Cache Slough Comprehensive Regional Planning:

DRAFT Baseline Characterization Report for the Advancement of Proposition 1 Eligible Projects

DRAFT Final Phase 1 Report

July 2017

CONTENTS

Participating Agencies and Organizations

- CA Department of Fish & Wildlife
- CA Department of Water Resources
- CA Natural Resources Agency (EcoRestore)
- Delta Stewardship Council
- Delta Science Program
- Dixon RCD
- Reclamation District 2068
- Sacramento-San Joaquin Delta Conservancy
- Solano County
- Solano County Water Agency
- Solano Land Trust
- Solano RCD
- UC Davis
- Yolo County
- Yolo County RCD

Consultant Support

- FlowWest
- San Francisco Estuary Institute
- The Catalyst Group

Introduction

This report summarizes Phase 1 of the Cache Slough Comprehensive Regional Planning Project for the Advancement of Proposition 1 Eligible Projects (Cache Slough Planning Project). The Cache Slough Planning Project is unique and necessary in that beneficial use interests (e.g., agriculture, flood management, water supply, ecosystem, and recreation) at the State, regional, and local level collaboratively engaged in discussions and data development to develop a balanced approach for sustainable integrated management of resources and land uses within the current and future conditions of the Cache Slough Complex (CSC).

The overarching objectives to be balanced to achieve a successful outcome are:

- Preserve a sustainable agriculture and recreational economy.
- Facilitate flood management infrastructure improvements.
- Maintain access to reliable regional urban and agriculture water supplies.
- Enhance ecosystem function and connectivity.

A balanced Cache Slough Planning Project should contribute to and advance the actions of the California Water Action Plan and Delta Plan and be eligible for implementation with Proposition 1 funding. Such a plan requires (1) the integration of new ideas with ongoing efforts that the state and federal government, local agencies, and others are already engaged in and (2) collaboration across levels of government through interagency/stakeholder cooperation in planning and implementing multi-objective actions.

Phase 1 of the Cache Slough Planning Project was a pilot test of a new concept of collaborative planning in the Delta. The project brought together Cache Slough regional interests with State and local government agencies to evaluate all components of the system to determine potential opportunities and conflicts among all beneficial uses within the CSC. Where could ecosystem values be enhanced while co-existing sustainably with other current beneficial uses of land and resources in the CSC?

A work group was established consisting of representatives from Solano and Yolo counties, Solano, Dixon, and Yolo County Resource Conservation Districts, Reclamation District 2068, Solano County Water Agency, Natural Resources Agency, Department of Fish and Wildlife, Department of Water Resources, Delta Stewardship Council, and Delta Conservancy, with technical support from The Catalyst Group, FlowWest, and the San Francisco Estuary Institute. The work group and sub-groups met several times per month from November 2016 through June 2017. Initial steps included developing key management questions and reviewing existing data and information for the agricultural, water supply, and flood management systems, and for the ecosystem.

The collaboration effort was successful in demonstrating that the various interest groups are motivated to work together to gather, evaluate, and support the use of appropriate data sets and other information for consideration in the planning process. Data collection, review, and validation was viewed as valuable by the participants. Data overlays, evaluation, and interpretation was limited in Phase 1, but began to show the potential for visualization to

foster discussion and agreement. Additional collaboration will be needed in Phase 2 to determine which data will be most useful in analysis and decision-making.

The collaboration also proved to be valuable in developing relationships, bridging information divides, and sharing other viewpoints, all of which would be helpful developing a regional plan as a potential Phase 2 effort. The group also began to explore the utility of data platforms and decision support tools to enhance their ability to use information in ways that provide new insights and transparent decision support. Phase 1 discussions also identified and illuminated the complexities and tensions inherent in multi-benefit planning for the CSC. Of particular note for the participants were the complexities associated with related planning processes (each moving at a different pace), system connections beyond the CSC in each topic area, and concerns about commitments, assurances, and mitigation for impacts of programs and projects. With these complexities in mind, the Phase 1 participants support continuing the collaborative planning effort, which can consider the complexities and tensions, discover opportunities for multiple benefits, and provide a useful model for other Delta planning processes.

