Burrowing Owl Conservation Strategy

for Large-scale Solar Photovoltaic and Battery Energy Storage Projects in California

This Burrowing Owl Conservation Strategy was prepared by the Large-scale Solar Association ("LSA") and other solar energy companies in collaboration with research ecologists and field monitoring biologists with deep expertise in the ecology of the western burrowing owl (*Athene cunicularia,* "BUOW"). LSA is a non-partisan association of solar and battery storage developers that advocates appropriate policies to enable market penetration of utility-scale solar technologies in California and the western United States while protecting the natural resources of California and the West. LSA's members are leaders in the utility-scale solar industry with deep experience in all disciplines necessary to site develop, engineer, construct, finance, and operate utility scale solar and battery storage systems. LSA and its members are committed to natural resources protection under the law and beyond, and this template Burrowing Owl Conservation Strategy demonstrates not only our commitment to avoiding and minimizing impacts to BUOW during the construction, operation, and decommissioning of the state's critical clean energy infrastructure, but a commitment to managing this infrastructure in a way that maintains, creates, and enhances BUOW habitat where possible. LSA members endorse this document as voluntary guidance for the industry. This Conservation Strategy has been made public so that permitting authorities, regulators, developers, and land managers may have a clear understanding of the justification and rationale for the standardized definitions, development and construction practices, monitoring recommendations, data collection methodology, and research findings presented herein.

The BUOW was petitioned for protection under the California Fish and Game Code (CFGC) by the Center for Biological Diversity on March 5, 2024. The California Fish and Game Commission (CFGC) found the petition complete on October 10, 2024, and the species was officially advanced to candidacy status on October 15, 2024, affording the species the same protections under state law as a threatened or endangered species.

This Conservation Strategy presents BUOW conservation in the context of land use changes anticipated from large-scale solar and battery energy storage development in California, describes the life history of the BUOW and offers standardized life history terms that have been used to-date without common definition in the relevant literature, discusses the various overlapping federal and state regulatory protections for the species, outlines various permitting and mitigation pathways potentially available to solar and battery storage projects, and describes LSA's recommended BUOW field methodologies, monitoring best practices, data collection, and research efforts.

1. Burrowing Owl Conservation and Solar Energy Development in California: 2025-2045

Impacts to BUOW from solar energy development occur primarily during the construction phase of projects. During the long-term (30-50+) operations phase, solar projects have a high potential to provide a net conservation benefit if sites are managed to enhance, manage, and monitor habitat and owl survival and reproduction and minimize harm. However, such management actions are costly and risky, and therefore must be encouraged and incentivized for developers, owners, operators, and investors in large-scale solar and battery storage projects to take them on. Figure 1 shows the California Energy

Commission's modeling of locations of solar energy development in the state with the lowest overall impact on natural resources, which is used as a guide for the California Public Utilities Commission's long-term transmission planning process. As is evident in the mapping, the current and recently retired agricultural lands in the San Joaquin Valley demonstrate that burrowing owl habitat has been degraded by commercial agricultural practices, but remnant populations and pockets of habitat persist.

Up to a million acres of land are anticipated to be retired as a result of statewide irrigation water pumping curtailments under state law by 2040, and an estimated 700,000 acres of land are required to be converted to solar energy production to decarbonize the state's grid in alignment with state policy.

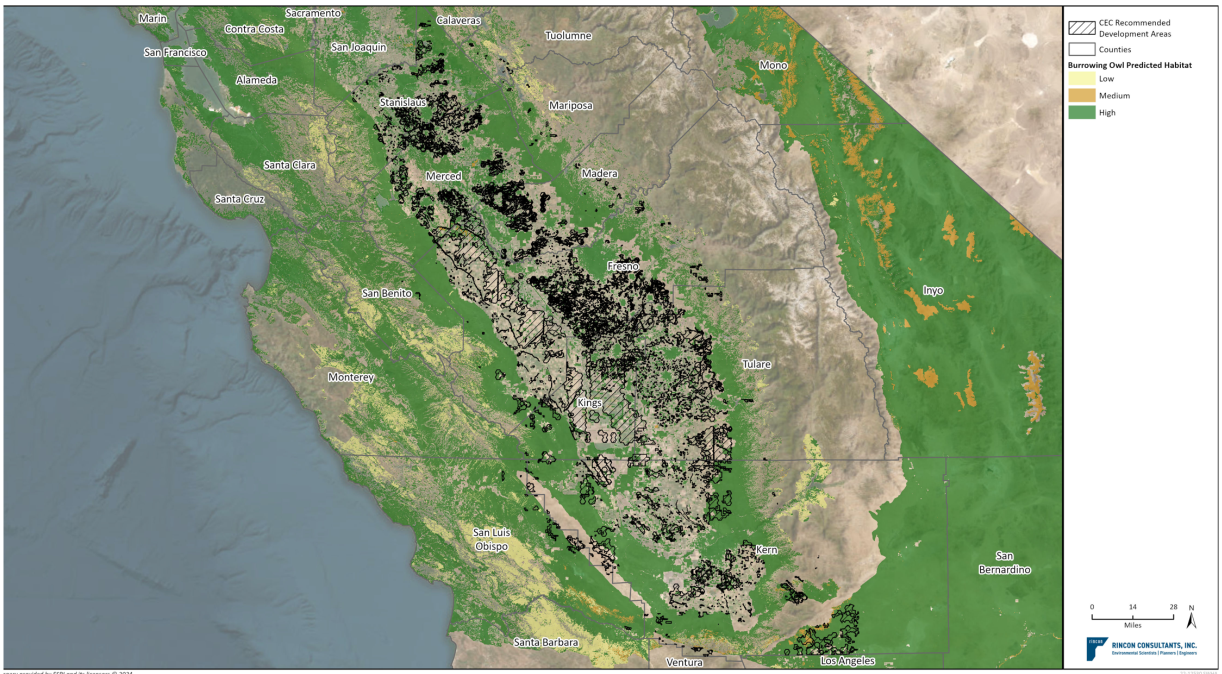

Figure 1. Burrowing Owl Habitat Suitability and Solar Potential in the San Joaquin Valley

Because solar energy development includes the cessation of annual and routine harvesting, disking, planting, and herbicide and pesticide use, redevelopment of retired agricultural lands represents an opportunity for restoration of grassland habitats in the San Joaquin Valley for the benefit of BUOW and many other species.

2. Life History of the Western Burrowing Owl

2.1 Range and Habitat

The BUOW inhabits arid lands throughout much of the western United States and southern interior of western Canada (Haug et al. 1993). Suitable habitat for western burrowing owl includes open habitat with available burrowing opportunities, including agricultural fields (active and fallow), creosote scrub, desert saltbush, ephemeral washes, and ruderal areas (Haug et al. 1993; Rosenberg et al. 1998; Wilkerson and Siegel 2011).

Burrowing owls are unique among the North American owls in that they nest and roost in abandoned burrows, especially those created by ground squirrels, kit fox, desert tortoise, and other wildlife (Zarn 1974; CDFG 2012). Burrowing owls have a strong affinity for previously occupied nesting and wintering sites and will often return to previously used burrows, particularly if they had successful reproduction in previous years (Gervais et al. 2008). They generally depend on other species to dig suitable burrows for use but may also use anthropogenic surrogate burrows such as rubble piles or drainage pipes (Rosenberg et al. 1998). If formerly occupied burrows are badly damaged or collapsed, burrowing owls cannot repair them and must seek alternate sites.

Burrowing owl habitats may be described simply: they require burrows for shelter, nesting, and escape from predators. Short, sparse vegetation provides visual security from their predators and makes their prey vulnerable to the burrowing owl's mode of hunting.

There is a considerable volume of literature attesting to the habitat characteristics selected by burrowing owls; how these characteristics differed from the area generally; and the productivity, nest density, and nest site reuse among years that can result.

1. Availability of nest sites, and not prey availability, limits grassland raptor populations (Olendorff and Stoddart 1974), and burrow availability limits burrowing owl abundance (Coulombe 1971).
2. Vegetation structure may be more important than plant species composition (Haug and Oliphant 1990). Nesting burrowing owls select nest burrows with shorter grass and forb height, greater burrow density, and greater percentage of bare ground than generally available (Plumpton and Lutz 1993).
3. Adult burrowing owls will return to successful nest sites, and these owls can return to the same locations where they were hatched. Burrowing owls can nest semi-colonially, defending only the immediate vicinity around their nests from conspecifics, but foraging in common areas. Nest site fidelity can be high, even among migrant owls. Continuity of habitat quality (i.e., short, sparse vegetation and high burrow density as found in active ground squirrel colonies) may promote increased nest density (Lutz and Plumpton 1999).

Burrowing owls can be found in various anthropogenic landscapes where ground squirrels create burrows, including fallow agricultural fields, adjacent to wastewater treatment plants, ruderal infill lots, airports, and other landscaped areas (Rosenberg et al. 1998; Wilkerson and Siegel 2011).

