Potentilla hickmanii
(Hickman's potentilla)

5-Year Review:
Summary and Evaluation

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U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California

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5-YEAR REVIEW

Potentilla hickmanii (Hickman's potentilla)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview: *Potentilla hickmanii* (Hickman's potentilla) is a small perennial herb in the rose family. It is restricted to two general areas, one in San Mateo County and one in Monterey County, California, where it occurs within coastal terrace prairie habitat. In San Mateo County, a population of between 2,000 and 3,000 individuals is scattered over a half square mile (sq mi) (130 hectares (ha)). In Monterey County, one population comprised of less than 20 plants occurs on less than one quarter of an acre (0.1 ha). In addition to the two native populations, greenhouse-grown plants were outplanted to a site at Point Lobos State Reserve in Monterey County in 2006; whether these plants result in the establishment of a viable population remains to be seen. The coastal terrace prairie habitat that the species occurs in has been subjected to alteration and destruction due to development, changes in hydrologic regime, and invasion by nonnative species. In addition, the Monterey County population of *Potentilla hickmanii* is subject to grazing by deer, cattle, gophers, snails and slugs, and is experiencing reproductive failure.

Methodology Used to Complete This Review:

This review was prepared by the Ventura Fish and Wildlife Office (VFWO), following the Region 8 guidance issued in March 2008. We used information from the Recovery Plan (Service 2004), survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game. The Recovery Plan and personal communications with experts were our primary sources of information used to update the species' status and threats. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review.

We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

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Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 5, 2008 (73 FR 11945). The Service received one response to the notice, which we have considered in preparing this 5-year review.

Listing History:

Original Listing
FR Notice: 63 FR 43100
Date of Final Listing Rule: August 12, 1998
Entity Listed: *Potentilla hickmanii*, species
Classification: Endangered

State Listing
Potentilla hickmanii was listed by the State of California as endangered in 1979.

Associated Rulemakings: N/A

Review History: N/A

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Potentilla hickmanii* is 5C according to the Service's 2007 Recovery Data Call for the Ventura Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a species that faces a high degree of threat and has a low potential for recovery. The "C"

indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline

> **Name of Plan or Outline:** Recovery Plan for Five Plants from Monterey County, California
> **Date Issued:** August 19, 2004

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status

Species Biology and Life History
Potentilla hickmanii is a small, long-lived, herbaceous perennial. The plant develops a woody taproot which presumably persists through years with unfavorable conditions (Abrams 1944); observers estimate the lifespan of an individual may be on the order of at least 25 or 30 years (Morosco 1997, Yadon in litt. 1997). Each individual consists of a basal rosette of leaves from which flowering stems are produced in favorable years. Each rosette can produce several yellow flowers; each flower has approximately 10 ovules and therefore a potential to produce 10 seeds. Plants also reproduced vegetatively by sending out runners which establish new rosettes.

Historical Distribution
Potentilla hickmanii was historically known from two general areas along the central coast of California: on the Monterey Peninsula in Monterey County, and in the Half Moon Bay area in San Mateo County. The type specimen was collected from the Monterey Peninsula "near the reservoir which supplies Pacific Grove" and described by Alice Eastwood in 1902. Several other collections were made from the Monterey Peninsula during the 1930s, but detail on specific locations is lacking.

The species was collected from Moss Beach in San Mateo County, 60 miles (97 kilometers (km)) north of Monterey, in 1905 by Katherine Brandegee, and then again in a nearby location in 1933 by E.C. Sutliffe (Consortium of California Herbaria 2008). The plant is presumed extirpated from both of these sites due to changes in land use, primarily development.

Current Distribution

The species is currently known from two native populations. In Monterey County, one population occurs on the south end of the Monterey Peninsula near Pebble Beach, where it occupies less than 0.25 acre (ac) (0.1 ha) of degraded coastal prairie habitat on private lands owned by Pebble Beach Company and is designated as a recreational day-use area.