This collaborative planning effort was initiated and funded by the Sacramento-San Joaquin Delta Conservancy with funding from the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) and Federal Bay-Delta funds from the US Bureau of Reclamation.

SECTION 1: Project Purpose and Objectives

The project purpose is to develop a multi-beneficial use plan that balances the resource interests (agriculture, local government, flood management, water supply, ecosystem, and recreation) within the current landscape of the Cache Slough Complex (CSC) and identify opportunities (action programs and projects) eligible for Proposition 1 funding consistent with State policies such as the California Water Action Plan, Delta Plan, and advancement of the co-equal goals. Through engagement in a collaborative planning process among local, State, and Federal agencies and interests, a locally-supportable vision and strategic planning approach will be developed that considers multiple beneficial uses, land use plans, and processes focused in the CSC, reduces potential conflicts among those uses, and identifies opportunities for a landscape-level integrated approach. This regional planning effort complements already-ongoing collaborative work among local, State and Federal agencies in the larger Yolo Bypass/Cache Slough (YBCS) Region and builds on and further develops efforts by the local partners in the Corridor Management Framework (CMF).

Phase 1 Objectives

Phase 1 included five primary objectives:

1. **Assemble and prepare relevant data sets.** Identify readily available data sets and information to be integrated for analysis and identify missing information or data gaps.
2. **Conduct additional agricultural analysis**. Conduct landowner outreach, engagement, and analysis using the California Agricultural Land Evaluation and Site Assessment Model (LESA) [Solano County and the Natural Resources Conservation Service (NRCS)].
3. **Overlay information to view integrated data spatially**. Review assimilated data, information, maps, and overlays to discuss where multiple beneficial use potential and constraints exist on the regional landscape.
4. **Develop concepts and approaches for Phase 2**. Work collaboratively to identify additional information and analysis requirements and next steps for completing a comprehensive regional plan, including tools, tasks, costs and timeline.
5. **Prepare final report**. Describe baseline conditions, progress to date, and next steps.

Related Programs

The work group considered numerous programs and efforts that relate to resources, landscape, and project planning in the Cache Slough Complex, including the following:

- California Water Action Plan
- DSC Delta Plan
- CA EcoRestore
- Fish Restoration Program Cache Slough Conservation Assessment

- Central Valley Flood Protection Plan and related Regional Flood Management Plans
- Yolo Bypass restoration planning and the Corridor Management Framework (CMF)
- Solano and Yolo County General Plans
- Delta Conservation Framework
- Salmon and Delta Smelt Biological Opinions
- North Bay Aqueduct Alternate Intake Project

SECTION 2: Planning Process and Participants

The Phase 1 planning process centered on a collaborative work group established by the partner agencies.[1] The agencies identified and invited key stakeholder agencies and organizations to participate and kept the format open to any interested participants. Phase 1 participating agencies and organizations are shown in the sidebar. See Appendix A for the list of participants.

Process and Roadmap

Phase 1 of the Cache Slough Planning Project began in November 2016 and concluded in June 2017. Over that time, the work group met eight times to review data and information, consider major issues, and identify data and analysis needs for Phase 2. Between work group meetings, stakeholder subgroups met to develop, review, and validate data and information for use in the work group. The Delta Conservancy and the consultant team planned meeting agendas and prepared data, visualizations, and issues for review and discussion.

The work group considered four primary topics through eight meetings:

- Land Use/Agriculture
- Flood Management
- Water Supply and Water Quality
- Ecosystem

The initial presentations on each of these topics provided planning context, basic information, and readily available data to build shared understanding of issues, needs, and opportunities among the work group participants. Sub-groups of participating subject matter experts then worked with the consulting team to review and verify data. The second iteration on each major topic offered the opportunity to evaluate revised data and information in relation to other three main topics and related planning programs. During these discussions, participants identified other relevant topics and data, such as other infrastructure (e.g., roads and energy facilities) and land uses (e.g., recreation). ***Figure 2-1*** depicts the timeline of major work group discussions.

The work group then began preliminary overlays and integration of collected information sets to understand integration approaches and learn more about potential opportunities and conflicts among the beneficial uses. A parallel process with Solano County and agricultural interests conducted a Land Evaluation and Site Assessment (LESA) modeling analysis as input to the Phase 1 agricultural data. The results of this analysis were integrated into the larger effort toward the end of Phase 1. The expectation is that the work group will continue its efforts in a Phase 2, to develop and finalize a Comprehensive Regional Plan for the CSC.

