

# Delta Conservation Framework

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## *Section II*

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## 1 II. Integrating Delta Community with Conservation

2 Today, the Delta is at a crossroads between a long legacy of change as a result of reclamation and  
3 agricultural development and an uncertain future over  
4 the next 100 years, with pressures to change water  
5 conveyance,<sup>1</sup> and restore habitat as the climate changes  
6 and sea levels rise. Restoring ecological processes will  
7 nurture ecosystem resilience in the face of future  
8 changes and will ensure continued and improved  
9 *ecosystem services* to local Delta communities and  
10 agriculture. This includes, but is not limited to: open  
11 space; opportunities for hunting, fishing, boating, and  
12 other recreation that also promote tourism; clean water  
13 and fertile soils; subsidence reversal; carbon  
14 sequestration; crop pollination; biodiversity; and flood  
15 control.

16 There is growing recognition that to be successful, it is  
17 essential for conservation practices to be better  
18 reconciled with the needs of Delta community members  
19 and all Californians.<sup>2</sup> Improved alignment between  
20 conservation goals and the needs of Delta stakeholders,  
21 including the agricultural and local community (*see box*),  
22 will be a critical component in planning for the  
23 successful implementation of future conservation  
24 projects in the Delta.

25 Section II of the Delta Conservation Framework  
26 highlights the need for a more inclusive approach to  
27 conservation improving stakeholder communication and integrating socioeconomic considerations (Goal  
28 A). Goal B emphasizes the need to increase Delta-focused education and outreach. Goal C focuses on  
29 multi-benefit solutions (“floating all boats”) by integrating the needs of people and Delta ecosystems  
30 and offers strategies for implementing conservation projects that also benefit agriculture and the Delta  
31 community over the short and long term (Figure 2.1).

32 It should be acknowledged that win-win solutions intended to benefit the Delta ecosystem and local  
33 communities do not always distribute wins equally. In fact, multi-benefit solutions may sometimes  
34 include disadvantages or even losses for some stakeholders.<sup>2, 3, 4, 14</sup> Recognizing the potential for  
35 inequality of benefits is critical for gaining the trust and cooperation of all stakeholders. According to  
36 2016 Delta Conservation Framework workshop participants, Delta farmers, business owners, and  
37 residents feel that they have gotten the “short end of the stick” in the past. It is important to find  
38 appropriate conservation solutions with long-term benefits for all stakeholders whenever possible and

### **DELTA STAKEHOLDERS**

- Residents and landowners;
- Agricultural, recreational and other businesses operating or situated in the Delta;
- Native American tribes;
- The public, including citizens who rely on the Delta for water supply or for recreational uses;
- Beneficiaries up- and downstream of the estuary;
- Restoration practitioners;
- Local, state, and federal agencies; nongovernment organizations;
- Academic and other science-focused institutions;
- Private entities; and
- Policymakers.

39 to minimize impacts to landowners by focusing conservation efforts on public lands first, while  
40 remaining open to potential opportunities with willing private landowners.

41 Although there is potential to plan conservation projects with minimal impacts and multiple benefits,  
42 the degree of agricultural and community benefits from conservation will likely vary within the Delta  
43 and over time. It is imperative to engage stakeholders collaboratively in conservation planning efforts to  
44 make “all boats float” in the Delta in  
45 the long term.

46 Participants in the 2016 Delta  
47 Conservation Framework stakeholder  
48 workshops (2016 workshops)  
49 expressed concern about the possible  
50 impacts of conservation on  
51 agriculture and Delta counties and  
52 communities. Many of these concerns  
53 pertain to the economic impacts of  
54 conversion on productive agricultural  
55 lands—including loss of a local tax  
56 base for Delta counties—and  
57 associated decreases in processing,  
58 labor, and equipment sales. Other concerns  
59 include the potential for constrained  
60 agricultural operations as a result of listed  
61 or invasive species encroachment near conservation areas, potential drainage and seepage issues in  
62 agricultural lands adjacent to restoration or levee setback sites, and other negative effects associated  
63 with implementation, management, and, in some instances, public access to conservation lands.  
64 Section V offers potential solutions for concerns regarding permitting and funding conservation projects.  
65 Despite their concerns regarding potential impacts of conservation on local communities, workshop  
66 participants also acknowledged possible benefits of  
67 conservation through ecosystem services.

68 Specific physical, societal, and economic benefits of  
69 conservation for Delta communities could include control of  
70 invasive aquatic vegetation in both conservation areas and  
71 adjacent agricultural waterways; removal in or near  
72 conservation sites of submerged debris and abandoned  
73 vessels; installing and managing water gates, screens, and  
74 barriers for the benefit of fisheries and irrigation systems;  
75 improved water quality; beneficial reuse of dredge sediment  
76 in restoration of tidal wetlands (e.g., subsided lands or  
77 flooded islands); improved fishing access from levees and  
78 public conservation staging areas; enhanced wildlife viewing

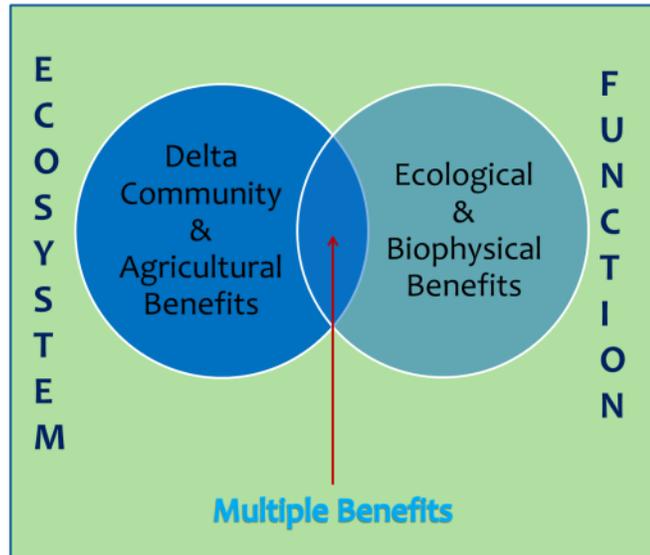


Figure 2.1: Improving ecosystem function can provide multiple benefits for people and ecosystems in the Delta.

**DELTA COMMUNITY**  
*refers to the residents;  
landowners; and  
agricultural, recreational,  
and other businesses  
operating or situated in  
the Delta.*

79 destinations accessible from boats (e.g., Calhoun Cut Ecological Reserve); direct public access in certain  
80 conservation areas;<sup>5,6,7,8</sup> subsidized business from increased tourism; and improved air quality and scenic  
81 value from the planting of trees.

82 This section also highlights the Delta Reform Act concept of “*Delta as an evolving place*” and outlines the  
83 suggestions and feedback received from Delta stakeholders during the 2016 workshop series. It offers  
84 an overview of Goal C, and associated strategies and objectives, with a detailed discussion of the need  
85 to seek multi-benefit outcomes and integrate conservation with community through collaborative  
86 partnerships in the Delta.

## 87 **The Delta as an Evolving Place**

88 The concept of “*Delta as Place*” emerged from the 2007 Delta Vision Blue Ribbon Task Force process<sup>9,12</sup>  
89 and connects to the language in the Delta Reform Act of achieving the coequal goals “*in a manner that*  
90 *protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the*  
91 *Delta as an evolving place*” (California Water Code §85054). This language calls for including the human  
92 dimension in ecosystem conservation, and by extension, ensuring a place for people and wildlife in a  
93 changing Delta. However, it is necessary to clearly articulate how to integrate or reconcile human uses  
94 with the Delta ecosystem in the future.<sup>2,10</sup> Chapter 5 of the Delta Plan outlines regulatory policies and  
95 recommendations to carry out strategies aimed at protecting and enhancing the unique cultural,  
96 recreational, natural resource, and agricultural values of the *Delta as an evolving place*. It also contains  
97 several performance measures that track progress in achieving those policies and recommendations.<sup>11</sup>

98 The concept of “*Delta as Place*” acknowledges that the Delta is a place for people, homes, and  
99 businesses, filled with history, cultural richness and diversity, in addition to being the hub for  
100 water distribution in California and a crucially important ecosystem.<sup>12</sup> Stakeholder workshop  
101 participants described “*Delta as Place*” as the locals’ great love of the Delta as a home, rooted in a multi-  
102 generational linkage to the land and a different way of life founded on farming and land management  
103 (Appendix VI). The concept, therefore, captures residents’ deep connections to the Delta as their roots  
104 and their ties to its unique communities, land, heritage, and legacy throughout the last 160 years.

105 Along with the strong ties between communities and the landscape of the Delta, local Delta  
106 stakeholders expressed a reluctance to embrace change, especially if change is initiated from outside of  
107 their communities. The Delta community members who participated in the 2016 workshops expressed  
108 concerns that their lifestyle would cease to exist or drastically change if state agencies manage more  
109 land in the Delta and agriculture and residents are displaced. In particular, they commented that  
110 conversion of agricultural lands through restoration by state agencies or other outsiders could adversely  
111 affect water quality and availability and increase regulatory restrictions. In order for Delta conservation  
112 to succeed, these concerns must be part of a continued socioeconomic research program; and they  
113 need to be acknowledged and taken into consideration to inform ongoing planning and implementation  
114 of conservation projects.<sup>13,14,15,16,,17,18</sup> Addressing these may also help to achieve buy-in for long-term  
115 solutions. For example, some loss of agriculture could be balanced by improved long-term economic

116 sustainability or other benefits, as current agricultural operations may change in the future due to direct  
117 climate change impacts or changes in markets.

***“I think the biggest risk is, if there isn’t community buy-in on the restoration projects, then oftentimes they’re seen as an imposition rather than a type of amenity for the community. Those projects that have a good connection with the local community really increase their rate of success, because you have those communities looking out for those projects. If restoration is imposed, it plays itself out where it can get sabotaged, and there isn’t support for it. I think most of the scientific community is aware of this now. I’m not sure it has been put in a set of best practices yet. But I think that has come to light through trial and error.”***

*(Brett Milligan, UC Davis)<sup>10</sup>*

118

119 The *Delta as Place Interagency Working Group* (DPI-WG) was conceived by the Delta Protection  
120 Commission in the spirit of the “*Delta as Place*” concept. This working group focused on implementing  
121 policies and recommendations identified in the Delta Plan and advancing Delta values by coordinating  
122 activities across federal, state, and local agencies to promote Delta agricultural sustainability, culture,  
123 economic development, energy and transportation infrastructure, recreation, and subsidence  
124 reversal/carbon markets.<sup>12</sup> Recent DPI-WG actions include several initiatives: *Community Action*  
125 *Planning*, *Delta Narratives*, a *Delta Awareness Campaign*, a *Delta Leadership Program*, and a proposal  
126 for a federal designation of the *Delta as a National Heritage Area* (NHA).<sup>12</sup> A NHA is defined as “a region  
127 designated by the United States Congress, where natural, cultural, historical, and recreational resources  
128 combine to form a cohesive, nationally-distinctive landscape arising from patterns of human activity  
129 shaped by geography.”<sup>12</sup>

***Among Delta stakeholders there is growing recognition that building a socioeconomically and ecologically sustainable Delta must go hand in hand, as sea levels rise and other impending environmental and related economic changes unfold during the upcoming decades.***

*(2016 Delta Conservation Framework workshop participants)*

130

131 The understanding of “*Delta as Place*” has evolved over time and will continue to do so. By integrating  
132 the concept of “*Delta as an evolving place*” (as phrased in the Delta Reform Act) into conservation  
133 planning, local community initiatives could be considered alongside conservation planning as the Delta  
134 “*evolves*” into the future. It is best to prepare for future changes through a forward-thinking  
135 collaborative effort, rather than deeply divided factions that are rooted in the past or status quo.

***“Big changes are always impractical for those deeply embedded in existing practices that are failing us.”***

*Richard Norgaard, Professor Emeritus of Energy and Resources, UC Berkeley<sup>19</sup>*

136 **Integrating the Human Dimension with Conservation**

137 It is necessary for public agencies, restoration practitioners, and scientists to work collaboratively with  
138 Delta residents, landowners, farmers, and nongovernmental organizations in collaborative partnerships,  
139 at the local and regional levels, to plan conservation projects that will be successful over the long term  
140 and achieve ecosystem sustainability in the Delta.<sup>2,15,16,15,16</sup> The intention of these partnerships is to  
141 overcome the current climate of wariness and doubt and move toward productive regular  
142 communication and collaboration. Mutual respect and a commitment to evaluating challenges and  
143 opportunities together are essential to the success of conservation, since Delta ecosystem function  
144 could be improved through multi-benefit projects, when feasible.<sup>2,14</sup>

145 Therefore, the Delta Conservation Framework includes Goal A: *Integrate regular stakeholder*  
146 *communication and socioeconomic considerations into Delta conservation planning, implementation,*  
147 *science, and adaptive management processes* (Table 2.1). Two strategies focus on 1) utilizing  
148 collaborative regional partnerships and regular coordinated forums to plan, implement, and manage  
149 conservation and evaluate progress; and 2) aligning conservation practices with best practices (BPs) for  
150 supporting Delta agriculture and community needs. Associated implementation objectives are outlined  
151 in the text boxes below.

152 **Table 2.1:** Goal A and related strategies and objectives for implementation.

**GOAL A: Integrate regular stakeholder communication and socioeconomic considerations into Delta conservation planning, implementation, science, and adaptive management processes.**

**Strategy A1: Utilize collaborative regional partnerships and regular coordinated forums to plan, implement, and manage conservation and evaluate progress.**

- **OBJECTIVE A1-1:** By 2019, establish a permanent public advisor position to serve as:
  - Liaison between Delta community members, agency representatives, scientists, and other stakeholders;
  - Coordinator of regularly scheduled meetings to develop *Regional Conservation Strategies* with regionally focused conservation targets and timelines.
- **OBJECTIVE A1-2:** By 2022, identify a lead organization that develops web tools and content to include recommended collaboration and coordination practices and links to other existing resources.
- **OBJECTIVE A1-3:** By 2022, continue existing partnerships, and initiate new partnerships, to engage stakeholders (conservation practitioners, federal, state, and local planning and permitting agencies, willing farmers, landowners, and other community members) when planning *Regional Conservation Strategies*, implementing conservation projects, and managing conservation areas.
- **OBJECTIVE A1-4:** By 2022, initiate two new *Regional Conservation Strategy* planning processes, or similar partnership planning processes, as suggested in the Conservation Opportunity Regions (COR) outlined in the Delta Conservation Framework.