In San Mateo County, a population was discovered in 1995 near the town of Montara, approximately 2 miles (3.2 kilometers) away from the historic populations. The population occupies approximately a half sq mi (130 ha) of habitat; individuals are clustered into approximately six colonies. The California Natural Diversity Database (CNDDB) divides the colonies among two occurrences to reflect separate land owners (CNDDB 2008). Most of the individuals and colonies occur on lands owned by Peninsula Open Space Trust; a few of the individuals and colonies occur on adjacent lands owned by California Department of Transportation (CalTrans).

In addition to the two remaining native populations, one outplanting is currently being attempted to establish a new population at Point Lobos State Reserve (Reserve), approximately 10 miles (16 km) south of the Pebble Beach population. However, it is too early for us to assess whether this outplanting effort will result in the establishment of a third viable population.

Abundance

Montara population, San Mateo County: since the population was discovered in 1995, the number of individuals observed has generally ranged between 2,000 and 3,000. Due to the small number of observations and difference in census methodology, no trends can be determined from these numbers. See Table 1 below for a summary of census data.

Pebble Beach population, Monterey County: between the years 1987 and 2000, the number of individuals ranged from 5 to 35 (Doak et al. 2000, CNDDB 2008). The population in 2008 was approximately 10 individuals (Rutherford, pers. obs. 2008). Efforts to augment this population through the introduction of outplanted individuals carried out in the 1990s were not successful (see section on site-specific research below for more information). Despite these efforts and several management activities undertaken to improve habitat conditions, the population does not appear to be increasing in abundance. See Table 1 for summary of census data.

At least four attempts have been made to augment the number of individuals in the Indian Village population. Prior to 1997, 12 individuals had been outplanted at the site; by 1998, 4 adults had survived and 1 seedling had been produced. In 1998, an additional 10 individuals were outplanted at the Indian Village site. By 2000, only 7 of the 15 individuals from the 2 outplantings combined had survived (46 percent) (Doak et al. 2000). In 2004, Pebble Beach Company outplanted 33 individulas, and in 2005 they outplanted 30 individuals at this site. Despite these multiple outplanting efforts to augment the native individuals, by 2008 only 11 individuals were observed (Staub in litt. 2008).

In 1998, ten individuals were also outplanted at Point Lobos State Reserve; by 2000, none of these individuals had persisted. A second outplanting attempt was made at the Reserve in 2006; 886 greenhouse-grown individuals were outplanted in 11 plots scattered over approximately 1 ac

(0.4 ha) (Doak et al. 2008). As of May, 2008, approximately 200 individuals were still alive (Rutherford pers. obs. 2008).

Table 1: Areas historically and/or currently occupied by *Potentilla hickmanii*; does not include outplanted individuals and populations (prepared for 5-year review in 2008).

CNDDB #	Name	Current trend	Year observed	Year surveyed	Adult Pop size	Reference
San Mateo County occurrences						
1	Moss Beach near Point Montara	Presumed extirpated by development	1905 1933	-- --	-- --	CNDDB 2008 CNDDB 2008
6 and 7	Montara (SE of Martini Creek)	Stable		1995 (Vonarb) 1996 (Vonarb) 2000 Vasey) 2002 (Morosco) 2008 (Kramer)	2600* 1990* 104 (present) 3161*	CNDDB 2008 CNDDB 2008 CNDDB 2008 CNDDB 2008 Kramer 2008
Monterey County occurrences						
2	Indian Village, Pebble Beach	Decreasing	1907 (Patterson and Wiltz collection)	 1979 1987 1991 1995 1998 1999 2000 2008	-- 6 20 5 14 35 32 25 11	CNDDB 2008 CNDDB 2008 CDFG in Ferreira CNDDB 2008 CNDDB 2008 Doak et al. 2000 Doak et al. 2000 Doak et al. 2000 Staub in litt. 2008
3	"Monterey" collection from Eastwood in 1900	Unable to locate	1900	--	--	CNDDB 2008
4	Pacific Grove near reservoir on road to Cypress Point	Presumed extirpated by development	1968 (Norman collection)	1992	-- --	CNDDB 2008

CNDDB identification # = occurrence number assigned by the California Natural Diversity Database (CNDDB 2008).