[1] The initial partner agencies included the Delta Conservancy, Solano County, Solano County Water Agency, Reclamation District 2068, and Yolo County.

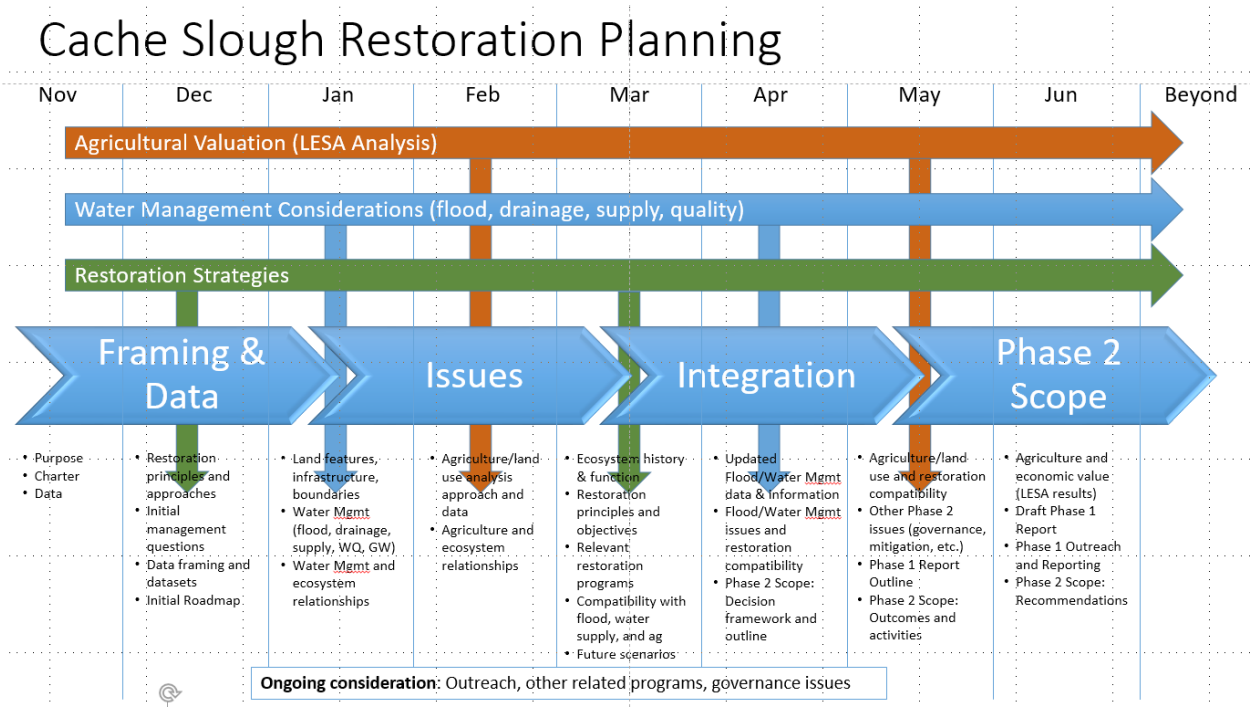


Figure 2-1 - Planning Roadmap

Related Activities

As part of the Cache Slough Planning Project and with funding from the Delta Conservancy, Solano County developed a Land Evaluation and Site Assessment (LESA) Model to develop a more comprehensive understanding of agricultural significance and landowner values for parcels located within the study area. The purpose of the LESA project is to quantify, communicate, and analyze the agricultural productivity and/or potential of parcels in the Cache Slough region based on soil-based and non-soil based factors that are grounded in the local agricultural environment.

The LESA model uses a set of factors developed by local stakeholders to evaluate agricultural lands and create a LESA score for a user-defined project area. The County Assessor's parcel is the smallest spatial unit in the LESA model, and project areas are user-defined collections of parcels. Through the innovative addition of GIS functionality, this process has developed a tool that can incorporate shared values into a data-driven world where they can complement and expand the information base used in decision-making. Values that were identified but are harder to show in GIS are also described in the technical memo, which together show the cohesive and connected system that is agriculture in the region.

