

Chapter 5

Terrestrial Plants and Animals

This chapter addresses impacts and mitigation for terrestrial plants and animals. Terrestrial communities are those not directly associated with the shoreline and marine environment. Marine plants and animals involve different issues and, therefore, are discussed in a separate chapter (Chapter 6).

5.1 Primary Issues

Wildlife and habitat protection is a common issue for any project involving removal of forest or other natural vegetation. Areas yet to be mined at the project site contain forests that have grown back after logging on the site, and this forest and surrounding habitats support a variety of wildlife. Many residents have commented that stands of Pacific madrone on the site are important and rare plant communities that provide good wildlife habitat. Others have stated that they enjoy watching wildlife on the site and have noted the presence of interesting species, including northern alligator lizard and western fence lizard.

This chapter addresses the following primary issues:

- Would the project adversely affect a plant or animal listed or proposed for listing under the Endangered Species Act, or other species listed by the state, tribes, or King County as sensitive?
- What would the loss of existing madrone imply in terms of (1) regulations, (2) functional values of madrone forest on the site, and (3) regional distribution of madrone?
- Over the life of the mine, what is the overall effect on habitat of reactivating high-production mining on the site?

5.2 Affected Environment

Existing plant and animal communities at the site have been documented based on:

- a plant and wildlife assessment prepared by Raedeke Associates, Inc. (1998);
- records from the Washington Natural Heritage Program regarding rare plants and high-quality native plant community locations;
- examinations of aerial photographs of the site and vicinity;
- site visits and spring wildlife inventories conducted by Jones & Stokes Associates wildlife biologists;
- records from the Washington Department of Fish and Wildlife (WDFW) regarding threatened, endangered, and otherwise sensitive wildlife and wildlife habitat types; and
- the scientific literature and published reports, as identified.

5.2.1 Threatened, Endangered, and other Sensitive Animal Species

5.2.1.1 *Bald Eagle*

Bald eagle is the only threatened or endangered species that occurs regularly in the project vicinity (bald eagles are federally and state listed as threatened in Washington). Based on direct observations and on typical bald eagle behavior, bald eagles use the shoreline and surrounding bluffs of the site. Eagles have been seen to perch on the dock at the site and on trees present on the hillsides above the shoreline.

The project site is not a particularly high-use area for bald eagles. Bald eagles do not concentrate in this area to feed or seek shelter, but rather use the shoreline as part of large foraging territories. Since there are no nest sites in the immediate vicinity, the Maury Island shoreline near the project site may be used more by “transient” eagles (those that have not yet established territories or that are wintering or migrating through the area). Immature eagles, which are often nomadic in their early years, have been seen along the shorelines of the site.

Four bald eagle nests are located between 3 and 6 miles from the site, and individuals from these nesting territories are expected to occasionally use the shoreline area near the site during foraging ventures. The bluff faces are often exposed to winds that provide good updrafts that are used by bald eagles to gain altitude and glide with little effort. Jones & Stokes Associates biologists have observed such use by bald eagles at the site (as well as similar use by red-tailed hawks). Due to the distance from the nearest nest (over 3 miles), this site is not considered a major element of any bald eagle nesting territory.

5.2.1.2 *Peregrine Falcon*

Based on habitat conditions and lack of reported observations, peregrine falcons do not use the site regularly, nor do they rely on the site for survival. Peregrine falcons are known to occur in small numbers throughout the Puget Sound region, particularly during winter. They tend to concentrate where waterfowl and shorebirds concentrate. The site and adjacent shoreline, while likely to be visited from time to time by migrating or wintering peregrine falcons, is not particularly significant habitat. The site provides no peregrine falcon habitat features that are not available at many other locations along the shoreline of Maury and Vashon Islands.

5.2.1.3 *Other Sensitive Species*

Other sensitive species known to occur on the project site and vicinity include great blue heron, osprey, olive-sided flycatcher, willow flycatcher, pileated woodpecker, and purple martin. These species occur in similar habitats and undeveloped areas throughout Maury and Vashon Islands.

Great blue herons are communal nesters, meaning that several pairs will nest near each other. These communal nest areas are known as heron rookeries. Two such rookeries are located within the project vicinity, including the Maury Island rookery, 2 miles northeast, and the Dumas Bay rookery, 4 miles southeast. Herons from these two colonies, as well as migrant, non-breeding, and other individual herons, are expected to forage on the shoreline areas of the site.

