ECOSYSTEMS WEST
CONSULTING GROUP

July 20, 2010

Attn: Department of Planning and Community Development

City of Santa Cruz Planning
and Community Development
809 Center Street, Room 107
Santa Cruz, California 95060

Subject: Response to habitat fragmentation and Santa Cruz tarplant (*Holocarpha macradenia*) at Arana Gulch

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During the course of review by the Coastal Commission staff and commissioners, a concern was raised regarding the potential of habitat fragmentation for the Santa Cruz tarplant by the City of Santa Cruz's proposed east-west multi-use paved trail alignment bisecting the central portion of the Arana Gulch terrace, and a north-south trail from Agnes Street to its intersection with the east-west trail. The City proposed Creek View to Canyon Trail alignment is oriented in an arcing east-west alignment over primarily flat to slightly sloping contours through the terrace. The typical width of impact is 12 feet with eight feet of paved trail and two feet on either side as graded shoulders. The majority of the proposed alignment would require little cut or fill to maintain ADA grade with the typical depth of pavement approximately 6 inches. For the most part the walking surface would be at the grade of the existing native substrate of the terrace.

The California Native Plant Society (CNPS) contends that this alignment will result in significant fragmentation of the tarplant habitat on the terrace (CNPS 2010). The CNPS asserts that the east-west trail in association with the north-west trail connector will split the grassland terrace into three smaller habitat units resulting in increased edge effect and a decrease in core habitat necessary for the tarplant's persistence. They also contend that the species movement patterns are altered by fragmentation and dispersal. Specifically, Santa Cruz tarplant recruitment would be limited by the boundaries created by the edge areas and the 8 foot wide multi-use path could potentially present an effective barrier to dispersal of the tarplant seed which is suggested to have a maximum unassisted seed dispersal radius of 1.5 feet (45 cm) from the source plant. In addition, the CNPS asserts that increased edge effect of the paths and the resulting separation of the three habitat blocks (fragments), along with the increased edge disturbance area, will increase the amount of area subject to invasion by non-native weedy plant species. Their calculations for the total area of disturbance including trail edge at three feet on either side of the trails are 0.40 acres with a total linear extent of 5,914 feet. The CNPS states that the combination

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of the above factors and other potential incidental impacts over the life of these trails may result in a decline in community composition and native biodiversity.

The classic view of habitat fragmentation "is the breaking up of a large intact area of a single vegetation type into smaller intact units (Lord and Norton 1990). Habitat in this case applies only to the species level because habitat is defined with reference to a particular species (Franklin et al. 2002). Therefore, the case for fragmentation must be made that the action or feature is resulting in an alteration of the spatial configuration of habitat(s). This involves an external disturbance that alters the large patch so as to create isolated or tenuously connected patches of the original habitat that are not interspersed with an extensive mosaic of other habitat types (Franklin et al. 2002). It is argued that habitat fragmentation has not occurred when habitat has been separated by non-habitat while occupancy, reproduction, or survival of the species has not been affected. Key components in defining habitat fragmentation are scale, the mechanism causing separation of habitat from non-habitat, and the spatial arrangement of habitat and non-habitat (Franklin, et. al. 2002). The majority of fragmentation studies demonstrating a reduction in species fecundity focus on birds or small mammals where a significant alteration in community structure resulting from fragmentation alters movement rates, foraging behavior, predator-prey interactions, or niche availability (Foster and Gaines 1991, Robinson et al. 1992, Diffendorfer et al. 1995, Wolf et al. 1997). In many cases, these same conclusions do not hold for non-clonal (i.e. seed dispersed) plant populations (Quinn and Robinson 1987, Robinson et al. 1992, Holt et al. 1995).

In uniform landscapes, such as is found on the Arana Gulch terrace, the presence of a 12-foot wide trail corridor is not likely to result in significant changes in habitat conditions on either side of the proposed trail(s). The current vegetation composition and structure adjacent to the east-west trail alignment is dominated by a dense assortment of non-native grasses and weedy herbs (BMP Ecosciences 2005). The east-west trail will not be a barrier to the persistence or movement of these non-native weedy species since there is already a propensity for establishment in disturbed edge areas. Moreover, since this trail does not require significant cut and fill, there will be less exposure of raw substrates attractive to noxious plant species such as broom that do not currently occupy the site. In particular, due to the already isolated distribution of the historical Santa Cruz tarplant polygons (A-D) the trail would not further contribute to the fragmentation or isolation of these occupied habitats (i.e. these distinct occurrences within Arana Gulch are not bisected). Additionally, Santa Cruz tarplant does not have a singular species pollinator. Rather, the plant is pollinated by as many as 8 different insect families comprised of many different insect species observed on tarplant flowers including bees, weevils, and assassin bugs (Hayes 2003). These pollinators will not face a physical barrier to crossing the trail bordered by a 5-foot tall post and wire cattle fence.

