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TECHNICAL MEMORANDUM

To: Michael Watson
Coastal Planner
Central Coast Office
California Coastal Commission
725 Front Street, #300
Santa Cruz, CA 95060

Date: August 20, 2015
SUBJECT: Monterey Bay Shores Dune Restoration Plan (DRP)

Mr. Watson:

I am submitting the following technical comments on the SNG Dune Restoration Plan for Monterey Bay Shores Resort, at the request of Laurens Silver, on behalf of Audubon California, the Center for Biological Diversity, Sierra Club, and Monterey Audubon Society. I have previously commented on technical aspects of this plan and CEQA documents. My comments focus primarily on coastal dune ecology and management.

I am currently serving as a scientific advisor on a interdisciplinary peer-review panel convened by the Commission (North Central District) for Lawson's Landing CDP, which required a similarly deferred post-permit habitat management/restoration plan and approval process. I would recommend a similar independent scientific advisory/review group for this post-permit plan, which contains many substantial deficiencies scientific and technical implementation levels, including monitoring and reporting. Schedule constraints limit the scope of my comments, but I am highlighting those that address fundamental vegetation, topography, drainage, and sediment transport processes controlling environmentally sensitive habitats and species.

Document organization: The DRP plan is highly redundant and duplicative, making it difficult to track and review specific subjects scattered throughout the document. The document should follow a standard organization for restoration plans and consolidate all related methods and criteria, or at least internally cross-reference all related information across hierarchical presentation of general and management unit sections. Some comments below are also duplicated because of the source document organization, but I attempt to minimize this.

*Invasive plant removal (*p. 2-3, 15 *et seq*.)

Invasive plant removal activities in ecologically sensitive and highly specialized dune and beach habitats are proposed to be conducted by a "licensed landscape professional", but the professional training of landscape professionals generally does not include vegetation management of dynamic beach and dune habitats. The appropriate qualifications for invasive plant species removal would be a qualified ecological restoration professional with experience in California coastal vegetation, or a landscape professional under the direct field supervision of a qualified ecologist with expertise in coastal California vegetation management. Conventional landscape management methods invasive plant removal are not applicable to dynamic, complex beach and dune vegetation including species with diverse growth forms in sandy substrate that is naturally subject to wind and wave erosion and deposition.

Herbicides are needed for treatment of large, established clonal populations of iceplant. Herbicides would not be used as a routine management tool for iceplant after an initial sequence of primary treatment (mass mortality) and follow-up treatment of surviving shoots (low frequency), when the population is reduced to low to moderate frequency of small (juvenile) plants with limited seminal root systems that have not spread clonally. Once the majority of iceplant clonal populations is eliminated, subsequent recolonization occurs primarily by small (<30 cm across) seedlings and juvenile plants (recruited from seed banks and seed dispersed from adjacent populations outside the management areas) and infrequent small shoots vegetatively regenerating from surviving segment of the original clonal populations. Management of this population structure consists of removal of plants before they spread clonally. Small plants are easily removed manually before mid-summer. Herbicides in sensitive dune habitats should be limited to glyphosate only; other commercial formulations like Roundup contain other herbicides that are not suitable for protected wildlife areas. Spreader/sticker should be added to the herbicide tank mix to ensure wetting and penetration of the repellant succulent leaf surface. Herbicide should be applied in moist morning hours with high humidity and very low wind to maximize duration of wetted leaf surface and herbicide absorption time.

Herbicide should be applied only after native annual plants have completed seed production and senescence, so that annual plants will not be affected by potential spray drift. In contrast, the iceplant herbicide treatment in the plan (p. 3) proposed manual removal of iceplant around annual spineflower. This would allow spineflower seeds to colonize iceplant litter following winter-spring germination season; decaying and decayed iceplant litter enhances spineflower population growth. The plan also proposed manual removal of iceplant adjacent to the native shrub coast buckwheat. Manual removal of deep, tenacious iceplant roots around coast buckwheat would unnecessarily disturb buckwheat roots and risk dislodging juvenile plants. Herbicide should be applied by wicking iceplant around buckwheat rather than manual removal. Locally, use wick applicator for herbicide on iceplant around coast buckwheat in mid-late summer (1 m zone); manual removal of iceplant around buckwheat is likely to have greater impact on coast buckwheat adults and seedlings/juveniles than wick-applied herbicide.

