4.0 MANAGEMENT GOALS, OBJECTIVES AND STANDARDS

This section identifies different management elements for the project area and defines overall management goals, objectives, and performance standards. The goals are used to identify the intent or purpose of the proposed management strategy. The objectives specify the direct actions necessary to achieve the stated goal. Performance standards are the measureable values of specific indicators that ensure the management plan and its actions are meeting the goals. Landscape Management Procedures used to implement these goals, objectives and standards are located in Section 5.0. Specifications on the implementation of these management elements are provided in Appendix D.

4.1 TARGET ECOSYSTEM

Historically, the project area ecological system consisted of the North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest (WDNR 2011; "target ecosystem"). Late seral stands of this forest type contain an overstory canopy dominated by Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla)*, and western redcedar (*Thuja plicata*), codominant grand fir (*Abies grandis*) with bigleaf maple (*Acer macrophyllum*) and red alder (*Alnus rubrus*) as subcanopy codominants. This ecological system normally develops through natural succession over time, in which the climax species, such as western hemlock and western redcedar, supplant earlier successional species such as red alder and bigleaf maple. Bigleaf maple and red alder are currently the dominant species throughout the project area, and no presence of sapling/seedling development by secondary or "climax" species has been observed. The introduction of these climax species (Target Ecosystem) is essential to the recovery and future sustainability of the target ecosystem on the Schuster Slope.

Since European settlement, stressors, (e.g., development and timber harvest), have impacted the native forest structure, composition, and tree regeneration. In this target ecosystem, continual presence of stressors and lack of a native seed bank can cause the development of a closed canopy forest dominated by pioneer species (bigleaf maple and red alder) with poor understory development (WDNR 2011) as observed within the project area. The red alders observed on the site are mature, nearing the later stages of their effective healthy life, and many trees are exhibiting signs of decay. Mismanagement of the bigleaf maples (discussed in Section 3.2.3) has also caused these trees to decline. There are little to no observed tree seedlings or saplings of any native species, which indicates that once the mature trees fail, there will be few, if any, replacements, leaving the soil and slope at increased risk for erosion and colonization by invasive species.

Plant species diversity is important for slope stabilization and improving habitat conditions. A diverse, vegetative cover consisting of mature trees, large shrubs, and groundcovers allows for varying root depths to stabilize soil and multiple layers of foliage to intercept rainfall (Myers 1993).

4.2 MANAGEMENT CONSIDERATIONS

Five 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 project area and will be considered critical in areas where slopes exceed 40 percent.

FOREST HEALTH: This element should be applied throughout the project area in order to ensure the long-term success and habitat improvement of the project area.

PUBLIC SAFETY AND INFRASTRUCTURE PROTECTION: This element should be applied within public areas and adjacent to infrastructure where there is public interaction.

VIEWS FROM ADJACENT AREAS: This element may be considered in areas where view management has been identified in this management plan (City directed public views) or by a private project proponent (private views).

VOLUNTARY STEWARDSHIP: This element should be considered in areas that have the appropriate site conditions to provide for community volunteerism and restoration.

4.2.1 SLOPE STABILITY AND GEOLOGIC HAZARD MITIGATION

The entire project area contains moderate- to high-risk landslide areas (GeoEngineers 2000). Infrastructure such as Stadium Way, Stadium High School, numerous private residences located along the slope crest, and public sidewalks and Schuster Parkway along the slope toe, represent significant public and private investment that necessitates protection. Proper vegetation management can help increase slope stability by controlling soil moisture content and runoff and creating varied depths of soil binding root mass. In situations where the slope exceeds 67 percent, the management of vegetation alone may not provide the needed infrastructure protection; thus, additional measures, such as tailored engineering solutions, may need to be implemented (See Sections 5.3, 5.4 and Appendix D for recommendations specific to slope percentages).

All actions proposed in this plan that pertain to slopes 67 percent and greater (regardless if it is work proposed by ES or by private citizens) will need to 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 the vegetation management prescriptions outlined in this plan. Additional engineering solutions may also be appropriate where public safety or infrastructure protection is a concern.

