3.0 RESULTS

The following section describes the results of the model verification and the various model analyses conducted to estimate both the impact from the Phase II landfill expansion and the value of the proposed mitigation after the expansion has occurred.

3.1 MODEL VERIFICATION

Using ArcGIS, we calculated the impact of the Phase II landfill expansion employing the method and equations provided by Shaffer and Searcy (Airola et al., 2007). The pre- and post- project habitat value of the lands within the project area is shown in Table D.

Table D: PHLF Calculated Value of Impacted Land by Pond Using Shaffer and Searcy's Model.

Pond #	(A) Pre-Project Value	(B) Post-Project Value	(B-A) Net Project Impact to Onsite Ponds
Pond 1	1,655.52	0.00	-1,655.52
Pond 2	1,948.12	1,511.42	-436.70
Pond 3	1,947.49	1,198.85	-748.63
Pond 4	1,806.40	0.00	-1,806.40
Pond 5	2,010.58	1,692.54	-318.04
Pond 7	2,035.03	1,990.87	-44.16
Total	**11,403.14**	**6,393.68**	**-5,009.46**

The overall value calculated for the impact to CTS habitat by us (-5,009.46) is about 7.1 percent greater than the value calculated by Shaffer and Searcy (-5,394.271). The calculated value derived from the ArcGIS analysis shows a slightly more positive value (i.e. a lower impact value) than the Shaffer and Searcy results, but for purposes of verifying the model results we do not believe this difference is significant. This difference is also due to changes in the impact area. On a pond-by-pond basis, the percent deviation from the Shaffer and Searcy calculations ranged from about 0.2 to 42 percent. In both the Shaffer and Searcy calculations and our calculations, the loss of Ponds 1 and 4 had a significant effect on the value of the habitat remaining to CTS. Figure 2 graphically shows the habitat value of lands around ponds on the parcels owned by Potrero Hills Landfill prior to project development (Column A total in

Table D, above). Figure 3 shows the post-project habitat value of lands around ponds on parcels owned by Potrero Hills Landfill (Column B total in Table D, above).

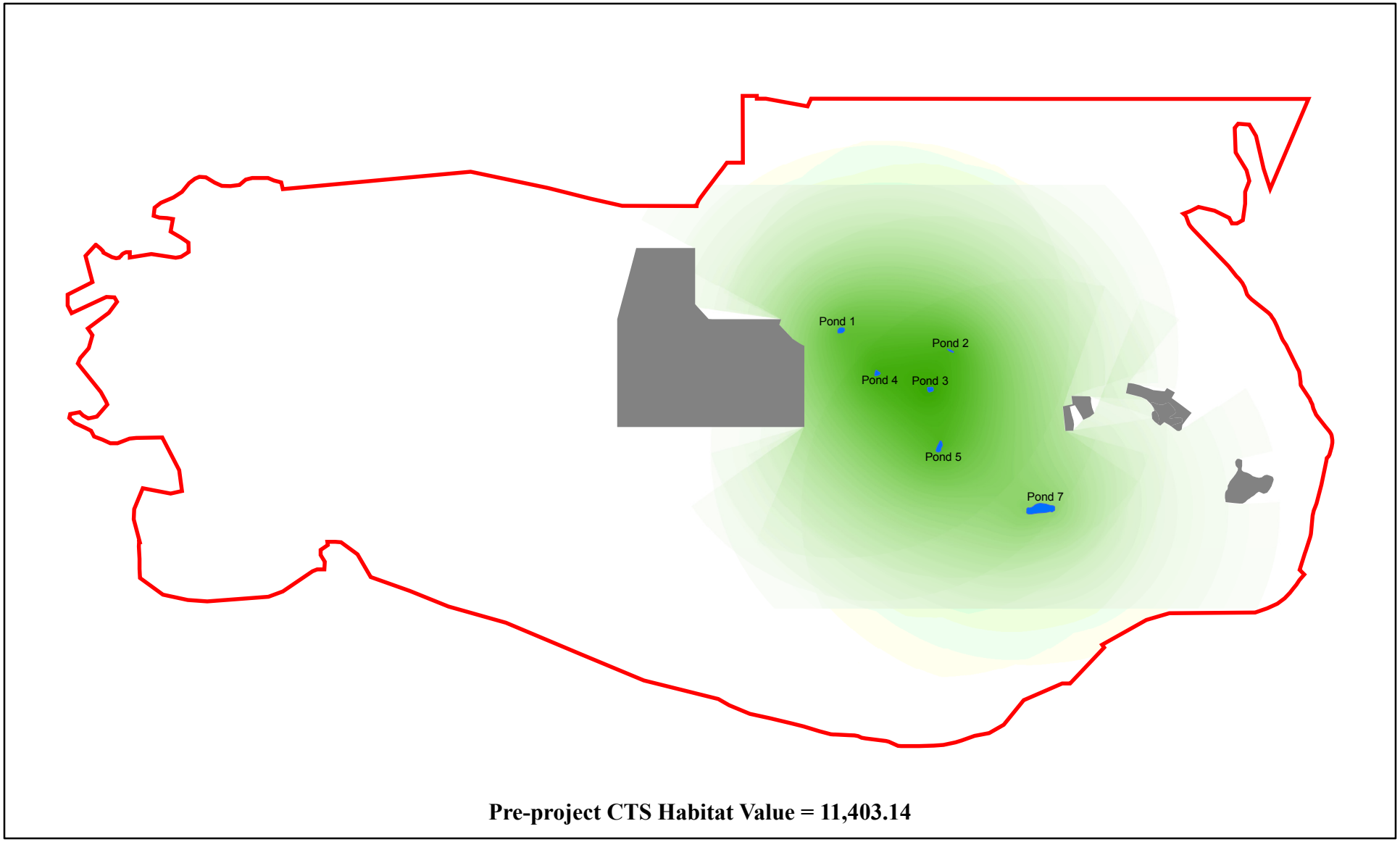
Calculation of the value of the proposed mitigation lands is also in good agreement between the two analyses. We calculated the value of the mitigation parcels as 1,730.33 credits, while Shaffer and Searcy's calculation was 1,732.49 credits, a difference of about 0.1 percent. Subtracting these credits from the overall impact results in a deficit of 3,279.13 for the PHLF calculation and a deficit of 3,661.78 under the Shaffer and Searcy model. Our calculation is about 10.4 percent less than the Shaffer and Searcy calculation and results in a slightly greater deficit remaining after mitigation for the Shaffer and Searcy calculation than our analysis. Under both analyses, however, the preservation of lands and breeding ponds on the adjacent parcels reduces the overall impact to tiger salamander habitat, but does not fully compensate for the impact. Table E shows the mitigation credits and overall remaining deficit of the project as calculated by LSA and ESP (i.e., PHLF) and Shaffer and Searcy.

Table E: Summary of Mitigation Credits and Project Impacts as Calculated by Shaffer and Searcy and PHLF for the Mitigation Proposed in the Original MMP (LSA and ESP 2006).

	Shaffer and Searcy Calculations	PHLF Calculations
Mitigation Credits	1,732.49	1,730.33
Project Impact	-5,394.27	-5,009.46
Remaining Deficit	**-3,661.78**	**-3,279.13**

In terms of the remaining deficit between the project impacts and mitigation credits, our calculations result in a deficit that is about 10.4 percent less than what Shaffer and Searcy calculate. Although we are unable to attribute this difference in calculation of mitigation value precisely, this difference may have its basis in the methods used by each team to calculate the model results or slight differences in the project area. Our calculations used the latest project footprint which is 167.63 acres. Shaffer and Searcy used a 193.8-acre project area. By using the reduced project footprint as currently proposed by the landfill and as presented to BCDC in the revised project description (Potrero Hills Landfill., 2007), the impact of the project is expected to be less.

Although there is a difference in the calculated values of the mitigation lands, both calculations still result in a deficit using the model. Given the relatively small overall difference between the results of the two models and given that neither team had access to the other's complete methodology, we believe that our method closely approximates the original Shaffer and Searcy method of calculating the model and can be used to further investigate assumptions of the model.



Pre-project CTS Habitat Value = 11,403.14

Onsite Ponds

Existing Development

CTS Mitigation Analysis Area

High : 16.51

CTS Habitat Value

Low : 0.00

N

0 1,500 3,000

FEET

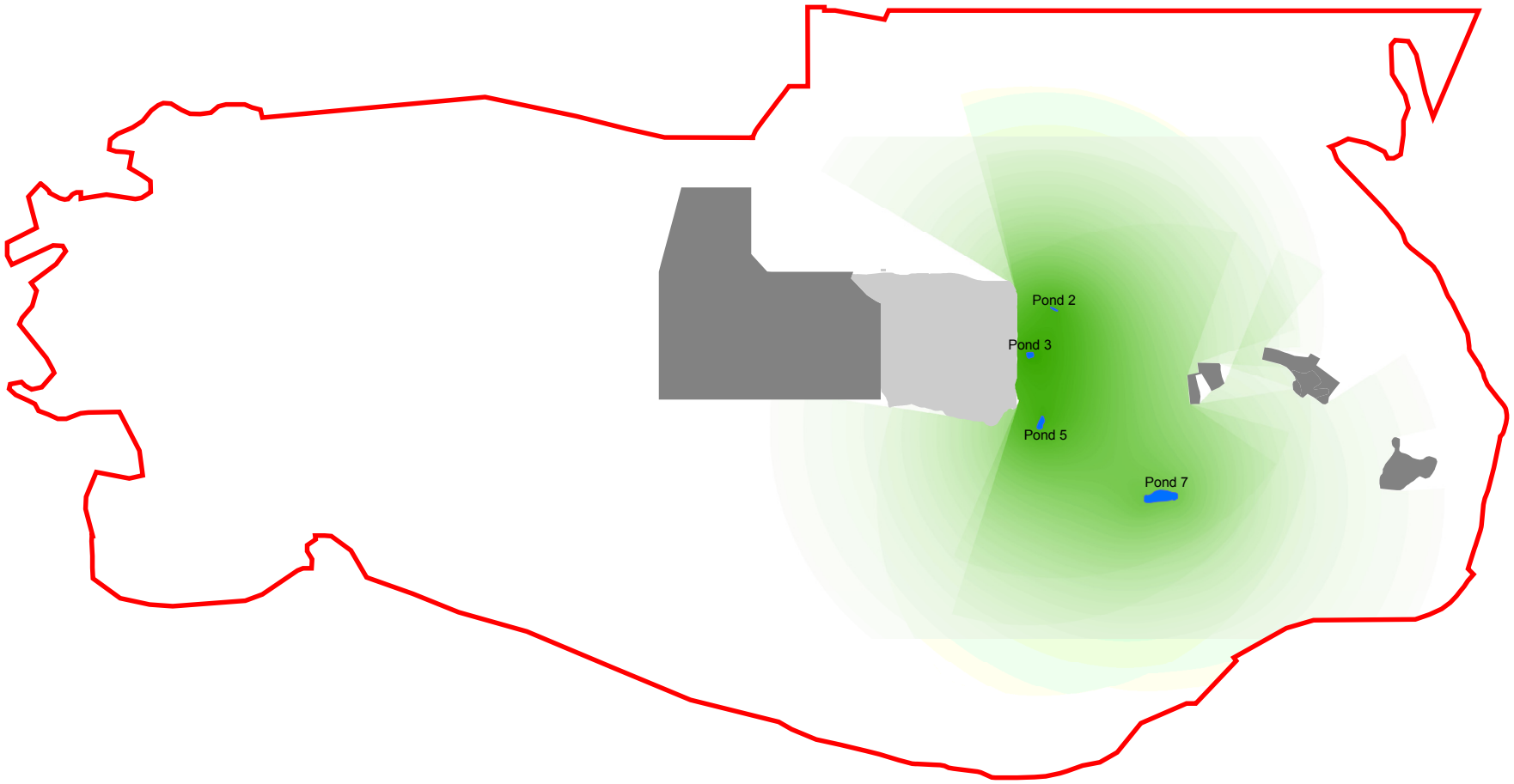
FIGURE 2

Potrero Hills Landfill
Phase II Expansion

Pre-project Habitat Value

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure2_Pre-Project Habitat Value.mxd (11/05/2007)

This page left blank.



Post-project CTS Habitat Value = 6,393.68

FIGURE 3

Potrero Hills Landfill
Phase II Expansion

Post-project Habitat Value

Onsite Ponds
Existing Development
Proposed Phase II Impact Area
CTS Mitigation Analysis Area

High : 12.37
CTS Habitat Value
Low : 0.00

N

0 1,500 3,000
FEET

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure3_Post-Project Habitat Value.mxd (11/05/2007)

This page left blank.

A direct comparison between the values calculated by Shaffer and Searcy and those calculated by PHLF are shown in Table F. Figure 4 graphically shows the post-project mitigation credits on the mitigation lands as calculated by PHLF using the Shaffer and Searcy model.

3.2 MODIFICATIONS TO THE MODEL ASSUMPTIONS

3.2.1 Inclusion of the Eastern Valley (Modification of Assumption 5)

Shaffer and Searcy included in their analysis an alternative that would include the Eastern Valley as part of the mitigation lands for the Phase II landfill expansion. PHLF has not included this area in their mitigation proposal, but will continue the current land use (grazing) on this parcel. The Eastern Valley currently provides both upland habitat and breeding habitat (Ponds 2 and 3) for CTS.