The LESA model will help Solano County and the collaborative partners develop an improved, more comprehensive understanding of agricultural land resources within the study area and associated landowner values of these lands. This information has the potential to improve significantly the ability to balance the goals for the ecosystem and agricultural sustainability in Phase 2.

SECTION 3: Baseline Conditions and Data Tools

This section describes the advanced data management tools and data review and validation process used to facilitate collaborative use of best available data in Phase 1 of this project. In addition, this section documents the acquisition, improvement, and initial interpretations of key data identified in Phase 1. Finally, this section offers useful insights related to integration of data in Phase 1 from all of the perspectives represented in the CSC stakeholder group engaged in Phase 1.

Data Management Tools

MapTerra

MapTerra (CacheSloughMapTerra.sfei.org) is a web-based mapping tool that was developed and used during Phase 1 to facilitate an integrated approach of assessing important data for each of the four topic areas. Additionally, MapTerra allows for combination of datasets among topic areas to reveal insights and tradeoffs. This web tool allows for stakeholders to engage in quick high-level analysis and exploration of data, both within group meetings and remotely. Each layer is accompanied with metadata describing the source and display. This data catalog includes both geospatial and time series data that can be combined to highlight a multitude of issues and interactions within and between topic areas. The tool highlights data layers that were identified as crucial to each topic area. The "Share" feature of MapTerra allows for customized views with different orientations, zooms and sets of layers displayed to be shared via a simple URL link. Shared maps can be used to highlight conflicts and opportunities between group members and larger audiences.

R Shiny

R Shiny (https://shiny.rstudio.com/) is a web application framework for R, a free, open source software environment for statistical computing and graphics. The R shiny web application (app) for the Cache Slough Complex (https://flowwest.shinyapps.io/cache-slough-complex) includes web mapping capability similar to MapTerra, as well as a wide array of analytical and visualization tools that can be customized to provide functionality tailored to specific use cases. The Cache Slough app includes the "key" mapping datasets described later in this section as well as time series data on streamflows, water quality, fish populations, phytoplankton, and zooplankton relevant to the agricultural, water supply, flood management, and ecological systems in Cache Slough. The app was used sparingly because the project stakeholders determined early on that only high level mapping data was required in Phase 1, but will provide extremely valuable data and functionality that will likely be required in Phase 2.

Data Review and Validation

Data Inclusion Criteria

For each topic area, subgroups of the larger team met to determine which layers were available and critical in representing their topic area concerns and priorities. These groups identified data needs, specific data layers, and data gaps pertaining to their priorities and concerns. Furthermore each group identified what data gaps could be filled during Phase 2. If priorities could not be directly reflected by a data layer, subgroups worked to identify and include data or information that could serve as a surrogate or substitute for preliminary analysis. Thus, it is not

the intent of Phase 1 to put a cap on what data will be included in MapTerra, but rather to provide a substantial leap forward in providing data to reflect the priorities and important aspects for each topic area.

During the Data Review Process, subgroup members: (1) suggested suitable data layers; (2) reviewed the survey of data for their subject matter by applying the appropriate data inclusion criteria; (3) reviewed metadata and sources to recommend the most appropriate layer when there were multiple sources for a data type; (4) presented to the larger workgroup the results of the review to gain additional input and suggested datasets.

Each data layer identified to be included in MapTerra was assessed through the use of Data Inclusion Criteria developed during Phase 1:

1. **Public** – Data should be sharable with all stakeholders.
2. **Accurate** – Data should accurately reflect the realities of the study area and be as up to date as possible.
3. **Applicable** – Data should cover a geographic range that covers the area of interest and relate to relevant drivers for stakeholder topics.
4. **Accessible** – Data should be displayed and communicated in a way that is understandable and available for all stakeholders.
5. **Clear Provenance** – Data included should clearly identify an authoritative, defensible source.

Topic Areas

Stakeholders in Phase 1 of this project considered five general topic areas in the CSC: Agriculture, Water Supply, Flood Management, Ecosystem, and Other Land Use and Infrastructure. The following sections describe the data acquisition and integration process, preliminary baseline conditions, and data gaps relevant to each topic area. Additional data considered for each topic area is described in the appendix.

