

# Delta Public Lands Strategy

Guidance for Conservation and Sustainability  
Across the West, Central, and Northeast Delta

JANUARY 2019



SACRAMENTO - SAN JOAQUIN

**DELTA CONSERVANCY**

*A California State Agency*



## Note to the reader:

**T**his document reflects a progress report and compilation of the ideas and concepts for an integrated conservation strategy for publicly-funded lands in the west, central, and northeast Delta. This strategy is a high-level view of the opportunities and constraints for conservation, agricultural sustainability, flood management, recreation, and other important Delta priorities. The strategy also includes implementation approaches for continuing the successful coordination, engagement, and planning that formed the basis of this report. Supporting documents, maps, information, and meeting summaries are available on the Delta Conservancy website: [www.delta-conservancy.ca.gov/centraldeltacorridor](http://www.delta-conservancy.ca.gov/centraldeltacorridor).

This report is the product of staff-level work among the participating and authoring organizations. The ideas and concepts presented here have not been endorsed or approved by any of the participating organizations.

## Acknowledgements

This strategy is the product of constructive discussion and input from a broad array of Delta landowners, stakeholders, and governing bodies.

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- Sacramento-San Joaquin Delta Conservancy
- Metropolitan Water District of Southern California (MWD)
- California Department of Water Resources (DWR)
- The Nature Conservancy (TNC)

### Participating Owners of Publicly-Funded Lands

- The Nature Conservancy (TNC)
- Metropolitan Water District of Southern California (MWD)
- California Department of Water Resources (DWR)
- California Waterfowl Association (CWA)
- Bureau of Land Management (BLM)
- US Fish and Wildlife Service (USFWS)
- California Department of Fish and Wildlife (CDFW)

### Funders

- Sacramento-San Joaquin Delta Conservancy (Conservancy)
- Delta Stewardship Council (Council)
- Metropolitan Water District of Southern California (MWD)
- California Department of Water Resources (DWR)
- California Department of Fish and Wildlife (CDFW)

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# 1. INTRODUCTION AND PURPOSE

Historically, the Sacramento-San Joaquin River Delta (Delta) has been an abundant resource supporting people and wildlife. More recently, the decline of fish and wildlife habitats and populations, stresses on water supplies and levee systems, and uncertainties about the viability of working landscapes have been well documented. There is growing concern about the threats to the Delta from climate change, invasive species, land use changes, and other disruptors. State and federal policy

directs and guides actions to protect and restore Delta ecosystems and improve water supply reliability while protecting and enhancing the unique features that shape the culture, character, and economy of the Delta region. The Delta community has expressed a strong interest in focusing conservation actions first on the public lands of the Delta.

This report explores the conservation opportunities on public lands in the west, central, and northeast Delta, as well as opportunities for those investments to contribute to other important benefits for the region, including flood management, sustainable agriculture, recreation and tourism, and the regional economy.

**Conservation** is defined as the protection, enhancement, and restoration of ecological function of Delta ecosystems. (CDFW Conservation Framework, 2018)

**Purpose**  
This draft strategy provides a high-level approach for connecting investments in habitat conservation, flood protection and levee improvement, land management, and recreation and tourism to maximize benefits to the Delta ecosystem, regional economy, and water quality.

Approximately 50,000 acres of the Central and Northeast Delta are publicly-funded lands. As owners of working lands, habitats, and levees, the owners and managers share a common interest in maintaining and enhancing the ecosystem functions of these lands and adjacent waterways, while improving economic productivity wherever possible. These public lands constitute the majority or entirety of several islands and tracts, which offers unique opportunities to research and implement innovative land management approaches for restoration and sustainability. Figure 1.1 shows publicly-funded lands and conservation easements in the Central and Northeast Delta.







As the owners of publicly-funded lands planned conservation investments for their properties, opportunities arose to connect habitats and functions between and among islands and tracts to increase the ecosystem value of conservation actions. The landowners also recognized that they are subject to the forces of change in and around the Delta—changing land uses and cropping patterns, increasing flood flows, and rising sea levels.

Recognizing these opportunities and challenges, the Sacramento-San Joaquin Delta Conservancy (Conservancy) convened a working group of these landowners and other specialists to explore the opportunities and constraints, develop a high-level strategy to guide conservation investments and connect with and support other programs and objectives in the region—flood management and levee investment, sustainable agriculture, water supply and water quality, and recreation and tourism. Community outreach and engagement was an important ingredient in shaping the overall strategy. This report describes those opportunities and outlines next steps, implementation approaches, and sources of funding to develop multi-benefit conservation actions on these public lands.

This report does not attempt to establish a policy for what each landowner should do with its lands. Each landowner operates under different mandates and constraints and some may not choose to carry out conservation actions on their lands for a variety of reasons. Some of these public lands are also in process with planning and feasibility studies, e.g., Franks Tract and McCormick-Williamson Tract. To the extent that a public landowner considers conservation actions on its lands, this report can provide important information to facilitate and integrate conservation.

## Outreach and Coordination

The working group met six times through 2018 to review conservation plans for publicly-funded lands and conservation principles for the region, guided by prior

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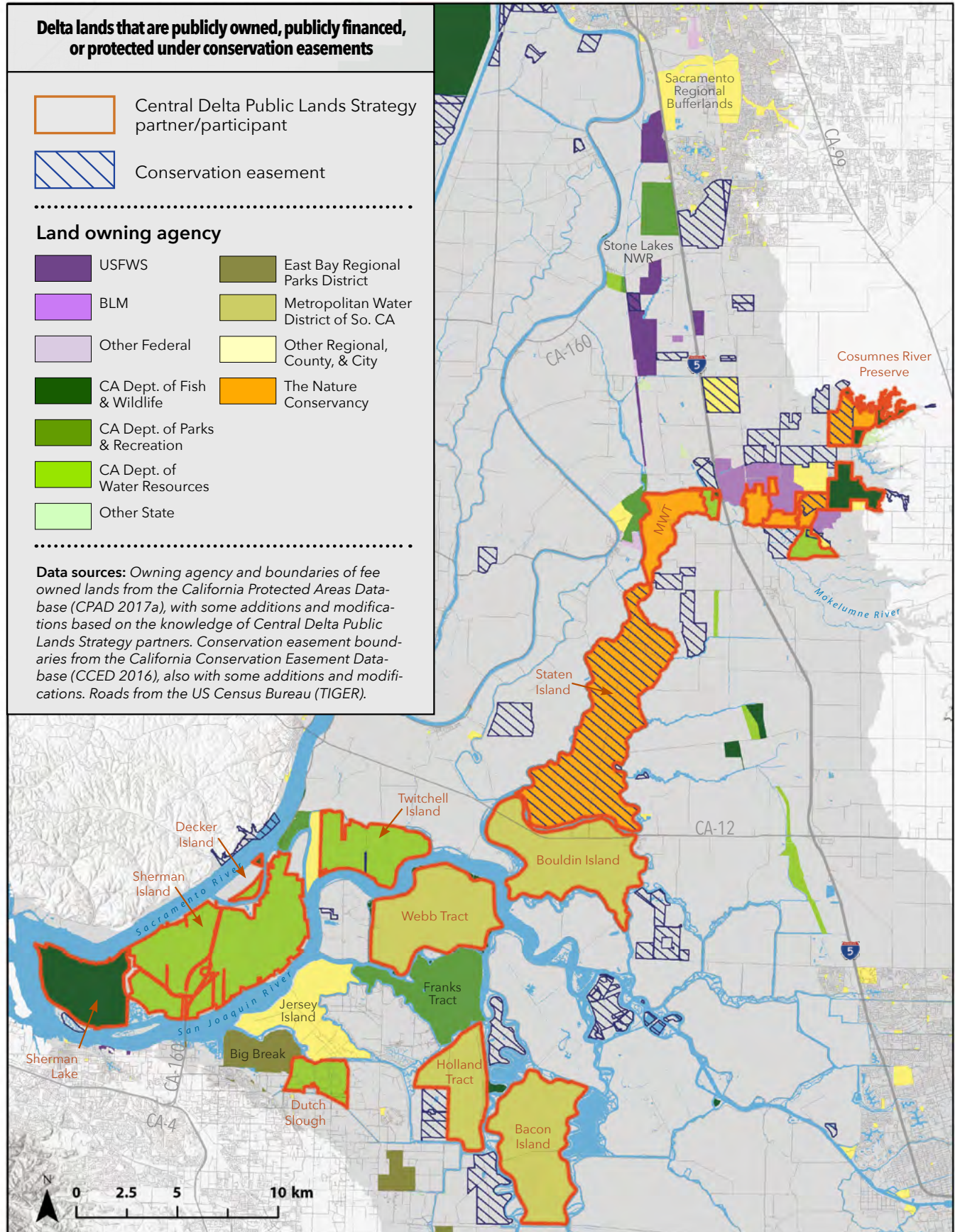
### Participating Owners of Publicly-Funded Lands

The Nature Conservancy (TNC)  
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Figure 1.1 Delta Publicly-Funded Lands and Conservation Easements



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### Project Timeline - 2018

<u>May</u>	<u>August</u>	<u>November</u>	<u>November</u>	<u>December</u>
Community Workshop	1.5-day Design Charrette	Draft Strategy	Community Workshop	Final Strategy

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conservation research and planning for the Delta. Expert and community input was a critical element of the process to develop this strategy. The centerpiece of the process was a one-and-a-half-day design charrette, at which approximately 70 experts, landowners, community members, and agency staff reviewed conservation opportunities and concepts and discussed regional needs and objectives, economic sustainability, and potential constraints and impacts. The charrette was preceded by a community workshop attended by approximately 50 community members to introduce the project and solicit ideas for discussion at the charrette. Notices were distributed to Delta residents and stakeholders through existing lists (e.g., Delta Protection Commission, Conservancy, and Delta Stewardship Council), as well as posted notices throughout the Delta before the first workshop. The draft strategy was discussed at a community workshop in November 2018. In addition to these engagement meetings, owners of the publicly-funded lands continue to discuss and coordinate their plans and projects with neighboring landowners.

