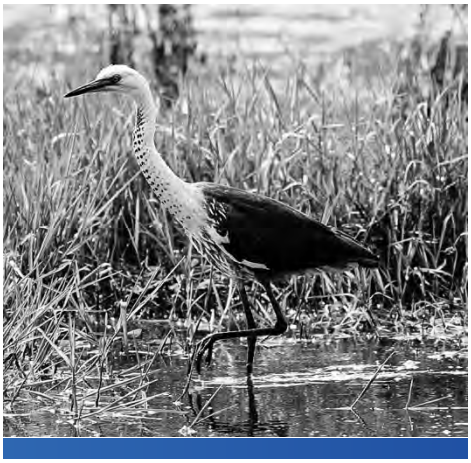
Kern Fan Groundwater Storage Project

RESPONSE TO DEC REVIEW FINDINGS

Addendum No. 2: Recharge Basin Design and Operation for Intermittent Wetland Benefits

July 1, 2020



Irvine Ranch WATER DISTRICT

Rosedale-Rio Bravo WATER STORAGE DISTRICT

Addendum No. 2

Recharge Basin Design and Operation for Intermittent Wetland Benefits

Finding #2:

Feasibility Study:

a. *As currently designed the recharge basins may not meet the requirements for classification as an intermittent wetland.*
b. *Determine requirements for creation of intermittent wetlands, and update design and cost estimate to include these features.*

Response to Finding #2:

- The wetlands that will be incidentally created by the constructed recharge basins will most closely resemble a classification of *Intermittent Flooded Riverine Wetlands with Unconsolidated Sandy Bottoms*.
- The Project will create incidental intermittent during recharge for periods of upward to 12 months. Specific features are incorporated into the design, operation and maintenance of the wetlands, so that during the recharge periods hydric soils conditions will form allowing for the development of hydrophytes and the establishment of habitat for shorebirds and migratory birds.
- Project recharge basins will typically hold water from 1 month upwards to 12 months which allow for the development of hydric soils during the growing season. Hydric soils typically form within existing recharge basins by the third or fourth week of flooding due to gradual saturation of the soils.
- Project berm and island banks will be built at a 4:1 slope with a minimum 1.5' freeboard which will result in at least a 6 to 10-foot-wide vegetative strip above the water line with vegetation extending into shallow water areas.
- Recharge basins will be designed to provide bird habitat in the intermittent wetlands created in the Project recharge ponds. Per the recommendation of the Environmental Defense Fund, recharge basins will be constructed at multiple water depths to benefit both shorebirds and waterfowl. Shorebirds prefer mudflats to a depth of up to 6" with sparse vegetation (<40%) while waterfowl prefer depths of 6" to above 18" with a combination of open water and wetland cover. Dry land (berms or islands) are important for resting areas with dense vegetation.
- The project costs include the design features for the intermittent wetlands such as dry land berms or islands and raptor boxes. The costs for dry land berms or islands are included in the line item for levee embankment fill. The costs for raptor boxes are included in the interbasin structure line item for miscellaneous steel and weir boards.
- The operations and maintenance costs associated with these design features have already been anticipated and therefore does not result in any changes to the project operations cost estimates.

More detailed information is provided below.

Wetland Classifications

The United States Fish and Wildlife Service maintains important documents related to the classification of wetlands in the United States. The most current is the Second Edition – Classification of Wetlands and

Deepwater Habitats of the United States[1]. Based on this document, wetlands are classified as Marine, Estuarine, Riverine, Lacustrine, and Palustrine. A Riverine System has four subsystems: Tidal, Lower Perennial, Upper Perennial, and Intermittent. Wetland classes are further defined based on bottom substrate and flooding regime as well as dominant vegetation types.