Likewise, ospreys may occur in the area but do not nest on or near the site. The site is not part of any known osprey nesting territory.

Olive-sided flycatcher populations have been declining throughout North America. The reasons for this decline are not well understood, but could include loss of wintering habitat in southern

latitudes and loss of breeding habitat in the north. Olive-sided flycatchers use tall trees adjacent to open habitats and clearings, and may nest on the site where mining has created open clearings. However, none were observed at the site during spring wildlife surveys.

Willow flycatchers have also been in decline due to loss of habitat (from development and cattle grazing), as well as nest parasitism by brown-headed cowbirds (Rothstein 1994). The species uses dense thickets dominated by willow, red alder, or vine maple (Sharp 1992). Declines appear to be more in drier habitats, where breeding is limited to narrow bands of riparian habitat. In western Washington, willow flycatchers remain relatively common (Smith et al. 1997). The project site contains some potential breeding habitat for this species in the alder/willow thicket northwest of the existing excavated portion of the mine, and willow flycatchers have been documented on the site along roadside "thickets".

Pileated woodpeckers are associated with mature conifer forest, but also utilize a wide variety of habitats. They feed mostly on wood-eating insects, so they are typically found where large rotting logs and standing dead trees (also called snags) are common. The forested areas of the site do not contain a large quantity of such dead and dying tree materials, so the site, overall, is only marginally suitable for this species. However, this species is wide ranging, is known to be able to forage among widely dispersed patches of trees, and has persisted in rural areas throughout King County, including Maury Island. A pileated woodpecker was seen within the mixed Douglas-fir/madrone habitat type on the site. Due to habitat conditions, the site is not likely used for nesting because of the lack of snags. The site contains forest about 50 years old and lacks suitable nest trees (which are typically much older than 50 years). The site is expected to be visited by foraging pileated woodpeckers as they fly between forested patches amid developed areas on the island.

Purple martins nest in cavities (small holes in trees). In the Puget Sound region, they are often found in old pilings along shoreline areas. Since the site does not contain many cavities for cavity-nesting birds, it does not provide good nesting habitat for this species. Dock pilings and the clusters of pilings located adjacent to the dock (structures known as "dolphins") were searched for evidence of purple martins, yet only European starlings were observed nesting in these structures.

Likewise, due to the lack of suitable nesting habitat, the site is only marginal for other cavity-nesting birds, which include a variety of woodpeckers, creepers, owls, nuthatches, and other birds.

5.2.2 Plant Communities and Habitat

5.2.2.1 Overview

Almost two-thirds of the site (about 60 percent, or 137 acres) contains forest, including 55 acres of madrone woodland (Figure 5-1) and 74 acres of mixed Douglas-fir/madrone woodland (Figure 5-2). Douglas-firs on the site range from about 6 to 20 inches in diameter and average about 80 feet tall, while madrones range from about 6 to 22 inches in diameter and about 35 to 40 feet tall.

About one-third of the site (81 acres) contains mixed grasses, invasive shrubs (such as Scot's broom), and open ground, including areas where mining and other clearing has taken place. Pacific madrone and red alder have recolonized these areas and are present in thickets within previously cleared areas (Figure 5-3). Other vegetation communities include red alder and willow thickets (8.4 acres), as shown in Figure 5-4, and beach and bank (8.5 acres).

A variety of mammals use the project site, including black-tailed deer, raccoon, bats, Douglas squirrel, and possibly black bear. Deer mice, voles, moles, and shrews are likely to be relatively abundant. Twenty-one species of birds were observed during spring bird surveys conducted at the site by Jones & Stokes Associates. Within open and disturbed habitats, white-crowned sparrow, rufous-sided towhee, and American robin were fairly common. Red-tailed hawks are also expected to forage within this habitat type. The madrone and mixed Douglas-fir/madrone forests support a variety of birds, including western wood pewee, black-throated gray warbler, orange crowned warbler, Swainson's thrush, and yellow-rumped warbler. Pileated woodpecker have been observed in the mixed Douglas-fir/madrone forests and other woodpeckers, such as sapsuckers and downy woodpeckers, are expected to be present in this habitat type as well.

The site also supports at least three species of reptiles. The open, dry, and gravelly habitat interspersed with shrub and grass cover and dense leaf litter from madrones provides good habitat for reptiles, including western fence lizard, northern alligator lizard, and terrestrial garter snake. Because the site is quite dry and

contains no surface water features (other than a small hillside seep) and few rotting logs, amphibian use of the site is expected to be limited. Nevertheless, the leaf litter provided by madrones and the dense understory of salal present in madrone woodlands provides fairly good habitat for salamanders, such as the ensatina and Northwestern salamander. Pacific chorus frogs are the only amphibians that have been documented on the site.