## Report Structure

The remainder of this report is organized in three sections: Guidance and Goals, Conservation Strategy, and Implementation Approaches and Next Steps. This report describes how the landowners could make investments that would contribute to varied benefits for the Delta. It also acknowledges that landowners and funders should consider impacts to neighboring islands and the resources of the Delta as plans and projects are developed.

The public lands that are a part of this strategy have been grouped generally into the Northeast Delta and the Central Delta, primarily due to the different opportunities and constraints presented in these two areas by land surface elevations. Land surface elevations and oth-

er landscape variations across the Delta offer opportunities and constraints for conservation planning. For example, in areas with deeply subsided islands, there are few opportunities to set back or breach levees to establish tidal habitat. However, integrated approaches to levee maintenance and improvement can provide smaller opportunities to enhance aquatic habitat over the long term. This strategy begins to identify the opportunities that can improve conditions within the Delta landscape constraints. The local knowledge of farmers and land managers can be an especially important resource as landowners develop plans for these public lands.

This report also acknowledges the important implementation considerations as plans and projects are developed. There are important considerations related to adjacent landowners, Delta hydrodynamics, flood management, and water quality. These considerations are noted in Section 3 and would be evaluated as each landowner develops plans and projects.

This report is not intended as an implementation plan for conservation actions in the Central Delta. The strategies and concepts described here are not developed at the project scale for implementation. Instead, this report provides a high-level view of how conservation actions on publicly-funded lands could be connected across the Central and Northeast Delta to improve ecological functions and the opportunities to incorporate and support other regional objectives. Additional development of these strategies and concepts by each landowner is needed for the islands and tracts identified. Coordination among the landowners and with the Delta community, stakeholders, funders, and regulatory agencies would continue to add value. Additional landowners may join with the publicly-funded landowners and further contribute to the strategy and coordinated conservation actions.



## 2. GUIDANCE AND GOALS FOR THE PUBLIC LANDS STRATEGY

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This section describes the relevant Delta policy and planning guidance and the strategy goals to guide landscape-scale planning and implementation in the Central Delta. Numerous policies and plans provide research and guidance for considering investments on the public lands in the Delta. The major reports and programs are listed in the sidebar. While this guidance has been considered in the development of this strategy, the specific application of the guidance and alignment with policy objectives would occur as landowners refine their land planning and develop specific projects, as described in Section 4.

In developing the overall strategy for public lands in the Central Delta, the landowners clarified the overall goal for the strategy and integrated priorities to which their investments and management could contribute. They also identified important implementation and coordination goals as the strategy proceeds.

### Public Lands Strategy Goal

*Public landowners will coordinate to manage public lands at the landscape scale to improve Delta ecological functions and the overall economic viability of the region.*

Through institutional coordination among public landowners, the Central Delta public lands strategy sets vision and direction for near-term and long-term investments and management on public lands.

### Conservation and Restoration

[Delta Plan](#), Chapter 4, Delta Stewardship Council (2013)

[Delta Conservation Framework](#), CA Department of Fish and Wildlife (2018)

[Delta Renewed](#), San Francisco Estuary Institute (2016)

[Central Valley Joint Venture Implementation Plan](#), Central Valley Joint Venture (2006, update underway)

### Flood Management and Risk Reduction

[Delta Plan](#), Chapter 7 levee investment priorities (2018)

[Delta Levees Subventions](#) and [Special Projects Programs](#), Department of Water Resources

[Central Valley Flood Protection Plan](#), Central Valley Flood Protection Board (2017)

[North Delta Program](#), Department of Water Resources (2010)

### Agricultural Sustainability

[Delta Economic Sustainability Plan](#), Delta Protection Commission (2012)

[Delta Plan](#), Chapter 5 (2013)

### Water Supply and Water Quality

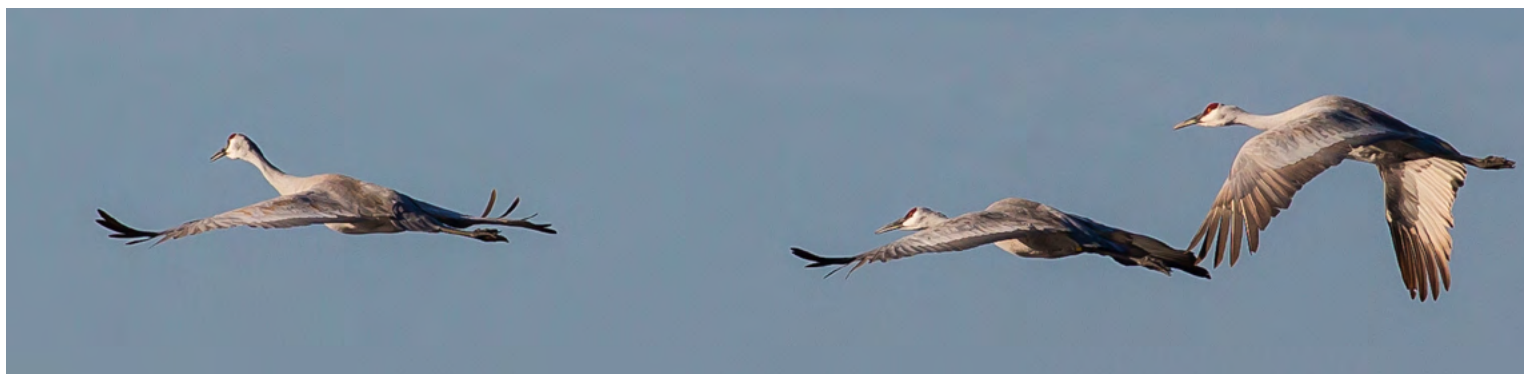
[Delta Plan](#), Chapters 3 and 6 (2013, 2018)

[Bay-Delta Water Quality Control Plan](#), State Water Resources Control Board (2006)

### Recreation and Tourism

[Delta Plan](#), Chapter 5 (2013)

[Delta Recreation Proposal](#), California State Parks (2011)



## Public Lands Strategy Drivers

Throughout the outreach and engagement process, the Conservancy and the working group participants found broad agreement and support among the Delta community and other stakeholders for the following:

- 1. Stop Subsidence.** Efforts to stop and reverse subsidence are a very high priority for sustaining the Delta. New management approaches are needed, particularly managed wetlands and rice that can keep peat soils submerged.
- 2. Enhance Economic Viability.** The economic productivity of Delta lands is critical for generating revenues to support levee maintenance and rehabilitation, even on the public lands. Sustainable sources of public funds are also an important component of economic viability.
- 3. Demonstrate Improved Management.** Public lands could demonstrate a mosaic approach of crops and wetlands to improve both economic and habitat value.
- 4. Support Multiple Benefits.** Opportunities abound for providing multiple, integrated benefits including habitat, flood management, recreation, agricultural sustainability, and carbon sequestration.

## Integrated Priorities

As the public landowners identify and develop conservation actions on their lands, they will consider the opportunities to contribute to one or more of the following priorities. These priorities are described in Section 3.

- Protect and enhance desired ecological functions.
- Stop and reverse subsidence on deeply subsided islands.
- Reduce flood risk.
- Demonstrate opportunities and strategies to increase agricultural sustainability.
- Protect and enhance Delta water quality and water supply.
- Support and improve recreation opportunities and contribute to the regional economy.

## Implementation Goals

The public landowners see value in continued coordination and adaptation as island and tract plans develop, conditions change, and policies evolve. Therefore, the public landowners intend to continue to work with governing and regulatory organizations, other landowners, and other interested parties to improve implementation approaches toward the following goals:

- Coordinated actions and investments to maximize resource benefits and achieve implementation efficiencies.
- Coordinated and simplified review and approval processes for projects that provide multiple benefits for the region.
- Use of management incentives and public-private partnerships to increase efficiency and effectiveness.
- Consideration and mitigation of significant adverse impacts that result from actions and investments.
- Transparency and accountability to reduce conflicts and build support for multi-benefit investments.



## Implementation Considerations

Through the workshops and design charrette, the project participants also identified important implementation considerations and concerns. As plans and projects are developed, these considerations would be addressed in project plans and review and approval processes. These considerations can be grouped generally in three categories:

**Potential Impacts on Adjacent Landowners.** Many participants highlighted the potential impacts on adjacent landowners that could result from management actions and investments on publicly-funded lands. Those concerns include the following:

- *Endangered Species/Safe Harbor.* Improved habitat could result in additional fish and wildlife on and near the restored lands that could lead to regulatory constraints on agriculture or other activities on adjacent lands.
- *Seepage/Levee Impacts.* Changes in levees, wetlands, or floodplains on publicly-funded lands could change hydrodynamics in the vicinity, potentially resulting in increased levee seepage or erosion on adjacent islands and tracts.
- *Trespassing.* Increased public access on publicly-funded lands could increase trespassing, littering, or other related adverse impacts.
- *Water Quality and Water Supply.* Changes in land use, wetlands, and runoff could result in adverse water quality impacts for some users.
- *Loss of Agricultural Production/Regional Economy.* Changes in crops and land uses on publicly-funded lands could result in a loss of agricultural production on those lands, which reduces local revenues available for levee maintenance and could have secondary impacts on the regional economy.
- *Mosquitoes.* Increases in wetlands could result in increases in mosquitoes and resulting public health risks from West Nile Virus and other concerns.

Different public landowners will prioritize different actions in different parts of the Delta based on local constraints and conditions, including topography (e.g., el-



evation and degree of subsidence), physical processes (e.g., the relative influence of tidal vs. fluvial flows), expected future changes (e.g., expected amount and timing of sea-level rise), and ecological needs (e.g., current extent and configuration of nearby habitats). This strategy outlines the high-level constraints and conditions for the publicly-funded lands in the Central and Northeast Delta.

