Ben Lomond Spineflower
(Chorizanthe pungens var. *hartwegiana)*

5-Year Review:
Summary and Evaluation

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

September 2007

5-YEAR REVIEW
Ben Lomond Spineflower/*Chorizanthe pungens* var. *hatwegiana*

I. GENERAL INFORMATION

I.A. Methodology used to complete the review: This review was carried out by staff of the Ventura Fish and Wildlife Office. The Sandhills Conservation and Management Plan based on the doctoral work of J. McGraw (2004) was the primary source of much of the information used in this review. Other information was collected from a variety of sources including: the Internet, published and unpublished literature, and personal communications with experts in the field. Due to land ownership patterns and the fragmented nature of the sand parkland habitat containing *Chorizanthe pungens* var. *hartwegiana* populations, information was obtained through personal communication with various private and public entities.

I.B. Reviewers

Lead Regional Office:
California-Nevada Operations Office:
Mary Grim, 916.414.6464

Lead Field Office:
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Chris West, Biologist, 707.822.7201
Connie Rutherford, Recovery Coordinator (Plants), 805.644.1766 ext. 306

I.C. Background

I.C.1. FR Notice citation announcing initiation of this review:
The initial FR notice was published on March 22, 2006 (71 FR 14538) and initiated a 60-day request for information. A second FR notice was published on April 3, 2006 (71 FR 16584) that clarified the contact office. No information was received as a result of this request.

I.C.2. Listing history

Original Listing
FR notice: 59 FR 5499
Date listed: February 4, 1994
Entity listed: subspecies (*Chorizanthe pungens* var. *hartwegiana*)
Classification: endangered

I.C.3. Associated rulemakings: None

I.C.4. Review History: None

I.C.5. Species' Recovery Priority Number at start of review: 9. This denotes a subspecies that faces a moderate degree of threat and has a high potential for recovery.

I.C.6. Recovery Plan or Outline

Name of plan: *Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California*
Date issued: September 28, 1998
Dates of previous revisions: No revisions have been made.

II. REVIEW ANALYSIS

II.A. Application of the 1996 Distinct Population Segment (DPS) policy:

II.A.1. Is the species under review listed as a DPS?

No. The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes. The plan details direction needed for recovery and lays out clear objectives.

II.B.2. Adequacy of recovery criteria.

II.B.2.a. Do the recovery criteria reflect the best available and most up to date information on the biology of the species and its habitat?

The recovery criteria reflect the most up to date information about the species biology and habitat; however, the criteria could be rewritten to better define criteria for populations trends.

II.B.2.b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

Yes; however, the recovery criteria are not explicitly threats-based.

II.B.3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.

The recovery objective for *Chorizanthe pungens* var. *hartwegiana* is delisting through habitat protection and appropriate management actions.

Listing Factors B and C are not applicable to this species.

The downlisting criteria in the recovery plan are laid out in a narrative format distinguished by bullets in the margin. We have separated and numbered them here for ease of analysis.

1. The 21 currently known populations have been secured through fee-title acquisition, conservation easements, or habitat conservation plans:

This recovery criterion addresses Listing Factors A, D, and E. Habitat conservation plans (HCPs) are in place at some quarry sites (B. Davilla, biological consultant, pers. comm. 2006). One specific occurrence site, the former Olympia Quarry, has only limited protections afforded through the original county mining permit in accordance with the rules in place at the time the permit was acquired (S. Schettler pers. comm. 2006). HCPs are under development concerning county lands, but none have been completed (P. Levine pers. comm. 2006). One regional HCP is currently under development as a collaboration between the County of Santa Cruz and the City of Scotts Valley focusing on Santa Cruz sandhills habitat (McGraw 2006). Additionally, an interim programmatic HCP is under development, also by the County of Santa Cruz and the City of Scotts Valley, as a stop-gap measure until the regional plan can be completed. A major development toward the completion of the interim programmatic HCP is the imminent approval of management and monitoring of the Ben Lomond Sandhills Preserve (BLSP) by the Zayante Sandhills Conservation Bank (ZSCB). The agreement for the ZSCB has now been reviewed and executed by the Service (Service, in litt. 2006) and is awaiting the subordination of the deed of trust to the conservation easement. Habitat management by this conservation bank will provide an avenue for off-site mitigation of impacts resulting from small scale residential projects within already highly developed sandhills habitat (McGraw 2006). Additional progress has been made through the acquisition by the Save-the-Redwoods League of the Henry Cowell Foundation Sandhills site, which was slated for development. This site

will be transferred to the California Department of Parks and Recreation (J. McGraw in litt. 2006).