Project Recharge Basins as Intermittent Wetlands

Since the Project recharge basins will be intermittently flooded with captured stream flows that are diverted into the California Aqueduct, through the Project canal and into man-made impoundments, the wetlands that will be incidentally created by the constructed recharge basins will most closely resemble a classification of *Intermittent Flooded Riverine Wetlands with Unconsolidated Sandy Bottoms*. Accordingly, the recharge basins constructed for the Project will be designed to meet intermittent wetland requirements during recharge operations. The following explains the application of design criteria used to meet the project goals of establishing intermittent wetlands and providing bird habitat in the recharge basins.

As described in the Project Feasibility Report (Sections 1.4.3, 2.1.3, 4.1.4.2 and 5.1.3.2), the Project will establish intermittent wetland habitat through intermittent recharge events. The primary purpose of the Project lands is to construct and operated recharge basins that allow water to infiltrate and recharge into the underlying aquifer for storage until it is needed. During the years that the Project takes and recharges water into storage, the basins will be inundated with water and will provide intermittent wetland habitat to support waterfowl, shorebirds, raptors and other migratory birds along the Pacific Flyway. The wetlands to be established by the Project are considered intermittent because the water supply delivered for recharge may not be available for recharge year-round or during periods of drought. The term "incidental" is also used to describe these intermittent wetlands because they are incidentally created as a result of water recharging in the Project basins.

In addition to Rosedale-Rio Bravo Water Storage District (RRBWSD) and Irvine Ranch Water District's (IRWD) existing recharge basins, which support similar intermittent wetland habitat, the Kern Water Bank, located south of the Project, represents a larger reference site for the future conditions of the Project recharge basins and the intermittent wetland establishment. The Kern Water Bank spans 20,000 acres of water recharge and recovery infrastructure. Their recharge basins were established and are operated and managed as a habitat matrix of upland and intermittent wetland habitat. Through 2018, over 206 species of birds have been identified on Kern Water Bank lands (Kern Water Bank Authority 2019). It is anticipated that the Project will result in similar habitat conditions as established through the existing RRBWSD and IRWD basins and within the Kern Water Bank.

[1] Wetlands Subcommittee of the Federal Geographic Data Committee, August 2013. "Classification of Wetland and Deepwater habitats for the United States", Adapted from Cowardin, Carter, Golet and LaRoe (1979). Available at: https://www.fws.gov/wetlands/data/wetland-codes.html

Intermittent Wetland Requirements

Project recharge basin design and operation will align with the ecological requirements of intermittent wetlands. Intermittent wetland ecological features include:

(1) The intermittent presence of water at the surface or within the root zone;
(2) Saturated soil conditions that result in anaerobic conditions in the upper part (i.e., hydric soil);
(3) Water tolerant (i.e., hydrophytic) vegetation; and
(4) Establishing habitat for waterfowl and shorebirds.

For intermittent wetlands, the presence of water is variable and spans a variety of wetland types. For example, vernal pools, pond or lake fringes, and seasonal riverine wetlands are all considered intermittent wetlands.

Recharge Basin Design and Operation Criteria to Create Intermittent Wetlands

The design, construction and operation of the Project recharge basins fulfill the requirements of Intermittent Wetlands described above. Since the Project recharge basins will be intermittently flooded with captured stream flows diverted into the California Aqueduct, through the Project canal and into man-made impoundments, the wetlands that will be incidentally formed by the constructed recharge basins will be intermittent wetlands. The Project recharge basins include design features that will function as intermittent wetlands to support and benefit water birds and wetland-dependent upland birds and wildlife. The variable presence of water, soil, and vegetation, as well as bird habitat features, were considered in the design and operation criteria for the recharge basins as described in the following.

Design Criteria #1: Allow water to be maintained on site during recharge operations -- Recharge basins use man-made berms to maintain water on site. Several thousand acres of groundwater recharge basins have been constructed on the Kern River Fan over the past 30 years. Some are in the primary flood plain that was not previously developed, but most are on previously farmed and leveled properties. Typical construction matches the existing field boundaries as they neighbor existing agricultural production.