* This number is combined # of individuals for EOs 6 and 7.

Habitat or Ecosystem

On a broad scale, habitat for *Potentilla hickmanii* has been described as coastal terrace prairie (Holland 1986, Stromberg et al. 2001) and valley grassland (Holland and Keil 1990). On a finer scale, these grasslands would be described as belonging to various vegetation series including the California oatgrass series (Sawyer and Keeler-Wolf 1995).

In San Mateo County, the following plants have been noted to occur with *Potentilla hickmanii* and are associated with grassland habitat: needlegrass (*Stipa* spp.), bluegrass (*Poa scabrella*), California oatgrass (*Danthonia californica*), hairgrass (*Aira caryophylla*), quaking grass (*Briza minor*), English plantain (*Plantago lanceolata*), and lupine (*Lupinus* spp.) (CNDDB 2008). Kramer (2008) noted that Monterey pines (*Pinus radiata*) from adjacent areas are encroaching upon the grassland habitat. In addition to nonnative annual grasses, the nonnative pampas grass (*Cortaderia jubata*) is also encroaching upon the grassland habitat where *Potentilla hickmanii* occurs.

In Monterey County, *Potentilla hickmanii* is found within a degraded meadow in an opening within a Monterey pine forest. The meadow once supported a larger cover of the native California oatgrasss (Yadon pers. comm. 2008). However, it now supports a larger cover of nonnative species, including brome (*Bromus hordeaceus*, *B. mollis*, *B. diandrus*), wild oat (*Avena barbata*), vulpia (*Vulpia myuros*), ryegrass (*Lolium multiflorum*), foxtail barley (*Hordeum leporinum [jubatum]*), velvet grass (*Holcus lanatus*), and tall fescue (*Festuca arundinaceae*) (Ferreira 1995, Jones and Stokes 1996, CNDDB 2008). The thicker cover provided by the nonnative grasses may be shading out *Potentilla hickmanii.*

Changes in Taxonomic Classification or Nomenclature
No changes have been made since the name of the species was first published in 1902 (Eastwood 1902).

Genetics
No genetic studies have been done for this species.

Species-specific Research and/or Grant-supported Activities
In 1997, Federal funds were awarded to the University of California at Santa Cruz (UCSC) through the Service's Endangered Species Act section 6 grant program to identify the ecological factors affecting the recovery of *Potentilla hickmanii* as well as four other plant taxa endemic to the Monterey Peninsula area (Doak et al. 2000). Specific to this species, research focused on establishing baseline levels of natural recruitment, determining if reproductive failure was limiting population growth, quantifying the effect on growth of reducing the biomass of competing species, and outplanting indivduals at Indian Village as well as Point Lobos State Reserve.

A larger outplanting effort at Point Lobos State Park was undertaken by UCSC in 2006-2007 (Doak et al. 2008) and funded by the Ventura Fish and Wildlife Office. Initial monitoring indicated a high survival rate of individuals at the end of the first year. Follow-up monitoring by the Service and UCSC to determine survival rates will continue on an annual basis.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

At the time of listing, we discussed that the Pebble Beach population of *Potentilla hickmanii* was threatened by a proposed residential development that would have increased alteration to the hydrology of the habitat, and by ongoing recreational activities. Since the time of listing, that particular development was reconfigured. However, alterations in hydrology were previously noted from reconstruction of the Spyglass Hill Golf Course, and continue to the present. Water flow now occurs throughout the year as a result of watering of the golf course, whereas the original prairie habitat that supports *Potentilla hickmanii* may have been moist during the spring

months, but would have dried out over the course of the year. An effort has been made to divert this flow, but may be only partially effective. Year-round water flow has allowed the spread of invasive species, such as tall fescue (*Festuca arundinacea*), velvet grass (*Holcus lanatus*), and reed (*Juncus* sp.), that are competing with *Potentilla hickmanii* (Doak et al. 2000). Pebble Beach Company has undertaken various management activities, including mowing, selectively spraying nonnative species, and hand-weeding directly around *Potentilla hickmanii* individuals in efforts to maintain suitable habitat for the species (Pebble Beach Company in litt. 2005). Pebble Beach Company has put forth several proposals to develop additional golf courses and residences over the last decade; the most recent proposal was withdrawn in 2006 and no proposals are pending at this time.

