

# Determination of Available Credits and Service Areas for ESA<sup>1</sup> Vernal Pool Preservation Banks

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**ABSTRACT.** Adverse effects on vernal pool species resulting from development projects should be fully compensated. Mitigation should include preservation of remaining high quality habitats for these species and contribute to the recovery of threatened and endangered species found in these habitats, in a manner consistent with the long-term ecological functioning of these preserves. Preservation banks offer the option of off-site mitigation that can overcome piecemeal mitigation and indefensible avoidance areas for development projects. A system for determining the number of compensation credits available in preservation banks is needed to allow for off-site mitigation. This credit determination method is designed to provide incentive for the preservation of large parcels of high quality habitat, small parcels with several rare species, and parcels with rare vernal pool types (e.g. northern basalt flow vernal pools). A bank's value is determined by the number of endangered, threatened, and other rare vernal pool species occurring on the bank site, the size of the preserve, pool type, and condition and defensibility of the site. The number of credits awarded is determined by multiplying the bank's value by the number of acres of vernal pools on the bank site. The goal is to achieve multi-species/multi-habitat protection while preserving a full spectrum of vernal pool types as mitigation for development projects in California's Central Valley. Service areas for vernal pool preservation banks are based on soil and ecological attributes. Adverse effects on listed vernal pool species can only be mitigated in a bank that supports the species for which mitigation is required.

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## INTRODUCTION

Most remaining vernal pools in California are privately owned and not protected from development. Habitat for vernal pool organisms addressed in this paper is considered to be vernal pools, swales, and other seasonal wetlands that support these species and the upland areas associated with these wetlands. Vegetation types where vernal pools occur within California's Central Valley include valley and foothill grasslands, savannas, oak woodlands, and other areas where vernal pools, playas, or other seasonal wetlands that support vernal pool species occur. Continued urban growth and agricultural conversions in the Central Valley are threatening much of this remaining habitat. Adverse effects on vernal pools resulting from development projects should be fully compensated. Mitigation should include preservation of remaining high quality habitats and should contribute to the recovery of threatened and endangered species found in these habitats, in a manner consistent with the long-term ecological functioning of these preserves. Mitigation banking is one method for preserving large parcels of high quality habitat and for ensuring long-term protection for these preserves.

Mitigation banks have been recognized as a way to set aside large preserves while avoiding piecemeal mitigation and indefensible avoidance areas that often result in numerous small

preserves (DOD et al., 1995). Many such preserves will not be successful over the long term due to their small size and isolation, lack of buffers from adjacent land uses, and/or the lack of adequate plans and funds for their management. Mitigation banks can also facilitate the permit process for project applicants by saving them the time and effort required to locate and acquire an acceptable off-site preserve and provide for the long-term management of that preserve.

To allow for off-site mitigation, a system for determining the number of credits available in these mitigation banks is needed (Environmental Law Institute, 1993). The Sacramento Fish and Wildlife Office of the U.S. Fish and Wildlife Service (Service) has issued an "Interim Method for Determining the Number of Available Credits and Service Areas for Vernal Pool ESA Preservation Banks in the California Central Valley" (USFWS, 1996b). This credit method is now in use and is the subject of this paper. Determination of service areas for these preservation banks is also discussed.

## BACKGROUND

Four species of vernal pool crustaceans were listed as federally threatened or endangered on September 19, 1994 (USFWS, 1994a). These four species, *Branchinecta lynchi*, *B. conservatio*,

<sup>1</sup> Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)

*B. longiantenna*, and *Lepidurus packardi*, are endemic to the Central Valley of California. In addition to these crustacean species, a number of rare vernal pool plant species also occur within the Central Valley. *Limnanthes floccosa* ssp. *californica* was listed as endangered on June 8, 1992 (USFWS, 1992). *Orcuttia pilosa*, *O. viscida*, *Tuctoria greenei* were listed as endangered and *Castilleja campestris* ssp. *succulenta*, *Chamaesyce hooveri*, *Neostapfia colusana*, *O. inaequalis*, and *O. tenuis* were listed as threatened on March 26, 1997 (USFWS, 1997a). Four other plant species (*Lasthenia conjugens*, *Navarretia leucocephala* ssp. *pauciflora*, *Navarretia leucocephala* ssp. *plieantha*, *Parvisedum leiocarpum*) that occur in vernal pools and mesic areas in Northern California were listed on June 18, 1997 (USFWS, 1997b). Other non-listed, rare vernal pool species occur within the Central Valley and other areas of California. These are identified as Species of Concern by the Service and by various other designations by the state and the California Native Plant Society.