Applying the Shaffer and Searcy model to a mitigation plan that includes the Eastern Valley, Shaffer and Searcy calculate that 4,103.95 mitigation credits could be gained. This gain, compared to the original mitigation plan, comes from preserving breeding ponds 2, 3, 5, and 7 and the upland habitat around those pools that would be preserved in the Eastern Valley and on other mitigation parcels. Including the Eastern Valley parcel in the mitigation proposal, the mitigation deficit as calculated by Shaffer and Searcy is reduced from 3,661.78 to 1,290.32, a reduction of about 65 percent. Our calculations of the overall benefit of including the Eastern Valley reduce the deficit to CTS habitat from 3,279.13 to 1,496.75, a reduction of about 54 percent but 16 percent greater than the value calculated by Shaffer and Searcy. In this case, our calculations would value the mitigation lands less than Shaffer and Searcy. Table G summarizes the incremental benefit of including the Eastern Valley under the two analyses (See Table F for summary values in format from Chapter 4, Airola et al., 2007).

Table G: Summary of Mitigation Credits and Project Impacts as Calculated by Shaffer and Searcy and PHLF for the Mitigation Proposed in the MMP plus Inclusion of the Eastern Valley (Analysis 2).

	Shaffer and Searcy Calculations	PHLF Calculations
Mitigation Credits including Eastern Valley	4,103.95	3,512.71
Project Impact	-5,394.27	-5,009.46
Remaining Deficit	**-1,290.32**	**-1,496.75**

Under both calculations, inclusion of the Eastern Valley results in a significant benefit to the CTS and their habitat. Our calculations range from 6 percent (Pond 5) to 25 percent (Pond 2)

less than the Shaffer and Searcy calculations for individual ponds. We believe that the difference between the Eastern Valley calculations in the two analyses lies mainly in the difference between the project areas used (see the Section 3.1) and the way the Eastern Valley was defined. The Eastern Valley is defined by PHLF as the east end of the Potrero Hills Valley, below the ridgeline of the hills surrounding the valley and not within the Southern Hills parcel. Shaffer and Searcy did not specify the exact boundaries that they used for the Eastern Valley, so we cannot compare them directly.

Figure 5 graphically shows the post-project mitigation credits on the mitigation lands and Eastern Valley as calculated by PHLF using the Shaffer and Searcy model.

3.2.2 Landscape Analysis (Modification of Assumptions 6 and 8)

Shaffer and Searcy contend that their model is neutral with respect to the offsite ponds and does not take into account any cost or benefit to offsite ponds as these ponds are not proposed for protection. We conducted an additional analysis of the model to investigate how the proposed mitigation plan would benefit CTS habitat if the scale of the analysis was expanded to include all ponds in the Potrero Hills. Although ponds on lands not owned by the landfill have not been sampled for CTS, our experience suggests that all ponds similar to those on the project site, mitigation parcels, and Eastern Valley, provide suitable breeding habitat for CTS in the Potrero Hills and the Potrero Hills Valley. The exception to this would be ponds that are known to be perennial or ponds that have tidal influence; such ponds were not included in the landscape analysis.

In this analysis, we also included additional costs that would be incurred to offsite ponds from the Phase II expansion as well as credits gained from the preservation of the mitigation parcels so that with the exception of the scale at which the model is applied, all other assumptions remain the same. Table H Shows the results of the analysis for which offsite ponds are also considered.

Table H: Summary of Mitigation Credits and Project Impacts as Calculated for the Landscape Analysis.

Analysis	Mitigation Credits	Deficit From Phase II Expansion	Total
3. Model per Shaffer and Searcy	1,730.331	-5,009.46	**-3,279.15**
Offsite Pond Increments	2,046.46	-473.03	**1,573.43**
Total	**3,776.79**	**-5,482.48**	**-1,705.69**

Table F: California Tiger Salamander Habitat Values for Landfill Expansion, and Proposed Mitigation Areas, and Adjacent Eastern Valley Lands (Units of Mitigation Value) (Modified from Airola et al., 2007)

Pond	Mitigation Ratio Functions	Mitigation Cost (Equivalent Acres of Habitat Value)[a]			
		Subdivisions		Shaffer & Searcy Calculated Totals	PHLF Calculated Totals
Pond 1	$y = 5.651e^{(-0.0019x)}$	Deficit wedge	-2,066.978		
		Credit wedge	414.93	**-1,652.048**	**-1,655.521**
Pond 2	$y = 5.683e^{(-0.0019x)}$	Deficit wedge	-573.583		
		Credit wedge	57.344	**-516.239**	**-436.697**
Pond 3	$y = 5.667e^{(-0.0019x)}$	Deficit wedge	-896.375		
		Credit wedge	73.662	**-822.713**	**-748.634**
Pond 4	$y = 5.667e^{(-0.0019x)}$	Deficit wedge	-2,061.646		
		Credit wedge	237.992	**-1,823.654**	**-1,806.399**
Pond 5	$y = 5.615e^{(-0.0019x)}$	Deficit wedge	-590.953		
		Credit wedge	44.31	**-546.643**	**-318.044**
Pond 7	$y = 5.464e^{(-0.0019x)}$	Deficit wedge	-32.974	**-32.974**	**-44.16**
			Total cost	**-5,394.271**	**-5,009.458**
Pond 5	$y = 5.615e^{(-0.0019x)}$	Mitigation credit (excl. Parcel E)	708.239	**708.239**	**784.073**
Pond 7	$y = 5.464e^{(-0.0019x)}$	Mitigation credit (excl. Parcel E)	1,024.251	**1,024.251**	**946.258**
			Total credit (excl. Parcel E)[b]	**1,732.49**	**1,730.33**
			Grand total (excl. Parcel E)[b]	**-3,661.781**	**-3,279.13**
Pond 2	$y = 5.683e^{(-0.0019x)}$	Mitigation credit (incl. Parcel E)	850.762	**850.762**	**637.368**
Pond 3	$y = 5.667e^{(-0.0019x)}$	Mitigation credit (incl. Parcel E)	873.365	**873.365**	**713.013**
Pond 5	$y = 5.615e^{(-0.0019x)}$	Mitigation credit (incl. Parcel E)	1,144.988	**1,144.988**	**1,078.517**
Pond 7	$y = 5.464e^{(-0.0019x)}$	Mitigation credit (incl. Parcel E)	1,234.836	**1,234.836**	**1,083.812**
			Total Credit (incl. Parcel E)[b]	**4,103.951**	**4,106.608**
			Grand Total (incl. Parcel E)[b]	**-1,290.32**	**-1,496.75**

[a] Units are "acre equivalents" of habitat value, which are a measure of relative habitat value for lands in each area (see "Methods"). Negative values for Phase II lands indicate habitat values lost due to project construction. Values are accumulated independently for each pond to derive total gains and losses associated with each pond, each parcel, and a net value of directly impacted and protected mitigation lands.

[b] Parcel E is the Eastern Valley parcel that is neither slated for development nor for protection.

This page left blank.

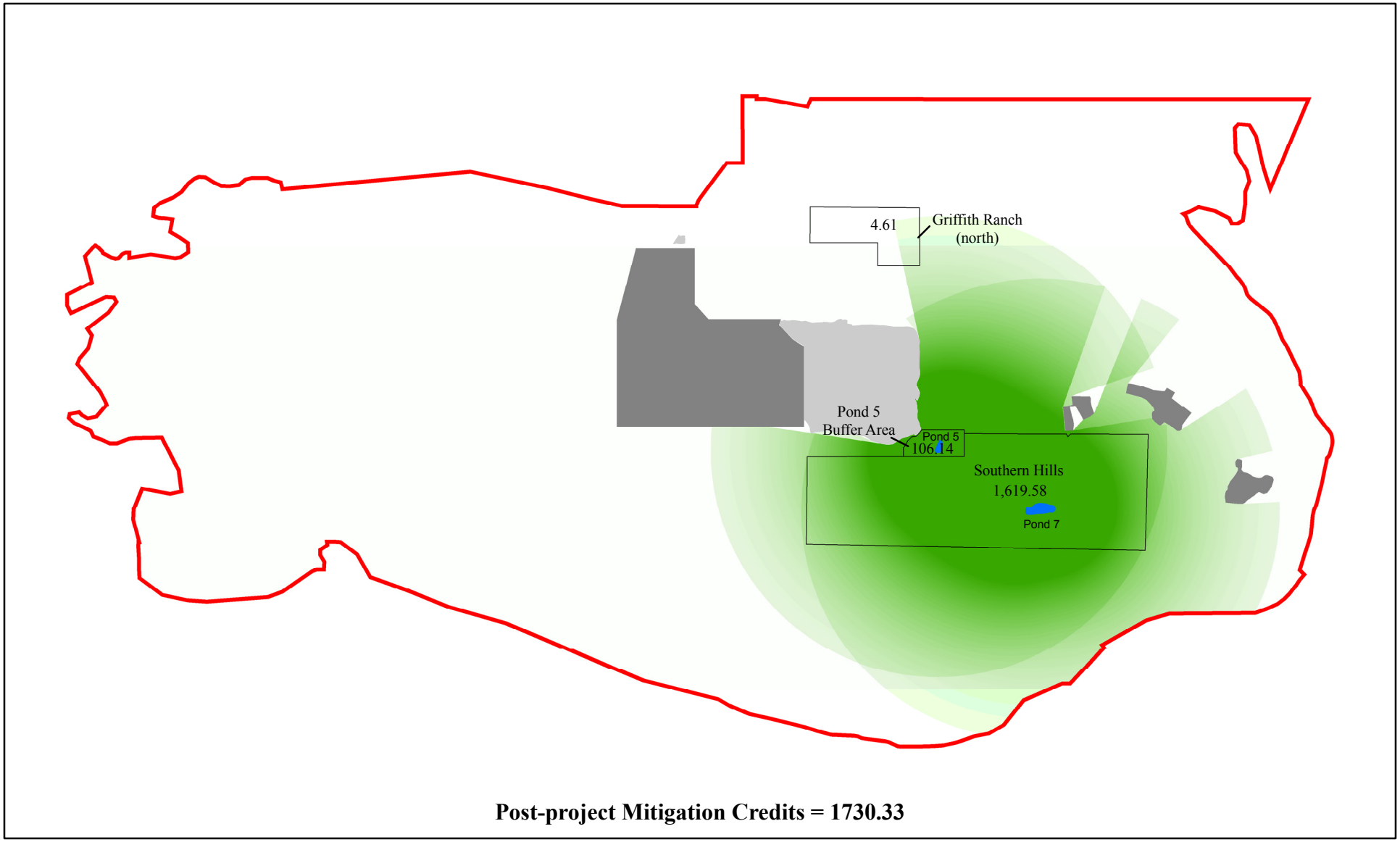


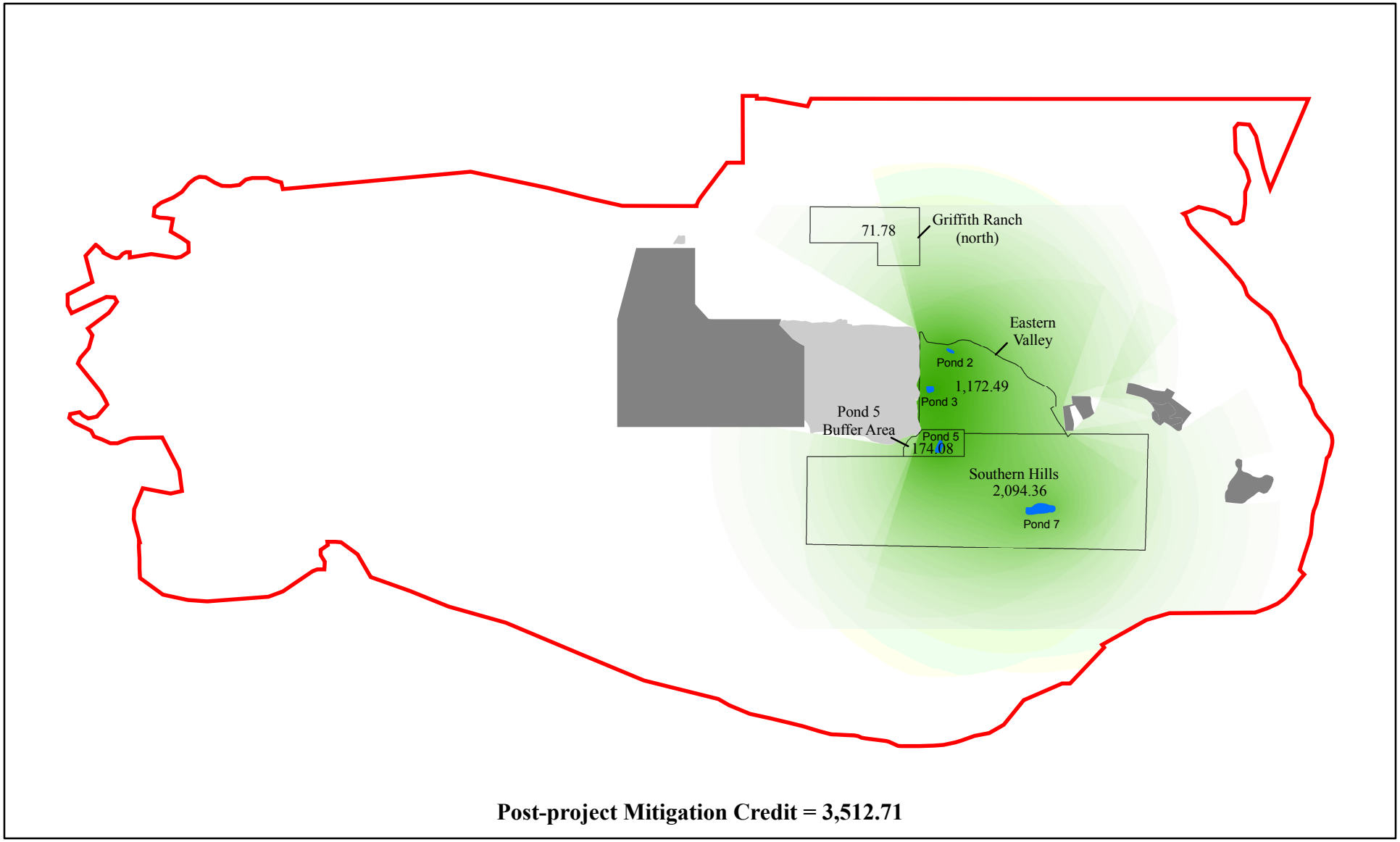
FIGURE 4

Potrero Hills Landfill
Phase II Expansion

Shaffer and Searcy Model Verification
Mitigation Credits

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure4_Model Verification.mxd (11/05/2007)

This page left blank.



