed to be nearing their expected life span of 70 years (Menashe 1993). In a typical North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest ecosystem (see description in Section 4.1), these early successional trees would naturally start to be replaced by longer lived or “climax” coniferous species. There are essentially no tree seedlings or saplings of any native coniferous species on the project site, which indicates that once the mature early succession trees like bigleaf maple fail there is a limited potential for the forest to mature to the next successional stage.

Bigleaf maples on the slopes along N. Stevens Street and N. Mason Avenue appear to have been topped around 1995. The topping of the big leaf maple improved the views temporarily. Unfortunately, bigleaf maple sprouts profusely when cut (even to a stump). The sprouts are typically profuse and vigorous – capable of growing 17 feet in only three years. Most of the topped bigleaf maples have rotten stems (from fungal infections) which is affecting the structural integrity of the trees. This condition is exacerbated by additional wind load on the canopy of multiple shoots attached to the same (rotting) stump.

Exhibit 1. Bigleaf Maple Topped in 1995 Showing Grown Sprouts and Rotting Stump

The topped bigleaf maples on the western slopes in the gulch are essentially the same age. These bigleaf maples, topped in the mid-nineties, show signs of fungal infection and rotting in the remaining stumps and support (in most cases) several sprouts which form a large canopy. This combination of multiple sprouts growing out of rotting stumps is likely to result in comparatively shorter lifespans for these bigleaf maples than those that were not topped.

The native understory is very limited in coverage and is concentrated at the lower elevations of the gulch where trees were left in their natural (not-topped) state and where soil conditions are wetter due to groundwater. In these areas, the dominant native understory species is Western swordfern (*Polystichum munitum*), a long-lived, evergreen fern which is included in the target ecosystem. Stinging nettle (*Urtica dioica*) and salmonberry are also common as the understory in the wetter lower elevations.

3.2.2 Invasive Species

Understory vegetation within the lower elevations of the gulch includes invasive species such as Johnson laurel (*Prunus laurocerasus*) and American holly (*Ilex opaca*) scattered around the wetland buffers and lower slopes. The upper slopes on the western end of the gulch contain the most invasive species including Himalayan blackberry and Japanese knotweed (*Polygonum cuspidatum*) which are identified by the Washington State Noxious Weed Control Board (NWCB 2014) as noxious weeds.

As defined by the Noxious Weed Control Board, a noxious weed is an invasive plant that when established is highly destructive, competitive, or difficult to control by cultural or chemical practices.

On the upper slopes of at the west end of the Gulch, Himalayan blackberry and Japanese knotweed have created aggressive monocultures which are actively outcompeting native trees and shrubs. These monocultures prevent the regeneration potential and compete with desirable vegetation for resources such as sunlight, water, and available nutrients.

Exhibit 2. Himalayan Blackberry Growing at the top of the West Slope of Mason Gulch

Invasive species observed within the project area include, but are not limited to:

Class B Noxious Weeds

- Japanese knotweed (*Polygonum cuspidatum*)
- Scotch broom (*Cytisus scoparius*)

Class C and Monitor List as Noted

- Himalayan blackberry
- Reed canarygrass (*Phalaris arundinacea*)
- English holly (*Ilex aquifolium*) - Monitor list.
- Field bindweed (*Convolvulus arvensis*, a.k.a. morning glory)

3.2.3 Trees

Exhibit 3. Topping of Bigleaf Maple on the West Slope of Mason Gulch

Past Management Practices

Vegetation within Mason Gulch has not been formally or routinely maintained by the City due to funding constraints and the gulch's status as Open Space. In addition, historic management practices of the trees within the project site have created pathways for the introduction of disease and decay, and thus have increased hazard potential and decreased overall health. Past tree topping may have exacerbated the instability of the western slope. Both permitted and unpermitted cutting and vegetation removal has occurred along and below the slope crest to create views from private residences. This is observed in bigleaf maple in which repeated topping of the tree and subsequent re-sprouting has caused extensive decay in the residual stump and older stems.

Hazard Potential

Trees are considered hazardous when all or a significant portion is likely to fail with a high risk of causing injury, damage, or disruption to a target (Smiley et al. 2011). Risk is determined when there is a target within the area which would be affected if the tree were to fail. Targets specific to the hazard potential include: public roadways, sidewalks, and persons and/or work crews within or adjacent to the project area. Without the presence of a target, a tree failure is not considered a hazard. Damage caused by tree failure is often compounded on steep slopes, as the resulting soil disturbance has the potential to cause further erosion and slope failure.

Tree safety will be increasingly important in the western slopes of Mason Gulch as the bigleaf maple reach maturity and the end of their natural lifespan. As part of this plan, it is recommended that hazard tree assessments be conducted regularly, and subsequent tree removals be conducted as necessary to mitigate the hazards outlined above. Hazard tree mitigation work should be conducted based on the tree risk assessment recommendations to maintain a low risk potential in public areas and prior to work crews performing any vegetation management activities.

Disease

Tree disease presents a concern for slope stability, public safety and forest sustainability. As trees become diseased, both the living and structural portions of the tree can actively decay, resulting in the loss of structural integrity. Damaged trees commonly have decay caused by wood-rotting fungi (Peterson et al. 1999). Improper pruning, such as topping and repeated coppice sprout removal, is a form of repeated injury which creates the opportunity for fungal disease to infect trees. Fungal diseases enter through cut wounds, decay the trunks, and can spread into the rooting system. Due to the historic improper pruning techniques (used principally on bigleaf maple trees adjacent to the slope crest) a number of trees along the slope crest are exhibiting advanced signs of decay which can present a slope stability and safety risk.

3.3 SURFACE WATER

3.3.1 Springs/Seeps

Numerous springs were observed to emanate from the slopes of Mason Gulch, forming the headwaters of approximately fourteen tributary streams.

Smaller seeps also emanate from the hillsides, saturating the surficial soil and contributing to wetland hydrology; see Grette Associates (2016) for information on Mason Gulch wetlands. Seeps and springs in Mason Gulch vary greatly in discharge from small seeps that only locally wet the surface of the soil to large springs that are estimated to discharge over a hundred gallons per minute and abruptly create larger tributary streams. This information is based upon observations made by ESA during field visits conducted in April 2016.

Springs and seeps occur in Mason Gulch due to the differing permeability between the overlying higher permeability advance outwash sediments and underlying lower-permeability clayey deposits (fine-grained pre-Fraser sediments).

Exhibit 4. Mason Gulch Tributaries (PLACEHOLDER)

Where saturated ground intersects the steep hillside in the gulch, springs and seeps emanate from the slope. Some springs appear to discharge above localized clay lenses above the main advance outwash-pre-Frasier sediments geologic contact (typically at higher elevations in Mason Gulch), whereas other springs appear to discharge closer to the main geologic contact between these formations. See Section 3.1 for a more detailed description of the geology.

The springs exhibit signs of headward erosion, whereby the water emanating from the springs erodes the hillside. This erosion results in the discharge point of the spring moving back into the existing slope, causing the length of the stream to increase. This headward erosion is a source of sediment in the creeks and can contribute to mass movements.

In addition to natural seeps and springs on the slopes of Mason Gulch, piped springs were also observed at the toe of slope.

3.3.2 Piped Water Sources

Several pipes were observed at the toe of the slope in Mason Gulch; these appear to be intercepting groundwater sources. Pipes observed, consisting of clusters of 2-inch diameter steel pipes embedded subhorizontally into the hillslope, were installed as a means to develop the Mason Gulch springs between 1883 and 1926 when Mason Gulch was owned by the private Tacoma Water Supply Company (Robinson, Roberts & Associates, 1964). Three pipe areas were observed during our field visit on April 14, 2016, including the pipe areas numbered 1, 2, and 3 in the GeoEngineers (2014) report and Robinson, Roberts & Associates (1964) report. The pipes are in poor condition, with significant rust damage, and at least two of the pipes (in Pipe Area 2) are visibly broken off. [Needs a figure here to help the reader understand where these are located.]

The three pipes at Pipe Area 2 were all flowing at the time of the April site vist, albeit at relatively low rates (a constant but small stream coming out of each pipe) during our site investigation.

A clayey layer outcrops in the vicinity of Pipe Area 2. The two pipes at Pipe Area 3 were discharging at a higher rate than the three pipes at Pipe Area 2. One pipe was discharging close to full and the other pipe was discharging approximately one-quarter to one-third full.

Exhibit 5. Piped Springs at the Toe of Slope

Exhibit 6. Area 2 Piped Springs at the Toe of Slope

Exhibit 7. Area 2 Piped Springs at the Toe of Slope

The outlet of both pipes is located just a few feet above where clayey material is visible in the channel created by the water discharging from the pipes. Pipe Area 1 was viewed from farther away, so the number of pipes was not confirmed but was at least 2, both of which appeared to be flowing at rates between those of the pipes at Pipe Area 2 and Pipe Area 3.

3.3.3 Tributary streams

Exhibit 8. Mason Creek Main Stem

Tributary streams in Mason Gulch originate as headwater springs and are generally small, with a typical ordinary high water mark (OHWM) width of up to approximately 2 feet. Some larger tributary streams have an OHW width of around 5 feet. The tributaries are generally steep, fast-moving riffles, but in some areas are step-pool channels with steps formed by large woody debris. Tributary bed material is generally sandy, with some rounded gravel, and in some instances contains softball-size cobbles. During our April field visit, water depth in the tributaries varied from less than an inch deep to a few inches deep. Mason Creek is the main stream conveyed through the area (see Exhibit 8). The mainstem of Mason Creek is approximately 8 feet wide at the OHWM.