153

**Strategy A2: Align conservation practices with best practices for supporting Delta agriculture and community needs.**

- **OBJECTIVE A2-1:** By 2019, engage with existing and establish new public advisors to help farmers and landowners navigate regulatory requirements associated with agricultural areas near conservation lands, and advocate for funding to provide financial incentives for implementing wildlife-friendly agricultural practices and associated research and evaluation.
- **OBJECTIVE A2-2:** Within four years after initiation of a *Regional Conservation Strategy* or similar planning process, conduct at least two region-specific socioeconomic research projects investigating the costs and benefits of Delta conservation (including ecosystem services) and show how findings can be incorporated into conservation project planning and evaluation.
- **OBJECTIVE A2-3:** By 2022, regional partnerships and individual project proponents consider inclusion of applicable Department of Water Resources (DWR) *Agricultural and Land Stewardship Workgroup strategies*,<sup>20</sup> and available socioeconomic and natural resource management research outcomes, in the planning of *Regional Conservation Strategies* and for project implementation and management.
- **OBJECTIVE A2-4:** By 2022, regional planning partnerships implement and evaluate efficacy of DWR *Agricultural and Land Stewardship Workgroup strategies*<sup>20</sup> intended to minimize the impacts of conservation projects on agricultural productivity and maximize societal benefits from ecosystem services according to a suite of relevant performance measures.

154

155 **Incorporating Regular Stakeholder Communication into Conservation Practice**

156 The Delta Conservation Framework provides general landscape-scale goals, strategies, and objectives  
157 that are relevant throughout the Delta. Specific goals, strategies, and objectives are outlined as boxes  
158 throughout the document as relevant to the topics of specific sections. Collaborative regional  
159 partnerships among public and private stakeholders should be used to develop and implement *Regional*  
160 *Conservation Strategies* within sub-regions of the Delta, which focus on local ecosystems, land uses, and  
161 communities. Existing regional partnerships and newly-formed *Regional Conservation Strategy*  
162 partnerships should be organized by a lead organization or agency and consist of conservation  
163 practitioners, federal, state, and local planning and permitting agencies, scientists, willing landowners,  
164 and other community members. A public advisor role should be established to function as a liaison  
165 between the Delta community and agency representatives. These cooperative regional partnerships  
166 should hold regular meetings over the long term and focus on collaboration to plan, implement, and  
167 manage conservation projects within a specific Delta opportunity region. Potential regional conservation  
168 opportunity regions (COR) are described in Appendix II and include the Suisun Marsh, Yolo Bypass,  
169 Cache Slough Complex, Central Delta Corridor Partnership, South Delta, North Delta, and Contra Costa  
170 (see Section VI).

171 Easily accessible web tools and content should be made available to support *Regional Conservation*  
172 *Planning Partnerships*. These resources could include existing conservation planning frameworks such as  
173 the *Open Standards of the Practice of Conservation*<sup>21</sup> (Appendix XV) and web links to current agency  
174 webpages, including California Department of Fish and Wildlife (CDFW), DWR, the Delta Conservancy,  
175 the Delta Protection Commission, the Delta Stewardship Council, and the Good Neighbor Checklist  
176 prepared by DWR.<sup>22</sup> Websites and online communication forums (e.g., blogs, email list serves) should be  
177 designed to facilitate early and consistent communication among all Delta stakeholders. Physical  
178 mailings, published announcements, and posted flyers should also be used to inform potentially  
179 interested Delta community stakeholders about conservation-related meetings within each Delta region.

## 180 *Existing and Emerging Conservation Partnerships*

### 181 Suisun Marsh Habitat Management, Preservation and Restoration Plan

182 The Suisun Marsh Habitat Management, Preservation and Restoration Plan (SMP)<sup>23</sup> was established in  
183 2013 to provide a structure for conservation planning and implementation in the Suisun Marsh region.  
184 The SMP is a 30-year comprehensive conservation plan that balances protection and enhancement of  
185 managed wetlands and the restoration and protection of tidal wetlands (*SMP Final EIR/EIS, Volume II,*  
186 *App E, and Page E-4*). It addresses habitats and ecological processes, public and private land use, levee  
187 system integrity, and water quality through tidal restoration and managed wetland activities.  
188 Implementation of the SMP is overseen by the Principal Agencies Adaptive Management Advisory  
189 Team,<sup>24</sup> made up of the Suisun Principal Agencies: U.S. Fish and Wildlife Service (USFWS); U.S.  
190 Department of Interior, Bureau of Reclamation; CDFW; DWR; National Marine Fisheries Services; Suisun  
191 Resource Conservation District; and the Delta Stewardship Council (successor to the CALFED Bay-Delta  
192 Program; please see Appendices II and VII for more information).

### 193 Central Valley Joint Venture

194 The Central Valley Joint Venture (CVJV) is another long-standing and cooperative partnership in the  
195 region. The CVJV programs focus on all migratory birds found in the Central Valley, including waterfowl,  
196 shorebird, and waterbird species, and on special status species such as western yellow-billed cuckoo  
197 (*Coccyzus americanus*), bank swallow (*Riparia riparia*), least Bell's vireo (*Vireo bellii pusillus*), California  
198 black rail (*Laterallus jamaicensis oturniculus*), Swainson's hawk (*Buteo swainsoni*), and greater sandhill  
199 crane (*Antigone canadensis tabida*). The CVJV is led by a management board of 21 public and private  
200 entities and has been successfully championing wetland conservation to benefit migratory birds and  
201 other wildlife throughout the Central Valley since 1988.<sup>25</sup> The CVJV is one of 18 Joint Ventures  
202 throughout North America formed under the North American Waterfowl Management Plan that  
203 leverages public and private resources for projects throughout the Central Valley. The CVJV has a long  
204 history of success bringing partners together to focus on coordinated regional bird conservation efforts,  
205 including wildlife-friendly agriculture.<sup>25,26</sup>

206 The 2006 CVJV Implementation Plan outlines objectives for Central Valley habitats that support  
207 shorebirds, waterbirds, and riparian songbirds.<sup>27</sup> A revised CVJV Implementation Plan with updated bird  
208 population objectives is slated for release in 2017.<sup>28,29,30,31,32,33,34,35</sup> The objectives set by the CVJV for the  
209 Yolo-Delta, Delta Basin, and Suisun Marsh are relevant to Delta Conservation Framework Goal C,

210 Strategy C2, “Support sustainable wildlife-friendly agriculture to provide additional wildlife and  
211 migratory bird habitats”; Goal D, Strategy D1, “Restore, enhance, and manage ecosystem processes  
212 Delta-wide, as identified and specified by existing or emerging Regional Conservation Partnerships in  
213 Regional Conservation Strategies, to improve function and life history support for native and migratory  
214 wildlife”; and Goal D, strategy D2, “Through technical analyses conducted by given Regional  
215 Conservation Partnerships, identify and prioritize available areas to protect Delta ecosystems and  
216 transition zones with the potential for providing landscape connectivity and resiliency to ecosystem  
217 function.”

### **Updated CVJV Habitat Objectives for Bird Species**

- **Riparian** bird species habitat objectives for the Sacramento, Yolo-Delta, San Joaquin, and Tulare Basins include restoring 5,900 acres of riparian habitat in the Yolo-Delta Basin within the next 10 years, and up to 108,627 acres within the next 100 years<sup>29</sup>.
- **Shorebird** species habitat objectives for Butte, Colusa, American, Sutter, Yolo, Delta, San Joaquin, and Tulare Basins include making available 12,943 acres of wetland habitat for nonbreeding shorebirds and other bird use, including 5,213 acres flooded agricultural habitat for rice, 213,926 acres of corn, and 183,124 acres of other crop types<sup>31</sup>.
- **Waterfowl** habitat objectives are also being developed as part of the updated CVJV Implementation Plan to be released in 2017.

218

219 Regional conservation strategy partnerships or individual project proponents should work closely with  
220 the CVJV and, in their planning and implementation efforts consider and reference the geographically  
221 relevant habitat objectives for resident and migratory birds.

### **Yolo Bypass-Cache Slough Complex Planning**

223 Several partnership efforts have focused on conservation and floodplain management issues in the Yolo  
224 Bypass-Cache Slough Complex. At the government agency level, the Yolo Bypass-Cache Slough Complex  
225 Partnership offers a way for high-level collaboration among agencies and other stakeholders. The  
226 Corridor Management Framework allows local and regional agencies to engage more specifically in the  
227 Yolo Bypass partnership efforts. As a long-standing stakeholder partnership, the Yolo Bypass working  
228 group has engaged local stakeholders, especially in the southern Yolo Bypass region. Combined, with  
229 sufficient coordination, these partnerships can serve as a conduit for successful conservation planning  
230 and management in the Yolo Bypass-Cache Slough region.

231 *Yolo Bypass-Cache Slough Partnership*  
232 In 2016, the policy-level Yolo Bypass and  
233 Cache Slough Partnership was initiated via a  
234 Memorandum of Understanding that  
235 emphasizes the importance of achieving  
236 across-the-board improvements in habitat,  
237 flood protection, agricultural sustainability,  
238 recreation, and other public values.<sup>36</sup> Made  
239 up of 15 local, state, and federal agencies, its  
240 purpose is to improve executive-level  
241 interagency coordination. The high-level  
242 partnership has set the stage for improved  
243 trust between stakeholders, a key ingredient  
244 in successful efforts of this scale. It also  
245 provides a vehicle to incorporate local  
246 governments into planning and decision  
247 making, relative to restoration actions in the  
248 Yolo Bypass and Cache Slough (see Yolo  
249 Bypass COR summary in section VI for  
250 further details).

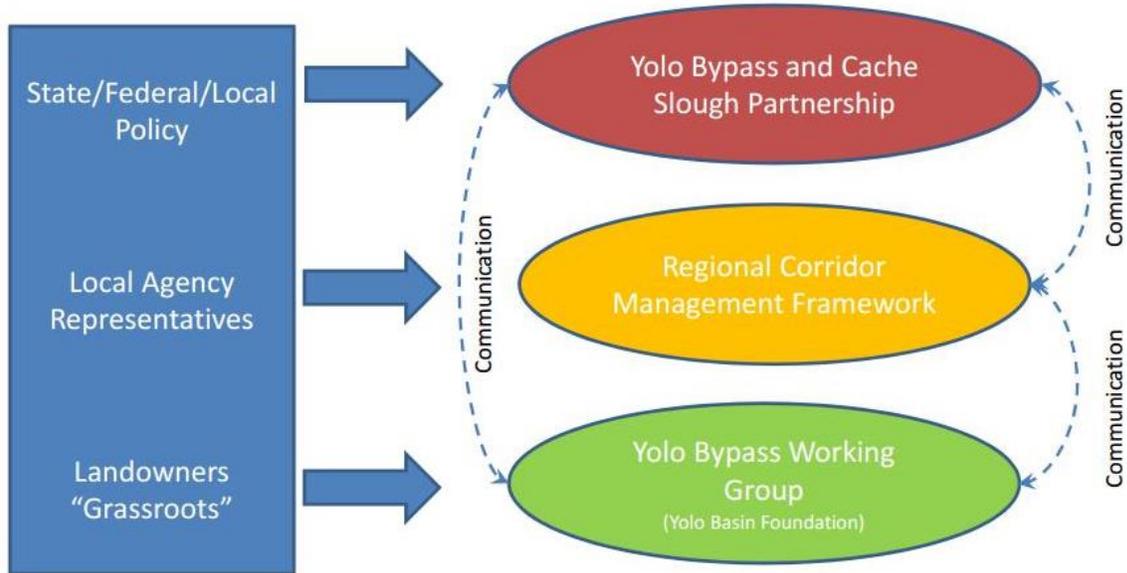
251 *Corridor Management Framework*  
252 In 2015, local reclamation districts, counties,  
253 and flood control agencies developed the  
254 Corridor Management Framework (CMF), a  
255 vision for the integration of local, state, and  
256 federal interests in the region (including the  
257 Cache Slough Complex). The CMF continues  
258 to guide local agency participation in the Yolo Bypass Partnership and other forums.<sup>37</sup>

259 *Yolo Bypass Working Group*  
260 The Yolo Bypass Working Group, established in 1998, is a grassroots example of a multi-stakeholder  
261 partnership approach to conservation planning.<sup>38</sup> Forty regular attendees represent a wide range of  
262 stakeholders interested in managing the multiple uses of the Yolo Bypass for flood control, agriculture,  
263 recreation, and floodplain habitat supporting juvenile salmon, waterfowl, and other waterbirds.<sup>38</sup> Figure  
264 2.2 shows the existing Yolo Bypass Partnership structure.

#### YOLO BYPASS WORKING GROUP

***“Every working group agenda contains specific and new issues as they develop. Topics include flood protection; improvement of salmon passage and rearing habitats; vector control; water quality, especially methylmercury production; changes in land ownership; and land use and habitat restoration and maintenance. Preservation of agricultural productivity is another important topic. Participants include landowners (farmers, ranchers, duck clubs), Department of Water Resources, Central Valley Flood Protection Board, CA Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, Dixon and Yolo Resource Conservation Districts, Sacramento Area Flood Control Agency, Yolo County, City of West Sacramento, City of Davis, California Waterfowl Association, Ducks Unlimited, Sacramento-Yolo Mosquito Vector Control District, American Rivers, and others.”***

(Yolo Basin Foundation 2017)<sup>38</sup>



265

266 **Figure 2.2 Existing Yolo Bypass Partnership Structure**

267 *Cache Slough Complex Planning Partnership*

268 The Cache Slough Restoration Planning (CSRP) effort is an example of a new regional conservation  
 269 partnership process underway in the Delta. The CSRP partnership was launched in 2016 by the Delta  
 270 Conservancy and includes Solano and Yolo counties, Solano County Water Agency, Reclamation District  
 271 2068, agricultural community stakeholders from Resource Conservation Districts, and government  
 272 agency representatives from the Delta Stewardship Council, California Natural Resources Agency, DWR,  
 273 and CDFW. The CSRP’s purpose is to develop a regional conservation strategy for the Cache Slough  
 274 Complex (CSC) that identifies areas for habitat restoration and projects that would be eligible for  
 275 Proposition 1 funding and avoid or minimize potential conflicts between land uses.<sup>39</sup> The CSRP has been  
 276 incorporating existing land use plans and input from local stakeholders to develop a locally supportable  
 277 vision using a strategic planning approach. Ultimately, the CSC conservation strategy will integrate with  
 278 adjacent planning efforts in the Yolo Bypass (upstream) or Suisun Marsh (downstream). This regional  
 279 planning compliments ongoing collaborative work among local, state, and federal agencies in the Suisun  
 280 Marsh and the larger Yolo Bypass/Cache Slough region, and it builds on past efforts by the coalition of  
 281 local agency partners in the Lower Sacramento/Delta North Region Corridor of important habitat for  
 282 birds and other wildlife.