Post-project Mitigation Credit = 3,512.71

Onsite Pond

Existing Development

Proposed Phase II Impact Area

Mitigation Area

CTS Mitigation Analysis Area

High : 12.37

Mitigation Credit

Low : 0.00

N

0 1,500 3,000

FEET

FIGURE 5

Potrero Hills Landfill
Phase II Expansion

Shaffer and Searcy Model
with Eastern Valley
Mitigation Credits

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure5_Inclusion of Eastern Valley.mxd (11/05/2007)

This page left blank.

When we look at the costs and benefits to the value of CTS habitat at a landscape level, there are additional costs (impacts) and benefits (credits) that accrue to the proposed project. The cost and credit values were calculated by PHLF as Shaffer and Searcy originally calculated the value for the onsite ponds (see Section 3.2.1 Model Verification), and the values (both costs and benefits) for offsite ponds were added to the analysis. Like Shaffer and Searcy's original analysis, onsite credits come solely from preservation of Ponds 5 and 7 with no added benefit for preservation of the playa pool on the Director's Guild or from any created ponds. Adding the values for offsite ponds to the analysis as done by Shaffer and Searcy, the deficit to CTS habitat value remaining from the proposed Phase II landfill expansion is reduced significantly to about 48 percent of the value for the project area only.

These results indicate that the original Shafer and Searcy model significantly undervalues the mitigation parcels because they provide important habitat value for CTS that breed in offsite ponds (Figure 6). Portions of the mitigation parcels such as the western end of the Southern Hills parcel that have low value to onsite ponds (see Figure 5), are valued more correctly in the landscape model as this area provides important habitat for the CTS that likely breed in the pond located about 550 feet west of the western boundary of the Southern Hills parcel. The implications of using the model at the landscape and project scale to directly determine mitigation value is discussed in Section 4.

3.2.3 Creation of Replacement Ponds (Modification of Assumption 10)

A second assumption that the Shaffer and Searcy model makes in calculating the value of the CTS habitat is that ponds created as new breeding habitat have no value in the model when analyzing the mitigation plan. This is an assumption that is made in the model but one that artificially undervalues the mitigation proposal. Creation of breeding ponds for CTS is not an experimental or untested method to mitigate impacts to this species. The strongest evidence for this comes from observations of the study site itself. All of the ponds within the Phase II expansion area, Southern Hills, and Eastern Valley are man-made ponds that were colonized by CTS. In addition, CTS have been found during the breeding season at almost all water bodies that do not have fish, including quarry ponds (e.g., Ponds 1, 2, 6), spring boxes, and seeps. This species will attempt to breed in a variety of aquatic sites and provided that the ponds are of sufficient size and depth to pond water for the required 12 weeks or so during the winter and spring, salamanders can be expected to use the ponds for successful reproduction (i.e., larvae survive to metamorphosis and move to the uplands).

We calculated the value of the mitigation sites assuming that mitigation ponds will contribute to the overall value of the CTS habitat on the mitigation site. The results of the calculations are shown in Table I.

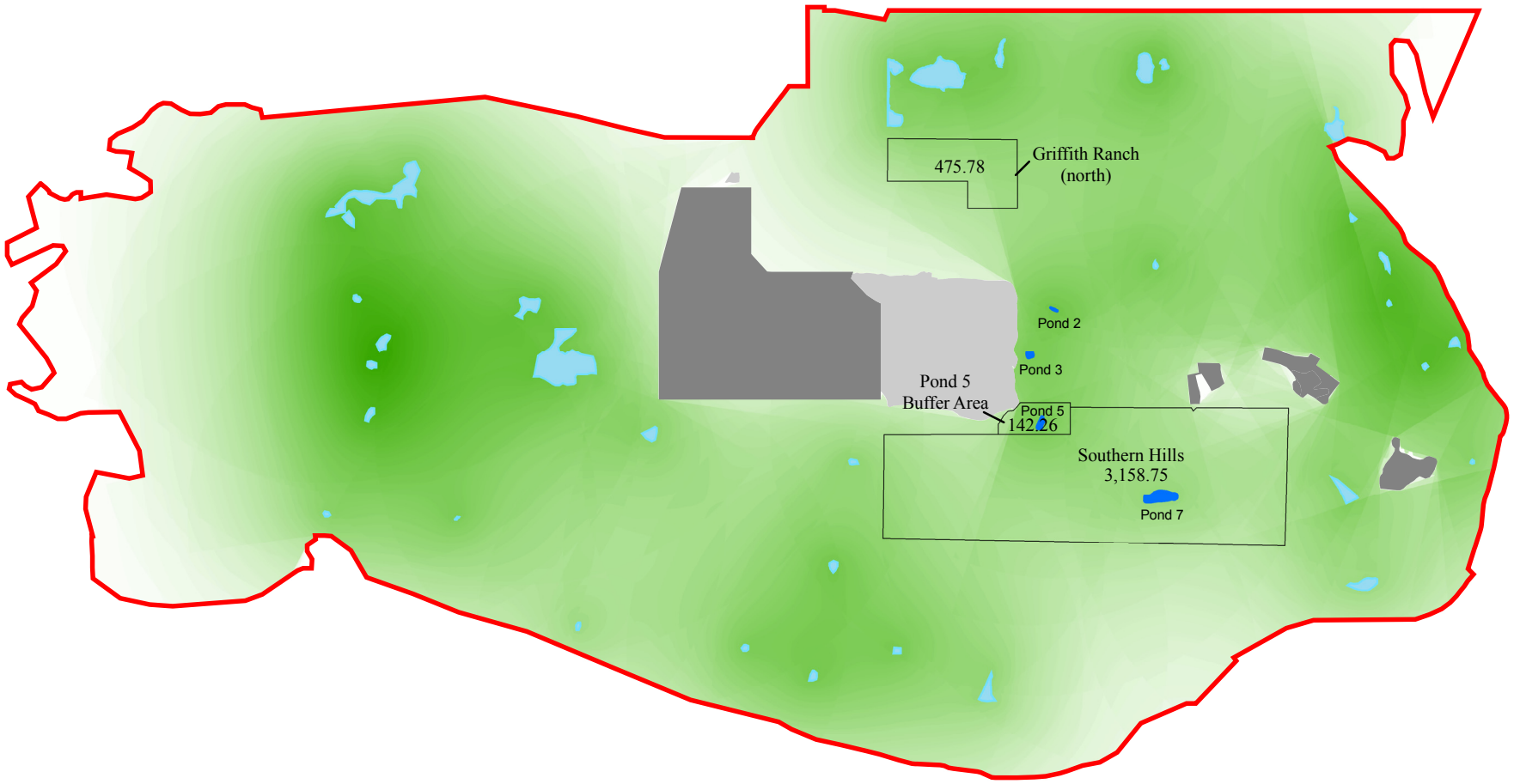
Table I: Summary of Mitigation Credits Assuming Mitigation Ponds Provide Suitable Breeding Habitat.
(Note: Deficit from Phase II Expansion is the same as in the model verification analysis.)

Analysis	Mitigation Credits	Deficit From Phase II Expansion	Total
4. Original Mitigation Proposal- MMP with additional Breeding Habitat in Seasonal Wetland 4, Griffith Ranch, and Director's Guild	4,030.14	-5,009.46	**-979.32**
5. Revised Mitigation Proposal – MMP plus additional upland and breeding habitat at Griffith Ranch	4,678.12	-5,009.46	**-331.34**

We analyzed the original mitigation proposal as described in the MMP (LSA and ESP 2006) in both Analyses 4 and 5. However, in Analysis 5, a second breeding pond was added to Griffith Ranch at the location previously proposed for the power plant and the southeastern portion of the Griffith Ranch was also incorporated into the lands proposed for preservation (revised mitigation proposal as described in Section 1.4.2). Only parcels included in the mitigation plan and existing or created ponds were included in this analysis. As in the MMP, the playa pool located within the Director's Guild property is considered as a potential breeding pond, and the ponds proposed for creation on the Southern Hills and Griffith Ranch parcels are also considered as breeding ponds. The basis for inclusion of these features is discussed in further detail in Section 4 (Discussion) of this report.

Inclusion of the mitigation ponds in Analysis 4 shows that a substantial amount of the habitat value for CTS is replaced by including the mitigation ponds in the analysis. These additional ponds result in a deficit to the habitat value that is approximately 70 percent less than in the Shaffer and Searcy model (-979.32 vs. -3,279.13). In Analysis 5, adding a second breeding site to the Griffith Ranch and including the southern portion of the site as preserved mitigation lands[5] (an additional 48.56 acres) results in only a small deficit remaining from the proposed project, which is only about 10 percent of the original deficit as calculated by Shaffer and Searcy or a reduction of about 90 percent over the values calculated by Shaffer and Searcy. Failure to include mitigation ponds in the model calculations artificially reduces the value of the mitigation lands and sets up a situation where the project cannot be mitigated within the Secondary Marsh Management Area. Figures 7 and 8 graphically show the value how the lands around the ponds are valued in the Analyses 4 and 5, respectively.

[5] The power plant and sedimentation basin formerly proposed for the southern portion of the Griffith Ranch site were relocated into the existing and proposed landfill footprint, thereby allowing the southeastern portion of the parcel to be included in the mitigation lands.



Post-project Mitigation Credit = 3,776.79

Onsite Pond
Offsite Pond
Existing Development
Proposed Phase II Impact Area
Mitigation Area
CTS Mitigation Analysis Area
High : 22.59
Mitigation Credit
Low : 0.00

N

0 1,500 3,000
FEET

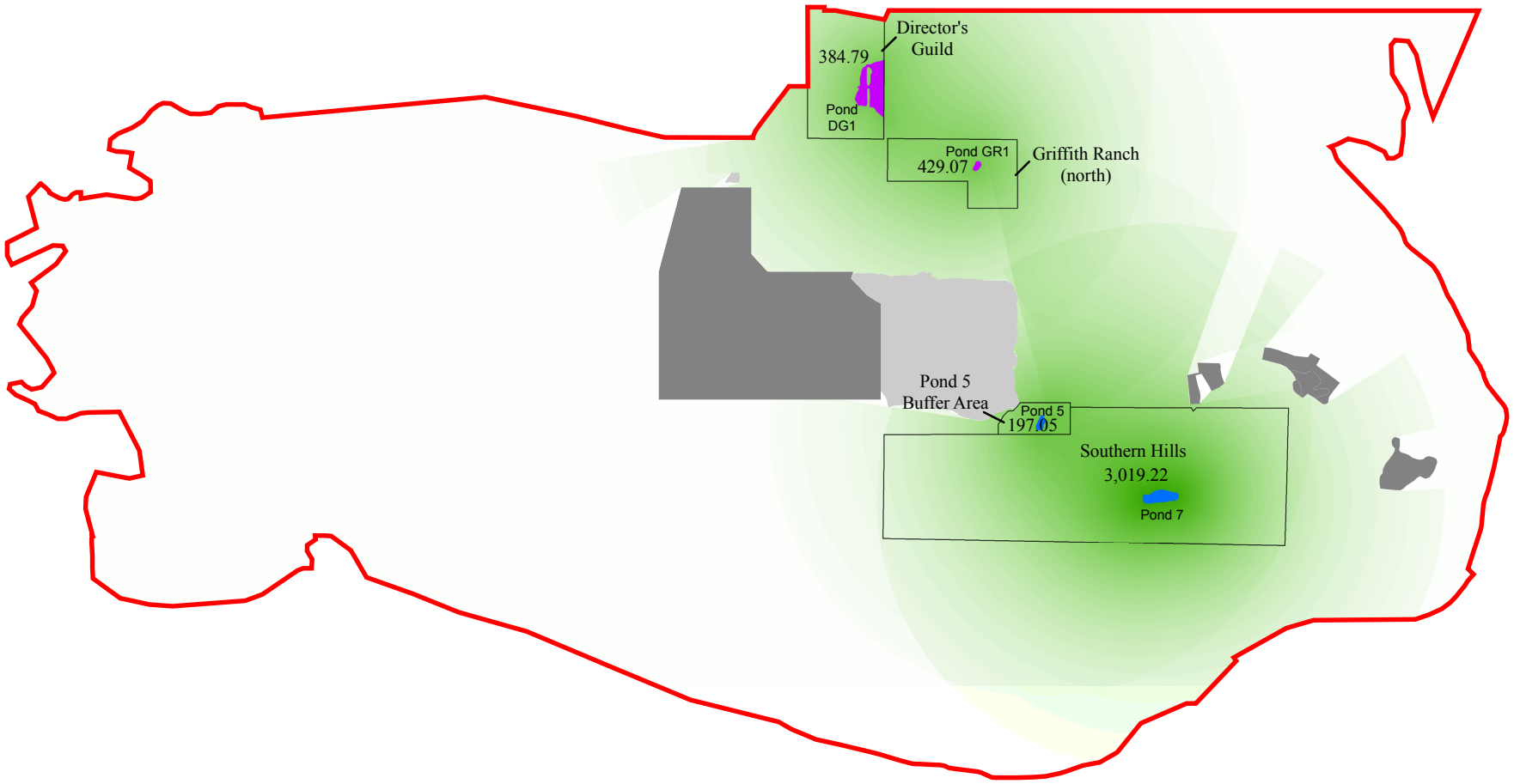
FIGURE 6

Potrero Hills Landfill
Phase II Expansion

Shaffer and Searcy Model
Landscape Analysis
Mitigation Credits

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure6_Landscape Mitigation Credits.mxd (11/05/2007)

This page left blank.