3.3.4 Mainstem Mason Creek

Exhibit 9. Mason Creek Pool above Wastewater Treatment Plant looking upstream

Near the downstream end of Mason Gulch, Mason Creek enters a culvert just west of the North End Wastewater Treatment Plant. This culvert ultimately conveys the creek to Commencement Bay. In the reach just above the wastewater treatment plan, the stream's gradient flattens somewhat, its width widens relative to farther upstream, and the creek deposits much of its sand and gravel bedload in a large pool immediately above the culvert inlet.

Exhibit 10. Mason Creek Pool Wastewater Treatment Intake

The sediment deposited in this area is periodically dredged by the City of Tacoma. Above the pool immediately above the culvert inlet, there is some large wood which creates some small step pools. During our site visit on April 14, 2016, water depths in this reach were only a few inches, even in the small step pools.

Farther upstream, in the lower middle reach, the creek is dominated by fast-moving, shallow riffle morphology, with typical creek depths on the order of an inch or two on the day of our visit. Bed materials include sand and rounded gravels up to two to three inches in diameter. Gravel bars are active indicating regular bedload movement. Due to the confined nature of Mason Gulch, as well as due to much of its flow being sourced from groundwater, there is limited floodplain development and a general lack of off-channel habitat. The creek has good tree canopy cover and shade, and likely has cold water temperatures year-round due to much of its flow being sourced from groundwater. However, the creek’s steep gradient, shallow water depths, and non-fish-passable, long culvert connecting it to Commencement Bay make it inaccessible to anadromous fish and is therefore of limited habitat value for many species of salmon. Nonetheless, the creek and Mason Gulch do provide good habitat for a variety of other species, including songbirds, mammals, insects, and amphibians.

In their 2005 report, Herrera staff documented tall, actively eroding banks in the upper middle reach of the creek (Photo G in their report) and an active headcut in the southern branch of the upper reach of the creek where they describe undercut and highly unstable banks. However, we did not walk the upper middle reach or upper reach of Mason Creek during our April 14, 2016 site visit, so we have not personally observed these areas. Based on Herrera’s description of these features in their 2005 report, these actively eroding streambanks and the headcut could potentially be contributing a substantial amount of bedload sediment to the creek, which could subsequently be delivered to the pool above the wastewater treatment plant, necessitating sediment removal by the City. If these areas are of potential concern to the City of Tacoma due to the potential for sediment input to the creek and/or streambank/streambed instability, we could investigate these areas and provide recommendations.

3.3.5 Stormwater Outfalls

Although the draft wetland delineation report (Grette Associates, 2016) mentions residential outfalls and stormwater features collecting and conveying stormwater to Mason Gulch, we did not observe any residential or municipal stormwater outfalls discharging into Mason Gulch during our site visit. The City of Tacoma does not believe that there are any mapped stormwater outfalls that discharge to Mason Gulch (Desiree Pooley, City of Tacoma, personal communication).

3.4 PUBLIC USE

Open space areas provide public value and function from recreational opportunities to stormwater benefit. For Mason Gulch, potential public access to the interior of the gulch is limited by private property, steep slopes and the wastewater treatment plant. Based on verbal public comments during community meetings and written comments, development of new trails in Mason Gulch is not generally desired by the community. In addition, we recommend that no public accessible trails be developed on the steeply sloping parts of the gulch because of the potential for soil erosion and wet conditions due to groundwater saturation. Therefore because of slope instability issues, recreational trail development will not be considered in this LMP.

3.4.1 Views

Public Views

The City of Tacoma's Comprehensive Plan recognizes public views as a beneficial amenity of our urban area and geographic location, to be accommodated when feasible with a balanced approach with respect to safety and habitat. During the public outreach process of this LMP, the community encouraged this plan to improve scenic views from areas on the west side of Mason Gulch overlooking Commencement Bay (COT Comprehensive Plan). Views from the public right-of-way will be improved over time as City led work on restoring the vegetation on the west slopes of the gulch is completed.

Exhibit 11. Scenic View From the West end of Mason Gulch

Private View Enhancement Requests

The TMC, Chapter 9.20, currently controls how and when pruning or vegetation removal can occur on public property by, in specific instances, allowing individuals to apply to prune or remove vegetation on public City property. In accordance with this application process, an applicant is required to demonstrate that the proposed vegetation removal will not further degrade the stability of the slope or any regulated critical area per TMC 13.11. Although, maintaining views from private property is not a goal this LMP; it is intended to include processes that would allow for Private View Enhancement Requests in accordance with the LMP.

4.0 MANAGEMENT GOALS, OBJECTIVES, AND STANDARDS

This section identifies different management elements for Mason Gulch and defines overall management goals, objectives, and performance standards. The goals are used to identify the intent or purpose of the proposed management strategy. Objectives specify the direct actions necessary to achieve the stated goal. Performance standards measure how actions taken are meeting the goals. Landscape Management Procedures used to implement these goals, objectives and standards are located in Section 5.0.

4.1 TARGET ECOSYSTEM

The target ecosystem is of the North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest (WDNR 2011). Late seral stands of this forest type contain an overstory canopy dominated by Douglas-fir, western hemlock, and western redcedar, codominant grand fir with bigleaf maple and red alder as subcanopy codominants. This forest type is described in more detail in Section 3.2 Vegetation. The introduction of these native coniferous tree species is essential to the recovery and future sustainability of the target ecosystem in Mason Gulch.

4.2 MANAGEMENT ELEMENTS

Three management elements have been identified for the project area based on existing conditions and the end goal of a healthy target ecosystem. Multiple management elements may be applicable to the same location within the project area. These elements are:

Slope Stability and Geologic Hazard Mitigation: This element is the main priority within the steeply sloping areas of the gulch and will be considered the top priority in areas where slopes occur below roadway and utility infrastructure.

Forest Health: This element should be applied throughout all of Mason Gulch in order to ensure the long-term success and habitat improvement.

Scenic View Enhancement: This element may be considered where view enhancement has been identified in this LMP (views from public land) or by a private landowners (views from private land). View enhancement may occur incidentally with hazard tree removal and intentionally by planting lower-growing trees and shrubs in identified view corridors.

4.2.1 Slope Stability and Geologic Hazard Mitigation

Mason Gulch has steep slopes that are considered potential landslide hazard areas (GeoEngineers 2014, Robinson Noble 2016). Infrastructure, such as N. Stevens Street and N. Mason Avenue along with utilities and private residences located along the slope crest, and public safety are a threat if a landslide occurs that impacts the streets and sidewalks.

Effective vegetation management can help increase slope stability by controlling soil moisture content and runoff and by creating varied depths of soil binding root mass. The vegetation management plan for the west slopes of Mason Gulch also includes consideration of improperly managed trees that over time may destabilize steep slopes below public areas.

In areas where the slope exceeds 67 percent, the management of vegetation alone may not provide the benefits of public safety or infrastructure protection; thus, additional measures, such as tailored engineering solutions, may need to be implemented should the City desire to further stabilize the slopes or increase slope protection. All actions proposed in this plan on slopes 67 percent and greater (regardless if it is work proposed by ES or by private landowners) will need to be evaluated by a geotechnical engineer or an engineering geologist experienced in slope stability.

Also, the use of irrigation to maintain plantings should not be applied on any slope greater than 60 percent (Myers 1993) due to the increased potential for slope failure and erosion. With any planting (trees, shrubs, forbs, and grasses) on steep slopes, installation of additional slope stabilization and moisture retention measures may need to be done concurrently to ensure plant establishment.

Vegetation Influence on Surface Erosion and Slope Stability

Vegetation can influence the effects of precipitation on hydrology, surface erosion, and slope stability in a number of ways:

Interception

Interception is the process by which precipitation is caught on plant surfaces and is returned to the atmosphere via evaporation or, to a lesser extent, absorption by the plants without ever reaching the ground. Interception increases exponentially during a storm, and substantially reduces the intensity of precipitation reaching the ground, until the interception capacity of the vegetation is achieved. Therefore, interception is relatively more effective for smaller precipitation events which do not exceed the interception capacity of the vegetation than larger precipitation events which exceed the interception capacity of the vegetation.

Studies of coniferous forest in the western Cascades of Washington indicate that on average, 23% of precipitation is intercepted by vegetation (Link et al. 2004; Pypker et al. 2005). Studies of deciduous forests indicate that the median canopy interception is only 13 percent (Dunne and Leopold 1978). Furthermore, in the Tacoma area the majority of precipitation occurs during winter when canopy interception by leafless deciduous trees is reduced; deciduous trees are relatively less effective at interception than conifers during the rainy season which is also when slopes are more prone to mass movement. Groundcover and shrubs also intercept precipitation. For example, grasses intercept 10-20 percent of precipitation from individual storms during the peak of the growing season, but less during other times of the year when they have less bulk (Dunne and Leopold 1978).

Managing vegetation to maximize interception will help to reduce effective precipitation intensity, effective precipitation magnitude, and soil moisture, all of which can help to increase slope stability. In addition, interception is vital for reducing the amount of soil erosion by diminishing the erosive impact of raindrops. Interception can be maximized by planting multiple layers of vegetation, with large coniferous trees making up the canopy and shrubs, understory, and forest litter below, all of which will contribute to interception.

Infiltration

Infiltration is the movement of surface water into the soil. Root growth, as well as root decomposition, increases the rate and capacity of water infiltration by increasing secondary permeability in the soil. Managing vegetation to create a dense vegetation layer to increase the amount of root growth and to build-up the forest litter layer will help to both increase infiltration rates and reduce overland flow, which would otherwise contribute to surface erosion.