### 3. INTEGRATED CONSERVATION STRATEGY FOR PUBLIC LANDS

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This section describes and depicts a high-level strategy for implementing conservation actions that could provide ecosystem benefits while also contributing to important local and regional objectives, including flood management, agricultural sustainability, recreation and tourism, and the regional economy. The strategies and concepts identified below are not at the project scale. Additional planning and evaluation are needed to describe benefits and consider potential adverse impacts of specific projects. Section 4 describes the general implementation approach.

#### Integrated Priorities

One purpose of this coordinated effort to develop a conservation strategy for publicly-funded lands is to identify how conservation priorities could be aligned with other Delta priorities. The public workshops and the day-and-a-half design charrette were organized to solicit ideas on other priorities and develop collective understanding about the opportunities for integrating actions to achieve multiple objectives and provide greater benefits. Through these workshop discussions, the community members, agencies, experts, and the owners of publicly-funded lands identified five priorities for integrating actions and providing benefits for the region. These priorities received broad support from workshop and charrette participants and form the basis for the strategy described below.

- **Protect and enhance desired ecological functions.** Public landowners can support and implement actions that together contribute to the establishment of an ecosystem that provides habitat to support robust, self-sustaining, and resilient populations of native fish, marsh wildlife, riparian wildlife, waterbirds, and terrestrial wildlife. These actions include the expansion and improvement of wildlife-friendly agricultural practices and green infrastructure on working lands, as well as the conservation and process-based restoration of native Delta ecosystem types—including

tidal wetlands, seasonal wetlands, floodplains, woody riparian vegetation, oak woodlands/savannas, and grasslands.

- **Stop and reverse subsidence on deeply subsided islands.** Stopping and reversing subsidence is fundamental for the long-term sustainability of agricultural practices, levee maintenance, and, ultimately, terrestrial and aquatic habitat connectivity in some areas.
- **Reduce flood risk.** Public lands strategies can and should consider investments to maintain and improve levees to protect terrestrial habitats and economic productivity while considering opportunities to modify or move levees to accommodate flood flows or improve aquatic and riparian habitat.
- **Demonstrate opportunities and strategies to increase agricultural sustainability.** Publicly-funded lands provide an opportunity to explore and demonstrate innovative agricultural and conservation approaches that provide both revenue and ecosystem benefits.
- **Protect and enhance Delta water quality and water supply.** Delta islands and tracts, particularly in the West and Central Delta, serve an important function for protecting Delta water quality and supplies for users in and outside the Delta. Public lands strategies should consider Delta hydrodynamics and changes to water quality that could adversely affect water users.
- **Support and improve recreation opportunities and contribute to the regional economy.** Recreation is an important element of the regional character and economy. Public lands strategies can consider opportunities for increasing and diversifying recreation access and support infrastructure.

These priorities are intended to guide how and where investments on publicly-funded lands could provide the greatest benefit for the public resources and regional economy of the Delta. As these landowners consider conservation actions and other investments for their



lands, they can consider these priorities, coordinate with other programs, and integrate project development efforts. Considering these priorities would increase the benefits provided by actions and projects, improve the connectivity to other initiatives in the region, and diversify the sources of project funding.

## Overall Conservation Strategy for Public Lands

This section provides guidance on supporting the first integrated priority and how that priority can be integrated with the other regional priorities:

### **Protect and enhance desired ecological functions.**

*Public landowners can support and implement actions that together contribute to the establishment of an ecosystem that provides habitat to support robust, self-sustaining, and resilient populations of native fish, marsh wildlife, riparian wildlife, waterbirds, and terrestrial wildlife. These actions include the expansion and improvement of wildlife-friendly agricultural practices and green infrastructure (levee habitat enhancements) on working lands, as well as the conservation and process-based restoration of native Delta ecosystem types (including tidal wetlands, seasonal wetlands, floodplains, woody riparian vegetation, oak woodlands/savannas, and grasslands).*



The section is organized in three major topics:

- 1. High-level considerations** guide conservation planning in the region. These considerations include principles around the importance of process-based restoration, wildlife-friendly working lands, and an overview of the landscape opportunity (i.e., what types of actions are appropriate in different areas).
- 2. An example vision** shows how the public landowners might enhance desired ecological functions across the region over the near and long terms. This vision utilizes science-based guidelines for ecosystem restoration in the Delta.
- 3. Specific guidance for the Central and Northeast Delta** elaborates on the vision by acknowledging local variations in these sub-regions. This guidance includes the types of actions appropriate for each sub-region and how these actions together support different ecological functions and relate to other integrated priorities.

## Additional Resources

These resources provide additional information on the scientific rationale for the conservation strategies described below:

- *A Delta Renewed* describes process-based restoration in the Delta by geomorphic zone in greater detail and scientific rationale (SFEI-ASC 2016).
- Justification and break down for the process of establishing an ecological vision guided by *A Delta Renewed*, as applied to the Northeast Delta, is explored in more detail in *Resilient Landscape Vision for the Northeast Delta* (Safran et al. 2018).
- A technical presentation with guiding principles and associated spatially explicit restoration opportunities informed by *A Delta Renewed* can be found in Safran et al. 2018.

## High-level considerations

**Desired Ecological Functions.** The vision supports a suite of desired ecological functions. Ecological functions of interest are shown in Figure 3.1 (derived from SFEI-ASC 2014 & 2016).

Conservation actions and projects can and should be integrated to cumulatively support these ecological functions. Each of these functions has an associated list of guiding principles, based on recommendations compiled in *A Delta Renewed* (SFEI-ASC 2016) and further developed through this and other related efforts (e.g., Safran et al. 2018). This work was then used to develop the vision maps on pages 13 and 14. For example, to support habitat and connectivity across the landscape for marsh wildlife, one guiding principle proposes that moderately-sized marshes of greater than 100 hectares (ha) (approximately 250 acres) should be placed at least every 5 kilometers (km), which the landscape vision reflects. An emphasis on public lands in some cases limits the capacity to implement all aspects of these guiding principles. For example, if the lands surrounding a marsh are privately held, establishing functional terrestrial-transition zone above marshes is not always possible.

**Location matters.** Many environmental gradients span the Delta, including gradients in elevation, salinity, turbidity, degree of subsidence, and relative degree in tidal and fluvial influence. These gradients all inform conservation opportunities in a given location. The Central and Northeast Delta, for instance, support somewhat distinctive sets of conservation opportunities. Figure 3.2

Figure 3.1.  
**Ecological functions supported by the Delta.**



### **FISH**

Provides habitat and connectivity for native fish



### **MARSH WILDLIFE**

Provides habitat and connectivity for native marsh wildlife



### **WATERBIRDS**

Provides habitat and connectivity for native waterbirds



### **RIPARIAN WILDLIFE**

Provides habitat and connectivity for native riparian wildlife



### **EDGE WILDLIFE**

Provides habitat and connectivity for native edge wildlife



### **BIODIVERSITY**

Maintains biodiversity by supporting diverse natural communities



### **PRODUCTIVITY**

Maintains food supplies and nutrient cycling to support food webs

and the associated tabular descriptions depict the landscape potential in the Central Delta and demonstrate the full potential of what actions can be supported best in different geomorphic zones (based primarily on elevation and informed by approximate areas of tidal and fluvial influence), identified in Chapter 3 of *A Delta Renewed* (SFEI-ASC 2016).



Figure 3.2 Landscape Potential in the Central and Northeast Delta

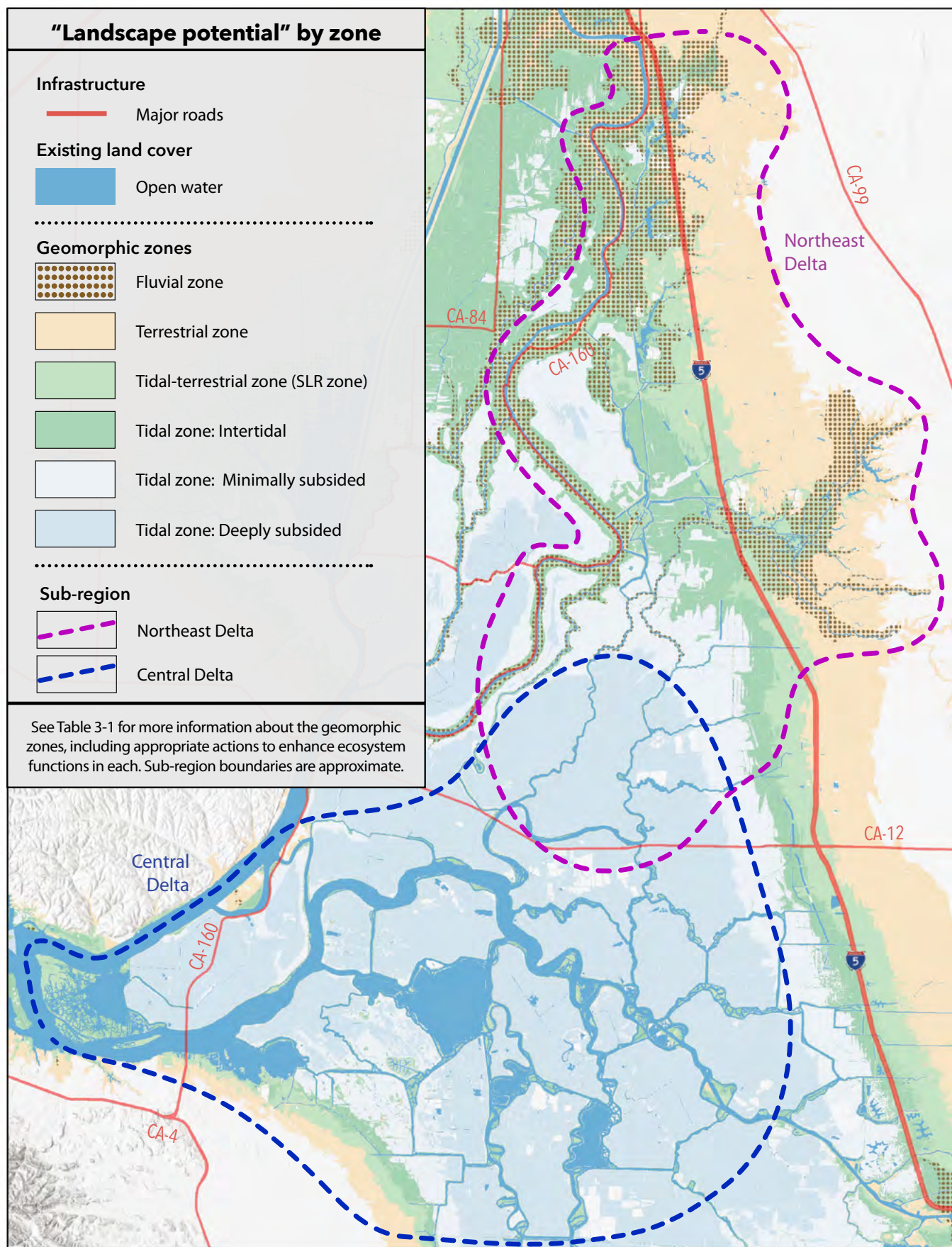


Table 3.1. Describing and distinguishing geomorphic zones. These zones are mapped in Figure 3.2.