Post-project Mitigation Credits = 4,030.14

Onsite Pond

Mitigation Pond

Existing Development

Proposed Phase II Impact Area

Mitigation Area

CTS Mitigation Analysis Area

High : 12.30

Mitigation Credit

Low : 0.00

N

0 1,500 3,000

FEET

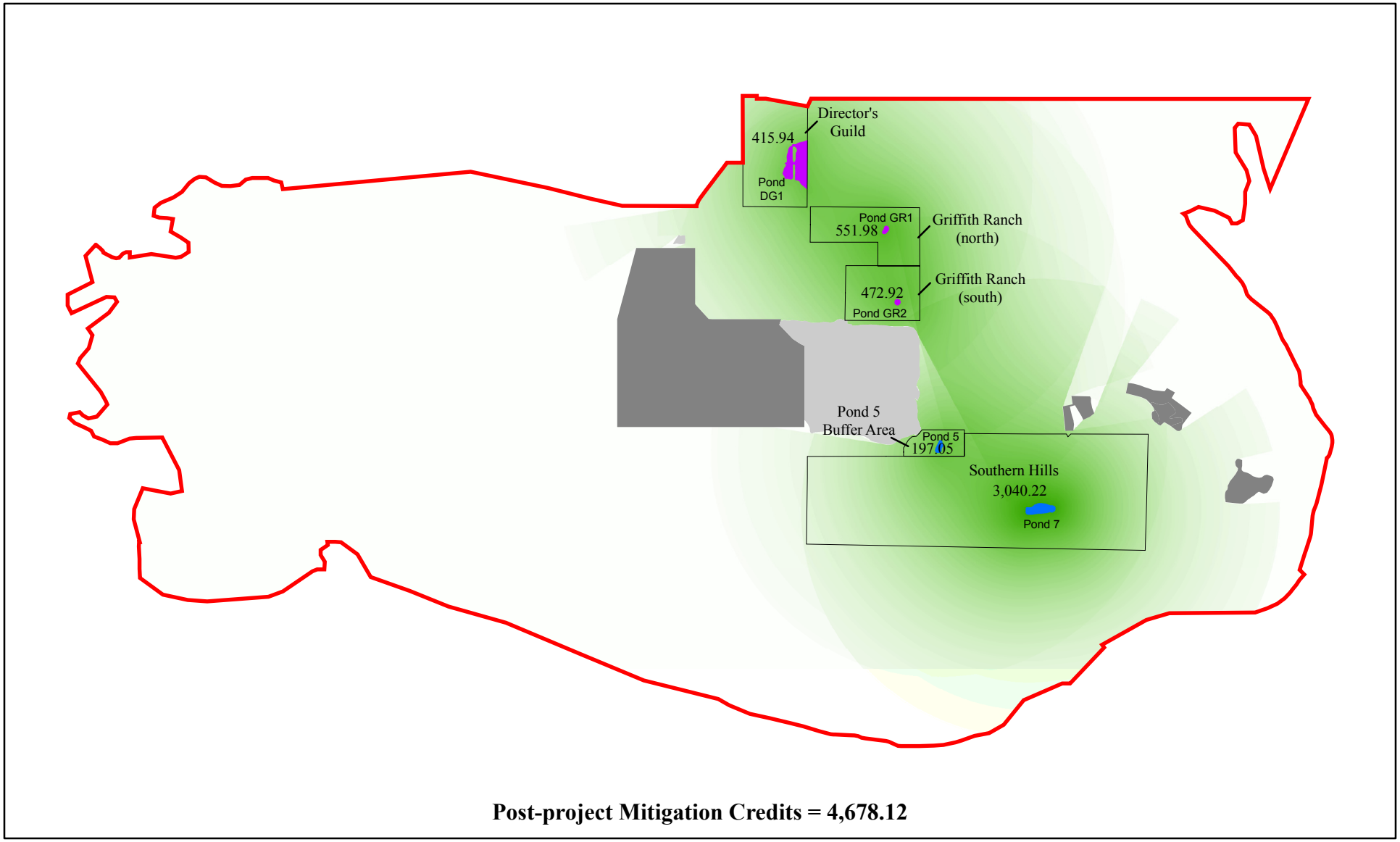
FIGURE 7

Potrero Hills Landfill
Phase II Expansion

Original MMP
Mitigation Credits

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure7_Original MMP Mitigation Credits.mxd (11/05/2007)

This page left blank.



Post-project Mitigation Credits = 4,678.12

Onsite Pond
Mitigation Pond
Existing Development
Proposed Phase II Impact Area
Mitigation Area
CTS Mitigation Analysis Area
High : 12.23
Mitigation Credit
Low : 0.00

N

0 1,500 3,000
FEET

FIGURE 8

Potrero Hills Landfill
Phase II Expansion

Revised MMP
Mitigation Credits

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure8_Revised MMP Mitigation Credits.mxd (11/05/2007)

This page left blank.

3.2.4 Inclusion of Offsite Ponds and Replacement Ponds (Modification of Assumptions 6, 8, and 10)

In addition to the analyses described above that tested assumptions explicit in the model, additional analyses were carried out to assess the effects of changing combinations of assumptions on the value of mitigation lands. As shown in Section 3.2.2, the scale at which the analysis is carried out significantly affects the results of the model. Modifying the scale is not merely an exercise to artificially manipulate the Shaffer and Searcy model, but instead can demonstrate that the value of the mitigation parcels is undervalued by the model. In addition, the inclusion of the mitigation ponds in Analysis 4 shows that a substantial amount of the habitat value for CTS is replaced by including the mitigation ponds in the analysis. Therefore, we conducted an analysis combining the inclusion of offsite ponds and replacement ponds for both the original MMP and the revised mitigation. The calculated values generated for each analysis are shown in Table J.

Table J: Summary of Mitigation Credits Calculated and Project Impacts Calculated at the Landscape Level and Assuming Mitigation Ponds Provide Suitable Breeding Habitat

Analysis	Mitigation Credits	Deficit From Phase II Expansion	Total
6. Original Mitigation Plan (MMP) + Offsite Ponds	6,588.06	-5,482.48	**1,105.58**
7. Revised Mitigation Plan + Offsite Ponds	7,454.57	-5,482.48	**1,972.09**

By incorporating the value of the mitigation ponds, as well as the offsite ponds, both the original mitigation proposal described in the MMP (Section 1.4.1) and the revised mitigation proposal (Section 1.4.2) result in positive values. The addition of the second breeding pond and additional preserved uplands on Griffith Ranch reflected in Analysis 7 results in the greatest positive value of any of the analyses. Under both these analyses, the habitat value for CTS preserved in the mitigation proposals is greater than the habitat value lost due to the Phase II landfill expansion (Table J). Again, the implications of calculating mitigation at the landscape level are discussed in more detail in Section 4. Figures 9 and 10 graphically show how the lands around the ponds are valued in the analyses 6 and 7, respectively.

3.3 ADOPTED CONSERVATION PLANS

3.3.1 Santa Rosa Plain Conservation Strategy Analysis

Under the Santa Rosa Plain Conservation Strategy and Programmatic Biological Opinion for the Santa Rosa Plain, lands around a breeding pond would be mitigated at a ratio of between 3:1 and 1:1 depending on distance to a breeding pond up to 1.3 miles from the pond. Figure 11 shows the areas impacted around each of the breeding ponds from the Phase II landfill expansion.

Table K shows the acreage of land impacted within each impact distance and the required mitigation under the Santa Rosa Plain Conservation Strategy.

Table K: Impacted Acreage and Mitigation Requirements Using the Mitigation Ratios of the Santa Rosa Plain Conservation Strategy

Distance From Pond	Acres Impacted	Mitigation Ratio	Mitigation Requirement (acres)
0-500 feet	44.67	3:1	134.01
501-2,200 feet	121.95	2:1	243.90
2201-6,864 feet	0	1:1	0
Total	**166.62**		**377.91**

In this analysis, a total of 377.91 acres of CTS upland habitat would be required as mitigation for impacts to both the onsite and offsite ponds. In addition, the breeding pond would be mitigated according to the Corps guidelines, which would likely require a minimum of 2:1 mitigation (1.22 acres mitigation for 0.61 acres impacted).

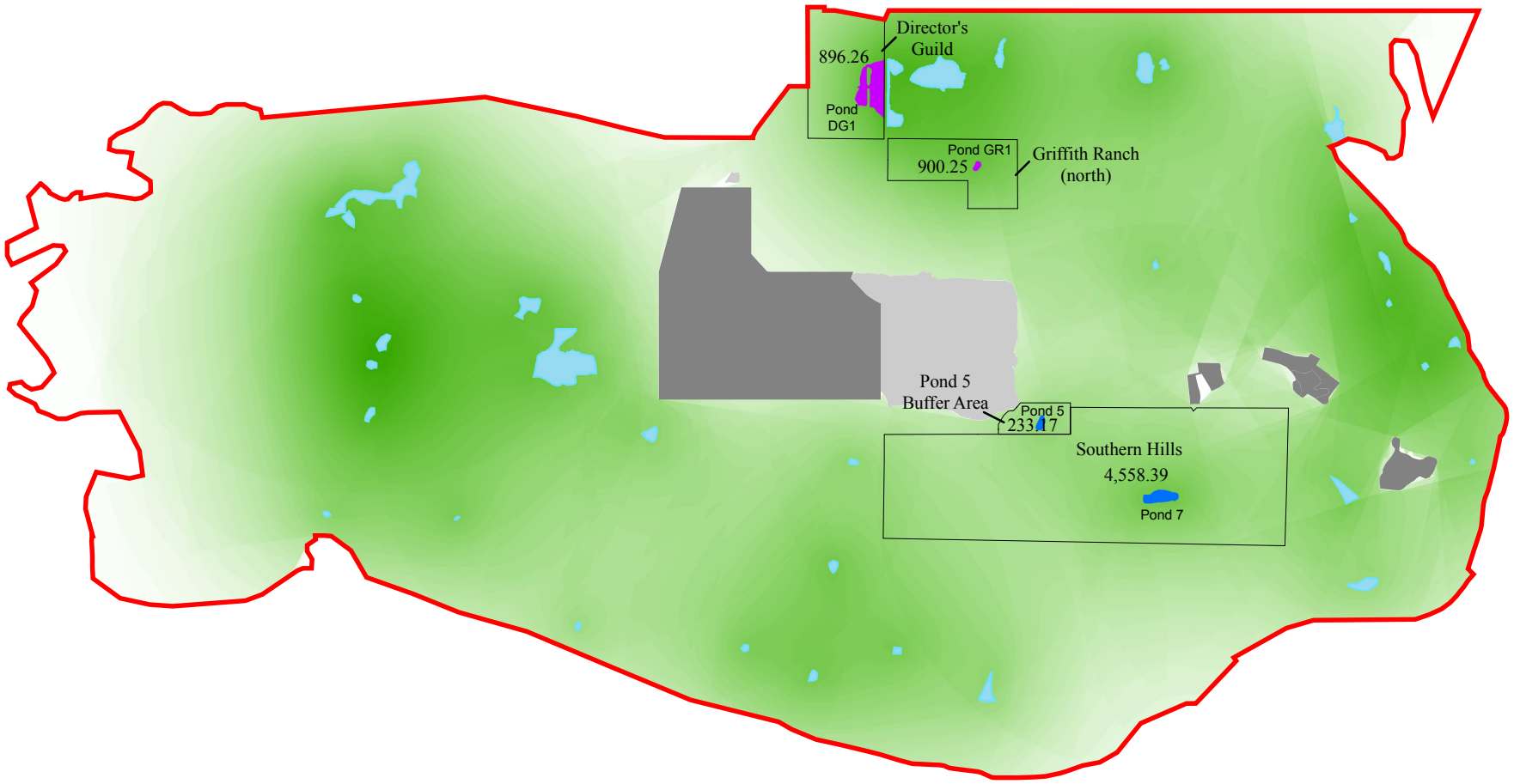
3.3.2 East Contra Costa County Habitat Conservation Plan and Other Plans

Under the approved ECC HCP, the derived mitigation ratio for impacts to California tiger salamander upland habitat is 6:1 (preserved:impacted). The Phase II expansion project will impact 164.6 acres of upland habitat for tiger salamanders. Table L shows the mitigation requirements under the ECC HCP under various scenarios. Column 2 shows the mitigation requirement at the full, derived mitigation ratio of 6:1. Column 3 shows the applicant's portion calculated at approximately one half the full requirement or 3:1. Columns 4 and 5 show the potential mitigation requirements for projects that buy into the ECC HCP reserve fund.