283 *Central Delta Corridor Partnership*

284 The recently formed Central Delta Corridor Partnership is currently evaluating conservation  
 285 opportunities available on Delta islands recently purchased by the Metropolitan Water District of  
 286 Southern California, including Webb Tract, Holland Tract, Bacon Island, and Bouldin Island; lands owned  
 287 by DWR on Sherman and Twitchell Islands,<sup>40,41,42,43</sup> and their upstream neighbors on Staten Island and  
 288 McCormack-Williamson Tract in the Cosumnes River Preserve, managed by The Nature Conservancy

289 (TNC). These Delta islands are central to a potentially emerging landscape-scale conservation “corridor.”  
 290 This corridor is uniquely promising, as a large portion is publically owned or publically financed, and it  
 291 would link together approximately 49,000 contiguous acres in the northeastern and central portions of  
 292 the Delta (Figure 2.13, see a more detailed description in Appendix II).

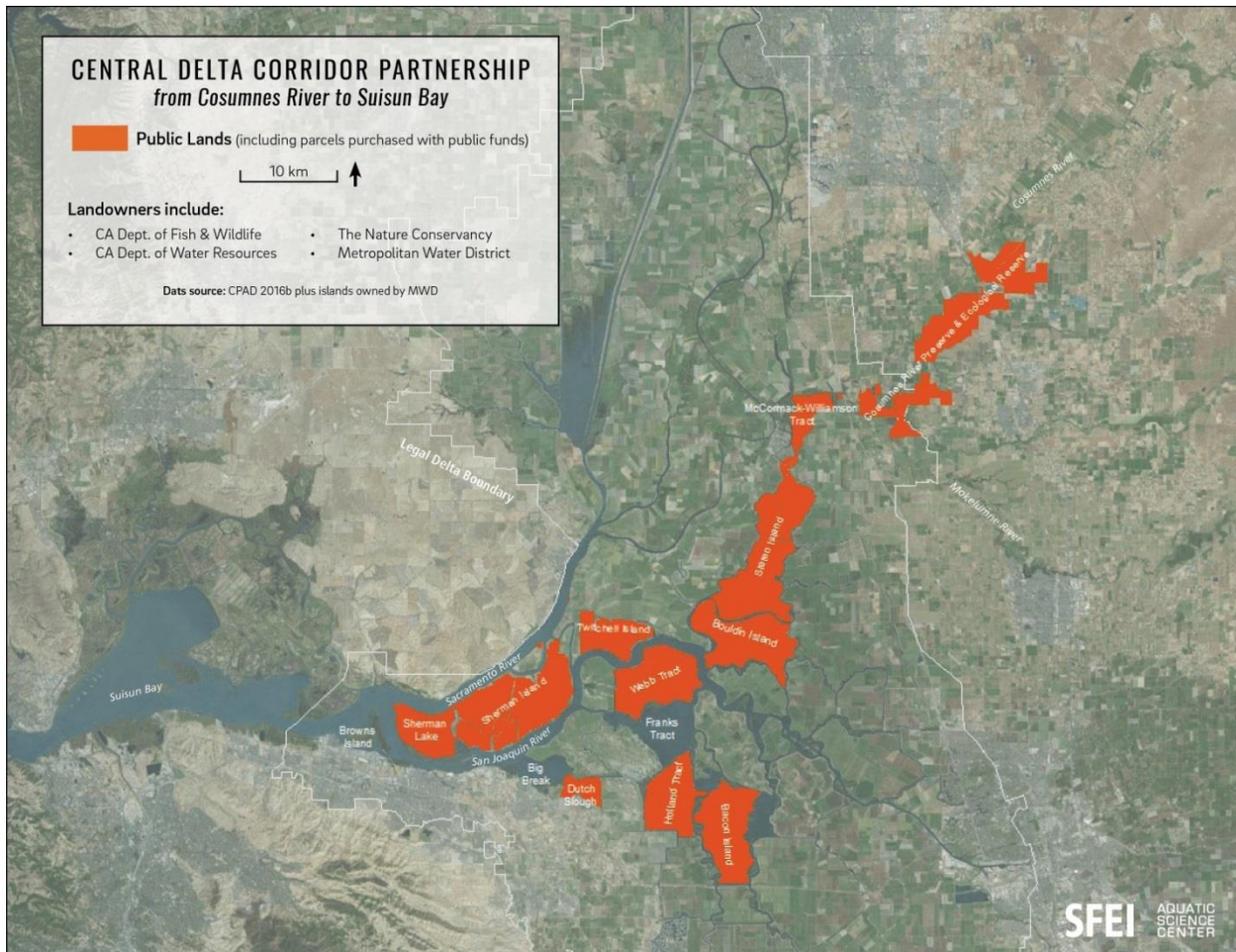


Figure 2.3: Map of Central Delta Corridor Source: SFEI

293  
 294 *North Delta Habitat Arc*  
 295 Landscape-scale connectivity is emerging as an important emphasis for Delta conservation. Connecting a  
 296 series of habitats across regions allows for continuous habitat “corridors” that are more ecologically  
 297 valuable than individual disconnected parcels. The “North Delta Habitat Arc,” as another example, is a  
 298 reconciled ecosystem strategy that creates an arc of habitats connected by the Sacramento River to  
 299 benefit native fish and other wildlife.<sup>44</sup> The upstream end of the arc starts in the Yolo Bypass, continues  
 300 through the Cache-Lindsey Slough-Liberty Island region (CSC) into the Sacramento River, includes  
 301 Twitchell and Sherman Islands, and ends in Suisun Marsh. Regional conservation plans for the two  
 302 southern components of this “arc” (Suisun Marsh and CSC) are already being implemented by  
 303 conservation partnerships. The northern portion includes public lands managed by CDFW (Yolo Bypass  
 304 Wildlife Area) and has several existing successful planning efforts underway, including the CMF, Yolo  
 305 Bypass working group, and the CVJV. While all the geographic subregions of this arc have benefited from

306 conservation planning, there may be an opportunity to tie these efforts together through a landscape-  
307 scale approach.

### 308 **Aligning Conservation Practices with Agriculture and Land Stewardship**

309 Delta communities have two primary concerns regarding conservation projects in their region.<sup>5</sup> They  
310 believe:

- 311 1. Conservation projects will undermine the long-term viability of Delta agriculture by converting  
312 productive lands into restoration projects, and
- 313 2. Agricultural operations will be negatively impacted by insufficient long-term management of  
314 neighboring conservation areas.

315 Local landowners are concerned that conservation projects will spread invasive species, provide  
316 mosquito habitat, impact water supply, increase the risks of drainage and seepage, and draw scrutiny  
317 from regulatory agencies if listed species move onto their lands.<sup>5</sup> In the 2016 workshops, stakeholders  
318 pointed out that public lands are generally not well managed, due to insufficient staffing and funding for  
319 long-term monitoring and maintenance. They suggested that public agencies focus on finding solutions  
320 to improve land management (Strategy A2, Table 2.1) and stewardship practices (this is addressed  
321 below by Goal C, Strategy C4). Several solutions were proposed to address potential conflicts between  
322 conservation projects and local community goals (see textbox for details).

**Potential conflicts between conservation projects and local community goals could be resolved by:**

- Inviting stakeholder participation and incorporating stakeholders' perspectives during the conservation planning and implementation processes;
- Using good-neighbor practices when managing conservation lands over the long term;
- Offering financial, regulatory, or other incentives to compensate landowners for their participation in conservation.

323

***REGIONAL CONSERVATION STRATEGIES** and individual conservation project implementation in the Delta should aim to minimize the impacts of conservation projects on agricultural productivity and consider the region-wide consequences of converting agricultural lands through restoration. However, small-scale impacts on agriculture should also be compared to the potential direct and indirect landscape-scale benefits of ecosystem conservation to society.<sup>5,45</sup> There is a need for all Delta stakeholders to recognize that Delta agriculture and local communities are fundamentally supported by functional ecosystems. Ultimately restoring ecosystem processes via conservation may provide more valuable benefits to stakeholders and may contribute more to local and statewide economies than maintaining marginal agricultural lands in perpetuity.<sup>46</sup>*

324

325 Conservation partnerships, state agencies, local agencies, and project proponents should utilize the  
326 2014 DWR *Agricultural and Land Stewardship* (ALS) framework and strategies<sup>20</sup> to minimize potential  
327 impacts of conservation projects on agricultural lands. The ALS strategies contain specific tools for  
328 conservation project proponents to minimize potential impacts on agriculture and ensure solutions that  
329 balance the needs of agriculture and conservation. They provide an outline for assessing the ecosystem  
330 benefits of a given project, while ensuring that local landowners can achieve or maintain agricultural and  
331 economic viability in the surrounding region.

332 During conservation planning efforts, effective coordination among agricultural practitioners (or their  
333 local representatives), local planners, conservation planners, and other stakeholders is essential to  
334 ensure that potential impacts to agricultural lands and the environment can be recognized promptly and  
335 evaluated. To balance agricultural goals and emerging conservation projects in the Delta, farmers and  
336 landowners should be involved in planning from the start. Assistance and incentives for farmers and  
337 landowners to engage in conservation partnerships are essential. Because landowners and farmers are  
338 understandably busy managing their own lands, the ALS strategies include a suggestion to appoint a  
339 public advisor for government projects aimed at conservation. Besides providing support to landowners  
340 navigating regulatory requirements, the advisor would be responsible for informing farmers and  
341 landowners about ongoing conservation planning processes and would advocate for funding to provide  
342 incentives to farmers willing to use wildlife-friendly farming practices.<sup>20</sup>

### 343 **Promoting Delta Cultural and Ecological Values at Local, State, and National** 344 **Levels**

345 To acknowledge the ecological and economic value the Delta provides California and the nation,  
346 California residents need to gain a better understanding of these values and the Delta’s unique history  
347 and culture. Most Californians who live and work outside the Delta don’t easily grasp its sense of place  
348 and don’t understand how the Delta natural ecosystems support local and state-wide economies  
349 through water supply and other ecosystem services. Some only drive “through the Delta without a clear  
350 sense of being in it and less notion of where it begins and where it ends”.<sup>5</sup> Statewide and national Delta  
351 education initiatives should work in concert with ongoing efforts through the Delta Awareness  
352 Campaign<sup>12</sup> to focus a spotlight on the Delta’s historical legacy and economic importance,<sup>47</sup> as well as  
353 the urgency of transforming its degraded natural areas into novel, functional ecosystems that are  
354 important to Delta residents and native wildlife.<sup>48</sup> Accordingly, 2016 workshop participants developed a  
355 goal and related strategies to promote public education and outreach relative to integrating the “*Delta*  
356 *as an evolving place*” with ecosystem conservation. The aim is to build on existing initiatives—such as  
357 the *Delta Awareness Campaign* and the *Delta Narratives* led by the Delta Protection Commission and  
358 Delta Conservancy—to promote education and outreach programs at the national, state, and local levels  
359 (Strategy B1, Table 2.2).

360 **Table 2.2:** Goal B and related strategies and objectives for implementation.

**GOAL B: Support and expand existing public education programs and run state and national outreach campaigns focused on Delta values and ecosystem conservation.**

**Strategy B1: Support and expand existing public education programs to include a focused curriculum on integrating agriculture, Delta communities, and ecosystem conservation that also communicates impending changes to resources and ecosystem services from climate change.**

- **OBJECTIVE B1-1:** By 2019, secure funding support for the 5-year implementation of a coordinated Delta public education program integrating a conservation focus into existing curricula.
- **OBJECTIVE B1-2:** By 2022, lead organization initiates the expanded 5-year Delta public education program focused on multiple local audiences, including community groups and schools.

**Strategy B2: Continue support for the expansion and implementation of existing outreach and education campaigns to promote the Delta and the importance of multi-benefit conservation outcomes to a wide audience at both state and national levels.**

- **OBJECTIVE B2-1:** By 2020, secure funding support and expand existing programs to continue statewide and national outreach with a focused campaign about water, people, and wildlife in the Delta.
- **OBJECTIVE B2-2:** By 2022, lead organizations secure funding support and build on initial efforts to launch a three-year statewide and national media campaign to promote the Delta widely and build support for conservation.

361  
362 **Delta Public Education Programs**

363 Several organizations are engaged in public education in the Delta, such as the Delta Regional  
364 Foundation, Delta Conservancy, Delta Protection Commission, and Water Education Foundation. Their  
365 programs include Delta-focused public education components on Delta issues, water, environmental  
366 health, and activities and resources for people. For example, the Delta Heritage Area Initiative has  
367 resulted in the creation of a defined area, with specific boundaries within which projects and resources  
368 are focused to preserve the human heritage of the Delta.<sup>12</sup> The nonprofit Delta Regional Foundation was  
369 formed by members of the public in 2015 to highlight *Delta as Place* values, with a mission to promote  
370 cultural and historical preservation, education, and events; tourism and recreation operations; and  
371 agricultural projects and programs.<sup>49</sup> Example efforts by the Delta Regional Foundation include the Delta  
372 Leadership Program and the Delta FOREVER art show, presented at California State University,  
373 Sacramento, in March of 2016.<sup>49</sup>

374 The Delta Regional Foundation or another organization could also coordinate an expanded Delta public  
375 education program focused on promoting the Delta values, including the importance of ecosystem

376 conservation to the local Delta community. A well-coordinated, widely accessible local education  
377 program that includes a focus on conservation would heighten awareness around the benefits and  
378 challenges of Delta conservation. This increased awareness can foster ongoing local collaboration in  
379 conservation planning, and it will heighten recognition and appreciation of the direct and indirect  
380 contributions of ecosystems to human well-being that support our survival and quality of life. For  
381 example, these *ecosystem services* supported through conservation—including maintained or expanded  
382 areas for recreational activities such as boating, fishing, and hunting--benefit Delta residents and all of  
383 California. Increased awareness will also help to highlight how the integrated Delta Conservation  
384 Framework goals for combined conservation and community benefits aid both humans and wildlife.  
385 Engaging the local community through regular Delta conservation-focused educational opportunities is  
386 critical to keeping conservation-related discussions current and ongoing.