At this time, very few of the known populations have been secured. Considering that populations vary greatly in size, a more accurate unit of measure would be area of occupied habitat. However, this is also not clearly known due to varying level of detail that is used in mapping the populations included in NDDB records. A very rough estimate of total potential habitat is approximately 900 to 2000 acres. Out of this, it is likely that secured habitat comprises roughly 200 to 300 acres. This gives a range of roughly 10% to 30% of habitat that is secure. The Service derived these estimates by reviewing the NDDB records and opinions of experts in the field, and they are not the result of any quantifiable methodology. This estimation should be taken as such and should not be used as the basis of any further reports or management decisions

For the reasons above, this criterion has only partially been met. Also, new populations of *Chorizanthe pungens* var. *hartwegiana* have been identified since the recovery plan was issued, which are not included in the California Department of Fish and Game California Natural Diversity Database (CNDDB); these should be considered in future management actions (McGraw 2004). We believe this criterion is appropriate and adequate with respect to the recovery of the taxon.

2. Conservation measures for this species are included in habitat conservation plans (Graniterock Quarry, Kaiser Sand and Gravel Felton Plant, and the County of Santa Cruz) that have been developed and implemented for the listed insect species:

This recovery criterion addresses Listing Factors A, D, and E. Habitat Conservation Plans have been developed and implemented for both the Graniterock Quail Hollow Quarry and Kaiser Sand and Gravel Felton Plant (now Hanson Aggregates). The HCP for the County of Santa Cruz is still in the process of being developed (P. Levine, pers. comm. 2006). This criterion has only partially been met. We believe this criterion is appropriate and adequate with respect to the recovery of the taxon.

This recovery criterion addresses Listing Factors A, D, and E. This species was included in two Habitat Conservation Plans (HCP's) implemented for both the Mount Hermon June beetle and the Zayante band-winged grasshopper. Both HCPs, Quail Hollow Quarry (short term permit) issued in 1997 and Quail Hollow Quarry Amendment #1 (long-term permit) issued in 1998, were developed to cover Quail Hollow Quarry owned by Graniterock Company. The Kaiser Sand and Gravel Felton Plant is now known as the Hanson Aggregates, Felton Sand Plant. An HCP, Hanson Aggregates Felton Sand Plant HCP, was issued for the two insect species in 1999 and has been implemented. Ben Lomond spineflower was not included in this HCP. The County of Santa Cruz HCP has been developed in two versions, the preliminary Interim Programmatic HCP and the

County of Santa Cruz Regional HCP. Both of these plans should include both insect species and the Ben Lomond spineflower; however, neither of these plans has yet been permitted (P. Levine, pers. comm. 2006). Since the Ben Lomond spineflower is not included in all HCPs developed for the locally listed insect species and not all HCPs indicated in the recovery plan have been implemented, we consider that this criterion has not been met. We believe that inclusion of this species in all HCPs which overlap geographically with known Ben Lomond spineflower occurrences is appropriate. We believe the intent of the criterion was, and still is appropriate. However, the wording should be revised to indicate that conservation measures for this taxon should be included in any habitat conservation plans that are developed for areas that are within the range where it occurs. See section IV.6.

