

## ATTACHMENT E

### SURVEY METHODS

#### **Waterbird Usage: Bird Surveys**

Bird surveys will be conducted by field biologists with experience and training in conducting surveys for ground nesting avian species at the evaporation basins, Compensation Habitat, and Winter Waterfowl Habitat. All surveys will be conducted between sunrise and sunset. Levee routes, locations of survey points, and data forms will be standardized. Field data forms will be divided into columns for each cell in the MEB and each lane at the Compensation Habitat. Observers, using 20X-60X spotting scopes and 8X-10X binoculars, will identify all birds to species when possible. Some grouping categories (dabbling duck species, Western/Least sandpiper, dowitcher species, gull species, etc.) will be used when species identification is not possible.

A survey of the Compensation Habitat requires that a vehicle with one observer who will record the data, drives up the east side of the Compensation Habitat with the early morning sun shining from behind the observer as they look west across the habitat. The observer will stop the vehicle at the end of the lane; using the vehicle as a blind, counts will be made of the birds on the lane and in the adjacent channel on the north side of the lane. The observer will use a tripod-mounted spotting scope and binoculars to locate, identify, and tally all of the birds seen on the eastern half of the one-mile long lane. When the lane has been counted from the east observation point, the process will be repeated from the west when the angle of the rising sun allows for clear viewing and accurate color differentiation. All data will be recorded and tallied.

All waterbirds and land birds (terrestrial upland species) will be recorded on survey data sheets. This includes individuals that are nesting, foraging (on, in, or over), roosting, or loafing on MEB cells, and at the edges of the levees that surround them.

#### **Selenium Exposure and Contamination: Egg Selenium Concentrations and Condition of Collected Embryos**

##### ***Compensation Habitat***

A total of five American avocet (*Recurvirostra americana*) five black-necked stilt (*Himantopus mexicanus*) eggs (if available, for a total of ten eggs) will be collected from the MEB and five additional eggs will be collected from the Compensation Habitat each year (typically in June). The geometric mean selenium concentration for the ten MEB recurvirostrid embryos will be calculated (dry wt.). The embryo age will be estimated and their condition described (e.g., alive, normal, too young to determine condition, etc.).

The eggs will be analyzed for embryological abnormalities (avian teratogenesis) by a qualified laboratory (e.g., South Dakota Agricultural Laboratories). Data on embryological abnormalities will be compiled and summarized in the TLDD quarterly and annual compliance monitoring reports and submitted to the Regional Board and California Department of Fish and Wildlife.

### **Nesting Activity and Success: Semi-monthly (April through July) Nest Monitoring Surveys**

Semi-monthly nest monitoring surveys will be conducted by field biologists at the MEB and Compensation Habitat. Before conducting any nest surveys, observers will review the latest bird count data (from the previous surveys) to determine where the majority of activity by potential breeding species is taking place. Observers will also regularly consult with hazers at the MEB for current information about centers of nesting activity and locations of potential nest starts.

A stratified sampling design will be used for conducting water bird nesting surveys at the MEB. Nesting surveys at the MEB will include (1) specific levee areas to be surveyed by the observer traveling by vehicle during each of the scheduled surveys. The observer will stop at set points on all levees and exposed channel margins to observe sitting birds, then they will proceed to drive all levees on the MEB; (2) surveys conducted within specific areas of the MEB where results of previous abundance monitoring or observations during hazing suggest that potential accumulations of birds and nesting activity may be occurring; and (3) reaches of interior and exterior levees randomly selected for nesting observations during each scheduled survey. At the MEB all levees will be selected for inclusion in nest monitoring during the initial survey. Nest surveys will be conducted, to the extent possible, during morning and evening hours to reduce the potential effects to nesting birds and incubating eggs as a result of survey activities.