Geomorphic zone and description	Key opportunity types (actions)	Key habitat types	Key ecological functions	Ecosystem services + -	
<b>FLUVIAL ZONE:</b> Areas that are potentially subject to strong fluvial influence that could potentially support riverine habitat types and features. Roughly defined by the historical extent of natural levees, riparian habitat types and non-tidal freshwater emergent wetlands. Note that, while fluvially-dominated, much of the fluvial zone is still tidally influenced.	<ul style="list-style-type: none"> <li>Woody riparian restoration</li> <li>Levee habitat improvements</li> <li>Floodplain and flood basin restoration</li> <li>Wildlife-friendly agriculture (e.g., hedgerows)</li> </ul>	<ul style="list-style-type: none"> <li>Woody riparian habitat types</li> </ul>	<ul style="list-style-type: none"> <li>Fish</li> <li>Riparian wildlife</li> <li>Waterbirds</li> </ul>	<ul style="list-style-type: none"> <li>Recreation</li> <li>Potential improved flood control</li> <li>Pollination/pest management</li> <li>Reduction in levee maintenance/repairs</li> <li>Wood/fuel, Windbreaks</li> <li>Improved water quality</li> </ul>	<ul style="list-style-type: none"> <li>Potential loss of agricultural acreage/revenue</li> </ul>
<b>TERRESTRIAL ZONE:</b> Areas higher than the projected reach of 6 ft [1.8 m] of sea-level rise over the next century and therefore expected to remain above the influence of the tides over a relatively long period of time. Represents elevations >3.8 m NAVD88 (more than 6 ft [1.8 m] above current MHHW).	<ul style="list-style-type: none"> <li>Seasonal wetland and dryland habitat type restoration</li> <li>Wildlife-friendly agriculture (e.g., rangeland management)</li> <li>Urban greening</li> </ul>	<ul style="list-style-type: none"> <li>Terrestrial habitat types (seasonal wetlands, wet meadows, vernal pool complexes, oak woodlands, grasslands)</li> </ul>	<ul style="list-style-type: none"> <li>Waterbirds</li> <li>Edge wildlife</li> </ul>	<ul style="list-style-type: none"> <li>Recreation</li> <li>Potential improved flood control</li> <li>Pollination/pest management</li> <li>Windbreaks</li> <li>Improved water quality</li> </ul>	<ul style="list-style-type: none"> <li>Potential loss of agricultural acreage/revenue</li> </ul>
<b>TIDAL-TERRESTRIAL ZONE:</b> Areas that are not currently at intertidal elevation, but could be with up to 6 ft [1.8 m] of sea-level rise. These areas are therefore expected to transition over the long term from terrestrial to tidal. Represents elevations between 2.0 and 3.8 m NAVD88 (between present MHHW and MHHW plus 6 feet of SLR).	<ul style="list-style-type: none"> <li>Restoration of t-zone (e.g., remove barriers)</li> <li>Seasonal wetland and terrestrial habitat restoration</li> <li>Wildlife-friendly agriculture (e.g., seasonally inundated fields)</li> <li>Land-side terrestrial habitat restoration</li> </ul>	<ul style="list-style-type: none"> <li>Transition zone habitat types</li> </ul>	<ul style="list-style-type: none"> <li>Marsh wildlife</li> <li>Waterbirds</li> <li>Edge wildlife</li> </ul>	<ul style="list-style-type: none"> <li>Recreation</li> <li>Potential improved flood control</li> <li>Pollination/pest management</li> <li>Improved water quality</li> </ul>	<ul style="list-style-type: none"> <li>Potential loss of agricultural acreage/revenue</li> </ul>
<b>TIDAL ZONE (INTERTIDAL):</b> Areas currently at intertidal elevation. Expected to transition in the long term from intertidal to subtidal, or to maintain intertidal elevation through marsh accretion. Represents elevations between 0.6 and 2.0 m NAVD88 (between present MLLW and MHHW).	<ul style="list-style-type: none"> <li>Tidal marsh restoration</li> <li>Levee habitat improvements (e.g., planting benches)</li> <li>Wildlife-friendly agriculture (e.g., rice)</li> </ul>	<ul style="list-style-type: none"> <li>Tidal marsh</li> </ul>	<ul style="list-style-type: none"> <li>Fish</li> <li>Marsh wildlife</li> <li>Waterbirds</li> </ul>	<ul style="list-style-type: none"> <li>Recreation</li> <li>Potential improved flood control</li> <li>Reduction in levee maintenance/repairs</li> <li>Improved water quality</li> <li>Carbon sequestration</li> </ul>	<ul style="list-style-type: none"> <li>Potential loss of agricultural acreage/revenue</li> <li>Levee seepage</li> <li>Mercury methylation</li> <li>Potential downstream increases in salinity</li> </ul>
<b>TIDAL ZONE (MINIMALLY SUBSIDED):</b> Areas that, if connected to the tides, would be permanently inundated at a depth of less than 2.5 m at MLLW (the amount of elevation that could be recovered in 50 years, assuming 5 cm of reverse subsidence per year). Expected to transition in the long term to deeper subtidal habitat with no action, or to recover elevation toward intertidal elevation with targeted reverse subsidence efforts. Represents elevations between -1.9 and 0.6 m NAVD88 (2.5 m or less below present MLLW).	<ul style="list-style-type: none"> <li>Non-tidal managed wetlands</li> <li>Levee habitat improvements</li> <li>Wildlife friendly agriculture (e.g., rice)</li> <li>Tidal marsh restoration [long term]</li> </ul>	<ul style="list-style-type: none"> <li>Managed wetlands [near term]</li> <li>Tidal marsh [long term]</li> </ul>	<ul style="list-style-type: none"> <li>Fish [long term]</li> <li>Marsh wildlife</li> <li>Waterbirds</li> </ul>	<ul style="list-style-type: none"> <li>Recreation</li> <li>Potential improved flood control</li> <li>Reduction in levee maintenance/repairs</li> <li>Improved water quality</li> <li>Carbon sequestration</li> </ul>	<ul style="list-style-type: none"> <li>Potential loss of agricultural acreage/revenue</li> <li>Levee seepage</li> <li>Mercury methylation</li> <li>Potential downstream increases in salinity</li> </ul>
<b>TIDAL ZONE (DEEPLY SUBSIDED):</b> Areas that, if connected to the tides, would be permanently inundated at a depth of more than 2.5 m at MLLW. Expected to transition in the long term to even deeper subtidal habitat with no action, or to recover some elevation with targeted reverse subsidence efforts. Represents elevations less than -1.9 m NAVD88 (>2.5 m below present MLLW).	<ul style="list-style-type: none"> <li>Non-tidal managed wetlands</li> <li>Levee habitat improvements</li> <li>Wildlife friendly agriculture (e.g., rice)</li> <li>Tidal marsh restoration [long term]</li> </ul>	<ul style="list-style-type: none"> <li>Managed wetlands [near term]</li> <li>Tidal marsh [long term]</li> </ul>	<ul style="list-style-type: none"> <li>Fish [long term]</li> <li>Marsh wildlife</li> <li>Waterbirds</li> </ul>	<ul style="list-style-type: none"> <li>Recreation</li> <li>Potential improved flood control</li> <li>Reduction in levee maintenance/repairs</li> <li>Improved water quality</li> <li>Carbon sequestration</li> </ul>	<ul style="list-style-type: none"> <li>Potential loss of agricultural acreage/revenue</li> <li>Levee seepage</li> <li>Mercury methylation</li> <li>Potential downstream increases in salinity</li> </ul>

**Process-based Restoration.** The vision seeks to conserve and restore native ecosystem types wherever possible (including tidal wetlands, seasonal wetlands, floodplains, woody riparian vegetation, oak woodlands/savannas, and grasslands) through process-based restoration (Beechie et al. 2010; SFEI-ASC 2016). For many of these ecosystem types, the reconnection of land and water is a critical component of process-based restoration where physically possible. This type of re-connection (achieved, for example, by removing, breaching, or reconfiguring levees where elevations are appropriate) can restore important hydrological processes and promote the establishment of dynamic and adaptable habitat, such as floodplains and flood basins, tidal marshes, and woody riparian vegetation. Conserving and restoring large and connected habitats types is also important, since many important physical and ecological processes require large patches to operate (or scale with patch size) and are driven by exchanges of energy, materials, and biota between different habitat types. For example, restoring terrestrial habitat above marshes within the tidal-terrestrial transition zone allows wildlife to access different resources at different times of the year, and allows marshes to migrate and persist over time with sea-level rise. Finally, promoting within-habitat heterogeneity is both an important component and outcome of process-based restoration. For example, restoring marshes large enough to support a blind channel network can also increase the heterogeneity of aquatic habitats, since blind channels generate gradients in residence time, temperature, and turbidity.

