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December 18, 2014

Clerk of the Board
California Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, CA 95812-2815

Climate Wedge Comments on the June 20, 2014 Updated Informal Discussion Draft-- ARB Compliance Offset Protocol for Rice Cultivation

Dear Clerk of the Board,

Please find attached our client Climate Wedge's comments on the June 20, 2014 Updated Informal Discussion Draft --ARB Compliance Offset Protocol for Rice Cultivation. We submitted these comments on behalf of Climate Wedge on June 30, 2014 and are resubmitting them today as technical comments.

Regards,

Richard M. Saines

Richard Saines
Partner
312-261-2835
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Via Electronic Filing

June 30, 2014

Yachun Chow (ychow@arb.ca.gov)
California Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, CA 95812-2815

Climate Wedge Comments on the June 20, 2014 Updated Informal Discussion Draft - ARB Compliance Offset Protocol for Rice Cultivation

Dear Ms. Chow,

We are submitting comments on behalf of our client, Climate Wedge LLC, to urge the California Air Resources Board (ARB) to **include rice straw removal after harvest (also known as baling) as an eligible activity** under the proposed ARB Compliance Offset Protocol for Rice Cultivation (Draft Protocol). As you know, Climate Wedge has been actively involved in the compliance protocol process, including submitting comments on the March 14, 2014 version of the Draft Protocol and participating as a member in the Rice Protocol Technical Working Group. We strongly believe that ARB should include baling in the Draft Protocol as it would: (i) materially improve the greenhouse gas benefits of the Draft Protocol; (ii) make the Draft Protocol much easier to scale for purposes of attracting private sector investment; (iii) enhance the habitat for a number of waterbird species and result in no significant impact under CEQA; and (iv) result in a more sustainable utilization of scarce water resources in California.

We applaud ARB's continuing leadership in the development of this important and highly anticipated Draft Protocol. If adopted with the inclusion of baling as an eligible activity, the Draft Protocol could lead to significant reductions in methane emissions from the rice cultivation sector and be a model for others to follow. The Draft Protocol, with baling activities included, would also support cost-effective compliance with the cap-and-trade targets by encouraging greater farmer participation and private sector investment in offset projects created thereunder because such projects would be more likely to yield a sufficient volume of offset credits to support such investment. Baling would also allow for more sustainable utilization of precious water resources in the State, as a field that is baled can be effectively flooded using substantially less water than an unbaled field. Without baling, we have serious reservations that the Draft Protocol will

be successful in achieving any of these important goals. It would forego significant in-State greenhouse gas emission reductions to help reduce compliance costs, not likely attract meaningful investment from the private sector based on the emission reductions achievable merely through dry rice seeding and/or early drainage activities alone, and miss a real opportunity to make an important contribution in reducing water consumption throughout the State.

We understand that baling was removed from the initial discussion draft of the Draft Protocol over ARB's concerns on the potential impacts to migratory waterbirds that currently rely on winter flooding of rice fields for certain habitat needs. In our prior comments filed on April 1, 2014, we stated that we were concerned about the scientific robustness of the Point Blue Conservation Science report entitled "*Assessing the Environmental Trade-offs of Greenhouse Gas Emission Reduction in California's Rice Fields: The Effect of Baling on Waterbird Use of Winter Flooded Rice Fields, Interim Sub-Report.*" (Point Blue Report) We also stated that we would further investigate this matter and report our findings back to ARB.

Two separate well established and highly regarded wildlife ecologists, Joe Drennan and Tamara Klug, reviewed and critiqued the Point Blue Report. We attach to our comments the findings and reports from these wildlife ecologists along with their curriculum vitaes as Exhibits A and B, respectively (collectively, the Ecologists' Reports). In short, the Point Blue Report should not be relied upon by ARB in setting important policy, including regarding the eligibility of baling under the Draft Protocol. The Point Blue Report is replete with statistical and methodological flaws to point of being wholly unreliable as a basis for policy decision making.

Separately, Ms. Klug further considered the science behind the current mix of rice cultivation practices in California and the wide and varied number of waterbird species that utilize the winter flooded rice fields for habitat as part of their annual migration. It is clear that there are numerous bird species that migrate through California each year. It is also clear that different species have different habitat needs. Not all of the ideal habitat conditions exist with the predominant current practice of deep flooding depths for post harvest rice fields. In fact, many species of waterbirds that migrate through California each year prefer shallower flood depths to meet their habitat needs than those required to decompose the rice straw where such straw is not removed from the field after harvest. Where baling occurs post harvest, the level of flood depth (and water used for such purpose) can be much lower. Thus, contrary to the Point Blue assertions and based on well established principles derived from peer reviewed literature, ***including baling activities under the Draft Protocol would actually enhance the habitats for a number of waterbird species***. (*See* Exhibit B for an in depth discussion on this point).

We also recognize ARB's concern over habitat loss due to the potential for no flooding of post harvest rice fields that have been baled. We concur that if baling were included as an eligible activity and a substantial number of rice fields shifted from flooding to no flooding, that could have a negative impact on certain waterbirds. Accordingly, we

propose herein that baling be included as an eligible activity under the Draft Protocol provided that each project demonstrates that its baled field was also flooded post harvest in accordance with the California State Office of the USDA's Natural Resources Conservation Service program entitled Wetland Wildlife Habitat Conservation Practice 644 (USDA's Practice 644 Procedure) (attached as Exhibit C). By making the post harvest flooding of baled fields in accordance with a well established procedure part of the eligibility criteria, it completely removes ARB's stated primary concern over habitat loss. Moreover, as Ms. Klug's Report (Exhibit B) shows, **increased baling with flooding would improve the habitat for a large number of waterbird species and have no significant impact for CEQA purposes**.

SUMMARY OF COMMENTS

1. Baling is a very important activity to include within the Draft Protocol because it represents a substantial portion of the greenhouse gas reduction potential as well as the most likely means to attract private sector investment into eligible offsets from the Draft Protocol. It also will help to more effectively manage water consumption and help secure increasingly scare water supplies in the State. Without baling, the underlying greenhouse gas reductions to be achieved and the commercial viability of the Draft Protocol are questionable.

2. Including baling would not negatively impact waterbirds in California. To the contrary, it would enhance the habitat for a number of waterbird species and should result in no significant impact under CEQA.

3. The Point Blue Report is fundamentally flawed and as such is an imprudent basis for ARB to determine whether to include baling activities under the Draft Protocol.

RECOMMENDED BALING LANGUAGE[1]

For the reasons set forth in these comments, including Exhibits A, B and C attached hereto, we urge ARB to include baling activities with the assurance that the baled fields would be flooded in accordance with USDA's Practice 644 Procedure. Our suggested language is as follows:

Insert the following definitions:

> *(1) "Baling" is the collection, compression and binding together of rice straw into bundles after the removal of rice grain and husks during harvest.*
>
> *(2) "Rice straw" is an agricultural by-product, i.e. the dry stalks of rice plants, that remain after the grain and husks have been removed during harvest.*

[1] Please note that our proposed language would also require various technical changes to certain sections of the Draft Protocol that are not reflected in these comments.

(3) *"USDA Practice 644" is the procedure adopted by the California State Office of the United States Department of Agriculture's Natural Resource Conservation Services entitled Wetland Wildlife Habitat Management Conservation Practice 644 Job Sheet, available at ____.*

(4) *"Low intensity flooding" is the procedure specified as such in the USDA Practice 644.*

Insert a new Section 2.4 as follows:

2.4 Rice Straw Removal Activities

This protocol applies to rice cultivation projects that remove rice straw from rice fields after harvest and before winter flooding, resulting in the reduction of methane that would otherwise be released into the atmosphere if the rice fields were solely flooded to decompose residual material. Rice straw removal and management may include baling and other collection methods.

(a) For rice straw removal activities, low intensity flooding must be done in accordance with USDA Practice 644.

(b) The management records specified in appendix A for the baseline period for rice fields implementing rice straw removal activities must be available.

While we feel strongly that ARB currently has a proper basis to include baling activities in the Draft Protocol, to the extent that ARB remains concerned about potential waterbird impacts from including baling, we would urge ARB to include the operative language above regarding baling in the Draft Protocol, but make any ARBOC issuance from such activity contingent on the Board further approving an environmental review under CEQA for baling activities. Therefore, as an alternative proposal, we would urge ARB to include the following language in addition to the baling language above:

"(c) ARBOCs cannot be issued for rice straw removal activities until there is a Board-approved environmental review for such activities under CEQA, including a review of impacts to waterbirds."

If deemed necessary by ARB, the above alternative proposal would allow for additional time to consider the waterbird impacts without requiring a formal amendment to the Draft Protocol to be undertaken in the future. ARB has employed a similar approach regarding carbon capture and storage provisions under the cap-and-trade program. (*See* § 95852(g))

We look forward to continuing to engage with ARB on the development of the Draft Protocol and would welcome the opportunity to further discuss our comments on the Draft Protocol at your convenience. Both Mr. Drennan and Ms. Klug are also available to discuss any questions ARB may have regarding their Reports.

Attached hereto are the following:

1. Drennan, J., *Technical Review of the Effects of Baling Rice Straw on Migratory Waterbird Use of Winter Flooded Rice Fields in California,* Garcia and Associates, June 30, 2014 memorandum.

2. Klug, T. & Simpson, K., *Rice Straw Baling Effects on Waterbirds*, CardnoEntrix, June 30, 2014 memorandum.

3. California State Office of the United States Department of Agriculture's Natural Resource Conservation Services, Wetland Wildlife Habitat Management Conservation Practice 644 Job Sheet, January 2013.

All of these attachments are incorporated herein and are an integral part of these comments. We will also continue to review materials and ensure that additional supporting materials are made part of the official administrative record in this proceeding.

Yours sincerely,

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Enclosures

Cc: Rajinder Sahota
California Air Resources Board

Greg Mayeur
California Air Resources Board

Holly Stout
California Air Resources Board

Exhibit A

Drennan, J., *Technical Review of the Effects of Baling Rice Straw on Migratory Waterbird Use of Winter Flooded Rice Fields in California,* Garcia and Associates, June 30, 2014 memorandum.

Garcia and Associates
2601 Mission St., Suite 600
San Francisco, CA 94110
Phone: (415) 642-8969
Fax: (415) 642-8967

Date: June 30, 2014

To: Richard M. Saines, Principal
Baker & McKenzie LLP

From: Joe Drennan

Re: Technical review of the effects of baling rice straw on migratory waterbird use of winter flooded rice fields in California

On behalf of Climate Wedge LLC and Baker & McKenzie LLP, Garcia and Associates (GANDA) was requested to perform a technical review of the Point Blue Conservation Science (PBCS) "Interim Sub-report—Assessing the environmental trade-offs of greenhouse gas emission reduction in California's rice fields: The effect of baling on waterbird use of winter flooded rice fields" (2013; hereafter "report"). The goal of this technical review was to provide an analysis of the report, including a critique of its design, field methodology, and statistical analysis.

In addition, this review examines the validity of the conclusions presented in the report, and answers specific questions regarding these conclusions.

Overview

The report's stated goal is to "assess . . . the effects of baling on waterbird use of [flooded] rice fields during the winter." To perform this assessment, the researchers at PBCS conducted opportunistic winter waterbird surveys in flooded rice fields, in which straw had been removed (baled) or left behind (non-baled). Based on the observations of this report, some waterbirds appear to prefer non-baled rice fields over baled rice fields. However, several problems in the report's design, execution, and analysis compromise the validity of this conclusion.

Study Design

The methods in this report are presented as a statistically rigorous protocol; however, there are basic flaws in terminology and study design that undermine this assertion. The misapplication of the word "treatment" is at the heart of this issue. The term "treatment" indicates that all fields were in the same condition at the outset, and that treatments were applied in a statistically robust, randomized, and consistent way across all sites. In fact, this does not appear to be the case: the presented "treatment" is a grouping of plots in which similar, yet unquantified, farming techniques were practiced. No "control" was included, to which the treatments could be

compared. As a result of these problems with the study design, no result can be attributed to the so called treatment.

The report also contains a basic misunderstanding of the sample unit. The report considers the individual paddy to be the sample unit. In fact, the sample unit should be the "survey visit." For the type of statistical analysis performed in this report, the sample units must be independent of each other. In this report the paddies within a field are not independent of each other due to myriad covariates including their proximity to one another, water depth, surrounding landscape features (i.e. proximity to refuges, hunting areas, etc.). Because the report misinterprets this sample unit, it cannot account for the many other factors (or covariates) that may have caused the variation in waterbird use among the rice fields. If the study had measured all the variables that likely affect bird abundance and distribution, an entirely different conclusion may have been reached. However, in limiting their understanding of the differences among sites to the 'baled rice treatment', that single factor is, by default, the only variable that could explain the differences.

The farms sampled were "opportunistically contacted" (i.e. a convenience sample) rather than randomly selected. Valid inference cannot be made from a convenience sample because the participating farms may differ from non-participating farms. Since the farms were not randomly selected from all rice farms in the study area, inferential statistics are not appropriate. Conclusions based on this study are only relevant to the 24 farms that were surveyed and cannot be extrapolated to all rice farms in the northern Sacramento Valley, as would be the case if they were a truly random sample.

There are many missing details in how the farms were sampled. The report states the number of farms surveyed during years one and two and the number of survey points, but does not state the number of fields surveyed at each farm, the number of paddies surveyed in each field, how many (if any) farms were surveyed both years, or whether all farms were surveyed on the same day. This lack of basic information limits a reviewer's ability to independently assess the results. The lack of detailed information also precludes repeating the study to verify the results, a practice that is a basic standard of scientific research. If a study cannot be repeated because of lack of details on the methodology, then the conclusions cannot be considered meaningful.