2.2 Breeding

The California breeding season (defined as the time from pair bonding of adults to fledging of the offspring) generally occurs from February to August, with peak breeding activity from April through July (Haug et al. 1993; CDFG 2012). Nest burrows are usually 1 to 3 meters long, with a downward slope of about 15 degrees, a J- or U-shaped bend, and an enlarged nest chamber at the end (Coulombe 1971). Burrowing owls exhibit strong site fidelity and adults often return to the same burrow or a nearby area each year (Botelho and Arrowood 1998; CDFG 2012). Adult males often use one or more "satellite" burrows near the nest burrow during the nesting period, as do juvenile owls for a few weeks after they emerge from the nest. Both adults in a pair prepare the burrow for nesting using their feet, beaks, and wings to scrape out dirt (Thomsen 1971; Martin 1973; Voous 1988). They often begin these renovations at several burrows, eventually selecting the best one as a nest site. The burrow is frequently lined with horse or cattle dung and other material such as grass, feathers, and other debris, but is sometimes left unlined (Thomsen 1971; Martin 1973; Evans 1982; Johnsgard 1988; Voous 1988). It has been speculated that the lining material acts as an absorbent, attracts dung beetles eaten by the owls, masks odors produced by the birds (making detection by predators more difficult), or produces heat by decomposition, controlling temperature and humidity within the nest cavity and aiding in the incubation of eggs (Martin 1973; Green and Anthony 1989). The habit of lining the burrow with manure is so strong that owls will promptly replace dung when it is removed (Martin 1973). Nest burrows are often also adorned by animal carcasses, toad skins, canid scat, clumps of grass, and shiny objects such as plastic trash (see Smallwood and Morrison 2018 for references).

Burrowing owls are primarily monogamous for the nesting season (Coulombe 1971). Females usually produce only one clutch per year, but may lay a second clutch if the first is lost. Pairs are capable of laying a second clutch after the first brood successfully fledges (Gervais and Rosenberg 1999). Burrowing owls will lay up to 12 eggs in a chamber of the nest burrow, one of the largest clutch sizes of any raptor species, although 7 eggs is the norm (Haug et al. 1993). Eggs are laid between March and May depending upon location. The incubation period lasts 29 days (Coulombe 1971). The female incubates the eggs while the male brings food to the female and stands guard near the burrow by day. After hatching, the nestlings remain in the nest chamber for approximately 2 to 3 weeks. By this time, the young are large, the burrow is very crowded, and young birds will often stand at the burrow entrance eagerly waiting for the parents to bring food. Just before or just after they emerge (mid-May through early August), young lose their natal down and gain juvenal plumage. Juveniles emerge from the burrow weighing approximately half to two thirds of adult weight and they reach adult weight within a month of emergence (Landry 1979; Priest 1997; Lantz and Conway 2009). Young fledge (acquiring the feathers necessary for flight) after 44 days (Haug et al. 1993). Burrowing owl parents will feed young for another 6 to 8 weeks after emergence, with young remaining near the burrow with their parents until fall. By mid-September, the young molt into adult plumage and disperse to find their own burrows. The timing of nesting activities may vary with latitude and climatic conditions. Burrowing owls may change burrows several times during the breeding season, starting when nestlings are about three weeks old (Haug et al. 1993). Although published accounts for life expectancy of burrowing owls are lacking since returns of banded owls are sparse, an average longevity of 5 years is informally used (Kennard 1975).

2.3 Migration and Residency

In northern portions of the range of the burrowing owl in Canada and the United States, some populations are migratory, leaving their breeding areas in fall and returning to the same area in the spring. Most migrants from these areas are thought to winter in Mexico and in the southern portion of the western burrowing owl's range in the United States. In California, burrowing owls are predominately nonmigratory (Brenkle 1936; Ligon 1961; Thomsen 1971; Haug et al. 1993) or appear to wander within the region during the winter months (Coulombe 1971; Martin 1973; Botelho 1996), particularly in central and southern California. Burrowing owls in California will continue to use burrows during the winter or become strictly nocturnal (Thomsen 1971; Trulio et al. 2023). Winter migrants from outside of California may augment some California populations during winter months (Coulombe 1971; Kute et al. 2003). It is assumed that migrants may travel from northern areas that are covered in snow during the winter where their burrows and food may be inaccessible (as far away as Canada, Washington, Oregon, and Idaho). California has a large number of burrowing owls in the winter relative to other portions of the species' North American breeding range.

2.4 Foraging and Predation

Owls will generally spend most of the day near their burrows, coming out in the late afternoon to perch and beginning to forage at dusk. Adults with young to feed return to the burrow at night (Thomsen 1971). They forage in natural, ruderal (areas such as roadsides where vegetation has been disturbed), or manicured grasslands. Burrowing owls predate primarily on large insects and small rodents but will take a wide variety of prey and are known to be opportunistic in their feeding habits (Thomsen 1971; 1974a). Burrowing owls may hunt from a perch, capturing prey after short flights or glides, or hovering while hunting and returning to the perch after catching their prey. Burrowing owls will also walk, run, or hop after prey on the ground. Hunting style varies with type and activity of prey pursued, time of day, and vegetative substrate (Thompson and Anderson 1988; Haug et al. 1993). Burrowing owls probably also take insects that live in their burrows (Coulombe 1971).

Important food items for burrowing owls include small rodents such as voles (*Microtus spp.*)*,* mice (*Peromyscus spp., Mus spp., Reithrodontomys spp., Zapus spp.*), pocket mice (*Perognathus spp.*), pocket gophers (*Thomomys spp.*), kangaroo rats (*Dipodomys spp.*), and young ground squirrels (*Otospermophilus beecheyi*) (York et al. 2002; Trulio and Higgins 2012). Burrowing owls also eat a wide array of arthropods (such as beetles, grasshoppers, crickets, dragonflies, and crustaceans), reptiles, amphibians, small birds, fish, and even carrion (Bent 1938; Glover 1953; Earhart and Johnson 1970; Thomsen 1971; Zarn 1974; Gleason and Craig 1979; Conroy and Chesemore 1987; Haug and Oliphant 1990).

2.5 Natural Predators

Predators of burrowing owls are of two general types: predators that enter or dig up burrows to eat eggs, nestlings, and/or adult females, or predators that prey on older nestlings and adults when they are above ground. Because burrowing owls are ground nesters, their eggs and young are quite susceptible to predation. Predators that can access nest chambers and are known predators of the burrowing owl include striped skunk (*Mephitis mephitis*), badger (*Taxidea taxus*), foxes (*Vulpes, V. macrotis mutica*, and *Urocyon cinereoargenteus*), raccoon (Procyon lotor), and various snakes, including rattlesnakes (*Crotalus spp.*) (Coulombe 1971; Kemper 1996). Predators that mainly catch owls above ground include peregrine falcon (*Falco peregrinus*), prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), ferruginous hawk (Buteo regalis), northern harrier (*Circus hudsonius),* golden eagle (*Aquila chrysaetos*), great horned owl (Bubo virginianus), common raven (Corvus corax), American crow (*Corvus brachyrhynchos*), coyote (*Canis latrans*), and possibly shorteared owl (*Asio flammeus*) (Fowler 1931; Haug et al. 1993).

2.6 Anthropogenic Causes of Population Decline

The Center for Biological Diversity's 2024 petition for listing the BUOW under CESA provides evidence that the species is in decline across the state of California and describes a number of anthropogenic sources of population declines. The most important of these are direct mortality and permanent habitat loss caused by urbanization, and reduction or elimination of their primary burrow excavators, ground squirrels, from grazing and agricultural lands. However, the petition is misleading on several points. It is clear from Figure 1 above that cultivated agriculture has eliminated vast areas of habitat (tens of millions of acres) for burrowing owls in California's Central Valley. The petition fails to mention this. Secondly, the petition extensively cites renewable energy development as a major threat to burrowing owl populations. This claim, particularly with regard to large-scale solar and battery energy storage development, is wholly unsupported, and evidence refuting this claim is presented herein.

While relocation of owls and removal of habitat has occurred in connection with some solar and battery projects in California, tens of thousands of acres of at-risk, high-quality native desert and grassland habitats have been permanently protected under conservation easements as a result these projects (as compensatory mitigation for impacts to other listed species). Additionally, artificial burrow construction has in some cases provided supplemental habitat for burrowing owls in connection with solar project development. Furthermore, burrowing owls are known to reoccupy solar energy development sites during the post-construction phase and continue to feed, nest, and breed within solar arrays (see Section 9). However, there has been little systematic monitoring and no formal research comparing pre-and post-construction burrowing owl occupancy of solar project sites in California, which this Conservation Strategy aims to change (see Section 9). Finally, less than 1% of the land surface of California is required to meet the State's solar energy and battery storage deployment requirements to meet our decarbonization and renewable energy goals, and large-scale solar systems have a high potential to provide a net conservation benefit to BUOW, especially when converting intensively cultivated agricultural lands to solar energy production.

3. Regulatory Background

Management actions for burrowing owl have long been subject to restrictions under the federal Migratory Bird Treaty Act ("MBTA") and the California Fish and Game Code ("FGC"). Listing (and before that, the species' candidacy for listing) under the California Endangered Species Act ("CESA") could reinforce those restrictions while also providing opportunities to explore more creative management strategies because of the availability of incidental take permitting. The subsections below summarize allowable actions under current and potential future legal requirements.

3.1 Migratory Bird Treaty Act

MBTA (16 U.S.C. §§ 703-712) makes it unlawful, unless otherwise authorized by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture, or kill, [or] possess…any migratory bird, [or] any part, nest, or egg of any such bird…" (16 U.S.C. § 703). Burrowing owl is one migratory bird subject to protections under the MBTA (50 C.F.R. § 10.13).