### 387 **State and National Delta Outreach Campaigns**

388 In 2013, the Delta Protection Commission and the Delta Conservancy joined forces in response to a  
389 statewide survey that showed that 78% of voters had never heard of the Delta. In a two-stage effort  
390 they initiated a *Delta Awareness Campaign* to help raise Californians' awareness of the Delta as a  
391 historic, cultural, recreational, and ecological treasure of the State.<sup>12</sup> As part of this, the Delta branding  
392 effort—led by the Delta Protection Commission—supported tourism research, identified market trends  
393 that offer opportunity to the Delta, and commissioned logos and brand standards for the Great  
394 California Delta Trail and the proposed Delta NHA.<sup>12</sup> The second phase, led by the Delta Conservancy, is  
395 creating a Delta-focused web presence linked to *Visit California*,<sup>50</sup> which will provide a more  
396 comprehensive overview of the Delta's cultural, recreational, historical, ecological, and agricultural  
397 tourism opportunities to potential visitors.

398 "Where does your water come from?" was suggested as the theme of a statewide and national outreach  
399 campaign by 2016 workshop participants, to inform people throughout California and the U.S. about the  
400 Delta as a major source of water and ecosystem services for the sixth largest world economy (Strategy  
401 B2, Table 2.2).<sup>47</sup> In addition to highlighting the role of the Delta in statewide water distribution, culture,  
402 recreational value, and history, the current state and nationwide outreach campaigns should be  
403 expanded to also promote an appreciation for the unique ecosystems and wildlife in the Delta, as well as  
404 the impending changes associated with climate change. Effective public education that clearly links the  
405 value of the Delta to the rest of California would heighten awareness, appreciation, and commitment to  
406 Delta conservation, including future conservation funding initiatives.<sup>51</sup>

407 **"Floating all Boats" by Seeking Multiple Benefits**

408 It is important to balance environmental and human needs when developing Delta conservation  
409 strategies. When stakeholders and conservationists are able to collaborate, it is possible to identify  
410 effective “win-win” projects that simultaneously improve ecosystem function and provide human  
411 benefits. Examples of “win-win” conservation strategies include wildlife-friendly farming, multi-use  
412 floodplains with annual crops, and low-impact outdoor recreation in conservation areas. For example,  
413 the Cosumnes River Preserve encompasses 46,000 acres of conservation lands with extensive  
414 recreational and educational opportunities, including hiking trails, canoe and kayak launches, waterfowl  
415 hunts for youth and mobility-impaired hunters, fishing, and classroom field trips  
416 ([www.cosumnes.org/activities/](http://www.cosumnes.org/activities/)). The Preserve also includes agricultural lands (e.g., row crops such as  
417 corn) mainly farmed in a manner that benefits wintering migratory waterfowl and waterbirds, especially  
418 sandhill cranes and Swainson’s hawks.<sup>52,53</sup> In addition to recreational and agricultural opportunities,  
419 conservation lands also provide benefits to local Delta economies through improved flood protection,  
420 maintaining and improving in-Delta water quality, and trees planted along channels and in riparian areas  
421 to improve aesthetics.<sup>5,6,7,8</sup>

**LANDSCAPE-SCALE BENEFITS**

It is essential to plan conservation at a landscape scale. As long as individual projects fit within a larger context and are connected across a landscape over the long term, not every project needs to result in multiple benefits.

422

423 Conservation  
424 includes the  
425 protection,  
426 enhancement,  
427 restoration,  
428 and long-term  
429 adaptive  
430 management  
431 of Delta  
432 ecosystems.  
433 The benefits of



Figure 4: Sandhill cranes foraging in flooded corn on Tyler Island. Photo: Randi Logsdon, CDFW

434 conservation  
435 actions to  
436 ecosystems and Delta communities can be realized immediately  
437 after construction of restoration actions or more slowly after a  
438 project is established over the course of years or decades.  
439 Individual conservation projects can be designed to achieve  
440 multiple benefits on a short time frame, such as incentives for  
441 farmers to use wildlife-friendly practices or restoration sites  
442 with hiking trails and boat launches. Benefits can also accrue  
443 more slowly, over the long-term, by improving ecological  
444 function after multiple projects become established in a region.

445 Forward-thinking strategies and attitudes will be especially  
446 critical for all Delta stakeholders considering and preparing for  
447 prolonged drought, extreme runoff events, potential levee  
448 failures, and seepage causing water-logged soils or increased  
449 soil salinity levels that prevent productive agriculture in  
450 adjacent fields. These are of particular concern on subsided  
451 lands (e.g., at the southern end of Staten Island). Any one of  
452 these factors could threaten agricultural productivity.<sup>54,55,56,57,58</sup>

453 In order to effectively explore a variety of possible solutions that  
454 make sense economically and ecologically, all Delta  
455 stakeholders should focus on science-based approaches, such as  
456 projections of long-term climate; ecological trends; and  
457 economic, social, and land-use drivers. These approaches have  
458 the potential to develop meaningful multi-benefit solutions and  
459 make community-supported conservation a reality. If all stakeholders are willing to give a little and  
460 embrace certain tradeoffs—for example, short-term losses in light of longer-term gains—multi-benefit  
461 conservation is a real possibility.

## Sandhill Cranes in the Delta

Conservation of wintering sandhill cranes not only benefits recovery of the species, but provides cultural and economic benefits to the people in the Delta. Conservation on Staten Island and Brack Tract (Isenberg Sandhill Crane Reserve) is not only a result of wildlife friendly agriculture, but also draws enthusiastic visitors to the Delta, who in turn bring in local revenue. Local residents regard the sandhill crane as an icon of their Delta; for example, the Lodi Crane Festival celebrates the anticipated event of the cranes' winter arrival, showcasing the Delta's natural beauty.

**Table 2.3:** Goal C and related strategies and objectives for implementation.

**GOAL C: Develop multi-benefit-focused conservation and land management solutions to balance environmental and human needs.**

**Strategy C1: Incorporate conservation goals with levee maintenance and flood management practices to provide habitat along Delta channels, river corridors, and riparian zones.**

- **OBJECTIVE C1-1:** By 2022, identify and implement conservation opportunities for enhancing wildlife habitat along Delta channels, river corridors, and riparian zones in the context of flood management within regions identified by the 2017 Central Valley Flood Protection Plan (CVFPP) Conservation Strategy and in collaboration with the Delta Levee Habitat Advisory Committee.

**Strategy C2: Support sustainable wildlife-friendly agriculture to provide additional wildlife and migratory bird habitats.**

- **OBJECTIVE C2-1:** By 2019, create a common understanding of science-based wildlife-friendly agricultural practices and their potential benefits to wildlife in the Delta.
- **OBJECTIVE C2-2:** By 2022, utilize existing incentives (including agricultural conservation easements) and develop new incentives, such as *Habitat Exchange* programs run by non-governmental organizations or state agency-run funding programs, to support wildlife-friendly farming conservation projects in the Delta.
- **OBJECTIVE C2-3:** By 2019, appoint a local farmer *Ombudsman* for all Delta counties to provide outreach and support to willing agricultural practitioners and landowners about economic and other incentives to help expand wildlife-friendly agriculture in the Delta.

**Strategy C3: Control and reverse land subsidence and support climate change mitigation efforts by implementing carbon farming projects where plants sequester carbon and build up soils over time.**

- **OBJECTIVE C3-1:** By 2030, at least quadruple the number of Delta “carbon farming” projects that aim to manage lands to reverse land subsidence and sequester carbon with funding support through available carbon market opportunities.
- **OBJECTIVE C3-2:** Prioritize carbon management activities that are consistent with the carbon sequestration strategies, such as carbon farming practices, for Natural and Working Lands presented in the state’s 2017 Scoping Plan.

464

**Table 2.3 continued:** Goal C and related strategies and objectives for implementation.

**Strategy C4: Advance state and local agency and stakeholder land management processes and procedures.**

- **OBJECTIVE C4-1:** By 2022, identify a suite of 5-10 recommended tactics to improve cross-agency and stakeholder communication and coordination related to the management of state-owned lands.

**Strategy C5: Develop best practices for assuring reliable water distribution for in-Delta uses and when implementing conservation.**

- **OBJECTIVE C5-1:** By 2022, develop a suite of 5-10 best practices to help preserve reliable in-Delta water supplies when implementing conservation projects.
- **OBJECTIVE C5-2:** By 2020, assess the need to install fish screens at agricultural water diversions throughout the Delta and make recommendations for appropriate action.

**Strategy C6: Integrate solutions for improving surface- and groundwater quality into conservation project planning and implementation.**

- **OBJECTIVE C6-1:** By 2022, integrate and/or expand existing best practices for improved water quality into conservation projects, where appropriate, with focus on both surface- and groundwater.

465

***“FACING FORWARD will entail envisioning and implementing preferred transitory futures. We will need to drop old battles more quickly and look ahead to what the future holds for our environment and how it fosters our economy and well-being.”***

*Richard Norgaard, Professor Emeritus of Energy and Resources, UC Berkeley<sup>19</sup>*

466

### DELTA CONSERVATION ACTIONS WITH SOCIOECONOMIC BENEFITS

The following conservation and restoration measures may be beneficial to the Delta economy through improved recreation, ecotourism, and flood control, without substantial adverse effects on agriculture in the Delta (adopted from Delta Protection Commission 2012):<sup>5</sup>

- Encourage more farms to adopt wildlife-friendly agricultural practices based on successful examples in the Delta, such as sandhill crane habitat on Staten Island.
- Construct new flood bypasses, or improve existing bypasses, to provide habitat and improve flood protections; for example, in Yolo Bypass and McCormack-Williamson Tract-Cosumnes (north and central Delta) and Paradise Cut (south Delta).
- Conduct restoration on already flooded islands like Frank's Tract to reestablish habitat for listed species, according to the Delta Smelt Resiliency Strategy,<sup>36,59</sup> before converting agriculturally productive land.
- Focus restoration efforts on the mid-channel berms or islands that are in danger of being lost, before converting agriculturally productive land, as a wide variety of species are dependent on those types of habitats, including Delta smelt (*Hypomesus transpacificus*), chinook salmon (*Oncorhynchus tshawytscha*), Sacramento splittail (*Pogonichthys macrolepidotus*), western pond turtle (*Emys marmorata*), and Mason's lilaeopsis (*Lilaeopsis masonii*).<sup>60</sup>
- Encourage the growth of native vegetation on the water side of Delta levees, where appropriate, to provide habitat for aquatic and semi-aquatic species and provide recreational and tourism benefits.<sup>60</sup>
- In some areas, instead of planning restoration across large swaths of land, enhance existing habitat in smaller restoration areas by improving natural slough structure using dredge and fill material in strategic locations, increasing the variability of flows and residence times, and creating more natural channel margins along existing sloughs and waterways by establishing native plants. Examples include Twitchell Island and Southport.<sup>61,62</sup>
- Restore historic floodplains to provide ecosystem benefits onsite and in the Delta to enhance, for example, sediment transport and food web support and to improve system-wide flood management (Example: Conaway Ranch in the northern Yolo Bypass).

468 **Integration of Flood Management and Conservation**

469 The 2016 CVFPP Conservation Strategy includes a comprehensive, nonregulatory approach to providing  
470 ecological benefits while protecting public safety, with multi-benefit projects that improve riverine and  
471 floodplain ecosystems.<sup>60</sup> It offers a regional programmatic framework for increasing the efficiency of  
472 planning and permitting, improving individual project cost effectiveness, and enhancing ecosystem  
473 benefits associated with flood control projects (Strategy C1, Table 2.3). Planning partnerships and  
474 project proponents should follow the more specific guidance in the Central Valley Flood Protection Plan  
475 (CVFPP) Conservation Strategy<sup>60</sup> when planning and implementing projects that integrate flood  
476 management and conservation in the Delta. Project proponents should also coordinate directly with the  
477 Delta Levee Habitat Advisory Committee—a group that has been operating for 25 years to balance the  
478 need to conduct regular levee maintenance with habitat conservation efforts—and consult the Delta  
479 Levees Investment Strategy Decision Support Tool.<sup>63</sup>  
480

**EXTREME WEATHER EVENT EFFECTS**

*Flooding and levee stress have already started to affect the Delta during extreme weather conditions. In the winter of 2017, heavy rains caused levee damage along the North Mokelumne River, and residents on Tyler Island were advised to evacuate.<sup>64</sup> Flooding caused evacuation of residents in the New Hope Landing Trailer Park and Marina and damage to farmland.<sup>65</sup> This area also contains habitat for wildlife, such as sandhill crane. Farmland was also damaged along New Hope Road at another levee breach.<sup>65</sup> Planned levee adjustments on nearby McCormack-Williamson Tract, where a levee breached in 1997, will also provide tidal habitat for endangered species. Extreme events may become more frequent as the climate changes.*

481 Planning partnerships and project proponents should further consider lessons learned from past  
482 projects, including the need for long-term success monitoring and evaluation and accurate cost  
483 assessments of levee/habitat enhancement projects.<sup>66</sup> Other recommended considerations include the  
484 importance of variations in water elevation for channel margin enhancements; vegetated, gently sloping  
485 banks with soft substrates and emergent vegetation to benefit salmonids; and the negative effects of  
486 riprapped banks on juvenile salmonids, for example.<sup>66</sup> Combined, these recommendations, the CVFPP  
487 Conservation Strategy,<sup>60</sup> the Delta Levees Investment Strategy,<sup>67</sup> and the Delta Levee Habitat Advisory  
488 Committee will provide a balance of large-scale Central Valley wide planning and local site-specific  
489 expertise, both of which are essential for the success of individual projects that will ensure consistency  
490 with the broader goals of the Delta Conservation Framework.

## Twitchell Island Setback Levees

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Setback levees are designed to provide a functional flood-control system and habitat value to native fish and wildlife. For example, a project on Twitchell Island under the California EcoRestore initiative will stabilize a threatened section of the levee along the San Joaquin River; and at the same time, water-side habitat features will be constructed. These features include riparian, intertidal, and vegetated upland habitats created by waterside beaches, benches, and undulations. The project will span nearly all of the San Joaquin River levee plus a proposed 80-acre tidal marsh restoration site. Funding will come from Cap-and-Trade funds, Proposition 1 grants, and State Water Project mitigation.<sup>68</sup> The project will address a number of problems on the island. Heavy winds cause waves to run up onto the roads and fields, there is inadequate freeboard space between high water levels and farms or structures, and the waterside levee slopes are overly steep<sup>62</sup>. In addition to the benefits of levee stability and additional freeboard, the project will also create waterside habitat and gently sloping “fish friendly levees,” which are generally lacking in the region. The “fish friendly levees” will provide rearing and outmigration habitat for juvenile salmon. Tidally submerged and emergent vegetation will benefit fish and marsh species, and a continuous corridor of riparian and upland scrub habitats will provide a diversity of vegetation and canopy structure for riparian birds and other wildlife.<sup>62</sup> This is an example of a multi-benefit project that meets the needs of both the Delta community and ecosystem function.