Table 5-1 lists the plant communities, their distribution on the project site, and associated wildlife communities.

5.2.2.2 Madrone Forest

The presence of madrone forest on the site has been the focus of several public comments. Madrone forest was once common along the shores and bluffs of Puget Sound; however, stands larger than 40 acres are becoming rare in the region, due to development and, recently, a blight (an infectious disease that has killed branches and whole madrone trees). The blight is a concern for the long-term viability of madrone populations. Diseased trees are present on the project site, although the stands on the site appear relatively healthy overall.

Madrone is not protected by county, state, or federal regulations. The Washington Natural Heritage Program (WNHP) advocates protection of Washington native plants and maintains a database of known sensitive plants and high-quality plant communities.

Some scoping comments have stated that the project site contains the largest stand of madrone in the state. This is not the case. Two stands of high-quality mixed Douglas-fir and madrone (natural madrone communities contain Douglas-fir) have been identified by the WNHP at two other locations on Maury Island. These include a stand located on the southern and southwestern tip of Maury Island (visible in Figure 1-2) and the majority of the newly established Maury Island Marine Park. Forests on the Lone Star site were not identified by the WNHP as high-quality madrone woodlands. Other stands of madrone of equal or larger size are located in the San Juan Islands and along steep bluffs of Puget Sound.

It is important to note that the pure stands of madrone present on the site are not representative of natural madrone ecosystems and are likely a result of past logging and intensive burning. The stands contain uniform, densely spaced, even-aged madrone, with no Douglas-fir or different-age madrone providing variety in stand structure and composition. Because the madrone trees are so

densely packed, their growth appears stunted and few or no live branches are present below the top of the canopy (Figure 5-1). This condition is similar to the disturbed stand conditions reported in a study by Chappel and Giglio (1994) that described madrone ecosystems in the Puget Sound region. This madrone community, which covers about 55 acres of the Lone Star site, would not be considered a prime example of a natural madrone community.

The mixed stands of madrone and Douglas-fir on the Lone Star site, which cover about 74 acres, do include a variety of size classes of madrone (with some notably large individuals) as well as larger Douglas-fir. These stands are much more similar to natural madrone ecosystems than are the pure madrone stands on the site.

As mentioned earlier, madrone and mixed madrone forests support a variety of wildlife. The leaf litter of the madrones and relatively dense understory of salal and sword fern provide good habitat for small mammals, amphibians, and reptiles. Band-tailed pigeons and several other species of birds are known to feed on madrone berries. Deer are relatively common throughout the site and find daytime resting spots within the forests. A diverse bird community is also present, including several species of warblers.

5.3 Impacts

5.3.1 **Would the project adversely affect a plant or animal listed or proposed for listing under the Endangered Species Act, or any other species listed by the state, tribes, or King County as sensitive?**

5.3.1.1 *Proposed Action*

Threatened and Endangered Species. Peregrine falcon and bald eagle, the two listed species present in the area, are not likely to be significantly affected by the project because no key habitat would be affected.

In Washington, bald eagles are protected under the Bald Eagle Protection Rules. These rules protect nest sites and communal roosting areas (communal roosting areas are typically protected forest stands where more than three eagles spend the night,

generally during winter). The site contains neither bald eagle nest sites nor roosting sites, so the state law does not apply.

Bald eagles would avoid mining and barge loading areas; however, several factors moderate this impact:

- Similar shoreline foraging habitat is abundant in the area, and no nest or roost sites would be disturbed.
- Puget Sound bald eagles are fairly well adapted to human activities, so long as shoreline habitat and nest sites are not disturbed. Bald eagles on Vashon Island and throughout Puget Sound exist within areas of relatively high development. They have adapted to boats, cars, airplanes, helicopters, homeowners, joggers, and kayakers, among many other disturbances.
- The project is not a particularly high-use area for bald eagles. In other words, it is not an area where eagles concentrate to feed or seek shelter, but rather is part of much larger bald eagle foraging areas that can cover several square miles.
- Bald eagles are expected to still use perches and the shoreline area with the Proposed Action, even during periods of active mining. During periods of relative inactivity at the mine site, as is expected under the Proposed Action, bald eagle use and habitat would be essentially the same as it is now.