Under the MBTA, "take" is defined to mean "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, tap, capture, or collect." (50 C.F.R. § 10.12; *see also* 50 C.F.R. § 10.1). Note that unlike the Endangered Species Act, the MBTA's definition of "take" does not include harm to or harass. (*See* 16 U.S.C. § 1532(19) [ESA's definition of "take"].)[1] The U.S. Fish and Wildlife Service (USFWS) currently interprets the MBTA to not allow (or provide a permitting mechanism for) incidental take of covered species (*See* 86 Fed. Reg. 54642).

3.2 California Fish and Game Code

FGC Section 3503.5 makes it "unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nests or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto."[2,3] "Take" is defined under

[1] Regulations provide further definition of harm and harass. "Harm in the definition of 'take' in the [ESA] means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." (50 C.F.R. § 17.3.) "Harass in the definition of 'take' in the [ESA] means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." (*Id*.)

[2] Burrowing owl is a member of the order Strigiformes.

[3] Burrowing owl is also subject to protection under FGC section 3503, which makes it "unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto." However, FGC section 3503.5 is broader and more stringent than section 3503—*e.g.*, 3503.5

the FGC to mean "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch capture, or kill." (FGC § 86.) This definition of "take" includes *direct* killing, pursuit, or capture of a listed species but does not extend to indirect harm to listed species occurring through habitat modification. Activities that cause abandonment of active nests or loss of eggs may also constitute "take" under the FGC. Like the MBTA, FGC section 3503.5 also does not provide a permitting mechanism for incidental take.

Similar to the MBTA, FGC section 3503.5 applies to individual burrowing owls as well as their nests and eggs. For individuals and eggs, the prohibition is fairly straightforward: a person may not take, possess, or destroy a burrowing owl or its eggs. The plain language of the statute also states that it is unlawful to take, possess, or destroy a burrowing owl nest .[4] A definition of BUOW take that could potentially result from large scale solar and battery storage projects that is used for the purposes of this Conservation Strategy is presented in Section 4.

3.3 California Endangered Species Act

The California Endangered Species Act ("CESA"; FGC § 2050, *et seq.*) makes it unlawful for any person to "import into [California], export out of [California], or take, possess, purchase, or sell within [California], any species, or any part or product thereof" that is listed as endangered or threatened (FGC § 2080). As with section 3503.5, "take" for purposes of CESA also means "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch capture, or kill" (FGC § 86). Moreover, like the MBTA and FGC section 3503.5 (but unlike the federal ESA), CESA's definition of "take" is not as broad as the federal ESA's definition of "take," and does not extend to indirect harm to species resulting from habitat modification.

Unlike the MBTA and FGC section 3503.5, CESA provides a permitting mechanism for incidental take. Specifically, CESA authorizes CDFW to issue an incidental take permit (ITP) for take of endangered, threatened, or candidate species so long as the take is "incidental to an otherwise lawful activity" and any impacts of the take are "minimized and fully mitigated" (FGC § 2081). The Commission can also authorize take of any candidate species subject to certain terms and conditions as provided for in FGC Section 2084.[5] (FGC § 2084). Other mechanisms authorizing incidental take are described herein.

Under FGC section 2081(b), CDFW may authorize take of endangered, threatened, or candidate species so long as the take is "incidental to an otherwise lawful activity," any impacts of the take are "minimized and fully mitigated," and that the applicant ensure sufficient funding to implement any required mitigation measures

3.4 CDFW Guidance

The Staff Report on Burrowing Owl Mitigation ("Staff Report" CDFG, 2012) sets forth breeding and non-breeding season survey protocols, and pre-project clearance surveys and reporting recommendations (Appendix D) and is incorporated herein by reference.

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applies to *individuals* as well as nests and eggs, and 3503.5 applies to *any* destruction of nests, not just "needless" destruction. We therefore do not address FGC section 3503 here. Burrowing owl would also be subject to protection under FGC section 3513, which makes it unlawful to take migratory nongame birds as designated under the MBTA.

[4] It is unclear how "take" as defined in Fish and Game Code section 86 would apply to nests, as it is not immediately apparent how one would "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch capture, or kill" a nest.

[5] FGC section 3503.5 prohibits certain actions "except as otherwise provided by this code or any regulation adopted pursuant thereto." Accordingly, any incidental take coverage provided pursuant to CESA would not represent a violation of FGC section 3503.5.

4. Definition of Terms

The following terms are used throughout the remainder of this Conservation Strategy.

Suitable burrow: A burrow within the known range of the western burrowing owl that is suitable for burrowing owl use and that may or may not have sign of burrowing owl presence.

Occupied burrow: A burrow that is suitable for burrowing owl use that shows sign of burrowing owl presence (whitewash, feathers, pellets, prey remains, eggshell fragments) where monitoring overseen by a qualified biologist demonstrates the presence of at least one burrowing owl.

General breeding season: February 1 through August 31.

Non-breeding season: September 1 through January 31.

Occupied nest burrow: A burrow that is suitable for burrowing owl use where monitoring overseen by a qualified biologist demonstrates the presence of at least one burrowing owl exhibiting nesting behaviors during the breeding season.

Occupied non-nesting burrow: A burrow that is suitable for burrowing owl use where monitoring overseen by a qualified biologist demonstrates the presence of at least one burrowing owl during the non-breeding season.

Sensitivity period: One of three periods of differential sensitivity of burrowing owls to disturbance. The period of highest sensitivity is February 1 to April 15, during arrival, pairing, burrow selection, egg laying, incubation, hatching, and thermoregulation and provisioning of nestlings. The period of moderate sensitivity is April 16 through August 31 when chicks are well feathered and capable of thermoregulation. For any given nest burrow, this sensitivity period ends when chicks have fledged, which may occur as late as the end of August but may occur much earlier, when they are feeding independently and are no longer dependent on the nest. The period of low sensitivity is September 1 through January 31 where there is no breeding use of burrows by burrowing owls.

Satellite burrow: A burrow in close proximity to an occupied nest burrow that is suitable for burrowing owl use where monitoring overseen by a qualified biologist demonstrates the occasional presence of a male burrowing owl taking shelter during the breeding season or of a female during the late breeding season, but where nesting activities are not occurring.

CESA take of burrowing owls: Solar and battery storage projects could result in take of burrowing owls during construction, operations, and decommissioning.

- During construction or decommissioning, use of vehicles and heavy equipment may result in disturbance of owls causing abandonment of active nests or loss of eggs, injury, or mortality of burrowing owls. Burrowing owls, if present during construction or decommissioning, may shelter inside burrows where they could be crushed by heavy equipment. Construction materials such as open pipes or tubing can attract owls, which can become trapped inside. Active translocation of owls may result in injury or mortality of owls, or abandonment of active nests or loss of eggs. During long-term operations, project facilities may present hazards to owls: guy wires and overhead cables may present collision hazards during flight, and uncovered water tanks may attract burrowing owls that subsequently drown without a means of exit.

Fully mitigated CESA take of burrowing owls: in most cases, take of burrowing owls by solar and/or battery storage project development can be fully mitigated through implementation of one of two approaches:

- Permanent protection of off-site compensatory habitat (see Section 8); or
- Long-term management of on-site compensatory habitat (see Section 7.8). Long-term management of on-site compensatory habitat need not include the provision of a permanent conservation easement or property deed restriction, provided that there is no net loss of BUOW nesting or foraging activities by BUOW over long-term project operations relative to baseline conditions, the management actions and habitat maintenance or enhancement measures are documented and monitored over time, and adaptive management measures are introduced should a long-term loss of habitat suitability be observed.
- Projects would not be required to mitigate separately for CESA take and CEQA potentially significant impacts (see definition below).
- If incidental take permit coverage does not cover the decommissioning phase of a project, consultation with CDFW may be needed prior to carrying out project decommissioning activities.

CEQA "potentially significant impacts" to burrowing owls:

- Project construction and operation may substantially modify occupied burrowing owl habitat, including potentially occupied nest burrows, overwintering burrows, and satellite burrows as demonstrated by burrowing owl surveys conducted during pre-project planning, temporarily or permanently displacing burrowing owls to adjacent, unsuitable habitat, resulting in loss of fitness and/or mortality. Burrowing owls dispersing from a construction site could be at increased risk of predation and possible vehicle collisions as they flush from cover during site clearing. Long-term operation of the project site may reduce the quality of burrowing owl habitat by eliminating natural burrows and due to the ongoing, though infrequent, presence of human activities. Installed fencing or gen-tie poles may provide augmented perching opportunities for predatory birds, such as red-tailed hawks, falcons, or ravens, which may indirectly increase mortality of burrowing owls. Presence of trash may similarly attract ravens or coyotes, which may result in increased predation of burrowing owls. Passive relocation of owls to natural or artificial burrows may in some cases be unsuccessful, resulting in potentially significant impacts to owls. Artificial burrows, if not properly maintained, may become clogged and unusable by owls, resulting in loss of sheltering or nesting opportunities.
- If a project would result in potentially significant indirect impacts to burrowing owls, including habitat modification, project applicants would avoid, minimize, or compensate for these impacts in accordance with this Conservation Strategy (see Sections 7.8 and 8; projects would not be required to mitigate separately for CESA take and CEQA potentially significant impacts).