If beachgrass is not present it could only colonize by seedlings forming isolated clumps less than 2 yr old, in which case only manual removal after early detection would be appropriate. Herbicide treatment of beachgrass is appropriate and necessary only for established (> 2 yr clonal spread) populations with substantial below-ground rhizome populations.

Invasive species for the local coastal dune system cannot be defined solely by statewide invasive species lists. The criterion for invasive species in this distinctive location should be based on local rates of spread trends towards local dominance in any habitats occupied by special-status species, regardless of statewide invasion. For example, *Cakile maritima* is not a noxious statewide weed, but it may occur as either a non-invasive (low % cover, low biomass, low rate of spread) or invasive (high % cover and biomass, dominant) in beach drift-line habitats and foredunes. At high cover or high rates of spread, it may be adverse for western snowy plover habitat; but at low frequency (isolated discrete clumps) and low rates of spread, the insects and roughness (wind-shadows, camouflage, shelter) it facilitates may be beneficial for plovers. Threshold for "invasive" must be based on ecological effects in foredunes and blufftop climbing dunes, not statewide lists. Agricultural weed lists are ecologically irrelevant and inappropriate as criteria for beach and dune invasive species.

Restoration measure #5 (p. 5) is not enforceable as written: it is vaguely prescriptive of "enhanced characteristics…attractive to plovers", but does not distinguish between successful breeding or forging habitat, and attractive nuisance habitat (demographic sinks; attractive but resulting in elevated risk of mortality or reduced fitness due to high energy expenditure relative to foraging, low nest success). It needs to cite or incorporate by reference complete and scientifically sound, peer-reviewed, USFWS-approved habitat management plan (as part of an Incidental Take Statement or HCP).

The restoration goals and objectives are largely redundant and most are vague and unenforceable. The biological "standards" listed under objectives following p. 9 are actions, not measurable objectives, thresholds, or criteria. Key examples that require revision to be biologically meaningful, measurable, and enforceable include:

Restoration measure # 6 (page 5) lacks criteria for qualifications, expertise or experience of the "on-site biologist", and would allow inexperienced generalist biologists (with no criteria) to comply with this condition. Expertise for on-site biology monitoring must be species-specific.

Restoration measure # 8 (p. 5) is vague and unenforceable because it fails to identify any substantive measures that mitigate for cumulative impacts, and it fails to identify (or incorporate by reference) cumulative impacts to spineflower; and finally, it fails to identify any measurable thresholds or indicators for either impacts or mitigation. The condition is broadly aspirational, not a biological condition.

Conservation easement: the plan cites no information on the conservation easement identified on p. 4, including the conservation easement holder, its ability to enforce the easement, and funding mechanisms to support the easement administration.

Smith's blue butterfly

Host plant coast buckwheat planting specifications to ensure high survivorship are lacking. High mortality is likely unless weather-specific planting protocols are enforced. This is not addressed adequately under "Restoration and Enhancement" generalized specifications on p. 17 & seq. which recommend inappropriate fertilizer and irrigation methods applied to dune sand. Irrigation in dune sand plantings (outside of cultivated borders) is generally not feasible because of water-repellent dry sand particles, restricted infiltration in dry sand, and very shallow and irregular fingers of wetting zones under irrigation. Planting of transplants must be restricted to conditions including a fully wetted sand profile in late fall to early winter (not patchy or shallow irrigation in dry sand; planting time restricted to fall-winter rainfall periods sufficient to moisten the top 40 cm of sand in the dune profile), and include pruning 1/3 or more of shoot mass of container-grown transplants immediately prior to transplanting. The seasonal protocols on p. 18 fail to specify necessary sand moisture profile criteria.

Nursery/greenhouse transplants must be tested and inspected to be free of pathogens (including *Phytophthera* spp.) that may jeopardize natural populations with nursery-transmitted plant diseases that are currently a serious threat to wildland plantings and host vegetation of the SF Bay and Monterey Bay area. Alternatively, on-site partially cultivated source populations of juvenile/seedling plants may be established as planting stock, avoiding import of any nursery soils or other offsite vectors of pathogens.