Since peregrine falcon visits to the site are expected to be rare, and no nest sites or key foraging areas are present, peregrine falcons are not likely to be affected by the project.

Sensitive Species. The Maury Island heron rookery, 2 miles northeast, and the Dumas Bay rookery, 4 miles southeast, are located too far from the site to be impacted by the Proposed Action. Herons from these two colonies, as well as migrant herons and others, are expected to forage on the shoreline areas of the site. This use is not expected to change significantly, since herons are relatively well adapted to feeding near human activities (e.g., herons are common at the Ballard Locks within the City of Seattle), and the project would not significantly alter areas where herons feed.

Likewise, osprey use of the site is limited to occasional foraging or perching, and such use would not be precluded by the Proposed Action.

Olive-sided flycatcher nests could be destroyed during clearing, if tall trees adjacent to open habitats and mining areas are removed during the breeding season (generally from April through June). Seasonal restrictions or bird surveys could avoid this impact (see Section 5.4, Mitigation Measures). Overall, habitat for this species may increase over the life of the mine, as reclamation areas sprout young, open plant communities adjacent to the forested site buffer, presenting good potential habitat for this species.

As with the olive-sided flycatcher, the greatest potential impact to willow flycatchers would be direct removal of nest sites, if any exist, during clearing. Again, seasonal restrictions or bird surveys could greatly reduce the potential for this impact (see Section 5.4, Mitigation Measures). Reclamation areas would provide willow flycatcher habitat at about 5 to 20 years of age. Subsequently, overstory trees would predominate on most areas, assuming reforestation efforts take place. It is likely that some willow or alder thickets would persist onsite.

No pileated woodpecker nest site or key foraging area would be disrupted by the Proposed Action. Clearing of forest would remove currently marginal habitat that is likely used as part of much larger foraging areas. These forests are currently too young to provide ideal habitat, but would soon mature into suitable habitat; clearing would delay the development of habitat on the site by about 50 years.

Purple martins are not expected to nest on the site, and no shoreline habitat would be removed, so impacts to this species are negligible.

Habitat is currently only marginal for other cavity-nesting birds (woodpeckers, creepers, owls, nuthatches, and other birds) due to the lack of suitable nesting habitat. Removal of forest would delay the eventual development of habitat for cavity-nesting birds by about 50 years, since reclaimed areas would take about that much time to develop conditions similar to those present onsite.

5.3.1.2 Alternative 1

Impacts would be the same as the Proposed Action, with negligible impact on threatened or endangered species. Since mining would likely progress at a slower rate than under the Proposed Action, so too would the loss of forest and other habitats.

5.3.1.3 Alternative 2

Impacts would be the same as the Proposed Action, but, as with Alternative 1, the project would last longer and nighttime activity and disturbances would be less.

5.3.1.4 No-Action

The current operation is having little or no effect on bald eagle or peregrine falcon. Continued clearing would have similar impacts as the Proposed Action, but clearing would take place at a much slower pace and over a longer time.

5.3.2 What would the loss of existing madrone imply in terms of (1) regulations, (2) functional values of madrone forest on the site, and (3) regional distribution of madrone?

5.3.2.1 Proposed Action

Overview. Over the active life of the mine, up to 49 acres of madrone woodlands and 59 acres of mixed madrone/Douglas-fir forest would be removed. This represents about 90 percent of existing pure madrone woodlands and 80 percent of the existing mixed madrone/Douglas-fir.

About 20 acres of madrone and mixed madrone/Douglas-fir would remain within the 50-foot buffer along the northern and western site perimeter and within the bluff located in the southwestern corner of the site (the area closest to Sandy Shores).

Based on observations at the site, and on the ecology of madrone, this species would reestablish itself within reclaimed areas and, with additional efforts, may actually become the dominant species. Madrone has been observed to grow vigorously within apparently pure sand on the project site (see Figure 1-4, where much of the vegetation that can be seen growing within previously mined area is young madrone).

Madrone is naturally predisposed to growing on disturbed sites. According to "The Silvics of North America" (Burns and Honkala 1990):

They (madrone) usually become established in disturbed areas, along road cuts, on bare mineral soil at the base of uprooted

trees, or in semi-open forests...The most favorable seedbed for establishment seems to be bare mineral soil free from all, or nearly all, organic material.

Based on this description, it is reasonable to predict that madrones could be reestablished within final reclamation areas. Section 5.4, Mitigation Measures, provides more information on recommendations to encourage the reestablishment of madrone on the site.