Nest monitoring at the Compensation Habitat will be done consistently during each survey on one selected lane. As with previous surveys, each individual nest observed will be flagged and nest fate for the sub-sampled population monitored using established protocol and criteria developed in previous TLDD nest fate surveys. The modifications to nest monitoring were developed in 1998 and have been refined in more recent years in an effort to reduce disturbance of nesting water birds at the Compensation Habitat, while continuing to provide estimates of the species composition and numbers of nesting birds, in addition to estimates of nest fate. Results of the subsampled nest monitoring at the Compensation Habitat will then be expanded to account for the area of the habitat actually surveyed in developing estimates of the total numbers of American avocet, black-necked stilts, and other birds nesting at the Compensation Habitat.

Estimates of nesting water birds at the Compensation Habitat will be further modified to account for potential nest survey bias using Mayfield corrections based upon results of

nest fate monitoring, and nest survey frequency. Mayfield adjustments will also be made for MEB survey results if a sufficient number of nests are detected.

During nest surveys, the trained observer will search for nest cups and eggs of stilt, avocet, snowy plover, killdeer, duck, grebes, coots, terns, mourning dove, horned lark, blackbirds, and other species. During each nest monitoring visit at the Compensation Habitat, the entire width of the selected lane will be walked in such a way that the maximum number of detectable nests will be discovered and the nests will be subsequently rechecked on any survey visit thereafter. Observers will vary the direction of lane checks and levee surveys in order to provide a varied perspective for nest discovery. When nests are located, a color-coded wire pin flag will be placed approximately two feet from the nest (yellow for stilt, orange for avocet, and blue for other species). Each flag will be numbered to identify a given nest. At the MEB, cell number, nest strata (such as interior levee, windbreak, etc.), and nest location grid numbers will be recorded. Lane number and position on the lane will be recorded for nests at the Compensation Habitat. At the Compensation Habitat, most nests are relatively easy to find early in the nest season (April through May). Despite the application of pre-emergent herbicides prior to the breeding season, annual weedy vegetation may be dense in some areas by June and especially in July, making it difficult to discover new nests and to relocate old ones. Weed and vegetation control at the MEB however, is expected to be extremely effective, further reducing the risk that nests at the evaporation basin are not detected in these surveys.

When a clutch hatches or when it is determined that eggs are abandoned, the identifying flag will not be removed, but rather will be “retired”; it will be angled into the ground to signify the location of a previously active nest. This will be done to determine when new nests are established in old cups. In addition to the location of nests, observations will be recorded during each survey regarding the fate of eggs and chicks when possible.

The field biologist will use the following criteria for classifying nest fates. Nests classified as “hatched” will be those where (1) live chicks were seen in the nest cup or (2) a clean empty cup with no signs of disturbance or predation was seen subsequent to a nest check where pipping eggs were observed. Nests classified as “presumed hatched” will be those where a full clutch of eggs (3-4 eggs) had been recorded on one or more field surveys but for which no pipping or chicks were seen prior to finding a clean, empty nest cup (with no signs of disturbance or predation).

Nests classified as “abandoned” will be those where one to four eggs were laid in a cup but were no longer being incubated. Evidence for abandonment will be either (1) incomplete clutch (only one or two eggs present in cup six or more days after first egg was found in a cup) or (2) eggs no longer being tended. Abandoned eggs may be cold or extremely hot when touched, sunburned (bleached pale above with darkest colored markings beneath because eggs are not being turned regularly), or else they will be stuck to the substrate or covered with spider silk (both are additional signs that eggs are no longer being turned). Untended nests (eggs and the soil in the cup) are often dry on

hot days when active nests in the area are being kept damp with water brought to the nest site in the soaked breast feathers of a sitting bird. Whenever an egg is first presumed to be abandoned, a single line inside a circle will be drawn on the uppermost surface of the egg with a permanent marker pen. If, on a subsequent visit, the egg(s) had not been turned by a sitting bird, the mark will be changed to an "X" inside a circle and the nest will then be classified as abandoned. Any clutches that are classified as abandoned will be additionally classified as "abandoned unknown", since an accurate determination of the cause (the agent) of the abandonment cannot be made with certainty. For example, whether a sitting bird abandoned its nest because it was killed at an unknown location by a predator, affected by a severe weather event, or disturbed by the presence and activities of the survey crew (observer impact), there would be no visible signs at the nest to make a reliable determination of the agent of abandonment.