**Wildlife-friendly Agriculture and Green Infrastructure.** Where process-based restoration is not feasible, public landowners can still enhance desired ecological functions through other means—particularly the expansion and improvement of wildlife-friendly agricultural practices and green infrastructure on working lands. Most of the Delta is agricultural lands, including a sizeable amount on public lands. Opportunities abound

to create various types of habitat on agricultural lands, including through the seasonal flooding of agricultural lands (such as rice and other grain fields) that support wildlife. Other opportunities include modifying levees to support marsh or woody riparian channel margin habitat (Davenport et al. 2016); integrating perennial managed wetlands into the agricultural matrix to provide habitat, reverse subsidence, and generate revenue through the carbon market (e.g., Deverel et al. 2014; American Carbon Registry 2017); and implementing other best management practices and techniques (agroforestry and diversified farming) to improve habitat and connectivity for wildlife on working lands (Kremen and Merenlender 2018). Urban greening also has potential to provide some benefits by integrating ecological functions into urban areas through green stormwater infrastructure, native plantings in urban forestry, and landscaping.

**Long-term Planning.** Long-term planning is a critical component of an effective conservation strategy. Near-term actions should support a long-term vision (and not preclude important long-term opportunities). In general, the goal is to restore natural processes that allow these habitats to evolve over time with change, rather than restoring static habitats that need to be maintained in place forever. For example, a key element of this strategy is to allow for the migration of marshes over time with sea-level rise. To achieve this long-term goal, near-term work can conserve lands upslope of marshes, remove barriers to tidal flows on these lands, and mitigate losses in upland habitat types that are likely to become tidal in the future. Other examples of near-term actions to support long-term goals include the beneficial reuse of sediment and the establishment of non-tidal managed wetlands to reverse subsidence in subsided areas that could eventually reach intertidal elevation, especially in minimally subsided areas. Even where intertidal elevations are not reached, these features can provide support for marsh wildlife and increase levee stability to protect other ecosystem services provided by the islands.



## ***An Example Vision***

The following maps present an ecological-based vision for the network of public lands in the Central and Northeast sections of the Delta. The vision depicts opportunities almost exclusively on public lands (along with conservation easements on private lands) and incorporates existing and planned conservation projects on these lands. The opportunities represent a synthesis of ecological guidance following from policy and research reports, feasibility considerations from the landscape potential map (Figure 3.2), and consideration of other integrated priorities.

Figures 3.3 and 3.4 show examples of near- and long-term vision maps for the publicly-funded lands in the Central and Northeast Delta. These maps represent changes in environmental conditions, habitat evolution, and landscape trajectory over time. Other iterations of this arrangement of conservation actions are possible—what is shown here is one example of how the public lands could cumulatively improve support for desired ecosystem functions. The vision and its individual com-

ponents ultimately need to be aligned with the related integrated priorities.





“Near term” is defined as all activities that would best be implemented as soon as possible, or additionally correspond with the timeline of existing or planned conservation projects. An exact time frame is not proposed, due to the uncertainty around progression of environmental changes in the Delta as well as the desire to provide flexibility for management agencies for the most appropriate mechanisms and coordination of conservation. “Long term” is defined as the progression and desired distribution of processes and habitat types on the landscapes over a much longer timeframe, as well as incorporating predicted changes in landscape trajectory and distribution of processes and habitat types with sea-level rise. Not all deeply subsided wetlands may be expected to recover even in this time period.

Following the maps are narrative descriptions of integrated priorities, strategies, and desired ecosystem functions in the Central and Northeast Delta.







## Landscape vision components (detailed legend for Figures 3.3 and 3.4).




### MARSH & TIDAL CHANNEL RESTORATION

-  **Non-tidal managed wetlands** • Hydrologically-disconnected marshes that can provide habitat, sequester carbon, halt/reverse subsidence, and reduce the risk of levee failure. Can incorporate terrestrial habitat types on levees and berms above marshes to provide transition zone.
-  **Tidal marsh** • Marshes at intertidal elevation with full tidal influence. Blue lines denote potential dendritic channel networks embedded in marshes. Note that the creation of tidal marshes in subsided areas will only be possible through fill placement or long-term sustained reverse subsidence (on the order of centuries in some of the depicted areas). Even if tidal marsh is not ultimately achieved in some of these locations, non-tidal wetlands managed for reverse subsidence will provide other benefits (See above).
-  **Levee habitat enhancements- marshes** • Water-side levee modifications to support narrow marshes along channel margins.
-  **Reconfiguration of channel cuts** • Potential to restore long blind/dendritic channel networks through flow barriers.



### WOODY RIPARIAN & FLUVIAL ZONE RESTORATION

-  **Woody riparian habitat type restoration on natural levees** • Restoration along existing or historical natural levee areas. Opportunity areas denoted with line to highlight concept of riparian corridor, but width of line not to scale with expected habitat width.
-  **Levee habitat enhancements - woody riparian** • Levee modifications (e.g., planting benches) to support limited woody riparian vegetation where process-based restoration not possible.
-  **Willow thickets and willow-fern swamps** • Woody vegetation supported in areas with high-groundwater (including in tidal zone embedded within marshes).
-  **Floodplains and flood basins** • Areas subject to periodic inundation from riverine flows. Underlying habitat type dependent on landscape position, but mostly mixed woody riparian, seasonal wetlands, and non-tidal marshes. Not shown in areas that are subject to tidal inundation now or over long-term, even though these areas can function as floodplains (instead see "Tidal marsh" above and "Restoration of marsh transition zone" below).

### TERRESTRIAL & TRANSITION ZONE RESTORATION

-  **Restoration of marsh transition zone (seasonal wetlands and dryland habitat types above marshes)** • Prepare for future marsh migration with sea-level rise by removing tidal flow barriers. Underlying habitat type dependent on landscape position (see below). Likely to be fluvially inundated in many cases during high flow events.
-  **Seasonal wetland habitat types** • Including wet meadows, alkali seasonal wetlands, and vernal pool complexes. In some areas (particularly the Cosumnes Preserve), also includes a mosaic of other mixed non-tidal wetlands, including perennial marsh and woody riparian vegetation.
-  **Dryland habitat types** • Oak woodlands, grasslands, and stabilized interior dunes

### INTEGRATING ECOLOGICAL PROCESSES WITH HUMAN LAND USES

-  **Wildlife-friendly agriculture** • Crop selection and managed flooding of fields to support wildlife. Potential for rice to halt subsidence.
-  **Urban greening** • Improvements include urban stream restoration, native street trees/landscaping, and installation of green storm-water infrastructure.

#### COMPONENTS CATEGORIZATION




-  **Potential** modification in **particular** location
-  **Potential** modification in **general** location
-  **Existing** habitat type

Figure 3.3. Example near-term landscape vision for supporting desired ecosystem functions.