Transpiration

Transpiration is the transfer of water from the soil to the atmosphere in gaseous form via the plant's leaves. In locations where plant roots can penetrate the saturated zone below the water table, plants can transpire water directly from the groundwater. In the Pacific Northwest, 10 percent of precipitation is transpired by conifers during the dry season (Unsworth et al. 2004). Transpiration for deciduous trees in the Pacific Northwest is estimated to be 5 percent (Xiao, unpublished, as cited in Herrera Environmental Consultants 2008). Managing vegetation to replace deciduous trees with conifers and to increase the overall density of vegetation will help to reduce soil moisture, which in turn will help to increase slope stability.

Stabilization via root material (live and dead)

Plant roots help to stabilize soils via both increasing soil cohesion and shear strength. Plants vary in their rooting characteristics, but in general, trees provide a greater benefit to slope stabilization than shrubs or grasses due to their larger and deeper root systems. Deeply rooted species with well developed, large root systems provide more slope stabilization benefits. However, the depth of root penetration is a function of the presence or absence of a clay layer, soil moisture, soil type, and soil depth more so than the characteristic rooting depth of any particular tree species (Washington State Department of Ecology [Ecology] 2016). After trees die or are cut down, their roots decay and the stabilizing effects of the dead tree roots lessens over a three to nine year period (Ecology 2016). It should be noted that trees that are growing within 10 feet of each other and share canopy space function as a group, and removing one of these trees may destabilize the other trees (Ecology 2016).

Based on field observations as well as mapping of recently downed trees in the GeoEngineers (2014), there appears to be a concentration of recently downed trees just below the break in slope in Mason Gulch at an elevation that is similar to, or just below, that of many of the seeps and springs. One mature bigleaf maple that fell on April 14, 2016 was very shallowly and broadly rooted in saturated sandy advance outwash deposits without substantial roots extending into the clayey underlying pre-Frasier sediments. On the day that the tree fell, the soil was thoroughly saturated in the area exposed by the uprooting and groundwater was actively seeping into this area

Exhibit 12. Toppled Bigleaf Maple at Toe of West Slope in Mason Gulch

Exhibit 13. Clayey, Saturated Sediments Exposed by Toppled Bigleaf Maple

Trees are likely to preferentially root in the advance outwash deposits and will root less or not at all in the lower-permeability clayey deposits which resist root penetration. In areas of Mason Gulch where the advance outwash deposits are relatively thin over the clayey deposits, trees may have a tendency to be shallowly rooted and susceptible to uprooting. In addition, areas of soil saturation in the advance outwash deposits contribute to a localized reduction in soil strength which increases the potential for uprooting. Trees in this situation will be more prone to toppling than, say, trees located higher on the slope that have the ability to root more deeply in sandy soils which are not saturated. Tree toppling in this case may be related to both shallow rooting as well as exceptionally wet conditions in February and March of 2016.

Managing vegetation to increase the number of trees with large, deep root systems will help to stabilize the soils. However, the clay layers within Mason Gulch will act to limit the rooting depth in areas where the clay layers are closer to the soil surface than the typical rooting depth, so less soil stabilization will be achieved via root material than on sites without a clay layer. The roots of trees that are cut down will only continue to provide stability for a limited number of years, so clearing and re-vegetation efforts need to consider this limitation.

Overall, the limited removal of existing trees and vegetation and replanting with young conifers will likely cause a short-term increase in slope instability. Newly planted tree seedlings won't have the same level of interception, transpiration, and root stabilization as the more mature trees being suppressed. Therefore, in order to mitigate (but not eliminate) this increased risk, careful planning and sequencing of tree removal and replanting is important. Areas where vegetation is removed should be limited in size and the number of trees removed phased over time to minimize slope disturbance.

New plantings of native conifers should be allowed to re-grow to the point that the new vegetation is adequately rooted and providing slope stability benefits before new individual trees are cut. However, in the long term, replacing some of the deciduous trees with conifers and a dense, multi-layered canopy should help to improve slope stability, but only to the degree that increased stabilization is possible using only vegetation. Any additional slope stability concerns or slope treatments that are over and above vegetation applications should be investigated and addressed by an engineering geologist and/or geotechnical engineer with specific expertise in this area.

Water pipes

The horizontal water pipes conveying groundwater described in Section 3.3.2 are helping to drain the slopes and are likely keeping the water table lower than it would be without them. Therefore, they are likely contributing to slope stability as long as they are functioning as constructed. However, as the pipes deteriorate, and no longer drain the hillslope, resulting increases in groundwater levels could increase existing slope soil saturation and stability concerns. Any concerns regarding the future functioning of the water pipes or potential changes to them should be investigated and addressed by an engineering geologist and/or geotechnical engineer with specific expertise in this area.

Sediment Load Reduction via Vegetation Management

Vegetation management actions that reduce slope instability (both shallow and deep instability) and/or reduce surface erosion will all help to reduce the sediment load in the creek over the long term. Establishing vegetation which provides increased interception, transpiration, infiltration, and root strength, as well as increased groundcover, will all help. In addition, planting dense vegetation close to streams and in wetlands will help to trap sediment before it reaches the creek. Planting trees with large, deep root systems along the streambanks will help to strengthen streambanks and reduce bank erosion. Preventing stormwater from surrounding residential areas out of Mason Gulch will also help, because larger streamflows are capable of conveying more sediment.

Additional methods, aside from vegetation management, for reducing the sediment load arriving at the wastewater treatment plant are possible, and might include (but are not necessarily limited to) streambank and streambed stabilization. Stabilizing these areas could be achieved via bioengineering or more traditional engineering methods. More investigation would need to be done if these additional methods are to be considered.

Vegetation Removal and Planting Recommendations

- Avoid soil compaction and soil disturbance during vegetation removal and planting to the extent practicable.
- Avoid irrigation due to slope stability concerns.
- Leave tree roots in place to help promote soil stability.
- To maximize interception, plant a multi-tiered vegetation community including a canopy of large conifers, shrubs, and understory to maximize interception; forest litter will also help to increase interception. The denser and more multi-layered the vegetation is year-round, the more interception will occur.
- Carefully design spacing and phasing of treatments and plantings to reduce a short-term increase in slope instability in active management units.
- Plant dense vegetation near seeps, springs, wetlands and streams to help stabilize slopes, strengthen streambanks, and trap sediment in wetlands.
- If additional measures are desired to reduce sediment load in Mason Creek, streambank and/or streambed stabilization measures could be put in place. This work would require additional geotechnical investigations.

GOAL: A self-sustaining native plant community (Target Ecosystem) to provide rainwater interception, erosion control, and overall stormwater benefit.

Objective: To create an evergreen-dominated, mixed species, multi-layer canopy structure of large trees, small trees, shrubs, and groundcover.

- **Standard:** A 100 percent soil-binding effective tree root zone shall be maintained for healthy mature trees; the effective root zone shall be calculated as 1-foot radius of lateral root extent for every inch of diameter at breast height (DBH) of the tree’s trunk.
- **Standard:** One-half to two-thirds of the tree cover will consist of evergreen conifers in the long term.
- **Standard:** A minimum tree density of 436 trees per acre will be maintained on the site (approximately 15’-0” on-center triangular spacing between trees).
- **Standard:** Monitoring for a minimum of five years will be required to ensure establishment and survivability of the plantings.

Timeframe: Site preparation and installation of select planting areas are anticipated to be completed in three phases with a minimum of 1 year between phases for monitoring. Monitoring and maintenance will be conducted over a 5-year period to allow for plant establishment and adaptive management.

Effort: Low to moderate effort for direct planting with minimal planting area preparation, moderate effort for additional site preparation such as invasive species removal and the installation of erosion control measures.

Deep Slope Stabilization

Vegetative and engineering solutions as proposed in this LMP can reduce the rate erosional processes, but those processes are naturally occurring and cannot be stopped entirely. Control of geologic conditions cannot be achieved through vegetation management alone. The intent is to create conditions that increase slope stability in order to allow the establishment of vegetation with soil binding root systems to increase public safety and infrastructure protection. The following standards shall be considered where applicable to protect the integrity of the hillside by defining the acceptable management practices.

GOAL: Improve slope stability throughout Mason Gulch.

Objective: Implement soil stabilization and erosion control measures where applicable to allow the establishment of vegetation and provide public safety and infrastructure protection.

- **Standard:** Erosion control measures will be implemented in accordance with the most current version of the City erosion control best management practices (BMPs) as provided in the City's Stormwater Management Manual on slopes 40 percent and greater and where applicable within all disturbed areas.
- **Standard:** Slopes 67 percent or greater over a distance of 10 feet in vertical height or greater should be evaluated by a geotechnical consultant or an engineering geologist experienced in slope stability to evaluate for the appropriateness of working on that slope and implementing a landscape management program.

Timeframe: Erosion control BMPs should be implemented prior to land disturbing activities, including planting. Implementing soil stabilization and erosion control measures during restoration on slopes 67 percent or greater requiring engineering solutions, specifically in areas where public safety and infrastructure protection are a concern, may require a considerable amount of time to allow for slope assessment, design, permitting, and installation activities.

Effort: Low to moderate effort for the preparation and implementation of erosion control BMPs, moderate to very high effort for the design and implementation of slope stability measures, or engineering solutions, on slopes 67 percent or greater.