5. Tolerance to Anthropogenic Disturbance

Burrowing owls exhibit a range of responses to human disturbances, and some populations have become well accustomed to human disturbance, while other, more remote populations may exhibit more caution in the presence of human activities. It is well documented that BUOW have adapted to a variety of disturbed and developed sites (Klute et al., 2003). In preparing this Conservation Strategy, we reviewed field monitoring reports from the West of Devers Transmission Project construction provided to us by Southern California Edison. The reports were from 2019 through 2021 and included 10 burrowing owl occurrences where the biological monitor documented burrowing owl behavior during various construction related activities. Of the monitoring reports, nine occurred during the breeding season, and one occurred during the non-breeding season. These observations occurred throughout a range of locations, from highly remote with low human presence to semi-urban with high human presence. All instances included reduced buffers relative to what is recommended in the 2012 Staff Report. Please note that a much larger data set is in the process of being analyzed (see Section 9).

Non-breeding season buffers were as small as 8 meters. Breeding season buffers ranged from 20 to 30 meters. Activities ranged from low-impact, like driving vehicles, to high-impact, like grading and excavation. For this data set, burrowing owl responses during the non-breeding season displayed initial agitation from grading activities at an 8-meter buffer, but subsequent construction activities resulted in no agitation.

Early breeding season owls showed adverse effects of grading at 45 meters, resulting in a failed nest. But during this season, other burrowing owls showed no adverse effects from wire stringing at 27 meters, resulting in successful fledging of the nest. Burrowing owls showed no adverse effects of helicopter use at a 30-meter vertical buffer, resulting in successful fledging of the nest. Burrowing owls showed no adverse effects of concrete truck driving at 30 meters, resulting in successful fledging of the nest. During the late breeding season, reports indicated that burrowing owls showed some agitation from telecom activities at a 20-meter buffer when the cable was dropped, but showed no agitation thereafter, and there was successful fledging of the nest. During the late breeding season, burrowing owls showed no adverse effects of tower assembly at 27 meters, resulting in successful fledging of the nest. Table 1 summarizes these observations. While it is recognized that this is not a statistically robust analysis, and it cannot be relied upon to demonstrate that the buffer distances implemented in these cases will be tolerated by all owls, it does offer preliminary observational data demonstrating that in some cases, owls tolerate substantially reduced buffer distances very well. A statistically robust evaluation of a vastly larger data set is proposed (see Section 9). The colors in Table 1 indicate the following: green = no adverse response; yellow = short-term adverse response and recovery; red = adverse response and nest abandonment.

Table 1. Burrowing Owl Responses to Reduced Buffers from Varying Levels of Disturbance

Time of Year	Buffer Distance (m) and Level of Intensity of Activity		
	Low	Moderate	High
Early Breeding	27	27	45
	30	-	60
Late Breeding	-	20	-
	-	27	-
Non-Breeding	-	-	8

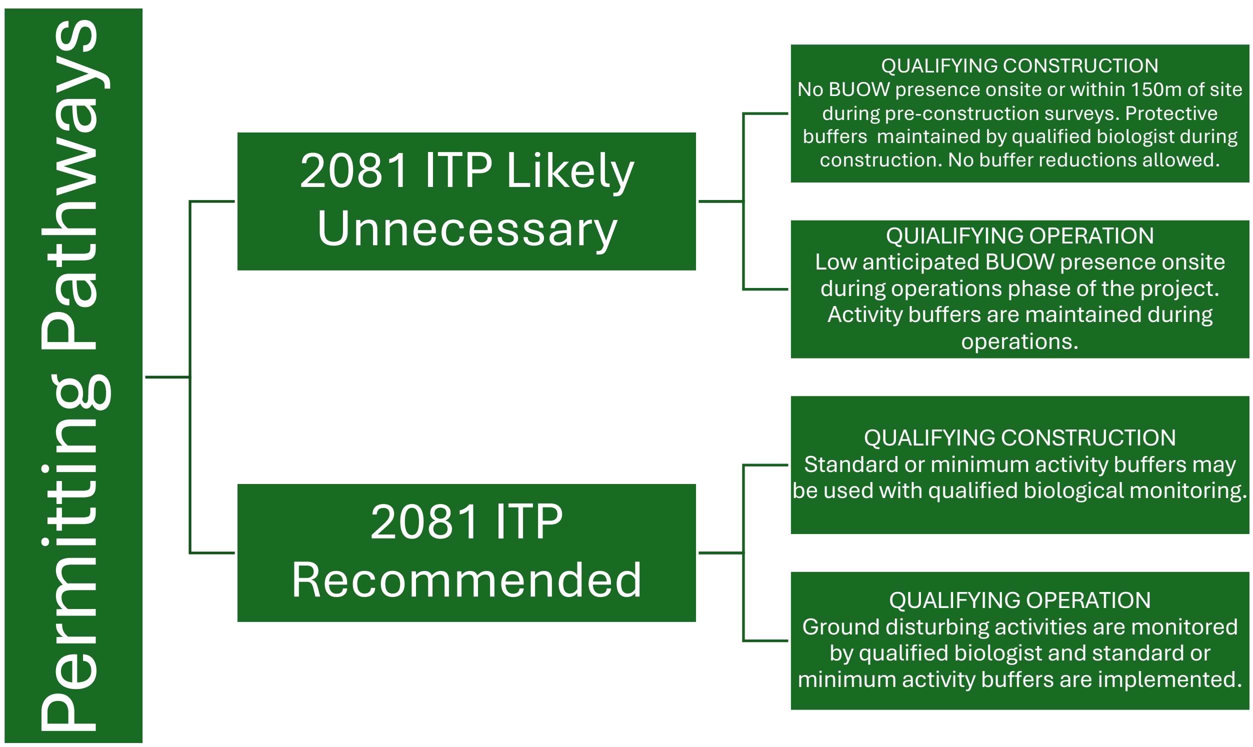
6. Pathways for Large-scale Solar and Battery Projects

Although large-scale solar and battery energy storage systems are developed and installed to replace harmful fossil fuels, reverse global warming, and minimize the worst effects of the climate crisis globally, including but not limited to limiting species extinctions from loss of suitable habitat conditions driven by dramatic changes in local and global climate trends, the construction and operation of large-scale solar energy and battery storage projects has the potential to result in direct take of BUOW as the species tends to inhabit flat, sunny areas that are also ideal for siting solar and battery projects. If managed properly, solar projects can provide replacement of long-term suitable habitat for BUOW and avoid take. This section describes a range of permitting and mitigation pathways available to large-scale solar and battery energy storage projects under CESA.

6.1 Permitting Pathways

Anticipated permitting pathways available to large-scale solar and battery projects include not obtaining incidental take coverage by implementing and documenting BUOW avoidance, or obtaining incidental take coverage under an ITP authorized under FGC Section 2081(b).

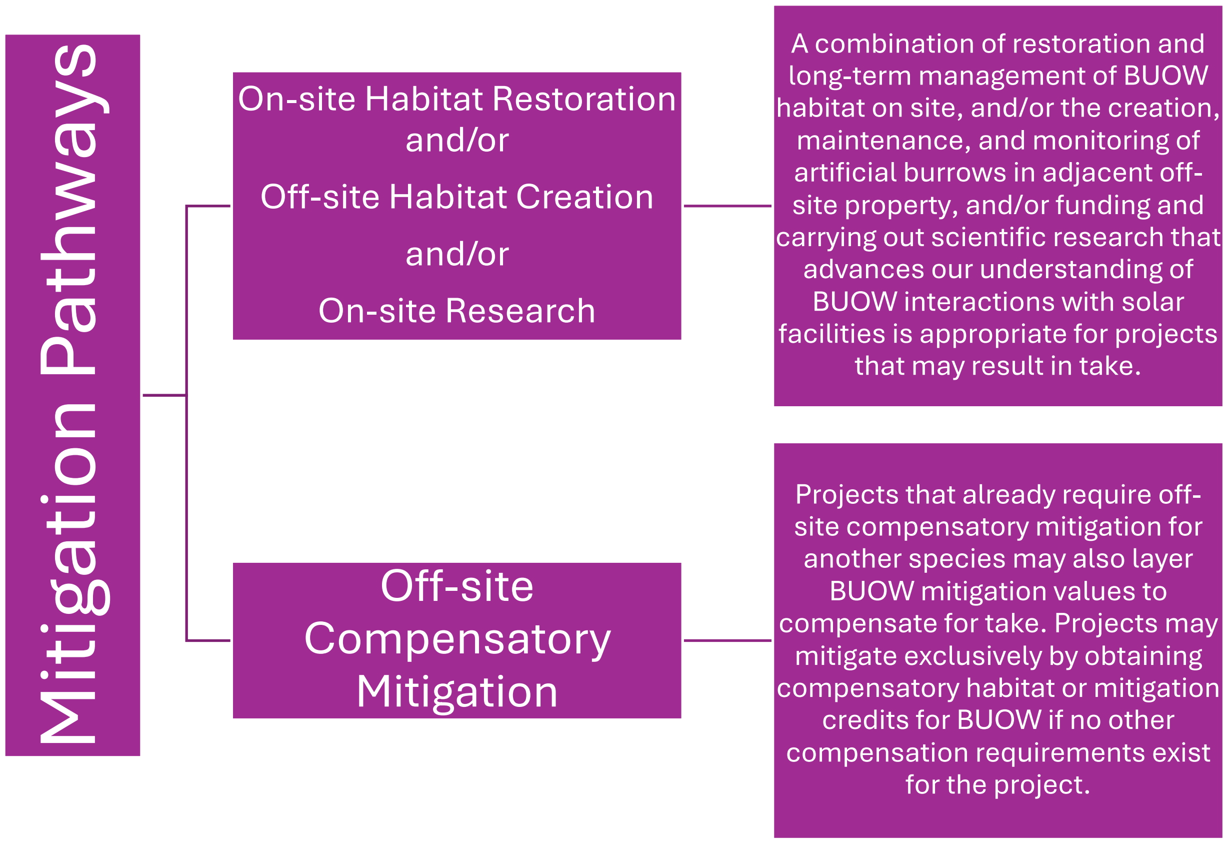
Figure 2. Permitting Pathways for Large-scale Solar and Battery Energy Storage in California



6.2 Mitigation Pathways

Multiple mitigation pathways are available depending on a project developer's level of risk tolerance, opportunities for habitat restoration at the project site (e.g., when replacing active or recently fallowed agricultural lands), availability of adjacent relocation sites, an owner's preferred level of operational site management and monitoring, and compounding factors such as management of and mitigation for other special-status species.