3. Management plans for populations on Quail Hollow Ranch County Park and the adjacent State-owned parcel, Bonny Doon Ecological Reserve, Henry Cowell Redwoods State Park, Big Basin State Park, and Gray Whale Ranch State Park are developed and being implemented:

This recovery criterion addresses Listing Factor A. None of the management plans for the areas specifically listed in this criterion have been completed at this time (J. DeWald, Reserve Manager, pers. comm. 2006; T. Hyland, resource ecologist, California State Parks, pers. comm. 2006; J. McGraw in litt. 2006). Although the plan for the Bonny Doon Ecological Reserve has not been completed (J. DeWald, Reserve Manager, pers. comm. 2006), significant progress has been made on the plan by the California Department of Fish and Game, and a final draft has been prepared (J. McGraw in litt. 2006). Although not specifically listed in this criterion, progress has also been made toward a "Long Term Management and Maintenance Plan" for the Quail Hollow Quarry lands (J. McGraw in litt. 2006).

Even though progress has been made on a few management plans, much work is needed to complete this criterion. We believe this criterion is appropriate and adequate with respect to the recovery of the taxon.

4. Population numbers are stable or increasing:

There is no information indicating that this criterion has been entirely or partially met. Since this species was listed, virtually no monitoring has been undertaken to provide data that may be used to examine population trends. Efforts have been made to remove invasive plants from a few areas (e.g., San Lorenzo Valley Water District property) (J. McGraw in litt. 2006), but without monitoring the benefits of these projects to *Chorizanthe pungens* var. *hartwegiana*, if any, cannot be ascertained. Impacts to the species have been noted at many sites, including habitat type conversion due to fire suppression, secondary impacts of urban development (e.g., landscaping, water drainage alterations), and recreational use (e.g., mountain bikes, off-highway vehicles (OHVs), equestrian use, hiking)

(McGraw 2004; P. Levine, pers. comm. 2006; J. McGraw, pers. comm. 2006; S. Schettler, pers. comm. 2006). Although these observations are anecdotal and do not constitute formal monitoring, their frequency and widespread nature may indicate pressures likely to cause population declines; however, there are no data to confirm this. We believe this criterion should be modified at some point in the future. Although targets for sizes of populations are useful as a general guideline, due to the large annual fluctuations in population numbers, we believe it would be more appropriate to redefine the criterion in terms of size, quality, and geographic configuration of habitat that is being conserved for the species.

II.C. Updated Information and Current Species Status

1. Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

This taxon is a short-lived annual species which undergoes large variations in population numbers from year to year depending on climatic conditions and other factors. Ongoing monitoring would be necessary to generate data useful in determining any sort of population trend. Monitoring of this sort is only taking place at two quarry sites; Hanson Aggregates Quarry (previously Kaiser Sand and Gravel Felton Plant) and Quail Hollow Quarry. Hanson Aggregates is moving into closure mode and will be entering a reclamation phase (B. Davilla, pers. comm. 2006). Monitoring efforts have only recently begun, and 2006 spring surveys found low numbers of individuals, possibly due to late and heavy precipitation that occurred during winter 2005/2006 (V. Haley, biological consultant, pers. comm. 2006). Reliable, long-term data should be available in the future from this site where monitoring will continue to 2030 as directed by the current HCP (V. Haley, pers. comm. 2006). Quail Hollow Quarry began its monitoring regime as called for in its HCP with baseline surveys in May 2006, so long-term data are not yet available (B. Davilla, pers. comm. 2006).

2. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

A genetic study of the *Pungentes* complex of the genus *Chorizanthe* (and including this species) was recently completed by Brinegar (2006). The study indicated a close relationship between this taxon and Scotts Valley spineflower (*Chorizanthe robusta* var. *robusta*); however, no taxonomic revisions are being undertaken at this time based on this information.

3. Taxonomic classification or changes in nomenclature:

None.

4. Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species' within its historic range, etc.):

This taxon is restricted in distribution to a unique edaphic ecosystem referred to as the Zayante sandhills. The central range of the species is generally bounded by the communities of Ben Lomond, Glenwood, Scotts Valley, and Felton, with outlying populations located near Bonny Doon, Boulder Creek, Big Basin State Park, and Gray Whale Ranch State Park, all in Santa Cruz County, California. Two new occurrences and three new populations extending area coverages of existing occurrences have been documented since the original listing of *Chorizanthe pungens* var. *hartwegiana*; these all occur within the known range of the taxon (McGraw 2004). Information on these new occurrences and populations has not yet been submitted to the CNDDB for inclusion in updated versions of the database. Additionally, the well known and documented occurrence at Gray Whale Ranch State Park is not included in the CNDDB. The majority of occurrences listed in the CNDDB have not been checked in the last 10 years for the continuing presence of the taxon. If any of these occurrences have been extirpated, a contraction in range or spatial extent may have occurred.

The newly identified occurrences and populations listed above are the only known instances which would alter spatial distribution known at the time of listing. Habitat conversion (due to fire suppression and encroachment of woody shrubs and non-native annual grasses) and human disturbances (such as landscaping, alteration of drainages, and recreational use) are believed to be having a negative impact on remaining populations of this species (McGraw 2004; P. Levine, pers. comm. 2006; J. McGraw, pers. comm. 2006). Based on this habitat conversion and disturbance, we would expect the spatial distribution to be somewhat reduced as well as an increase in fragmentation of habitat within known occurrences and populations since the time of listing.

5. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

The main threats described for this species are habitat destruction and habitat conversion. Habitat destruction, mainly due to sand mining, has mostly stopped at this time; however, very little restoration work has been undertaken at previously mined sites. Habitat conversion due to fire suppression and human disturbance, as discussed in "II.C.4" above, continues to be a major concern when examining suitability of habitat and ecosystem dynamics for continued survival of this species.

6. Reproductive characteristics:

Chorizanthe pungens var. *hartwegiana* seeds germinate in the late fall after the first substantial winter rains. The plants remain small through the winter, then grow quickly and begin producing flowers in April. The length of the flowering season may persist for several months if the climatic conditions during the spring and early summer are favorable. Flowers are pollinated by a variety of insects, including wasps, bees, flies, and butterflies (Morgan 1997 in Service 1998). Seed set varies with site conditions; in

controlled experiments with plants transplanted into grass, manzanita, and pine sites, seed set varied from none to about 60 seeds per plant. Higher seed set was closely tied to the lack of shading (Kluse 1994).

7. Microhabitat requirements:

Much research has been independently undertaken by J. McGraw during work on her Doctoral Dissertation through the University of California, Berkeley. Results of this work have been presented in the Sandhills Conservation Management Plan (McGraw 2004). There is focused attention paid to *Chorizanthe pungens* var. *hartwegiana* in this document. Most of the recommended actions favor general sandhills habitat management. In addition to *Chorizanthe pungens* var. *hartwegiana*, this specialized and fragile habitat supports five Federally listed endangered species and one species of special concern. Habitat management recommendations within this management plan may be the most prudent to follow in order to maximize conservation of multiple listed species. One critical finding presented in this management plan is the vital role of microhabitat conditions on the larger scale persistence of the sandhills parkland habitat. Clearing of accumulated litter on the soil surface in the absence of fire is critical to maintain the open environment required by *Chorizanthe pungens* var. *hartwegiana* and prevents encroachment by woody native species and non-native annual grasses which lead to habitat type conversion (Kluse and Doak 1999; McGraw 2004).

II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

II.C.2.a. Present or threatened destruction, modification or curtailment of its habitat or range:

At the time *Chorizanthe pungens* var. *hartwegiana* was listed, sand quarrying on a large scale was occurring on large holdings of land and was the primary threat to the species. Quarrying is generally no longer a threat to the existing habitat of the species because many of the mining operations are scheduled to close. However, a substantial amount of the species' habitat had already been destroyed by mining operations prior to listing. Recovery of the species will depend to a great extent on habitat restoration of these private mining areas.

Fire suppression was also originally identified as a major threat at the time of listing and remains as one of the most serious ongoing threats to the persistence of *Chorizanthe pungens* var. *hartwegiana* (McGraw 2004; P. Levine, pers. comm. 2006; J. McGraw, pers. comm. 2006; S. Schettler, pers. comm. 2006). In large part stemming from the disruption of natural fire cycles, encroachment by woody species and litter buildup encourages habitat type conversion (McGraw 2004, P. Levine, pers. comm. 2006).