Agriculture

PROCESS AND PARTICIPANTS

A comprehensive set of available agricultural data--as identified and compiled by the larger team--was presented to the agricultural subgroup for discussions of quality and relevance. Through these discussions, a subset of key data was identified as the most critical in representing Agricultural concerns and priorities. Subgroup members for the agricultural topic area included Roberta Goulart (Solano County), Wendy Rash (NRCS), Simone Hardy (Solano County), and Mike Hardesty (Reclamation District 2068). It is important to note that because Reclamation Districts serve water supply, flood management, and agricultural functions in the Cache Slough Complex, they provided input on data through all three subgroups. The full set of data considered is available in the appendix.

KEY DATA SETS

The following table summarizes the key agricultural data sets used in Phase 1. ***Figure Ag-1*** (page 10) is a map that overlays some of the key agricultural data illustrating how integrated data for the CSC can be used to facilitate discussions about potential land use changes in the CSC.

Name	Description	Source
Land Capability Class	Irrigated Land Capability Classification collected from NRCS SSURGO database	NRCS (2000)
Delta Crop Map	Landuse dataset delineated on Pleiades Image from July 13-14, 2015. Also contains agricultural classes from Spring 2015.	Land IQ (2015)
Irrigated Lands	Irrigated crop types from Delta Crop Map (LandIQ 2015) based on expertise provided by Joel Kimmelshue (LandIQ) and verified by Wendy Rash (USDA-NRCS, Vacaville, CA). Updated through stakeholder input during the LESA process.	Land IQ, FlowWest (2017)
Permanent Crops	Permanent crop types from Delta Crop Map (Land IQ 2015) include Citrus/Subtropical, Vineyards, and Other Deciduous. Many in Agricultural subgroup think more permanent crops have been planted in the Cache Slough Complex since these data were collected in 2015.	Land IQ, FlowWest (2015)
Cache Slough regional LESA scores	Developed during the Cache Slough Land Evaluation and Site Assessment (LESA) Study. This raster was made by calculating the LESA score for each parcel in the Cache Slough LESA study area based on stakeholder input, and then transforming those results into a 1000-ft pixel raster (image) layer.	Solano County, NRCS, FlowWest 2017