4.2.2 Forest Health

Forest health is evaluated by considering forest age, structure, composition, function, presence of unusual levels of disease, and resilience to disturbance based on land management objectives (Society of American Foresters 1998). Although mature native trees are present within the project area, forest health is considered poor in regards to its structure, species diversity, and ability to provide for stormwater benefit, forest sustainability, and slope stability. Identified issues associated with forest health include: invasive species, tree disease, lack of native species diversity, lack of evergreen species, tree rejuvenation, and low or threatened soil binding root mass.

Native Vegetation

Historically, the project area ecological system consisted of the target ecosystem described in Section 4.1 (WDNR 2011). This forest type contains an overstory canopy dominated by Douglas-fir, western hemlock, and western redcedar, codominant grand fir, with bigleaf maple and red alder as subcanopy codominants. The historical ecological system can be used as a guide for selecting native species to enhance vegetation within the project area. Other suitable native species and climate-adapted species may be included to meet the goals for slope stability and geologic hazard mitigation, habitat, public safety, and views from adjacent areas.

The intent of this LMP is to increase year-round evapotranspiration through evergreen vegetation, create a multi-layered canopy to intercept rainfall, and create a soil binding root mass with roots at varying depths to resist soil erosion. Additionally, the creation of a mature forest dominated by conifers will benefit slope stability as deep-rooted conifers can generally resist slope creep and provide a deep rooting network to bind soils.

GOAL: Create a multi-layered canopy of vegetation and improve habitat.

Objective: In addition to the tree requirements contained in the Surface Water and Erosion Control Goal above, planting areas will contain a mature shrub layer and groundcover layer.

- **Standard:** Mature shrub and groundcover layer shall be maintained at 100 percent aerial cover once established.
- **Standard:** Shrub layer shall consist of at least three native species, and a minimum of one species shall be native evergreen; groundcover layer will consist of at least two native species, and a minimum of one species shall be a native evergreen tree.
- **Standard:** Each planted shrub and groundcover layer will meet 80 percent survival by Monitoring Year 3 and 60 percent survival by Monitoring Year 5.

Timeframe: Site preparation and installation of select planting areas are anticipated to be completed within 1 year during the allowable time frame. Monitoring and maintenance will be conducted over a 5-year period to allow for plant establishment and adaptive management.

Effort: Low effort for direct planting with minimal planting area preparation, moderate effort for additional site preparation such as invasive species removal and the installation of erosion control measures.

Invasive Vegetation

Removal and ongoing control of invasive species that have a direct impact on forest health is a priority. Invasive plants are those which compete with existing native vegetation for resources, in such a way that negatively impacts the native plants' health and condition or the success of the project area. These priority invasive plants are also those that actively prohibit the establishment of new desirable vegetation. Invasive species which do not have a direct impact on forest health should be monitored and included in invasive species removal and control activities. For a list of these priority and otherwise invasive plants refer to Section 5.5 Invasive Species Control.

During the removal of invasive species, erosion control BMPs should be implemented. After removal is complete, ongoing monitoring and maintenance of and any repopulation by the invasive plants should be conducted on an annual basis. Planting vegetation and/or seeding immediately following invasive removal will assist in providing slope stability and/or erosion control once plants are established (Section 5.3). In areas with existing erosion and slope stability issues, temporary engineering controls may be needed to assist new plants in becoming established (see Section 5.4).

Management and control of invasive species within the project area is constrained by steep slope conditions and the potential short-term increase in surface soil erosion associated with their removal. Although invasive species control must be included in the LMP, the root systems of invasive species do provide soil stability and their foliage does provide a stormwater benefit. Their control must take into account the potential for soil and slope disturbance until appropriate native plantings can become established. Additional information regarding removal of the invasive species identified within the project area is provided in Appendix B.

Long-term management of invasive species must be supported through providing appropriate native vegetative communities, which limit opportunities for invasive species to become established. Fast-growing, shade-producing species (e.g., Douglas-fir) are good choices for vegetation management because they provide canopy cover for other native species and reduce opportunity for shade-intolerant invasives, such as Himalayan blackberry. Initial removal of invasives in combination with monitoring and maintenance will be needed for native vegetation to become established (Soll 2004; Myers 1993).

GOAL: Provide for a native dominated, healthy target ecosystem.

Objective: Less than 20 percent of the aerial coverage of vegetation will consist of invasive species.

- **Standard:** Remove invasive vegetation from the project area and monitor and maintain to prevent resurgence for a minimum period of five years.
- **Standard**: Replant area where invasive vegetation was removed with new native vegetation which conforms to the target ecosystem forest type.

Timeframe: The initial removal of invasive species per planting area is anticipated to be completed within one year. Monitoring and maintenance will be conducted over a 5-year period to control invasive species and allow for native plant establishment.

Effort: Level of effort is anticipated to be moderate to high for initial invasive species removal with associated erosion control measures; however, level of effort may increase pending slope conditions.

4.2.3 Public Safety

Improperly pruned, dead, damaged or diseased trees may present a hazard from falling branches or tree failure due to advanced decay. Lastly, vegetation composition on a slope can play a role in mitigating or exacerbating geological hazards including landslides, which pose risk to both people and infrastructure. Planting near the top of slopes should include plants that are dense and armored such as Nootka rose to discourage people from accessing the gulch via the steep slopes.

A Level 1 tree risk assessment could be conducted annually in the spring after the winter storm season has passed to include all public or work areas with the potential to be affected by hazard trees. A Level 1 Tree Risk Assessment is a limited visual assessment focused on identifying trees with imminent and/or probable likelihood of failure. A Level 2 Tree Risk Assessment should be applied to all trees identified by the Level 1 Assessment to have the potential to cause damage and/or injury to a target. A Level 2 Tree Risk Assessment is a more thorough visual inspection of a specific tree and its surrounding site (Dunster et al. 2013).

The goal for this management element is to enhance public safety using vegetation management with the objectives of maintaining vegetation as a barrier to slope access and maintaining tree safety within public or work areas.

GOAL: Enhance public safety using vegetation management.

Objective: Vegetation will be maintained areas as a natural barrier to slope access at the top of slopes in public property.

- **Standard:** Plant a band or thickets of thorny plants wide enough to discourage access.

Objective: Maintain public and/or worker safety through tree management.

- **Standard:** Conduct tree assessments as needed for all public or work areas.
- **Standard:** Remove hazardous trees and branches where they can impact public areas and infrastructure or work areas.

Timeframe: The initial vegetation management is anticipated to be completed over a minimum five-year period in phases for active management areas. Vegetation maintenance and tree assessments should be conducted annually as long as the public safety and infrastructure protection applies.

Effort: Level of effort is anticipated to be moderate for the initial vegetation management, level of effort for annual maintenance and assessment is considered low. Vegetation management for public safety should be applied to future public areas such as trail systems.

4.2.4 Scenic Views from Adjacent Areas

Scenic views along the slope crest of Mason Gulch from the streets, residences and public spaces include views of Commencement Bay, Browns Point and the Port of Tacoma. The existing mature trees, primarily deciduous species, are impeding scenic views over time because of past mismanagement practices. Any requests for view pruning (public or private) are subject to City review and approval for adherence to City policies, regulations and plans. The topping of trees is prohibited. Refer to Section 6 for more information on the private view request application process. Vegetation management for views can be done provided that forest health/habitat and public safety, which are directly related to slope stability, goals and objectives are met.

View obstruction occurs where the mismanagement of bigleaf maples on the west side of Mason Gulch has created a dense layer of regrowth sprouts adjacent to the slope crest. This method of topping or cutting off of trees at the base causes damage to the trees leading to their decay from fungal disease and loss of root mass (Section 3.2.3), reduces stormwater benefit through the loss of vegetative surface area (Section 3.2), and creates crown openings that allow establishment of invasive species (Section 3.2.2). The negative effect of vegetation mismanagement to maintain views is often not immediately apparent. Over time, however, slope destabilization can result from compromised forest health (Menashe 1993). Eventually, this type of destabilization can threaten infrastructure along the slope crest. Any vegetation removal for view purposes must be conducted in a phased approach to allow native evergreen vegetation to become established to support slope stability, forest health/habitat, and stormwater benefit.

Vegetation thinning and removal can improve the health and vigor of existing vegetation if done correctly (such as through removal of dead, damaged and diseased wood); it can also be detrimental to a site if done incorrectly. In addition, if vegetation clearing or pruning opens significant holes in the forest canopy, the area may become readily colonized by invasive species. When removing significant vegetation on the slope, it should be conducted selectively to increase the vigor of the native surrounding vegetation while still maintaining appropriate ground and crown cover. Mature trees (those with a diameter greater than 6 inches) should not be removed without a significant reason, and removal may not be done unless a 100 percent soil-binding effective tree root zone is maintained by surrounding established vegetation (Section 4.2.1). Mason Gulch neighbors who are interested in pruning trees to enhance a private views will need to follow the process presented in Section 6.2 and Appendix C (Process still in development).

Public Scenic View Management

A goal of this management element is to support enhancement and maintenance of scenic views from public areas. Maintaining views from private property is not a goal for vegetation management within Mason Gulch.

GOAL: Provide public views while promoting mature mixed conifer forested conditions.

Objective: Establish native vegetation prior to vegetation pruning or removal for public views.

- **Standard:** Trees shall be pruned to current industry standards according to the most current versions of the American National Standard Institute (ANSI) Z133.1for safety of pruning operations, the ANSI A300 Standard Practices, and the Tree Pruning Guidelines of the International Society of Arboriculture.
- **Standard:** Tree removal and/or pruning to maintain views shall not be conducted until the management area has met all other applicable goals, objectives, and standards.
- **Standard:** No more than 25 percent of any one tree's crown may be removed in any pruning event and for a minimum of one year following. No tree topping will be allowed under any circumstance.
- **Standard:** If mitigation planting is required in order to satisfy the goals, objectives and standards of this LMP, pruning for view enhancement may not be conducted until the planting has become established (3 years following planting).