Figure 3. Mitigation Pathways for Large-scale Solar and Battery Storage in California



7. Burrowing Owl Management

7.1 Biologist Designations and Qualifications

Biologists may be qualified to carry out burrowing owl surveys, monitoring, and reporting, depending on their roles and responsibilities. Two different categories of qualified biologist are herein identified: the Lead Avian Biologist, and Avian Monitors.

Lead Avian Biologist: Oversees pre-project burrowing owl protocol surveys and pre-construction surveys for burrowing owls. Oversees burrow monitoring. Makes burrow occupancy determinations. Establishes activity buffers in accordance with permit conditions. May authorize reduced activity buffers. Conducts or directly oversees burrow excavations, passive relocations, active translocations[6]. Oversees report preparation. Serves as the primary liaison with CDFW on burrowing owl management issues that may arise in the field during construction monitoring.

The Lead Avian Biologist is expected to have the following minimum qualifications:

- A bachelor's degree in biological sciences, zoology, botany, ecology, or a closely related field, or equivalent field experience.
- Three years of focused experience with Western burrowing owl, performing surveys in accordance with CDFW protocols, passive relocation, and monitoring burrowing owl nests for disturbance from construction activity.
- Worked on 10 or more substantial multi-season bird projects, or the equivalent, performing surveys, habitat assessments, etc. in the field. Of these, at least 8 must be in the Southwest, preferably in California.

Avian Monitor: Conducts pre-project and pre-construction surveys under the supervision of the Lead Avian Biologist. Establishes appropriate buffers around active nests following guidance provided by the Lead Avian Biologist. Monitors occupied burrows and adjacent construction activities. Communicates regularly with the Lead Avian Biologist about any burrowing owl behaviors observed. Enters burrowing owl monitoring data. Contributes to burrowing owl monitoring reports. The Avian Monitor may halt construction at any time to protect burrowing owls.

To be approved as an Avian Monitor, an individual is expected to have the following qualifications:

- Worked on 3 or more substantial multi-season bird projects or the equivalent, performing surveys, habitat assessments, etc. in the field. Of these, at least 2 must be in the southwestern United States, preferably in California.

7.2 Pre-project Surveys

Pre-project surveys may be conducted without incidental take authorization.

Baseline Surveys

Baseline surveys should be conducted as a part of a project's CEQA and/or NEPA documentation and should be performed in accordance with the 2012 Staff Report or as approved by CDFW, although data collection should be carried out in accordance with Section 9.2 of this document.

Pre-construction Surveys

All projects should conduct pre-construction surveys. Pre-construction should be conducted by a qualified biologist no more than 14 days prior to the start of initial ground-disturbing activities in accordance with the 2012 Staff Report. For large construction sites that will be disturbed in phases within discrete areas of the site, pre-construction surveys should be phased such that surveys are conducted no more than 14 days prior to initial ground disturbing activities in each area.

7.3 Nesting Deterrence

Because construction activities may have adverse effects on burrowing owls, it may be most protective of owls to deter nesting behaviors at a project site just prior to the start of construction during the non-

[6] If other protected species are present, additional qualifications may be required by CDFW or other trustee agencies.

breeding season. Suitable burrows that may or may not be occupied by burrowing owls or other protected species may be made less desirable for nesting by the Lead Avian Biologist by placing small rocks, sticks, or other natural debris near the entrance of the suitable burrow, without blocking it or preventing ingress or egress by any protected species; these activities may be conducted without incidental take coverage during the non-breeding season, but only just in advance of the start of construction activities. Deterrence shall not be conducted for sites that lack proximate suitable burrowing habitat. If nesting deterrence activities are shown to have an adverse effect on owls present in the area, all activities must stop, and consultation must be initiated with CDFW. Alternatively, or in combination with deterrence, BUOW attractants may be installed in offsite natural or agricultural areas that are not anticipated to have human disturbance, or in onsite wildlife buffer areas, in order to encourage returning BUOW to favor these locations for nesting compared with locations that may be preparing for construction work to begin during the next breeding season. Attractants may include perches or rock piles.

7.4 Burrow Monitoring, Determination of Occupancy, and Excavation

Construction burrow monitoring may be conducted by a qualified biologist without incidental take authorization. Potentially occupied burrows and occupied burrows will be monitored prior to the start of ground-disturbing or other activities that could result in take of BUOW.

- Suitable burrows within the project areas will be visited and evaluated for the presence of burrowing owl sign.
- Suitable burrows within 150 meters of the project site will be visited and evaluated for owl presence only if site control is available.
- For on-site suitable burrows, burrowing owl sign (feathers, whitewash, pellets) will be noted and removed. Only burrows with sign, or burrows that are potentially occupied as determined by the Lead Avian Biologist, will require monitoring to determine occupancy.
- Suitable burrows with sign will be visited twice daily for two days (48 hours) for surveillance purposes, to look for any new sign of burrowing owl.
- Motion-activated game cameras will be used in combination with burrow visits to determine burrow occupancy. Cameras will be placed within 10 meters of potentially occupied on-site burrows for a minimum of 48 hours. Cameras will be placed as close as possible to off-site burrows to document owl activity.
- If owls are determined to be present by the Lead Avian Biologist after 48 hours of continuous camera monitoring and/or documented presence of new burrowing owl sign, the appropriate exclusion buffer will be delineated and marked.
- If 48 hours of continuous monitoring and site visits demonstrate no presence of owls, a burrow may be determined to be unoccupied.

Burrows that are determined by a qualified biologist to be unoccupied by any protected species, including burrowing owls, using the above criteria, may be excavated and either blocked or collapsed without incidental take authorization. If a burrow is determined to be occupied or potentially occupied by another protected species (e.g., Mojave desert tortoise, San Joaquin kit fox, desert kit fox, Mohave ground squirrel, blunt-nosed leopard lizard, California tiger salamander, giant kangaroo rat, Tipton's kangaroo rat, San Joaquin antelope squirrel, etc.), burrows may only be excavated, blocked, and/or collapsed in accordance with permit conditions.

- For on-site unoccupied burrows, excavation may occur, using techniques identified in the 2012 Staff Report, or other techniques that may be required for other protected species (e.g., desert tortoise).

- Burrows located outside the construction activity zones will not be excavated.
- On-site occupied burrows may be prepared for passive relocation or active translocation (see Section 6.6).

7.5 Activity Buffers

Construction activities may proceed without incidental take coverage if take avoidance activity buffers are maintained throughout construction and operations of the project as overseen by a qualified biologist in accordance with Table 2. If take avoidance activity buffers cannot be maintained, or take is reasonably expected to occur, incidental take coverage should be considered prior to the start of project activities.

If an occupied burrow is detected within any project disturbance area, or within 150 meters of the disturbance area within line of sight, activity buffers should be established in accordance with Table 2 under the supervision of a qualified biologist. Activity buffers will be maintained for the duration that a burrow remains occupied as determined by a qualified biologist. Table 2 provides construction buffers for the following permitting pathways:

1. Minimum exclusion buffer requirements that must be maintained to avoid take; if at any point during construction or operations, take of BUOW is determined to occur, the activity causing the take shall immediately cease and shall not begin until the activity is properly permitted or upon authorization by CDFW;
2. Standard Buffer Distances with Take Coverage
3. Minimum Buffer Distances with Take Coverage

Table 2. Activity Buffer Distance for Occupied Burrows

	Avoidance of Take: Minimum Buffer Distance (m) and Level of Disturbance			
Time of Year	**Minimal**	**Low**	**Moderate**	**High**
Feb 1 – April 15	10	200	500	500
Apr 16 – Aug 31	10	200	200	500
Aug 31 – Jan 31	10	50	100	500
	With Take Coverage: Standard Buffer Distance (m) and Level of Disturbance			
Time of Year	**Minimal**	**Low**	**Moderate**	**High**
Feb 1 – April 15	0	100	200	300
Apr 16 – Aug 31	0	75	100	250
Aug 31 – Jan 31	0	35	50	100
	With Take Coverage: Minimum Temporary Buffer Distance (m) and Level of Disturbance*			
Time of Year	**Minimal**	**Low**	**Moderate**	**High**
Feb 1 – April 15	0	30	90	150
Apr 16 – Aug 31	0	25	65	90
Aug 31 – Jan 31	0	20	35	50

*Requires approval of the lead avian biologist, and other conditions may apply, including, but not limited to: installation of visual and/or sound barriers, other minimization measures, and enforcement of increase in buffer from Minimum to Standard as soon as activity is complete.