Nests classified as "lost" are those, which during the time period of a normal incubation cycle (21-24 days) are simply unable to be physically relocated. As with all newly discovered nests, a color-coded pin flag will be placed approximately two feet from the nest and its position will be accurately described on a data sheet. On the following visit(s) if the nest itself is not found because the flag has been destroyed (a few tear off in strong winds leaving only a thin, nearly invisible wire) or because the flag is obscured by growing vegetation, the observer will do his or her best to locate the nest cup by referring to the location notes on the data sheet. If it simply cannot be relocated, such a nest will be classified as "lost".

Most nests classified as fate "unknown" on the evaporation basin will be those which had three to four eggs on an initial visit but are found empty on a subsequent visit with no clear sign of whether the eggs hatched (usually only tiny chips of egg shell from hatched eggs remain in the cup since large pieces of shell from hatched eggs are removed by adult birds) or were taken by a predator. In nests with "unknown" fates the nest cup (and its associated soil, plant stem, and clam shell decorations) are still intact, no large shell fragments or damaged eggs are present in the nest vicinity, and there is no sign of yolk in or just outside of the nest cup). Nests at the MEB and at the Compensation Habitat will also be classified as fate "unknown" if the nest cup contains a full clutch (three to four eggs) but does not show any clear signs of being abandoned (since these clutches could be abandoned or may be past term/nonviable).

Nests classified as fate "destroyed/predator" will be those where a clutch with anywhere from one to four (or occasionally more) eggs shows clear signs of damage by mammal or bird predators. Damage may be (1) whole eggs cracked open with large shell fragments present and yolk either licked clean or spilled about the nest cup (typical of mammal predation), (2) whole eggs with puncture entries and some yolk in the nest vicinity (typical of the damage left by the beaks of gulls, ravens, or herons), or (3) extensive physical disturbance of the nest cup (nest construction material usually strewn about) and yolk either in the nest cup or in close proximity to the cup (spilled yolk often "glues" together bits of soil and organic matter used by adults to camouflage the nest cup).

Nests classified as fate "destroyed/flooding" will be those where (1) the nest cup, at a land-water interface, is inundated or saturated with water and wet eggs are still in the cup or are floating nearby, (2) where a nest is inundated but the eggs are absent (having presumably floated away) before the clutch was due to hatch, or (3) where a very muddy clutch, is present near the water's edge when revisited and does not hatch.

Nests classified as "destroyed/Levee slump" will be those which (1) had been located on a wave-cut "beach terrace" at the toe of a steep levee which is subsequently weakened by wave action and falls on the nest or (2) had been located at the "cliff-top" edge of a steep levee and is subsequently undermined by wave action, dropping the nest and/or eggs to the beach below.

Nests classified as "destroyed/observer" will be those where an observer either dropped or stepped on an egg(s).

Nests classified as "destroyed/unknown" will be those where none of the eggs in a full clutch hatched but where (1) one or more eggs exhibited non-predatory damage to the shell or (2) chicks began to pip but died before hatching. In such a case it is difficult to know whether the presence of a predator, a combination of extreme heat and absent or inattentive parents or simply exhausted or otherwise compromised chicks may have resulted in the destroyed clutch.

Nests classified as "past-term/nonviable" will be those with a full clutch (three to four eggs) that are still being actively tended (eggs are being turned regularly and/or are being kept wet) by an adult bird beyond the normal incubation period (usually well beyond 24 days). These birds may be inexperienced or naive first-year parents, they may be tending infertile eggs, which fail to elicit the proper incubation terminating behavior of the adult, or other unknown factors may be involved. In most cases where a nest is classified as "past-term/nonviable" an adult is usually clearly in attendance and exhibits typical distraction display behavior.