Western snowy plover

The caveat "if feasible" vitiates the enforceability of the requirement to "avoid" degradation to western snowy plover habitat because it provides no criteria for feasibility, or contingencies to minimize impacts if avoidance is not feasible.

Management units

The "biofiltration basin" of Management area 2 and areas downslope of it subject to subsurface seepage discharge pose a special risk for recruitment of iceplant after removal. Elevated sand moisture and nutrients in biofiltration discharge zones will likely result in concentrated recruitment zones for non-native plants including iceplant at levels that may result in unacceptably high chronic disturbance from removal activities, including herbicide application. This predictable conflict with biological management objectives is not addressed in the management unit description. Biofiltration discharges during and after high runoff (storm) periods will also increase risks of temporary sand saturation and slope failure and result in significant disturbance of vegetation (also a conflict with objectives) This predictable conflict with biological management objectives is also not addressed in the management unit description. Runoff and biofiltration should be discharged landward (interior dune basins, away from the active coastal bluff) to avoid this significant impact and conflict with objectives, or the biofiltration design should be reviewed by a qualified coastal geomorphologist and hydrologist to set limits on maximum storm discharge rates into the basin to minimize risk of slope instability. This issue is not addressed at all under "Dune Creation/Stabilization" on p. 15 & seq.

The threshold for non-native species (p. 11) should not be based on instantaneous static percent cover, but the rate of increase of invasive species population growth, which drives cover. Vegetation cover does not increase linearly; invasion rates may be exponential, so rapid rates of increase are biologically more significant than the absolute level of cover, and the same instantaneous percent cover level may reflect either exponential or slow linear population growth. As such, percent cover without consideration of rate of spread is not a meaningful or practical biological criterion for management or success. This also applies to other management units.

Sequenced static target native cover (p. 11, 27-28) is also not a meaningful ecological target for performance criteria, because annual fluctuation of plant cover will occur throughout the year, and variability within a year will predictably exceed 20% cover because of sand accretion/burial and winter storm erosion. This is not reflected in the footnote parenthetic comment on p. 28 about storms and variability; this footnote illustrates the disconnection between methods and purposes of monitoring. In addition, no measures of variance (standard deviation, confidence intervals, or statistical tests) are incorporated in performance criteria. If percent cover is used, a "floating" range of percent cover should be based on a set of <u>related reference sites</u> with similar wave exposure (wave energy levels, shoreline orientation) in the vicinity, reflecting natural seasonal and interannual variability in beach and foredune vegetation cover.

The methods for estimating cover should be based on annual aerial photography (vegetation mapping), not a small number of transects; transects will generate more variability (data noise over signal) than direct measurements of vegetative cover estimates from aerial photos. The proposed aerial photography at 5 year intervals will provide no useful monitoring data; annual August photos, supplemented by winter oblique bluff-top photos to capture winter storm-induced shoreline vegetation and topographic changes, is necessary to monitor vegetation at this spatial scale. Transect methods applied to a small area with high natural variability would effectively ensure that data will be inconclusive and not interpretable. This also applies to other management units.

The programmatic threshold for western snowy plover take/habitat modification lacks any objective indicators that can be measured, reported, and evaluated; they simply recite legal thresholds unrelated to site-specific measurements or indicators. This makes the "minimization" standard unenforceable.

Revegetation and Habitat Enhancement

Hydroseeding proposed on p. 18 is entirely inappropriate for dune surfaces subject to deflation and destabilization under brief periods of high wind velocities (high shear stress wind-unstable dunes. Coherent cellulose-based hydroseed mulch layers form fibrous mats that are readily undermined by non-cohesive dune sand erosion from below the mat edge. Dry hydroseed mulch mats act as low-strength fabrics that fragment under stress from loose sand undermining and high wind shear; fragments with embedded seed are transported downwind in bulk during high wind shear events. Hydroseeding proposed for dunes without modification for non-cohesive dune sand is one of many examples in which the plan inappropriately and uncritically transfers ornamental landscaping techniques to dune restoration (like irrigation, fertilization) and imposes naïve risks of failure.

Fertilizer and irrigation application to naturally nutrient-poor dune sand significantly increases competitive ability of non-native invasive species over target native species, and fertilizer applications can have counter-productive lasting effects on nutrient-enriched dune sand with even small organic or fine (oxidative weathering) sediment content.