Recreational threats identified at the time of listing, including mountain biking, OHVs, equestrian use, and hiking, have resulted in habitat degradation and

fragmentation (McGraw 2004). Other human disturbances, such as landscaping and alteration of water drainages, are also affecting the species. These factors continue to threaten the existence of this species and remain relatively unaddressed at this time (McGraw 2004; P. Levine, pers. comm. 2006).

Private development was occurring on a limited scale within the habitat of the species at the time of listing; it is still occurring at the present time most likely at low levels. Thus, recent private development has had only a limited effect on the overall habitat and range of the species (P. Levine, pers. comm. 2006).

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes:

Overutilization was not identified as a factor at the time of listing, and is not known to currently be a factor.

II.C.2.c. Disease or predation:

Disease or predation were not identified as factors at the time of listing, and are not known to currently be factors.

II.C.2.d. Inadequacy of existing regulatory mechanisms:

At the time *Chorizanthe pungens* var. *hartwegiana* was federally listed in 1994, there were no local, State, or Federal regulatory mechanisms in place to protect this species; the species is not listed as threatened or endangered by the State. Populations on State Park and State Reserve lands were the only ones receiving consideration as a sensitive resource, though even here, these entities have not completed specific management plans for the species. Some of the populations on private lands have benefited from the development of HCPs and management plans involving county, and city agencies; however, some of these are still under development, and others have only provided a portion of the necessary protections. The sandhills parkland habitat is protected by the Santa Cruz County Sensitive Habitat Ordinance. Only a few HCPs and management plans discussed in the recovery plan have been implemented so far; therefore, many populations and their fragile habitat on private land have not received protection or conservation. Where the species occurs on private lands, protections afforded by section 7 of the Act are triggered only if there is a Federal nexus (i.e., an action funded, permitted, or carried out by a Federal agency). The Service has participated in the efforts to develop the HCPs mentioned above through section 10 of the Act.

II.C.2.e. Other natural or manmade factors affecting its continued existence:

At the time of listing, fire suppression leading to encroachment by native woody species and non-native annual grasses threatened habitat type conversion.

Research was completed by McGraw (2004) on various habitat management strategies, including the use of prescribed fire and manual clearing and the response of *Chorizanthe pungens* var. *hartwegiana* to these strategies. Several restoration projects have included the removal of woody non-native plants: the Mount Hermon Association and the San Lorenzo Valley Water District removed brooms (*Cytisus* sp. *Genista* sp.) and *Acacia* with private stewardship grants through the Service; the Zayante Fire Department and the Santa Cruz Resource Conservation District removed *Acacia* from Quail Hollow Ranch County Park; and State Parks removed woody vegetation within sandhills habitat at Henry Cowell State Park (J. McGraw, in litt. 2006).

II.D. Synthesis

The primary threat to *Chorizanthe pungens* var. *hartwegiana* at the time of listing was habitat destruction from sand and gravel mining within sandhills parkland habitat. This threat has largely been halted due to scheduled completion of many mining contracts. Unfortunately, a substantial amount of the species' habitat had already been destroyed by mining operations prior to listing, and recovery of the species depends to a great extent on habitat restoration of these private holdings in accordance with HCPs. Some of this restoration work is currently under way and monitoring on many of these sites has begun.

Habitat conversion due to fire suppression was another threat described at the time of listing for this species. Prescribed burns and manual clearing of brush and vegetative litter buildup to keep woody native plants and non-native annual grasses from encroaching on sandhills parkland habitat have been discussed for several areas. Raking of areas to remove litter buildup and non-native herbaceous species on some experimental plots, and manual removal of non-native woody shrubs has been undertaken at several sites with good success (McGraw 2004). These efforts have so far focused on relatively small areas and no plans for large scale operations have been developed.

Human disturbance on private lands due to recreational use and private landscaping continues to be a threat, as well as some limited, small-scale, private land development. Habitat conservation plans are in place for some quarries, HCPs and general area management plans required from State and county parks and city and county offices have yet to be completed, and implementation of conservation efforts have subsequently been limited.