Timeframe: Site preparation and installation of select planting areas are anticipated to be completed over a five-year time frame. Monitoring and maintenance will be conducted over a 5-year period to allow for plant establishment. Pruning actions are also only permitted during the allowable time frame.

Effort: Level of effort is anticipated to be moderate for the initial vegetation management, level of effort for annual maintenance and assessment is considered low. Pruning actions are on an as needed basis or as requested and approved.

Private View Management (Process still in Development)

While the City recognizes that private view corridors are a sensitive issue for the Mason Gulch neighbors along the slope crest, property owners have no common law right to a view across neighboring properties (Asche v Bloomquist, 2006). Within the Tacoma city limits, public views have been designated and acknowledged as part of the City's comprehensive plan; however, private views are not part of the comprehensive plan. Additionally, the City's charter prohibits City funds from being used for private benefit. As such, City funds cannot be used to fund pruning efforts solely for the purpose of creating or maintaining private views. This plan provides for the ability for the public to apply to manage portions of the project area (City property) for the benefit of their private view. All private view pruning requests are subject to City review and approval for adherence to City policies, regulations and plans. Refer to Section 6.2 and Appendix C for more information on the application process.

GOAL: Provide a process for a private vegetation modification request on City property to enhance a private view.

Objective: Provide a transparent process where private landowners may apply for and receive approval to conduct landscape management activities in Mason Gulch that are in conformance with the techniques and goals in this LMP.

- **Standard:** All management actions approved for private view management shall be conducted in accordance and compliance with this LMP.
- **Standard:** Tree removal to maintain views shall not be conducted until the management area has met all other applicable goals, objectives, and standards.
- **Standard:** No more than 25 percent of any one tree's crown may be removed in any pruning event and for a minimum of one year following. No tree topping will be allowed under any circumstance.
- **Standard:** If mitigation planting is required in order to satisfy the goals, objectives and standards of this LMP, pruning for view enhancement may not be conducted until the planting has become established (3 years following planting).

Timeframe: Site preparation and installation of select planting areas are anticipated to be completed within 1 year. Monitoring and maintenance will be conducted over a 5-year period to allow for plant establishment.

Effort: Level of effort is anticipated to be moderate for process and application, moderate for the initial vegetation management, level of effort for annual maintenance and assessment is considered low.

4.2.5 Voluntary Stewardship

As discussed above, preserving natural systems in urban environments is critical in maintaining the community's environmental health and the quality of life that Tacoma's citizen's value. While the City continues to experience urban pressures, the community's desire and need for contact with nature will continue.

Partnerships, volunteers, and community support are keys to the preservation of natural resources. Citizen participation in natural resource protection and programs results in community ownership and awareness. ES could support the development of a coordinated, pro-active volunteer management program to provide this critical linkage between the community and the project area.

In open spaces, trained volunteers who have interest in specific sites or restoration efforts and who lead work groups are referred to as "Habitat Stewards". Potential activities for Habitat Stewards may include: environmental education programs and open space restoration. Any volunteer stewardship activities in Mason Gulch would need to be organized and approved by City staff in recognition of the presence of critical areas (wetlands and streams), as well as the hazardous conditions related to steep slopes.

GOAL: Offer public "hands-on" opportunities to gain access to and restore Mason Gulch.

Objective: Provide volunteer opportunities for the diverse Tacoma demographic while implementing the strategies and tactics outlined in this plan.

- **Standard:** Engage, train, deploy and support volunteers in specific areas where volunteers can safely and effectively work towards the goals and objectives of this LMP.

Timeframe: Ongoing.

Effort: Level of effort is anticipated to be moderate for the initial volunteer engagement and the level of effort for ongoing support for volunteers is considered moderate.

5.0 LANDSCAPE MANAGEMENT PROCEDURES

This Landscape Management Procedures chapter is intended to direct the work as determined by the management goals, objectives and standards (Section 4.0) in a way which is consistent with industry BMPs. This chapter is supplemented by to the specifications (Appendix D) of this LMP. In addition, the following management procedures have been permitted as acceptable approaches for performing work within the project site, which is regulated by the Critical Areas Preservation Ordinance. Any deviation from these standards must first be granted written approval from the City's permitting authority prior to the management action being approved.

5.1 PROJECT SIZE

The total project area is approximately 36 acres. This plan recognizes that resources and funding availability dictates the management procedures that will need to be phased over time. Project size thresholds are needed in order to ensure that any given phase does not exceed the ability to be managed effectively if a complex issue or setback arises, for example an erosional event or a high level of plant mortality.

Disturbance is defined as permitted maintenance and management activities such as pruning, invasive removal, and planting. Site grading is not considered permitted maintenance and management activities through this LMP.

5.1.1 Maximum Project Size

The allowable maximum site disturbance for any contiguous phase of work is:

1. A maximum disturbance of 0.33 contiguous acres (15,000 square feet) in any given year with an Erosion Control Management Plan. Several 15,000 square foot areas may be disturbed provided the areas are not contiguous.

5.1.2 Minimum Project Size

The allowable minimum project size is one of the following (whichever is greater):

1. 400 square feet; or,
2. if work is proposed to prune and/or remove an existing tree the minimum project size shall be the measurement for the 100 percent soil-binding effective tree root zone (refer to Section 4.2.1.1).

5.2 PLANT SELECTION

Plant selection is intended to replicate the Target Ecosystem. This ecosystem includes a multi-layer canopy structure with a mix of large trees, small trees, shrubs, and groundcover. Appendix D, Table 1 includes recommended plantings for specific locations, light and soil conditions within the project area to develop a planting palette for a specific project.

In addition to plants typical of the Target Ecosystem, there are native species and climate-adapted species such as plants found along the Oregon coast which may be better suited to conditions within the project area and have been documented as good choices for providing slope stability. This is especially true for planting the exposed upper slope where well-drained soils and the mature height of plants are considerations. A planting palette may include climate-adaptive species where slope stability or other conditions are particularly challenging.

5.2.1 Trees

Large trees should generally consist of climax species of native conifers (Douglas-fir, Western hemlock, Western redcedar, and grand fir). Douglas-fir and grand fir are considered an excellent species for reforestation due to their ability to tolerate a wide range of conditions; however these species would not be appropriate for wet areas. Western redcedar and western hemlock are late successional species which require shade/part-shade and mature soils with organic matter for healthy growth; cedar and hemlock species should be installed selectively in areas with appropriate conditions. Deciduous pioneer species such as red alder and bigleaf maple are not recommended for planting as they currently dominate the project area. Small trees may include species whose mature height is typically less than 50 feet, such as shore pine (*Pinus contorta var. contorta*), vine maple (*Acer circinatum*) and cascara (*Rhamnus purshiana*).

5.2.2 Shrubs and Groundcover

Understory vegetation in the target ecosystem includes, but is not limited to: vine maple, sword fern, salal, low Oregon grape (*Mahonia nervosa*), salmonberry, devil's club (*Oplopanax horridus*), and evergreen huckleberry (*Vaccinium ovatum*). Of those, sword fern, salal, low Oregon grape and evergreen huckleberry are evergreen species which provide a dense ground cover (typically under 4 feet) below the forest canopy. These species require shaded forested conditions to thrive and are recommended for installation in areas with established canopies of evergreen trees. Vine maple is an excellent species for revegetation and can tolerate a wide range of conditions; however, it is deciduous and should be planted in combination with other evergreen subcanopy species.

5.2.3 Edge Habitat

Vegetation within edge areas and openings should consist of native species which can tolerate diverse light and low soil moisture conditions, while providing for fast, aggressive growth in order to compete with invasive species such as Himalayan blackberry. In addition to planting evergreen trees, which will eventually provide a shaded cover and restrict the growth of Himalayan blackberry, aggressive, fast growing shrubs such as Nootka rose and snowberry (*Symphoricarpos albus*) should be included.

5.2.4 Top of Slope

Planting areas which have the potential to impact views include the top of slope and the upper slope face. Therefore, the planting focus at the top of slope should consist of a well-developed cover of small evergreen trees, shrubs, and understory in order to retain top soil and prevent surface stormwater runoff from eroding the top of slope. This planting strategy can also support views, as there are many low growing, well rooted native species which can provide this function.

5.3 PLANT INSTALLATION

Plant installation on steep slopes requires additional care and planning. Soil disturbance associated with installation has the potential to increase erosion of surface soil, which could damage existing understory vegetation or plantings installed downslope. This effect can be minimized by limiting the total time spent on the slope for installation through careful planning and adhering to the following procedures (Myers 1993):

- Avoid planting in excessively wet weather conditions.
- Identify planting areas and establish minimal access routes for installation.
- Conduct digging concurrently with plant installation (this limits the number of trips into and out of the site).
- Use the smallest plant stock (e.g., seedling stock or stakes) available whenever feasible to minimize soil disturbance.

The removal of existing mature deciduous species (red alders and bigleaf maples) to accommodate new plantings is not recommended unless they are hazard trees, because removal can cause further slope instability.

Planting Stock

Plant stock may include containerized stock, bare root stock, and seedlings and are installed by planting the material into excavated holes in the soil surface. Well-developed rooted plant material creates root mass faster than other methods (such as seeding), especially when planting species with varied rooting characteristics (Myers 1993). Disturbance to the slope can be minimized by using the smallest feasible planting stock and the least intrusive planting method. Additionally, smaller (a.k.a. younger) plant material often adapts more quickly after transplant. Larger plantings require regular care and maintenance (such as irrigation) which should not be applied to steep slopes. Younger plant material is also easier to carry and handle, less expensive, and requires less soil disturbance during installation.