The Service is responsible for the protection of federally listed species. Pending a recovery plan for these listed vernal pool species, as well as a number of other listed, proposed, and candidate vernal pool species, it was determined that a combination of preservation of remaining high quality vernal pool habitat and creation (i.e., restoration, enhancement, and/or creation) of vernal pools is needed to protect the listed crustacean species. The creation component of mitigation satisfies national, regional, and local no-net-loss of wetlands policies and may be a necessary part of the recovery process for some species. The Service issued a "Programmatic Formal Endangered Species Act Consultation on Issuance of 404 Permits for Projects with Relatively Small Effects on Listed Vernal Pool Crustaceans Within the Jurisdiction of the Sacramento Field Office, California" (Programmatic Consultation) (USFWS, 1996a). The Programmatic Consultation specifies mitigation ratios for preservation and creation credits to be dedicated in Service-approved mitigation banks, or acres of habitat to be preserved and created outside of mitigation banks (either on-site or off-site) to mitigate for adverse effects on these listed vernal pool crustacean species. Under the Programmatic Consultation, less mitigation is usually required of project applicants willing to mitigate at a Service-approved bank, rather than at a non-bank site. The Programmatic Consultation facilitates the permit process for small impact projects (generally those projects that affect less than one acre of vernal pools) that cannot avoid habitat for the listed vernal pool crustaceans and must mitigate for adverse effects on these species. The credit determination method described in this paper is designed to work with the Programmatic Consultation, but it can also be used for projects that are unable to be appended to the Programmatic Consultation if off-site mitigation is appropriate.

## METHODS

The Service initially worked with three other agencies on the Mitigation Banking Review Team, an interagency team consisting of several federal agencies and the California Department of Fish and Game (CDFG), on a credit determination method. When a joint method for crediting both creation and preservation banks was determined to be unattainable within the time frame allowed, the Corps and the EPA removed themselves from the working group, and only participated in the review process. The Service continued to work with CDFG to produce a credit method for vernal pool preservation banks. Methods for crediting wetlands creation banks, including vernal pool creation, already exist.

The Service compiled a mailing list of interested parties including landowners, prospective bank managers, consultants, biologists and other scientists, and other agency personnel. A copy of the draft credit determination method was sent to those on the mailing list along with an invitation to a facilitated workshop. Written comments were requested by the Service at this time. The workshop was held on December 13, 1995. Comments received at the workshop were recorded and distributed by mail to all workshop participants and to any other interested persons. The written comment period was extended to January 26, 1996. All comments received were reviewed. The credit method (USFWS, 1996b) was revised and issued on May 28, 1996. The Service held another facilitated workshop on June 26, 1996, to discuss the method and answer questions.

## RESULTS AND DISCUSSION

### *Determination of Available Credits*

The credit determination method is shown in Table 1. This method is designed to provide incentives for the preservation of large parcels of high quality vernal pool habitat, smaller parcels with several rare species, and parcels with rare vernal pool types (e.g., northern basalt flow vernal pools). A bank's value is determined by adding the points received for each of six categories: (1) preserve size, (2) vernal pool type, (3) the number of endangered, threatened, and other rare vernal pool species occurring on the bank site, (4) the number of rare species of particular concern (defined below) occurring on the bank site, (5) condition of the site, and (6) defensibility of the site; and then dividing that point total by the number of categories (six). This number, the bank value, will usually be a number between 1.000 and 2.000. The number of credits awarded is determined by multiplying the bank's value by the number of acres of vernal pools on the bank site.

A maximum of 2.000 points is available for 3 of the six categories. In general, point values were chosen such that most proposed banks will not receive a bank value greater than 2.000

TABLE 1. The method below is used to determine the number of credits available in vernal pool preservation banks. Points are assigned for the six categories shown. The bank value is an average of the total points (i.e., total number of points divided by the number of categories). The number of credits assigned to the bank is determined by multiplying the bank value by the number of acres of vernal pools and other seasonal wetlands that occur on the bank site that support vernal pool species.