## Setback Levee Recommendations

Integrating science into setback levee construction will be necessary for the project to succeed. For example, evaluating the effectiveness of different types of habitat improvements in benefitting fish and wildlife species requires monitoring data to evaluate the effects of the project on target species.<sup>66</sup> Considerations to guide future setback levee projects should include monitoring fish (primarily salmonid) responses to habitat levee design and life history requirements for birds using marsh and riparian habitats for protection, foraging, and nesting. While setback levees provide natural riverine processes that benefit aquatic and terrestrial wildlife, Delta-specific constraints need to be considered in the design. For example, elevation of inundated areas needs to be evaluated to determine if: 1) frequent inundation will support riparian, wetland, and upland habitats and species; 2) the setback distance will be sufficient to allow the channel to reinitiate riverine processes; and 3) the timing, duration, and frequency of flood flows are appropriate for habitat improvement. To create a multi-benefit project, the required setback distance, for example, will need to be balanced with the loss of productive farmland. Other considerations in the Delta include evaluating the costs of constructing setback levees on subsided islands and conditioning Delta peat soil to provide stable levee foundations. Working with willing landowners and ensuring protection of existing structures and utilities are also important consideration.<sup>66</sup> Risk assessments and outcome strategies will be required when choosing the location and design for setback levee construction. For example, the probability of flooding at a given location due to seismic events needs to be assessed, as well as State priorities for levee improvements. Planning partnerships or project proponents should consult the Delta Levees Investment Strategy and associated tools when planning setback levee projects.<sup>63,67,69</sup>

493 **Supporting Economically Viable, Wildlife-friendly Agriculture**

494 Wildlife-friendly agricultural practices are tools farmers  
495 can use to improve ecosystem services, including  
496 agricultural pest control, maintenance of biodiversity,  
497 preservation of soils, and renewal of soil fertility.<sup>45,46,70</sup>

498 Wildlife-friendly farming is compatible with, and can  
499 even increase crop yields.<sup>46</sup>Therefore, wildlife-friendly  
500 farming, coupled with financial incentives, offers  
501 benefits to both farmers and wildlife (Strategy C2,

502 Table 2.3). For example, wildlife-friendly farming

503 operations on Staten Island have benefited waterbirds—particularly migratory waterfowl and wintering  
504 sandhill cranes (*A. canadensis*)—while growing crops like corn, triticale, potatoes, alfalfa, and supporting  
505 permanent pastures.<sup>53,71,72</sup>

506 Crop rotation is another tool that is used to benefit wildlife as well as economic feasibility of the  
507 farmland. For example, Swainson’s hawk primarily forages in alfalfa fields within heterogeneous  
508 agricultural lands.<sup>73</sup> Because Swainson’s hawk also forages in other crop types, they may benefit from  
509 crop rotations that follow fluctuating market values, as long as a percentage of the cropland is  
510 maintained in high-value foraging crops. For example, fallowed fields, grain crops, sunflower, safflower,  
511 dryland pasture, and row crops such as beets or tomatoes are used by Swainson’s hawk and other  
512 special status birds, such as white-tailed kite (*Elanus leucurus*)<sup>74,75,76</sup> and tricolored blackbird (*Agelaius*  
513 *tricolor*). Crop rotation patterns are considered when scoring Swainson’s hawk habitat value for the  
514 Central Valley Habitat Exchange program (see box below).<sup>77</sup>

515 “Carbon farming” is another example of a multi-benefit approach to agriculture that can occur in  
516 subsidized areas and provide financial incentives for farmers. Carbon farming occurs when rice or wetland  
517 plants such as tules (*Schoenoplectus acutus*) are planted to replace conventional crops in subsidized areas.  
518 The rice and wetland plants, in part, sequester carbon, increase organic substrate, reverse subsidence,  
519 and provide landowners income through the emerging carbon market<sup>78,79</sup> (see Strategy C3, Table 2.3). In  
520 this example, tule marshes and rice fields could also support Delta wildlife, including giant garter snake  
521 (*Thamnophis gigas*) and tricolored blackbird.<sup>79</sup> If conservation-focused financial incentives are available  
522 to allow farmers to continue earning revenue from wildlife-friendly agriculture, despite changes in  
523 ground water salinity levels and flooding frequencies, they could bolster long-term agricultural  
524 sustainability in the Delta.

***Wildlife-friendly farming is the attempt to integrate conservation and agricultural production to benefit wildlife and conserve biodiversity on land that is used to produce agricultural commodities.***

## **WILDLIFE-FRIENDLY AGRICULTURE**

*Some insights gained from the 2005 Ecosystem Restoration Program grant solicitation that focused on wildlife-friendly agriculture are listed below.<sup>70</sup>*

### **Examples of typical wildlife-friendly agriculture practices or actions include:**

- Deferring fall tillage until later in the year to increase the quantity of forage on cornfields for waterfowl and greater sandhill cranes
- Shallow flooding of seasonal croplands in fall/winter to increase the availability of forage for wintering waterfowl, shorebirds, and other species
- Retaining a percentage of the crop in the agricultural field for wildlife use to enhance the value of flooding
- Screening agricultural water diversions
- Improving fish passage at water diversion structures
- Maintaining individual trees and tree rows at the margins of agricultural fields
- Planting native hedgerows along farm and district waterways to provide wildlife, pollinator, water conservation, and erosion control benefits
- Promoting vegetated waterways and tail-water ponds
- Using livestock for weed control as a key tool to maintaining desirable habitat conditions, for example, in vernal pool grasslands

### **Potential benefits to agricultural stakeholders from improving conditions for wildlife include:**

- Groundwater recharge to aquifers used for summer irrigation
- Leaching salts from soils
- Biological decomposition of crop residue
- Reduction in soil erosion
- Creating an opportunity for income from hunting and increased aesthetic values, both of which may increase property values
- Financial incentives associated with agricultural conservation easements
- Improved relationships with regulatory entities

525

**Habitat Exchanges** are voluntary programs that create new financial returns for landowners and utilize habitat credit markets to serve as the currency to leverage wildlife habitat that willing landowners can provide. The Central Valley Habitat Exchange aims to generate a future where landowners are rewarded for sustainable management and restoration activities that result in measurable environmental improvements. This includes healthier streams, resilient floodplains and riparian corridors that translate into more jobs and support benefits for farmers who “grow” habitat.<sup>80</sup>

526

527 *Incentives for Wildlife-friendly Agriculture*

528 Programs that work with farmers to create and maintain habitat on private land should be promoted  
529 and expanded where possible. Many agricultural fields already contain wildlife-friendly features, such as  
530 hedgerows, irrigation canals with vegetation, and tree rows. Governmental and nonprofit entities  
531 recognize the value of establishing a mosaic of wildlife-friendly agricultural areas for wildlife habitat.  
532 Resource Conservation Districts, the Natural Resources Conservation Service, and Federal Farm Bill  
533 Programs—including the Conservation Reserve and Wetland Reserve Programs—have been working in  
534 collaboration with farmers to improve wildlife habitat and other aspects of environmental quality on  
535 agricultural land.<sup>71,81</sup> The ALS workgroup developed a series of strategies to expand these existing  
536 collaborations between farmers and local, state, and federal agencies.<sup>20</sup> They suggested establishing  
537 additional collaborative partnerships to maintain and enhance environmental quality on agricultural  
538 land. Examples of wildlife-friendly farming programs that have included incentives are:

- 539 • Migratory Bird Partnership<sup>81</sup>
- 540 • TNC - Bird Returns program<sup>71</sup>

541

542 Considerations for promoting wildlife-friendly agricultural practices include:

- 543 ○ Demonstrating economic benefits of habitat-friendly cultural practices;
- 544 ○ Understanding the social, economic, environmental, and governmental policy hurdles  
545 and/or incentives to perform conservation practices;
- 546 ○ Communicating the advantages of wildlife-friendly agricultural practices to landowners.

547

# DIVERSE LANDSCAPE MOSAIC

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*Guidelines for farming in diverse landscapes with a mixture of restored ecosystems and agriculture:*

- Maintain the existing benefits from a mixed landscape of agricultural and natural ecosystems, and encourage agricultural practices that maintain this diversity (e.g., maintain forest remnants, scattered trees, and crop diversity).
- Restore native ecosystem connectivity through agreed-upon projects across property boundaries or strategic land acquisition. These measures will benefit species that need large areas and are sensitive to agriculture.

*Guidelines for farming in areas where farming is the predominant land use:*

- Protect and expand large patches of native vegetation, because these provide important refuge habitat for species sensitive to agriculture.
- Create connections between existing conservation areas to increase the adaptive capacity of wildlife in the face of climate change. Connections may be created by traditional corridors or by innovative management strategies within agricultural lands, such as temporary fallows or intermittently flooded wetlands.
- Increase landscape heterogeneity by diversifying land use and crops, subdividing large fields to create more, smaller fields, and establishing beneficial vegetation such as hedgerows along field boundaries and roads.  
(Fischer et al. 2008)<sup>82</sup>

549 **Solutions for Land Subsidence**

550 In 2006, the Global Warming Solutions Act (AB 32, 2006)<sup>83</sup> was signed by Governor Schwarzenegger to  
551 scale back California’s greenhouse gas emissions to 1990 levels by 2020. AB 32 required the California  
552 Air Resources Board to develop solutions to meet emission reduction goals, including carbon  
553 sequestration and carbon credit trading. The Delta’s peat soils are rich in carbon. *“If California converted  
554 an area the size of the subsided lands in the Delta into carbon farms, the annual benefits could equal:  
555 Changing from standard lightbulbs to compact fluorescents in all California households; turning all SUVs  
556 in California into small hybrids; or turning off all residential air conditioners in California”*.<sup>78</sup> Therefore,  
557 the emerging carbon market might offer some opportunities for reversing land subsidence in the Delta  
558 while providing benefits to society in the form of carbon storage and financial incentives. Biophysical  
559 benefits of Delta conservation for natural resources and human needs include improved tidal  
560 connections to and within tidal marshes, enhanced transition zones between wetland and upland  
561 habitats, better floodplain hydrology, upgraded water quality, subsidence reversal, and carbon  
562 sequestration (Strategy C3, Table 2.3).<sup>48,84,79</sup>

563 In April 2017, the American Carbon Registry (ACR) approved a new carbon offset methodology to  
564 scientifically quantify greenhouse gas emission reductions from California wetland restoration efforts in  
565 the Delta and the coast.<sup>85</sup> Opportunities for restoring wetlands or converting to rice cultivation in the  
566 Sacramento-San Joaquin Delta, Suisun Marsh, and California coastal areas are available. Carbon offsets  
567 generated by these projects can be sold by landowners to corporations, to meet their voluntary  
568 emissions-reduction goals. Offsets are being considered by California regulators for eligibility in the  
569 state’s Cap-and-Trade Program that mandates power plants and oil refineries to reduce or offset their  
570 emissions.<sup>85</sup> The passage of AB 398 in July 2017 extended the life of the Cap-and-Trade Program and  
571 identified climate adaptation and resiliency projects as eligible funding recipients of Cap-and-Trade  
572 auction proceeds.<sup>86</sup> Activities to build ecosystem resilience to climate change—for example, through  
573 restoration and enhancement—can have benefits for climate mitigation as well.

***“State and federal funding remains insufficient to address land subsidence that threatens the California water system, and carbon market revenues could help fill the funding gap. The new ACR methodology provides an incentive to landowners in the Sacramento-San Joaquin Delta, Suisun Marsh, and other historically natural wetland areas in California to convert their most subsided and marginal agricultural lands to wetlands or to produce wetlands crops such as rice, which will stop land subsidence and reverse it over time.”***

Campbell Ingram, Executive Officer, Sacramento-San Joaquin Delta Conservancy<sup>85</sup>.

574  
575 On Twitchell Island in the western Delta, USGS is collaborating with a team of university researchers to  
576 conduct a large-scale demonstration project, the Carbon Capture Program,<sup>78</sup> to show that flooding tule

577 wetlands or rice fields during most of the year (especially during the summer and early fall months)  
578 reverses subsidence. Inundated tules and rice halt peat soils from subsiding, and reverse subsidence by  
579 increasing root structure (accretion) and producing new soil. The Carbon Capture Program shows  
580 promise as a technique to rebuild subsided Delta islands and help combat climate change by taking  
581 carbon dioxide (CO<sub>2</sub>; an important greenhouse gas) out of the atmosphere.<sup>78</sup> This approach could  
582 benefit Delta landowners trying to capitalize on the emerging carbon market by switching from growing  
583 traditional crops to “farming” carbon by planting tules, rice, or alfalfa and maintaining the land in  
584 agricultural use. The potential for multiple benefits associated with carbon farming offers a unique  
585 opportunity to increase elevation on subsided lands, restore a large portion of the Delta wetlands, and  
586 benefit the local Delta community.<sup>78</sup>

587 The ALS workgroup recommends ways landowners can take advantage of carbon farming opportunities  
588 (Strategy C1) by managing land in ways that sequester carbon and reverse subsidence, while earning  
589 revenue from greenhouse gas offset credits.<sup>20</sup>

#### **BENEFITS OF CARBON FARMING TO REBUILD SOIL AND REVERSE SUBSIDENCE:<sup>78</sup>**

- Reduces the cumulative stress on the levees
- Decreases the risk of levee failure, flooding, and costs of recovery
- Halts the soil loss
- Reverses the effects of subsidence
- Sequesters carbon (captures and converts CO<sub>2</sub> to an organic compound and stores it)
- Generates revenue through carbon credits
- Creates habitat for Delta wildlife
- Reduces greenhouse gas emissions to meet the 2020 goal established by AB 32
- Provides room for adaptation to sea level rise associated with climate change
- Preserves open space

590

591 While this opportunity has much promise, some issues should be considered and addressed, including  
592 the following.<sup>20</sup>

- 593 • Potential adverse environmental impacts need to be resolved, including contamination from  
594 mercury and dissolved organic carbon, and the need for mosquito control.
- 595 • Implementation will be difficult on islands with multiple owners, unless all owners agree to take  
596 part in the project.
- 597 • Subsidence reversal requires land management practices that differ from much of conventional  
598 agriculture in the Delta.
- 599 • Expansion of low-carbon agriculture, in the form of rice cultivation, may not be economically  
600 feasible for farmers, because rice yields are lower in the Delta than in the Sacramento Valley.