At the time the rule to list was prepared, the discovery of the Montara population was known, but no threats to this population were discussed in the rule. However, the recovery plan noted that potential future development of a highway construction project by CalTrans was a threat (Service 2004). Specifically, one proposal for rerouting Highway 1 inland of the problematic Devil's Slide portion of the highway along the coast would have altered habitat for approximately one-third of the Montara population. Although the project has been under consideration since the 1970s, it was defeated by public referendum in 1996 (Committee for Green Foothills 2008). Land that had been purchased by CalTrans for construction of the bypass is scheduled to be transferred to California State Parks. Adjacent lands, known as Rancho Corral de Tierra, that support the remaining portion of the population were acquired by the Peninsula Open Space Trust in 2003. The Peninsula Open Space Trust has secured access points to this property and has been actively removing nonnative species. These lands will be transferred in phases to Golden Gate National Recreation Area starting in 2009 (Detwiller pers comm. 2008).

In summary, current threats to the population at Pebble Beach, Monterey County, are relatively the same as at the time of listing. Because a second population has been discovered since the time of listing (Montara population in San Mateo County) and threats to the population are less than they are for the Pebble Beach, Monterey County, population, the threats to the species overall are less than they were at the time of listing. In addition, the Montara population has been transferred from private ownership to state and local agency ownership (CalTrans and Peninsula Open Space Trust), and long-term plans are to transfer these lands to California State Parks and Golden Gate National Recreation Area, respectively. However, threats to the habitat remain at both locations, and include conversion of coastal terrace prairie habitat by native and nonnative species, alteration in hydrology, and recreation. The Pebble Beach population is threatened with extirpation from alteration and destruction of habitat because the size of coastal prairie where *Potentilla hickmanii* occurs is less than 0.25 ac (0.1 ha) and the number of individuals is so few; therefore, the remaining individuals may not be able to persist if the condition of the habitat continues to decline.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for any purpose was not known to be a factor in the 1998 final listing rule (63 FR 43100), and is not considered a threat at this time. In that rule, we discussed the threat of

vandalism under Factor B because the perceived threat of vandalism was associated with recreational use of the site. However, vandalism is also not considered a threat at this time.

FACTOR C: Disease or Predation

Disease was not discussed as a threat at the time of listing. Predation on *Potentilla hickmanii* by mule deer (*Odocoileus hemonius*) on the Pebble Beach population in Monterey County has been observed by Yadon (in litt. 1997) and others (Jones and Stokes Associates 1996). Since the time of listing, herbivory by voles (*Microtus* spp.), snails (various species), and slugs (various species) has also been observed on both vegetative and reproductive structures (Doak et al. 2000). As recently as 2008, Staub (in litt. 2008) noted that gophers (*Thomomys* sp.) and mice (various species) are likely affecting the population. With so few individuals comprising this population (11 individuals as of 2008), predation exacerbates the threat of stochastic extinction (see Factor E).

We have also become aware that the Montara population in San Mateo County is within an area being grazed by cattle (CNDDB 2008). Cattle grazing may be either beneficial or deleterious to the species, depending on the intensity and duration. Cattle grazing may benefit the species by reducing competition from nonnative species. Too little grazing may allow nonnative species to outcompete *Potentilla hickmanii*, while too much grazing may result in predation or trampling of *Potentilla hickmanii*. We do not have specific information concerning the intensity or the overall impact of grazing that is occurring within this area.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, we discussed that regulatory mechanisms with potential to protect *Potentilla hickmanii* included: (1) listing under the California Endangered Species Act (CESA); (2) the California Environmental Quality Act (CEQA); (3) the California Coastal Act; and (4) local land use laws, regulations, and policies. The listing rule (63 FR 43100) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain currently valid. *Potentilla hickmanii* was listed as endangered by the State of California in 1979. As such, projects that would affect *Potentilla hickmanii* are subject to CESA and CEQA requirements. Protection of listed species through CEQA is dependent upon the discretion of the lead agency involved.