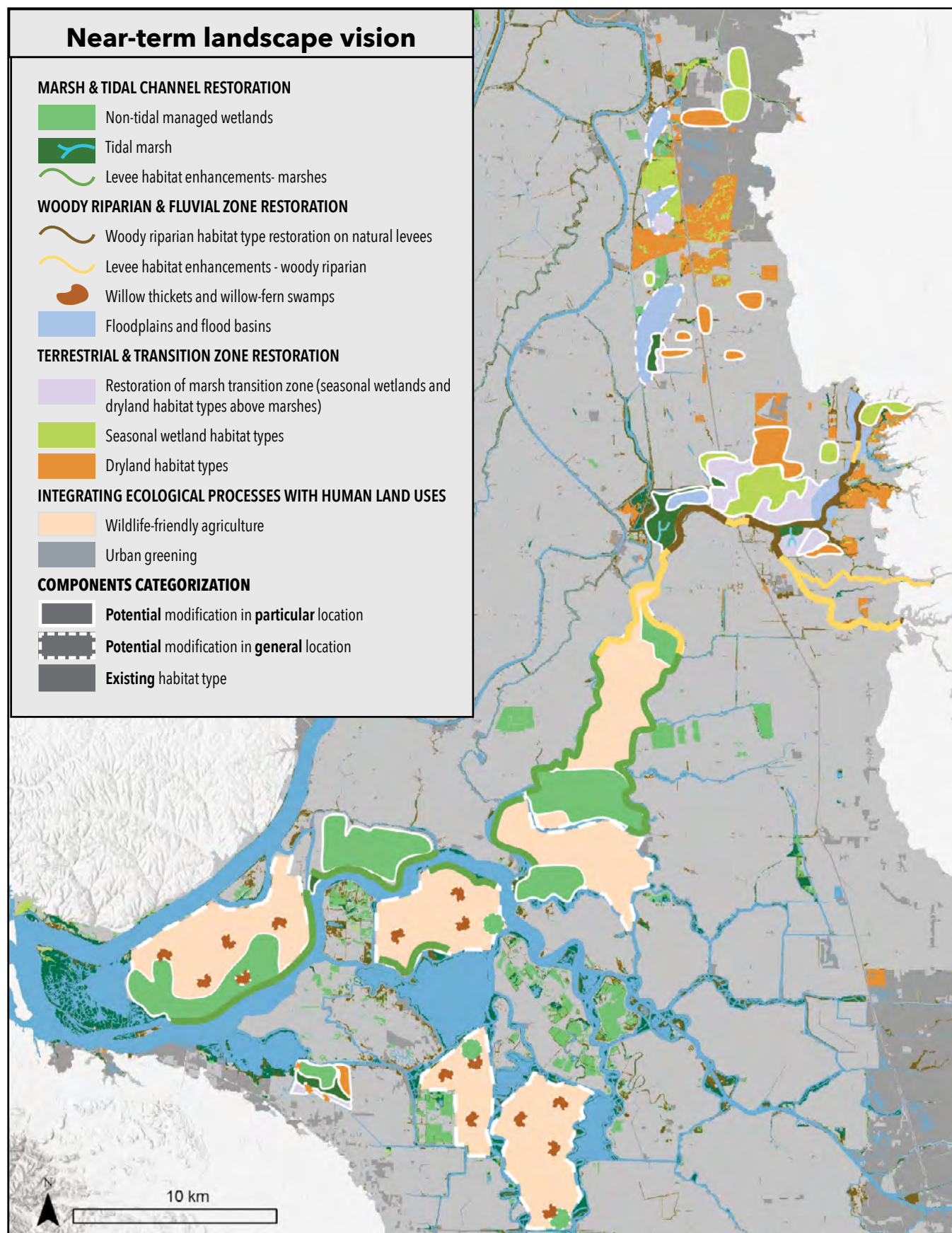
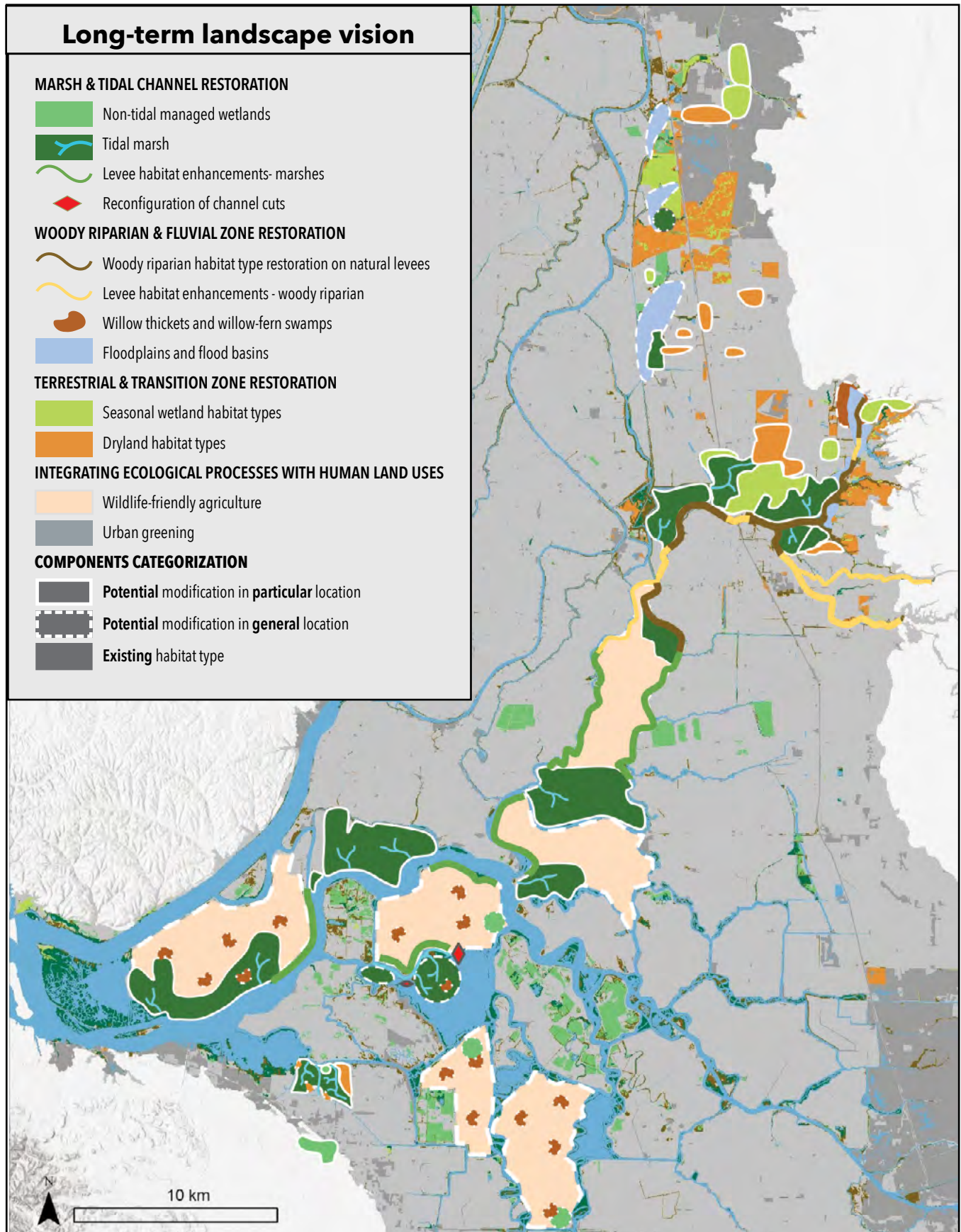




Figure 3.4. Example long-term landscape vision for supporting desired ecosystem functions.



## Specific Guidance for Central and Northeast Delta Public Lands Strategy

### Central Delta Strategy

Historically, the Central Delta was characterized by immense islands of tidal freshwater emergent marsh. These extensive marshes were inundated by daily tides, and during the wet season, some areas were fully submerged. Tidal sloughs branched out like capillaries into dendritic channel networks, exchanging tides on and off the wetland plain and promoting the exchange of nutrients and organic materials. Patches of stabilized interior dune vegetation and willow-fern swamps dotted the marshes, contributing to diversity of the landscape (Whipple et al. 2012).

Beginning in the mid-1800s, much of the Central Delta was diked, drained, and converted to agriculture. Over time, this landscape conversion led to widespread land subsidence, and subsequent levee failures have led to permanent island flooding (SFEI-ASC 2014). Thus, in addition to other challenges for conservation and management in the Central Delta—water quality, the proliferation of non-native predators, and the paucity of native habitat types—subsidence and levee stability are of high concern today. There are opportunities to address these challenges with strategically placed managed wetlands, levee improvements, and wildlife-friendly agriculture.

#### **Integrated Priorities: Benefits and Tradeoffs**

- **Stop and reverse subsidence.** The actions highlighted in the vision—including managed non-tidal marshes, expansion of wildlife-friendly agriculture (such as rice), and the creation of tidal marshes—have the potential to halt and reverse subsidence in the Central Delta. Although recovering elevation to sea level using managed marshes may take centuries and may not be a reasonable goal in some places (Deverel et al. 2014), these projects would still provide near-term benefits to waterbirds and other marsh wildlife, significantly reduce carbon emissions, sequester carbon, and likely improve levee stability, even if intertidal elevations are never reached. Given the importance of stopping subsidence in deeply subsided areas of the

Delta, additional research, pilot projects, and investments are needed to accelerate these efforts.

- **Maintain and strengthen levees and accommodate flood flows.** To sustain managed wetlands and other wildlife habitats in the Central Delta over the long term, significant investment in levee maintenance will be required. Halting and reversing subsidence through the expansion of rice cultivation and managed wetlands, would be expected to improve levee stability and reduce flood risk on Central Delta islands over time to some degree (Deverel et al. 2014). There are opportunities to incorporate habitat improvements into routine levee maintenance and major levee upgrades, although questions remain about the sustainability of these habitats due to boat wake stress and the expected ecological benefits relative to the high cost of these actions. Given these questions, current and planned projects should be researched and monitored.
- **Demonstrate innovative economic productivity approaches for Delta lands.** The long-term sustainability of agriculture is threatened by the risk of levee failure and flooding on deeply subsided islands, a problem only exacerbated by forms of agriculture that contribute to subsidence. With managed marshes comes opportunity for increased ecotourism, as well as opportunities for paludiculture (the use of wet and rewetted peatlands for agriculture) and other innovative wetland farming techniques that could yield economic benefits. Rice cultivation would also be expected to yield revenue while providing some ecosystem benefits. Managed wetlands and rice cultivation might therefore play a role in maintaining the economic viability of agriculture in subsided areas by improving levee stability. These actions might make the most sense in areas that already experience reduced yields due to subsidence and the accumulation of salts (e.g., the south end of Staten Island). Finally, managed wetlands can contribute to economic viability by providing access to emerging carbon

markets (ACR 2017). Additional research and pilot efforts are needed to understand more fully the viability and benefits of these approaches.

- **Protect and enhance Delta water quality and water supply.** Increased production of rice may impair water quality if significant quantities of pesticides are used without mitigation. Additional managed wetland habitats may help mitigate water quality degradation in some areas. Increased monitoring and additional mitigation measures would likely be required with additional rice production.
- **Increase recreation access and opportunity, compatible with conservation actions.** Opportunities for wildlife viewing would likely be expanded with increases in habitat provision. Improvement of channel margins in some areas could increase the natural aesthetic for boating experiences.

### **Key conservation strategies in the Central Delta**

- **Managed wetlands and long-term tidal marsh restoration:** Prioritized and arranged in a way to support species movement and wildlife population connectivity (e.g., marsh patches at regular intervals across Staten, Bouldin, Franks Tract, Twitchell, and Sherman). Tidal marsh restoration is included for some areas of the Central Delta, but more evaluation is needed to determine if tidal elevations could be restored on subsided lands in a reasonable long term. Note that wetlands in subsided parts of the Central Delta are vulnerable to levee failure and catastrophic flooding. While actions here can provide near-term benefits, such as roosting sites for Sandhill Cranes, it will be important over the long term to expand water bird habitat in less risky parts of the region (e.g., the Northeast Delta).
- **Expand wildlife-friendly agriculture in subsided areas:** Permanently flooded crops such as rice provide an alternative to managed wetlands to limit subsidence and sustain agriculture in the Central Delta (e.g., Webb Tract).
- **Conservation/restoration of rare habitat types—dunes and willow-fern swamps:** Opportunities to restore heterogeneity and conserve or restore rare

habitat types such as stabilized interior dune and willow-fern swamp fragments (e.g., near Dutch Slough).

- **Channel margin enhancements through levee modifications:** Planting benches on levees with fringing marshes may provide some near-term ecological benefit for aquatic and riparian habitats (e.g., along Bouldin Island).
- **Reconfiguration of channel cuts:** Reconfiguring channel cuts can help restore blind dendritic channel networks that promote habitat heterogeneity and the exchange of energy, matter, and biota (e.g., Franks Tract).
- **Conserve and restore in-channel islands:** As some of the last remnant tidal freshwater emergent wetlands, these habitats may hold unique genetic diversity and ecological value. However, these habitats are under continual threat from erosion, and more research is needed to understand the value and restoration of these areas (e.g., San Joaquin River islands near Twitchell Island and Webb Tract).