Table 3. Typical Project Activities and Their Disturbance Levels

Project Phase	Construction Activity	Intensity	Disturbance Level
Preconstruction	Site Visits	Short-duration, on foot, driving on established roads, quiet	Minimal
	Environmental Resource Surveys and Monitoring	Short-duration, on foot, driving on established roads, quiet	Minimal
	Activity Buffer Staking and Flagging	Short-duration, on foot, driving off-road after wildlife surveys, quiet	Minimal
	Civil Survey, Staking, and Flagging	Short-duration, on foot, driving off-road after wildlife surveys, quiet	Minimal
	Met Tower Installation	Short-duration, on foot, driving off-road after wildlife surveys, quiet	Low
	Geotechnical Testing	Short-duration, on foot, driving off-road after wildlife surveys, quiet	Low
	Trenchless Wildlife Exclusion Fence Installation	Short-duration in any one location, driving off-road after wildlife surveys, fairly quiet	Low
	Trenched Wildlife Exclusion Fence Installation	Short-duration in any one location, trenching, driving light and heavy equipment, low-moderate noise	Moderate
Site Preparation	Environmental Monitoring	Short-duration, passive observation of natural resources conducted by trained environmental field professionals on foot and in vehicles	Minimal
	Vegetation Mowing (4+in)	Mowing well above the ground surface to de-bulk grassland, cropland, or weedy vegetation, single pass, short duration in any single location	Moderate
	Vegetation Mowing (0-4in)	Mowing of vegetation very close to the ground surface, single pass, short duration in any single location, low to moderate soil disturbance, noise, and vibration	High
	Woody Vegetation Removal and Site Grubbing	Removal, chipping, and grubbing of soils to remove woody bulk, medium duration, targeted in locations with high woody vegetation content, extensive soil disturbance, noise, and vibration	High
	Site Grading	Movement of soil and recontouring of site topography, medium duration, may be targeted in localized areas, extensive soil disturbance, noise, and vibration	High
	BMP Installation (Hand Tools)	Short-duration, on foot, driving on established roads, quiet	Low
	BMP Maintenance (Hand Tools)	Short-duration, on foot, driving on established roads, quiet	Low
	BMP Installation (Light Machinery)	Short-duration, using light equipment, driving on established roads and offroad	Low
	BMP Installation (Heavy Machinery)	Short- to moderate-duration, using heavy equipment, driving on	High

		established roads and offroad, extensive soil disturbance, noise, and vibration	
	Security Fence Installation	Shallow foundation excavation, concrete pouring, and post establishment, and laying fencing fabric, short duration in any one location	Low
	Road Compaction	Use of graders and rollers, extensive noise and vibration, moderate duration in any one location	High
	Equipment and Material Laydown	Movement and staging of equipment and materials, extensive noise and vibration, moderate duration in a few locations	Moderate
Major Equipment Installation, Site Cleanup, Restoration	Cable Trenching (Ditch Witch)	Single-pass cable zippering with minimal soil disturbance, extensive noise and vibration, short duration in any one location	Moderate
	Cable/Fiber Trenching (Excavate Full Trench)	Trench excavation with heavy machinery, extensive noise and vibration, moderate duration in any one location	High
	Pile Driving	Vibratory pile driving, low noise and moderate vibration, moderate duration in any one location	Moderate
	Panel Installation	Use of hand tools to secure panels to mounts, short-distance driving, low noise, low duration in any one location	Low
	Inverter Installation	Skid assembly; inverter delivery; hand tools and light equipment; moderate noise; moderate duration in any one location	Moderate
	Substation Assembly	Isolated to one location, hand tools and light equipment use, component deliveries, welding, high noise, moderate-to-high duration	Moderate
	BESS Delivery and Interconnection	Isolated to one location, hand tools and light equipment use, component deliveries, welding, high noise, moderate-to-high duration	Moderate
	Gen-tie Pole Foundation Excavation	Drilling and excavation with heavy machinery, extensive noise and vibration, moderate duration in any one location	High
	Helicopter Construction	High noise and creation of local wind and dust; moderate duration in any one location	High
	Water + Other Truck Use	Spraying water for dust suppression, low noise and vibration, low duration in any one location	Low
	Hydroseeding	Spraying seed mixture, low noise and vibration, low duration in any one location	Low

	Broadcast Seeding	Hand tools or light equipment use, quiet, single pass	Minimal
	Drone Use	Vertical distance, low noise, no vibration, low duration in any one location	Low
	Directional Drilling	High noise and vibration, isolated, moderate duration in any one location	Moderate
O&M	Drone Inspections	Vertical distance, low noise, no vibration, low duration in any one location	Low
	General Maintenance of Equipment	No ground-disturbing, hand tools or light equipment use, low duration in any one location	Low
	Soil Binder Application	Spraying mixture, low noise and vibration, low duration in any one location	Low
	Fenceline Trash Cleanup	Hand tools or light equipment, low duration in any one location	Low
	Panel Washing	Spraying water for panel cleaning, low noise and vibration, low duration in any one location	Low
	Ground-disturbing O&M Activities	Major equipment replacement or maintenance requiring ground disturbing (excavation, drilling, etc.)	Moderate-High

7.6 Relocation and Translocation

Passive relocation and active translocation are two methods used to minimize killing or harming owls when occupied burrows are within a planned development. Passive relocation involves excluding owls from their burrows and then blocking or collapsing the burrows once owls are absent. The owls are then expected to relocate on their own without human assistance (passively). Artificial burrows may be installed nearby to encourage rapid resettlement and possibly reduce mortality risks associated with relocation to a completely new area (Trulio 1995). In some circumstances, artificial burrows are not installed nearby, and there is no attempt to influence the birds' post-relocation choice of burrow sites. By contrast, active translocation involves capturing owls at their burrows, moving them off-site, holding owls temporarily in a large field enclosure, then releasing them (Trulio 1995; Smith and Belthoff 2001). Active translocation release sites are typically supplemented with artificial burrows to encourage owls to remain there. In California, passive relocation is the most common mitigation strategy for BUOW affected by projects, though active translocations are more common elsewhere in North America (Leupin and Low 2001; Smith and Belthoff 2001; Bloom Biological, Inc. 2009; Mitchell et al. 2011; Wild at Heart 2011).

Passive relocations may be limited by the availability of suitable habitat in close proximity to burrows, with relocations of 100 meters producing the best results (Trulio 1995). Passive relocations have a high success rate at 96% (Hennessy et al. 2020). Active translocations have a lower success rate at 61% (ibid) but provide flexibility in management where passive relocation is not feasible or to discourage the return of BUOW to solar project sites that cannot be managed to provide ongoing suitable habitat.

7.6.1 Passive Relocation

Passive relocation will typically occur only during the non-breeding season, September 1 to February 1, but will be adjusted during the late summer months (August and September) if a nest is determined to be no longer active or during the winter months (January) if early nestbuilding activities are observed (as may be more common in the desert region). Passive relocation is a technique to exclude burrowing owls from a project site by first providing replacement burrows off site (if needed), blocking or collapsing all unoccupied burrows within the construction site, and finally installing a one-way door on the occupied burrow to evict the burrowing owl without handling it. The methods involved to relocate burrowing owls are outlined below.

Artificial Burrow Installation

Artificial burrows may be constructed off site to replace on-site burrows that may be removed for Project construction. The number of artificial burrows (if any) will be dependent on the availability of suitable unoccupied burrows in the surrounding area and on the number of burrowing owls evicted from the site. Prior to initiating passive relocation, biologists will survey nearby public lands and private lands with site control to identify and inventory suitable unoccupied natural burrows that may be available. Suitability evaluation shall include the presence of surrounding protected foraging habitat. If two or more natural burrows are available for each burrowing owl to be evicted, no artificial burrows will be constructed. If fewer suitable natural burrows are available, then new artificial burrows will be constructed to provide a total of two suitable burrows for each burrowing owl to be evicted.

- Artificial burrows will be placed 110 meters to 300 meters from suitable natural burrows or from other artificial burrows to minimize territorial conflicts and nest abandonment by neighboring burrowing owl pairs (if any are present).
- Artificial burrows will be located at least 50 meters outside any temporary or permanent Project impact areas, but as close as possible to the original burrow and no more than one mile from the original burrow location if possible. Artificial burrows will be located in coordination with CDFW (and BLM on public land).
- Artificial burrows will be designed, constructed, and installed following guidelines provided in CDFW (2012), Barclay (2008), Barclay et al. (2011), and Johnson et al. (2010 unpublished report). Design will include a large nest chamber (approximately 1,750 cm2 to 1,960 cm2 interior floor space) and small diameter (approximately 7.5 cm to 10 cm) entrance tunnel. The tunnel will slope gently downward (15-20°) towards the nest chamber, with a 60° bend in the tunnel approximately midway along its length. The floor of the main chamber will be located 91 cm (36 in.) below ground level. Perching locations such as low mounds (e.g., 17 20 cm) or short perches (< 60 cm) will be added outside (in front of) the burrow. Rocks will be placed at the entrance to prevent trampling and deter predator digging.
- The locations of all natural and artificial burrows will be recorded, and the burrows will be photographed. Distances to the nearest construction activity, road, drainage, and any other natural and artificial burrows will also be recorded. A comparison of vegetation, habitat types, fossorial species usage, and other features will be made between the occupied and artificial burrow sites and will be recorded. All data will be included in progress reports.

Artificial Burrow Inspections

- Artificial burrows shall be left in place throughout all phases of the Project.
- All artificial burrows and mapped natural burrows will be monitored for burrowing owl use at least once per quarter throughout the construction phase of the Project. During monitoring visits, the burrows will also be inspected to ensure they are still suitable for burrowing owls.