Table L: Mitigation Requirements Using the Mitigation Ratios Derived from the East Contra Costa County Habitat Conservation Plan

Phase II Upland Impact (ac)	ECC HCP Derived Mitigation Requirement 6:1 (acres)	ECC HCP Applicant Portion of Mitigation (approximate) 3:1 (acres)	"Buy-In" Applicant Portion at 10% Penalty 3.33:1 Ratio (acres)	"Buy-In" Applicant Portion at 25% Penalty 3.75:1 Ratio (acres)
164.60	987.6	493.8	548.1	617.25

Under the San Joaquin County HCP and draft Solano County HCP, the 3:1 mitigation ratio would result in a mitigation requirement of about 493.8 acres for impacts to 164.6 acres of tiger salamander upland habitat.



Post-project Mitigation Credits = 6,588.06

Onsite Pond
Mitigation Pond
Offsite Pond

Existing Development
Proposed Phase II Impact Area
Mitigation Area
CTS Mitigation Analysis Area

High : 22.59
Mitigation Credit
Low : 0.00

N

0 1,500 3,000
FEET

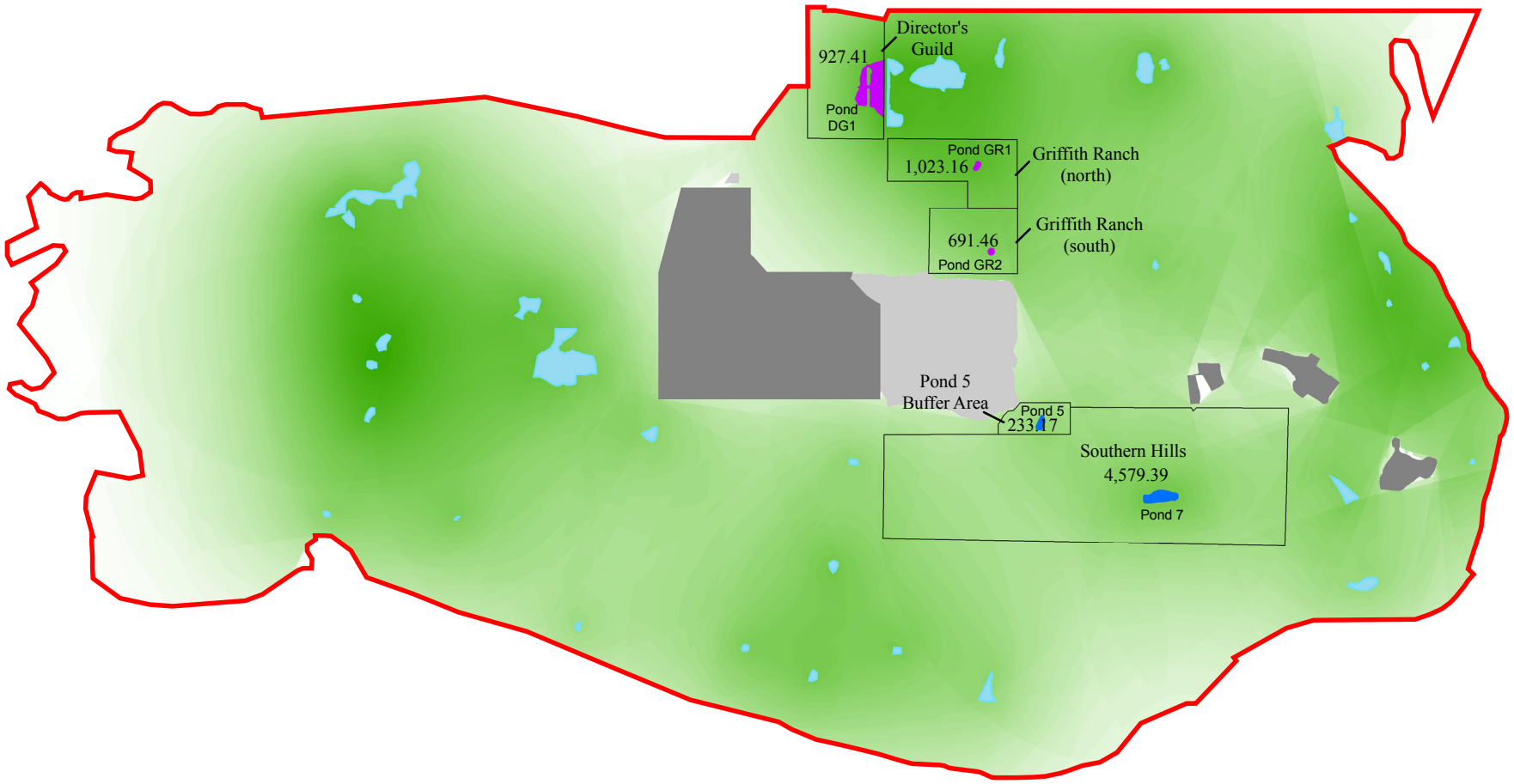
FIGURE 9

Potrero Hills Landfill
Phase II Expansion

Original MMP
Landscape Analysis
Mitigation Credits

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure9_Original MMP w Landscape Mitigation Credits.mxd (11/05/2007)

This page left blank.



Post-project Mitigation Credits = 7,454.57

Onsite Pond
Mitigation Pond
Offsite Pond

Existing Development
Proposed Phase II Impact Area
Mitigation Area
CTS Mitigation Analysis Area

High : 22.59
Mitigation Credit
Low : 0.00

N

0 1,500 3,000
FEET

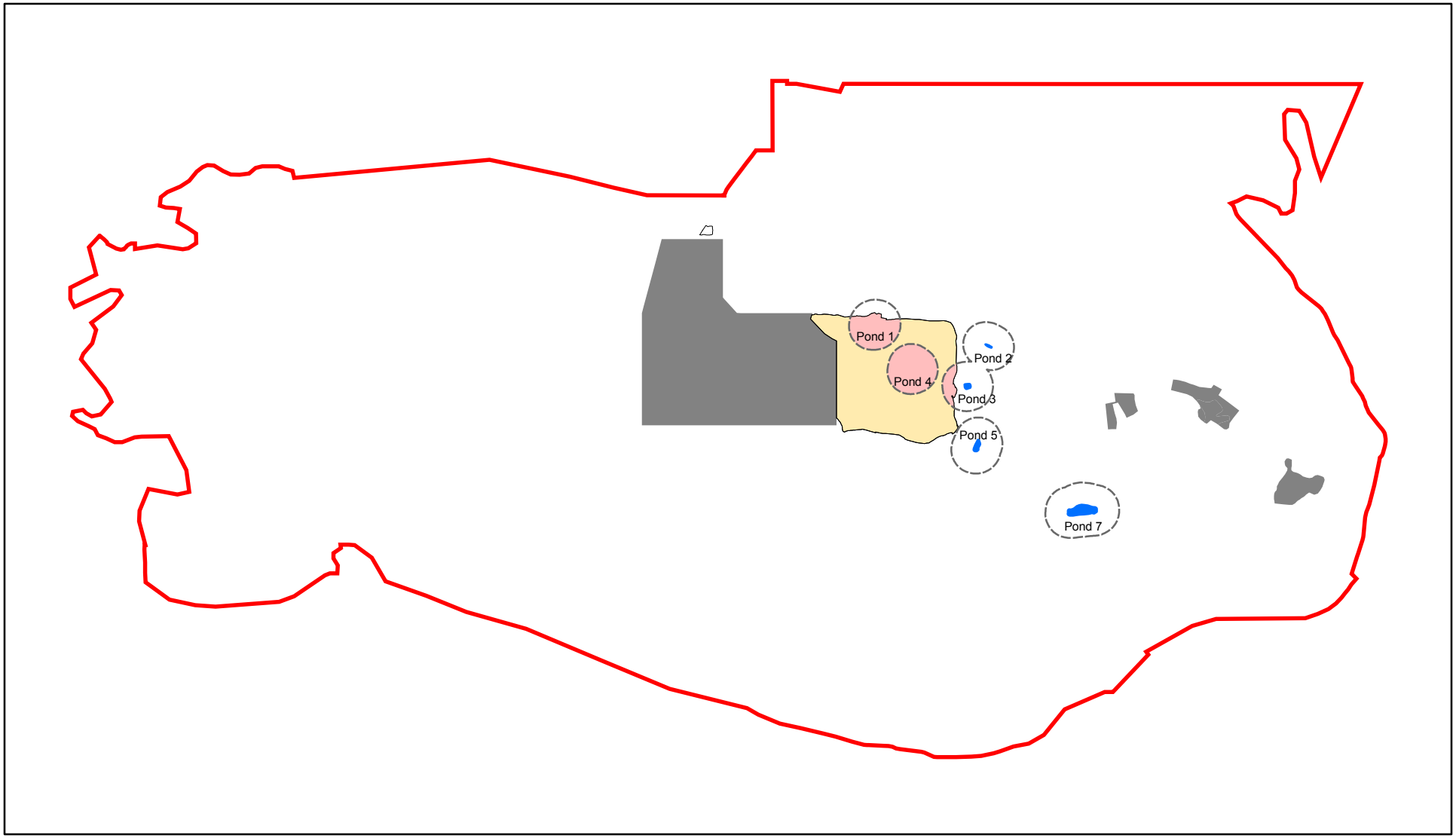
FIGURE 10

Potrero Hills Landfill
Phase II Expansion

Revised MMP
Landscape Analysis
Mitigation Credits

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure10_Revised MMP w Landscape Mitigation Credits.mxd (11/05/2007)

This page left blank.



Onsite Pond not Directly Impacted by Project

Onsite Pond Directly Impacted by Project (Loss of Breeding Site)

3:1 Mitigation Ratio (0 - 500 feet from Pond)

2:1 Mitigation Ratio (501 - 2200 feet from Pond)

Existing Development

Proposed Phase II Impact Area

CTS Mitigation Analysis Area

N

0 1,500 3,000
FEET

FIGURE 11

Potrero Hills Landfill Phase II Expansion

Santa Rosa Plain Conservation Strategy Analysis

I:\ESP930\GIS\Maps\CTS Impact Assessment\2007 October\Figure11_SRP Cons Strategy Analysis.mxd (11/05/2007)

This page left blank.

4.0 DISCUSSION

The Shaffer and Searcy model is a tool to assess the value of CTS habitat for both pre- and post-development conditions, however, like any model, it has limitations. These limitations become particularly apparent when trying to use the model directly to determine appropriate mitigation. In addition, some of the assumptions of the model do not reflect actual on-the-ground conditions and therefore impose biases in the calculation of deficits and credits. The Shaffer and Searcy model is solely focused on CTS and consciously ignores land use designations (including the Suisun Marsh Protection Act), the habitat requirements of other threatened and endangered species protected by the State of California and the USFWS, and the wildlife management goals of adjacent property owners.

In this section, we discuss the implications of changing some of the assumptions of the model to better reflect the biology of CTS populations in the Potrero Hills.

4.1 MODEL VERIFICATION

We independently implemented the model based on Shaffer and Searcy's written description in Chapter 4 of the scientific panel review report (Airola et al., 2007). Comparison of the values calculated by PHLF and Shaffer and Searcy show that we are able to accurately implement the model and thereby use our implementation of the model to conduct the additional analyses of testing assumptions of the model.

In the model verification, we interpreted the impact areas and mitigation lands as Shaffer and Searcy described (Airola et al., 2007), namely giving no value as breeding habitat to the playa pool on the Director's Guild parcel and no value to created ponds. Under the conditions imposed by the model's authors we were able to replicate their results with a high degree of accuracy. Acceptance of these conditions, however, was for model verification purposes only[6]. The remainder of this section will focus on providing further explanation for using our modified set of assumptions and the results of our various analyses.

4.2 MODIFICATION OF MODEL ASSUMPTIONS

4.2.1 Inclusion of the Eastern Valley (Modification of Assumption 5)

Shaffer and Searcy included this analysis in their calculations and we also ran the calculations to verify their results. Both sets of model calculations (PHLF and Shaffer and Searcy) were in

[6] Significant disagreements regarding the assumptions inherent in the Shaffer and Searcy model are defined herein.

agreement that inclusion of the Eastern Valley could significantly contribute to the compensation of lost habitat value from the Phase II expansion. This parcel occupies a strategic link between the Southern Hills parcel and Griffith Ranch parcel to the north, and contains two confirmed breeding ponds. Including this parcel in the mitigation proposal reduces the Phase II deficit by one half to two thirds (depending on which calculations are used). However, inclusion of this parcel alone is not sufficient to compensate for the impacts from the Phase II expansion.

As this parcel is not proposed by PHLF for inclusion in the mitigation plan, compensation is proposed to be provided from other areas owned and controlled by PHLF.

4.2.2 Landscape Analysis (Modification of Assumptions 6 and 8)

One of the critical assumptions of the Shaffer and Searcy model that we investigated was the assumption of scale. In Shaffer and Searcy's version of the model, offsite ponds are considered neutral, neither providing cost nor benefit to the impacts and mitigation analysis. We believe that this is a significant shortcoming of the model. Salamander populations in the Potrero Hills do not observe property ownership or parcel lines, and as such, a model that only considers these lines undervalues the mitigation lands, as well as project impacts. When we calculate the model to include the costs and benefits to offsite ponds, we see that the remaining deficit in CTS habitat value is reduced by about half and is about equal to the deficit calculated when the Eastern Valley is included in the mitigation proposal. By itself, inclusion of the offsite ponds in the calculation of the value of the mitigation lands does not completely compensate for the Phase II expansion impacts, but it does reduce the habitat value deficit by about half.