Slope and Berm Construction: The Project area has a predominate land slope of 2 feet per mile which will remain after recharge basin construction. Project recharge basin berms will be constructed with compacted earth from the project site at approximately two to six feet in height. Berms may also serve as roadways. Project recharge basin water depths will range from 0 up to 24 inches.

Ponding duration and timing: Project water will provide wetland habitat during the winter months of wet, above normal and normal water years when recharge activity occurs. Water is expected to be in the recharge basins for an average duration of 1.5 months during years in which active recharge of Article 21 water occurs in the winter months. Based on historical availability of other water supplies during normal and wet years, the benefits from the intermittent wetland habitat could be extended by upwards of 12 operating months.

Design Criteria #2: Develop hydric soils during recharge operations -- The United States Department of Agriculture defines hydric soil as a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part[2]. Soils that are sufficiently wet because of artificial measures, such as operations of recharge basins, are included in the concept of hydric soils.

Presence of Hydric Soils: Project recharge basins will typically hold water from 1 month to upwards of 12 months which allow for the development of hydric soils during the growing season. RRBWSD finds that hydric soils typically form within existing recharge basins by the third or fourth week of flooding due to gradual saturation of the soils. This is expected to occur at the Project recharge basins. During this period, typical recharge rates within the basins are expected to slow from an initial infiltration rate of up to 1 acre-foot per day to a maintenance rate of about 0.4 acre-feet per day.

Design Criteria #3: Establish hydrophytic vegetation during recharge operations -- Hydric soils result in sufficiently wet conditions to support the natural growth and regeneration of hydrophytic vegetation. Recharge basin design, operation, and maintenance also allow for the planting and establishment of hydrophytic vegetation.

Project Berms and Islands: Project berm and island banks will be built at a 4:1 slope with a minimum 1.5' freeboard which will result in at least a 6 to 10 foot wide vegetative strip above the water line with vegetation extending into shallow water areas. Each basin would include 1-2 islands with similar gradual sloped banks and freeboard requirements. During recharge periods mowing of the berms and islands is limited to support growth of significant vegetation ranging from 6 to 36 inches tall. Shallow water areas would also experience vegetation growth of variable height. Established hydrophytic vegetation is expected to include common spikerush (*Eleocharis macrostachya*), Baltic rush (*Juncus balticus*), common knotweed (*Polygonum lapathifolium*), annual beard grass (*Polypogon monspeliensis*), broadleaf cattail (*Typha latifolia*) Fremont cottonwood (*Populus fremontii*), and Goodding's black willow (*Salix gooddingii*).

Design Criteria #4: Establish habitat for birds during recharge operations – RRBWSD has been working with the Environmental Defense Fund (EDF) in an effort to construct and operate recharge facilities that have multi-benefits, including intermittent wetlands and bird habitat. EDF partnered with Point Blue Conservation Science, Audubon California and Sustainable Conservation to develop a guide on how to build this kind of preferred recharge basin that provides operational benefits to basin management while also creating valuable water bird habitat. Figure 9, included at the end of this addendum, is the guide prepared by EDF. This guide describes the wildlife benefits associated with the multi-uses of recharge basins as intermittent wetlands.

Basin Design: The Project basins are designed to improve recharge and are less likely to plug with fine sediments while also incidentally creating habitat through the formation of hydric soils. Additional recharge basin design considerations are included to provide bird habitat in the intermittent wetlands created in the Project recharge ponds. Per EDF's recommendation, recharge basins will be constructed at multiple water depths to benefit both shorebirds and waterfowl. Shorebirds prefer mudflats to a depth of up to 6" with sparse vegetation (<40%) while waterfowl prefer depths of 6" to above 18" with a combination of open water

[2] US Department Agriculture, Natural Resources Conservation Service: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961

and wetland cover (see Figures 1, 2 and 3). Dry land (berms or islands) are important for resting areas with dense vegetation (see Figures 4, 5 and 6).

Basin Depths: Each typical basin would yield 1/3 of the depths suitable for shorebird mudflats and 2/3 suitable for waterfowl preferred depths (see Figures 2, 3 and 7).