Regulations. Clearing of madrone (assuming Best Management Practices) is not prohibited by law, since madrone trees are not protected under the Endangered Species Act, King County Sensitive Areas Ordinance, or other county, state, or federal laws or regulations.

Functional Values. Clearing would remove habitat for several common species of wildlife and would reduce other benefits of forest, including production of oxygen, visual enhancement, and human use and enjoyment of madrone woodlands. These losses could be offset over time by proper site reclamation, as described under Section 5.4, Mitigation Measures. The madrone stands on the site are not critical for listed or otherwise rare species. The site does not contain nesting eagles, great blue herons, or other species that may elevate concerns regarding removal of the forest.

Regional Distribution. Madrone stands have been declining throughout the Puget Sound region due to development and, recently, disease and absence of natural fire regimes (Chapel and Giglio 1994). Accelerated mining at the site, as proposed, would temporarily reduce madrone trees on the site. Within the context of Maury Island, the loss of madrones would be notable, since development has removed much of the other existing madrone.

Within the regional context of King County and the Puget Sound region, the magnitude of this loss would be low, since madrone, although declining, is still a relatively common tree in the region. Madrones are protected at numerous parks and within steep hillsides throughout Puget Sound. The madrone community type, while declining, is expected to persist throughout Puget Sound and the San Juan Islands, especially since many of the remaining stands are located in parks or undevelopable open spaces along steep bluffs.

Based on site conditions, madrone forest could be replaced on the site through mitigation (see Section 5.4). In addition, the site has

been disturbed previously and, even under the No-Action Alternative, madrone would be eventually removed.

5.3.2.2 Alternative 1

The factors regarding madrone forest removal considered for the Proposed Action would also apply to Alternative 1. Reduction of night barging and lower maximum production ability would likely result in slower removal and restoration of forest, but, ultimately, the same result as the Proposed Action.

5.3.2.3 Alternative 2

Same as Alternative 1, but with an expected slower rate of forest removal and restoration.

5.3.2.4 No-Action

Should the applicant be restricted to only current levels of mining, then madrone would be lost very slowly as mining progresses. Forest may be cleared in patches up to 32 acres as new phases are initiated.

5.3.3 Over the life of the mine, what is the overall effect on habitat of reactivating high-production mining on the site?

5.3.3.1 Proposed Action

By reactivating high-volume extraction and barging at the sand and gravel mine, wildlife habitat loss would accelerate and more area would be affected at any given time. Wildlife would be affected in three general ways: habitat loss, habitat alteration, and disturbance from noise and activity.

Habitat Loss. At any one time, up to 64 acres of the site would be of little value to wildlife, which includes the active mining area and areas being reclaimed. Roads and other facilities on the site would also provide little wildlife habitat.

Habitat would exist within the vegetated buffer surrounding the site, within areas yet to be mined, and within reclaimed areas. The buffers surrounding the site would support some breeding birds and other wildlife, although species that require more interior habitats (e.g., warblers, flycatchers, and large mammals, such as bear) would leave these areas, once clearing has been completed to the buffer edge.

Areas yet to be mined would provide similar habitat to that which is present now. This habitat would be gradually removed over the life of the mine, followed by vegetation regrowing on reclaimed areas (until subsequent human use of the site, if any).

Habitat Alteration. Reclaimed areas would provide different habitat values, depending on the site's age and other factors, such as slope, exposure, surrounding vegetation, and reclamation treatments and techniques. Initially, reclaimed areas would provide a seedbed for a variety of plants, including native plants, invasive plants, and plants seeded or planted as part of reclamation efforts.

Areas under reclamation could actually be quite productive in terms of plant growth and diversity and may attract deer, small mammals, and other foraging animals. (Wildlife foraging could, in fact, hamper restoration efforts. Monitoring and subsequent protective measures can effectively reduce this potential problem.)

As proposed, the applicant would hydroseed slopes and plant the floor of the mine with Douglas-fir (see Figure 2-3 in Chapter 2). This would probably not restore madrone forest on the site, although some madrone would likely grow on the grassy slopes. Should this be the case, then species adapted to shrubby and grassy habitats would predominate on the slopes, and forest-associated species would utilize the floor of the mine where Douglas-fir forest had been established. Overall, the site would still provide wildlife habitat, but for a different complement of species, with more common species such as American robin, northern flicker, white-crowned sparrow, and American crow, and fewer forest species, such as woodpeckers, creepers, and chickadees.