VERNAL POOL PRESERVATION BANK CREDIT DETERMINATION METHOD		
CRITERIA CATEGORY	VALUE	POINTS
1) Preserve Size	0 → 1000+ acres	0 → 2+
2) Vernal Pool Type*	add up to 2.00 points for rare types	0 → 2
3) Number of Federal/state listed, proposed listed, and candidate vernal pool species considered rare or endangered under CEQA	add up to 1.00 point for each species	0 → <i>n</i>
4) Rare Species of Particular Concern (see Table 3)*	add up to 1.00 point for each species	0 → <i>n</i>
5) Condition of the Site*	4 subcategories	0 → 2
6) Defensibility of the Site*	3 subcategories	0 → 2
Total Points = _____		
Bank Value = Total Points ÷ 6 (number of categories above).		
Total Bank Credits = Bank Value ÷ number of acres of vernal pools on the bank site.		
*See text for explanation.		

(i.e., total points less than 12.000). The bank value is relative to the impact sites for projects that will be mitigated at the bank, and assumes the impact sites have a value of 1.000. Banks should be valued at greater than 1.000 because proposed banks are expected to be sites with the best remaining vernal pool habitats. It is assumed that, acre for acre, the bank is worth more than the areas of effected vernal pools that will be lost. Valuing banks at greater than 2.000, however, would result in less than 50 percent of the remaining vernal pools being preserved based on the current methods for assessing impacts and determining adequate mitigation.

The criteria, six categories shown in Table 1, on which bank sites are evaluated, are discussed below. An example of the results of an evaluation of a hypothetical bank is provided in Table 2.

*1. Preserve Size.* Although in some cases a large number of small preserves may have greater conservation value, larger pre-

serves are likely to be more effective in preserving vernal pool ecosystems. Large preserves are more likely to exhibit a greater diversity of vernal pools (more variation in pool size, depth, and duration of inundation), which influences the number of species a site can support (Jones & Stokes Associates, 1990).

Large preserves may also include other habitats that will add to the potential sustainability of the site. Riparian, grassland, savanna, oak woodland, and other adjacent habitats will increase the likelihood of preserving some vernal pool biota. Vernal pool fauna that requires adjacent non-vernal pool habitat during part of their life cycle (e.g., California Tiger Salamanders, Western Spadefoot Toads) (Ruibal et al., 1969, Zedler, 1987) generally require large preserves. Interactions among species (e.g., obligate vernal pool plants and their pollinators) will also be enhanced by preserving large parcels that include substantial upland habitat (Thorpe and Leong, 1995). Large preserves which include other adjacent habitats are more likely to support and attract non-vernal pool fauna (e.g., waterfowl, raptors, mammals) that may feed and rest at vernal pools, benefiting the vernal pool ecosystem through nutrient cycling and control of non-native plants (Zedler, 1987).

Small preserves, however, may be of great value in preserving certain species of rare plants (Reznicek, 1987). Some rare obligate vernal pool plants are found in areas where the opportunity to set aside a large preserves has been lost. Some of these species/populations may be able to persist in a limited amount of space and could survive on a small preserve with appropriate management. Small preserves, particularly in urban settings, are also valuable tools for educating the public on the importance of preserving vernal pools and the unique organisms that occupy this habitat.

Points are assigned along a continuum for preserve size, with every 500 acres awarded 1.000 point. Because the credit method is designed to award preserves a maximum bank value of 2.000 in most categories, the point value for preserve size is presented as 0 to 2 points for 0 to 1000 acres, respectively. The plus (+) sign after the 2 under the "points" column in Table 1 indicates that preserves in excess of 1000 acres will be awarded greater than 2.000 points along this scale. For example, a 400-acre preserve would be awarded 0.800 point (400 acres ÷ 2.000 points per 1000 acres = 0.800 point), a 640-acre preserve would be awarded 1.280 points (640 acres ÷ 2.000 points per 1000 acres = 1.280 points), and a 1200-acre preserve would be awarded 2.400 points (1200 acres ÷ 2.000 points per 1000 acres = 2.400 points). The target amount of 1000 acres was chosen because large expanses of privately owned land still exist within the Central Valley, and it is still possible to get a 1000-acre preserve. This scale can be adapted for other vernal pool regions where remaining parcels of vernal pool habitat are smaller by lowering the value from 1000 acres to a size more appropriate for that area.