This species occurs within a portion of the Monterey Peninsula included in the California Coastal Zone. The Del Monte Forest Land Use Plan of 1984 was developed to comply with the Coastal Act's requirement that all counties prepare a plan for those portions of the Coastal Zone within their jurisdiction. Once the Del Monte Forest Land Use Plan was certified by the Coastal Commission, development permits within the Del Monte Forest coastal zone became the responsibility of the County of Monterey. The County of Monterey also has designated certain areas, including where *Potentilla hickmanii* grows, as Environmentally Sensitive Habitat Areas. Protection of listed species through the California Coastal Act and local land use designations is dependent upon the discretion of the lead agency involved. Although no projects have been proposed for the site where *Potentilla hickmanii* grows, these state and local regulations may not protect the species from secondary impacts that occur from such threats as changes in hydrology

in adjacent areas and the spread of nonnative species.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

At the time of listing, we discussed other Factor E threats to *Potentilla hickmanii* including competition with nonnative species and the stochastic extinction due to low numbers of populations and individuals.

Competition with nonnative species

At the Monterey Peninsula site, at least five nonnative plant species occur within *Potentilla hickmanii* habitat. These include: hairgrass, various bromes, tall fescue, and ryegrass (Ferreira 1995, Yadon pers. comm. 2008). Nonnative grasses including Harding grass (*Phalaris aquaticus*) also occur at the Montara site. Several of these nonnative taxa are known to outcompete and displace native species in general (Bossard et al. 2000). To determine the effects of competition on *Potentilla hickmanii*, Doak compared the number of inflorescences and the number of flowers on *Potentilla hickmanii* seedlings within plots where surrounding vegetation was either clipped or unclipped; *Potentilla hickmanii* seedlings in the clipped plots produced more flowers and inflorescences than those in the unclipped plots (Doak et al. 2000).

At the Montara site, pampasgrass was noted as being a potential threat to one colony of *Potentilla hickmanii* (Kramer 2008).

Reproductive failure

At the time of listing, we discussed that reproductive failure was a concern, primarily because the Monterey Peninsula population had a very low number of new seedlings established over a 2-year period (Morosco 1997). In addition, low seed set had been observed by several biologists (Ertter in litt. 1997, Yadon in litt. 1997). Since the time of listing, Doak et al. (2000) compared seed set in flowers that were cross-pollinated by hand with those in a control group. Based on number of ovules, each flower has the potential to produce approximately 10 seeds; the researchers found that hand-pollinated flowers achieved a higher seed set than the control group (4.8 per flower compared to 3.2) (Doak et al. 2000). The lack of pollinators observed in the field has been put forth as a potential cause for low seed set by several observers (Yadon in litt. 1997, Ertter in litt. 1997, Doak et al. 2000).

Small numbers of individuals and populations

Conservation biology literature discusses that small populations are threatened by inbreeding depression (Ellstrand and Elam 1993). Small populations can have significantly lower germination rates than larger populations of the same species due to high levels of homozygosity (Menges 1991). Based on historical records, we believe that urban development and secondary impacts associated with such development has already reduced the distribution of this species in the two areas where it occurs. Indirect effects from urbanization in the watersheds include changes in hydrology, changes in vegetation, and an increase in nonnative species. The effects of competition with nonnative species is most problematic immediately adjacent to urban areas and in habitat that has been isolated or fragmented by development (Alberts et al. 1993). While any one of these factors may not be enough to threaten the survival of *Potentilla hickmanii* independently, its limited range, the cumulative and synergistic effects of all of these factors combined could be a threat to the survival and recovery of *Potentilla hickmanii*.