### **Supporting ecological functions in the Central Delta**

Priority ecosystem functions in the Central Delta include providing habitat and connectivity for marsh wildlife, fish, and waterbirds and increasing overall primary productivity to support food web processes.

- **Marsh wildlife:** Near-term managed marshes in subsided areas may benefit marsh wildlife, even if these marshes are disconnected from tidal action. Benefits could be enhanced over the long term as large functional marshes recover elevation and habitat complexity. Marshes of at least 100 ha (approximately 250 acres) should be placed at least every 5 km to support habitat and connectivity for marsh wildlife across the Central Delta (see SFEI-ASC 2016).
- **Fish:** In the near term, exported pulses of productivity of managed marshes channel margin enhancements may benefit fish. The Central Delta is generally a hostile place for native fish, but significant improvements in extent and quality of rearing habitat could help change this over the long term. In the long term, marshes of at least 500 ha (approximately 1,250



acres) are thought to be required to support dendritic channel networks and high-quality rearing habitat (SFEI-ASC 2016). Creating these features at regular intervals (at least every 20 km) along major fish migratory corridors would be expected to improve fish survival and growth as they move through the Delta (SFEI-ASC 2016). This sort of network can only be realized through long-term projects to reverse subsidence.

- **Waterbirds:** Managed marshes and any additional open water habitat that may develop in the long term

can support some waterbirds. Wildlife-friendly agriculture, in the form of rice or grains, can also support waterbirds in the Central Delta. A functional mosaic of inundated habitat types is needed to support the full diversity of waterbirds.

- **Food web:** Managed marshes can potentially provide short-term exports of productivity, and long-term food web support with development into tidal marshes. Rice and grain fields can also provide forage for key waterbirds, such as cranes and geese.

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## Northeast Delta Strategy

Historically, the Northeast Delta was characterized by broad natural levees on the Sacramento and Mokelumne rivers, with broad zones of non-tidal marsh accommodating fluvial floodwaters. These non-tidal marshes transitioned to tidal wetland towards the Central Delta. Vegetation on the natural levees of the region transitioned from woody riparian forest upstream to riparian scrub as the size of the levees decreased downstream. These natural levees provided connected riparian habitats that facilitated the movement of terrestrial and riparian wildlife, shade for aquatic organisms, and sediment that transported downstream enabling the growth and maintenance of marshes. As it entered the Delta, the Cosumnes River spread into many distributaries and supported a large willow thicket, before converging into a single tidal channel near the confluence with the Mokelumne. The edge of the Delta supported seasonal wetlands and various terrestrial habitat types that graded into the lower perennial wetlands, creating an important transition zone (Whipple et al. 2012).

Overtime, much of the Northeast Delta has been converted to agriculture. The functional flows that maintained long-term and extensive inundation are interrupted or lessened (especially along the Mokelumne and Sacramento rivers) due to changes in water management and landscape structure. The Northeast Delta no longer spreads water and sediment over vast tracts of flood-

plains and marshes, as wetlands have been diked and drained for agriculture and levees constructed for flood protection. Some habitat types have been lost nearly entirely, such as oak woodlands/savannas (separate from dense oak-dominated riparian forests, which are still found in the northeast Delta), while most others have been dramatically reduced in extent (SFEI-ASC 2014). All this said, subsidence is more minimal here and the Cosumnes River Preserve retains more functional flows, seasonal inundation, and habitat connectivity than in the Central Delta. There are opportunities to create resilient mosaics of wildlife-friendly agriculture, tidal marshes, floodplains, connected woody riparian corridors, and terrestrial habitats that evolve over time in response to climate change and sea-level rise.

### **Integrated priorities: Benefits and Tradeoffs**

- **Stop and reverse subsidence.** Subsidence is least severe in the Northeast Delta, so reversal can be most cost effective. Elevation to sea level is potentially recoverable in some areas in the near- to medium-term.
- **Maintain and strengthen levees and accommodate flood flows.** Fluvial flooding is of high concern in the Northeast Delta. Expansion of tidal and fluvial floodplain habitat types could mitigate some concerns about levee stability and flood risk. Additional fluvial floodplains and wildlife-friendly habitat that can accommodate high fluvial flows may also help manage flooding.

- **Demonstrate innovative economic productivity approaches for Delta lands.** Increased natural areas improve recreational opportunities and ecotourism, which could supplement the local economy. As in the Central Delta, rice may provide economic opportunity while supporting wildlife. If productive lands are taken out of agriculture for wildlife habitat, alternative sources of funding may be needed to maintain critical infrastructure. Projects that employ process-based restoration are expected to be less expensive to maintain over time than more carefully engineered/managed approaches. In some areas, levees would no longer need to be maintained.
- **Protect and enhance Delta water quality and water supply.** Additional wildlife-friendly habitat with seasonal flooding, as well as additional floodplains and other habitat types like willow thickets, can help recharge aquifers through groundwater storage, potentially helping provide water supply resilience during drought in higher elevation areas with more depleted groundwater.
- **Increase recreation access and opportunity, compatible with conservation actions.** This vision may support more opportunities for wildlife viewing, as well as access for non-motorized boating.

### **Key conservation strategies for the Northeast Delta**

- **Tidal marsh restoration:** The Northeast Delta provides lands at the right elevation for tidal marsh restoration in the near term (e.g., McCormack Williamson Tract [planned]). There are also undeveloped upslope areas that can provide space for marshes to migrate as sea levels rise (e.g., Lost Slough).
- **Managed wetlands and long-term tidal marsh restoration:** The Northeast Delta has areas that are only minimally subsided and could potentially be restored to intertidal elevation through subsidence reversal activities over relatively short timescales.
- **Restoration of marsh-terrestrial transition zone:** Removing barriers to tidal flows (e.g., berms or water control structures) and implementing near-term seasonal wetland restoration above managed or tidal

marshes can provide transitional habitat over the near term and migration space over the long term (e.g., western Cosumnes River Preserve).

- **Floodplains and flood basins:** Supporting broad, hydrologically connected floodplains is important for maintaining fluvial processes and dynamic habitats for waterbirds, riparian wildlife and fish. The Northeast Delta offers large areas suitable for seasonal floodplains (e.g., Grizzly Slough [planned]).
- **Woody riparian habitat type restoration:** Various opportunities exist for restoring a diverse array of connected woody riparian habitat types, including riparian forests upstream (e.g., within the Cosumnes Preserve), riparian scrub downstream (e.g., along the north end of Staten Island), and willow thickets (e.g., at the former site of the Cosumnes Sink).
- **Levee habitat improvements:** Where process-based restoration of woody-riparian habitats is not feasible, the continuity of the riparian corridor can be improved through levee modifications, with planting benches to support some woody riparian habitat vegetation (e.g., on the lower Mokelumne). Further downstream, these levee modifications could support fringing marshes (e.g., along lower Staten Island).
- **Terrestrial habitat types:** The Northeast Delta offers unique opportunities to restore lost or rare terrestrial habitat types, including seasonal wetlands (like vernal pool complexes and wet meadows) and dryland habitats (like oak woodlands/savannas and grasslands). For instance, oak woodlands/savannas could be restored on higher elevation rangelands (e.g., near the uplands of Grizzly Slough). Sea level rise and the risk of levee failure in subsided areas increase the need to restore these habitats in higher elevation areas.
- **Wildlife-friendly agriculture, seasonally flooded fields:** Given the need to transition and migrate habitats and species to higher elevation, combined with the threat of changing crop use patterns from grains to orchards and vineyards in the Delta, supplying seasonally flooded fields (e.g., agricultural fields around or in the Cosumnes River Preserve) at higher elevations is needed.

- **Urban greening:** Coordinated green infrastructure, native plantings, and urban forestry can be performed at large scales in the Northeast Delta (e.g., Sacramento and Elk Grove).

### **Supporting ecological functions in the Northeast Delta**

Priority ecosystem functions in the Northeast Delta include providing habitat and connectivity for marsh wildlife, fish, waterbirds, riparian wildlife, and terrestrial wildlife. Also important is increasing overall primary productivity to support food web processes and enhancing biodiversity through provision and resilience of a variety of communities.

- **Terrestrial wildlife:** Opportunities to restore habitat for terrestrial wildlife are greatest in the Northeast Delta, given the abundance of supratidal habitat. In the long term, some supratidal habitat will become intertidal or subtidal with sea-level rise, so the vision proposes expanding terrestrial habitat types (such as seasonal wetlands and oak woodlands/savannas) in areas above the future sea-level rise zone. This approach would also require protecting the marsh-terrestrial transition zone. Integration of ecosystem elements through urban greening can also support terrestrial wildlife in the large cities on the periphery of the Delta.
- **Riparian wildlife:** Riparian wildlife would have the greatest opportunity for benefit here, given the wide expanses of woody riparian habitat already present and potential for additional restoration to connect gaps in habitat. Restoring corridors can aid with wildlife population migration over time. Restoring rare or lost willow thickets can improve habitat and wildlife diversity.
- **Marsh wildlife:** Tidal marsh restoration, managed wetlands, and restoration of marsh-terrestrial transition zone can support a broad array of marsh wildlife and allow marshes to migrate and expand with sea-level rise.
- **Fish:** Native fish can potentially benefit from large fluvial floodplain habitat and expansion of rearing habitat in the Northeast Delta in the long term. Also in the long term, large marshes that support dendritic channel networks can be strategically placed to support functional rearing habitat, as described in the Central Delta section. Woody riparian habitat in the fluvial zone can provide fish with supplemental food resources, cover, and local habitat heterogeneity.
- **Waterbirds:** The Northeast Delta can support an array of wetland types to support a diversity of waterbirds. These wetland types include tidal marshes (e.g., McCormack-Williamson Tract [planned]), non-tidal marsh and floodplains (e.g., Grizzly Slough [planned]), woody riparian vegetation (throughout the Cosumnes Preserve), seasonal wetlands (e.g., Cosumnes Preserve, Stone Lakes), and ponds (already existing at Stone Lakes). Conversion of flooded agricultural lands and managed wetlands to tidal marsh may displace some habitat for cranes, some shorebirds, and waterfowl. As noted above, subsided parts of the Central Delta with important waterbird habitat are vulnerable to levee failure and catastrophic flooding. It will be important over the long term to expand waterbird habitat in less risky parts of the region. This habitat should be re-established upslope and further to the periphery of the Delta over the long term (there is extensive opportunity for flooded agriculture across the greater Central Valley, but nowhere else can tidal freshwater marshes be supported).
- **Food web:** The region supports abundant productivity of different types from various habitat types, especially in high productivity environments such as large tidal marshes and fluvial floodplains.
- **Biodiversity:** By envisioning a broad variety of diverse habitat types and habitat heterogeneity, in connected blocks, this strategy promotes the capacity to sustain species from many different guilds throughout space and time. Redundancy of habitat patches and types can allow for source population recolonization with local extinction and resilience.