The key potential impact of the paved trails is a permanent loss of potential tarplant habitat. As noted by the CNPS the combined paved trails will occupy an area of 0.4 acres (CNPS 2010). The Coastal Terrace Prairie habitat on Arana Gulch has been estimated at approximately 27 acres (the majority of which is now heavily disturbed and better characterized as non-native grassland). The permanent potential suitable habitat loss therefore represents less than 1.5 percent of the total available habitat as determined in the Critical Habitat designation (USFWS 2002). In 1988, the year with largest estimated count of tarplant individuals at Arana Gulch since census counts began; approximately 115,000 individuals were found occupying four distinct occurrences. The total area occupied by these plants was mapped at 2.6 acres or approximately 9.6 percent of the total potential suitable habitat.

The proposed trail alignments would occur on terrace habitat that has never been documented to support the tarplant during the last 20+ years. Therefore, these trails are not likely to displace any historical seed banks, particularly with the proposed minor adjustments to the alignments that will avoid all occurrences, both contemporary and historic. In contrast, the CNPS alternative would require significant grading and cut/fill to meet ADA standards and will pass through or immediately adjacent to several remaining patches of coastal prairie habitat comprised of indicator species including California oatgrass (*Danthonia californica*) (R. Buck, 2010). The additional grading is far more likely to expose bare ground to a potential increase in weedy propagules originating from activities related to trail usage. Approximately 0.37 acres of remnant coastal prairie as mapped in 2010 will be potentially impacted by the CNPS proposed trail alignment.

It is universally accepted that the tarplant cannot be maintained or expanded without active management, particularly grazing, mowing, fire, and/or scraping. Without active management the species is not expected to persist under the current vegetation structure and cover (BMP Ecosciences 2005, CNPS 2010). A principle concern is whether the trails would inhibit the ability to implement these management activities on the terrace. As recommended by EcoSystems West, realigning the north-south trail closer to the western edge of the property would provide two large pasture units for reintroducing grazing or other large scale management actions such as scraping or mowing. These activities would not be constrained by the trails except for the east-west alignment being the fixed boundary of both the north and south pastures. Cattle or other livestock can be moved freely between these pastures (e.g. via herding through lockable gates) providing for a potential exchange or movement of tarplant seed from one occurrence area to another. These pastures would more than double the size of past management areas, providing more then sufficient habitat area for large-scale ongoing management actions. Without management intervention, natural recruitment alone is likely to result in the extirpation of the species at Arana Gulch whether or not the trails are developed. Finally, assuming an unassisted dispersal radius of 1.5 feet per year, it would take the plants documented in Area A in 2009 over 360 years to come in contact with nearest portion of the east-west trail alignment.

Direct Observations of tarplant populations in other parts of Santa Cruz County demonstrate that this species is inordinately tolerant of edge effect habitat conditions. Examples include the sustaining occurrences between and adjacent to the paved runways of the Watsonville Airport, the population adjacent to the fairways at Spring Hills Golf Course, and the recently observed occurrence at Atkinson Lane adjacent to the paved PG&E substation (Bill Davilla, personal observation).

In summary, Santa Cruz tarplant is not expected to undergo population declines as a result of the City of Santa Cruz proposed trail system at Arana Gulch. The site currently supports extant populations of Santa Cruz tarplant persisting in weedy non-native grassland. The grassland within Arana Gulch supporting Santa Cruz tarplant is already heavily disturbed and will be largely unaffected by weedy propagules originating from trails limited to pedestrian, wheelchair, and bicycle traffic. By placing the trail at the existing grade of the terrace, there will be very little ground disturbance adjacent to the trail to encourage the establishment of noxious weeds not already present on the terrace. The two pastures will be sufficiently large to manage using grazing, mowing, fire and/or scraping and cattle will be allowed to move between the pastures with limited effort providing a vector for tarplant seed dispersal. Moreover, active management is critical for the long-term viability of these populations. Cattle remove vegetative cover of competing plant species and trampling is an effective means of embedding the seed into the soil

layer for germination. Additionally, cattle assisted seed transport is a far more effective means for population expansion than passive dispersal at a rate of 1.5 feet per year. Because cattle will be moved between the two pastures, there is little concern for the creation of genetically isolated populations (bottlenecks/genetic drift) within Arana Gulch. Considering the largest occurrences of Santa Cruz tarplant in 1988 occupied approximately approximately 9.6 percent (2.6 acres) of grassland habitat at Arana Gulch, a reduction of less than 1.5 percent of the total 27 acres of potential suitable habitat is not expected to result in the decline or extirpation of the Santa Cruz tarplant at Arana Gulch.

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