Alteration of fire frequency

At the time of listing, we discussed that alteration of fire frequency was a potential threat to all five taxa in the listing rule, due to fire suppression activities that increased on the Monterey Peninsula as development increased over time; we did not discuss specifically how reducing the frequency of fires in the area would affect *Potentilla hickmanii*. Although *Potentilla hickmanii* itself is associated with grassland habitats, the small meadow where it occurs is within an opening of Monterey pine forest. Without periodic fire, the pine forest would tend to expand in range over time and eventually shade out the habitat where *Potentilla hickmanii* occurs. Shading by Monterey pine was also noted as a threat to several colonies of *Potentilla hickmanii* at the Montara population (Kramer 2008). Based on current information, alteration of fire frequency may continue to be a threat to *Potentilla hickmanii* at both sites.

Climate change

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007). Recently, the potential impacts of climate change on the flora of California were discussed by Loarie et al. (2008). Based on modeling, they predicted that species' distributions will shift in response to climate change, specifically that the species will "move" or disperse to higher elevations and northward, depending on the ability of each species to do so. Species diversity will also shift in response to these changes with a general trend of diversity increases shifting towards the coast and northwards with these areas becoming de facto future refugia. However, predictions of climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects. While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to *Potentilla hickmanii* at this time.

In summary, the combination of threats associated with urban development (discussed in Factor A), predation (Factor C), and the already-low numbers of individuals and populations of *Potentilla hickmanii* make it particularly vulnerable to extinction from stochastic events.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is

likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of the species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The Recovery Plan indicates that downlisting for *Potentilla hickmanii* can be considered when all of the following criteria have been achieved:

1. At least five viable populations (i.e., populations that are stable or increasing based on a minimum of 10 years monitoring) occur in suitable habitat (addresses Listing Factors A and E). This criterion is relevant and up-to-date. This criterion has not been met. In addition to the two populations known at the time of listing, one outplanting effort is underway at Point Lobos State Park.

2. All five of the sites are on land that is protected from human-induced disturbance. Funds must be available for appropriate long-term management. As determined by research, protected habitat must be of adequate size (large enough to support a functioning ecosystem; e.g., species present to support seed dispersal and pollination, areas that support fluctuating distributions, areas that harbor suitable unoccupied habitat for population expansion) and configuration to ensure that ecosystem and community processes and associated species (e.g., hydrologic regime, food webs, pollinator fauna, forest meadow communities) are maintained, and that an adequate diversity of sites exist for population expansion and for colonization of new areas as microhabitat conditions change. One of these protected sites should be the Indian Village (Pebble Beach) population; another should be the Montara population in San Mateo County (addresses Listing Factors A and E). This criterion is relevant and up-to-date. This criterion has not been met.

3. Surrounding vegetation has been managed for a reduction of nonnative plant species and nonnative snails and slugs. The populations should be adequately maintained, such that encroachments by nonnative plants and herbivorous predators (including deer) are not negatively affecting *Potentilla hickmanii* directly or indirectly (addresses Listing Factor C). Individuals have been caged at the Pebble Beach population, and this has reduced deer browse. However, additional management is needed to control nonnative species. This criterion is relevant and up-to-date. This criterion has been partially met for one population.

4. The populations have been appropriately managed to such a degree that monitoring has determined the populations are of adequate size, density, and number that the trend for each of the populations is projected to be stable or increasing in the future (addresses Listing Factors A and E). Population censusing and demographic studies have been conducted for the Pebble Beach population, but not in a manner that is able to detect long-term trends. This criterion is relevant and up-to-date. This criterion has not been met.

5. A seed bank has been established at a recognized institution certified by the Center for Plant Conservation (addresses Listing Factor E). This criterion is relevant and up-to-date. This criterion has been partially met in the following way: a portion of seed from the Pebble Beach

population that was previously collected for research is being stored at the University of California, Santa Cruz (UCSC); UCSC is not a Center for Plant Conservation affiliate. A small amount of seed was collected from the Montara population in 1995 by staff from the University of California, Berkeley (Jones and Stokes 1996); its current disposition is unknown.