If left uncontrolled, some reclaimed areas could develop stands of Scot's broom, mixed grasses, and other weedy species that provide poor wildlife habitat. This has occurred on some areas of the existing site. However, little active reclamation has taken place on the site following past mining activities because it was expected that the existing cleared areas would be subsequently mined as the site excavation expands. Slopes were seeded to maintain stability and meet standards, but were not actively restored to forest or controlled for weeds.

Specific mitigation measures, performance standards, monitoring, and contingency plans could prevent or minimize undesirable vegetation within reclaimed areas (see Section 5.4).

Assuming monitoring and restoration efforts occur, native plant communities, once established, would develop over time and become similar to existing forests in about 50 years. Madrone, Douglas-fir, willows, and a variety of ground plants such as bracken fern, evergreen huckleberry, elderberry, and ocean-spray, would take hold if competition from invasive plants were not too intense or were controlled by active removal.

Between the time when native plants become established, and when they reach current site conditions, plant communities would go through a maturation process that provides differing habitat values as the community grows. Initially, deer, small mammals, and other wildlife may be attracted by the initial flush of green vegetation (as noted earlier). Vegetation would become thick as shrubs and sapling trees grow, becoming suitable for some nesting birds (e.g., rufous-sided towhee, song sparrow, dark-eyed junco) and a variety of small mammals. Red-tailed hawks and bald eagles may use these open areas to forage as well. As trees develop, they would begin to shade out some of the shrubs, eventually developing a forested overstory with moderate shrub growth beneath, similar to existing forests.

Effects of Disturbance. Noise and other activities would cause some wildlife to leave or avoid adjacent habitats that would otherwise be suitable. Noise associated with mining in the upland areas of the site would include heavy equipment, the conveyor system, and vehicles and trucks. Some animals are more sensitive than others, and it is difficult to predict exactly which species would avoid the area. Animals that occur in and around the existing developments on the island would likely be the same species that occur near activities at the mine.

5.3.3.2 Alternative 1

Habitat loss would be the same as under the Proposed Action, but clearing and restoration would likely progress at a slower pace. Since the project would likely last longer, impacts associated with disturbance would also last longer. Without much nighttime activity under Alternative 1, as compared to the Proposed Action, disturbance would be much less at night, and nighttime wildlife use of the site and surrounding lands may be greater.

5.3.3.3 Alternative 2

Same as Alternative 1, only with a further reduction in mining capacity and associated decrease in the pace of mining across the site.

5.3.3.4 No-Action

Should the operation continue as it has over the past 20 years, then the rate of habitat loss would be much less than as proposed, with many portions of the site and associated habitats remaining indefinitely.

5.4 Mitigation Measures

5.4.1 Measures Already Proposed by the Applicant or Required by Regulation

5.4.1.1 Revegetation

As outlined in the reclamation plan submitted by the applicant to DNR, mined areas would be revegetated with shrubs and trees. See Chapter 2, Description of Proposed Action and Alternatives, for further details on the reclamation plan.

5.4.1.2 Wetland Creation

Following completion of the project, the applicant has suggested that a small wetland community could be planted around the retention pond at the foot of the slope. The created wetland would be designed using best design practices and planted with native plant species. To support amphibian use of the wetlands for reproduction, the created wetland would be designed to minimize substantial fluctuations in the water surface during the breeding season.

If, as recommended in Chapter 4, the applicant were to establish several water collection areas rather than a single retention pond, then similar wetland and/or moist-habitat plant communities could be established to support amphibian use.

5.4.1.3 Soil Augmentation

To address public safety concerns regarding arsenic, the applicant is proposing to fully contain most topsoils at the site within a sealed berm. At full capacity (when mining is complete), the berm would measure up to 30 feet high and 2,100 feet long. No topsoils would be removed from the site.

Because most existing topsoils would be unavailable for reclamation, either soils manufactured onsite, or offsite soils, or a combination of these two materials would be used to establish

planting soils. Onsite topsoils would be prepared using composted and/or mulched organic matter (from cleared vegetation) added to non-contaminated till and/or sands. Additional soils and/or organic materials would be brought in as necessary to assure that reclamation performance standards are met. Reclamation performance would be monitored by the DNR, under their statutory jurisdiction over mining reclamation within the State of Washington.

Specific test plots may need to be established to determine the appropriate mix of organic material and/or augmented soils. For example, where madrone is to be established, large amounts of organic material may not be appropriate since this species prefers more mineral-based soils.