This analysis demonstrates that there is a substantial benefit (and some costs) to the value of CTS habitat when offsite ponds are considered. This is not a small contribution and biologically could have great implications for CTS populations in the Potrero Hills. Provided that the offsite ponds remain as stock ponds and the land remains as grazing lands, a reasonable assumption given current zoning, preservation of the uplands around the offsite ponds secures those areas for CTS adults into the future. Further, preservation of the uplands around offsite ponds would increase the habitat value of other CTS conservation efforts that may be undertaken in the Potrero Hills by conservation organizations in the future.

Of course, giving credit for unprotected lands is not typically accepted by the agencies when determining suitable mitigation, however, mitigation is not typically subjected to an analysis that assigns weighted projections of habitat value to a single species for each and every acre, as required by the Shaffer and Searcy model. Using this tool, we can attribute the incremental value of the mitigation lands to offsite ponds and thereby the value these lands have on CTS populations in the Potrero Hills. Failure to give credit to portions of the mitigation parcels not only undervalues the mitigation lands, but fails to acknowledge the ecological relationships among ponds and uplands in the Potrero Hills. For example, in the model, the western end of the Southern Hills parcel has reduced value due to its distance from the onsite breeding ponds (Figure 5). However, another stock pond, located on the Dittmer property, lies just 550 feet west of the western boundary of the Southern Hills parcel. Although, according to the model, the

western end of the Southern Hills parcel has low value to salamanders that breed in Pond 7, it does provide important upland habitat for the offsite pond. If we allow the impact assessment to only consider the onsite ponds as a benefit to CTS, then there are areas on the Southern Hills parcel that have no mitigation value at all. These lands could also be interpreted as being available for development with no mitigation requirements. From a biological standpoint, this would be a mistake and salamanders would likely end up killed under such a scenario.

We recognize that from a mitigation standpoint, it is contrary to typical mitigation practices to give full value to upland areas that only serve offsite ponds that are neither protected in conservation easements nor managed for wildlife habitat values. However, the inclusion of the offsite ponds in the impact and mitigation analysis gives us a better idea of the value of these lands to the CTS population in the Potrero Hills as a whole. In order to account for the habitat value of onsite uplands to offsite ponds, future versions of the model could apply a different weighting to offsite ponds and/or the straight-line movement assumption could be modified to give additional value to areas that provide habitat for offsite ponds but are in the shadow of onsite facilities (See section 4.2.5 for further discussion of this alternative).

4.2.3 Creation of Replacement Ponds (Modification of Assumption 10)

With respect to giving no credit for the creation of breeding ponds, we strongly disagree with Shaffer and Searcy's position on this issue. The documented success of numerous mitigation projects and mitigation banks permitted by the USFWS do not support Shaffer and Searcy's position. Breeding ponds, constructed in proximity to occupied CTS habitat, rapidly become used by CTS as breeding sites. Provided that the breeding ponds have sufficient depth and hydroperiod, these ponds contribute to the population through the increased recruitment of metamorphs each year. As discussed in Section 2, the presence of CTS breeding in artificial, human-created stock ponds on the project site is conclusive evidence that such ponds are used by CTS. Further evidence of such ponds being used comes from Trenham and Shaffer's earlier work in Monterey County (Trenham et al., 2000) where the study site consisted of natural and modified ephemeral ponds as well as cattle watering ponds. In addition, creation of ponds at Brushy Peak Regional Park and the Ruby Hills development in Alameda County, Windemere development in Contra Costa County, Elsie Gridley Mitigation Bank in Solano County, and various mitigation banks and mitigation sites including the Shiloh Mitigation Site in the Santa Rosa Plain (Sonoma County), provide ample evidence that breeding pond construction is not an untested or experimental mitigation technique (LSA field observations). For this reason, we included breeding ponds proposed for construction in our analyses.

We also analyzed both the original mitigation proposal and revised mitigation proposal as discussed in Sections 1.4.1 and 1.4.2 to investigate the effect of creating replacement ponds on the value of mitigation lands. Based on the CTS population model developed by Trenham et al. (2005), adding additional breeding ponds would increase the adult population. In the population model developed by Trenham et al. (2005), the size of the adult population was dependent on the area of breeding habitat (i.e. density dependence was incorporated into the larval life stage).

When the model is run for the two mitigation proposals (original and revised), the deficit to CTS habitat value remaining after mitigation is reduced by about two-thirds for the original mitigation plan (MMP) and almost completely eliminated for the revised mitigation plan (i.e. with the second breeding pond on Griffith Ranch and inclusion of the additional upland acreage on Griffith Ranch)(Table I). Although inclusion of the created ponds in the calculation of the value of the mitigation lands under the original mitigation plan results in a significant benefit, the habitat value lost due to the Phase II expansion is not fully compensated. The revised mitigation plan, in which an additional breeding pond as well as additional upland habitat is dedicated on the Griffith Ranch parcel, almost completely compensates for the loss of habitat value from the Phase II expansion. The second breeding pond located in the vicinity of the formerly proposed power plant site, is about 1,000 feet northeast of Pond 1 and 1,850 feet northwest of Pond 2. A pond at this location could form a linkage between existing ponds in the Potrero Hills and created ponds on the Griffith Ranch and Director's Guild property.

As noted above, there is ample evidence to support the concept that additional breeding ponds are used by CTS and that including these ponds in model calculations more accurately represents the true value of the mitigation lands under the proposed mitigation and monitoring plan by including the significant benefits that the additional ponds would accrue to the habitat value of the mitigation lands. Failure to include these ponds causes a significant, artificial undervaluing of the proposed mitigation lands.

On a final note, with respect to breeding ponds, Shaffer and Searcy further justify deletion of created CTS breeding ponds in their analysis because they are "not proven" and requirements for mitigation banks require that the ponds be established before credits are sold.

Shaffer and Searcy have incorrectly used the standards established for mitigation banks for a mitigation site. These two types of mitigation areas are very different in terms of implementation. A mitigation bank is set up to sell credits on the open market for the species preserved by the bank. A mitigation site, such as is being proposed for the Phase II landfill expansion, is created expressly for the project at hand. All the mitigation will be used for proposed project and no credits will be held for sale over time. As such, mitigation sites do not have to demonstrate that the ponds are fully functional in order for the mitigation to be deemed acceptable. The mitigation site must meet performance standards defined by the USFWS and Corps of Engineers permit conditions, including remediation and contingency plans that include financial commitments for dealing with plans that fail to meet permit standards. Therefore, given these contingency measures, if the mitigation that is proposed is based on proven techniques and methods (i.e., creation of CTS breeding ponds), the mitigation plan can be approved and allowed to proceed.

In this case, the mitigation plan does not propose any unusual methods or untried techniques and as such can be approved by the agencies without the ponds being first fully functional. That being said, since the construction of the Phase II landfill will be completed over an extended period, it may be possible to time the pond creations so that they can become functional prior to elimination of the onsite pond and the majority of its associated upland habitat within the

Phase II area. This is a desirable situation, but not necessarily a requirement for proposed mitigation to be determined acceptable by the USFWS and Corps of Engineers.

4.2.4 Inclusion of Offsite Ponds and Replacement Ponds (Modification of Assumptions 6, 8, and 10)

In addition to testing the model assumptions individually, we also looked at changing different combinations of model assumptions. In analyses 6 and 8, we further investigated the effects of modifying both the assumption of scale and the assumption of the value of created breeding ponds for both the original and revised mitigation proposals. *For both analyses, the effect of modifying both assumptions is to more than fully compensate for the lost habitat value due to the Phase II expansion project*. Under these analyses, between 594.2 (original MMP) and 642.76 (revised mitigation proposal) acres would be protected and managed for the benefit of CTS and other plants and wildlife. This translates to a 3.5:1 or 3.8:1 mitigation ratio on a total (gross) acreage basis. This amount of land is about 1.6 to 1.7 times more than would be required under the Santa Rosa Plain Conservation Strategy for a similar impact in that region and within or exceeding the range of mitigation values required by the ECC HCP.

4.2.5 Straight-line Movements (Assumption 2)

For our review, we limited our analyses to four assumptions (i.e. assumptions 5, 6, 8 and 10); however, in addition to those, we also disagree with the authors' straight-line movement assumption. The straight-line movement assumption is not supported by observations of salamanders on the ground and strict adherence to this assumption may result in unintended consequences during impact analysis. The model's authors state that evidence from their work in Monterey County supports the assumption of straight-line movements and therefore the incorporation of this assumption into the model. We have not reviewed Shaffer's raw data on salamander trapping in Monterey, but generally accept that on a landscape level, the salamanders do move in basically straight lines. However, applying the assumption directly to movements from individual ponds is a source of error that affects the impact and mitigation analysis. Like the model's authors, we maintained this assumption in the implementation of the model in order to make the calculations easier; however, our analysis shows that this oversimplification has significant consequences when assessing the value of the mitigation lands.

The major consequence of Shaffer and Searcy's straight-line movement assumption is that salamanders are not allowed to move around corners. Any development that blocks salamander movement is assumed to not only make the development area unsuitable as habitat, but the development area also creates a shadow effect that reduces or eliminates the habitat value of mitigation lands in the shadowed areas. Shadowed areas thereby reduce the overall value of lands that may be proposed for mitigation. Negating the value of lands in the shadow of development may make sense in certain circumstances, such as when the shadowed area is isolated from other natural lands that may support CTS (i.e., surrounded by unsuitable habitat or

development) or when there is no separation between the development area and the habitat areas (i.e., no barrier separating the development area from the habitat area). However, in cases where the shadowed area is contiguous with other natural open spaces that provide suitable habitat for CTS and where the development area can be isolated from the natural areas (i.e., installation of a barrier fence), negating the value of the shadowed areas artificially undervalues the mitigation lands.

Field observations confirm that tiger salamanders, when confronted with an obstacle in their path, will move along fences or solid barriers. In such cases, the animals move along the barrier until they are able to resume their previous direction. This movement behavior is the underlying basis for the effectiveness of drift fences and trapping arrays, techniques on which the Shaffer and Searcy studies are based. Salamanders that are caught in pitfall traps of a trapping array are not just the individuals that are on a straight-line trajectory for the trap. Traps also capture animals that encounter the drift fence between two traps, move along the fence and then fall into the first open trap that they encounter. At the scale of the pond as analyzed in the model, the straight-line distance assumption treats salamanders as if they immediately die once they encounter the developed areas. This may be the case for some development projects, but barriers can be built to prevent salamanders from entering developed areas. The Phase II landfill project proposes to create such a barrier around the landfill to prevent CTS from moving onto the landfill.

More importantly, the model's barrier assumptions fail to recognize the value of mitigation lands in the shadowed areas to CTS (see Figures 5 and 6). As an alternative to the straight-line assumption, the model could allow weighting in such a way to diminish the mitigation value of the lands that do not lie in a straight line from the ponds. Land that can be reached by making a less than 90-degree change in direction could be assigned a lower mitigation value than land accessible without change of direction. In GIS, a "cost distance," instead of a Euclidean distance function, could be incorporated in the GIS analyses to assess the added distance required to move around the edge of a barrier. Of course, there are practical limits to the degree of realism (and therefore complexity) that can be incorporated into models; however, the straight line constraint and scale at which the analysis is conducted as used by the model's authors undervalues the mitigation lands significantly and therefore is an inadequate tool for valuing mitigation lands directly.

4.3 ADOPTED CONSERVATION PLANS

4.3.1 Santa Rosa Plain Conservation Strategy

As noted previously, one of the few published mitigation guidelines for CTS are for the endangered Sonoma County DPS (U.S. Fish and Wildlife Service, 2005b). Applying the terms of the Conservation Strategy (U.S. Fish and Wildlife Service, 2005b) and Programmatic Biological Opinion (U.S. Fish and Wildlife Service, 2007) to the Phase II project, the mitigation requirement would be approximately 378 acres. This is far less than the mitigation proposed in

either the original MMP or revised mitigation proposal, Sections 1.4.1 and 1.4.2, respectively. On an upland acreage basis, the original mitigation plan would result in preservation of 1.4 times the acreage required under the Santa Rosa Plain Conservation Strategy and the revised mitigation proposal that includes the additional upland acreage on the southeastern portion of the Griffith Ranch results in 1.5 times the preserved uplands required under the Santa Rosa Plain Conservation Strategy and Programmatic Biological Opinion. We acknowledge that the Santa Rosa Plain Conservation Strategy and Programmatic Biological Opinion are part of a comprehensive, regional plan that has been developed to identify and eventually secure sufficient lands on the Plain to preserve and eventually recover the CTS population on the Santa Rosa Plain; however, on a project by project basis, applicants are not required to mitigate at ratios above 3:1 for impacts to this endangered population's habitat. Including both aquatic and upland habitats, the revised PHLF mitigation proposal results in 1.7 times the gross acreage required under the Santa Rosa Plain Conservation Strategy and the Programmatic Biological Opinion, and the parcels are all within movement distance of CTS from known breeding ponds.

4.3.2 East Contra Costa County Habitat Conservation Plan and Other Plans

As the most recently adopted regional habitat conservation plan in Northern California, the ECC HCP sets precedence for all subsequent regional plans in the area. The time and level of effort that goes into the plans from diverse stakeholders including federal and state agencies, cities, counties, and private landowners, ensure that the strategies and requirements adopted in the plans will form the basis for evaluation of all other such projects whether they are in the plans or not.