- As needed, artificial burrows may be cleaned and maintained to ensure suitability for burrowing owl use during the construction phase.
- If natural burrows are no longer suitable for burrowing owl use (e.g., due to mammal digging) new artificial burrows may constructed as replacements, or additional inventories of natural burrows may be needed to ensure sufficient availability.
- After the construction phase of the project ends, monitoring and maintenance of artificial burrows will be subject to O&M phase monitoring requirements, in coordination CDFW.

Burrowing Owl Exclusion

- Following the elimination of all suitable inactive burrows within the construction area and installation of artificial burrows, burrowing owls will be passively excluded from occupied burrows.
- Burrow exclusion will involve the installation of one-way doors in burrow openings during the nonbreeding season. One-way trap doors will be installed, completely sealing the entrances to the burrows, and the doors will be left in place for a minimum of 48 hours to ensure owls have left the burrow.
- Documented natural and artificial burrows adjacent to and outside the project site will be monitored twice daily for at least one week following the installation of the trap doors to confirm burrowing owl use of habitat and burrow availability outside of the impact area.
- If burrowing owls are not detected outside the active burrows after the 48-hour exclusion period, scoping and/or remote cameras may be used to confirm the absence of burrowing owls prior to burrow excavation.

Burrow Excavation

- Following confirmation that passive exclusion burrows are unoccupied, the burrows will be carefully excavated using hand tools, or small tracked equipment, and backfilled to ensure that they are no longer suitable for burrowing owl use.
- If at any time, a burrowing owl emerges during excavation, all activities will halt, and burrow monitoring and passive relocation will begin again.
- The excavation and closure of burrows, including entrance exposure, will be documented, and photographed.

7.6.2 Active Translocation

Active translocation may only be conducted with incidental take permit coverage where active relocation is specifically authorized. Active translocation involves capturing and marking owls, immediately moving owls to release sites, and holding them in an aviary for an acclimation period ("soft release"). Actively translocated BUOW are moved to protected lands that may be a large distance from the burrow, but within the same regional population. Release sites may be identified through consultation with CDFW. Habitat suitability, predation risk, and security from disturbance should be considered in selecting translocation sites, and the installation of artificial burrows should be included as warranted (see Section 3.2.4). Actively translocated owls should be kept in a temporary holding field enclosure (acclimation aviary) for 30 days. Water and food, including rodent and invertebrate prey (crickets, mealworms) should be provided approximately 2-4 times per week or as required by CDFW. GPS telemetry units should be attached prior to owl release and removal of the acclimation aviaries.

7.7 Reporting

Construction projects that occur in BUOW habitat, even projects implementing a take avoidance pathway in the absence of a 2081 incidental take permit, should submit a report to CDFW, prepared by the project's qualified biologist, at the conclusion of construction activities which demonstrates compliance with all BUOW avoidance, minimization, and/or mitigation measures, as applicable.

7.8 On-site Compensatory Habitat

For projects that offer on-site compensatory mitigation for take of burrowing owl, the following habitat maintenance, enhancement, and monitoring techniques are recommended. One alternate natural or artificial burrow should be provided for each suitable burrow that will be excavated in the project impact zone. On-site compensatory habitat should be monitored over the long term and should demonstrate no net loss of nesting and foraging suitability compared to pre-project conditions, over the long-term project operations phase. Permanent conservation easements are not sensible[7] and are not recommended for on-site compensatory habitat.

7.8.1 On-site Habitat Maintenance

Perform Vegetation Management. Burrowing owls require areas with short, sparse grasses or forbs which allows them forage effectively, as well as to detect their predators. The height of vegetation is most important just before the breeding season starts because burrowing owls will be seeking out suitable nesting burrows and will not select locations where grass or other vegetation is taller that ~12 inches. If not managed, grasses can be tall during that time of year and areas can become unsuitable to burrowing owls. Any noxious weeds or invasive species that are aggressive enough to change the nature of the vegetative structure around artificial nest burrows within one nesting season will be removed. Some bare ground around nesting burrows can also be attractive. Note that if mowing is used to reduce grass height, advanced planning is critical, particularly if it is difficult to get a mower into a location in February due to soft ground from winter rains.

Minimize Impacts on Existing Burrow Systems. To minimize impacts on existing burrows, during construction, all feasible attempts would be made to avoid crushing or removal existing burrow systems in order to retain natural burrows for burrowing owl use. This includes both excavation of burrows and crushing of burrows or tunnels from heavy equipment or during wetter periods of the year. A burrow-avoidance site preparation technique is not feasible at many or even most sites, and will depend on the

[7] Solar and battery facilities may be developed on land owned in fee by the project developer, on long-term leases from private landowners, or some combination of the two. In California, roughly half of large-scale solar and battery projects are on leased land and half are on fee owned land. Lands leased for projects are unlikely to be available to place conservation easements over them. Furthermore, if conservation easements were to be placed on strips of BUOW habitat within or around the margins of solar facilities, the resulting future landscape would be one of tens or hundreds of strips or parcels of fragmented, isolated "habitat" subject to a challenging management regime for landowners. Long-term management of solar sites for BUOW residency can be successful for long-term BUOW conservation by creating the conditions of long-term BUOW occupancy. If and when a land use change is proposed at some future date (e.g., when a project is decommissioned some 30-40 years in the future), the land use change would be subject to CEQA and CESA requirements, and avoidance, minimization, and compensatory mitigation requirements would be imposed to address the requested land use change.

facility design, soil types, and location of existing burrows relative to trenching or excavation requirements for the project.

Install Wildlife Friendly Fence. Install security fencing with a gap at the bottom and a smooth bottom wire if feasible and not prohibited by other permits.

Remove Attractants for Predators. Trash removal should be conducted on a routine basis to ensure attractants for ravens are removed, especially along fence-lines where debris tends to accumulate. Raven nesting deterrence measures should be conducted in compliance with other permit conditions. Domesticated dogs should not be allowed on the project site. The presence of feral animals that may be BUOW predators should be documented, and local Animal Control or CDFW contacted to address the risk.

7.8.2 On-site Habitat Enhancement

Artificial Burrows. Use of artificial burrows has become standard practice for burrowing owls in California. Often artificial burrows are used to either attract burrowing owls to a location or to compensate for the removal of natural burrows. In either case, there are several sources that outline artificial burrow design that has been modified based on several decades of experience. Suitable locations for artificial burrows include locations where vegetation is short during the early breeding season. Artificial burrows should be cleaned out and functional in advance of the breeding season. Sometimes burrow entrances can get clogged with soil or vegetation or other animals can use the burrow complexes and fill them with debris. Some research has shown that artificial burrows decline in their effectiveness over time, including significant drop offs in use after the first year they are installed (Menzel 2014). In areas lacking ground squirrels (i.e., artificial burrows are the only burrows available), it may be advisable to dig up and completely reinstall artificial burrows to keep them attractive to burrowing owls, depending on the results of inspections.

Flooding Refugia. Raised earthen berms can be created to provide refugia for small mammals during flooding events, and to provide burrowing, denning, and perching opportunities for a variety of species. These berms can also be outfitted with artificial burrows, if desirable.

Natural Debris Piles. Piles of concrete or wood can also be attractive to burrowing owls, as well as California ground squirrels. If California ground squirrels are present near the areas of interest mounds of loose soil or small concrete rubble or rock piles can often attract them onto the site. Burrowing owls can then also be attracted to the site once burrow complexes have been established.

Perches. Wooden stakes may be installed to provide suitable perches. These stakes should be installed so that the top is roughly 18" above the ground. Perches are also a good way to make owls visible in a predictable location so that, if banded, the bands can be identified. Stakes should be placed close enough to known burrow locations, artificial or natural, so that nesting owls will use them but not so close that they may the burrow location obvious to people or predators (at least 5 meters away).

7.8.3 On-site Monitoring

Most regional conservation plans are addressing several grassland species at once, so when those plans outline habitat management and monitoring activities on conservation lands, they are more focused on maintaining suitable habitat conditions than confirming species occupancy. In most cases that is by design, since species monitoring can be more labor intensive and expensive, and often the lack of a species being present during any particular monitoring year does not necessarily mean they are not using the site at all. This is particularly true for species like burrowing owl that moves around a lot during the year, either through migration or just seasonal movements through a region. Monitoring should be conducted in accordance with permit conditions or as follows.

Compliance Monitoring

At the very least, compliance monitoring can be used to confirm that activities are occurring as planned, regardless of whether burrowing owls are actually using a particular site. For burrowing owls, compliance monitoring would consist of the following:

1. Any installed artificial burrows are functional (i.e., cleaned out and available as needed) by February 1 of each year.
2. Vegetation will be less than 4-6 inches within 100 feet around artificial burrows, as possible on February 1 of each year.
3. Any installed additional enhancement measures should be inspected each spring prior to the breeding season to make sure they are functional.

Data collection should be conducted in strict accordance with Section 9.2.

Effectiveness Monitoring

Effectiveness monitoring would be used if it was desirable to track whether and how many burrowing owls might be using artificial burrows or other nesting habitat within an area. The least invasive means of effectiveness monitoring is to use motion activated cameras close enough to burrow complexes to detect owls moving in and out of burrows, but not so close that they make the burrows uninviting to owls. Cameras can help discern failed nesting attempts, if/when nesting is initiated, what stage nesting is in (i.e., incubation, rearing of hatchlings), and ultimately, when young start to emerge from the nest burrow, how many young are hatched and presumed fledged from a given nest. Data collection should be conducted in strict accordance with Section 9.2.