4.2.1.1 Surface Water and Erosion Control

The interception of stormwater by a dense, multi-layered, evergreen dominated forest (Target Ecosystem) is the first line of defense against surficial soil erosion and soil movement. Vegetation provides stormwater benefit by dissipating energy of falling rain, which in turn reduces the rain's erosional impact. Vegetation also increases evapotranspiration by absorbing and removing water from the soil and releasing it back into the atmosphere. A dense vegetative ground cover also protects the absorptive capacity of the soil, slows runoff velocity, and acts as a filter to catch sediment (Menashe 1993). In addition to intercepting rainfall, layered vegetation including a mature tree canopy, small tree/large shrub understory, and groundcover creates a dense network of soil binding root mass extending to varying depths (Myers 1993).

Unlike deciduous trees, coniferous trees retain their foliage during the wet winter months and provide greater rainfall interception, water storage, and evaporation potential (WSU 2012). Forests dominated by conifers have been observed to intercept between 18 to 51 percent of the annual rainfall, whereas forests dominated by deciduous trees have been observed to intercept between 8 to 13 percent of the annual rainfall (Herrera 2008).

Surface soil creep on slopes of 60 percent or more causes butt-bowing of trees. Unlike red alders and bigleaf maples, deep-rooted conifers growing in well-drained soil can generally resist creep if they become established. On slopes underlain by poorly drained soil, conifers are generally unable to become deeply rooted and can be affected by soil creep. In difficult rooting conditions within the project area, it may be preferred to install smaller trees, shrubs, grasses, or forbs (GeoEngineers 2000).

The use of irrigation to maintain plantings should not be applied on any slope area 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.

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, 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-ft radius of lateral root extent for every inch of diameter at breast height (DBH) of the tree's trunk.
- **Standard:** Two-thirds of the tree cover will consist of evergreen conifers.
- **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 within 1 year during the allowable timeframe. 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.

4.2.1.2 Deep Slope Stabilization

Vegetative and engineering solutions as proposed in this management plan can significantly slow the erosional processes, but they cannot be stopped entirely. This management plan recognizes that control of geologic conditions cannot be achieved through vegetation management alone. The intent is to provide 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 the project area.

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 ft in vertical height or greater shall 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 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 (SAF 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.

4.2.2.1 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. An example layered native species understory of this ecological system includes, but not limited to: vine maple (*Acer circinatum*), Indian plum (*Oemleria cerasiformis*), evergreen huckleberry (*Vaccinium ovatum*), sword fern (*Polystichum munitum*), salal (*Gaultheria shallon*), and low Oregon grape (*Mahonia nervosa*). 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 may be included to meet the goals for slope stability and geologic hazard mitigation, habitat, public safety, and views from adjacent areas.

Rotational type management will only be considered when the desired native plants are established in the densities and coverage as required by this plan. In any circumstance, vegetation removal shall not cause the site to become more non-conforming to TMC 13.11.

The overarching intent of this management plan is to provide year-round transpiration 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 evergreen; groundcover layer will consist of at least two native species, and a minimum of one species shall be evergreen.
- **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.

4.2.2.2 Invasive Vegetation

Removal and management of invasive species identified as having a direct impact on forest health should be 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 management plan, 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; Myers1993).

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

Objective: Less than 10 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

Public safety is an important consideration in landscape management. Improperly pruned, dead, damaged or diseased trees may present a hazard from falling branches or tree failure due to advanced decay. Vegetation also has the potential to obscure areas and encourage trespassing, transient camping, and other illicit behavior. 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 within public areas presents a unique challenge in maintaining natural surveillance. Crime Prevention Through Environmental Design (CPTED) standards are recommend in order to maintain natural

surveillance and a sense of safety in areas located within 10 ft of public trails and roadways. This includes providing for a zone between 3 and 8 feet above ground surface to be clear of view blocking vegetation. This necessitates planting small shrubs and forbs that do not exceed 3 ft in height, and trees that can be limbed up to 8 ft over time. Native vegetation located in public areas and within 10 ft of public areas which does not meet this standard should be replaced with more appropriate plants or thinned to provide adequate surveillance. In problem areas where additional natural surveillance area may benefit in deterring illicit use, the CPTED measures may be considered and applied beyond the 10 foot standard.