Variation among sites are not considered in this study, yet there were likely considerable differences within each "treatment" which may have led to significant within-group differences. Both baled and unbaled fields may have been subject to chiseling, disking, or other combinations of straw/soil manipulations prior to flooding, as described in Elphick et al. (2010). Fields may have been left for long or short periods prior to flooding, in turn allowing varied levels of rice grain decomposition (Nelms and Twedt 1996) and exposure to foraging flocks of terrestrial granivores (e.g. sparrows and finches; Lourenço and Piersma 2008). Though species richness has been shown to vary significantly with water depth and paddy size (Elphick and Oring 2003), neither of these variables was accounted for, and differences in these were not recorded in sample sites. Impacts due to soil manipulation and pre-flooding straw may significantly alter the availability of both plant matter and invertebrates, and their avian predators (Elphick et al. 2010).

Landscape-level variables were also not evaluated in this study. Management practices in surrounding areas may play a role in species presence and densities at survey sites. Differences between agricultural or conservation regimes across the surrounding landscape are not presented. Nor did the report state whether farms were situated near hunting areas, or overlapping with

them. Hunting may itself account for some variation in distribution of waterbirds in the study area. For example, in the Sacramento Valley, northern pintails generally spend daylight hours in wildlife refuges and feed in rice fields at night (Miller 1985). However, no such landscape-level information is given.

Analysis

There are several issues of concern in the analysis section of this report. The values of the mean density estimates and 95% confidence intervals (CI) are not sufficiently presented (Figure 2). They should be presented in tabular form, which is a more explicit and easily interpreted representation. Also, the use of non-overlapping CIs to establish significant differences is not a valid approach. Overlapping CIs do not always indicate non-significance. In addition, comparing "baled" and "non-baled" groups using a two-sample 95% CI ignores a multitude of potentially important explanatory variables such as water depth, preflooding treatment (i.e. disking, chiseling or rolling), duration of flooding (i.e. how long field has been flooded), proximity to wildlife refuges, etc. The inclusion of these explanatory variables would likely lead to a more refined understanding of the factors affecting bird distribution.

While the analysis attempts to determine statistically significant differences between rice fields, it omits any biological analysis of the data. The most glaring detail that is not discussed is the actual densities of waterbirds observed. For dabbling ducks and shorebirds, the mean density (birds per hectare) at non-baled fields for the two years of survey data is approximately five birds per hectare. This is an extremely low density suggesting that most of the study area supported low numbers of waterbirds. For a comparison, Elphick and Oring (2003) recorded mean densities of waterbirds at flooded rice fields during the winters of 1993-1994 and 1994-1995 at approximately 20 per hectare.

Study Species:

We find three issues with the avian species presented in the report. First, species are grouped into taxonomic guilds instead of ecologically-based groupings or the individual species level. Second, each guild includes species with extremely low and statistically insignificant representation throughout the study area. Finally, the report omits multiple species for which abundant representative individuals were likely present during surveys, for which post-harvest rice field management is consequential. All of these issues present problems in analysis that are described below.

Taxonomic guilds:

From a general cataloging perspective, the grouping of bird species into taxonomic guilds makes some sense, especially when taxonomic groupings have an ecological basis. However not all groups reflect this grounding. In some guilds, the ecologically significant differences between species were blurred, which resulted in unfounded generalizations.

While several species in the dabbling duck guild were present in higher densities in non-baled fields, the results from the other two guilds were less conclusive. Dabbling ducks as a whole occupy a similar niche, exploiting a combination of vegetation, aquatic insects, and mollusks, which may or may not be present in higher concentrations in non-baled fields.

However, as the authors themselves acknowledge, the long-legged wader guild is a less straightforward grouping. This guild includes generalist predator species (great blue heron, with

a diet of fish, frogs, rodents, table scraps), more specialized predators (white-faced ibis: aquatic invertebrates, insects), and an opportunistic omnivore species (sandhill crane: aquatic invertebrates, insects, grains, plants, etc.) (Poole 2005). By varying degrees, each of these species utilizes a different part of the landscape. In grouping these different species together, inferences of one species may be blurred by the behaviors of another. The results presented in Table 1 bear this out: all of the egret and heron species appear to have non-significant variation in use of baled versus non-baled fields. White-faced ibis appear to prefer baled fields, while sandhill cranes prefer non-baled fields. The authors wrestle with these disparate numbers, but besides attempting to remove the "anomalous" ibis group, cannot satisfactorily account for differences in numbers.

A similar problem is present in the shorebird guild. The high numbers of least sandpiper, dunlin, and dowitcher species (and to a lesser degree greater yellowlegs, long-billed curlew, and Wilson's snipe) in non-baled fields allow the authors to claim a shorebird preference for non-baled fields in spite of ambivalent (killdeer, black-bellied plover), or opposite (black-necked stilt) trends of other shorebird guild species.

Rather than lumping potentially dissimilar species together, the report could have arrived at more explicit (and biologically valid) conclusions regarding effects of rice baling if it considered species individually.

Inclusion of species with low representation:

This issue is related to the above question of analysis at a guild level, rather than at the species level. It does not make sense to conclude that Eurasian wigeon (*Anas penelope*) prefers non-baled fields (n=2), any more than to say that wood ducks prefer baled field (n=1). Inclusion of individual vagrant observations (sanderling, n=1) is not statistically valid. There is also no biological basis for the inclusion of a coastal species such as sanderling in an analysis of Sacramento Valley rice field management.

Omission of ecologically important species:

The report leaves out several species that would be expected to be observed and would be relevant to the report. Notable absentees include:

- Canada goose (*Branta canadensis*)
- Greater white-fronted goose (*Anser albifrons*)
- Ross's goose (*Anser rossii*)
- Snow goose (*Chen caerulescens*)
- American avocet (*Recurvirostra americana*)
- American coot (*Fulica americana*)
- Common moorhen (*Gallinula chloropus*)

Why such ecologically important species are omitted from this report is not apparent. The Sacramento Valley plays host to hundreds of thousands of geese each winter, many of them known to utilize flooded rice fields (Ely and Dzubin 1994; Elphick and Oring 1998; Mowbray et al. 2002). During both years of the report's two-month survey window, bird counts in the Sacramento National Wildlife Refuge Complex Waterfowl Survey documented vast flocks of these species across the Sacramento Valley. For December 2011 through January 2012, 1,167,189 geese (four species), and 295,314 American coot were counted (USFWS 2012).

During that same window from 2012 to 2013, 1,265,790 geese (four species) and 347,597 American coot were counted (USFWS 2013). With such relative abundance, it is hard to believe that no geese or coots were observed at any time during the surveys conducted for this report. Without the inclusion of these most common and abundant wintering waterbird species in this report, no valid conclusion about the role of rice baling effects on waterbirds can be made.

Conclusion

The report presents the effects of post-harvest management of rice fields on both greenhouse gas (GHG) emissions and avian populations in an oversimplified manner, which grossly undervalues the complexity of the issue. Flaws in report design and analysis, and the exclusion of ecologically significant species, contribute to invalidate the report's findings. In the end, the conclusions pertaining to avian use of baled versus unbaled fields were only moderately supported by the data. False assumptions, inadequate study design, and poor execution serve to undermine these conclusions at every step, and in our analysis call into question the findings.

Based on the above analysis, the following questions can be addressed:

1. *Is the variation in waterfowl use of flooded California rice fields (with and without rice straw) explained in the PBCS report by an adequate examination of the variables involved?*

   No. The report did not control for a variety of variables that could have confounded these results (e.g. straw/soil manipulations prior to flooding, water depth, timing of flooding, paddy size, land use of surrounding sample sites, rice harvest method, etc.). It is plausible that any of these variables could covary with the treatment type, thus confounding the results of the report. None of these variables was measured.

   The report addressed the issue of covariates in the conclusion section, suggesting that there are other variables that may affect waterbird use of rice fields. They also acknowledged that baled fields were "much less likely to have stubble straw incorporated than non-baled fields", which confirms that rice baling versus non-baling was not an isolated variable. The report makes it problematic to draw any solid conclusions about the specific effects of rice baling on waterbird use of winter flooded rice fields.

2. *If the variation is not explained, what are the conclusions that can be reasonably reached with the results from this field report?*

   There was variation in some waterbird species' presence in baled and non-baled fields. The significance of this variation was inconclusive. This report supports the notion that many waterbird species that overwinter in flooded rice field habitat are sensitive to differences in the environment. However, as explained in 1) above, due to uncontrolled variables, no concrete conclusions can be drawn about which habitat parameters affect waterbird use of flooded rice fields.

3. *What variables should have been examined to adequately address the issue?*

   Based on previous research on this topic, some parameters that likely affect waterbird use of winter-flooded rice fields in the Sacramento Valley include water depth, timing of flooding, harvest method, treatment of post-harvest stubble, and surrounding land use.

4. *Does the report conclude that shorebird versus waterfowl/wading bird densities varied by flood water depth?*

   No. Water depths at sample sites were not measured. Even if depths had been measured, it would have been difficult to conclude that water depth affects waterbird use of habitat due to the presence of various other uncontrolled variables in this report.

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GANDA

Joseph Edward Drennan

Wildlife Ecologist

Regional Manager/San Francisco Region

EXPERTISE

- Amphibians and Reptiles
- Raptors/Nesting Birds
- Threatened and Endangered Species
- Habitat Assessment
- Wetland Delineation
- Regulatory Permitting/Agency Coordination

EDUCATION

- Northern Arizona University: M.S. Forestry, 1995
- Dominican College of San Rafael: B.A. Outdoor Education, 1988

PROFESSIONAL HISTORY

- **Wildlife Ecologist,** Garcia and Associates (GANDA), 1999-Present
- **Wildlife Ecologist,** Environmental Science Associates, 1999
- **Wildlife Ecologist,** Garcia and Associates (GANDA), 1997-1999
- **Raptor Biologist,** HawkWatch International, 1996-1997
- **Wildlife Ecologist,** Arizona Department of Game & Fish, 1996
- **Research Specialist,** Northern Arizona University: School of Forestry, 1995-1996
- **Research Assistant,** Northern Arizona University: School of Forestry, 1993-1995
- **Owl Biologist,** U.S. Department of Agriculture: Forest Service, 1995
- **Research Biologist,** U.S. Department of Agriculture: Forest Service, 1995
- **Wetlands Specialist/Wildlife Ecologist,** BioSystems Analysis, 1991-1993
- **Instructor,** Yosemite National Institutes, 1989-1991
- **Park Ranger/Naturalist,** U.S. Dept. of the Interior: National Park Service, 1986-1990
- **Volunteer Wildlife Rehabilitator,** CA Marine Mammal Center, 1986
- **Crew Leader,** Marine Conservation Corps, 1985

PERMITS AND CERTIFICATES

- California Scientific Collecting Permit – 0721, Authorized to handle California Species of Special Concern, including California tiger salamander. Authorized to mark foothill yellow-legged frogs.
- US Fish and Wildlife Special Purpose Permit – MB07027-1 Authorizes bird salvage and egg collection.
- US Fish and Wildlife Recovery Permit TE-139628-authorizes take (harass by survey, capture and handling) of California tiger salamander and California red-legged frog.

SELECTED PROJECT EXPERIENCE

Caltrans San Francisco – Oakland Bay Bridge Seismic Safety Project.
Project manager to provide biological monitoring for special status species potentially affected by construction of the new East Span of the Bay Bridge. Conduct surveys for federally endangered California clapper rails and peregrine falcons. Submit weekly memoranda summarizing survey results. Provide additional compliance support services as needed to address regulatory and permitting issues. Professional services on this project began in 2002 and are ongoing.

Pacific Gas and Electric Company, Jefferson– Martin Transmission Line Upgrade Project. Managed 3 to 10 ornithologists for a seven month long nesting bird survey. The survey area included a 30 mile-long transmission line corridor in San Mateo and San Francisco Counties, largely through San Francisco watershed lands. Surveys resulted in identification of over 150 bird species and approximately 600 bird nests.

Santa Cruz Predatory Bird Research Group/Kenetech Windpower. Consulted on study design and statistical analysis for a California ground squirrel (*Spermophilus beecheyi*) population study. Determined areas of high and low density ground squirrels and investigated their relationship to locations of radiotagged golden eagles (*Aquila chryrsaetos*) using a variety of parametric and non-parametric statistical tests.

Pacific Gas and Electric Company, Ravenswood-Ames Bird Collision Study. Developed and implemented a study to evaluate bird collisions with a 230 kV transmission line in South San Francisco Bay. The final report provided a detailed analysis of bird movement patterns and recommendations to minimize bird collisions.

BART Warm Springs Extension Project. Project manager for environmental compliance monitoring for a 5.4 mile long extension of BARTs Richmond-Fremont Line. Duties include environmental compliance tracking, preparation of a Worker's Environmental Awareness Program (WEAP), and preconstruction surveys for special status species including burrowing owl, a California species of special concern.

Golden Gate National Parks Conservancy, Alcatraz Bird Management Plan. Prepared a bird management plan for Alcatraz Island. The plan described existing conditions and provided recommendations for bird management in general and specifically for areas with access restrictions due to concerns about potential negative impacts to nesting birds.

Pacific Gas and Electric Company, Marin Reconductoring Project. Managed a multidisciplinary team to survey for sensitive species and habitats along a 15-mile long transmission line corridor in Marin County. The final report was prepared in the format of a Biological Evaluation (BE) for submittal to the U.S. Fish and Wildlife Service. Special status wildlife species addressed in the BE included: California clapper rail (*Rallus longirostris obsoletus*), California black rail (*Laterallus jamaicensis coturniculus*), salt marsh harvest mouse (*Reithrodontomys raviventris halicoides*), California red-legged frog and 33 other species.

PG&E Rock Creek-Cresta Recreation and Pulse Flow Amphibian Studies, Plumas County, CA. *Project Manager:* Managed various studies designed to assess the impact of pulse and recreation flows on foothill yellow-legged frogs on the Rock Creek and Cresta reaches of the North Fork Feather River. Results of each seasons study were presented to the Ecological

Resource Committee (ERC). Results of the 2002 monitoring effort led to changes in the flow schedule for 2003 and 2004 to preserve egg masses that were impacted during early season recreation flows that coincided with the breeding period. Studies are ongoing through 2013.