The revised mitigation proposal put forth by PHLF is consistent with the requirements of the ECC HCP and exceeds the straight developer contribution by 0.4:1. The revised proposal results in a mitigation ratio for tiger salamander upland habitat at about 3.4:1 which falls well into the mitigation requirements of the ECC HCP for a project that would have to "buy-into" the reserve fund. The PHLF mitigation plan therefore is consistent with the mitigation standards that the agencies are employing in cases where breeding and upland habitat for tiger salamanders is being lost.

Not only does the proposed mitigation meet the standards being used by the agencies that have responsibility for the conservation of this species, but the mitigation proposal also almost completely compensates for the impact to CTS habitat using the more rigorous model developed by Shaffer and Searcy.

4.4 OTHER CONSIDERATIONS

4.4.1 Peer Review of Model

We have worked through the implementation of this model and have found a number of assumptions that bias results and undervalue proposed mitigation lands. We consider this critical review of the model and its implications an essential part of model development, particularly if it

is proposed to the USFWS for direct calculation of mitigation requirements. However, this review primarily focuses on some of the basic biological assumptions and does not focus on the correctness or appropriateness of the parameter values or model functions used. Such a review would best be conducted in the peer-reviewed literature.

Prior to applying the preliminary model to actual regulatory management decisions and the calculation of project impacts and mitigation credits, it should be fully peer reviewed and verified including the basis for the functions used to determine the habitat value of lands around the ponds. We did not check the validity of these values but implemented them in GIS as presented. Given that these values were derived from a unique study area, Jepson Prairie, a relatively flat area with little topographic relief dominated by a large playa pool, additional confirmation of the values for CTS populations that inhabit hilly areas and breed in stock ponds should also be made. Some of the salamanders observed in a long term study in the Pittsburg area (Contra Costa County) made much longer movements than those reported for Jepson Prairie (Orloff, 2007) and the applicability of the functions used in the model may need adjusting to account for these differences in terrain and type of breeding sites. A thorough review of the model would help to refine the model and confirm its general applicability to all CTS populations.

In spite of its shortcomings and the need for additional development to incorporate a variety of CTS habitats, the model is a useful tool to estimate impacts and investigate mitigation proposals. The final determination of mitigation requirements, however, should not be based solely on model analyses but instead should be determined by a full consideration of the mitigation proposal by the responsible resource agencies. These decisions cannot be solely focused on a single species and must, under state and federal law and regulation, consider the consequences of these actions on other protected species and habitats as well as land use and protection policies.

4.4.2 Mitigation Ratios

Shaffer and Searcy state that their calculations are for a 1:1 compensation for lost habitat value (i.e., full compensation), and that the actual mitigation should be multiplied by 2 or 3 times. The rationale for typical mitigation ratios or multipliers used by regulatory agencies (i.e., 2:1 or 3:1) are also founded on the assumption of full compensation – the ability to increase the value of a specified piece of land through preservation and management actions to replace lost habitat values or populations of target species. Therefore, we assert that the appropriate use of the model is to estimate how well a mitigation proposal compensates for the lost habitat value and then compare that with established mitigation ratios for the gross acreage lost.

In the current case, nearly full compensation is achieved under the revised mitigation proposal when the value of the mitigation ponds are included in the model calculations and results in a gross acreage mitigation ratio of about 3.8:1 (mitigated:impacted habitats). Under the landscape analysis with mitigation ponds included in the calculations, both the original MMP and revised mitigation proposal more than fully compensate for the impacts of the Phase II expansion resulting in a surplus of credits. The overall mitigation ratio (3.8:1 [mitigated:impacted

habitats]) does not change under the landscape analysis because only onsite, preserved lands are included in the calculation of the ratio.

The USFWS typically has required a 3:1 ratio for impacts to CTS habitat. Projects where this 3:1 ratio have been applied include the Freeport Regional Water Projects, PG&E Gas Line Repair in Solano County, and PG&E Tri Valley Capacity Increase Project in Alameda County (Jones & Stokes, 2005). The revised mitigation proposal would exceed this by 0.7. Although 3:1 is typical as a mitigation ratio for project involving CTS, other projects have had lower mitigation ratios applied to them. Mitigation for the Vista Del Mar project in Pittsburg, Contra Costa County, included 404 acres of upland habitat mitigation for impacts to 202 acres of CTS upland habitat (2:1) (U.S. Fish and Wildlife Service, 2005a). The lower mitigation requirement for impacts to CTS habitat at the Vista Del Mar project site reflects the fact that CTS had not been observed on the site since about 2000. Also, the dam of the stock pond had been breached leaving no suitable breeding habitat on the site.

If we followed Shaffer and Searcy's suggestion and multiplied the mitigation values by 2 or 3 to one, mitigation for impacts near the pond would be up to 18:1. This is because the curve in Figure 4-1 in Airola et al. (2007) (also shown in Appendix A) has a mitigation ratio of 6:1 at the pond shoreline.

The model is particularly sensitive to pond placement in assessing the value of mitigation lands. Use of the model to directly assess mitigation requirements could conceivably result in situations where a minimum size area could be created based on optimal distance between created or preserved pools. In other words, the model could be manipulated to result in a smaller mitigation ratio than would be required under a straight ratio using gross acreages. By using the model as a tool to help design mitigation and evaluate its effectiveness, the model can be used to estimate if the habitat value is compensated and then the actual habitat mitigation acreage ratios can be negotiated with the agencies.

4.4.3 Applicability of Model to Other Projects

The goal of the model that Shaffer and Searcy present in the scientific review panel report is to provide a new biologically based evaluation of whether or not the proposed mitigation is sufficient to offset the proposed losses of habitat to CTS. They also argue that the model provides a strategy that uses the same mitigation index for both lands that will be lost and lands that will be gained through mitigation and that this allows for an evaluation of the gains and losses of each parcel in an unbiased, biologically meaningful way. However, as we have shown, the model results are extremely sensitive to the basic model assumptions, which are determined based partially on the authors' biased assumptions of the system.

In addition, it would be difficult to apply the model to every project that would potentially impact CTS habitat. For a project like the Potrero Hills Landfill Phase II expansion project, this type of analysis was possible because the applicant has proposed onsite mitigation in order to provide the greatest benefit of the proposed mitigation to the population of salamanders being

impacted. However, not all projects will be amenable to such analysis. In particular, projects that choose to mitigate the impact to CTS through the purchase of credits in a mitigation bank, cannot be subjected to an analysis such as was conducted for the Potrero Hills Landfill expansion.

Credits in a mitigation bank whether they are for CTS, Contra Costa goldfield, vernal pool crustaceans, or other species are pre-determined as part of the bank approval process. Unless the bank was subjected to the model analysis as part of the bank approval process, it would be difficult if not impossible to equitably establish the value of credits available for CTS mitigation in banks where credits have already been sold. In addition, as the model is highly dependent on the distribution of breeding ponds, there would be no equivalency of credits between banks and the number of credits an applicant would have to purchase would be dependent on the bank from which they purchased their credits. If a bank had ponds spaced close together, fewer credits would be required than at a bank whose ponds were spaced farther apart (but still within movement distances for CTS).

If the model cannot be applied to all projects and all mitigation proposals, then its utility to directly determine mitigation requirements is limited to those projects that have onsite mitigation and potentially establishes a complicated system where mitigation requirements vary depending on where and how the mitigation is accomplished. Some projects would be subject to the acre for acre analysis, while others may not. In order to avoid such a scenario, the model should be considered one of a variety of tools that may be used to determine mitigation requirements.

4.5 MISCELLANEOUS RECOMMENDATIONS

Unrelated to the model analysis, Shaffer and Searcy have made a number of recommendations regarding mitigation for the proposed project. For completeness, we take this opportunity to respond to these recommendations.

4.5.1 Barn Near Pond 5

We have recommended that the decrepit barn near Pond 5 remain untouched and that its structural elements be allowed to continue to collapse. This recommendation carries no additional commitment or benefit other than leaving the structure in place. No mitigation credit has been attributed to this recommendation. It has been our observation over the past 9 years that the barn and the boards that are strewn around the barn are used regularly each year for 3-4 months during which time adult and subadult CTS can readily be found under the boards. Whether these cover boards provide significant benefit to CTS migrating to or from the pond has not been established, but their use is not a rare event as the review authors contend. Leaving the boards and barn onsite does not minimize any mitigation requirement nor change the analysis of impacts. In fact, removal of the barn and boards during the winter or spring would likely result in mortality to salamanders that regularly use the boards and barn for cover. We therefore recommend that the barn be left alone.

4.5.2 Relocating the Landfill

The reviewers have also recommended that a way to avoid or minimize impacts to the CTS population would be to move the Phase II landfill to another parcel. This option has been investigated by the landfill and has been rejected for operational and economic reasons (The reader is referred to the Clean Water Act § 404(B)(1) Alternatives Analysis for a discussion of the economic justification for the siting of the Phase II expansion area (LSA and ESP, 2006b)). In order to operate a commercially viable landfill, the Company must have future capacity that is only met by the proposed project. In addition, within the Potrero Hills area, Highway 12 is designated as a Scenic Highway by the State. This designation protects the scenic corridor from encroachment of incompatible land uses, such as the landfill, from occurring within direct sight of the highway.

From a biological standpoint, relocating the landfill expansion to other parcels owned by the landfill would also impact CTS as well as other threatened and endangered species populations. Shaffer and Searcy recommended relocating the landfill to a "less central site that eliminates fewer currently occupied ponds." The least central of the Company-owned lands is the Director's Guild parcel located north of the Potrero Hills. If the Phase II landfill were placed on the Director's Guild parcel, such a placement would arguably minimize the impacts to CTS (the site is still within movement distance of one confirmed CTS breeding pond (Pond 1) and closer still to a second potential breeding pond located on the property directly south of the Director's Guild parcel), but would most certainly impact jurisdictional wetlands habitats and other endangered species and their habitat resulting in highly significant impacts to those species. Three, federally listed species, vernal pool tadpole shrimp, Conservancy fairy shrimp, and Contra Costa goldfields are documented to occur on the Director's Guild parcel and the parcel lies within the designated critical habitat for all three species.

Additional considerations in siting the landfill on the Director's Guild parcel include both regulatory and engineering considerations. There are over 60 acres of jurisdictional wetlands on the Director's Guild parcel, and placement of fill within those areas would be subject to jurisdiction under the federal Clean Water Act. As other Company-owned parcels, including the Phase II expansion area, would impact significantly less jurisdictional area, it is unlikely that the Director's Guild parcel could be permitted due to its large impact on jurisdictional wetlands (The reader is referred to the Clean Water Act § 404(B)(1) Alternatives Analysis for a discussion of the justification for the siting of the Phase II expansion area (LSA and ESP, 2006b)). From an engineering perspective, the high ground water levels on the Director's Guild parcel make it doubtful that a landfill can be successfully engineered and constructed at this location within the California disposal site regulatory climate. In addition, there would be no liner or cover soil available on the site, which is a major factor in the selection of a feasible landfill. Given these

various considerations, PHLF determined that the most viable location for the Phase II landfill is in the Potrero Hills Valley[7].

4.5.3 Rodent Control

The review authors have recommended that rodent control be eliminated on the mitigation lands. This is consistent with the MMP (MMP Section 7.1.3).

4.5.4 Monitoring

We agree with the reviewers' recommendation that monitoring is an essential part of the mitigation program. The monitoring schedules will be determined in consultation with the various permitting agencies to monitor performance criteria for the various resources. Monitoring will occur throughout the life of the project and beyond and will be paid for through the endowment provided by the Company.

4.5.5 Salamander Barrier

The review authors' recommendations for the design of the salamander barrier are noted and will be considered in the design of the barrier fence. The final design will be submitted for approval to the USFWS.

[7] It should also be noted that when planning for the landfill expansion began, the Director's Guild parcel was not owned by the landfill and therefore not considered. The parcel was later purchased for its exceptional biological resource and conservation value and incorporated into the mitigation plan.

5.0 CONCLUSIONS

The Shaffer and Searcy model is a still developing tool for evaluating certain types of projects where CTS habitat is impacted; however, the model cannot be considered a universal tool to directly assess mitigation requirements for impacts to CTS habitat. The model should be peer reviewed to ensure that the values used to calculate the mitigation curves are correct and additional field data from sites throughout the species range where the primary breeding habitat is composed of stock ponds rather than natural vernal pools should be incorporated into the model to ensure its broad applicability to the variety of habitats that CTS inhabit. In its current usage by the model authors, the model creates an overly simplified situation that undervalues mitigation lands for CTS and could have unintended consequences that would negatively impact CTS populations.

In spite of the fact that the model has yet to be fully developed, application of this early version of the model to the Phase II expansion project does provide insight into the proposed mitigation, particularly when the assumptions are modified to examine their effects on the model results. For example:

- Created ponds are an essential component of the mitigation plan. Inclusion of the created ponds in the calculation of mitigation credits results in significant value to CTS habitat. In fact, analysis of the Company's revised mitigation proposal shows that the habitat value lost due to the Phase II expansion is almost completely compensated under this plan. Creating mitigation ponds for CTS is not an experimental mitigation method; therefore, modifications to this assumption are viewed as appropriate. Constructed pools must have adequate hydroperiod and a sufficient watershed to support the ponds, which hydrologic analysis of the PHLF MMP shows is sufficient.