5.4.2 Additional Measures for Consideration to Further Reduce Impacts

5.4.2.1 Use of Native Plants

The applicant could plant native plants, including evergreen huckleberry and salal, to encourage the establishment of native plant communities within reclaimed areas.

5.4.2.2 Madrone Reforestation

The madrone habitat type is not protected under King County sensitive areas ordinances or other state or county law. However, the DNR, as the agency responsible for enforcing reclamation requirements, or King County, could call for replacement of madrone as part of the reclamation plan. Such replacement would serve to mitigate the loss of madrone as well as addressing public concerns. To do this, the reclamation plan would need to include:

- performance standards, such as the number of madrone stems per acre;
- planting of madrone cuttings in the absence of natural establishment of seedlings;
- control of Scot's broom and other plants that may discourage the establishment of madrone;
- irrigation of naturally established madrone seedlings during August and September; and

- monitoring of performance standards, with required corrective actions for below-standard areas.

These measures are similar to those typically employed as part of wetland mitigation requirements.

Soil and climatic conditions, together with the natural ecology of madrone, indicate that replacement of madrone stands would be effective mitigation. Madrone is adapted to the site and, therefore, is a natural candidate for restoration to create self-sustaining vegetation. In addition, madrone may actually be adapted to colonizing disturbed sites and populations could require some disturbance to remain healthy. While the ecology of madrone stands is not well known, madrone stands along the shores of Puget Sound may be adapted to periodic fires and stand replacement. Some have suggested that in the absence of fire, stands become old and vulnerable to disease, including the blight that has affected madrone throughout the Puget Sound region (Chappel and Giglio 1994).

In addition, because of the depth of sand and other well draining material, the soil profile at reclaimed areas would provide the well-drained conditions and shoreline environment favored by madrone. Groundwater monitoring, as would be required to prevent intrusion into the aquifer, would provide a minimum 15 feet of separation from the water table, allowing madrone to grow without concerns from root rot or other problems associated with high water tables.

It is reasonable to expect that madrone could be reestablished on portions of the site. According to discussions with the DNR reclamation specialist, madrone aggressively colonized a recently clearcut stand, even though that stand was planted with Douglas fir. Similar colonization may occur following mining and restoration of topsoils. However, such reestablishment may require additional actions by the site operator. As proposed, the applicant would hydroseed slopes and plant the floor of the mine with Douglas-fir. This would probably not restore madrone forest on the site, although some madrone would likely grow on the grassy slopes. Competition from shrubs, Douglas-fir, and other conditions may make some or all areas unsuitable for natural establishment of madrone stands.

The following additional actions by the site operator would help ensure reestablishment of madrone on the site:

- Reclamation could be developed to mimic the natural fire disturbance regime.

- Scot's broom and other weedy species could be controlled during the first 5 to 10 years of stand replacement.
- Restoration may require seeding or planting (of small cuttings), depending on the success of natural revegetation. If used, seeding and planting should use stock native to Maury Island, since these plants are the most likely to survive and would not risk introducing unfavorable genetic strains into the population. The applicant may wish to contract with a local nursery to provide seedlings or seeds for the site, if natural colonization is not adequate.

5.4.2.3 Measures to Protect Nesting Birds

Seasonal restrictions on clearing, and surveys for nesting birds, could be used to reduce impacts of clearing during the breeding season. Preventing clearing from March 1 to July 15 of any given year (or as otherwise determined through consultation with the WDFW) would greatly reduce the potential for affecting nesting birds.

5.5 Cumulative Impacts

Gradual removal of most forest stands on the site would continue the trend of deforestation on Maury Island and elsewhere in King County. Because the site is on a relatively small island, the loss of forest represents a greater proportion of available habitat than would occur on inland sites. Unlike other developments, however, this proposal involves revegetation as each segment of mining is completed.

Prior to reclamation, the greatest impact of the loss of woodland would be to animals that require a lot of space and cover, such as bear and deer. Other species, such as pileated woodpecker, screech owl, weasels, skunks, and coyotes, would also lose the protective cover of the forest. Reclamation would offset much of this loss over the long term.

In addition, development within King County and elsewhere has resulted in conflicts between people and animals, with deer browsing in gardens and bears entering neighborhoods. The development of the site would add to the causes of such conflicts.

Forests are expected to continue to decline on the island as development continues as zoned. Since much of the mine would be reforested subsequent to mining, the loss of forest habitat would

not be permanent, although it could be long term (up to 50 to 100 years, depending on mining and reforestation rates).