PG&E, Upper North Fork Feather River Project, Plumas County, CA. *Project Manager:* Managed a study of special status herpetofauna in the Upper North Fork Feather River Hydroelectric Project area, which includes Lake Almanor. The study was conducted following the protocol prepared by PG&E aquatic biologists, A Standardized Approach for habitat assessments and visual encounter surveys for the foothill yellow-legged frog. In addition, we conducted surveys for CA red-legged frog in the project area following the USFWS protocol. Our final report was incorporated into the relicensing application by PG&E.

PG&E Bucks Creek Hydroelectric Project, Plumas County, CA. *Project Manager:* Managed a study of special status herpetofauna in the Buck Creek Hydroelectric Project area. The study was conducted following the protocol prepared by PG&E aquatic biologists, A Standardized Approach for habitat assessments and visual encounter surveys for the foothill yellow-legged frog. Surveys identified a new location for one of the target species: mountain yellow-legged frogs. Our final report was incorporated into the relicensing application by PG&E.

PG&E Poe Flow Studies, Butte County, CA. *Project Manager:* Conducted two separate studies to evaluate the availability, extent and quality of foothill yellow-legged frog habitat at various flow levels ranging from base flow to 2000 cfs. Developed the study plan in collaboration with the Poe Collaborative Group, conducted field studies, analyzed data, and prepared report.

PG&E Oakhurst Transmission Line Pole Replacement Project, Fresno County. *Project Manager:* Managed a multidisciplinary team in a sensitive resource inventory of a 15-mile long corridor though the foothills of Madera County, CA. The final report included results of wildlife, botanical and wetland field surveys, GIS mapping and regulatory framework for permitting.

PG&E Diablo Canyon Nuclear Power Plant, San Luis Obispo County. *Project Biologist:* Conducted special status wildlife surveys of the property surrounding the power plant for passerine bird species, raptors, CA tiger salamanders, CA red-legged frogs and legless lizards. Results of field surveys were used to develop a long-term management plan for the property that included an assessment of constraints and opportunities for development and biological resources.

PG&E/Pacific Gas Transmission Pipeline Expansion Project, Bakersfield, CA to Oregon border. *Wetland Specialist:* Delineated wetlands along a 400-mile long right-of-way. Supervised technicians, managed daily work assignments, and assisted in preparation of the final delineation report. Worked closely with our client and biologists from Bechtel Corporation.

PG&E Diablo-Midway Project, Los Padres National Forest, CA. *Project Manager:* Managed a multidisciplinary team to survey for special status plants, animals, and habitats along a 10-mile long transmission corridor in the Los Padres National Forest. The project included preparation of a Biological Evaluation to fulfill U.S. Forest Service requirements. The project proposed implementing an integrated vegetation management plan on a transmission line corridor and included chemical use as an alternative to manual vegetation removal. Special status species addressed in the biological evaluation included CA red-legged frog, two-striped garter snake, CA horned lizard, and southwestern pond turtle. The final report evaluated impacts to special status species observed or expected to occur in the project area under 4 alternatives and a no-project alternative.

California Energy Commission, Frog Movement Study. Principal Investigator for a two year study investigating breeding movements of foothill yellow-legged frogs (*Rana boylii*). The objective was to determine the climatic and flow-level triggers associated with breeding activities of the foothill yellow-legged frog on the North Fork Feather River. The study employed mark/recapture techniques including photographic identification of chin and flank patterns and radio-telemetry to determine frog movements. Preliminary results were presented in July 2005 at the Pulsed Flow Workshop in Davis, CA and the final 'peer reviewed' report was submitted in August 2006.

Marin Municipal Water District, Foothill yellow-legged frog surveys. Serve as project manager for annual surveys for foothill yellow-legged frog within the Mt Tamalpais watershed. Conduct egg mass and metamorph surveys to document annual trends of two relatively small isolation populations.

Eldorado Irrigation District, Project 184, Amphibian surveys. Served as project manager for amphibian surveys and monitoring for the District's post license monitoring program for Project 184. The target species for the surveys was foothill yellow-legged frog. Assisted in developing the survey schedule, participated in surveys and prepared a final report to fulfill the District's commitments to the Ecological Resources Committee.

Southern California Edison, Proponents Environmental Evaluation, Eastern and Southern California. *Project Biologist:* Conducted a biological assessment of hydroelectric projects owned and operated by SCE. Responsibilities included conducting field surveys, reviewing literature, coordinating with state and federal land managers, and preparing a final report. The field surveys evaluated project facilities (reservoirs, dams, pipelines, penstocks, transmission lines, and buildings) for their potential to support special status plants, animals and habitats. Prepared the written biological section of the PEA utilizing results of field and database surveys and existing literature. Species addressed in the report and surveyed for include mountain and foothill yellow-legged frogs, CA red-legged frog, Yosemite toad, and more than 50 other special status plants and animals.

Three Mountain Power Project, Biological Resource Mitigation Implementation and Monitoring Plan, Burney, CA. *Project Biologist:* Conducted studies and participated in negotiations and consultations with the US Fish and Wildlife Service regarding biological impacts of a proposed 10-megawatt power plant in Burney, CA. As part of the project, I led the preparation of a Biological Resource Implementation and Monitoring Protection Plan (BRIMP). The BRIMP included plans to address impacts to federally listed species, including birds that might be impacted by the new power lines proposed as part of the project.

Parks Reserve Forces Training Area (PRFTA), Burrowing Owl Monitoring, Dublin, CA. *Project Manager:* Conducted surveys for burrowing owl during 2003 breeding season. Survey documented approximately 40 nesting pairs of burrowing owl in the expanded cantonment area. Banded burrowing owls during winter 2003-2004 and monitored owl locations on a weekly basis during 2004. Coordinated a passive relocation effort for a military housing development on PRFTA that required installation of approximately 4000 one-way doors.

Norcal Waste Systems, Vernal Pool Mitigation Bank Project, Yuba County, CA. *Project Manager:* Managed the development of a 150-acre property in Yuba County for designation as a

vernal pool mitigation bank. Directed survey efforts for special status species including vernal pool fairy shrimp, Swainson's hawk, western pond turtle and several rare plants. Coordinated project efforts with our client, endangered species contractors, USFWS, and The Nature Conservancy.

US Forest Service, Sierra Cascade Province, Forest Wildlife Surveys, Plumas County, CA. *Project Manager:* Managed more than 15 forest wildlife surveys for Forest Service Sensitive Species in the Plumas National Forest. Surveys were conducted as part of the Quincy Library Group's Forest Restoration Project. All surveys were conducted to established protocols. Species included in the surveys were: special status amphibians and reptiles (mountain yellow-legged frog, foothill yellow-legged frog, western pond turtle), northern goshawk, great gray owl, spotted owl, forest carnivores (fisher, marten, wolverine, and Sierra Nevada red fox), and willow flycatcher. Forest carnivore survey experience includes work on five separate project areas in the Plumas National Forest, including Red Clover, Crystal-Adams, Humbug-Mabie, Boulder-Wild, and Watdog Project Areas. Survey reports were submitted to the US Forest Service for preparation of biological assessments for proposed timber harvest projects.

Level (3) Communications, Fiber Optic Cable Installation Project. Throughout CA. *Project Biologist:* Conducted surveys for special status species along multiple cable alignments throughout CA. Prepared reports and permit applications for United States Fish and Wildlife Service (USFWS), CA Department of Fish and Game (CDFG), US Army Corps of Engineers (ACOE) and other regulatory agencies. Species addressed in reports, surveys, and consultations included, San Joaquin kit fox, blunt-nosed leopard lizard, Tipton kangaroo rat, CA red-legged frog and arroyo toad.

East Bay Municipal Utilities District, Folsom South Canal Project, Sacramento County, CA. *Project Biologist:* Delineated wetlands and other waters of the United States along an approximately 15-mile long proposed corridor in west Sacramento County. Wetland types identified included vernal pools and perennial marshes. Survey methods included extensive use of aerial photographs and color infrared photographs for remote surveys of inaccessible parcels. Completed all documentation required for ACOE Section 404 permitting.

OTHER EXPERIENCE

Echo Bay Ltd. Raptor Migration Survey, Baja California Sur, Mexico. *Raptor Biologist*: Surveyed the southern Baja California peninsula for raptor and passerine migration routes and conducted general surveys for herpetofauna (17 species documented). Responsibilities included finding observation sites, counting raptors, conducting point counts of passerine birds, establishing contacts with Mexican biologists and conservation groups and writing the final report. I presented the results at the 1999 Raptor Research meeting in La Paz, Mexico.

CA Department of Fish and Game, Cantara Loop Herpetofauna Surveys, Shasta County, CA. Herpetologist: Surveyed the Sacramento River and its tributaries from Lake Sisikyou to Shasta Lake for reptiles and amphibians following the 1991 Southern Pacific train derailment. Conducted time and area constrained surveys for reptiles and amphibians using a variety of equipment including: dip nets, D-nets, seines, lizard nooses and snake sticks. Captured animals were identified, weighed, measured, sexed and analyzed for health indicators.

Arizona Department of Game and Fish, Northern Goshawk Demography Study, Apache-Sitgreaves National Forest, Arizona.

Led surveys for nesting Northern Goshawks in the Sitgreaves National Forest as part of a long-term demography study. Responsibilities included: climbing nest trees, banding juveniles, attaching standard VHF and satellite radio transmitters, capturing and banding adults and monitoring dispersal movements of juveniles using a GIS system and ArcView Software. Monitored 45 known goshawk territories and surveyed for new territories using Forest Service protocol. Assisted the Department on surveys for sensitive wildlife species including: common black-hawks, leopard frogs (*Rana pipiens, R. chiricahuensis, R. yavapaiensis*), narrow-headed garter snakes and Mexican spotted owls.

PROFESSIONAL AFFILIATES

- The Wildlife Society
- Declining Amphibian Populations Task Force

PUBLICATIONS

Drennan, J.E. and P. Beier. 2003. Forest structure and prey abundance in winter foraging areas of Northern Goshawks. Journal of Wildlife Management 67:177-185.

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Exhibit B

Klug, T. & Simpson, K., *Rice Straw Baling Effects on Waterbirds*, CardnoEntrix, June 30, 2014 memorandum.

Cardno ENTRIX

Shaping the Future

Memorandum

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Date: June 30, 2014

To: Richard Saines (Baker & McKenzie) and Alex Rau (Climate Wedge LLC)

From: Tamara Klug and Katie Simpson

RE: **Rice Straw Baling Effects on Waterbirds**

This memo was prepared at the request of Climate Wedge and Baker & McKenzie to analyze the potential effects of rice straw baling on waterbirds use in the California rice growing region. Our understanding is that a study by Point Blue Conservation Science ("PBCS Study", Sesser et al., 2003) regarding waterbird abundance and diversity at rice fields has been considered for important policy decisions. Specifically, we considered three questions:

- Can the PBCS Study be relied on to evaluate impacts to waterbirds caused by rice straw baling practices?
- What information is available in the scientific literature regarding the effects of flooding on waterbird use of rice fields?
- Even if the results of the PBCS Study were valid, and as many as 20% of rice farmers switched from deep flooding to straw baling, would the overall effect on waterbirds be significant under the California Environmental Quality Act (CEQA)?

For the purposes of this analysis, we assumed that rice straw baling, if included in the protocol, would include mowing, baling, and flooding at sufficient depth to decompose the stubble that remains. In this regard, the low intensity flooding practices outlined in the California State Office of USDA's Natural Resource Conservation Services Wetland Wildlife Habitat Management Conservation Practice 644 would apply.

For reference, my resume is included as Attachment B.

Conclusions

The PBCS Study uses a flawed sampling methodology and incorrectly uses statistical tools, rendering the results unreliable. Of particular importance is its exclusion of important data and key species and groups that the scientific literature indicates are present in the study area.

Our literature review supports the conclusion that while flooding generally results in increased abundance of waterbirds, a variety of flooding depths results in a greater diversity of waterbird species.

Based on our literature review and best professional judgment, even if up to 20% or more of rice farmers switched from deep flooding to straw baling, the change in practice would not have a significant effect under CEQA.

1. Review of the PBCS Study

The PBCS Study attempts to evaluate the effects of baling on wintering waterbird use of flooded rice fields. However, the study has a variety of flaws including the study design and statistical analysis of the results, rendering the results unreliable.

The PBCS Study design included survey data collected over two winters. It did not compare differences between waterbird species, but rather considered certain guilds (dabbling ducks, long-legged waders, and shorebirds) and excluded others. This analysis of the survey data by guild, rather than by species or by all species grouped together as done by Elphick and Oring (1998), may have significantly skewed the results, portraying significant differences in use of baled and non-baled fields where none really exist. More importantly, the study excluded several key species from the analysis, specifically all diving duck species and geese. Excluding these guilds skews the results of the study and makes the study unreliable.

The PBCS Study also fails to consider the potential effects of a variety factors on waterbird densities in the fields, such as differences in rainfall between the two years surveyed, hunting in or adjacent to the surveyed fields, harvest methods, and water depth. The PBCS Study did not measure or account for water depth, although water depth varies within rice fields and may cause even greater impact on waterbird density and diversity than straw treatment (Elphick and Oring 1998 and 2003).

The survey methods used in the PBCS Study appear to leave room for miscounting. The surveys were conducted from pre-determined points and all birds of selected study guilds within a 200 meter radius of the points were counted. Each point was surveyed for 10 days (Sesser et al. 2013). It is difficult to estimate a 200 meter radius in the field, which could have led to not counting some individuals or counting some individuals outside the limits.

The PBCS Study acknowledges the potential for bias by time of day, and therefore rotated study sites for different times of day. However, it did not provide the times of day that the surveys were completed. Thus, it is unclear if the surveys were conducted at the same time each day. Survey time of day would influence both species and numbers of a particular species that were present.