IV. SYNTHESIS

At the time the proposed rule to list *Potentilla hickmanii* was prepared, we believed that the species consisted of approximately 40 plants all in one meadow less than 0.25 ac (0.1 ha) in size and was facing threats resulting from urbanization, and therefore was considered to be near extinction. Since then, one additional population has been discovered and the total number of individuals in an average year has increased from approximately 40 to over 2,000. Due to the extremely low numbers of individuals at the Pebble Beach site, the long-term persistence of *Potentilla hickmanii* there remains tenuous. The outplanted individuals contribute at least temporarily to the total number of individuals, but their long-term contribution has not been assured. However, even with these increases, the total number of populations and individuals remain very small.

Habitat threats remain at all native sites, and include alteration in hydrology, grazing by a variety of wildlife species, cattle, and nonnative slugs and snails. A portion of the Montara population has been secured from development due to abandonment of the Devil's Slide bypass project and the acquisition by the Peninsula Open Space Trust of the remaining portion of this population; the Pebble Beach population occurs on private lands with protective land use designations. However, due to the combination of low numbers of populations and individuals and continuing threats from habitat alteration, alteration in hydrology, and competition with nonnative species, we believe *Potentilla hickmanii* continues to be in danger of extinction throughout its range. Therefore, no change is needed in its status as an endangered species at this time.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
__X__ No Change

New Recovery Priority Number and Brief Rationale: No change

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Work with Pebble Beach Company to evaluate current conditions and improve habitat conditions at the Pebble Beach site. Determine if additional measures can be taken to reduce threats from overwatering, invasive nonnative species, and herbivores (a portion of recovery tasks 1.4.3 and 2.3).

2. Continue pollination ecology research initiated by Doak to determine if lack of pollinators is limiting seed set at the Pebble Beach site. Conduct research to identify pollinators at the Montara site and compare with those at Pebble Beach (a portion of recovery task 3.2.3).

3. Seek additional sites for outplanting additional populations in Monterey and San Mateo Counties. State Park lands (aside from Point Lobos) may offer opportunities for outplanting (a portion of recovery task 4.2.3).

4. Coordinate with Peninsula Open Space Trust to determine if management actions need to be taken to protect or enhance habitat for the species on lands they manage prior to transfer to Golden Gate National Recreation Area (GGNRA). Seek assurance from GGNRA that necessary management actions be continued.

VII. REFERENCES CITED

Literature Cited

Abrams, L. 1944. Illustrated flora of the Pacific States, Vol. II. Stanford University Press, California. Pp. 435-437.

Alberts, A.C., A.D. Richman, D. Tran, R. Sauvajot, C. McCalvin, and D.T. Bolger. 1993. Southern California Coastal Scrub. In: Keeley, J.E. (ed.) Proceedings of a symposium: interface between ecology and land development in California. Southern California Academy of Sciences, Los Angeles. Pp. 103-110.

Bossard, C.C, J.M. Randall, M.C. Hoshovsky. 2000. Invasive plants of California's wildlands. University of California Press, Los Angeles.

California Natural Diversity Data Base (CNDDB). 2008. Element occurrence reports for *Potentilla hickmanii*. California Department of Fish and Game, Sacramento, California.

Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western North America? U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, California.

Committee for Green Foothills. 2008. History regarding the Devil's Slide bypass. Accessed online at http://www.greenfoothills.org/index.shtml, on April 1, 2008.

Consortium of California Herbaria. 2008. Herbarium records for Potentilla hickmanii. Accessed online at http://ucjeps.berkeley.edu/consortium on November 1, 2007.

Doak, D. J. Borgeson, S. Danner, A. Graff, M. Kauffman, P Shahani, D. Thomson. 2000. Ecological factors affecting the recovery of coastal milkvetch (*Astragalus tener* var. *titi* Fabaceae), Hickman's cinquefoil (*Potentilla hickmanii*, Rosaceae), and Pacific Grove clover (*Trifolium polyodon*, Fabaceae), and ecological factors affecting the recovery of Gowen cypress (*Cupressus goveniana* ssp. *goveniana*, Cupressaceae) and Monterey clover (*Trifolium trichocalyx*, Fabaceae). Prepared for California Department of Fish and Game (section 6 program).

Doak, D., M. Goldman, S. Langridge. 2008. Propagation and establishment of a new population of *Potentilla hickmanii*, final report. Prepared for U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California.