601 Potential strategies for encouraging and implementing carbon  
602 farming in the Delta include the following:<sup>20</sup>

- 603 • Provide incentives to stabilize or reverse land  
604 subsidence.
- 605 • Help farmers and landowners produce and sell  
606 greenhouse gas offset credits.
- 607 • Investigate options to designate subsidence reduction  
608 and carbon sequestration crops as agricultural  
609 production for regulatory and incentive purposes.

### 610 **Advancing Agency Land Management Processes and** 611 **Procedures**

612 Participants in the 2016 workshop series identified a number of  
613 challenges with  
614 state and federal  
615 land management  
616 practices in the  
617 Delta. Many of the  
618 public lands in the  
619 Delta are owned  
620 and managed by  
621 state agencies such  
622 as DWR, CDFW, and  
623 California  
624 Department of  
625 Parks and  
626 Recreation. County  
627 agencies have title  
628 to, and



629 **Figure 2.5: Cosumnes River Preserve.**  
630 *Photo: Randi Logsdon*

631 responsibility for, other Delta lands including the Petersen  
632 property in the Cache Slough region, owned by the Solano  
633 County Water Agency. Federal agencies also own land in the  
634 Delta, including the Stone Lakes National Wildlife Refuge  
635 owned by the USFWS. Recurring messages voiced by Delta  
636 stakeholders during the 2016 workshops were that “there are  
637 too many agencies involved in the Delta” and government  
638 agency landowners can be “bad neighbors.” Because  
639 ownership and management of state lands in the Delta are  
640 split among several departments, better coordination among  
state and local agencies could improve land management practices and streamline conservation implementation (Strategy C4, Table 2.3; also see Appendix VI).

### ***The Cosumnes River***

***Preserve*** is an example of conservation lands that are owned and managed by multiple partners, including state and federal agencies (Bureau of Land Management, CDFW, California State Lands Commission, and DWR); Sacramento County; and non-governmental organizations (TNC and Ducks Unlimited). Centered along the Cosumnes River and its floodplains, the preserve is managed to protect riparian, wetland, and vernal pool habitats while utilizing compatible ranching and farming activities to sustain native plant and wildlife communities and ecosystem processes that perpetuate a dynamic mosaic of habitats. To attain this vision, the partners agreed on a set of overarching goals and a management plan to implement practices that would help to achieve the goals.

*(Kleinschmidt Associates 2008)*

641 The ALS workgroup provides a checklist for agencies and other conservation practitioners to ensure that  
642 they comprehensively consider the impacts of conservation lands on neighbors and the effects of  
643 neighboring land uses on the success of conservation when managing lands in the Delta.<sup>22</sup> The checklist  
644 includes specific actions including contacting and communicating with neighbors, agreeing upon site  
645 access routes, discussing the need for security or law enforcement, evaluating the potential for  
646 increased fire danger and introduction of invasive weeds or pests, identifying potential issues with flood  
647 control structures or other infrastructure, and understanding how neighboring agricultural operations  
648 may affect conservation projects through applications of chemicals or livestock presence (see Appendix  
649 IX). Through coordination and the development of standard procedures for management of both  
650 farmlands and conservation lands, impacts on either side could be measurably reduced.

### 651 **Best Practices for Reliable In-Delta Water Distribution**

652 Water diversions are used to distribute water to agricultural fields or ponds throughout the Delta. As a  
653 side effect, small fish and other aquatic or semi-aquatic wildlife may be pulled into these diversions and  
654 killed.<sup>37</sup> Recent studies show that most small diversions take place at times and places when Delta smelt,  
655 especially larval smelt, are not likely to be present.<sup>87</sup> Therefore, while small diversions are found  
656 throughout the Delta, few Delta smelt have been entrained at the generally small pump intakes located  
657 close to shore.<sup>88</sup> Entrainment of juvenile salmon in unscreened diversions was also low relative to other  
658 fish species.<sup>89</sup> A coordinated effort to develop BPs would encourage approaches to the approximately  
659 2,300 mapped water diversions that minimize adverse effects on native fish, wildlife, and water quality  
660 and help preserve a reliable water supply for human use. These BPs could include raised awareness of  
661 the critical times when native fishes, especially Delta smelt and juvenile salmonids, are most sensitive to  
662 entrainment to avoid negative effects. If this is not feasible—since screens are not effective in avoiding  
663 take of larval endangered fish species— BPs could also suggest implementing a program to assist  
664 conservation practitioners, neighboring farmers, and Delta residents to implement mitigation for the  
665 diversion-associated take, and consider safe harbor agreements, where appropriate, as part of the  
666 specific activity or restoration project (Strategy C5, Table 2.3).

667 Where fish screens are needed, there is an opportunity for famers to receive financial assistance to  
668 install them. For example, the Family Water Alliance partners with state and federal agencies and  
669 private contributors to fund and install fish screens on small agricultural diversions in the Sacramento  
670 Valley.<sup>90</sup> The success of the program has resulted in the delivery of diverted water that is free of fish,  
671 protecting both the fishery resource and the local agricultural community.<sup>90</sup> As a further benefit to  
672 farmers, certain fish screens can keep fish and debris out of irrigation pipes, saving substantial  
673 operational and maintenance costs.<sup>91</sup>

### 674 **Improving Conservation-Related Water Quality**

675 During conservation project construction and management, certain practices such as the removal of  
676 water hyacinth or other invasive floating plants, installing new infrastructure, or breaching levees to  
677 reestablish tidal flows into marshes may affect water quality. Potential impacts can include increased  
678 turbidity and decreased levels of dissolved oxygen; nutrients and specific toxicants can temporarily be  
679 affected. Solutions for improving surface- and groundwater quality should be integrated into

680 conservation project planning and implementation (Strategy C6, Table 2.3). In some cases, associated  
681 negative water quality effects can last over the long term, especially if they affect groundwater and  
682 legacy contaminants. For example, because of past extensive mercury use in Sierra Nevada gold mining  
683 in the upper watersheds, methylmercury production rates are higher in Delta wetlands than in other  
684 California aquatic ecosystems.<sup>92</sup> In some cases, wetland restoration may release mercury from sediment  
685 and increase the potential bioaccumulation of methylmercury in Delta wildlife.<sup>93,94</sup> Our current  
686 understanding is that methylmercury production is generally low in permanent tidal wetlands and some  
687 permanent freshwater wetlands, with higher production in seasonally flooded wetlands (see Table 3.3 in  
688 Wood et al. 2010a).<sup>95,96</sup> Bioavailable selenium can also be released from restoration projects and affect  
689 water quality, potentially resulting in adverse effects on fish and wildlife.<sup>97,98</sup>

690 However, wetland habitat restoration efforts in the Delta provide numerous positive effects, and  
691 potential mercury-related negative effects can be minimized (see BDCP *Conservation Measure 12*).<sup>97</sup>  
692 Best management practices can also be applied to minimize conditions that promote bioaccumulation of  
693 selenium in restored areas; for example, developing a selenium monitoring and management plan for  
694 each restoration project.<sup>97</sup>

695 Some pesticides, such as the banned organochlorine pesticide DDT, are also legacy problems in the Bay-  
696 Delta Watershed.<sup>99</sup> Yet, most contaminants responsible for reduced water quality arise from current-use  
697 compounds from industrial, agricultural, urban, transportation, and natural sources, and there is  
698 increasing concern over new classes of contaminants, such as pyrethroid pesticides, pharmaceuticals,  
699 and personal care products.<sup>99</sup> Further, major contaminants of California's groundwater include salt,  
700 organic compounds, nitrates, pesticides, and metals.<sup>100</sup> Such water quality issues may not only affect fish  
701 and wildlife, but also recreational waters, fisheries, and farming operations.

702 Therefore, to minimize adverse effects of restoration on water quality and Delta wildlife, a summary of  
703 BPs that align with State and Regional Water Quality Control Board policies for improved surface- and  
704 groundwater quality<sup>101,102</sup> should be developed, or expanded from existing BPs, and applied to  
705 conservation project implementation as appropriate to project conditions.

- <sup>1</sup> Natural Resources Agency (2016). California WaterFix - Fixing California's water system – securing state water supplies: Alternative 4A. California Natural Resources Agency, Sacramento, CA. <https://www.californiawaterfix.com/>. Accessed: July 7, 2016.
- <sup>2</sup> Milligan, B. and A. Kraus-Polk (2016). Human use of restored and naturalized delta landscapes. Department of Human Ecology, Landscape Architecture Unit, University of California, Davis, Davis CA. Available: [https://watershed.ucdavis.edu/files/biblio/Human%20Use%20Report\\_for%20screen%20viewing%20%28spread%29.compressed.pdf](https://watershed.ucdavis.edu/files/biblio/Human%20Use%20Report_for%20screen%20viewing%20%28spread%29.compressed.pdf). Accessed: January 2017.
- <sup>3</sup> Hanak, E. (2017). Five things you need to know about water. Public Policy Institute of California. Available: [http://www.ppic.org/main/blog\\_detail.asp?i=1736](http://www.ppic.org/main/blog_detail.asp?i=1736). Accessed: January 26, 2017.
- <sup>4</sup> Brown, J., N. Mitchell and M. Beresford (2005). The protected landscape approach: Linking nature, culture and community. J. Brown, N. Mitchell and M. Beresford (editors), IUCN - The World Conservation Union, World Commission on Protected Areas, Gland, Switzerland.
- <sup>5</sup> University of the Pacific, The Dangermond Group, Economic & Planning Systems Inc., Sapper West Inc., Garcia DeCredico Studio and Peterson Brustrad Inc. (2012). Economic Sustainability Plan for the Sacramento-San Joaquin River Delta. Prepared for the Delta Protection Commission, West Sacramento, CA. Available: [http://www.delta.ca.gov/files/2016/10/Final\\_ESP\\_w\\_Appendices\\_2012.pdf](http://www.delta.ca.gov/files/2016/10/Final_ESP_w_Appendices_2012.pdf). Accessed: December 6, 2016
- <sup>6</sup> Delta Protection Commission (2016). Clarksburg Community Action Plan. Delta Protection Commission, West Sacramento, CA. Available: [http://www.delta.ca.gov/files/2016/10/DCAP\\_2016-11\\_CBPlan.pdf](http://www.delta.ca.gov/files/2016/10/DCAP_2016-11_CBPlan.pdf). Accessed: December 6, 2016.
- <sup>7</sup> Delta Protection Commission (2016). Courtland Community Action Plan. Delta Protection Commission, West Sacramento, CA. Available: [http://www.delta.ca.gov/files/2016/10/DCAP\\_2016-11\\_CLPlan.pdf](http://www.delta.ca.gov/files/2016/10/DCAP_2016-11_CLPlan.pdf). Accessed: December 6, 2016.
- <sup>8</sup> Delta Protection Commission (2016). Walnut Grove Community Action Plan. Delta Protection Commission, West Sacramento, CA. Available: [http://www.delta.ca.gov/files/2016/10/DCAP\\_2016-11\\_WGPlan.pdf](http://www.delta.ca.gov/files/2016/10/DCAP_2016-11_WGPlan.pdf). Accessed: December 6, 2016.
- <sup>9</sup> Delta Vision (2007). Delta Vision Blue Ribbon Task Force. State of California, Sacramento, CA. Available: <http://deltavision.ca.gov/DeltaVisionBlueRibbonHome.shtml>. Accessed: April 2017.
- <sup>10</sup> Weiser, M. (2016). Humans are missing in Delta restoration plan. News Deeply. Available: <https://www.newsdeeply.com/water/community/2016/12/27/humans-are-missing-in-delta-restoration-plan>. Accessed January 25, 2017.
- <sup>11</sup> Delta Stewardship Council (2013). The Delta Plan: Ensuring a reliable water supply for California, a healthy Delta ecosystem, and a place of enduring value. Delta Stewardship Council, Sacramento, CA. Available: <http://deltacouncil.ca.gov/delta-plan-0>. Accessed: June 23, 2016.
- <sup>12</sup> Delta Protection Commission (2017). Delta Heritage. Delta Awareness. Delta Protection Commission, West Sacramento, CA. Available: [http://www.delta.ca.gov/delta\\_heritage/](http://www.delta.ca.gov/delta_heritage/), [https://www.delta.ca.gov/regional\\_economy/awareness/](https://www.delta.ca.gov/regional_economy/awareness/). Accessed: January 26, 2017.
- <sup>13</sup> Jacobson, S. K. and M. D. McDuff (1998). Training idiot savants: The lack of human dimensions in conservation biology. *Conservation Biology*. 12: 263-267.
- <sup>14</sup> Rosenzweig, M. L. (2003). Win-win ecology: How the earth's species can survive in the midst of human enterprise. Oxford University Press, New York, NY.
- <sup>15</sup> Heberlein, T. A. (2012). Attitudes, rivers, and environmental fixes. In: *Navigating environmental attitudes*. Oxford University Press, New York, NY.
- <sup>16</sup> Bennett, N. J., R. Roth, S. C. Klain, K. Chan, P. Christie, D. A. Clark, G. Cullman, D. Curran, T. J. Durbin, G. Epstein, A. Greenberg, M. P. Nelson, J. Sandlos, R. Stedman, T. L. Teel, R. Thomas, D. Verissimo and C. Wyborn (2016). Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biological Conservation* <http://dx.doi.org/10.016/j.biocon.2016.10.006>.
- <sup>17</sup> Delta Stewardship Council (2017). 2017 – 2021 Science Action Agenda. Delta Stewardship Council, Delta Science Program, Sacramento, CA. Available: <http://deltacouncil.ca.gov/docs/delta-stewardship-council-july-27-2017-meeting-agenda-item-11-attachment-1-2017-2021-science>. Accessed: September 12, 2017.