Misapplication of statistical methods used in the PBCS Study, based on the tabular summaries of the raw data found in the tables, also suggest the results of the study cannot be relied upon. For example, Table 1 shows clear differences, for some species, between counts. However, the differences are so large as to suggest the presence of unusual sampling events in the data set. For example, 808 northern pintails were recorded in baled fields versus 5,624 recorded in non-baled fields. It is highly unlikely that the treatment effect alone (baled versus non-baled) would be responsible for this degree of disparity. Rather, the counts are probably overly influenced by a few individual observations, and are not reflective of the true expected difference in bird counts associated with baling. Generally, in studies such as this, if a few very large observations occur, they overly influence the statistical conclusions. Other factors, such as proximity to natural wetlands, time of day, proximity to roadways, and/or a large flock of birds that appeared at one site, are likely factors accounting for at least a portion of this difference. However, the PBCS Study fails to employ any statistical technique to address this.

A second way in which statistics are misapplied in the PBCS Study involves the selection of statistical tools to address non-normality and a large number of zero observations. While the study uses a statistical procedure known as bootstrapping to calculate the treatment mean values and confidence intervals, bootstrapping is not a sufficient method for overcoming these issues and is not appropriate to use in this instance. An acceptable approach would have been to build a generalized linear model, with a log-link function, using either a negative binomial or Poisson sampling distribution. More particularly, a zero-inflated Poisson is required if the number of zeros in the data set approximates 30% or so of the total number of observations. This type of modeling approach explicitly accounts for the probability of finding no birds, as well as the probability of unusual sampling events. Based on the PBCS Study's failure to consider these methods, it cannot be determined if results displayed in the figures truly represent the effect of baling (or not baling) the rice straw on bird count.

The PBCS Study's inappropriate selection of statistical tools is further illustrated by the exclusion of a large flock of birds in the baled fields. The study notes that a large flock of white-faced ibis occurred in one of the baled fields during Year 1, but not Year 2; and due to this large flock, they analyzed the data without white-faced ibis. Thus, mean density (without white-faced ibis) was significantly higher in non-baled fields than in baled fields. The inclusion of white-faced ibis reverses this pattern in baled fields. This supports the observation that flocking can cause high variance in bird densities (Elphick and Oring 2003). However the effect of flocking on the results is not discussed or addressed in the PBCS Study for any of the waterbird species.

Under generally accepted statistical methods a statistical modeling analysis dealing with unusual sampling events (that is large flocks of birds and/or zero birds) is required to focus on the relative effect of variables such as baling. Even with a reasonable statistical model, with no available replicate data per sampling event, the ability to isolate the baling effect may not be possible.

2. Literature Review

Background

In 1991, California passed legislation to reduce rice straw burning to decrease air pollution in the Sacramento Valley and statewide (Bird et al. 2002). This legislation resulted in a significant increase in flooded rice fields (from 15% to more than 40% of fields) and a significant decrease in burned fields (from 40% to 1% of fields) (Miller et al 2010). The shift from burning to flooding rice fields resulted in the creation of alternative habitat for waterbirds, particularly where natural wetlands had been reduced in extent (Bird et al 2002; Day and Colwell 1998; Elphick and Oring 1998; Elphick and Oring 2003; Elphick 2010; Miller et al 2010; Strum et al 2013; Taft et al. 2007).

Flooded rice fields support a higher diversity of waterbird species than dry rice fields (Day and Colwell 1998). Elphick and Oring (1998) found that intentionally flooded rice fields had significantly greater use by 24 of 31 waterbird species studied. Only great blue heron and sandhill crane were significantly more common in unflooded fields, and geese occurred about equally in flooded and unflooded fields (Elphick and Oring 1998). The importance of flooded rice fields is further supported by studies that indicate that the increase in flooded rice fields has been associated with shifts in the distribution of wintering waterbirds from other regions in the greater Central Valley to the Sacramento Valley (Miller et al. 2010). This shift may also have led to an increase in Central Valley population densities for some waterbird species. A comparison of Christmas bird counts from 1976 to 2006 for four waterbird species (snowy egret, white-faced ibis, greater yellow-legs, and long-billed curlew) found that there has been a significant increase in these species in the Central Valley over the last 30 years (Pandolfino 2006).

Flooded rice fields provide a variety of environmental services to migrating waterbirds including foraging habitat and resting habitat (Taft and Elphick 2007; Miller et al 2010). In particular, rice that is not collected during the harvest process ("waste rice") has been identified as an important food source for waterbirds in rice fields (Taft and Elphick 2007; Stafford et al 2010). Studies also suggest that waste rice is slower to decompose as opposed to other grain crops (Stafford et al 2006). Other waterbird food sources in rice fields include seeds of other plants, roots and plants that grow in the fields (including rice plants and others), aquatic vertebrates and aquatic invertebrates (Taft and Elphick 2007; Stafford et al 2010). The timing of migrating waterbirds in California is closely timed with rice harvest, allowing little time for decomposition of waste rice prior to their arrival (Stafford et al 2010). Aquatic invertebrates thrive on detritus in rice fields and algae, producing a protein source for waterbirds (Stafford et al 2010). Detritus consists of decomposing rice straw including from stubble in fields left from baling as well as any other matter that accumulates in the field.

Several sources suggest that when straw is incorporated into the soil, rice grain availability as a food source is reduced (Day and Cowell 1998; Ephlick et al 2010). For example Kross et al (2008) studied post-harvest rice grain availability following several different harvest methods in Mississippi. They found that the abundance of waste rice in fields with standing stubble was more than two times greater than fields that were rolled or disked (Kross et al 2008). However, they did not detect a significant difference in quantity of waste rice between standing stubble, mowed, or burned stubble (Kross et al 2008). Thus, because the literature suggests greater rice-grain availability in fields that have been mowed or with standing stubble, baling practices (mowing with standing stubble) may provide greater availability of an important source of food for some wintering waterbird species than some other practices.

Agricultural Practices

While the habitat suitability of flooded rice fields for some waterbirds may vary with agricultural management practices, the majority of the studies indicate that no single straw management practice is ideal for all waterbird species. To the contrary, each species has a range of ideal habitat characteristics and those characteristics vary between species (Elphick and Oring 1998; Strum et al. 2013; Taft and Elphick 2007). In particular, different agricultural management techniques in the Sacramento Valley results in a greater variety of habitats within rice fields which support a greater diversity of waterbird species (MacArthur 1965; Tews et al. 2004). Flooded rice fields support many wintering waterbird species and the value of the rice fields for individual species varies along with the agricultural management practices (Day and Colwell 1998; Elphick 2010; Elphick and Oring 1998; Elphick and Oring 2003).

Harvest methods, flooding depths, and straw manipulation affect rice field use for some waterbird species (Elphick et al 2010). Elphick and Oring (1998) conducted a study comparing different straw manipulation methods in flooded rice fields in the Sacramento Valley. They analyzed the differences in rice field use for individual species and the differences in waterbird densities when all species were grouped. They found that different straw manipulation methods had little effect on overall waterbird populations, although some individual species were more abundant in fields with different straw treatments. For example, some long-legged wader species were more abundant in fields with no manipulation and some small shorebird species were more abundant in fields where straw had been incorporated into the soil. They did not detect differences in use of rice fields with different straw manipulation methods for the remaining 16 species (Elphick and Oring 1998 and 2003); however, based on preferences of some long-legged wader and small shorebird species, maintaining different straw manipulation methods would be necessary to support the suite of species. They concluded that water depth as opposed to straw treatment, was the critical factor in waterbird species occurrence, and demonstrated that different species had different ranges of preferred water depth (Elphick and Oring 1998). This is illustrated in Table 6 which is included as Attachment A to this memo for reference (Elphick and Oring 1998).

Along with differences between species, habitat requirements also vary between waterbird guilds. For example, shorebirds generally prefer shallower water, shorebirds and dabbling ducks prefer open expanses of habitat, and long-legged waders have less restrictive habitat requirements (Strum et al. 2013). Due to differing habitat requirements, no single straw management or flooding practice enhances habitat for all waterbirds (Elphick and Oring 1998; Strum et al. 2013; Taft and Elphick 2007). The benefit of providing variable habitats is consistent with the literature and greater habitat diversity is correlated with greater species diversity (MacArthur 1965; Tews et al. 2004). Using a variety of management practices in rice fields, including rice straw baling, could result in greater habitat diversity and benefit waterbird species diversity by providing preferred habitat for more species.

Baling fields could also benefit waterbirds by reducing water levels needed to decompose rice stubble in flooded fields. Baled fields do not need to be flooded as deeply as non-baled fields to decompose the remaining vegetation. Studies have found that flooding rice fields at shallow depths increases diversity of waterbird species and enables greater access to food (Elphick and Oring 1998; Isola et al 2000; Taft and Elphick 2007). This suggests that rice baling would not reduce waterbird use of rice fields and could lead to greater species diversity and increased conservation value of rice fields in the Sacramento Valley.

If baling rice straw becomes more common in the Sacramento Valley and even if some of the newly baled fields are not flooded, they could still provide quality habitat for waterbird species shown to use rice fields regardless of flooding (geese, great blue herons, and sandhill cranes) (Elphick and Oring 1998). Further, waterbirds are only a portion of the bird species that occupy rice field habitats. Elphick (2004) found that some species of raptors and other landbirds prefer dry rice fields to flooded fields. This further supports the concept that a mix of management approaches needs to be maintained in rice fields to support the variety of species that use them (Elphick 2004).

3. The CEQA Significance of Baling 20% of Rice Fields

We considered the CEQA Initial Study checklist to determine if baling twenty percent of rice fields would have a significant impact on waterbird species. We did not conduct any plans or policy analysis, but from a purely biological perspective, the change in practice would not have a significant negative impact waterbird species on the whole, to any special status waterbird species, or to important wildlife migration corridors.

The literature indicates that different straw management practices provide habitat for different waterbird species (Elphick and Oring 1998; Strum et al. 2013; Taft and Elphick 2007). Using a variety of agricultural management practices, including baling, would likely benefit waterbird diversity by providing preferred habitat for more species. The shallower water depths used to decompose rice stubble in baled fields could also increase waterbird species diversity and the conservation value of rice fields in California. Even if a portion of the baled fields are not flooded, they could still provide habitat for waterbird species that use rice fields regardless of flooding and other bird species that prefer dry rice fields to flooded fields (Elphick 2004).

Shallower flooding or not flooding could result in a reduction of preferred habitat for some species. We considered the list of species included in literature reviewed that contained species lists (Ephlick and Oring 1998; Messer et al 2013; Day and Cowell 1998; Ephlick and Oring 2003). Of the species reported, only three would be considered special status under CEQA in wintering habitat (greater sandhill crane, lesser sandhill crane, and greater white-fronted goose). Other species on these lists are only considered special status during breeding, and thus wintering rice field habitat would not apply.

Species that would experience an increase in preferred habitat (e.g. shorebirds) from increased baling practices include common species as well as several rare or specialstatus species (e.g. greater sandhill crane, lesser sandhill crane, greater white-fronted goose). The only species on any of the lists we reviewed that is state or

federally listed is the greater sandhill crane (state listed as threatened) and one study indicates that this species is more common on unflooded fields (Ephlick and Oring 1998). Another study indicates that this species is attracted to fields with rice straw stubble as the field is being flooded (Littlefield 2002).

Species that would experience a decrease in preferred habitat by the anticipated change in flooding depth would be common species (e.g. dabbling ducks and American coots), based on depth preference reported in Ephlick and Oring (1998). In addition, to the extent that there is ample habitat available for species with a preference for deeper water, they are very mobile during the winter (Ephlick and Oring 2003) and would be expected to move to suitable habitat.

None of the literature that we reviewed suggested that any special-status waterbird species would be negatively impacted by a reduction in flooding depth. In addition, sufficient area for species with a deeper water preference would remain, and suitable habitat for species with a preference for shallower water would be created. Therefore, based on our literature review and best professional judgment, even if up to 20% or more of rice farmers switched from deep flooding to straw baling, the change in practice would not have a significant impact on waterbirds under CEQA.

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ATTACHMENT A:

Table 6 from Elphick and Oring (1998)

Table 6. The dependence of bird use on water depth. 'Preferred' ranges are those hypothesized to be preferred by particular species. Significant *G*-tests show that occurrence rates were higher for depths within these ranges than for other depths. Significant *t*-tests show that when a species was present, densities were higher for these depths. d.f. = degrees of freedom (non-integer values arise from adjustments for unequal variance); *n* = number of observations. Significant *P*-values are marked in bold

Species	'Preferred' range (cm)	*G* (d.f., *n*)	*P*	*t* (d.f.)	One-tailed *P*
American bittern	0–7*	2.20 (1, 2054)	0.138	−0.22 (7.8)	0.415
Great blue heron	10–17*	0.20 (1, 2054)	0.652	2.02 (39.0)	0.975
Green-winged teal	9–20*	45.91 (1, 2038)	**<0.001**	−0.59 (175.3)	0.280
Mallard	7–14*	35.60 (1, 2038)	**<0.001**	0.44 (323.7)	0.671
Northern pintail	14–21*	47.72 (1, 2035)	**<0.001**	−0.93 (213.2)	0.178
Northern shoveler	17–23*	8.57 (1, 2038)	**0.003**	0.09 (138.2)	0.538
American coot	27–33*	69.38 (1, 2053)	**<0.001**	−1.80 (120.9)	**0.037**
Killdeer	0–3†	39.69 (1, 2054)	**<0.001**	0.88 (68.7)	0.810
Black-necked stilt	8–21†	2.55 (1, 2054)	0.110	−0.34 (21.0)	0.370
Greater yellowlegs	1–7*	49.90 (1, 2054)	**<0.001**	−0.99 (116.4)	0.163
	2–12†	92.71 (1, 2054)	**<0.001**	−2.45 (146.4)	**0.008**
Long-billed curlew	0–16†	63.46 (1, 2054)	**<0.001**	−0.17 (50.7)	0.433
Least sandpiper	0–5†	3.18 (1, 2054)	**0.075**	0.475 (29.2)	0.681
Dunlin	0–10†	44.79 (1, 2054)	**<0.001**	−0.77 (96.9)	0.222
Long-billed dowitcher	2–8*	12.32 (1, 2054)	**<0.001**	−1.45 (30.0)	**0.079**
	0–10†	24.01 (1, 2054)	**<0.001**	−1.05 (68.3)	0.149

* Depth range taken from Fredrickson (1991).
† Depth range taken from Helmers (1992).