Seeding

Seeding for vegetative cover can be used for forbs, grasses, shrubs, and trees. Seeding alone will not repair eroding slope areas (Myers 1993); however, when applied with other soil stabilizing or engineering techniques, seeding may be appropriate. Seeding methods which may be applicable on slope areas include:

- Hydroseeding is a very common application method and involves mechanically broadcasting a mix of seed, water, fertilizer, mulch, and bonded fiber matrix onto the slope. Locations where hydroseeding is applicable in the project area is limited due to access; however, it may be applicable within areas of the slope crest (hydroseed downslope) or the slope toe (hydroseeding upslope).
- Broadcast seeding scatters seeds uniformly by hand onto the slope. Seed germination will be more successful if the soil has been roughened slightly and should be mulched immediately with compost to help retain the seed and to keep the surface soil moist (Myers 1993).

Seeding should primarily be used for erosion control (Section 5.4), such as the use of grasses to stabilize surface soil. Seeding alone on steep slopes (greater than 60 percent) is not recommended, as seed applied to the soil surface tends to be easily “transported” by surface runoff.

Live Stakes

Live staking is the placement of freshly cut (live) individual shrub branches (stakes) directly into the ground. Live staking is appropriate for species that easily root from cuttings such as willow (*Salix* sp.), red osier dogwood (*Cornus sericea v. stolonifera*), and snowberry. Live stakes are effective in reinforcing the soil structure on relatively stable slopes greater than 60 percent but can also be used on slopes less than 60 percent (Myers 1993). Installation of live stakes requires very little soil disturbance, meaning the level of effort for installation is low; however, access to the slope face is an important consideration.

Live stakes generally require moist conditions for optimal growth and success and are most appropriate in areas with wetlands or seeps. Live stakes will be used in Mason Gulch only at lower elevations in the gulch where the soil is moist from seeps.

5.4 EROSION CONTROL

Erosion control BMPs can be implemented to aid in plant establishment. Erosion control BMPs include (but are not limited to) the use of erosion control nets and blankets, straw wattles, and placement of mulch. These BMPs generally require low to moderate installation effort and should be applied in accordance with the most current version of the City of Tacoma Stormwater Management Manual's erosion control BMPs (City of Tacoma 2012). Seeding is also a preferred BMP for erosion control and is discussed in Section 5.3.

5.4.1 Erosion Control Nets and Blankets

Erosion control nets and blankets are intended to temporarily prevent erosion and hold seed and mulch in place on steep slopes so vegetation can become well established (City of Tacoma 2012). Nets are strands of material woven into an open, but high-tensile strength net. Blankets are strands of loosely woven material that forms a layer of interlocking fibers, typically held together by biodegradable or photodegradable netting. Nets and blankets can be used for slopes greater than 50 percent.

5.4.2 Wattles

Wattles are temporary erosion control barriers consisting of straw wrapped in biodegradable tubular plastic or similar encasing material to prevent surface erosion. Wattles may reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment. The wattles are placed in shallow trenches and staked along the contour of disturbed or newly constructed slopes. Wattles can be used temporarily on slopes up to 67 percent until permanent vegetation can be established.

5.4.3 Mulching

Mulching is the application of straw, wood chips, or other suitable materials on the surface of a slope. This technique should be applied on slopes less than 50 percent and may be placed by hand or by a machine. Mulching can reduce erosion by protecting the soil surface from raindrop impact or wind. This BMP is also beneficial when included with plant installation, as it increases moisture retention, provides insulation from heat and cold, and can reduce the competition from grasses when mulch is placed around woody plantings.

5.4.4 Engineering Solutions

Engineering solutions typically are inert structural designs to slow or arrest the creep behavior of the surface soil on steep slopes, thus allowing vegetation to become established. These methods have a high level of effort and cost, as these methods generally require geotechnical engineering for design and construction crews for installation. Within the project area, the use of engineering solutions should be targeted for the support of public safety, infrastructure protection, and trail design. The following subsections describe several engineering solutions that may be applicable to the Schuster slope.

5.5 INVASIVE SPECIES CONTROL

Effectiveness of the various short-term control methods of invasive plants varies depending on species, density, and site access. (King County 2008a, b). Manual removal is effective when dealing with small populations or isolated invasive plants. Mechanical removal is effective for large-scale control especially when incorporated with engineering solutions; however, it may not be feasible on steep slopes or areas with limited access. Covering, sometimes referred to as "sheet mulching" is effective with small populations in targeted areas; however, covering may be impractical for larger areas, especially on slopes, because the process of cutting vegetation, covering the area and ensuring that the covering remains in place is labor intensive and may be cost prohibitive.

In accordance with the US Environmental Protection Agency's (EPA) guidance on Integrated Pest Management, the least invasive method of invasive control shall be employed, which may include herbicide use if the situation dictates that it is infeasible to use other control methods. Foliar herbicide treatment is not recommended for small patches of invasives surrounded by native vegetation since many herbicides are non-selective. If it is determined that the preferred removal practice of the large stands of invasive species is through the application of an herbicide, the limitations to herbicide use shall be in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and specific restrictions of the EPA and State Department of Agriculture, WDFW, and Ecology. Note, certain pesticides are considered Restricted-Use Pesticides under FIFRA, and may be applied only by or under the direct supervision of specially trained and certified applicators and restricted from certain areas (i.e. wetlands, streams and other aquatic areas). For specific control methods for the priority invasive species, refer to Appendix B.

Invasive species that are currently impacting forest health in the project area include:

- Japanese knotweed: Class B noxious weed. Once established, this species is difficult to control. It spreads via long, stout rhizomes and can form dense stands that crowd out native vegetation and degrade wildlife habitat. Japanese knotweed is commonly found in disturbed areas near the slope crest and the slope toe.
- Scotch broom: Class B noxious weed. This shrub spreads aggressively in sunny, dry areas, outcompeting understory vegetation and young trees.
- Himalayan blackberry Class C noxious weed. An aggressively growing species with large hooked thorns that creates dense thickets which severely inhibit native understory vegetation. Its ability to reproduce from a variety of vegetative pieces increases its ability to inhibit the growth of native understory and commonly creates monocultures in disturbed, sunny areas.
- Reed canarygrass: Class C noxious weed. Commonly found in wetlands, stormwater ditches, and disturbed wet areas. This species outcompetes native species and creates dense monocultures.
- English holly: Monitor list. Although slow-growing, this species survives in both sun and shade

and can reach 15 to 50 feet in height and 15 feet in width. This growth can create dense thickets and suppress the establishment of native species.

5.6 PUBLIC SAFETY

5.6.1 Access Control

Access control is the concept of physically guiding users to intended access areas and limiting opportunities for access into unintended areas (Virginia Crime Prevention Association 2005). Access control is intended to reduce opportunities for the public to enter areas not intended for public use, both to protect steep slope vegetation and also to discourage illicit use of areas that are infrequently monitored.

5.6.2 Selective Pruning and Removal

Proper pruning can be a tool in creating and improving views. Selective pruning should follow the guidelines presented in the *Open Space Management Plan for Stadium Way – Schuster Parkway* (Van Pelt 2002, "Chapter IV Vegetation Management; Section C Recommended Tasks for View Enhancement"). For conifer species, selective pruning includes methods such as windowing (removing select branches), inter-limbing (removing select branch whorls), and skirting up (removing lower branches; Menashe 1993). The pruning of broad leaf trees is usually more complicated and includes the select removal of branches and thinning of the crown. When completed correctly by a trained arborist, the tree's health is maintained; however, incorrect pruning can cause severe damage to the tree and can increase the likelihood of failure. Practices such as topping, of both conifers and broad leaf species, leave multiple areas for disease entry and trigger superfluous growth known as "coppice sprouting" which creates dense clumps of multiple stems with weak attachments. Additionally, excess removal of crown vegetation leaves large openings in the canopy, which can encourage invasive species such as Himalayan blackberry and allow for increase erosion due to lack of vegetative cover.

All pruning shall be conducted in accordance with the most updated version of the Approved American National Standard (ANSI) for Tree Care Operations – Tree, Shrub, and Other Woody Plant Management – Standard Practices (Pruning; Tree Care Industry Association Inc. 2008). No more than 25 percent of any one tree's crown may be removed in any pruning event. Additionally, pruning should be conducted in a manner to avoid large openings in the vegetation cover that may increase soil erosion.

Where feasible, the downed wood should remain in place so as to minimize the land disturbance that would otherwise be caused by the removal of the large debris from the site. If a tree is designated for removal, consider leaving a portion of the trunk in place as a "snag" to provide for additional forest habitat. This should only be done with consideration to potential conflicts with adjacent infrastructure or public areas.

6.0 LANDSCAPE MANAGEMENT PLAN IMPLEMENTATION

It is intended that this LMP will be implemented over a period of at least 20 years. Ongoing monitoring and maintenance will need to continue for the life of the landscape in order to ensure that Mason Gulch will continue to thrive in a healthy and safe condition.

Implementation of this plan will generally be carried out in one of two ways: through City lead actions in accordance with the prioritization of the project area as described in Section 6.1 and, through privately initiated actions as described in Section 6.2. City lead actions will be implemented as resources are available, and will specifically focus on slope stability, public safety, forest health and scenic views from public areas. The privately initiated actions (Section 6.2) are those which are driven by community member interests when a private landowner would like to make modifications to vegetation on a shorter timeframe than City resources can complete on its own.