While monitoring has been implemented on a limited scale in quarries with HCPs, virtually no monitoring of populations elsewhere has occurred. Lack of monitoring has led to limited information on current range extents and population trends. Many species occurrences identified by individual conservation entities are not mentioned in the recovery plan or identified in the CNDDB records. These populations are not being afforded adequate consideration for protection.

Because of the ongoing impacts of past and present threats to the species, the lack of monitoring data, and the great deal of additional work needed for recovery, we are not recommending any change to the status of *Chorizanthe pungens* var. *hartwegiana*.

III. RESULTS

A. Recommended Classification:

____ Yes, downlist to Threatened
____ Yes, uplist to Endangered
____ Yes, delist
_X_ No change is needed

B. New Recovery Priority Number

No change is recommended. The recovery number will remain a 9, as discussed above.

C. If applicable, indicate the Listing and Reclassification Priority Number (FWS only):

N/A

Reclassification (from Threatened to Endangered) Priority Number: ____

Reclassification (from Endangered to Threatened) Priority Number: ____

Delisting (Removal from list regardless of current classification) Priority Number: ____

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Coordination of recovery partners and consolidation of occurrence data is critical to get a better overview of the current status of *Chorizanthe pungens* var. *hartwegiana*.

2. Increased Service oversight as time allows, may accelerate completion of the HCP with the County of Santa Cruz and other management plans under development at Big Basin State Park, Henry Cowell Redwoods State Park, Gray Whale Ranch State Park, Quail Hollow Ranch County Park, and Bonny Doon Ecological Reserve. These plans need to be completed before implementation and effective recovery efforts may begin.

3. Surveys and ongoing monitoring should be undertaken to ensure that potential populations are identified and reliable demographic information is collected. These efforts should focus on sandhills habitats identified as population occurrences to clarify whether and where management actions are necessary. In addition, the CNDDB records should be updated with the most current information available. Specifically, the areas listed in McGraw (2004) as West Lompico, Weston Road, Hilton Drive, Sunset Ridge, Marion, and Landfill Heights; Gray Whale Ranch State Park; and Henry Cowell State Park.

4. More detailed knowledge of population occurrences and completion of management plans should allow active management to prevent encroachment of both native and non-native species in fire-suppressed areas which may lead to type conversion of the habitat and potential extirpation of individual populations. Prescribed burns are the most natural way to restore the vegetation thinning needed to restore open habitat, but in many areas proximity of human habitation precludes this as an option. Mechanical means of vegetation and leaf litter removal (i.e., raking) have proven effective in reducing the chances of habitat type conversion and increased germination rates in *Chorizanthe pungens* var. *hartwegiana* seeds (McGraw, 2004). This method may be used in places where fire would create unacceptable risk to local communities.

5. Outreach to owners of private holdings with potentially conservable habitat and populations should be attempted. These parties should be provided with information necessary to facilitate management of habitats on these holdings. These private efforts could prevent habitat type conversion due to encroachment by other species in fire suppressed areas, minimize unnecessary impacts, and could aid in maximizing the conservation potential of all suitable habitat and populations.

6. The second criterion for downlisting in the recovery plan should be reworded. The criterion as currently worded lists specific HCPs by name. Many HCP projects are abandoned for various reasons. Additionally, entities listed on HCPs may change name and ownership over time and even requirements may change. These changes may in turn lead to alterations of the HCP title or content. For these reasons, including specific HCPs in draft form as downlisting or delisting criterion should be avoided. A blanket statement

reflecting the need of the species to be included in any HCP that covers its geographic area would be more appropriate.

V. REFERENCES

Brinegar, C. 2006. Phylogeography of Listed *Chorizanthe* in the Monterey Bay Region: Implications for Conservation and Recovery. A report prepared for the U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. 16 pp.

California Natural Diversity Data Base (CNDDB). 2006. Rarefind: A database application for the California Department of Fish and Game, Natural Heritage Division data, California Natural Diversity Data Base, Sacramento. Records for *Chorizanthe pungens* var. *hartwegiana*.