This table from Elphick and Oring (1998) illustrates the variability of preferred depth ranges for different species. To maintain suitable habitat for multiple species, different flooding depths would be necessary.

June 30, 2014

Cardno ENTRIX
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ATTACHMENT B:

Resume for Tamara Klug

Cardno ENTRIX
Shaping the Future

Tamara Klug

Current Position
Senior Ecologist

Discipline Areas:
> NEPA/CEQA
> Project Management
> Endangered Species
> Wetland Delineation
> Habitat Restoration
> Permitting
> Vegetation Mapping/Rapid Vegetation Assessment
> Fire Ecology

Years' Experience
21 Years

Joined Cardno
2010

Education
> B.A., Ecology & Evolution, University of California at Santa Barbara, 1992

Affiliations
> Association of Environmental Professionals
> California Native Plant Society

Summary of Experience

Ms. Klug is a senior ecologist with over 20 years of experience in biology, field studies, impact analysis, and environmental planning. She has extensive experience in California, including most ecological subregions: south, central, and north coast; south coastal ranges; north coastal ranges, Sierra Nevada and foothills; Great Valley including the Sacramento Valley; Mojave Desert; Sonoran Desert, and Great Basin. Her experience includes projects in a variety of habitats including riparian systems; freshwater marshes; coastal dune systems; coastal scrub; chaparral, especially Burton Mesa chaparral and Nipomo Mesa chaparral; grasslands, especially native grasslands; oak woodlands, and conifer forests. She has also worked in Nevada, Arizona, Michigan, Louisiana, Alabama, Mississippi, and Indiana.

She has managed several database development projects that include research on species and habitat information, threats, and recovery. These include projects from very simple database tools for internal use to complex tools developed for a variety of users with a user-friendly interface or users without database experience. Database projects are provided to users either via CDs or over the internet.

She has extensive experience preparing and managing environmental reports to comply with state and federal regulatory requirements. These include environmental impact statements/reports (EIS/EIRs) and other documentation under the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) (e.g., environmental assessments and reports, negative declarations, and initial studies). Her role on these projects was varied and includes budgeting, coordinating with client committees to define a project, working with staff to meet tight project deadlines, problem-solving technical challenges, coordinating document production and shipment, and coordinating response to comments.

Mrs Klug has provided Endangered Species Act (ESA) services including strategic planning at the project, regional level and national level; Section 7 biological assessments, listed species protection plans, and mitigation plans for biological resources; and Section 10 permitting support including preparation and implementation of Habitat Conservation Plans (HCP), Natural Community Conservation Plans (NCCP), Multiple Species Habitat Conservation Plans (MSHCP) at several different steps in the process from projects just getting started to HCPs that are being implemented.

In addition, she has provided USACE Section 404, California Department of Fish and Game Section 1600 permitting support. She has been trained in Jurisdictional Delineation of Wetlands and Waters of the United States using the methodology defined by the U.S. Army Corps of Engineers (USACE). She has conducted wetland delineations throughout California, using both the regionally updated USACE methodology (Arid West Region and Western Mountains, Valleys, and Coast Region) and California state wetlands definition. In addition, she has been trained in the California Rapid Assessment Method (CRAM) to analyze wetland function and used it on projects.

Ms. Klug has managed substantial field efforts and subcontractors to ensure that various surveys are completed on-schedule and according to agency or client protocol. She has designed, led, and conducted floristic surveys to determine all identifiable species present at a given site and has developed creative approaches complex survey challenges. She has conducted numerous vegetation surveys including mapping, characterization, and analysis. She has used desktop GIS to determine the presence of vernal pools, scrub,

chaparral, and different forest types, based on signature colors and "textures," using vegetation classification systems in A Manual of California Vegetation and Preliminary Descriptions of the Terrestrial Natural Communities of California.

Ms Klug has extensive experience in habitat restoration planning, implementation, and monitoring to determine when a given site is considered restored. Some key areas of restoration experience include riparian vegetation, maritime (Burton Mesa and Nipomo Mesa) chaparral, grasslands, coastal scrub, wetlands, and oak trees and oak woodlands.

Ms. Klug is skilled in using a differential global positioning system (DGPS) to map various vegetation features, wetlands, and rare plant populations. She also uses ArcView to map vegetation and wetland features using ortho-rectified aerial photographs.

Ms. Klug has provided expert deposition testimony and reports that evaluated baseline ecological conditions, injury to resource services, habitat recovery and restoration of lost resource services following several large wildland fires to assist with damages estimation. In wildland fire damage cases, she has provided a balanced approach that measures or estimates injury and recovery based on different ecosystem functions to provide a blended value used for damage estimation.

Significant Projects

Endangered Species

Biologist, Bay Delta Conservation Plan; Solano, Contra Costa, San Joaquin, Sacramento, Yolo Counties, California

The Bay Delta Conservation Plan (BDCP) aims to balance water supplies with ecosystem restoration. The BDCP is intended to provide for conservation and management of covered species (typically Federally listed species), preserve their habitats, and also for projects that protect water supply and quality. Ms. Klug organized a team of scientists to revise, develop, and edit the monitoring and adaptive management section of the BDCP. The existing text and tables were extensive the effort focused on making the sections organized in a manner such that reviewers and users of the document were better able to follow the monitoring and adaptive management plan for streamlined implementation and straight-forward understanding of how measures would be successful.

Project Biologist, Butte County Habitat Conservation Plan/Natural Communities Conservation Plan (HCP/NCCP), Butte County Association of Governments, Butte County, California

Served as lead biologist for the baseline report of the Habitat Conservation Plan/ Natural Communities Conservation Plan (HCP/NCCP) for the Butte County Association of Governments. Prepared a land cover types map of the natural communities in the planning area which included approximately 570,000 acres of habitat with 22,000 acres of riparian, 92,000 acres of oak woodlands and savanna (valley, blue, and interior live oaks), and 100,000 acres of grassland segregated by extent of vernal pools. Grasslands were divided into classes containing less than 0.01 percent wetted surface of vernal pools, containing 0.01 percent to 1.0 percent wetted surface, or containing greater than 1.0 percent wetted surface. Prepared descriptions of mapping categories and mapping techniques. In addition, mapped and described several agricultural subtypes including rice, orchard, and irrigated grasslands. Prepared and oversaw preparation of baseline report descriptions that included research of habitat, range and ecological characteristics of federally listed covered in the plan. Provided quality assurance reviews of other section of the baseline report. Digitized a geology map of the planning area for inclusion in the document.

Project Manager, Endangered Species Project, American Petroleum Institute (API)

Ms. Klug is leading a project to research and evaluate rare or uncommon species for API. Phases I and II of the project included developing comprehensive annotated bibliographies with biological and threats information for 20 species located within states associated

within significant oil and gas basins. Phase II involved developing a web-based GIS tool for storing the information and viewing species range maps and other information. For each phase, Ms. Klug identified and developed measures to make the product more useful to the client, such as adding summary information in Phase I and adding a web-based component in Phase II. Phase III of the project has been initiated and will build off Phases I and II, including the addition of 10 new species and more range and distribution data for the species studied to date. Ms. Klug helped select the species for study including developing selection criteria and prioritization. She directs the project team that includes many researchers, area experts, GIS specialists, and web-developers. She is also responsible for budget forecast and adherence.

Lead Botanist, Rare Plant Surveys, Placer County, California

For the Placer County Water Agency (PCWA), Ms. Klug conducted rare plant surveys and vegetation analysis for several sites that would be impacted for repairs or improvements as part of relicensing PCWA facilities. Surveys were conducted in a variety of habitats in the El Dorado National Forest, including forest, scrub, recently burned habitat, riparian, and meadow.

Botanist, Multiple Species Habitat Conservation Plan, United Water Conservation District, Los Angeles County, California

Assisting with the Multiple Species Habitat Conservation Plan (MSHCP) for operation and maintenance of United Water Conservation District facilities in the Santa Clara River watershed. Ms. Klug's support includes analysis of covered plant species that may occur in the vicinity of the route including research on range and ecological requirements to gain an understanding of how the project could affect those species and development of avoidance/minimization and mitigation measures.

Botanist, Rare Plant Species Surveys, Big Creek, Southern California Edison, Madera and Fresno Counties, California

Conducted floristic botanical surveys of Southern Californian Edison's Big Creek facilities scheduled for relicensing. Surveys were conducted in early, mid, and late season in the vicinity of Mammoth Pool, Huntington Lake, Mono Hot Springs and Lake Thomas Edison. Target species of surveys included state listed plant species, federally listed plant species, plant species listed by the California Native Plant Society (CNPS) and plant species listed by the Forest Service. In addition, invasive non-native species and significant stands of plants that would be useful to Native Americans were mapped.

Botanist, Rare Plant Species Surveys, Vegetation Mapping, and Wetland Delineation for 50 Landing Zones, Sonora Pass, Navy Facilities Command, Mono and Alpine Counties, California

Served as a field team leader in a study to record biological resources present at 50 landing zones for the U.S. Marine Corps in the Sonora Pass area. All sites were located in the National Forest, and U.S. Forest Service survey protocols were used. Work included traveling to remote locations, sometimes miles from roads or established hiking trails; surveying sites for sensitive, rare, threatened, and endangered plant species; delineating wetlands; identifying non-native invasive species on site, and mapping these features. Elevation ranges were between approximately 3,000 and 11,000 feet. Habitats included several types of coniferous forest, sage scrub, willow woodland, freshwater marsh, alpine fell-fields, and unvegetated areas.

Key Botanist, Upper Amargosa Creek Recharge, Flood Control & Riparian Habitat Restoration Project, Palmdale, California

The purpose of the proposed project was to recharge the ground water basin by diverting

water from Upper Amargosa Creek into 6 basins for percolation. The project is located just west of Palmdale which is near Lancaster, California. The total project area was about 135 acres. Ms. Klug conducted detailed botanical surveys of the entire project area including vegetation and rare plant surveys. She also developed conceptual plans for the park and conducted a delineation of wetlands and other Waters of the U.S.

Botanist, Multi-species Habitat Conservation Plan, U.S. Army Corps of Engineers, San Bernardino County, California

Served as a key botanist in studies to support a Multi-Species Habitat Management Plan (MSHMP) for water diversion on the Santa Ana River for the USACE, Orange County Flood Control Division, and Riverside County Flood Control and Water Conservation District. Work included preparation of a detailed vegetation map of the wash, which identified different recovery phases of vegetation since historic flood/scour events. Participated in the development of field survey procedures with a team of biologists. Developed detailed vegetation mapping criteria and digitized a vegetation map of the wash. Led a field team in surveys for the identification and mapping of listed plant species. Conducted surveys for the slender-horned spineflower (*Dodecahema leptoceras*) and worked with a team of biologists to try to relocate formerly identified occurrences of this very small and elusive species. Conducted a study to determine annual changes in number of individuals and in extent of several occurrences of the slender-horned spineflower. Other key biological resources in the project area include the Santa Ana Woolystar (*Eriastrum densifolium* ssp. *sanctorum*), the San Bernardino Kangaroo Rat (*Dipodomys merriami parvus*) and several different phases of Riversidian alluvial fan sage scrub. Served as lead field botanist for a study of vegetation structure and species as part of a larger study to determine habitat preferences of the San Bernardino kangaroo rat.

Project Botanist, Beckworth-Genesee Road Improvement, Federal Highways Administration, Plumas County, California

Conducted rare plant and wetland surveys for a road improvement project (approximately 5 miles long) for Beckworth-Genesee in Plumas County, California. Work involved identifying wetland plants in numerous wetlands located during the survey, including many species of sedge (*Carex* spp.), and conducting rare plant surveys. Located two rare plant species along the route. Wetlands, other Waters of the U.S., and rare plants that were found were mapped both on project strip maps and on USGS maps.

Project Botanist, Quincy-Oroville Road, Federal Highways Administration, Plumas County, California

Conducted botanical surveys, analysis, and reporting for a road improvement project to realign a dangerous curve and replace a bridge on a Forest Service road in Plumas County, California. Surveys included examining the project location for rare plant species or appropriate habitat for rare plant species.

Project Botanist, Cuddy Valley Road, Federal Highways Administration, Kern County, California

Served as staff botanist to locate and map rare plant species and wetlands occurring along a road realignment of Cuddy Valley Road at Mt. Pinos, California. Plans were in place to straighten or realign several curves in the road to improve road safety. The purpose of the surveys was to locate individuals or clusters of individuals of the flax-like monardella (*Monardella linoides* spp. *oblonga*) and the salt spring checkerbloom (*Sidalcea neomexicana*). Precise locations of all rare plants discovered were determined using a global positioning system (GPS). Detailed maps showing the location of every population of rare plants encountered were included with the report.

Project Botanist, Contra Costa Pipeline, Marine Research Specialists, Contra Costa County, California

Served as botanist for an approximately 12-mile proposed hydrogen pipeline in Contra Costa County. Key tasks included identifying plants along the route, mapping rare plant occurrences, developing oak inventory procedures, mapping oak trees, and delineating and mapping wetlands. Prepared a report that included information on the locations of various biological resources on aerial photograph strip maps of the route.

Project Botanist, AT&T Cable Removal, AT&T, San Luis Obispo and Santa Barbara Counties, California

Served as lead botanist conducting rare plant, wetland, and sensitive vegetation surveys for an AT&T fiber optic cable removal project between the cities of Santa Maria and San Luis Obispo. The main route of the cable was parallel to Highway 101 from Santa Maria and then heading inland to follow Carpenter Canyon Road to Edna Road to San Luis Obispo. Where sensitive resources were known to be present or identified during surveys, the cable was not removed, but left in place. Areas to be avoided were clearly identified on maps.

Botanist, Stevenson Ranch Phase II, Lennar Homes, Los Angeles County, California

Worked with a team of biologists to identify sensitive botanical resources at Stevenson Ranch Phase II near Valencia, California. The purposes of the surveys included identifying vegetation, sensitive habitats, wetlands and other waters of the U.S., and rare plants present on the property. Conducted an oak tree inventory that identified each oak tree present on the property with a number designation in compliance with the Los Angeles County Oak Tree Ordinance. Conducted surveys to identify suitable host plants for the Quino checkerspot butterfly.