DETERMINATION OF AVAILABLE CREDITS AND SERVICE AREAS FOR ESA VERNAL POOL PRESERVATION BANKS

TABLE 2. This example is a hypothetical proposed bank used to illustrate the vernal pool preservation bank credit determination method. Points are assigned for the six categories shown. The bank value is an average of the total points (i.e., total number of points divided by the number of categories). The number of credits assigned to the bank is determined by multiplying the bank value by the number of acres of vernal pools and other seasonal wetlands that occur on the bank site that support vernal pool species.

EXAMPLE. The proposed bank is 600 acres with 40,000 acres of northern hardpan vernal pools (not considered a rare pool type as defined in criteria category 2) and an additional 10,000 acres of vernal pools lying on the Riverbank Formation (a rare type as defined in criteria category 2). The site has documented occurrences of *Branchinecta lynchi* (FT), *Lepidurus packardii* (FE), *Orcuttia viscida* (FPE, CE), and *Legenere limosa* (CEQA). Occurrences of these special status species are typical in abundance and distribution. Prior and current land use was/is primarily limited to grazing. Some dry wheat farming occurred on a portion of the property about a decade ago. The site is located adjacent to an existing 400-acre preserve. Other surrounding land use is currently agricultural, but these areas have been recently zoned for residential use. Service and California Department of Fish and Game biologists knowledgeable on the vernal pool ecosystem have determined that the condition of the site (criteria category 5) rates 1.600 points and the defensibility of the site (criteria category 6) rates 1.725 points.

CRITERIA CATEGORY	POINTS
1) Preserve Size (600 acres)	1.200
2) Vernal Pool Type (20 percent of pools on Riverbank Formation)	0.400
3) Listed, Proposed, Candidate, Rare, CEQA Species (4)	4.000
4) Rare Species of Particular Concern ( <i>Orcuttia viscida</i> )	1.000
5) Condition of the Site	
Native Species Diversity and Richness (max. poss. 0.8 pts.)	0.750
Habitat Diversity (max. poss. 0.6 pts.)	0.350
Degree of Physical Disturbance (max. poss. 0.4 pts.)	0.350
Degree of Exotic Infestation (max. poss. 0.2 pts.)	0.150
6) Defensibility of the Site	
Adjacent Land Uses (max. poss. 0.8 pts.)	0.600
Watershed Integrity and Defensibility (max. poss. 0.8 pts.)	0.800
Edge Effects (max. poss. 0.4 pts.)	<u>0.325</u>
TOTAL POINTS = 9.925	
BANK VALUE = 9.925 ÷ 6 = 1.654	
TOTAL CREDITS = 1.654 ÷ 50,000 acres of vernal pools = 82.700	

Key to abbreviations: CE = State endangered, CEQA = considered rare or endangered as defined in the CEQA Guidelines, FE = Federal endangered, FPE = Federal proposed endangered, FT = Federal threatened

2. *Vernal Pool Type*. In this credit determination method, rare pool types are awarded additional points to encourage protection of these remaining habitats. Vernal pool types are considered rare based on: (1) their historic distribution, (2) the extent and trends of conversion, and (3) present and likely future threats to these pool types. Through the public comment process, the following vernal pool types were identified as rare for the purpose of assessing preservation bank credits within the Central Valley and adjacent foothills: (1) northern claypan vernal pools within Sacramento and San Joaquin counties, (2) volcanic mudflow vernal pools within Placer and Sacramento counties, (3) northern basalt flow vernal pools, and (4) vernal pools occurring on the Riverbank Formation (young terrace pools). Definitions and distributions of these pool types are identified in

Holland (1986), Sawyer and Keeler-Wolf (1995), or Keeler-Wolf et al. (1995). Other vernal pool types may also be considered rare under certain circumstances and will be awarded points under this category at the Service’s discretion.