- Neither the impacts to upland habitat, nor the value of mitigation lands to offsite ponds is evaluated in the model developed by Shaffer and Searcy. By modifying the scale at which the model is applied, the value of the mitigation lands to CTS that may breed in offsite ponds can be examined. Analysis of the mitigation lands at the landscape level show that the value to CTS that breed in offsite ponds is considerable, reducing the Phase II project habitat value deficit by about 48 percent. If the model is used to determine mitigation directly, as proposed by Shaffer and Searcy, it undervalues the lands on a landscape level. Undervaluing of the mitigation lands at the landscape level could also have the unintended consequence of giving no credit to a portion of a parcel that only has value to an offsite pond. These areas could be mistakenly interpreted as being available for development, when they actually have high habitat value for offsite ponds.

- When the proposed mitigation for the Phase II expansion area is analyzed on a landscape level and the additional habitat value generated by mitigation ponds also is included in the analysis, both the original and revised mitigation proposals more than fully compensate for impacts from the proposed Phase II expansion.

The revised mitigation proposal would have the following components:

- Preservation of upland habitat totaling 565.29 acres on the Southern Hills, Pond 5 Buffer, Griffith Ranch, and Director's Guild parcels,

- Preservation of 0.79 acres of existing CTS breeding pond and 8.83 acres of potential breeding pond habitat on the Southern Hills, Pond 5 Buffer, and Director's Guild parcels (9.62 acres total),

- Creation of an additional 1.08 acres of breeding pond the Southern Hills (1 pond) and Griffith Ranch (2 ponds) sites, and restoration of 0.42 acre of potential breeding pond in the playa pool on Director's Guild,

- Preservation of 5.52 acres of seasonal wetland on the Southern Hills and Griffith Ranch parcels, and 53.10 acres on the Director's Guild parcel,

- Creation of 4.07 acres of seasonal wetlands on the Griffith Ranch parcel,

- Preservation of 1.86 acres of waters of the U.S. on the Southern Hills and Director's Guild parcels, and

- Creation of 1.80 acres of waters of the U.S. on the Griffith Ranch and Director's Guild parcels.

On a gross acreage basis, the revised PHLF mitigation represents a 3.8: 1 mitigation ratio (upland and wetland acreage combined). This ratio meets and exceeds the mitigation requirements for other projects where the USFWS have applied a 3:1 ratio. In comparison, the revised PHLF mitigation proposal provides 1.5 times greater upland habitat mitigation, on an acreage basis, than what would be required for the Sonoma County DPS under the Santa Rosa Plain Conservation Strategy (U.S. Fish and Wildlife Service, 2005b) and Programmatic Biological Opinion (U.S. Fish and Wildlife Service, 2007) and well within the range of mitigation required by developers under the ECC HCP. Furthermore, the PHLF mitigation proposal results in a mitigation ratio that is 0.4:1 greater for impacts to tiger salamander upland habitat than required in the other conservation plans such as those adopted in East Contra Costa County and San Joaquin County.

Considering that under the model analysis, the revised mitigation proposal nearly fully compensates for the impacts from the Phase II expansion project, and meets the standards for mitigation currently being used by the resources agencies, the revised PHLF mitigation proposal

should be considered appropriate and adequate mitigation for the Phase II impact. Further justification for accepting the proposed mitigation as sufficient for the Phase II impact comes from the combined landscape model analysis including mitigation (created) ponds. When the costs and benefits of the proposed project is considered on the landscape level, the level at which CTS experience the habitat, according to the model, both the original MMP and revised mitigation proposal more than fully compensate for impacts from the proposed Phase II expansion.

Multipliers of the model values, as recommended by the model authors, would result in a far greater mitigation ratio being applied to this project than has been approved for any other project. The multipliers are already included in the model; therefore no additional multiplier should be required.

This page left blank.

6.0 REFERENCES

Airola, D., P. C. Muick, H. B. Shaffer, C. Searcy, W. D. Shuford, and A. Solmeshch. 2007. Scientific Panel Review of Biological Resource Impacts and Proposed Mitigation for the Potrero Hills Landfill Phase II Expansion. Prepared for Bay Conservation and Development Commission. Prepared by Airola Environmental Consulting, Sacramento, CA.

Gurney, W. S. C. and R. M. Nisbet.1998 *Ecological Dynamics*. Oxford University Press New York.

Jones & Stokes. 2005. California Tiger Salamander Mitigation Review for Seven Vines Project. Prepared by Jones & Stokes, Inc., Sacramento, CA. 8 pp.

Jones & Stokes. 2006. Final East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan. October (J&S 01478.01). Prepared for East Contra Costa County Habitat Conservation Plan Association. Prepared by Jones & Stokes, San Jose, CA.

LSA and ESP. 2006a. Mitigation and Monitoring - Plan Potrero Hills Landfill Phase II Expansion, Solano County, Corps. File No. 26024N. Prepared for Potrero Hills Landfill. Prepared by LSA Associates, Inc. and Environmental Stewardship and Planning, Pt. Richmond, CA. 64 pp. + appends.

LSA and ESP. 2006b. Section 404(B)(1) Alternatives Analysis, Potrero Hills Landfill Expansion Project. Prepared for Potrero Hills Landfill, Inc. Prepared by LSA Associates, Inc. and Environmental Stewardship and Planning, Inc., Pt. Richmond, CA. 48 pp. + appends.

Orloff, S. 2007. Migratory Movements of California Tiger Salamander in Upland Habitat – A Five–Year Study Pittsburg, California. Prepared for Bailey Estates, LLC. Prepared by Ibis Environmental, Inc., San Rafael, CA. 47 pp. + appends.

Potrero Hills Landfill. 2007. Project Description - Potrero Hills Landfill Phase II Expansion Project, Bay Conservation and Development Commission Marsh Development Permit MD-88-09. Prepared for Bay Conservation and Development Commission. Prepared by Potrero Hills Landfill, Inc., Richmond, CA. 63 pp.

Shaffer, H. B. and C. Searcy. 2007. Unpublished data, which augments data from Trenham and Shaffer 2005.

Solano County Water Agency. 2007. Solano Multispecies Habitat Conservation Plan (Working Draft 2.2). Prepared by Solano County Water Agency, Vacaville, CA.

Swanson Hydrology. 2007. Draft Hydrologic Report, Wetland Mitigation Plan Potrero Hills Landfill - Phase II Expansion Technical Study, Solano County, California. Prepared for Potrero Hills Landfill, Inc. Prepared by Swanson Hydrology and Geomorphology, Santa Cruz, CA. 42 pp. + appends.

Tilman, D. and Kareiva, P, (Ed). 1997. *Spatial Ecology: The Role of Space in Population Dynamics and Interspecific Interactions*. Princeton University Press. Princeton, New Jersey.

Trenham, P. C., H. B. Shaffer, W. D. Koenig, and M. R. Stromberg. 2000. Life history and demographic variation in the California tiger salamander (*Ambystoma californiense*). Copeia. 2000 (2): 365-377.

Trenham, P. C. and H. B. Shaffer. 2005. Amphibian Upland Habitat Use and its Consequences for Population Viability. Ecological Applications. 15 (4): 1158-1168.

U.S. Fish and Wildlife Service. 2005a. Formal Endangered Species Consultation and Critical Habitat Conference on the Proposed Vista Del Mar Project (previously known as Alves Ranch), City of Pittsburg, Contra Costa County, California (Corps File #27934S). Report No.: USFWS # 1-1-04-F-0074. Prepared for U.S. Army Corps of Engineers, Regulatory Branch, San Francisco District. Prepared by U.S. Fish and Wildlife Service, Sacramento, CA.

U.S. Fish and Wildlife Service. 2005b. Santa Rosa Plain Conservation Strategy Final. Prepared by Santa Rosa Plain Conservation Strategy Team, Sacramento, CA. 62 pp. + appends.

U.S. Fish and Wildlife Service. 2007. Programmatic Biological Opinion (Programmatic) for U.S. Army Corps of Engineers (Corps) Permitted Projects that May Affect California Tiger Salamander and Three Endangered Plant Species on the Santa Rosa Plain, California (Corps File Number 223420N). Report No.: USFWS # 81420-2008-0261. Prepared for U.S. Army Corps of Engineers, Regulatory Branch, San Francisco District. Prepared by U.S. Fish and Wildlife Service, Sacramento, CA. 42 pp. + enclosures.

7.0 REPORT PREPARATION

7.1 LSA ASSOCIATES, INC.

Timothy Lacy, LSA Project Manager/Wildlife Biologist
Greg Gallaugher, GIS Specialist
Steve Foreman, Principal in Charge/Wildlife Biologist
Rebecca Doubledee, Wildlife Biologist

7.2 ENVIRONMENTAL STEWARDSHIP AND PLANNING, INC.

Steve Peterson, Principal in Charge/Project Planner
Amanda Rose, Senior Associate
Krysty Emery, Associate

This page left blank.

APPENDIX A

METHODOLOGY FOR CALCULATING THE DISTANCE CURVE OF PROPOSED MITIGATION RATIOS

Figure 4-1 from Chapter 4 of Airola et al. (2007)

This page left blank

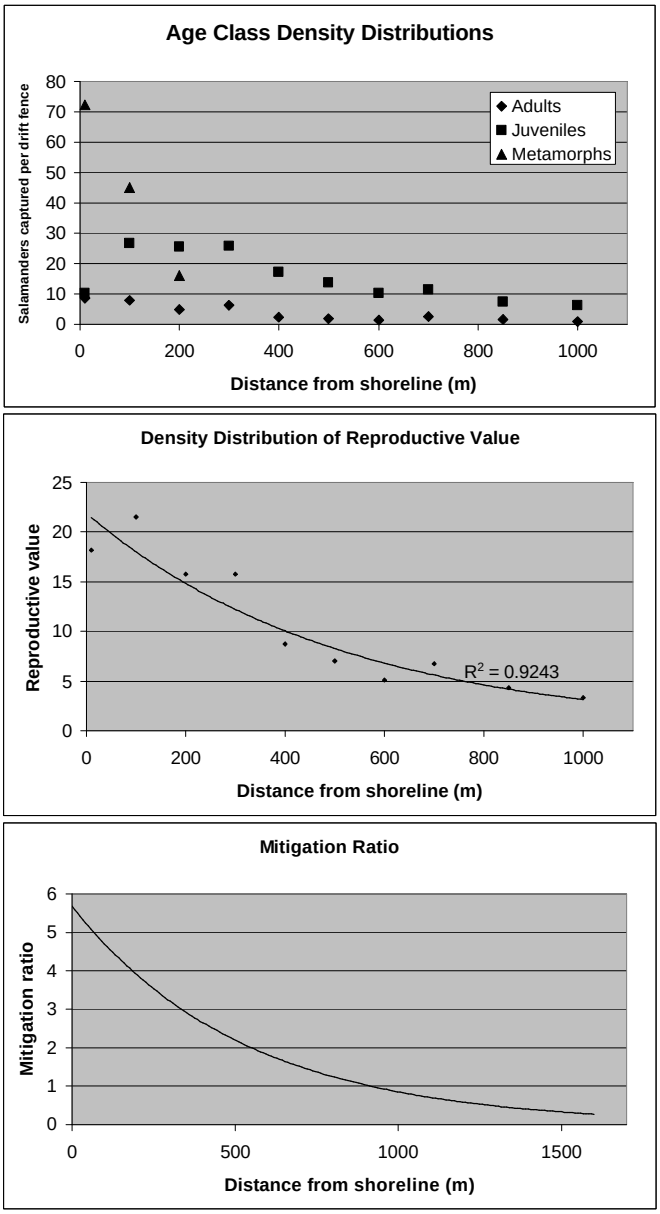


Figure 4-1. Methodology for Calculating the Distance Curve of Proposed Mitigation Ratios. Calculations are based upon the density distributions of the three age classes (metamorphs, juveniles, and adults) captured at Olcott Lake, Solano County during the 2005–2006 wet season (top panel). These density distributions were then weighted by multiplying them by their relative probabilities of reaching maturity (i.e., metamorph = 0.08, juvenile = 0.37, adult = 1.0) and added them together to give the density distribution of reproductive value (middle panel). This density distribution shows the relative value of land at different distances from the shoreline in contributing to maintenance of the salamander population. A curve of mitigation ratios (bottom panel) was generated with the same shape as the density distribution of reproductive value, so that land at various distances from the shoreline of a breeding pond have the same relative values as mitigation habitat for a salamander population. The magnitude of this curve is such that if one had to mitigate for all of the land within 1 mile (1.6 km) of a breeding pond, it would require the same amount of land as would be required with a 1:1 mitigation ratio applied to all lands within 1 mile of a breeding pond. (Figure taken from Chapter 4 of Airola et al. [2007])

This page left blank

APPENDIX B

LIST OF ACRONYMS

This page left blank.

Acronym	Definition
BCDC	Bay Conservation and Development Commission
CDFG	California Department of Fish and Game
Corps (of Engineers)	U.S. Army Corps of Engineers
CTS	California tiger salamander
DPS	Distinct Population Segment
ECC HCP	East Contra Costa County Habitat Conservation Plan
ESP	Environmental Stewardship and Planning, Inc.
GIS	Geographic Information System
GMP	Grassland Management Plan
GR1	Griffith Ranch Pond 1
GR2	Griffith Ranch Pond 2
HCP	Habitat Conservation Plan
LSA	LSA Associates, Inc.
MMP	Mitigation and Monitoring Plan
PHLF	Potrero Hills Landfill
USFWS	U.S. Fish and Wildlife Service

This page left blank.