Ponding Duration: The project is expected to provide wetland habitat to migratory birds whenever recharge activity occurs on the project sites. Based on historical availability of all water supplies, the duration of incidental wetland habitat from water ponding could range from 1.5 months to upwards of 12 operating months, which allows for the development of hydric soils during the growing season (see Figure 1).

Berms and Islands: Earthen berms and islands will also provide necessary resting areas on the banks. During recharge periods, mowing is limited on the berms and islands to support vegetation growth from 6 to 36 inches tall (see Figures 4, 5 and 6). The costs for dry land berms and islands are included in the Project cost line item for levee embankment fill. These costs are included in the earthwork quantities in the recharge basin construction costs. The cost of maintaining the berms and islands, including occasionally mowing, are included in the Project's operations and maintenance (O&M) costs.

Raptor Boxes: Burrowing rodents can cause structural damage to earthen berms. To offset harmful effects of rodenticides on wildlife --- owl and hawk boxes and perching structures will be installed every 0.25 mile of berm. The Project will rely on raptor boxes and perches and use of rodenticides only as necessary to protect berm stability and to thus protect the intermittent wetlands created by the operation of the Project recharge basins. The costs for installing raptor boxes are included in the interbasin structure line item for miscellaneous steel and weir boards. The estimated cost of occasionally maintenance or repair of raptor boxes is included in the Project's O&M costs.

Managing Basins During Non-Recharge

The Project recharge basins will allow native vegetation (non-noxious weeds) and seeded forage crops to provide dry cover crop and wildlife cover and forage during non-recharge periods (see photos in Figure 8). In order to promote future cover crops or natural vegetation growth each year, basins would be grazed by sheep or cattle or mowed as necessary. No-till planting methods, rather than disking, would be used to seed forage crops. Disking operations promotes noxious weed growth and would be avoided. The cost of the seeding and mowing activities is included in the Project's O&M costs.

Managing sediments: RRBWSD's managed recharge basins have not experienced recharge impacts from settlement of fine sediments or bacterial fowling. Sediment is typically settled prior to reaching this portion of the service area. To the extent that this does occur, these materials would be scraped and placed on islands. The estimated cost of occasional scraping of the basins is included in the Project's O&M costs.

Adaptive Management of Intermittent Wetlands

Land and wildlife management is dynamic. As weather and climatic patterns change -- landscapes, including intermittent wetlands, will react. Plants and wildlife will adapt to these changes on a variable basis, so it is recognized that recharge basin management will need to adapt as well to optimize wetland benefits. To meet the demands of the environment and Project an adaptive management plan will be developed and

implemented for the management of the Project recharge basins as well as the management of the intermittent wetlands created during the operation of the basins. This plan will include annual biota reports including adaptive management recommendations to be considered and implemented, as appropriate to optimize project water management and wildlife goals.

Figure 1. Example of a RRBWSD recharge basin with ponded water during the growing season that allows for the establishment of hydric soils and vegetation.

Figure 2. Typical RRBWSD Recharge Basin with mix of mudflats and open water

Figure 3. Mudflats with shorebirds on Strand Recharge Basins

Figure 4. Upland vegetation on recharge basin berm provides habitat for birds.