A total of 2,000 points are available for this category. Points will be awarded based on the percentage of vernal pool acreage occurring on the bank site that is rare as listed above. For example, a proposed bank site in Placer County with 40 acres of vernal pools, 10 acres of which are volcanic mudflow vernal pools (a rare type as listed above), would receive 0.500 points (10 acres ÷ 40 acres × 2,000 points = 0.500 points).

3. *Number of Listed, Proposed, and Candidate Species.* One point will be awarded for each federally listed, proposed, and candidate vernal pool species that occurs on the bank site. One point will be awarded for each state listed, proposed, rare, and candidate vernal pool species that occurs on the bank site. Only one point is available for each species in cases where a species is both federally and state listed. A point will also be awarded for each vernal pool species that does not fall under the above categories (protected by the Federal Endangered Species Act or the California Endangered Species Act), but which meets the criteria in subsection (b) of the California Environmental Quality Act (CEQA) Guidelines, section 15380 (1986) for rare or endangered species. Species, as used here, means a species or subspecies of animal or plant or a variety of plant.

Documented occurrences of these species, their distribution, and an estimate of their abundance on the bank site are required. A full point can only be awarded if a species' abundance and distribution on the bank site are considered average or typical. Only partial credit (less than 1.000 point per species) will be awarded for a species if its abundance is low and/or its distribution is poor on the bank site. Bank sites will need to be periodically surveyed to ascertain that the species continue to occur on the site and to check for appreciable changes in their abundance and/or distribution on the site. A management plan that involves monitoring for these species and allows for flexibility in management methods based on monitoring results is recommended.

4. *Rare Species of Particular Concern.* Some endangered, threatened, or rare vernal pool species are: (1) known from only one or a very few populations or occurrences, (2) are reduced to only a few disjunct populations, (3) have numbers/populations that continue to decline significantly, or (4) are otherwise extremely vulnerable to extinction. As an incentive to protect such species, an additional point will be awarded for each of the species listed in Table 3 that occur on the bank site.

Documented occurrences of these species, their distribution, and an estimate of their abundance on the bank site are required. A full point can only be awarded if a species' abundance and distribution on the bank site are considered average or typical. Only partial credit (less than 1.000 point per species) will be awarded for a species if its abundance is low and/or its distribution is poor on the bank site. Bank sites will need to be periodically surveyed to ascertain that the species continue to occur on the site and to check for appreciable changes in their abundance and/or distribution on the site. A management plan that involves monitoring of these species and allows for flexibility in management methods based on monitoring results is recommended.

5. *Condition of the Site.* This category addresses habitat quality. Bank sites will be evaluated "as-is." If a site could be im-

TABLE 3. The species included in this list are considered rare species of particular concern, a category within the credit determination method for vernal pool preservation banks. Banks will be awarded an additional point for each species listed below that occurs on the bank site.

SCIENTIFIC NAME	COMMON NAME
<u>Animals</u>	
<i>Ambystoma californiense</i>	California tiger salamander
<i>Branchinecta conservatio</i>	Conservancy fairy shrimp
<i>Branchinecta longiantenna</i>	longhorn fairy shrimp
<i>Elaphrus viridis</i>	delta green ground beetle
<i>Scaphiopus hammondi</i>	western spadefoot toad
<u>Plants</u>	
<i>Astragalus lentiginosus</i> var. <i>piscinensis</i>	Fish Slough milk-vetch
<i>Astragalus tener</i> var. <i>tener</i>	alkali milk-vetch
<i>Atriplex minuscula</i>	lesser saltscale
<i>Blennosperma bakeri</i>	Sonoma sunshine
<i>Eryngium constancei</i>	Loch Lomond button-celery
<i>Juncus leiostermus</i> var. <i>ahartii</i>	Ahart's dwarf rush
<i>Lasthenia burkei</i>	Burke's goldfields
<i>Lasthenia conjugens</i>	Contra Costa goldfields
<i>Limnanthes bakeri</i>	Baker's meadowfoam
<i>Limnanthes floccosa</i> ssp. <i>californica</i>	Butte County meadowfoam
<i>Limnanthes vinculans</i>	Sebastopol meadowfoam
<i>Montia howellii</i>	Howell's montia
<i>Navarretia leucocephala</i> ssp. <i>pauciflora</i>	few-flowered navarretia
<i>Navarretia leucocephala</i> ssp. <i>plieantha</i>	many-flowered navarretia
<i>Navarretia myersii</i>	pincushion navarretia
<i>Nitrophila mohavensis</i>	Amargosa nitrophila
<i>Orcuttia inaequalis</i>	San Joaquin Valley Orcutt grass
<i>Orcuttia pilosa</i>	hairy Orcutt grass
<i>Orcuttia viscida</i>	Sacramento Orcutt grass
<i>Paronychia ahartii</i>	Ahart's paronychia
<i>Parvisedum leiocarpum</i>	Lake County stonecrop
<i>Plagiobothrys hystriculus</i>	bearded popcorn-flower
<i>Plagiobothrys strictus</i>	Calistoga popcorn-flower
<i>Pleuropogon hooverianus</i>	north coast semaphore grass
<i>Polygonum polygaloides</i> ssp. <i>esotericum</i>	Modoc County knotweed
<i>Trichocoronis wrightii</i> var. <i>wrightii</i>	Wright's trichocoronis
<i>Tuctoria mucronata</i>	Solano grass
<i>Tuctoria greenei</i>	Greene's tuctoria