A Level 1 tree risk assessment should be conducted annually in the spring after the winter storm season has passed to include all public 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).

A Level 1 tree risk assessment should also be conducted as part of the development of future public areas (to include trails). If necessary, a Level 2 tree risk assessment should be conducted on select trees which pose a potential hazard to those areas.

The goal for this management element is to enhance public safety using vegetation management with the objectives of maintaining vegetation for natural surveillance and maintaining tree safety within public areas.

GOAL: Enhance public safety using vegetation management.

Objective: Vegetation will be maintained for natural surveillance within public areas.

- **Standard:** In an area measuring 10 horizontal ft adjacent to all public areas, vegetation should be actively maintained to provide open views in a zone between 3 to 8 feet above the ground surface. This includes planting low shrubs and ground covers and limbing up trees to 8 ft.
- **Standard:** In areas where homeless encampment or transient use is high, all trails should be thoroughly closed and selected species of plants should be planted that are vigorous and have thorns or other such protections that will deter public access.

Objective: Maintain public safety through tree management.

- **Standard:** Conduct tree assessments annually along all public areas.

- **Standard:** Remove hazardous trees and branches where they can impact public areas and infrastructure.

Timeframe: The initial vegetation management is anticipated to be completed within 1 year 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 VIEWS FROM ADJACENT AREAS

Views along the slope crest from the newly renovated Stadium Way and private residences include views of Commencement Bay, Browns Point and Mount Rainier. The existing mature trees within the project area, primarily consisting of deciduous species, can (and in many cases have) impeded these views. Any requests for view pruning (public or private) are subject to City review and approval for adherence to City policies and plans. The topping of trees is prohibited. Refer to Section 6 for more information on the private view request application process. Landscape management for views from adjacent areas can only be done provided that forest health/habitat and public safety, which are directly related to slope stability, standards goals and objectives are met.

View obstruction is prevalent where the mismanagement of bigleaf maples has created a dense layer of coppice sprouts adjacent to the slope crest. This repeated method of topping or cutting off trees at the base causes damage to the trees leading to their decay 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 typically not immediately apparent, however, over time, slope destabilization can result due to compromised forest health (Menashe 1993). Eventually, this type of destabilization can threaten infrastructure along the slope crest and at the slope toe. All proposals for vegetation removal 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, prior to thinning or pruning for views.

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). It is the intent of this management plan to encourage citizens who are interested in managing the vegetation growing on the Schuster Slope for private views to proactively create and/or maintain a 100 percent soil binding tree root zone so that vegetation can be removed as it becomes an impediment to views. Section 6 presents the process that a project proponent will follow in order to proceed with a vegetation modification request.

4.2.4.1 Public View Management

The goal for this management element is to support enhancement and maintenance of public views. Maintaining private views is not a goal for vegetation management within the project area; however, management options may be applied where there are private requests to maintain views. Where such requests are made, vegetation management can be applied to allow for views as long as all other goals, objectives and standards of this management plan are met.

GOAL: Provide public views while maintaining 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 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 management plan, 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 during the allowable 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.

4.2.4.2 Private View Management

While the City recognizes that private view corridors are a sensitive issue in the neighborhoods along the slope crest, it is clear that 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 and plans. Refer to Section 6 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 project proponents may apply for and receive approval to conduct landscape management activities on the Schuster Slope that are in conformance with the techniques and goals in this management plan.

- **Standard:** All management actions approved for private view management shall be conducted in accordance and compliance with this management plan.
- **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 management plan, 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 citizens value. As the City of

Tacoma continues to experience urban pressures, the community's desire and need for contact with nature will continue to increase.

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 should 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, open space restoration, resource management and trail construction/maintenance.

GOAL: Offer public "hands-on" opportunities to gain access to and restore the Schuster Slope project area.

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

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

Timeframe: Ongoing.

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