NEPA/CEQA

Lead Botanist, Salton Sea Species Conservation Habitat, U.S. Army Corps of Engineers and the Californian Natural Resources Agency, Coachella and Imperial Counties, California

Served as lead botanist for an EIS/EIR for project that will create approximately 2,400 acres of shallow habitat ponds along the Salton Sea to support fish and waterbirds. Ms. Klug provided input into pond configurations to improve habitat for waterbirds. She prepared a vegetation map for an area covering approximately 20 square miles that includes the area that could be used for construction of a diversion to carry water to the ponds and the area of ponds themselves. Vegetation categories were carefully developed to ensure that they were discernable from aerial photography, relevant to the analysis in identifying suitable habitat for species under consideration, and consistent with currently accepted vegetation mapping methodology. Ms. Klug prepared the analysis for rare plant species impacts as well as general vegetation impacts of the project. In addition, she reviewed the wetland delineation and California Rapid Assessment Method (CRAM) report for consistency, accuracy, and applicability.

Lead Botanist, Upper Llagas Creek Project, Santa Clara County, California

The Upper Llagas Creek Project was designed to manage flood risk in the Upper Llagas Creek watershed, between the cities of San Martin and Morgan Hill. Flooding in this creek has been recorded from 1937 to 2009. Development along this creek over the years has increased flooding risk by placement of impervious surfaces that prevent water from infiltrating into the soil. The project includes a series of improvements and widening of the creek over approximately 10 miles of creek. Ms. Klug provided an assessment of existing conditions along the creek and impacts of the project. One area of particular concern was western sycamore trees (*Platanus racemosa*), which are scattered along the creek banks.

Numerous very old western sycamores would be removed by the proposed project and are a disappearing resource in the project area due to changes in water availability due to streambed down cutting and to hybridization with non-native sycamore trees.

Lead Botanist/Project Manager, Five Biological Studies, Hollister Ranch, Santa Barbara County, California

Ms. Klug led five biological studies for a private developer at Hollister Ranch in Santa Barbara County, California. She conducted all the background research for known information regarding rare, threatened, endangered, and other special status species; wetlands, sensitive habitat, USFWS designated critical habitat, and other sensitive biological features. She conducted botanical surveys, directed wildlife surveys, prepared reports, coordinated with project teams (designers, architect, developer) to ensure that measures included in the report were consistent with the project. She also coordinated with the County of Santa Barbara regarding changes to the report based on comments from the County biologist.

Project Manager, Five Environmental Assessments at MCB Camp Pendleton, Navy Facilities Command, San Diego County, California

Provided day-to-day project management and oversight for preparation of 5 Environmental Assessments (EAs) and Biological Assessments (BAs) for various projects on Marine Corps Base Camp Pendleton. In addition, served as biological resources lead and field team supervision for surveys associated with the EAs and BAs. Provided oversight for subcontractors and all endangered species surveys. Key issues included three federally listed plant species [thread-leaved Brodiaea (*Brodiaea filifolia*), Moran's navarettia (*Navarretia fossalis*), and San Diego button celery (*Eryngium aristulatum* ssp. *parishii*)], two federally listed species of fairy shrimp [Riverside fairy shrimp (*Streptocephalus woottoni*) and San Diego fairy shrimp (*Branchinecta sandiegoensis*)], least Bell's vireo (*Vireo bellii pusillus*), and the Pacific pocket mouse (*Perognathus longimembris pacificus*).

Deputy Project Manager, P-637 Battle Course Range, MCB Camp Pendleton, Navy Facilities Command, San Diego County, California

Served as deputy project manager and lead botanist for an EA and BA for a range upgrade at Camp Pendleton near San Clemente, California. Key botanical issues include the presence of a federally listed as endangered plant species (thread-leaved Brodiaea), native grassland, and wetlands and other Waters of the U.S. Lead vegetation and rare plant survey efforts. Other key project issues include cultural resources and air quality. Directed field staff for rare plant surveys to insure that established survey protocols developed by the U.S. Marine Corps and U.S. Fish and Wildlife Service were met. Prepared vegetation and rare plant survey reports to support this effort.

Botanist, Salton Sea Programmatic EIR, California Resources Agency, Coachella and Imperial Counties, California

Assisted with research in support of the Programmatic EIR to restore the Salton Sea. Research included internet sources, library research, and personal communication on subjects such as the ability of different plant species to assimilate salts, bird usage of the Salton Sea, and the tolerance of different plant species to salts in the soil.

Lead Botanist, Santa Barbara County Oak Protection Ordinance EIR, Santa Barbara County Planning Department, Santa Barbara County, California

Prepared baseline discussion and botanical analysis for the Santa Barbara County Oak Tree Ordinance EIR. The basis for the EIR was to analyze the impacts of the oak removals that would be permitted under the proposed ordinance. Careful consideration was made for different classes of oaks: deciduous (valley and blue oaks) and non-deciduous (coast live

oaks). Authored discussion on success of oak establishment and factors that influence the establishment of oak trees. Work included researching magnitude, methods, timing, and success of oak tree mitigation projects conducted in Santa Barbara County.

Habitat Restoration

Restoration Specialist, Lower Sycamore Creek Improvement Project, Santa Barbara, City of Santa Barbara, California

Currently serving as the restoration specialist for the Lower Sycamore Creek Project for the City of Santa Barbara. The project consists of widening Lower Sycamore Creek for about 350 feet and restoring the habitat. Initial work on this project consisted of conducting a wetland delineation, rare plant survey and vegetation study to determine impacts of the project. Ms. Klug worked closely with the City of Santa Barbara Creeks Division and the landscape architect to develop a planting palette that would be both functional and aesthetically pleasing. She is currently working with the landscape contractor and construction manager to ensure that restoration plantings are installed according to plan. An unanticipated project delay resulted in part of the project being delayed an entire year and Ms. Klug worked with the nursery, construction contractor, construction manager, landscape contractor, and the City to ensure that portions of the project that were completed could be planted to shorten the disruption of the riparian function of the project. She also worked with the construction manager and the landscape contractor to ensure that areas that would be disturbed again for completion of the project were properly stabilized to protect the creek during storms while minimizing cost for these temporary features.

Lead Botanist, Manzana Wind Plant Habitat Restoration and Replacement, Iberdrola Renewables LLC, Kern County, California

Ms. Klug is providing monitoring and reporting for a habitat restoration plan and two replacement (mitigation) plans for the Manzana Wind Plant near Rosamond, California. The restoration plan includes 779 acres temporarily impacted during site construction for access roads, intertie of electrical cable, and turbine pads in desert native grassland, non-native grassland, Mojave creosote bush scrub, joshua tree woodland, Mojave desert wash scrub, Mojave juniper woodland and scrub, and disturbed habitats. The replacement plans are mitigation for Mojave desert wash scrub (10 acres) and desert native grassland (27 acres). Ms. Klug is conducting transect and photo station sampling as well as general documentation of the progress of restoration on the project site. She is preparing all reports which are submitted to Kern County and to the Regional Water Quality Control Board to document the status of the restoration.

Project Manager, Habitat Modification Project, Chevron

Served as project manager and lead botanist to develop a tool to provide information from the scientific and grey literature regarding natural recovery and artificial recovery of habitats that have been modified by intended and accidental human interactions. Effort was a pilot project to develop a tool that would be user friendly and usable by project managers that had limited understanding of habitat restoration and database function. Provided information in four forms: (1) a simple one-page flow chart for an overview, (2) a report with additional detail and discussion about the depth of the information, (3) a database with a user-friendly information to extract specific information as desired and limited by the user and (4) links to grey literature and journal articles that contain information in the database and summarized in the report. A key element of this project is to provide the information at the desired level of detail for the user and to make the information accessible to anyone with a general understanding of computers. The initial pilot was successful and the project moved into the next phase which includes additional habitats.

Project Botanist, Upper Sand Creek Basin Expansion Habitat Restoration Plan, Contra

Costa County Public Works Department. Contra Costa County, California

Developed a restoration plan and adaptive management plan for the Upper Sand Creek Basin Project. The project consists of deepening the low-flow channel, widening the primary floodplain, creating channel sinuosity, habitat restoration of the entire basin area, and stabilizing the banks of the low-flow channel using biotechnical features. The purpose of the project is to create a basin to decrease flooding in Marsh Creek, a tributary to the San Joaquin River, east of the City of Antioch. Ms. Klug worked with an interdisciplinary team to develop a planting plan that will meet project goals, be consistent the East Contra County HCP, addresses project-related mitigation requirements, and is cost-effective.

Project Manger and Lead Botanist, Toro Canyon Park Road. Confidential Client, Santa Barbara County, California

Project manager and lead biologist for development of a 160-acre parcel in the Summerland area. A previous consultant had prepared a mitigation plan that was technically infeasible and would cost over one million dollars, making the project infeasible. Ms. Klug prepared and negotiated a new mitigation plan with the client and the County of Santa Barbara that is both technically feasible and cost effective. The new plan has been approved at a cost of about $50,000. Ms. Klug is currently overseeing the implementation, monitoring, and reporting for this project.

Project Manger and Lead Botanist, Parcel 127 Development. Kent Mitchell, Santa Barbara County, California

Project manager and lead biologist for development of a 100-acre parcel in coastal Santa Barbara County. Key issues for the project include oak trees, sensitive plant species, sedimentation impacts to a creek that supports federally-listed wildlife species. Ms. Klug prepared the biological survey report and a mitigation program for oaks that would need to be replaced. The oak mitigation program was challenging because the parcel is very constrained by sensitive resources, water availability is limited, and suitable planting locations are very limited. Ms. Klug worked with the client and the County to reduce mitigation ratios where appropriate and design a technically feasible and cost-effective project.

Revegetation Coordinator. State Water Project, Central Coast Water Authority. Santa Barbara and San Luis Obispo Counties, California

Currently working as the project revegetation coordinator for the Central Coast Water Authority State Water Project in Kern, San Luis Obispo, and Santa Barbara Counties. Served as lead botanist to conduct pre-construction field surveys for vegetation, rare plants [e.g. Gambel's watercress (*Rorippa gambelii*), and marsh sandwort (*Arenaria paludicola*)], and other sensitive botanical resources (i.e., oak trees) for portions of the project between Arroyo Grande and Santa Ynez. Prepared vegetation maps on project strip maps for project from Arroyo Grande to the Santa Ynez Valley. Prepared the project revegetation plans, which included mitigation ratios for impacts to Burton Mesa chaparral (a sensitive habitat) and sensitive plant species, such as Sand Mesa manzanita (*Arctostaphylos rudis*), La Purisma manzanita (*Arctostaphylos purissima*), Santa Barbara ceanothus (*Ceanothus cuneatus* var. *fascicularis*), and Wells' manzanita (*Arctostaphylos wellsii*). Worked with agency personnel (CDFW) to determine mitigation hierarchy for different classes of Burton Mesa chaparral. Developed a Microsoft Access database and tracking system to follow success of sections of the pipeline right-of-way over time. Prepared and implemented a 25-acre off-site Burton Mesa chaparral mitigation project that was successful six years after initiation. Directing revegetation monitoring, maintenance, and reporting for all portions of the project from Tank 1, east of Cholame in San Luis Obispo County, to Meadow Lark Lane in the Santa Ynez Valley of Santa Barbara County. Habitats being restored include wetlands, riparian habitat, native and non-native grassland, coastal scrub, oak woodlands and forests (including over 10,000 oak trees), and chaparral (including Nipomo Mesa and Burton Mesa chaparral). Preparing annual revegetation reports for the project. Currently,

only a few areas are still being monitored, including a 40-acre riparian off-site mitigation area along Arroyo Grande Creek, a hilltop in Reservoir Canyon, and thousands of individual oak trees. The Central Coast Water Authority received the Theodore Roosevelt Environmental Award for the quality of their environmental program.

Botanical Lead, South Coast Conduit Upper Reach Reliability Project, Cachuma Operation and Maintenance Board (COMB), Santa Barbara County, California

Conducted vegetation, rare plant, oak tree, and wetland surveys and mapping for the proposed pipeline project. Work included field surveys and documentation, preparing botanical and wetland baseline and impact discussions, working with COMB to reduce impacts and lessen mitigation costs, working with COMB to reduce weed propagules that would lessen mitigation success in advance of construction, and developing a habitat restoration program for the project. The habitat restoration program addressed habitats to be restored over the pipeline corridor as well as mitigation for sensitive plant species including the Santa Barbara honeysuckle (*Lonicera subspicata subspicata*) and the late-flowered mariposa lily (*Calochortus fimbriatus*).

Project Manager, Oak Creek Canyon, Investec, Santa Barbara County, California

Managed an oak restoration program at a housing development in the City of Montecito, California. Conducted surveys of proposed development envelopes and worked with the developer to avoid oak trees to reduce mitigation requirements. Prepared initial oak restoration plan to plant 490 trees that included sources of local plant materials, weeding and other maintenance, watering schedule, monitoring schedule, reporting requirements, and performance criteria. Successfully negotiated with the County to change requirements of an existing mitigation plan that were infeasible and not cost-effective. Worked with project developer to hire a contractor to install and maintain oak plantings. Oversaw monitoring and reporting for the project.

Habitat Restoration Advisor, Los Flores Integrated Waste Management Facility, City of Santa Maria, Santa Barbara County, California
Provided review of EIR biological mitigation measures for the Los Flores Integrated Waste Management Facility. Focus of review was on the feasibility and appropriateness of coast live oak mitigation measures. Provided testimony at City Council meeting supporting oak mitigation measures.

Habitat Restoration Specialist: SEMPRA Gas Repair (Line 1004) and Habitat Restoration, SEMPRA Energy Utilities, Santa Barbara County, California

Provided a habitat restoration for an emergency repair of Line 1004 in coastal Ventura County. The project was very rushed due to the emergency nature of the repair. Ms. Klug provided a habitat restoration plan and provided assistance to SEMPRA in gaining approval from the County of Ventura. Ms. Klug oversaw all aspects of the restoration effort, from ordering seed and coordinating seeding contractors to monitoring and reporting of the restoration. Despite the weedy nature of much of the area surrounding the restoration site the habitat restoration was successful quickly and cost-effectively.