- 
- <sup>18</sup> Delta Independent Science Board (2017). Review of Research on the Sacramento-San Joaquin Delta as an Evolving Place. Delta Stewardship Council, Sacramento, CA. Available: <http://deltacouncil.ca.gov/docs/delta-stewardship-council-july-27-2017-meeting-agenda-item-9-review-research-sacrament-san>. Accessed: September 12, 2017.
- <sup>19</sup> Norgaard, R. B. (2013). The Econocene and the California Delta. *San Francisco Estuary and Watershed Science*. 11: 1-5. <http://escholarship.org/uc/item/4h98t2m0>.
- <sup>20</sup> DWR (2017). DWR Agricultural Lands Stewardship Workgroup – Potential Strategies. California Department of Water Resources, Agricultural Lands Stewardship Workgroup (DWR), Sacramento, CA. Available: <https://agriculturalandstewardship.water.ca.gov/web/guest/potential-strategies1>. Accessed: September 12, 2017.
- <sup>21</sup> Conservation Measures Partnership (2017). Open Standards for the Practice of Conservation – Guidance. Available: <http://cmp-openstandards.org/using-os/guidance/>. Accessed: January 28, 2017.
- <sup>22</sup> DWR (2017). DWR Agricultural Lands Stewardship Workgroup – Good Neighbor Checklist. California Department of Water Resources, Agricultural Lands Stewardship Workgroup (DWR), Sacramento, CA. Available: <https://agriculturalandstewardship.water.ca.gov/web/guest/good-neighbor-checklist>. Accessed: September 12, 2017.
- <sup>23</sup> USBR, USFWS, and CDFG (2013). Suisun Marsh habitat management, preservation, and restoration plan. U.S. Bureau of Reclamation, Mid-Pacific Region (USBR), Sacramento, CA; U.S. Fish and Wildlife Service (USFWS); California Department of Fish and Game (CDFG), Stockton, CA. Available: [http://www.usbr.gov/mp/nepa/documentShow.cfm?Doc\\_ID=17283](http://www.usbr.gov/mp/nepa/documentShow.cfm?Doc_ID=17283). Accessed June 9, 2016.
- <sup>24</sup> CDFW (2014). Adaptive Management Advisory Team charter for the Suisun Marsh Habitat Management, Preservation and Restoration Plan. California Department of Fish and Wildlife, Bay-Delta Region (CDFW), Napa, CA. Available: <https://nrmsecure.dfg.ca.gov/FileHandler.ashx?DocumentID=C&inline>. Accessed: July 17, 2017.
- <sup>25</sup> Central Valley Joint Venture (2017). What is the CVJV? Central Valley Joint Venture, U.S. Fish and Wildlife Service, Sacramento, CA. Available: <http://centralvalleyjointventure.org/partnership/what-is-the-cvjb>. Accessed: January 26, 2017.
- <sup>26</sup> USFWS (2017). Migratory Bird Joint Ventures - Conserving birds And Their habitats throughout North America. Available: <https://www.fws.gov/birds/management/bird-conservation-partnership-and-initiatives/migratory-bird-joint-ventures.php>. Accessed: April 2017.
- <sup>27</sup> Central Valley Joint Venture (2006). Implementation Plan – conserving bird habitat. U.S. Fish and Wildlife Service, Sacramento, CA. Available: [http://www.centralvalleyjointventure.org/assets/pdf/CVJV\\_fnl.pdf](http://www.centralvalleyjointventure.org/assets/pdf/CVJV_fnl.pdf). Accessed: April 2017.
- <sup>28</sup> G. Yarris, pers. comm.
- <sup>29</sup> Dybala, K. E., N. Clipperton, T. Gardali, G. H. Golet, R. Kelsey, S. Lorenzato, R. Melcer, Jr., N. E. Seavy, J. G. Silveira, and G. S. Yarris (2017). Population and habitat objectives for avian conservation In California’s Central Valley riparian ecosystems. *San Francisco Estuary and Watershed Science* 15: 1-20. Available: <http://escholarship.org/uc/item/7fb4k88r>. Accessed: April 2017.
- <sup>30</sup> Dybala, K. E., N. Clipperton, T. Gardali, G. H. Golet, R. Kelsey, S. Lorenzato, R. Melcer, Jr., N. E. Seavy, J. G. Silveira, and G. S. Yarris (2017). A general framework for setting quantitative population objectives for wildlife conservation. *San Francisco Estuary and Watershed Science* 15: 1-13. Available: <http://escholarship.org/uc/item/12c7f6qv>. Accessed: April 2017.
- <sup>31</sup> Dybala, K. E., M. E. Reiter, C. M. Hickey, W. D. Shuford, K. M. Strum, and G. S. Yarris (2017). A bioenergetics approach to setting conservation objectives for nonbreeding shorebirds in California’s Central Valley. *San Francisco Estuary and Watershed Science* 15: 1-14. Available: <http://escholarship.org/uc/item/12c7f6qv#page-3>. Accessed: April 2017.
- <sup>32</sup> DiGaudio, R. T., K. E. Dybala, N. E. Seavy, and T. Gardali (2017). Population and habitat objectives for avian conservation in California’s Central Valley grassland–oak savannah ecosystems. *San Francisco Estuary and Watershed Science* 15(1). *jmie\_sfews\_34350*. Available: <http://escholarship.org/uc/item/Odn9f9b4>. Accessed: April 2017.

- 
- <sup>33</sup> Gardali, T., J. T. Marty, and G. S. Yarris (2017). The science of setting conservation objectives for birds in California's Central Valley: An introduction. *San Francisco Estuary and Watershed Science* 15(1). Available: <http://escholarship.org/uc/item/2hr1m395>. Accessed: April 2017.
- <sup>34</sup> Shuford, W. D. and K. E. Dybala (2017). Conservation objectives for wintering and breeding waterbirds in California's Central Valley. *San Francisco Estuary and Watershed Science* 15(1). Available: <http://escholarship.org/uc/item/5tp5m718>. Accessed: April 2017.
- <sup>35</sup> Strum, K. M., K. E. Dybala, M. N. Iglecia and W. D. Shuford (2017). Population and habitat objectives for breeding shorebirds in California's Central Valley. *San Francisco Estuary and Watershed Science* 15(1). Available: <http://escholarship.org/uc/item/2836q0qg>. Accessed: April 2017.
- <sup>36</sup> Natural Resources Agency (2016). Agencies agree to coordinate on flood and habitat projects in the Yolo Bypass region – 15 separate agencies agree to synchronize efforts for sake of wildlife, flood risk reduction, agriculture, water supply, and recreation. California Natural Resources Agency, Sacramento, CA. Available: [http://resources.ca.gov/docs/press\\_release/160510-Agencies\\_Agree\\_to\\_Coordinate\\_on\\_Flood\\_and\\_Habitat\\_Projects.pdf](http://resources.ca.gov/docs/press_release/160510-Agencies_Agree_to_Coordinate_on_Flood_and_Habitat_Projects.pdf). Accessed: July 17, 2017.
- <sup>37</sup> Water Resources Association of Yolo County (2015). Lower Sacramento/Delta North Region: Corridor Management Framework. Water Resources Association of Yolo County, Woodland, CA. Available: [http://www.yolowra.org/board\\_agendas/2015/CMF-LS-ND.pdf](http://www.yolowra.org/board_agendas/2015/CMF-LS-ND.pdf). Accessed: August 8, 2017.
- <sup>38</sup> Yolo Basin Foundation (2017). Yolo Bypass Working Group. Yolo Basin Foundation, Davis, CA. Available: <http://yolobasin.org/yolo-bypass-working-group/>. Accessed January 26, 2017.
- <sup>39</sup> CDFW and DWR (2017). Cache Slough comprehensive regional planning: Draft baseline characterization report for the advancement of Proposition 1 eligible projects – Draft final Phase 1 report. Department of Water Resources, West Sacramento, CA.
- <sup>40</sup> MWD (2016). Delta islands. Metropolitan Water District of Southern California (MWD). Available: [http://www.mwdh2o.com/DocSvcPubs/Delta\\_Islands/](http://www.mwdh2o.com/DocSvcPubs/Delta_Islands/). Accessed: April 2017.
- <sup>41</sup> Rubissow-Okamoto, A. (2017). Back to the bones of the Delta. *Estuary News* 26 (1): 6-10. Available: <http://www.sfestuary.org/wp-content/uploads/2017/03/EstuaryNewsMar2017-v9.pdf>. Accessed: March 2017.
- <sup>42</sup> Fimrite, P. (2016). Southern California water district obtains delta islands. *San Francisco Chronicle*. Jul 19, 2016. Available: <http://www.sfgate.com/science/article/Southern-California-water-district-obtains-delta-8385657.php>. Accessed: January 27, 2017.
- <sup>43</sup> Kasler, D. and R. Sabalow (2016). Southern California water agency signs \$175 million deal to buy Delta islands. *Sacramento Bee*. April 11, 2016. Available: <http://www.sacbee.com/news/state/california/water-and-drought/delta/article71155097.html>. Accessed: January 27, 2017
- <sup>44</sup> Moyle, P., J. Durand and A. Manfree (2016). The North Delta habitat arc.: An ecosystem strategy for saving fish. *California Water Blog at WordPress.com*. Available: <https://californiawaterblog.com/2016/11/06/the-north-delta-habitat-arc-an-ecosystem-strategy-for-saving-fish/>. Accessed January 26, 2017.
- <sup>45</sup> Pywell, R. F., M. S. Heard, R. B. Bradbury, S. Hinsley, M. Nowakowski, K. J. Walker, and J. M. Bullock (2012). Wildlife-friendly farming benefits rare birds, bees and plants. *Biol. Lett.* June 6 2012: 1-4. Available: <http://rsbl.royalsocietypublishing.org/content/roybiolett/early/2012/05/28/rsbl.2012.0367.full.pdf>. Accessed April 2017.
- <sup>46</sup> Pywell, R. F., M. S. Heard, B. A. Woodcock, S. Hinsley, L. Ridding, M. Nowakowski, and J. M. Bullock (2015). Wildlife-friendly farming increases crop yield: evidence for ecological intensification. *Proc. R. Soc. B.* 282: 20151740.
- <sup>47</sup> Kasler, D. (2016). California economy surges to no. 6 in global rankings. *The Sacramento Bee*, Sacramento, CA. Available: <http://www.sacbee.com/news/business/article83780667.html>. Accessed January 26, 2017.
- <sup>48</sup> Robinson, A., S. Safran, J. Beagle, R. Grossinger, L. Grenier and R. Askevold (2014). A Delta transformed: ecological functions, spatial metrics, and landscape change in the Sacramento-San Joaquin Delta. Prepared for California Department of Fish and Wildlife, Ecosystem Restoration Program, Sacramento, CA. San Francisco Estuary Institute-Aquatic Science Center, Richmond, CA, Publication #729. Available:

---

<http://www.sfei.org/documents/delta-transformed-ecological-functions-spatial-metrics-and-landscape-change-sacramento-san>. Accessed: January 26, 2017.

- <sup>49</sup> Delta Regional Foundation (2015). What is the Delta Regional Foundation? Delta Regional Foundation, Sacramento, CA. Available: <http://www.deltaregionalfoundation.org/the-foundation.html>. Accessed: April 2017.
- <sup>50</sup> Visit California (2017). California Delta. Visit California, Sacramento, CA. Available: <http://www.visitcalifornia.com/attraction/california-delta>. Accessed: July 17, 2017.
- <sup>51</sup> ESP (2016). Ecosystem Services Partnership – Ecosystem service valuation database. Available: <http://www.es-partnership.org/services/data-knowledge-sharing/ecosystem-service-valuation-database/>. Accessed: April 2017.
- <sup>52</sup> Ivey, G. L., C. P. Herziger, and M. Gause (2003). Farming for wildlife: An overview of agricultural operations at Staten Island, San Joaquin County, California. The Nature Conservancy. Available: <http://www.cosumnes.org/wp-content/uploads/2015/05/STATEN-ISLAND-FarmingforWildlife.pdf>. Accessed: April 2017.
- <sup>53</sup> Golet, G. H. (2011). Conservation management needs and opportunities, Staten Island Ranch, San Joaquin County, California. The Nature Conservancy, Chico, CA. Available: <http://www.cosumnes.org/wp-content/uploads/2015/05/Staten-Island-Conservation-Management-Needs-and-Opportunities-Staten-Island-Ranch-FINAL.pdf>. Accessed: January 27, 2017.
- <sup>54</sup> Reclamation and DWR (2008). Appendix R: Sensitivity of future Central Valley Project and State Water Project operations to potential climate change and associated sea level rise - final report In: the CVP/SWP OCAP Biological Assessment on the continued long-term operations of the Central Valley Project and State Water Project. U.S. Bureau of Reclamation Technical Service Center, Denver, CO, and Mid-Pacific Region, Sacramento, CA (USBR) and California Department of Water Resources (DWR), Sacramento, CA. Available: [https://www.usbr.gov/mp/cvo/ocapBA\\_2008.html](https://www.usbr.gov/mp/cvo/ocapBA_2008.html). Accessed January 25, 2017.
- <sup>55</sup> Natural Resources Agency (2009). 2009 California Climate Adaptation Strategy - a report to the Governor of the State of California in response to Executive Order S-13-2008. California Natural Resources Agency, Sacramento, CA. Available: [http://resources.ca.gov/docs/climate/Statewide\\_Adaptation\\_Strategy.pdf](http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf). Accessed January 25, 2017.
- <sup>56</sup> Brown, L. R., W. A. Bennett, R. W. Wagner, T. Morgan-King, N. Knowles, F. Feyrer, D. H. Schoellhamer, M. T. Stacey and M. Dettinger (2013). Implications for future survival of delta smelt from four climate change scenarios for the Sacramento-San Joaquin Delta, California. *Estuaries and Coasts*. **36**: 754-774.
- <sup>57</sup> CO-CAT (2013). State of California sea-level rise guidance document. California Climate Action Team, Coastal and Ocean Working Group (CO-CAT). Available: [http://www.opc.ca.gov/webmaster/ftp/pdf/docs/2013\\_SLR\\_Guidance\\_Update\\_FINAL1.pdf](http://www.opc.ca.gov/webmaster/ftp/pdf/docs/2013_SLR_Guidance_Update_FINAL1.pdf).
- <sup>58</sup> Wheeler, S. M. (2014). Climate change and agriculture in the Delta region. PowerPoint presentation at The Science Behind Delta Climate Change Impacts Workshop on 13 February 2014. Water Education Foundation, West Sacramento Civic Center, West Sacramento, CA.
- <sup>59</sup> Natural Resources Agency (2016). Delta Smelt Resiliency Strategy. Natural Resources Agency, Sacramento, CA. Available: <http://resources.ca.gov/docs/Delta-Smelt-Resiliency-Strategy-FINAL070816.pdf>. Accessed April 2017.
- <sup>60</sup> DWR (2016). Central Valley Flood Protection Plan Conservation Strategy. California Department of Water Resources (DWR), Sacramento, CA. Available: [http://www.water.ca.gov/conservationstrategy/docs/cs\\_draft.pdf](http://www.water.ca.gov/conservationstrategy/docs/cs_draft.pdf). Accessed January 25, 2017.
- <sup>61</sup> Natural Resources Agency (2017). California EcoRestore – Southport setback levee, West Sacramento, CA. Natural Resources Agency, Sacramento, CA. California Natural Resources Agency, Sacramento, CA. Available: [http://resources.ca.gov/docs/ecorestore/projects/Southport\\_Setback\\_Levee.pdf](http://resources.ca.gov/docs/ecorestore/projects/Southport_Setback_Levee.pdf). Accessed: April, 2017.
- <sup>62</sup> KSN (2016). Resilience through restoration – Reclamation District No. 1601 Twitchell Island, San Joaquin River setback levee project. Kjeldsen, Sinnock & Neudeck, Inc. (KSN), Stockton, CA. Available: [http://c.ymcdn.com/sites/membersfloodplain.site-ym.com/resource/resmgr/2016Conference/Twitchell\\_Island.pdf](http://c.ymcdn.com/sites/membersfloodplain.site-ym.com/resource/resmgr/2016Conference/Twitchell_Island.pdf). Accessed August 10, 2017.