## Related Programs and Organizations

Numerous related programs provide guidance, requirements, and funding for actions that touch on the integrated priorities identified in this strategy. As the owners and managers of publicly-funded lands develop and implement management actions and investments for their islands and tracts they can coordinate with the following programs to identify and prioritize mutually beneficial opportunities consistent with this strategy.

- Flood management planning and Delta levees programs. Sacramento, Contra Costa, and San Joaquin counties flood management, Sacramento Area Flood Control Agency, San Joaquin Area Flood Control Agency, Central Valley Flood Protection Board, and DWR FloodSAFE (Small Communities Program, Delta Levees Special Projects, and Delta Levees Subventions).
- Delta conservation and restoration programs. Delta Conservancy, Delta Stewardship Council, CA Department of Fish and Wildlife, CA Department of Water Resources, U.S. Fish & Wildlife Service, National Marine Fisheries Service, and Central Valley Joint Venture.
- Recreation support and investment. Sacramento County Parks, East Bay Regional Parks, CA State Parks, Bureau of Land Management, and others.
- Delta economic development. Delta Protection Commission, Delta Conservancy, CA Department of Food and Agriculture, U.S. Department of Agriculture.

## 4. IMPLEMENTATION APPROACHES AND NEXT STEPS

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This section provides a general description of how the participating and authoring organizations anticipate further development and implementation of the concepts described in Section 3,

### Integration with Other Policy and Planning Processes

The project participants expect that this strategy will inform and enhance multi-benefit policy, project planning, and funding priorities for the following organizations.

**Conservancy.** Project grant-making process for Propositions 1 and 68 and other available funds.

**California Department of Fish and Wildlife.** Conservation Framework for the Delta and project grant-making process for Propositions 1 and 68 and other available funds.

**Delta Stewardship Council.** This strategy incorporates habitat restoration and risk reduction concepts from Chapter 4 of the Delta Plan (Protect, Restore, and Enhance the Delta Ecosystem) and other chapters.

**Delta Protection Commission.** The Delta Economic Sustainability Plan.

**California Department of Water Resources.** Delta Levees Subventions and Special Projects programs and flood planning for the Northeast Delta.

**California Department of Parks and Recreation.** Parks planning and management for the Delta region.

**California Natural Resources Agency.** EcoRestore project planning and California Water Fix mitigation planning.

**Central Valley Flood Protection Board.** Central Valley Flood Protection Plan and the associated Conservation Strategy and regional advance mitigation planning.

**Central Valley Joint Venture.** The Central Valley Joint Venture can provide valuable guidance on the habitat needs and priorities for a broad variety of bird species.

**Local and Regional Planning.** This strategy and multi-benefit concepts can be considered, incorporated in, and coordinated with local and regional flood management, recreation, water supply, and water quality planning, including Sacramento Area Flood Control Agency and Sacramento County flood planning in the Northeast Delta, Sacramento County and East Bay Regional Parks recreation planning, and others.

### Landowner Plan Development

The landowners of publicly-funded lands can use this strategy and the multi-benefit concepts to guide their planning and project development for the lands in their jurisdiction. Each public landowner has its own planning process, and each has a different management and governance structure for approving plans, priorities, and projects. This strategy provides guidance on conservation planning and opportunities for contribution to regional benefits. As plans and projects are developed, the landowners anticipate pursuing funding as necessary for review, permitting, and implementation.

### Funding

In the near term, as projects are identified, the working group participants identified the following sources of funds.

- **State grants** are, or may be, available from recent or future bond measures through the Conservancy, CDFW, the California Wildlife Conservation Board, DWR, California State Parks, and others.
- **Federal funds** may be available through federal partners, such the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Natural Resources Conservation Service, or other federal programs.
- **Mitigation funds** may be available from land development and infrastructure projects that have impacts in or around the Delta.

- **Other programs and partners** such as flood management, climate programs, or regional or county parks may also be available to support near-term projects.

## Pilot Projects and Research

While this strategy describes a high-level near- and long-term vision for the Central and Northeast Delta, there are substantial questions and uncertainties to address. Many of the projects implemented to date on these publicly-funded lands have provided valuable information on the benefits and impacts of various conservation and land management approaches. For example, Sherman and Twitchell Islands have been research laboratories for subsidence reversal, carbon sequestration, and crop strategies that can inform future planning and management.

The project participants noted the continued need for research and pilot projects to learn and adapt strategies and concepts for the future. This strategy can focus and accelerate pilot projects and research activities on the public lands in the Delta. The public landowners and other participants can and should use this strategy to

identify pilot projects and research activities to refine and adapt the strategy. For example, there is interest in expanding rice cultivation in the Delta to stop subsidence, provide economic value, and provide forage for wildlife. To date, rice cultivation results in the Delta have been mixed. Additional research and pilot efforts are needed to assess the needs, benefits, and viability of rice cultivation.

## Coordination

The project participants see value in continuing coordination and communication among the publicly-funded landowners, related programs, Delta stakeholders, and the community. This strategy began discussions to integrate conservation, levee improvements, flood management, recreation, agricultural sustainability, and economic development. Continued coordination is needed to turn these initial ideas into practical implementation across the Central Delta.

The Conservancy plans to continue to support convening, coordination, and community engagement on a regular basis to enhance connectivity among public landowners and other partners and to promote learning, improve planning, increase transparency, address concerns, and build support. The Conservancy and the working group participants expect to update the strategy on five-year intervals.

## Permitting and Decision-making

The project participants also acknowledged that permitting and approvals of multi-benefit initiatives and projects is a complex, time-consuming process. Given the urgency for conservation, flood management, and climate adaptation actions, there is high value in any effort to coordinate and simplify regulatory and funding approvals for multi-benefit projects on publicly-funded lands. Statewide and regional efforts are underway to improve permitting processes for conservation actions. These efforts and additional permitting coordination within the Delta would be a substantial contribution to the success of this strategy and the sustainability of the Delta.





## Conclusions and Next Steps

The public engagement process with Delta landowners and stakeholders, agencies, and experts provided valuable input and guidance that shaped this strategy. The Conservancy and the working group participants found broad agreement and support for the following:

- 1. Stop Subsidence.** Efforts to stop and reverse subsidence are a very high priority for sustaining the Delta. New management approaches are needed, particularly managed wetlands and rice that can keep peat soils submerged.
- 2. Enhance Economic Viability.** The economic productivity of Delta lands is critical for generating revenues to support levee maintenance and rehabilitation, even on the public lands. Sustainable sources of public funds are also an important component of economic viability.
- 3. Demonstrate Improved Management.** Public lands could demonstrate a mosaic approach of crops and wetlands to improve both economic and habitat value.
- 4. Support Multiple Benefits.** Opportunities abound for providing multiple, integrated benefits including habitat, flood management, recreation, agricultural sustainability, and carbon sequestration.

The communications and coordination through this project have been highly valuable for increasing understanding and building relationships. At the final public workshop, many participants supported the concepts presented, but expressed concern about how the strategy would be implemented. This strategy provides high-level guidance for public landowners and others as they consider conservation actions on their lands in the Central and Northeast Delta without prescribing a specific implementation plan. Integrated approaches for each island and tract, coordinated and connected with adjacent islands and the Delta region will likely have the greatest benefits. The strategy can be used in the following ways:

- 1. Island Planning.** Each public landowner is individually responsible for its land use plans and projects. The strategy can guide each as it develops plans and projects for its lands.

- 2. Landowner Coordination.** The strategy identifies conservation and other benefits that could be enhanced through coordinated, integrated plans and actions. The strategy can support and guide coordination efforts among public landowners to enhance conservation and other benefits that connect across islands.

- 3. Other Programs.** The strategy can guide and support other programs and initiatives to enhance the Delta, including the Delta Protection Commission Economic Sustainability Plan, Delta Levees Subventions and Special Projects Programs, Delta Conservancy and CDFW Propositions 1 and 68 grants, Delta Plan, and Central Valley Flood Protection Plan and Conservation Strategy.

- 4. Local Discussion.** Private landowners and community members can use this strategy to understand goals and objectives for the public lands and identify public-private partnerships for mutual benefit.

The Delta Conservancy intends to continue and sustain the constructive dialogue and coordination necessary for collective action towards the goals and priorities outlined in the strategy. Possible future coordination topics include the following:

- Restoration objectives, priorities, and performance measures – Are there targets for sustaining ecological function and support for specific species? How could all parties measure and report progress for the integrated priorities?
- Sustainable land use mosaic – What are the characteristics and features of an economically and ecologically sustainable mosaic of land uses for an example island or group of islands?
- Permitting and compliance alignment – Are there actions to coordinate and improve permitting and approval processes?
- Landowner incentives and public private partnerships – Are there alternate implementation structures to support and incentivize multi-benefit management?

The Conservancy and the authoring and participating organizations will present this report to their respective management and governing leaders to seek guidance and support for continued coordination, planning, and implementation.

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