Project Botanist, Campo Landfill Habitat Restoration and Adaptive Management Program, Bureau of Indian Affairs, San Diego County, California

Prepared a habitat restoration program and adaptive management plan for the proposed Campo Landfill. The program included a variety of challenges including preserving endangered species habitat (including Quino checkerspot butterfly and Jacumba milkvetch), maintaining topsoil viability after decades of storage for closed landfill phases, and a detailed adaptive management program to address potential new information. The proposed Campo Landfill would be approximately 500 acres made up of 15-20 phases, making it complex and requiring careful planning.

Project Botanist, Garrett van Horne Reservoir Revegetation, Goleta Water District, Santa Barbara County, California

Directed a revegetation project for the Goleta Water District in the City of Goleta, California to mitigate a water reservoir constructed on a hilltop. Prepared botanical analysis for the project Mitigated Negative Declaration (MND). Conducted preconstruction surveys to identify rare plants and sensitive vegetation that would be removed for the proposed project. Prepared a revegetation/mitigation plan to address common vegetation that was removed for the project as well as removal of a rare plant species, the Santa Barbara honeysuckle. The plan consisted of planting coastal scrub and oak trees to enhance riparian habitat along Los Carneros Creek. Oversaw the installation of the revegetation components following construction. Habitats and species restored included coastal scrub, the Santa Barbara honeysuckle, perennial grasses, riparian plants, and oak trees. Oversaw monitoring and reporting for this project.

Project Botanist, Santa Barbara City College Creek Restoration, Santa Barbara City College, Santa Barbara County, California

Conducted monitoring of a restoration project along a creek at Santa Barbara City College. The project purpose was mitigation for channel clearing to prevent flooding of the adjacent Carriage Museum. The mitigation consisted of restoration of the creek banks and slopes. Ms. Klug prepared the restoration plan that included a list of species, number and location of plants of each species, maintenance and watering, monitoring schedule and methods, performance criteria, and reporting requirements. Oversaw monitoring, to ensure contractor completed necessary maintenance plans on schedule, and prepared annual monitoring reports.

Project Botanist , SEMPRA Gas Line Repair, SEMPRA Energy Utilities, Santa Barbara County, California

Lead botanist for revegetation monitoring and reporting for disturbances during an emergency gas line repair at Goleta Slough, California. The restoration project involved removal of iceplant and other non-native plants and replacing them with native salt marsh species.

Project Botanist, Bautista Road Realignment Revegetation, Federal Highways Administration, Riverside County, California

Prepared vegetation mapping and a conceptual revegetation plan for the proposed Bautista Road realignment in Riverside County. Work involved participating in project meetings with consultants, County staff, lobbyists, National Park Service personnel, U.S. Forest Service personnel, and the Federal Highway Administration. The purpose of the road improvements was to straighten and pave the road and move the road out of a sensitive riparian area. Additional concerns considered were the importance of using plants in restoration that are used by Native Americans and use of species in revegetation that are suitable for the Quino checkerspot butterfly, which occurs in the area.

Wetland Delineation

Lead Botanist, Mission Street Bridges over Cota Street, De la Guerra Street, and Gutierrez Street, City of Santa Barbara California

Lead botanist to delineate wetlands and identify other sensitive habitat and resources for three bridge replacement projects for the City of Santa Barbara. Ms. Klug conducted the wetland delineations and prepared all necessary reports, a wetland delineation report for the Cota Street Bridge and Natural Environmental Study (NES) for the Del la Guerra and Gutierrez Street Bridges.

Lead Botanist, Functional Assessment of Old San Jose Creek, City of Goleta, California

Severed as lead botanist for a project to determine the boundaries of City of Goleta-defined

wetlands and riparian habitat and determine habitat function for a private (confidential) client. Old San Jose Creek was once part of a major creek in the City until the primary flow was diverted into another channel. As a consequence, much of the native riparian and wetland vegetation is still present, but flows are reduced to local runoff. The project site is a linear property adjacent to the old creek channel and any development is substantially constrained by the creek and standard City of Goleta setbacks from the wetland and riparian habitat in the creek. The purpose of the project is to study function of the habitat and provide recommendations for setbacks and hence define the portion of the site available for development.

Lead Botanist, Yosemite National Park Merced River Assessment, National Park Service, Mariposa County, California

Field team leader for river functional assessment and vegetation mapping to support development of a comprehensive river plan for the Merced River in Yosemite National Park. The California Rapid Assessment Method (CRAM) was applied to determine river function in 200 meter lengths of the River over a 10 mile section of the Yosemite Valley. CRAM uses a series of metrics to determine a numerical score for a given Assessment Area (AA). Such characteristics as buffer size and quality, presence of topographic complexity and biological diversity are considered when scoring an AA. Ms. Klug mapped vegetation within 25 meters of the River and digitized that information on a Geographic Information System (GIS). Vegetation categories were consistent with or modified from A Manual of California Vegetation.

Botanist, California Highway 112 Wetland Delineation, Federal Highways Administration, Del Norte County, California

Served as staff botanist to identify plants and prepare a wetland delineation report for a road upgrade project in the Six Rivers National Forest on California Highway 112 where there were landslides or other problems with road safety. Work included preparation of detailed maps showing the locations of wetlands, seeps, rivers, roadside ditches, and creeks and explanation of why they were or were not wetlands.

Botanist, Sisquoc River Project, Union Asphalt, Santa Barbara County, California

Conducted field studies and analysis for USACE permitting for gravel mining on approximately eleven miles of the Sisquoc River for two sequential Mining and Reclamation Plans (2007 and 2013). Work included examination of historic and recent aerial photographs to determine where and how vegetation had changed in the area over time, such as natural vegetation decrease through scour or development. In addition, conducted photodocumentatin of different sections of the river, delineated wetlands and other waters of the U.S., mapped extent and type of riparian vegetation within the project boundaries. Prepared GIS databases of wetland and riparian vegetation data for analysis and incorporation into permit documents. Prepared wetland delineation report and a detailed inventory of all wetlands, riparian scrub, riparian forest, and trees within the limits of the Mining and Reclamation Plans.

Project Botanist, Santa Barbara Ranch Vegetation and Wetlands Mapping, Santa Barbara County Planning Department, Santa Barbara County, California

Served as key botanist to conduct wetlands, rare plants, vegetation, and native grasslands surveys for Santa Barbara Ranch, in Santa Barbara County, California. Resources mapped included native grasslands, and a defensible approach was developed for their identification in compliance with Santa Barbara County standards and definitions. Although previous biological investigators of the Ranch did not find native grasslands, many acres were identified during the survey. Patches of native grasslands were marked in the field with pin flags and then a Differential Global Positioning System (DGPS) was used to define the edges of the patches. Other tasks included identification of wetlands meeting the state and federal wetlands criteria, vegetation, and vernal pools. The California Native Plant

Society (CNPS) relevé was employed to record vegetation data. Work supported baseline information to assist county decision makers prior to preparation of the EIR for the project.

Botanist, Monarch Point Field Studies, Santa Barbara County Planning Department, Santa Barbara County, California

Performed native grasslands and wetlands surveys of the Monarch Point property, a coastal mesa near Goleta, California. Work included using a DGPS to map individual patches of native grasses, wetlands, and vernal pools and preparing a report describing the results of the surveys. For each patch of native grasses identified, the species composition was determined and percent cover of native grasses was qualitatively assessed. Clusters of patches were joined in the office to map native grasslands that met the native grassland criteria established by Santa Barbara County. Wetlands were identified using the state (California Coastal Commission) and federal (USACE) wetlands criteria.

Litigation Support

Ecologist, Litigation Support, BP Exploration & Production Inc.

Ms. Klug is on the Cardno ENTRIX NRDA team responding to the Deepwater Horizon accident and oil spill in the Gulf of Mexico on behalf of BP Exploration & Production Inc. (BP). She has provided support to the restoration technical working group.

Expert Ecologist, Litigation Support, W. M. Beaty and Associates Inc.

Provided ecological analysis and expert report for damages resulting from the 65,000 acre Moonlight Fire which was allegedly triggered equipment use in a conifer-dominated area in the Plumas and Lassen National Forests (northern California). Conducted a review of plaintiff's expert report and provided and expert report to rebut specific information regarding the baseline condition of the habitat before the fire, degree of injury from the fire, recovery rate of the habitat, and restoration costs to offset damages caused by the fire. Provided expert deposition testimony. The case was settled agreeably to client.

Expert Ecologist, Litigation Support, Pacific Gas and Electric

Provided ecological analysis and expert report for damages resulting from the 4,000 acre Sims fire which was allegedly triggered by damaged power lines in a conifer-dominated area in the Six Rivers and Shasta-Trinity National Forests (northwestern California). Conducted a review of plaintiff's expert report and provided and expert rebuttal report to correct specific information regarding the baseline condition of the habitat before the fire, degree of injury from the fire, recovery rate of the habitat, and restoration costs to offset damages caused by the fire. The case was settled agreeably to client.

Lead Ecologist, Litigation Support, San Diego Gas and Electric

Provided ecological analysis for San Diego Gas and Electric in regard to damages resulting from the 163,000 acre Witch and Guejito fires which burned shrub and oak-dominated habitats in San Diego County. Analysis covered ecological baseline condition, degree of injury from the fire, and rate and pattern of recovery. Analysis also included detailed study of aerial photographs, helicopter over flight, on-site field observations, and research of scientific literature. In addition, Ms. Klug developed options for compensation including restoration and purchasing land in mitigation banks. Provided PowerPoint presentation at mediation meeting. The case settled agreeably to client.

Expert Ecologist, Litigation Support, Southern California Edison

Provided expert report and ecological analysis for Southern California Edison related to damages resulting from an 850 acre wildfire allegedly triggered by damaged power lines in

a conifer-dominated area of San Bernardino National Forest. Analysis included consideration of baseline ecological service levels, degree of injury, recovery rate, and restoration options. Because the fire occurred in forest habitat which can take numerous decades to recover and replanting similarly sized trees was not feasible, other compensation/restoration options were considered to reduce damages. The case was settled agreeably to client.

Certifications

- Jurisdictional Delineation of Wetlands and Waters of the United States, U.S. Army Corps of Engineers. Wetlands Training Institute, 1995
- Identification of species in the genus Carex. The Jepson Herbarium, 1996
- Rapid Habitat Assessment. Elkhorn Slough Foundation. Instructors: Todd Keeler Wolfe and Julie Evens (CDFG), 2004
- Defining and Delineating Maritime Chaparral on California's Central Coast. Elkhorn Slough Foundation, 2007
- CRAM wetlands functional assessment, 2011

Publications

Peer-Reviewed, Published Papers

- Mulroy, T. W., J. Storrer T. Klug , W. R. Ferren Jr. 2012. Lessons from 30 years of habitat restoration in Central California with three case studies. Presented at Ecological Society of America Conference, Portland, OR. August 6, 2012.
- Brown, L. M., T. Klug; T. W. Mulroy, and J. P. Walsh III. 2007. Coastal native grassland surveys in the Ellwood/Naples area near Santa Barbara, California. Presented at the California Native Grasslands Association Annual Meeting, Santa Barbara, California. May 18, 2007.
- Klug, T., R. A. Thompson, and T. W. Mulroy. 2007. Facilitating recovery of a long-disturbed maritime chaparral site in Santa Barbara County. Presentation at the 2007 National Meeting of the Ecological Society of America, San Jose California (Abstract PS 68-202).
- Klug, T., and R. A. Thompson. 2005. Facilitating recovery of a long-disturbed maritime chaparral site in Santa Barbara County. Presented at the Maritime Chaparral Workshop, Moss Landing California.
- Hendrickson, Beth, Ferren, Wayne R., and Tamara Klug. 1998. Botanical Resources of Hollister Ranch, Santa Barbara, California. Museum of Systematics and Ecology, University of California, Santa Barbara, Environmental Report 10.

Exhibit C

California State Office of the United States Department of Agriculture's Natural Resource Conservation Services, Wetland Wildlife Habitat Management Conservation Practice 644 Job Sheet, January 2013.

United States Department of Agriculture

NRCS Natural Resources Conservation Service

Wetland Wildlife Habitat Management (644)

Conservation Practice 644 - Job Sheet **January 2013**

Winter Habitat

Critical Habitat Pond

DEFINITION

The inundation of lands to provide habitat for fish and/or wildlife.

PURPOSE

To provide habitat for wildlife such as shorebirds, waterfowl, wading birds, mammals, fish, reptiles, amphibians, and other species that require shallow water for at least a part of their life cycle.

WHERE USED

Shallow water areas are developed on agricultural lands where water can be impounded or regulated by diking, excavating, ditching, and/or flooding. Shallow water management can be applied as a compatible agriculture practice to many types of agricultural fields where implementation of this practice manages shallow water to enhance agricultural lands which provides waterbird habitat. Optimal locations for such water management are fallow or post-harvest croplands. Additionally, shallow water areas can be developed on floodplain areas that provide refuge habitats for native fish during high flow periods.

RESOURCE MANAGEMENT SYSTEM

Shallow water areas can be established concurrently with other practices as part of a resource management system for a conservation management unit. This management practice can be implemented along with other structural practices when a change in management alone does not adequately address the limiting factor. Installing wildlife structures like nest boxes, basking islands, or nesting levees will provide for a greater diversity of wildlife species to meet their breeding needs.

