

FLOOD PROTECTION

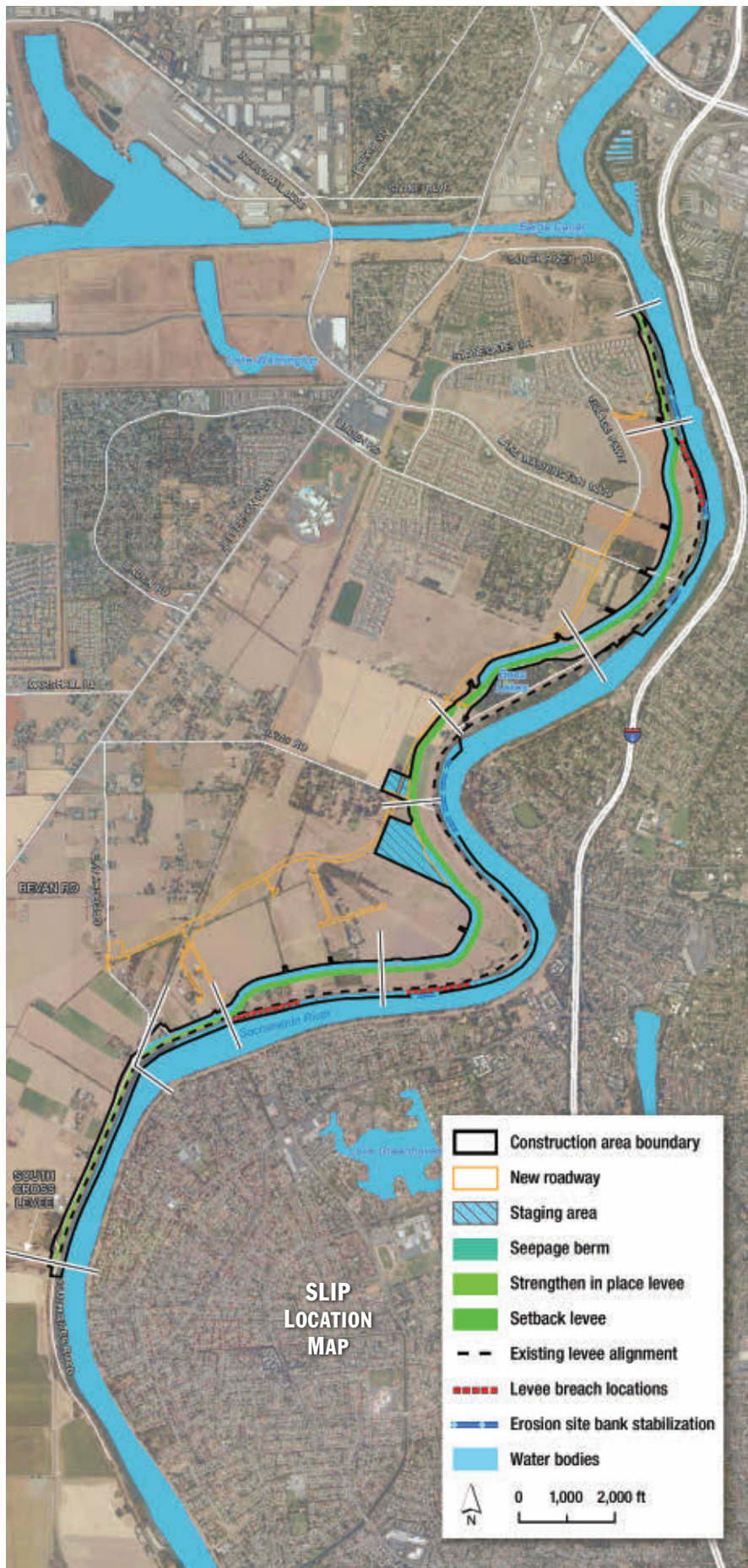
Key Stretch of West Sacramento Levee System Receives Envision Platinum Award

IN LATE 2019, work was completed on the third and final phase of the Southport Levee Improvement Project (SLIP), nearly 6 mi of flood-risk-reduction measures designed to improve the most vulnerable part of the critical levee system in low-lying West Sacramento, California. The project was overseen by the West Sacramento Area Flood Control Agency (WSAFCA), a joint powers authority involving the City of West Sacramento and two special governmental districts of Yolo County, California: Reclamation District 537 and Reclamation District 900. In February, the WSAFCA received an Envision Platinum Award, the highest designation available from the Institute for Sustainable Infrastructure (ISI), of Washington, D.C., for the approximately \$180-million project.

Because of its unique geography, West Sacramento relies heavily on levees, particularly during winter months when water levels in area waterways are often high. The flood-prone Sacramento River borders the city to the north and east, and the Sacramento River Deep Water Ship Channel essentially bisects the city. Two large bypasses that drain flood waters from the Sacramento River extend along the city's north and west sides. All told, West Sacramento maintains a levee system having a length of about 50 mi.

"During high-water events, we're almost surrounded on all sides by water," explains Greg Fabun, the general manager for the WSAFCA. In fact, if a levee failure were to occur during a flood event having a recurrence interval of 50 years or greater, more than 90 percent of West Sacramento would be inundated. Because flooding is most likely to occur during winter, the cold water would result in hypothermia for anyone caught in it for an extended time.