8. Off-site Compensatory Mitigation

For projects that include off-site compensatory mitigation for CESA take of BUOW or as mitigation for CEQA potentially significant impacts on BUOW, the following conditions are recommended, in accordance with the Burrowing Owl Survey Protocol and Mitigation Guidelines (Burrowing Owl Consortium, 1993). Projects would not be required to mitigate separately for CESA take and CEQA potentially significant impacts. Off-site habitat must be suitable burrowing owl habitat, as defined in Section 2.1, and the site approved by CDFW. Off-site compensatory land should be placed in a conservation easement in perpetuity and managed to maintain suitable habitat. Off-site mitigation for impacts to occupied habitat should use one of the following ratios:

1. Protection of occupied habitat: 1.5 times 6.5 (9.75) acres per occupied burrow displaced by the project.
2. Protection of suitable unoccupied habitat: 3 times 6.5 (19.5) acres per occupied burrow displaced by the project.

9. Research Program & Data Collection Standards

9.1 Research Program

This Burrowing Owl Conservation Strategy is envisioned as a living document that will be updated once statistical analysis of two important data sets on burrowing owl responses to 1) construction activities, and 2) the presence of solar arrays, are analyzed and conclusions drawn. Over the next 3-6 months, under the leadership of Drs. David Plumpton and Karl Kosciuch, we will update this Conservation Strategy to include the results of the following analyses:

1. **Burrowing owl response to construction activities**: We are evaluating burrowing owl responses to construction activities, to understand the nature of construction disturbances that elicited different behavioral responses, the exposure to these disturbances that resulted in various responses, and the distances at which responses may have been reduced or absent. Using a data set that contains 10,839 observations at 1,646 burrowing owl nest observations, we will refine applied research questions, categorize, analyze, and describe construction disturbances, buffer distances at which disturbances failed to elicit a response, and other variables of interest. These data include observation date, nest status, construction activity, buffer distances, narrative descriptions of categorical burrowing owl observations, and responses to disturbances. Distance from the nest to construction activity ranged from 1 foot to over 6,000 feet, providing a range of inference around the potential for disturbance. As important information (e.g., behavioral response) is included as a text description, analysis will include data mining to extract key words into distinct variables so that response patterns can be examined. We envision disaggregating behavior and opinion on owl responses into distinct variables and determining if the response was influenced by the interaction of construction activity and distance to construction. Other research questions will emerge as these data are refined and analyzed and patterns are identified. By conducting rigorous statistical analysis of observational data, we will provide results that may be used to gauge the probable effects of similar construction activities, and thereby produce an empirical basis by which we may minimize or avoid disturbance responses by burrowing owls under similar conditions.
2. **Burrowing owl response to solar array presence**: We are also evaluating the results achieved by a burrowing owl habitat mitigation program at a large solar photovoltaic project in California, using pre-project and post-construction data on burrowing owl presence, effectiveness of artificial burrows on an operational solar energy facility, and other data. By conducting rigorous statistical analysis of observational data, we will provide results that may be used to gauge the probable effects of similar solar facilities and management actions, and thereby produce an empirical basis by which we may minimize loss of habitat and increase burrowing owl use of operational solar facilities.

In addition, a long-term study of the potential beneficial impacts of land conversion from agriculture to solar energy on BUOW and other grassland ecosystem species in the San Joaquin Valley is anticipated to be designed and carried out.

9.2 Data Collection Standards

The goal for a BUOW data collection standard is to ensure a common approach to data acquisition that can be used for analysis across numerous solar and battery projects throughout the species range in

California. The information collected is adapted from the 2012 Staff Report, Appendix D "Survey Reports;" however, narrative/descriptive data collection is minimized to the greatest extent feasible.

A wide range of data collection methodologies, technologies, and software platforms are currently used across the industry. Biological resources consulting firms should continue using their preferred data collection platform, but the following requirements should be met. Solar and battery storage project developers, owners, and operators that voluntarily adopt this Conservation Strategy should notify LSA and make their field data available to LSA upon request. Data can be made anonymous and not attributed to any specific project upon request by the company to LSA.

- Field information should be collected using only quantitative methods (continuous or categorical data) to the greatest extent feasible.
- Qualitative text data describing observations should be provided sparingly, and only if quantitative data cannot be collected.
- Data should be exportable to Microsoft Excel format.
- BUOW data should be collected during pre-project planning (baseline data), during construction (construction data), and, where feasible, during the long-term operations phase of the project (operations & maintenance data).
- Baseline surveys should be conducted in accordance with published protocols or methods approved by CDFW.
- Construction-phase surveys should be conducted in accordance with permit conditions.
- Operations & maintenance-phase surveys should be conducted prior to ground-disturbing activities in accordance with permit conditions. If on-site BUOW habitat is being actively managed on-site, quarterly monitoring should be conducted for the first 3 years of project operations and again after 10 years. Artificial burrow inspections should be conducted at least once annually (ideally just prior to the breeding season) and after major storm events on site.

Baseline data collection: The purpose of baseline BUOW data collection is to inform a project of baseline conditions for the species during the breeding and non-breeding season surveys. The focus for this data collection is for BUOW, so other species that may be associated with BUOW burrows has a different data schema, but is noted if other species sign is present at the location.

- Standard survey information:
  - Date (continuous)
  - Project name (categorical)
  - County (categorical)
  - Surveyor(s) (categorical)
  - Weather information:
    - temperature (continuous)
    - approximate wind speed (categorical)
    - cloud cover (categorical)
  - Start and stop time (continuous)
- Primary species type (i.e. desert kit fox, coyote, badger, desert tortoise, etc…)
  - If BUOW is primary species type, parent form should contain the following information
  - If BUOW is secondary or tertiary species type, child form should contain the following information
- UTMs (continuous)

- BUOW Sign type (categorical)
    - Live individual present
        - # adults
        - # juveniles
        - # nestlings
        - # individuals of unknown age
        - Band or transmitter present
            - Yes
                - Band color
                - Band number
                - Transmitter number
                - Unknown type/color/number
            - No
            - Inconclusive
        - BUOW Response
            - No response
            - Feeding
            - Resting
            - Courting
            - Flushed
            - Territorial defense
            - Permanently abandoned nest
    - Carcass (categorical)
    - Burrow (categorical)
        - Status
            - active
            - potentially active
            - inactive
        - Burrow # or ID
        - Sign at burrow
            - Feathers
            - Whitewash
            - Pellets
            - Prey remains
    - Non-burrow attractant (categorical)
        - Debris pile
        - Perch
        - Flooding refugia
        - Other (descriptive)

<u>Construction data collection:</u> Baseline data sets will be augmented during this phase. Updates to baseline information should be made, and should include the same information collected for Baseline, in addition to the information below.

- Same as above
- Buffer distance imposed (continuous)
- Human activity type (categorical)
    - Activity Buffer Staking and Flagging
    - BESS Delivery and Interconnection
    - BMP Installation (Hand Tools)
    - BMP Installation (Heavy Machinery)
    - BMP Installation (Light Machinery)
    - BMP Maintenance (Hand Tools)
    - Broadcast Seeding
    - Cable Trenching (Ditch Witch)
    - Cable/Fiber Trenching (Excavate Full Trench)
    - Civil Survey, Staking, and Flagging
    - Directional Drilling
    - Drone Inspections
    - Drone Use
    - Environmental Monitoring
    - Environmental Resource Surveys and Monitoring
    - Equipment and Material Laydown
    - Fenceline Trash Cleanup
    - Gen-tie Pole Foundation Excavation
    - General Maintenance of Equipment
    - Geotechnical Testing
    - Ground-disturbing O&M Activities
    - Helicopter Construction
    - Hydroseeding
    - Inverter Installation
    - Met Tower Installation
    - Panel Installation
    - Panel Washing
    - Pile Driving
    - Road Compaction
    - Security Fence Installation
    - Site Grading
    - Site Visits
    - Soil Binder Application
    - Substation Assembly
    - Trenched Wildlife Exclusion Fence Installation

    - Trenchless Wildlife Exclusion Fence Installation
    - Vegetation Mowing (0-4in)
    - Vegetation Mowing (4+in)
    - Water + Other Truck Use
    - Woody Vegetation Removal and Site Grubbing
- Distance to construction activity (continuous)
- Visual barrier installed (yes/no)
- Noise barrier installed (yes/no)
- Actions taken at burrow (categorical)
    - apron swept
    - diatomaceous earth added
    - camera installation
    - camera check
    - one-way door installed
    - removed/collapsed
    - Other (descriptive)
    - Artificial burrow installed
        - Apron swept
        - Diatomaceous earth added
        - Camera installed
        - Camera checked
        - Additional sign placed to attract BUOW
        - Other (descriptive)

Operations and maintenance data collection: All data from previous phases will be available. This phase will primarily involve observational data. However, if on-site management of BUOW habitat is included, habitat maintenance activities will be documented.

- Same as above
- Number and location of natural burrows (continuous)
- Average height of vegetation (categorical)
    - No/minimal vegetation present
    - 1-6 inches
    - 6-12 inches
    - 12-24 inches
    - > 24 inches
- Artificial burrow maintenance action taken (categorical)
    - Inspected
        - Good condition
        - Requires maintenance
    - Cleaned
    - Reinstalled
    - Removed/replaced

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