Propagation description on p. 18 is similarly inadequate for dune applications. The "suitable medium" is not specified. The drainage and rooting characteristics of the propagation containers must be similar to dune sand or else transplant roots will concentrate in the higher moisture and nutrient zones of the root ball, and fail to spread rapidly enough into low-nutrient, low-moisture sand. Delayed root development in dune sand prior to the dry season increases mortality risk significantly. Conventional propagation methods must be adapted to dune environments or else high mortality will likely result.

The plan's recommendations for routine ornamental landscaping technique application to dune restoration methods indicates seriously deficient expertise in dune ecology and management, in my professional opinion.

Salvage methods on p. 19 are not feasible unless they are seasonally and weather-adjusted to cool (below 50ºF), overcast, moist weather during plant dormancy in Nov-Feb. Even brief exposure of actively growing roots and shoots to dry air or sun in spring-fall would result in lethal wilt and root apex necrosis, and very high mortality.

Overhead irrigation methods "just after first rains" proposed on p. 35 are completely infeasible for water-repellant dry dune sand, particularly weathered older sands with thin oxidized iron films. Irrigation provides a false germination cue for dune annuals that would elevate seedling mortality risk if they are not immediately followed by frequent rainfall after wetting the top 30-40 cm of sand in cool weather. Dune annuals avoid high mortality by delaying germination until sufficient moisture accumulates in the sand profile, in seasons of high rainfall frequency to support rapid growth of deep taproots into permanently moist deeper sand layers. Irrigation does not provide infiltration comparable to rainfall except at extremely high and unsustainable levels. No description of dune-adapted irrigation methods, capacity, duration, or water supply are provided in the plan, suggesting a critical lack of understanding of water-repellant dune sand and wetting fronts. Overhead irrigation of dune sand in the absence of consistent rains and cool temperatures would encourage shallow rooting followed by rapid desiccation in shallow sand layers, resulting in high seed mortality. Seeding should be synchronized with periods of cool, wet weather.

The proposed "1000 propagules" of seed and seedlings for Monterey spineflower (p. 37) is infeasibly low for an annual dune forb that would naturally experience seedling survivorship on the order of <1.0-10.0%. 1000 propagules is an arbitrary and unjustified target for 3.4 acres of dunes, particularly without survivorship criteria. The propagation plan lacks a necessary cultivated seed stock population phase to augment founder seed numbers proportionate for 3.4 acres, which would be several orders of magnitude greater for effective seeding. Seeding methods must incorporate persistent surface roughness to provide microsites stable enough to anchor germinating seeds during periods of wind deflation and ensure adequate survivorship to juvenile-adult transition. Broadcast of composted iceplant litter would satisfy this requirement. Straw with high C:N ratio would not: it is a nitrogen sink (anti-fertilizer).

Monitoring and reporting.

The monitoring and reporting plans provide no qualifications for scientific review at any level, from preparer to agency review stages. Most resource and regulatory agencies lack available staff with sufficient specialization and expertise to interpret all coastal habitat and species covered in this plan, and rely on internalized expert peer review as part of the monitoring and reporting process. The California Coastal Commission, for example, recently directed a Coastal Development Permittee to convene a Scientific Review Group to provide multidisciplinary expert supervision for the development of a preliminary restoration and enhancement plan of a sensitive dune system in West Marin County (Lawson's Landing), and continue advising Commission staff on monitoring and implementation. For example, it would be appropriate to require qualified experts in plover ecology to independently review monitoring data and interpretations, and advise the Commission on reported findings and recommendations for permit compliance.

The methods for estimating cover should be based on annual aerial photography (vegetation mapping), not a small number of transects; transects will generate more variability (data noise over signal) than direct measurements of vegetative cover estimates from aerial photos. The proposed aerial photography at 5 year intervals (p. 29) will provide no useful monitoring data; annual August photos, supplemented by winter oblique bluff-top photos to capture winter storm-induced shoreline vegetation and topographic changes, is necessary to monitor vegetation at this spatial scale. Transect methods applied to a small area with high natural variability would effectively ensure that data will be inconclusive and not interpretable or useful for adaptive management.

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