5.6 Significant Unavoidable Adverse Impacts

Removal of most of the existing madrone forest and associated wildlife habitat is an unavoidable impact of mining the site. With additional mitigation measures, impacts could be greatly offset, since madrone forest or other wildlife habitats could be reestablished on reclaimed lands.

No significant unavoidable impacts on wildlife or plants are expected from No-Action. As under the Proposed Action, loss of madrone stands would be unavoidable as the mining excavation expands over time.

5.7 Citations

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Table 5-1. Summary of Vegetative Communities and Associated Wildlife on the Lone Star Maury Island Property

Description and Comments	Approx. Acres*	General Location	Dominant Vegetation	Associated Wildlife
Mixed Madrone/Douglas-Fir Woodland (Figure 5-2)				
Dense stands dominated by mature madrone interspersed with Douglas-fir. Madrone has declined greatly from historic times. While species present are relatively common, the assemblage of wildlife species may be particular to madrone.	74 acres (31% of site)	Three large patches located at the northwest, northeast, and southwest portions of the site.	Madrone and Douglas-fir in the overstory; big-leaf maple, hawthorn, hazelnut, and evergreen huckleberry in the mid canopy and shrub layer; and sword fern and poison oak in the sparsely vegetated ground layer.	Provides nesting and foraging habitat for variety of song birds and cover for deer, raccoon, coyote, and other larger mammals. Common bird species include a mix of warblers, flycatchers, downy woodpeckers, crows, and American robin.
Madrone Woodlands (Figure 5-1)				
Densely spaced, even-aged madrone averaging about 10 inches in diameter. Includes some stands with canopy cover of madrone reaching 100%.	55 acres (23% of site)	Central and southern portions of the site.	Madrone dominates this vegetation type. The understory is composed primarily of salal, evergreen huckleberry, and bracken fern. Habitat lacks vertical diversity.	Similar to mixed madrone/Douglas-fir, although less habitat for birds associated with conifers, such as chickadees and woodpeckers. Common bird species include rufous-sided towhee, American robin, and several species of warblers.
Mixed Grasses/Invasive Shrubs and Open Ground (Figure 5-3)				
Unforested areas that have been disturbed by mining and/or natural slope erosion. Appears barren in places, but likely supports a variety of common wildlife species, including birds of open country and reptiles, such as the lizards mentioned in public comments.	91 acres (38% of site)	Includes most recent mining excavation upslope from the dock and area of previous mining and/or clearing on the easternmost edge of the site.	Dominated by Scot's broom, grasses, invasive weeds, and clusters of young madrone and red alder. Exposed sands in portions of the site that have been recently mined. Some open ground caused by bank erosion on steep slopes (unrelated to mining).	Small mammals (e.g., rabbits and deer mice) and birds associated with shrubby areas (e.g., rufous-sided towhee). Used by browsing deer and foraging hawks. Provides good habitat for snakes and lizards. Common bird species include white-crowned sparrow, American goldfinch, rufous-sided towhee, American robin, and barn swallow.

Table 5-1. Continued

Description and Comments	Approx. Acres*	General Location	Dominant Vegetation	Associated Wildlife
Beach and Bank				
Sand and cobble shoreline leading to the banks and slopes of the property. Banks contain forest for about the first third of the site, starting from the southwest corner. The remainder of the banks contain non-forested and disturbed areas with intermittent trees.	9 acres (4% of site)	Shoreline.	Sand, gravel, and cobbles on beach. Mature madrone and Douglas-fir on the southwestern shore; Scot's broom, young and mature madrone, and grasses and invasive shrubs on the rest of the banks.	Used by bald eagles, red-tailed hawks, gulls, and a variety of marine wildlife. See also Chapter 6.
Red Alder and Willow Thickets (Figure 5-4)				
Generally less well drained than other portions of the site.	8.4 acres (4% of site)	Northwest of existing excavated area.	Alder and willow 5 to 6 inches in diameter; understory contains mostly trailing blackberry and sword fern.	May be used by a variety of birds adapted to thickets and deciduous forest.
Hillside Seep				
Present in a seep bordering a road	<1 acre (<1% of site)	Located outside of the mining limits on the southeastern portion of the property.	Horsetail (along road), cottonwood, alder, madrone, and blackberry present on slope.	Potentially used by amphibians, such as Pacific chorus frog. Otherwise, similar to alder/willow habitat.
* Acreage and percent of site are approximate.				