proved by a couple of years of careful management, it may benefit the bank applicant to wait until conditions have improved in order to receive a higher point total for this category and

therefore a higher bank value. Bank sites are not scored relative to a particular reference site or an ideal site that does not exist. A team of agency biologists and others familiar with vernal pools in the area will score the site based on their best professional judgement. Sites are scored relative to the best site that could reasonably be assumed to exist in this area at the time of the evaluation. This “best site” tends to be a composite of the existing sites in this area for which each team member is knowledgeable. Each team member scores the site for each of the four subcategories described below. Team members scores are averaged for each subcategory. Averaged subcategory scores are added to get the total points for this category. A total of 2.000 points are available for this category. It is divided into the following four subcategories.

*a. Native Species Diversity and Richness.* A total of 0.800 point is available for this subcategory. The diversity and richness of native vernal pool plant and animal species, as well as native upland species, occurring on the site will be considered.

*b. Habitat Diversity.* A total of 0.600 point is available for this subcategory. The inclusion of other habitats, particularly other types of seasonal and perennial wetlands, contiguous (on-site or protected adjacent areas) with the vernal pool habitat will be considered. Is sufficient upland habitat included to support native pollinator populations? If the bank includes Western Spadefoot Toad and/or California Tiger Salamander, is the amount of upland habitat sufficient to support these species?

*c. Degree of Physical Disturbance.* A total of 0.400 point is available for this subcategory. Disturbance to soil or morphology of pools (i.e., damage from off-road vehicle use, cultivation, overgrazing, etc.) will be considered. Sites that are in good condition and lack physical disturbance are preferred. Highly disturbed sites which would benefit significantly if restored may be better candidates for vernal pool creation banks rather than preservation banks.

*d. Degree of Exotic Species Infestations.* A total of 0.200 point is available for this subcategory. The degree of infestation of pools and associated upland habitat by exotic species will be considered. Sites that are in good condition and have a minimum of exotic species will score high.

*6. Defensibility of the Site.* This category addresses the long-term sustainability of the site. It is assumed that an adequate management and maintenance plan, monitoring plan and reporting protocols, a contingency plan, etc. are already addressed in the mitigation banking instrument. This category is scored, as described above for Category 5, based on the best professional judgement of evaluation team members. A total of 2.000 points are available for this category. It is divided into three subcategories.

*a. Adjacent Land Uses.* A total of 0.800 point is available for this subcategory. Are adjacent land uses compatible with the bank site (e.g., grazing or other preserves)? If adjacent land use is urban are mechanisms in place to protect the bank site from unseasonal and contaminated run-off, off-road vehicle use, trespassing, domestic animals, and other potential impacts from the developed areas? If adjacent land use is agricultural, developed recreational (e.g., golf course, ball field, etc.), or landscaped, are mechanisms in place to protect the bank site from irrigation runoff, pesticide/herbicide drift and runoff, crop weeds, and other potential impacts from the developed areas? Will the site be subject to overland flooding from nearby streams that may allow the periodic introduction of predators such as fish and crayfish as a result of future development in the area? An adequate buffer should be ensured as part of the mitigation banking instrument.