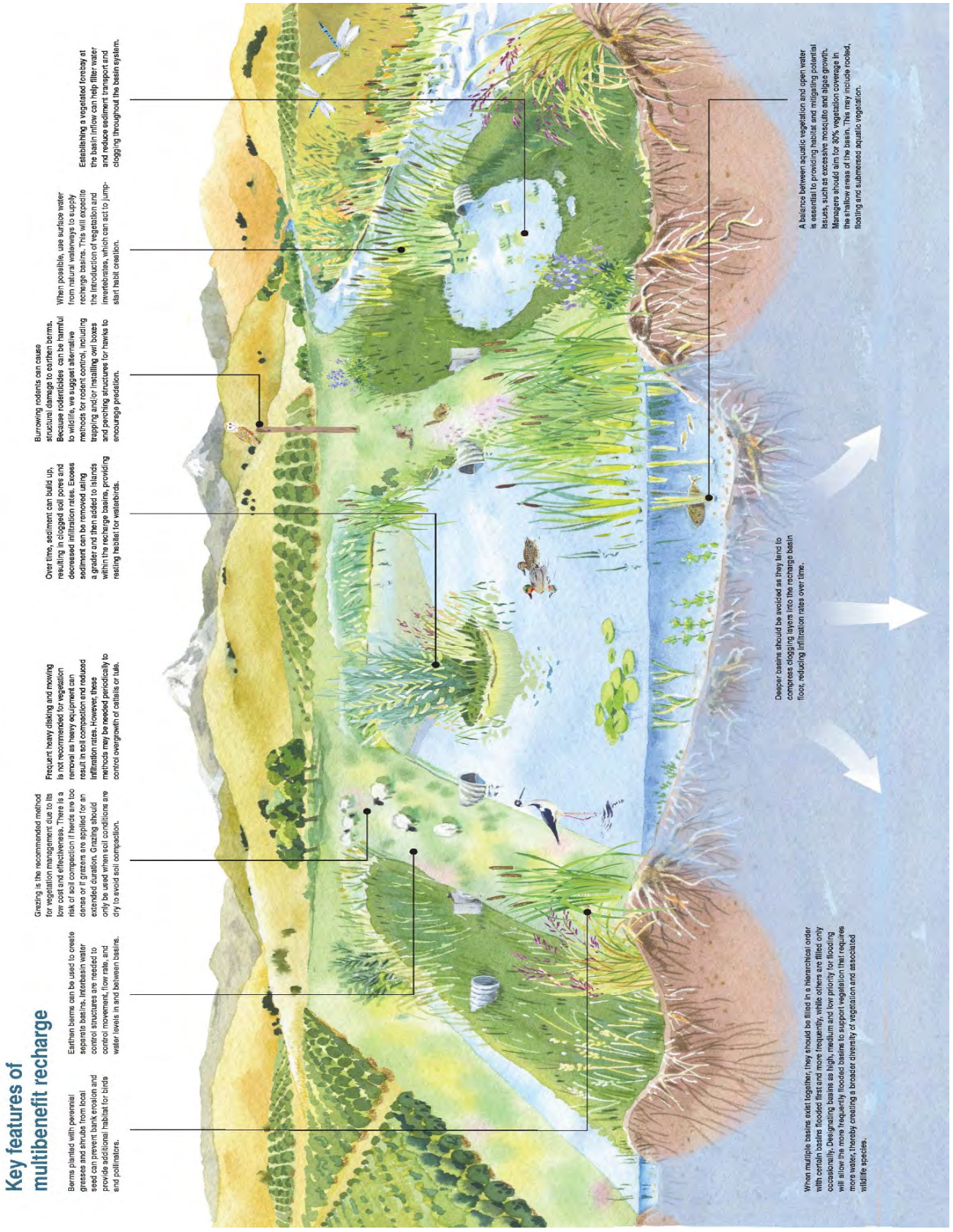
Figure 5. Typical RRBWSD Recharge Basin Berm Water Line Habitat

Figure 6. Typical RRBWSD Recharge Basin Island

Figure 7. Three Photos of typical waterfowl in Strand Recharge Basins during Recharge Periods

Figure 8. Three Photos of typical RRBWSD Recharge Basins During Non-Recharge Periods