Kluse, J. 1994. The effects of habitat on the demographic performance of *Chorizanthe pungens* var. *hartwegiana*. Senior thesis, Environmental Studies, University of California, Santa Cruz.

Kluse, J. and D. Doak. 1999. Demographic performance of a rare California endemic, *Chorizanthe pungens* var. *hartwegiana* (Polygonaceae). American Midlands Naturalist 142:244-256.

McGraw, J. 2004. Sandhills conservation and management plan: a strategy for preserving native biodiversity in the Santa Cruz sandhills. Report submitted to the Land Trust of Santa Cruz County, Santa Cruz, California. 310 pp.

U.S. Fish and Wildlife Service (Service). 1998. Recovery Plan for insect and plant taxa from the Santa Cruz Mountains of California. 83 pp.

LETTERS CITED

McGraw, J. 2006. Memorandum to U.S. Fish and Wildlife Service regarding the status of Ben Lomond spineflower. Dated February 20, 2006. 9 pp.

U.S. Fish and Wildlife Service. 2006. Letter to Paul Burrowes, Managing Partner Zayante Sandhills Conservation Bank from Diane K. Noda, Field Supervisor, Ventura Fish and Wildlife Office regarding execution of the Ben Lomond Sandhills Reserve. Dated June 8, 2006. 1 pp.

PERSONAL COMMUNICATIONS

Davilla, Bill. 2006. Telephone conversation. HCP requirements and *Chorizanthe pungens* var. *hartwegiana* status at Geyer, Olympia, Hanson and Quail Hollow quarries. Dated May 17, 2006. Consultant, Ecosystems West.

DeWald, Jeanine. 2006. Telephone conversation. Fuel breaks and reduction along trails, plans for prescribed burns, work on management plan, and *Chorizanthe pungens* var. *hartwegiana* status at Bonny Doon Ecological Reserve. Dated May 25, 2006. Reserve Manager, Bonny Doon Ecological Reserve.

Haley, Valerie. 2006. Telephone conversation. Status of *Chorizanthe pungens* var. *hartwegiana* at Hanson and Olympia quarries and population trend for 2006. Dated May 30, 2006. Consultant, Native Vegetation Network.

Hyland, Tim. 2006. Telephone conversation. Status of *Chorizanthe pungens* var. *hartwegiana* within state parks in Santa Cruz County, status of management plans for the species, plans for prescribed burns within the parks. Dated May 5, 2006. Resource Ecologist, California State Parks.

Levine, Paia. 2006. Telephone conversation. Status of HCP for Santa Cruz County for *Chorizanthe pungens* var. *hartwegiana*, development on unincorporated land holdings, Santa Cruz County Sensitive Habitat Ordinance, sources of habitat disturbance and degradation, and habitat conversion due to fire suppression. Dated May 16, 2006. Environmental Coordinator, County of Santa Cruz Planning Department.

McGraw, Jodi. 2006. Direct conversation. Status of *Chorizanthe pungens* var. *hartwegiana* throughout its range, history of quarry operations in sandhills habitat, fire suppression and effects on sandhills communities. Dated February 27, 2006. Population and Community Ecologist/Consultant.

Schettler, Suzanne. 2006. Telephone conversation. Status of *Chorizanthe pungens* var. *hartwegiana* and its recovery efforts in Olympia and Quail Hollow quarries, habitat conversion and non-native vegetation control efforts in Olympia and Quail Hollow quarries. Dated June 22, 2006. Consultant, Greening and Associates.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Ben Lomond Spineflower (*Chorizanthe pungens* var. *hartwegiana*)

Current Classification: Endangered
Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist**
_X_ **No change is needed**

Appropriate Listing/Reclassification Priority Number, if applicable N/A

Review Conducted By Christopher West

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve _____ Date 7/31/07

REGIONAL OFFICE APPROVAL:

Acting
Regional Director, Fish and Wildlife Service

Approve _____ Date 9/24/07