*b. Watershed Integrity and Defensibility.* A total of 0.800 point is available for this subcategory. Will the integrity and defensibility of the microtopographic watershed (area required to maintain the natural pool hydrology, i.e., the frequency and duration of ponding and soil saturation) be preserved? Consider the area needed to supply sufficient overland runoff and ensure that perched water tables are maintained at natural levels. Does the preserve design result in a truncated watershed? An adequate buffer should be ensured as part of the mitigation banking instrument.

*c. Edge Effects.* A total of 0.400 point is available for this subcategory. Edge is the perimeter of the preserve. Edge effects are the result of affects exerted on preserves by adjacent parcels, where the adjacent parcels consist of developed or more degraded habitat than the preserve parcel. Minimal edge, a low ratio of preserve perimeter to area, is desired. Preserve shapes which approach a circle or square have minimal edge for a given area.

Banks may be approved before all surveys for endangered, threatened, and other rare species are completed. Adjustments to the number of credits available to the bank, however, will only be made during a limited time, which will be determined by the Service at the time the bank is approved. Although banks may be awarded additional credits for newly recorded species, the Service recommends that all necessary surveys be conducted prior to final approval. Although additional credits will not be available after the determined time period, use of a bank will be expanded to include any listed, proposed, or candidate species that are found to occur on a bank site after the credit determination is finalized.

Additional credit may be available for other resource conservation needs, such as federally or state listed non-vernal pool species (e.g., Valley Elderberry Longhorn Beetle, Giant Garter Snake, Swainson’s Hawk) that occur on the bank site. Agencies

responsible for determining the appropriate mitigation for these species will determine the number of credits/acres available in the bank for these species. These credits will be in addition to the vernal pool preservation credits determined by this method and will be accounted for separately. With prior Service approval, a limited amount of creation (restoration, enhancement, and/or creation) may be permitted in preservation banks for §404 (Clean Water Act) mitigation credits. In such cases, vernal pool and other wetland creation credits will be accounted for separately from vernal pool preservation credits. Creation activities that may adversely affect existing vernal pool habitat on a bank site will not be permitted.

Banks may be divided into subareas and phased. Each subarea in a phased bank must be permanently protected through fee title or conservation easement and must be self-sustaining or part of a larger conservation strategy that has a reasonable expectation of being accomplished.

#### *Determination of Service Areas*

Service areas for vernal pool preservation banks are based on soil and ecological attributes. Boundaries for a bank's service area will be identified in the banking agreement. Service areas for banks that occur in the same region may overlap. Project applicants will be given the option of mitigating at any bank that has a service area that encompasses the project impact area. However, adverse effects on listed species can only be mitigated in a bank that supports the species for which mitigation is required. For example, if the project affects Vernal Pool Tadpole Shrimp (*Lepidurus packardii*), the project applicant will need to purchase credits in a bank with Vernal Pool Tadpole Shrimp.

Preservation banks that are part of a Habitat Conservation Plan (HCP) may use an alternate method to determine service areas. Service areas for preservation banks outside HCP boundaries may be affected by provisions of these HCPs.

#### CONCLUDING REMARKS

This method for determining the number of credits available in vernal pool preservation banks is currently in use by the U.S. Fish and Wildlife Service's Sacramento Fish and Wildlife Office. These preservation banks are for the mitigation of projects that adversely affect federally listed, proposed, and candidate vernal pool species. Mitigation for adverse effects on state listed and candidate vernal pool species and vernal pool species defined as rare under CEQA can also be mitigated at these banks with approval from the appropriate state agencies. The method will be applied to vernal pool mitigation banks in the Sacramento and San Joaquin valley regions, including the Solano and Livermore regions. It may be possible to modify this method for use in the Modoc Plateau, Sierra Valley, Mendocino, Lake-

Napa, Santa Rosa, Central Coast, and Carrizo regions. This method will be revised as needed. Also, this method may be incorporated with §404 of the Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act) guidelines for the assessment of §404 mitigation bank credits for vernal pools, when such guidelines are developed. Vernal pool mitigation bank applicants should also refer to the Federal Guidance for the Establishment, Use and Operation of Mitigation Banks (DOD et al., 1995), and the State of California's Official Policy on Conservation Banks, dated April 7, 1995.

#### LITERATURE CITED

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