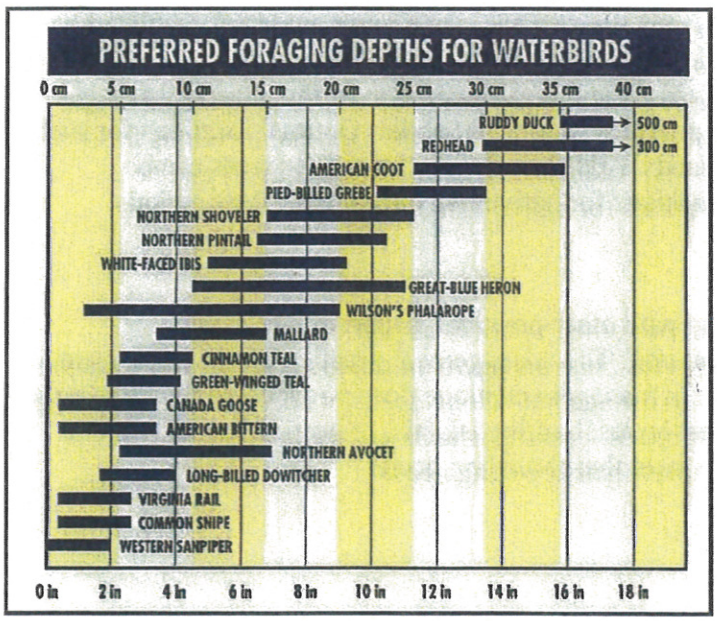
DEVELOPMENT AND MANAGEMENT OF SHALLOW WATER

California's Central Valley provides important habitat for migratory birds. In a state where over 90% of the natural wetland habitat has been lost, many birds use agricultural fields for nesting, foraging and roosting. Since 1990, the average counts of 2 million ducks and 650,000 geese are known to use the Sacramento Valley annually. The average breeding populations of waterfowl in the Sacramento Valley (since 1992) include 132,000 mallards, 7,000 gadwalls, and 6,000 cinnamon teal. The Sacramento Valley supports 33 species of shorebirds averaging 300,000 in winter. It is only one of two inland sites in Western North American that supports tens of thousands of shorebirds. The Sacramento Valley supports breeding black-necked stilt, American avocets, killdeer, and black terns, including over 22,000 stilts, and 4,000 avocets. Rice remains the key breeding habitat with over 90% of stilts and avocets nesting and brood-rearing in rice fields. Developing and managing shallow water on agricultural fields and moist soil areas can provide supplemental habitat for resting, feeding, and brood-rearing for waterfowl, shorebirds, and wading birds.

The following practices are a means to create habitat when it is limited or enhance existing habitat for waterbirds. They are designed to:

- Provide shallow water foraging, roosting and brood-rearing habitat.
- Provide sufficient open habitat to allow avoidance and escape from otherwise life-threatening conditions.
- Improve the amount and seasonal availability of shallow water habitat to provide surrogate wetland/ mudflat-like habitat that is relatively free of standing or emergent vegetation.

Flooded rice in the Sacramento Valley provides habitat to 40% of all shorebirds wintering in the Central Valley. Despite these impressive numbers, shorebird populations in the Central Valley have declined. One critical step in reversing these declines and increasing shorebird populations is to increase the amount of habitat available during migration and winter for these waterbirds.



Shallow water depths provide optimal access to preferred prey items by both shorebirds and waterfowl. Shallow water areas are flooded to a variety of depths depending on the target bird species. Shorebirds typically require shallow water depths between 1-4 inches whereas most waterfowl require an average depth of 4-18 inches of water (Figure 1).

Figure 1. Preferred foraging depths of certain waterbirds. Source: Fredrickson and Dugger, 1993; Fredrickson and Reid, 1986.

Smaller species of shorebirds such as dunlin, western and least sandpipers require water depths from 0 - 2 inches (mudflats) and whereas longer-legged shorebirds such as black-necked stilts and American avocets require depths greater than 3 inches. Shorebirds feed on invertebrates that live in the mudflats and in the soil at the bottom of shallowly flooded areas and also filter invertebrates from the water column. Dabbling ducks that tip to feed like mallard, pintail, and teal cannot feed effectively on the seeds and invertebrates found on pond bottoms if the water is deeper than 18 inches. The optimum feeding depth for these ducks is 5 to 12 inches.

VARIABLE DRAWDOWN

Requirements:

What is variable drawdown? Variable drawdown is the practice of pulling approximately 25% of check boards per week from February 1 through March 1 or later. This practice requires that check boards are replaced after harvest and water is applied at least one time to the field as part of the rice decomposition. Typically, all the check boards are removed from check boxes on January 31 at the same time. The practice of variable drawdown slows the pace of field drainage while creating a matrix of shallow water habitat on the landscape at a time when this habitat type is limited. All boards may be pulled by March 1 but extending the existence of shallow water habitat on the landscape beyond this date will continue to provide needed shallow water habitat. These practices are intended to extend the availability of shallow water habitat into the spring and provide water of multiple shallow depths (between 1-4 inches).

Low intensity variable drawdown refers to fields that are flooded once during winter to enhance straw decomposition, and the water depth throughout the winter relies on natural precipitation or maintained at water depths between 4-18 inches. The 'low intensity' portion of this practice refers to the cost of labor of pulling the boards in a staggered fashion.

High intensity variable drawdown refers to fields that are flooded once during early winter to enhance straw decomposition, with water actively applied to maintain shallow water habitat regardless of natural precipitation inputs. The 'high intensity' portion of this practice refers to the requirement to maintain a minimum water depth of 4 – 8 inches throughout late winter until February 1, when drawdown begins.

Planning considerations:

- Weekly removal of 25% of boards can be implemented in multiple ways.
  - Remove all the boards in 25% of the checks each week which results in the reduction of water depth in those particular checks. This is the preferred option. If you have enrolled 4 fields, you can remove the boards from one field each week. This is typically the best method for Low Intensity drawdown.
  - Remove enough boards in each check per week which results in the reduction of water depth by 25%. This approach may not be effective under the Low Intensity method because water depths may already be below the 4" threshold.
- For the high intensity scenario consider that in some irrigation districts, water supply is stopped in early January. To ensure the starting water depth of at least 4 inches prior to drawdown, overfill the fields prior to water shutoff to a depth of 12 inches, depending on the water holding capacity of the soils. Rates of water loss and water retention will vary from field to field, especially in fields with mostly sandy soils where water loss can occur rapidly.
- To better maintain water in the rice fields place plastic and/or pack soil on the upstream side behind boards.

SEASONAL INUNDATION

Requirements:
What is Seasonal Inundation? Spring or early Fall inundation is the application of water to fallow fields, fields that were harvested early, or fields that are not in production for any reason. Spring flood up is intended to provide nesting and brood-rearing habitat for local nesting birds. Fall flood up is intended to provide habitat to early migrants when flooded habitat is otherwise limited. This practice creates shallow water habitat (1-4 inches) for early fall migrants that are returning from the breeding grounds to the north. There is very little suitable habitat for early fall migrant waterbirds that arrive in the Central Valley as early as July. At this time of year, few wetlands are flooded and most croplands are still in cultivation.

- Maintain water level at 1-4 inches.
- Flood up shall be for a minimum of 30 days
- Maximum 20% emergent vegetation cover is allowed.
- Chop, stomp, burn, or light disking/light chiseling is allowable for stubble management. Stubble disking or deep chiseling that buries more than 35% of stubble is not allowed.

Fall Inundation: Flood up shall be for a minimum of 30 days between July 15th and October 1. *Spring Inundation:* Flood up shall be for a minimum of 30 days from April 1 - July 15.

Planning considerations:
- Early flooded fields can become overgrown with weeds, reducing habitat value for shorebirds. In order to maintain this practice beyond the thirty day minimum, the flooding of multiple enrolled paddies or fields may be staggered to ensure open habitats.

Additional Requirements
- Maintain at least 20% or less emergent vegetation cover to ensure habitat use by the greatest number of bird species.
- Flooding can begin as early as July 1 for early migrants, however this is in direct conflict with mosquito control recommendations, which request no flood-up until October 1 at the earliest.
- Initial implementation and scoping of this practice should be done in consultation with mosquito control officials.

CRITICAL HABITAT PONDS

Requirements:
What are Critical Habitat Ponds? Critical Habitat ponds are managed seasonal ponds that were formerly planted to rice. These ponds are typically placed in rice checks that are typically impacted by cold water inputs. The ponds will function as a warming pond where cold irrigation water is warmed before it is applied to adjacent checks. The cover provided by vegetation in the Critical Habitat Pond will provide habitat for secretive marsh birds and waterfowl. Creating a mosaic of habitat provides for seasonal needs of breeding and wintering waterfowl and wading birds. Ponds with areas of shallow depths between 1-4" with sparse vegetation benefit shorebirds. Deeper water depths with additional vegetation provides valuable brood habitat for breeding waterfowl and waders. The maintenance of rice checks provides suitable habitat for migratory and non-migratory waterbirds, including shorebirds, waterfowl and wading birds, amphibians and aquatic reptiles.

- Minimum size will be at least 1.5 acres.

- Ponds will be managed for water depths between 2-12"
- The pond will not be intentionally planted or fertilized.
- Emergent vegetation will be managed with stubble disk at same time as rice harvest to maintain at least 50% open water in the pond.

Planning considerations

- It may be necessary to build an additional internal levee to section off area of warming pond within a check or field.
- Breeding islands can be placed within warming ponds as long as the requirements for breeding islands are met. See breeding islands under Fish and Wildlife Structure (734) Job Sheet.
- Mow or till prior to flood-up helps reduce emergent vegetation growth to meet the 50% vegetation requirement.
- When applying fertilizer and pesticides make efforts to reduce negative impacts to warming pond emergent vegetation.

Additional requirements:

- It is important that flooding levels of shallow water areas managed as brood ponds be static throughout the nesting season in order to prevent inadvertent flooding of nest sites that may have been established during low water or dry periods.
- The warming pond will be drawn down when the adjacent rice fields are drawn down in late summer before harvest
- Management of cattail and other emergent vegetation will be necessary post drawdown.

OTHER CONSIDERATIONS FOR ALL PRACTICE TYPES

Planning Considerations

- Conduct a Wildlife Habitat Evaluation (WHEG) to determine if shallow water areas are a limiting factor for the targeted species.
- Consider planning additional practices, such as, Fish and Wildlife Structure (734), Conservation Cover (327), Structure for Water Control (587) and any other practice needed to properly manage shallow water and associated upland areas essential to maintaining growing populations of waterbirds.
- The presence of summer water may produce mosquitos. The landowner should consult with the local Mosquito Abatement District to ensure that timing and duration of water applications is compatible with approved pest and disease control practices.
- The ability to completely drain the shallow water area is important for several reasons. In addition to preventing excessive growth of emergent vegetation, draining seasonal wetlands, as opposed to allowing water to gradually evaporate, can help to reduce the accumulation of salts and guard against the spread of botulism and other waterfowl and shorebird diseases.
- Prior to construction of shallow water areas, landowners should check with their local county planning departments to ensure proper compliance with local grading regulations and permit requirements.
- Field preparation and straw management may include the following: light disking, chopping, stomping, and burning. The goal is to create a smooth surface where straw has been mostly

incorporated into the soil and little stubble is left standing. Shorebirds use mudflat-like habitats and the goal of these practices is to create these habitats during spring and fall migration and in winter.

- Shallow incorporation of straw into the soil without chiseling or creating deep ruts is thought to incorporate organic material into the soil, providing food and habitat for invertebrates (the prey items for many waterbird species), while also maintaining a smooth field surface.

General Operations and Maintenance

- Rice checks are not permanent levees and seepage may occur due to crawfish and beaver activity. Routine maintenance can ensure the proper impoundment of water.
- Check boxes and water control structures are to be inspected after each major storm or flooding event, to ensure they are functioning properly. Remove debris from around inlet and repair any damage to boxes.
- Periodically monitor check boxes to ensure that boards are in place and functioning to maintain desired water levels.
- Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals shall not compromise the capability of the practice to provide habitat for the target species.
- Exclude livestock from shallow water areas, especially levees and around water control structures.

REFERENCES

California Department of Fish and Game, Breeding Waterfowl Survey 1992-2011, CA Depart Fish & Game, Sacramento, CA, USA, Unpublished Data

Ducks Unlimited 1994, Managing Harvested Rice Fields for Straw Decomposition and Wintering Waterbirds

Personal Communication Greg Yarris, Central Valley Joint Venture Science Coordinator

Personal Communication Rodd Kelsey and Monica Iglecia, Audubon California.

Personal Communication Catherine Hickey and Khara Strom, Point Reyes Bird Observatory.

U.S. Fish and Wildlife Service, Winter Waterfowl Survey 1990-2011, Pacific Flyway, U.S. Fish and Wildlife Service, Portland, Oregon, USA

Wetland Wildlife Habitat Management

Conservation Practice 644 – Specification and Requirements Sheet **January 2013**

Client:		**Date:**	
County/RCD:		**Contract #:**	
Location:		**Acres:**	
Tract/Field:		**Planner:**	

Targeted Species	
Purpose of Shallow Water Management	
Field prep / straw management	
Water depth management	
Target date of drawdown, flood-up or boards-in	
Vegetation management	
Additional requirements	
Operation and maintenance	
Comments	

DESIGN APPROVAL:

Design Approved by:/s/_____ Job title:_____ Date:_____

CLIENT'S ACKNOWLEDGEMENT STATEMENT:

The Client acknowledges that:

a. They have received a copy of the specification and understand the contents and requirements.
b. It shall be the responsibility of the client to obtain all necessary permits and/or rights, and to comply with all ordinances and laws pertaining to the application of this practice.

Accepted by:/s/_____ Date:_____

Wetland Wildlife Habitat Management

Conservation Practice 644 – Specification and Requirements Sheet January 2013

CERTIFICATION:

Monthly Inspection Dates	Year 1	Year 2	Year 3
Initial Installation			
First Inspection			
Second Inspection			
Third Inspection			
Final Inspection			

Additional observations and/or recommendations:

I have completed a review of the information provided by the client or have conducted a site visit and certify this practice has been applied according to NRCS standards and specifications.

Certification by:/s/_____ **Job title:** _____ **Date:**_____ **(Year 1)**

Certification by:/s/_____ **Job title:** _____ **Date:**_____ **(Year 2)**

Certification by:/s/_____ **Job title:** _____ **Date:**_____ **(Year 3)**