Eastwood, A. 1902. Some new species of California plants. Bulletin of the Torrey Botanical Club 29:77-78.

Ellstrand, N.C. and D.R. Elam. 1993. Population genetic consequences of small population size: implications for plant conservation. Annual Review of Ecological Systematics 24:217-242.

Ertter, B. 1997. Letter regarding the status of *Potentilla hickmanii*. Letter sent to Field Supervisor, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. Dated May 2, 1997.

Ferreira, J. 1995. The status of four rare plants of Pebble Beach, Monterey County, California. Unpublished report prepared for U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California.

Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC.

Holland, R. F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. Nongame Heritage Program, California Department of Fish and Game, Sacramento, California.

Holland, R.F. and D. J. Keil. 2000. California Vegetation (4^{th} ed.). California Polytechnic State University, San Luis Obispo. Pp. 127-138.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: the physical science basis. Summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC Secretariat, World Meteorological Organization and United Nations Environment Programme, Geneva, Switzerland.

Jones and Stokes Associates, Inc. 1996. Recovery strategies for six coastal plant species on the Monterey Peninsula (JSA 95-079. Sacramento, California. Prepared for California Department of Fish and Game. Monterey, California

Kramer, N. 2008. Field survey form and supplemental observations on CNDDB EO #6 (Montara Mountain). Dated April 1, 2008.

Loarie, S.R., B.E. Carter, K. Haydoe, S. McMahon, R. Moe, C.A. Knight, D.D. Ackerly. 2008. Climate change and the future of California's endemic flora. Plos ONE 3(6): e2502 doi 10.1371/journal.pone 0002502.

Menges, E. 1991. Seed germination percentage increases with population size in a fragmented prairie species. Conservation Biology. 5:158-164.

Morosco, T. 1997. Brief summary of observations and research on *Potentilla hickmanii*. Letter sent to U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. Dated May 2, 1997.

Pebble Beach Company. 2005. Maintenance activity log for *Potentilla hickmanii* at Indian Village (April 2002 through January 2005), Pebble Beach, California. FAX sent to U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. Dated March 28, 2005.

Sawyer, J. and T. Keeler-Wolf. 1995. A Manual of California Vegetation. California Native Plant Society. Sacramento, California. P. 42.

Staub, S. 2008. Maintenance activity for *Potentilla hickmanii* at Indian Village. E-mail and summary table sent to Connie Rutherford, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. Dated July 20, 2008.

Stromberg, M.A., P. Kephart, and V. Yadon. 2001. Composition, invisibility, and diversity in coastal California grasslands. Madroño, Vol. 48, No. 4:236-252.

U.S. Fish and Wildlife Service. 2004. Recovery plan for five plants from Monterey County, California. U.S. Fish and Wildlife Service, Portland, Oregon. xii + 159 pp.

Yadon, V. 1997. Information on *Piperia yadonii*, *Cupressus goveniana* ssp. *goveniana*, and *Potentilla hickmanii* requested as peer review. Letter to U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. Dated April 26, 1997.

Personal Communications and Observations

Chris Detwiller. 2008. Conservation Project Manager, Peninsula Open Space Trust. Conversation with Connie Rutherford, U.S. Fish and Wildlife Service, on May 2, 2008. Regarding management activities on Rancho Corral de Tierra, San Mateo County, California.

Connie Rutherford. 2008. U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. Personal observations during site visit to Indian Village, Pebble Beach, California, on May 21, 2008.

Vern Yadon. 2008. Naturalist and Botanist, retired from Pacific Grove Museum of Natural History. Conversation with Connie Rutherford, U.S. Fish and Wildlife Service, on May 21, 2008. Regarding changes in vegetation at the Indian Village site, Pebble Beach, Monterey County, California.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

***Potentilla hickmanii* (Hickman's potentilla)**

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Appropriate Listing/Reclassification Priority Number: N/A

Review Conducted By: Connie Rutherford

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve Diane K Noda Date 1/14/09

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, U.S. Fish and Wildlife Service, Region 8

Approve [signature] Date 2-4-09