Figure 9. Environmental Defense Fund Guide on Building Multi-Benefit Basins



	Shorebirds	Waterfowl	Pollinators
			
WILDLIFE TARGET	• Legs are often long and thin. • Bills thin. If long, then used to probe in the soil. If short, then used to peck food off the surface of the ground. • Eat various bugs, worms and other invertebrates. • 13 species use the Central Valley regularly. • Some populations are declining; others are stable.	• Ducks, geese and swans • Most have flat bills that filter plants, seeds and invertebrates from the water and mud for food. • Webbed feet make them strong swimmers. • Some populations are declining; others are stable.	• More than 1,000 species of honey bees, native bees, butterflies and beetles. • Wide range of sizes and colors, from tiny sweat bees less than ¼" long to monarch butterflies larger than 3". • Nearly all populations are declining.
HABITAT CHARACTERISTICS	• Open mudflats or shallowly flooded environments. • Some short, sparse vegetation is OK. • Less than 40% vegetation cover is recommended. • Remaining vegetation should be smashed or incorporated.	• Open water is generally preferred for feeding. • Some species like vegetation (cattails/tules) to hide in. • Some dry land (berms or islands) is important for resting areas. • Vegetation on resting areas should not be very dense. However, some species that breed in Central Valley would use denser vegetation for nesting. • Forage plants for waterfowl (watergrass, smartweed and swamp timothy) will provide food during winter.	• Prefer a diversity of native vegetation that flowers (providing food and cover) throughout the year. • Plant vegetation along the sides and throughout the basin bottom. • Other areas should remain undisturbed (no disking) to provide nesting habitat in soil.
WATER MANAGEMENT	**Timing** • Shorebirds are present in the Central Valley year-round. • Migration is a critical period when habitat is needed: spring (March to May) and fall (July to September). **Depth** • Saturated mudflat to 6 inches deep. • Variable water depth is ideal and will benefit a wider diversity of shorebirds and other waterbirds.	**Timing** • Winter (October to March) is the most important time to provide habitat for waterfowl in the Central Valley. • Some species breed in the Central Valley from March to mid-July. **Depth** • Water depths from 6 inches to 18 inches are recommended. • Some species will use depths greater than 18 inches. • Forage plants may require additional irrigation in dry periods.	**Timing** • Water should not inundate vegetation for long periods in areas designated as a dry zone because it can kill the plants and drowns the burrowing insects. **Depth** • Plant in zones related to how much water each will likely receive. Some will only get winter rain, some flooded only occasionally, others flooded regularly.

This document highlights best practices as understood by wildlife experts and practitioners as of February 2020.
If you are interested in participating in a pilot project or providing feedback, please contact **recharge@pointblue.org**.

Audubon CALIFORNIA

EDF ENVIRONMENTAL DEFENSE FUND — Finding the ways that work

Point Blue Conservation Science

Sustainable Conservation

Building multibenefit recharge basins

As California faces an unpredictable water future, policy makers and water managers across the state are seeking solutions to build resilience into our water supply system. Groundwater recharge is an excellent tool to replenish depleted aquifers and bank water for future use. In addition to helping water managers balance their water budget, groundwater recharge also provides an opportunity to create habitat for wildlife. This guide highlights recharge basin management strategies that create wildlife habitat and provide operational benefits to basin managers.

Operational Benefits

Reduce sediment and clogging

Sediment buildup and pore clogging can greatly diminish the efficiency of basin recharge. Creating multiple subbasins within a series can allow for the first receiving basin to act as a settling area, enabling the successive basins to recharge more efficiently over time. Settling basins filter fine sediment in the water and minimize clogging of successive recharge ponds. Creating basins with a sloped floor will result in sediment accumulation in a smaller area, reducing the operational cost of removing sediment buildup.

Planting vegetation on basin bottoms during dry spells can also help maintain recharge rates over time as roots create channels for water to infiltrate the soil.

Stabilize basins

Planting vegetation along the sides of basins will help prevent erosion and stabilize berms. These plantings can also inhibit the establishment of nuisance weeds such as Russian thistle. Installing perching structures for hawks can help control burrowing rodents that can compromise berms.

Funding Sources

Potential federal, state and local funding sources for multibenefit recharge projects that create waterbird habitat include:

- Wildlife Conservation Board Pacific Flyway Program
- U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program
- Natural Resources Conservation Service Environmental Quality Incentives Program
- California Department of Fish and Wildlife California Waterfowl Habitat Program