The State of California requires that urban levees have the capability



to protect against at least a 200-year flood event. Fifteen years ago, West Sacramento's levees were thought to have a 400-year level of protection. That all changed after engineering standards for levees were revised in the wake of Hurricane Katrina's 2005 assault on levees and floodwalls in New Orleans. "Overnight, we found ourselves with less than a one hundred-year level of protection as measured by those new standards," Fabun says.

As it considered how to restore its levee system to the 200-year level of protection, the WSAFCA prioritized a nearly 6 mi long stretch of the Sacramento River

By moving the roadway landward, engineers were also able to advance some of the city's transportation improvements.

South Levee that adjoins the Southport neighborhood. "That was our most at-risk levee," Fabun says. "We advanced that project in partnership with the state financially in advance of federal funding."

The resulting SLIP was conducted in three phases. Designed by HDR, of Omaha, Nebraska, the first phase entailed relocating utilities and the roadway that was atop the existing levee to facilitate subsequent construction. By moving the roadway landward, engineers were able to replace it with a shorter road that also advanced some of the city's planned transportation improvements for the Southport area. Relocating the road "also removed any conflicts that might occur during high-water events, from levee inspections, levee patrols, flood fighting, and things that might occur in the future,"

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Fabun says. Completed in 2016, that initial phase was constructed by Teichert Inc., of Sacramento, California.

HDR also designed the second phase, which involved extensive levee upgrades to address deficiencies associated with through-seepage, under-seepage, slope stability, erosion, encroachments, and noncompliant vegetation. These “fix-in-place” improvements were made along the northern and southern edges of the existing levee, for a total of 1.8 mi. In these locations, the levee was first degraded to about one-third of its height, a slurry wall was installed to protect against under-seepage, and the upper sections of the levee were restored. The revamped levee sections feature 2:1 (H:V) slopes on the water side, 3:1 slopes on the land side, and a 20 ft wide crown.

The crown jewel of the second phase entailed the design and construction of a new 3.8 mi long setback levee. Rang-



The project included the design and construction of a new 3.8 mi long setback levee. The existing levee was breached in certain locations to facilitate the flow of water into and out of the setback area, which hosts various riverine and upland ecosystems.

ing in height from 38 to 42 ft, the setback levee also includes a slurry wall and has 3:1 slopes on both sides as well as a 20 ft wide crown.

The decision to construct a new levee landward of its original counterpart resulted largely from geotechnical conditions immediately adjacent to the river. There, the underlying ground layers did not provide adequate support for

the slurry wall to be installed within the new levee. Similarly, the soils available beside the river consisted mainly of very silty fines and sand, materials too porous for use in the new levee. “We were able to extract material and construct a brand-new levee landward with appropriate engineering material that is far superior in terms of its stability and its ability to prevent seepage,” Fabun says.

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MARK NEWTON, SKYHIGH PERSPECTIVES

An 80 ft wide seepage berm extends along the landside toe of approximately 80 percent of the entire 5.6 mi project. “That, in conjunction with the slurry wall, is what attenuates the through- and under-seepage,” Fabun says. “Where we couldn’t install the seepage berm, we ended up with a much deeper slurry wall.” Completed in 2018, the second phase was constructed by Los Angeles-based AECOM’s energy and construction arm.

Constructing the setback levee enabled the WSAFCA to include ecosystem restoration as part of the overall project. All told, the project restored 212 acres of habitat, 114 of which were formerly farmland protected by the original levee. As part of this phase, the existing levee was breached in certain locations to facilitate the flow of water into and out of the setback area, which was contoured to accommodate various riverine and upland ecosystems. “Depending on water levels in any particular season or year, that floodplain will inundate and remain flooded,” says Mark Zollo, a se-

nior administrative analyst for flood protection for the City of West Sacramento. In this way, the project is expected to provide habitat for such species as juvenile salmon.

Designed by GEI Consultants, of Woburn, Massachusetts, and constructed by River Partners, of Chico, California, SLIP’s third phase involved planting about 80,000 trees, shrubs, and other vegetation—all native to California. “We tried to create the most diverse habitat that we could,” Fabun says. In so doing, the WSAFCA restored more habitat than it needed to for the purpose of mitigating environmental impacts resulting from the project. As a result, the agency can apply the extra amount toward the fulfillment of mitigation requirements associated with future levee improvements.

The project’s habitat restoration and flood-reduction components certainly helped the WSAFCA earn the Envision platinum rating, says Jennifer Ninete, ENV SP, a sustainability consultant for HDR, which led the effort on behalf of the agency to achieve the verification.

Another contributing factor was the project’s recreational benefits, including a trail constructed on top of the levee that connects to a regional trail system. This aspect also illustrates how the project contributes to the city’s broader planning and transportation objectives. “We were able to use all of those elements to talk about how the project is addressing community needs and goals,” Ninete says.

A significant portion of the funding for SLIP was provided by the California Department of Water Resources. In developing the project, the WSAFCA worked closely with the U.S. Army Corps of Engineers, which has prepared a federal plan for upgrading all of West Sacramento’s levees to the 200-year level of protection by 2025. The federal plan, titled the West Sacramento Project, was authorized by Congress in 2016. To date, the Corps has received about \$2 million in funding, and the next project increment is in design. The Corps and the WSAFCA are seeking construction funding for a 2021 start.

—JAY LANDERS