- 
- <sup>63</sup> Delta Stewardship Council (2017). Delta Levees Investment Strategy Decision Support Tool – public version 2.2\_beta. Delta Stewardship Council, Sacramento, CA. Available: <http://deltacouncil.ca.gov/dlis-decision-support-tool>. Accessed: September 13, 2017.
- <sup>64</sup> Davis, A. (2017). Residents evacuated from Tyler Island over compromised levee concerns. East Bay Times, Dublin, CA. <http://www.eastbaytimes.com/2017/02/13/levee-breach-to-flood-tyler-island-residents-evacuated/>. Accessed: July 17, 2017.
- <sup>65</sup> Cornejo, C. (2017). Troubled waters: Storm breaks levees, floods roads in Lodi area and beyond. Lodi News-Sentinel, Lodi, CA. [http://www.lodinews.com/news/article\\_1d3a8324-d895-11e6-a7a9-eb3c5e5acba0.html](http://www.lodinews.com/news/article_1d3a8324-d895-11e6-a7a9-eb3c5e5acba0.html). Accessed: July 17, 2017.
- <sup>66</sup> Davenport, J., D. Austin, J. Duryea, D. Huang, and D. Livsey. (2016). Improving habitats Along Delta levees – A review of past projects and recommended next steps. Delta Stewardship Council, Sacramento, CA.
- <sup>67</sup> Delta Stewardship Council. (2017). Delta Levees Investment Strategy. Delta Stewardship Council, Sacramento, CA. Available: <http://deltacouncil.ca.gov/delta-levees-investment-strategy>. Accessed: April 2017.
- <sup>68</sup> Natural Resources Agency (2017). California EcoRestore – Twitchell Island – San Joaquin River setback levee. Natural Resources Agency, Sacramento, CA. Available: [http://resources.ca.gov/docs/ecorestore/projects/Twitchell\\_Island-\\_SJ\\_River\\_Setback\\_Levee.pdf](http://resources.ca.gov/docs/ecorestore/projects/Twitchell_Island-_SJ_River_Setback_Levee.pdf). Accessed: September 13, 2017.
- <sup>69</sup> Arcadis (2016). Risk analysis methodology – Delta Levees Investment Strategy. Prepared for Delta Stewardship Council, Sacramento, CA.
- <sup>70</sup> Burmester, D., D. S. Zzulak, E. Eggeman., K. Fleming, J. Garcia, M. Grube, S. Rodriguez, H. Spautz (2015). Wildlife-friendly agriculture – What we have accomplished, what we have learned. California Department of Fish and Wildlife, Ecosystem Restoration Program, Sacramento, CA.
- <sup>71</sup> Robbins, J. (2014). Paying farmers to welcome birds. The New York Times, New York, NY. Available: [https://www.nytimes.com/2014/04/15/science/paying-farmers-to-welcome-birds.html?\\_r=1](https://www.nytimes.com/2014/04/15/science/paying-farmers-to-welcome-birds.html?_r=1). Accessed: January 27, 2017.
- <sup>72</sup> CFR (2015). Population trends, habitat selection and food availability for sandhill cranes and large waterfowl on Staten Island and associated management recommendations - Annual report - August 2015, The Nature Conservancy, Conservation Farms & Ranches (CFR), Staten Island, CA.
- <sup>73</sup> Swolgaard, C. A., K. A. Reeves, and D. A. Bell (2008). Foraging by Swainson’s hawks in a vineyard-dominated landscape. *Journal of Raptor Research* 42(3):188-196
- <sup>74</sup> Babcock, K. W. (1995). Home range and habitat use of breeding Swainson’s hawks in the Sacramento Valley of California. *J. Raptor Res.* 29(3):193-197
- <sup>75</sup> Estep, J. A. (1989). Biology, movements, and habitat relationships of the Swainson’s Hawk in the Central Valley of California, 1986-87. California Department of Fish and Game, Wildlife Management Division, Nongame Bird and Mammal Section, Sacramento, CA.
- <sup>76</sup> Estep Environmental Consulting (2007). The distribution, abundance, and habitat associations of the Swainson’s hawk (*Buteo swainsoni*) in South Sacramento County. Prepared for City of Elk Grove, Elk Grove, CA. Estep Environmental Consulting, Sacramento, CA.
- <sup>77</sup> Stillwater Sciences (2015). Swainson’s hawk habitat quantification tool, scientific rationale document, Volume 3. Prepared for Environmental Defense Fund, Sacramento, CA.
- <sup>78</sup> U.S. Geological Survey (2016). California Water Science Center - What is the Carbon Capture Farming Program? Available: [https://ca.water.usgs.gov/Carbon\\_Farm/](https://ca.water.usgs.gov/Carbon_Farm/). Accessed: April 2017.
- <sup>79</sup> DWR (2012). A sustainable future for farming in the Delta. California Department of Water Resources, FloodSAFE Environmental Stewardship and Statewide Resources Office (CDWR), Sacramento, CA.
- <sup>80</sup> CVHE (2017). Central Valley Habitat Exchange – A voluntary program creating new financial returns for landowners. Central Valley Habitat Exchange. Available: <https://www.enviroaccounting.com/cvhe/Program/Home>. Accessed: September 13, 2017.
- <sup>81</sup> Migratory Bird Conservation Partnership (2017). Wildlife-friendly working lands. Audubon California, The Nature Conservancy, and Point Blue Conservation Service. Available: [http://www.camigratorybirds.org/?page\\_id=30](http://www.camigratorybirds.org/?page_id=30). Accessed: June 2017.

- 
- <sup>82</sup> Fischer, J., B. Brosi, G. C Daily, P. R. Ehrlich, R. Goldman, J. Goldstein, D. B. Lindenmayer, A. D. Manning, A. H. Mooney, L. Pejchar, J. Ranganathan, and H. Tallis (2008). Should agricultural policies encourage land sparing or wildlife-friendly farming? *Frontiers in Ecology and the Environment*: 6(7):380-385. Available: <http://onlinelibrary.wiley.com/doi/10.1890/070019/abstract>. Accessed: August 16, 2017.
- <sup>83</sup> AB 32 (2006). California Assembly Bill 32 Chapter 488 Available: [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf). Accessed: April 2017.
- <sup>84</sup> Robinson, A., S. Safran, J. Beagle, L. Grenier, R. Grossinger, E. Spotswood, S. Dusterhoff and A. Richey (2016). A Delta renewed: A guide to science-based ecological restoration in the Sacramento-San Joaquin Delta, a report for the Delta Landscapes Project: Management tools for landscape-scale restoration of ecological functions. Prepared for California Department of Fish and Wildlife, Sacramento, CA. San Francisco Estuary Institute (SFEI) Aquatic Science Center, Richmond, CA. Available: [http://www.sfei.org/sites/default/files/project/SFEI\\_DeltaRenewed\\_102616\\_lowres.pdf](http://www.sfei.org/sites/default/files/project/SFEI_DeltaRenewed_102616_lowres.pdf). Accessed January 25, 2017.
- <sup>85</sup> Delta Conservancy (2017). ACR approves landmark carbon offset methodology for California wetland restoration. Delta Conservancy, West Sacramento, CA. Available: <http://deltaconservancy.ca.gov/delta-carbon-program/>. Accessed: September 13, 2017.
- <sup>86</sup> California Legislative Information (2017). AB-398 – California Global Warming Solutions Act of 2006: market-based compliance mechanisms: fire prevention fees: sales and use tax manufacturing exemption. State of California Legislature, Sacramento, CA. Available: [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201720180AB398](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB398). Accessed: September 13, 2017.
- <sup>87</sup> Moyle, Peter B.; Brown, Larry R.; Durand, John R.; & Hobbs, James A. (2016). Delta Smelt: Life History and Decline of a Once-Abundant Species in the San Francisco Estuary. *San Francisco Estuary and Watershed Science*, 14(2). [jmie\\_sfews\\_31667](http://escholarship.org/uc/item/09k9f76s). Available: <http://escholarship.org/uc/item/09k9f76s>. Accessed: April 2017.
- <sup>88</sup> Nobriga M. and B. Herbold (2009). Sacramento-San Joaquin Delta Regional Ecosystem Restoration Implementation Plan - The little fish in California's water supply: a literature review and life-history conceptual model for Delta smelt (*Hyposmesus transpacificus*) for the Delta Regional Ecosystem Restoration and Implementation Plan (DRERIP). California Department of Fish and Game, Sacramento, CA. Available: <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=28420>. Accessed: April 2017
- <sup>89</sup> Vogel, D. (2013). Evaluation of fish entrainment in 12 unscreened Sacramento River diversions – Final report. Prepared for: CVPIA Anadromous Fish Screen Program (USFWS and USBR) and Ecosystem Restoration Program (CDFW, USFWS, NOAA-NMFS). Natural Resources Scientists, Inc. Red Bluff, CA.
- <sup>90</sup> FWA (2017). Sacramento Valley Fish Screen Program. Family Water Alliance, Inc. (FWA), Maxwell, CA. Available: <http://familywateralliance.com/our-issues/program-overview/>. Accessed: July 18, 2017.
- <sup>91</sup> FCA (2017). Introduction to the Farmers Screen. Farmers Conservation Alliance (FCA), Hood River, OR. Available: <http://farmersscreen.org/about-2/intro/>. Accessed: July 18, 2017.
- <sup>92</sup> Singer, M. B., R. Aalto, L. A. James, N. E. Kilham, J. L. Higson, and S. Ghoshal (2013). Enduring legacy of a toxic fan via episodic redistribution of California gold mining debris. *Proceedings of the National Academy of Sciences* 110:18436–18441.
- <sup>93</sup> Willacker, J. J., C. A. Eagles-Smith, M. A. Lutz, M. T. Tate, J. M. Lepak, and J. T. Ackerman (2016). Reservoirs and water management influence fish mercury concentrations in the western United States and Canada. *Science of the Total Environment* 568: 739-748.
- <sup>94</sup> Eagles-Smith, C. A., and J. T. Ackerman (2014). Mercury bioaccumulation in estuarine wetland fishes: Evaluating habitats and risk to coastal wildlife. *Environmental Pollution* 193: 147-155.
- <sup>95</sup> Wood, M. L., P. W. Morris, J. Cooke, and S. J. Louie (2010). Amendments to The Water Quality Control Plan for the Sacramento River and San Joaquin River basins for the control of methylmercury and total mercury in the Sacramento-San Joaquin Delta Estuary. Central Valley Regional Water Quality Control Board, Sacramento, CA. Available: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/delta\\_hg/april\\_2010\\_hg\\_tmdl\\_hearing/apr2010\\_bpa\\_staffrpt\\_final.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/april_2010_hg_tmdl_hearing/apr2010_bpa_staffrpt_final.pdf). Accessed: September 14, 2017.

- 
- <sup>96</sup> Wood, M. L., C. G. Foe, J. Cooke, and S. J. Louie (2010a). Sacramento – San Joaquin Delta Estuary TMDL for methylmercury - Draft Report. Central Valley Regional Water Quality Control Board, Sacramento, CA. Available:  
[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/delta\\_hg/april\\_2010\\_hg\\_tmdl\\_hearing/apr2010\\_tmdl\\_staffrpt\\_final.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/april_2010_hg_tmdl_hearing/apr2010_tmdl_staffrpt_final.pdf). Accessed: September 14, 2017.
- <sup>97</sup> BDCP (2013). Chapter 3 Conservation Strategy. In Bay Delta Conservation Plan - Public draft. Available:  
<http://baydeltaconservationplan.com/EnvironmentalReview/EnvironmentalReview/2013-2014PublicReview/2013PublicReviewDraftBDCP.aspx>.
- <sup>98</sup> Ackerman, J. T. and C. A. Eagles-Smith (2009). Selenium bioaccumulation and body condition in shorebirds and terns breeding in San Francisco Bay, California, USA. *Environmental Toxicology and Chemistry* 28(10):2134-2141.
- <sup>99</sup> EPA (2017). San Francisco Bay Delta – What are the challenges? United States Environmental Protection Agency (EPA). Available: <https://www.epa.gov/sfbay-delta/what-are-challenges>. Accessed: September 14, 2017.
- <sup>100</sup> NRDC (2001). California’s contaminated groundwater. Is the state minding the store? Natural Resources Defense Council, Inc., New York, NY. Available: [http://www.waterboards.ca.gov/gama/docs/nrdcgw\\_4\\_01.pdf](http://www.waterboards.ca.gov/gama/docs/nrdcgw_4_01.pdf). Accessed: May 2017.
- <sup>101</sup> Cal-EPA (2017). Bay-Delta Plan Update. State Water Resources Control Board, California Environmental Protection Agency (Cal-EPA), Sacramento, CA. Available:  
[http://www.waterboards.ca.gov/waterrights/water\\_issues/programs/bay\\_delta/](http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/). Accessed: April 2017
- <sup>102</sup> Sustainable Groundwater Management Act. (2016). Sustainable Groundwater Management. California Legislative Information. Available:  
[http://leginfo.ca.gov/faces/codes\\_displayexpandedbranch.xhtml?tocCode=WAT&division=6.&title=&part=2.74.&chapter=&article=](http://leginfo.ca.gov/faces/codes_displayexpandedbranch.xhtml?tocCode=WAT&division=6.&title=&part=2.74.&chapter=&article=). Accessed: April 2017.