6.1 CITY LEAD ACTIONS

As previously discussed in this LMP, the restoration of Mason Gulch to its ideal, sustainable target ecosystem can only be achieved through adaptive management techniques and best management practices at the time of implementation. Section 6.1 is reflective of the known data, industry standard practices, and compliance with regulations at the time of publishing (2016).

6.1.1 Prioritization

Landslide Susceptibility

Public safety and infrastructure protection is the top priority with regard to site management and mitigating potential soil erosion is critical. The prioritization of slopes with previously topped bigleaf maple has taken into consideration landslide susceptibility based on the age, health and condition of these trees, existing geologic conditions and the presence of roadways and other spaces used by the public at the top of steep slopes.

Vegetation Condition and Invasive Species Presence

The condition of existing vegetation is critical to management considerations and the level of effort moving forward. Any area with limited native tree canopy dominated by invasive plants should be addressed before proceeding with restoration of other areas because of the likelihood of invasive plants spreading to restoration sites

Scenic View Potential from Public Spaces

The City recognizes the benefits that high quality scenic views can provide to the public when achieved in a responsible manner. As such, the City is committed to performing work in compliance with this LMP in order to provide for improved public views in designated areas. View enhancements for pedestrians will also benefit motorists; however, the most scenic views from vehicles are viewed obliquely so not considered as important as views from users of the public spaces.

Exhibit 14. Scenic View of Commencement Bay from near N 37th Street

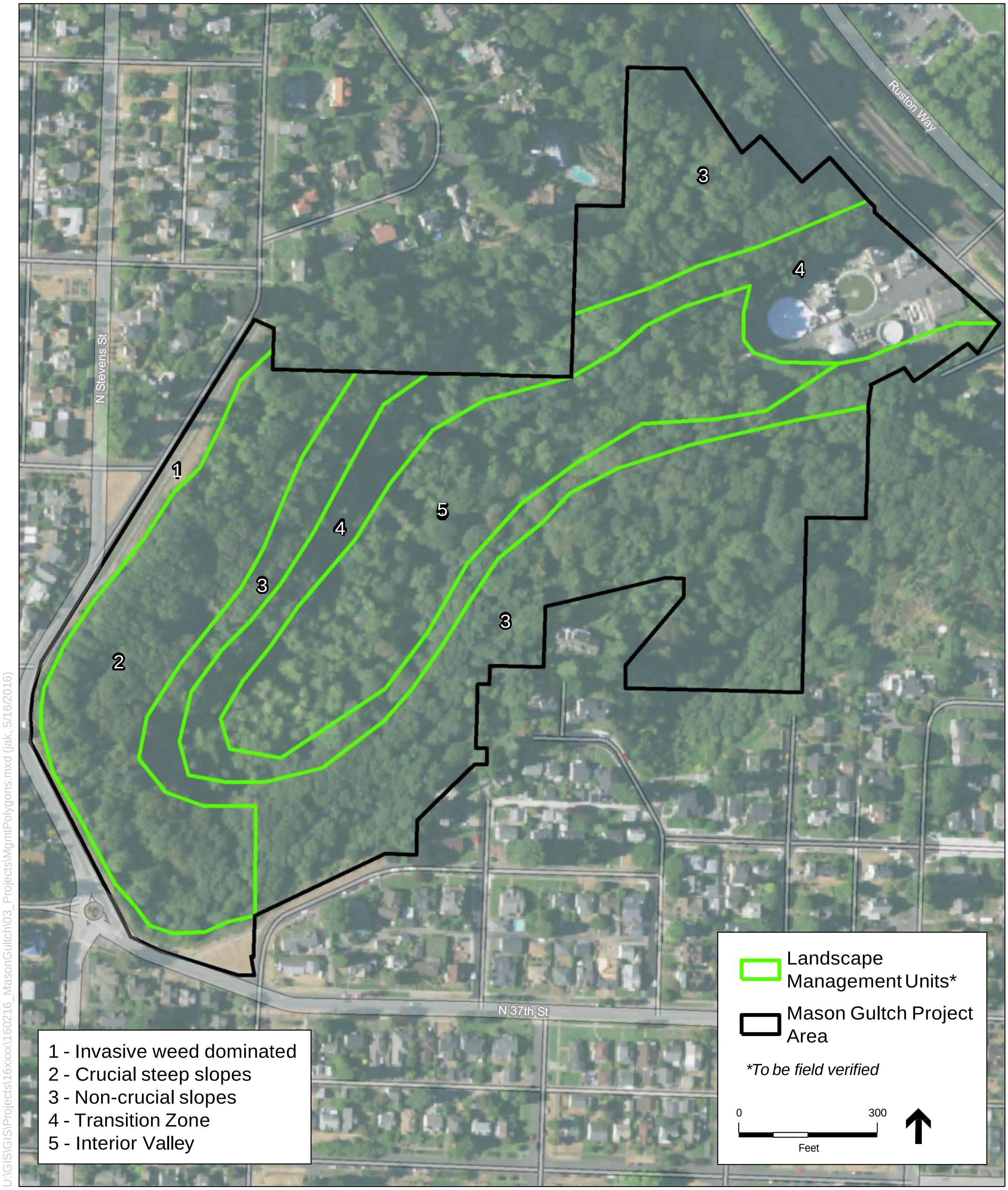
Aquatic Critical Areas (Wetlands/Streams)

Presence of aquatic critical areas, such as wetlands and streams, increases the need for management for both protection and enhancement of these sensitive waterbodies. Wetland and stream delineation (Grette Associates, 2016).

6.1.1 Management Units

The 36 acres of land in Mason Gulch are divided into five management units based on the type and level of treatment proposed. For example, the slopes on the west end of Mason Gulch that contain damaged trees are a separate management unit that will require much more intensive restoration efforts than the interior valley of the gulch which is mostly densely-vegetated wetlands. The management units are also designed to allow restoration work by trained volunteers in three of the five units. In addition,

restoration work can proceed in different management units simultaneously without risk of destabilizing steep slopes or other unintended results. Restoration work in the Crucial Steep Slopes area however, will be phased to avoid the risk of slope failures.



NAIP 2013; ESA 2016

Mason Gulch Landscape Management Plan . 160216

Exhibit 15

Landscape Managment Units in Mason Gulch

Crucial Steep Slopes (Ex 15, #2)

The stability of the steep slopes at the west end of Mason Gulch is crucial to protecting public safety. This Crucial Steep Slopes area is below roadways, utilities, sidewalks and public use open space that would be at risk in the event of a significant slope failure. The vegetation in this management unit is dominated by bigleaf maple sprouts that form trees and may be likely to topple and cause slope instability.

Exhibit 16. Topped Bigleaf Maple – Some with Bowed Trunks from Soil Creep

Non-Crucial Steep Slopes (Ex 15, #3)

Non-Crucial Steep Slopes are found on the north and south sides of Mason Gulch. These slopes contain mature native vegetation that has not been topped and could be considered generally healthy. The primary restoration actions needed are removal of sporadic invasive non-native plants and inter-planting with conifer seedlings and other species to add diversity and move toward the target ecosystem.

Exhibit 17. Non-Crucial Slopes Dominated by Deciduous Trees (PLACEHOLDER)

Invasive Weed Dominated(Ex 15, #1)

This management unit is located near the crest of the steep slopes in the western portion of Mason Gulch. This strip of hillside has Japanese knotweed, Scott's broom, and Himalayan blackberry in addition to other weed species that are preventing native vegetation from becoming established. The restoration will include weed eradication and replanting.

Exhibit 18. Himalayan Blackberry and Japanese Knotweed along the top of the western slope

Interior Valley(Ex 15, #5)

The flatter interior valley of Mason Gulch is predominately wetlands and Mason Creek including the groundwater seeps that feed the creek tributaries. Much of this area consists of dense native shrubs with a deciduous tree canopy. Sporadic invasive non-native plants (mostly laurel and holly) can be found in the Interior Valley. Restoration work will mostly consist of planting coniferous trees that are adaptable to wet conditions along with sub canopy trees and native wetland shrubs to add species diversity.

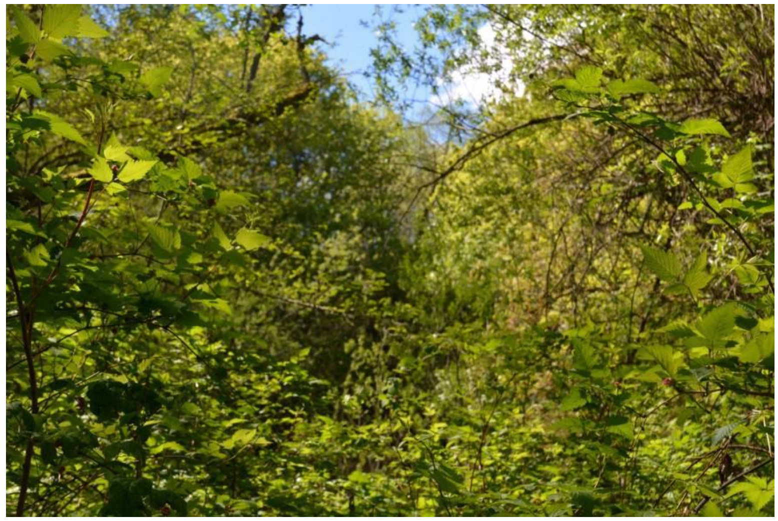


Exhibit 19. Dense Native (Mostly Deciduous) Vegetation in the Interior Valley of Mason Gulch

Transition Zone (Ex 15, #4)

The Transition Zone is a fairly narrow band at the base of the slopes where the soils are wetter and where underlying soil types change from sand to silty clay. The soil moisture and density of the soils affects what vegetation grows in this area. This management zone is experiencing mature tree toppling due to shallow-rooted trees and saturated (and thus structurally weak) soil conditions. As the opened tree canopy allows more light to the ground, there is a risk of invasive plants colonizing this zone. This zone also lacks coniferous trees and a diverse shrub layer. Many of the deciduous trees are mature and appear senescent. Restoration efforts in the Transition Zone will include invasive species removal, planting of coniferous tree seedlings and probably live stakes of wetland shrub species like red twig dogwood and snowberry to add to the sub canopy and diversity.

Exhibit 20. Transition Zone Groundcover

6.1.2 City Action Plan

Management Unit Progression

As mentioned, the Invasive Weed Dominated Management Unit should be the top priority in restoration in order to remove a source of weed infestation to adjacent restoration areas. Next, the Crucial Steep Slopes should undergo a phased restoration that limits the total acreage of individual restoration areas. The remaining management units; Non-Crucial Slopes, Transition Zone and Interior Valley are less of a priority but could have restoration work occurring simultaneously with the first two units depending on the resources available. Monitoring will be conducted for each management unit in order to evaluate the effectiveness of the restoration strategies

and techniques used. This monitoring information will be used to adaptively manage future restoration work.

6.1.3 Crucial Steep Slopes Management Unit 1 Restoration

Treatment currently under review….

6.2 PRIVATELY INITIATED ACTIONS

One of the goals of the Mason Gulch LMP is to allow for a transparent process for private landowners to perform work on this City-owned land, with City oversight. The process defined in this section is intended to supplement the current Tacoma Municipal Code (TMC) 9.20, Trees and Shrubs – View Blockage, process and requirements to remove and/or prune trees on City-owned property.

Essentially all of Mason Gulch contains Critical Areas as defined by TMC 13.11 Critical Areas Preservation, and all management actions are therefore governed by the requirements of this chapter of the TMC. This document is intended to receive a development permit from the City's Planning and Development Services (PDS) Department, in compliance with the requirements of the Critical Areas Preservation Code. This development permit will allow the ES Department and any other parties acting in compliance with this permitted LMP to perform work in areas up to 67 percent slope without having to obtain a separate permit for each and every proposed action. However, we understand that the City will review and approve citizen proposals for any such work in Mason Gulch and provide oversight of these actions and outcomes.

Proposed projects located within areas above 67% slope will need additional geotechnical review, specific to the site and proposed work plan, and will need subsequent additional City staff review. Proposed projects located within streams, wetlands or associated buffers will also need additional City staff review.

This process and submittal requirements are further defined in the Privately Initiated Vegetation Modification Requests (Appendix C).

7.0 CONCLUSION AND RECOMMENDATIONS

This LMP was designed to address landscape and vegetative challenges identified for Mason Gulch and to provide strategies for slowing slope erosion, improving forest health and stormwater benefit, ensuring public safety and allowing for improvements to views from adjacent areas. Included in this LMP are management goals, objectives, and standards with management options and implementation tools to ensure the best possible approach to managing this project area with the above priorities in mind.

This report was written to provide the City and the public with specific vegetation management prescriptions for Mason Gulch, and is not intended to provide blanket approval for all work within wetland and other critical areas. Work within these critical areas may require additional review and documentation. Additional review and approval will be required by the City for any management activities that are proposed as being compliant with this document.

8.0 USE OF THIS REPORT

This LMP was prepared in order to obtain a development permit per the TMC, 13.11 Critical Areas Preservation to implement the management strategies contained within this LMP. In addition, this LMP is intended to provide the City with the tools necessary to manage the landscape in a manner which will not further degrade the project area. To ensure that the intent of the Critical Areas Preservation Code is met, periodic review of this adaptive management plan and any subsequent project proposals should be conducted by City staff on a regular basis. Please note that any vegetation removal will decrease the soil binding root mass and could increase the likelihood of slope failure. This LMP however, presents specific actions and mitigation methods that make vegetation management in Mason Gulch an acceptable risk by the City.

9.0 GLOSSARY

ANSI A300 Standards: Industry developed standards of practice for tree care; acronym for American National Standards Institute.

ANSI Z60.1 Standards: Industry developed standards for nursery stock sizing and describing plants to facilitate the trade in nursery stock; acronym for American National Standards Institute.

ANSI Z133.1: Industry developed safety standards for tree care operations.

Arborist; also see Certified Arborist: 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 plants.

Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

Bare Root Stock: Plants grown in the ground in the nursery without artificial root restriction devices, such as containers or fabric bags. When dug the soil is removed from the root systems and the plants are transported and sold without soil.

Caliper: Diameter of a tree's trunk or stem measured at a point 6 inches above finish grade if the resulting measurement is up to and including 4 inches. If the resulting measurement is more than 4 inches the point of measurement shall be relocated to 12 inches above finish grade.

Central Branch; Central Leader: A singular, dominant, upright branch or stem which does not have any stems arising from a common junction having nearly the same size and diameter.

Certified Arborist: An individual who has achieved a level of knowledge in the art and science of tree care through experience and by passing a comprehensive examination developed by some of the nation's leading experts on tree care. Certified Arborists must maintain their certification and be in good standing with the International Society of Arboriculture (ISA), or equivalent agency.

Climate adapted: Both native and non-native plant species which are able to thrive in the local climate and soil conditions of a specific region. The two most authoritative references on climate adaptation for plants are the USDA Plant Hardiness Zones and the Sunset Climate Zones. Plants that are considered climate adapted shall be selected in accordance with one or both of these resources.

Codominant Branches; Codominant Leaders: Branches of stems arising from a common junction, having nearly the same size diameter.

Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant.

Topping: The practice of periodically cutting back the living, above ground portions of trees or shrubs to ground level or to a stump. This practice had been commonly used on the Schuster slope to accommodate for views.

Critical Root Zone (CRZ): The area under a tree whose diameter measures one foot per one inch of DBH from the trunk outwards and twenty-four inches in depth.

Deciduous: A plant that loses its leaves and remains leafless for some months of the year, usually in winter (temperate zones) or the dry season (tropical zones).

Diameter at breast height (DBH): A tree's trunk or stem diameter measured at four and one-half feet above the ground.

Drip Line: The area on the ground below the tree in which the boundary is designated by the edge of the tree's crown.

Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

Ecosystem Type: An Ecosystem is the combination of two words (ecological and system), which describes the collection of abiotic and biotic components and the process that governs behavior found therein. There are two types of ecosystems found on Earth: terrestrial and aquatic. All sub-types of ecosystems fall under these two categories.

Establishment Period: A minimum of a three year time period following the transplanting/installation of vegetation wherein maintenance is critical to the survival of the vegetation.

Evergreen: A plant that bears leafs throughout the year.

Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with a well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

Feeder Bluff: The term applied to certain coastal cliffs or headlands that provide sediment to down-current beaches as the result of wave action on the bluff.

Feeder Root Zone: The area under a tree whose diameter measures two feet per one inch of DBH from the trunk outwards and twenty-four inches in depth. For example, for a ten-inch DBH tree, the Feeder Root Zone is at least twenty feet in diameter and 24" deep.

Groundcover: Low and dense growing plants that cover the ground which can be planted for ornamental purposes, habitat or to prevent soil erosion. Turf lawn and mulch do not count as groundcover.

Hardiness Zones; USDA Plant Hardiness: Developed by the U.S. Department of Agriculture, Plant Hardiness Zones divide North America into geographic zones based on average winter lows.

Invasive Weeds; Noxious Weeds: Non-native plant species which have been proven to have a negative impact on the environment and are highly destructive, competitive, and difficult to control or eliminate. For a current listing of Pierce County Invasive/Noxious weeds consult the Pierce County Noxious Weed Control Board.

Perennial: A plant having a life cycle lasting three or more years.

Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, herbicides, fungicides, rodenticides, and molluscicides.

Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

Planting Area: Locations on private property or the public right-of-way proposed or required to be planted.

Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that that may be modified with soil amendments to produce a soil mixture best suited for plant growth.

Plants; Plant; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, groundcovers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

Root Flare; also called 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.

Shrub: A woody perennial plant that is generally less than fifteen feet in height at maturity.

Slope Face: The sloping portion of a high bank, typically the area between the slope crest and the slope toe.

Slope Toe: The point where the base of a slope meets flat ground.

Soil-Binding Root Zone; Effective Tree Root Zone; 100 Percent Soil-binding Effective Tree Root Zone: calculated as 1-foot radius of lateral root extent outward from the trees trunk for every one inch of DBH of the tree's trunk. See "Critical Root Zone".

Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

Stormwater Benefit: A term used to define stormwater management solutions aimed at improving water quality, restoring both terrestrial and aquatic ecosystems and controlling flooding and erosional issues.

Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

Surface Soil: Soil that is present at the top layer of the existing soil profile at the project site. In undisturbed areas, the surface soil is typically the topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Top of Slope: area above the slope extending to the point of slope crest.

Tree Protection Zone (TPZ): The area surrounding the trunk of a tree intended to protect roots and soil within the Critical Root Zone and beyond, to ensure future tree health and stability. The location of the Tree Protection Zone is at the edge of the Critical Root Zone or Drip Line, whichever is greater.

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Appendix A: Mason Gulch Geotechnical Engineering Report (In Review)