PRELIMINARY BASELINE CONDITION ASSESSMENTS

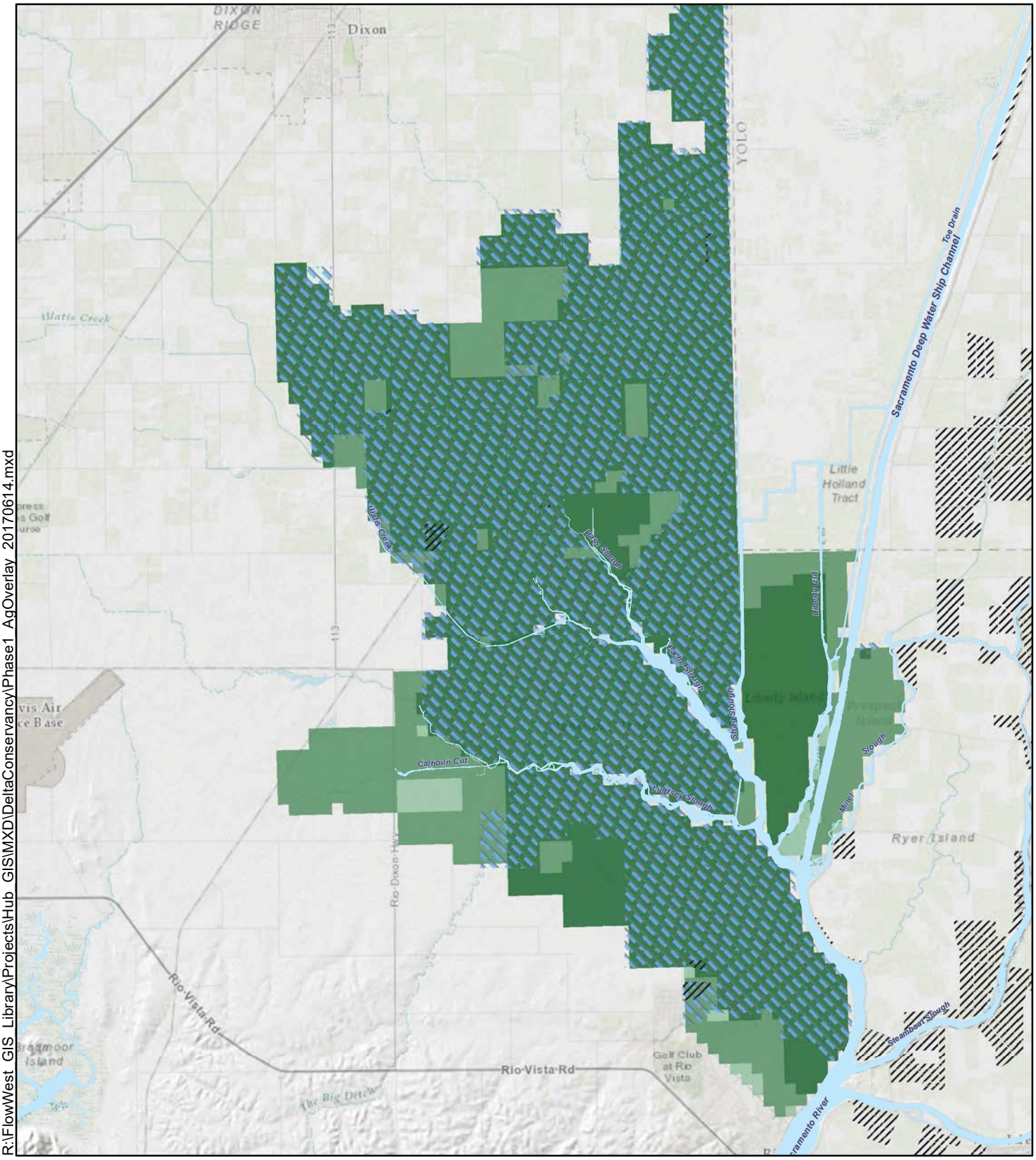
In addition to data validation and refinement, a set of preliminary baseline condition assessments arose from the agricultural data synthesis and evaluation exercises. The most prominent assessment being that valuation of agricultural lands should not be based on crop types grown in any given season or year. Rather, land value should be based on lasting properties of the land, such as soil type, water rights, infrastructure, and location. In addition, the agricultural economy should be viewed as a system with a set of interdependencies between its constituent parts as well as connections to other topic areas. However, how the agricultural system operates, the ability to impact that system by changing one of the parts, and relationships to other topic areas are not well documented or understood.

IDENTIFICATION OF DATA GAPS

Several key data gaps have been identified to address some of these questions. Geospatial locations of existing agricultural facilities (e.g., drainage and irrigation networks, processing plants, grain elevators, etc.) were identified as a missing dataset that would help inform the importance of these facilities to the operation of the agricultural system, as emphasized during presentations and discussions with Solano County (Jim Allan 2/10/17). Additionally, data that illuminate how these facilities interact within the system, along with interdependencies to elements in other topic areas, would be beneficial. The group also recognized the need for data defining habitat value and ecological significance of existing agricultural lands. These data would include agricultural easement information (location, type, duration, holder) along with some definitions of habitat value based on characteristics of agricultural lands.

OTHER DATA SETS CONSIDERED (DETAILED METADATA IN APPENDIX D)

- Roads
- Cache Slough Complex Levees
- California oil and gas wells
- Reclamation districts
- EcoRestore restoration sites
- Recreation sites
- Conservation easements (CCED)



R:\FlowWest GIS Library\Projects\Hub GISMXD\DeltaConservancy\Phase1 AgOverlay 20170614.mxd

Figure Ag-1: Agricultural Overlay

0 2.25 4.5 Miles

N

Irrigated Lands

Permanent Crops

LESA Scores at 1000-ft Pixel Scale

- < 40 (Low)
- 40 - 65 (Moderate)
- 65 - 80 (High)
- > 80 (Very High)

Data Sources

Irrigated Lands - Land IQ, FlowWest 2017

Permanent Crops - Land IQ, FlowWest 2015

LESA - Solano County, NRCS, FlowWest 2017

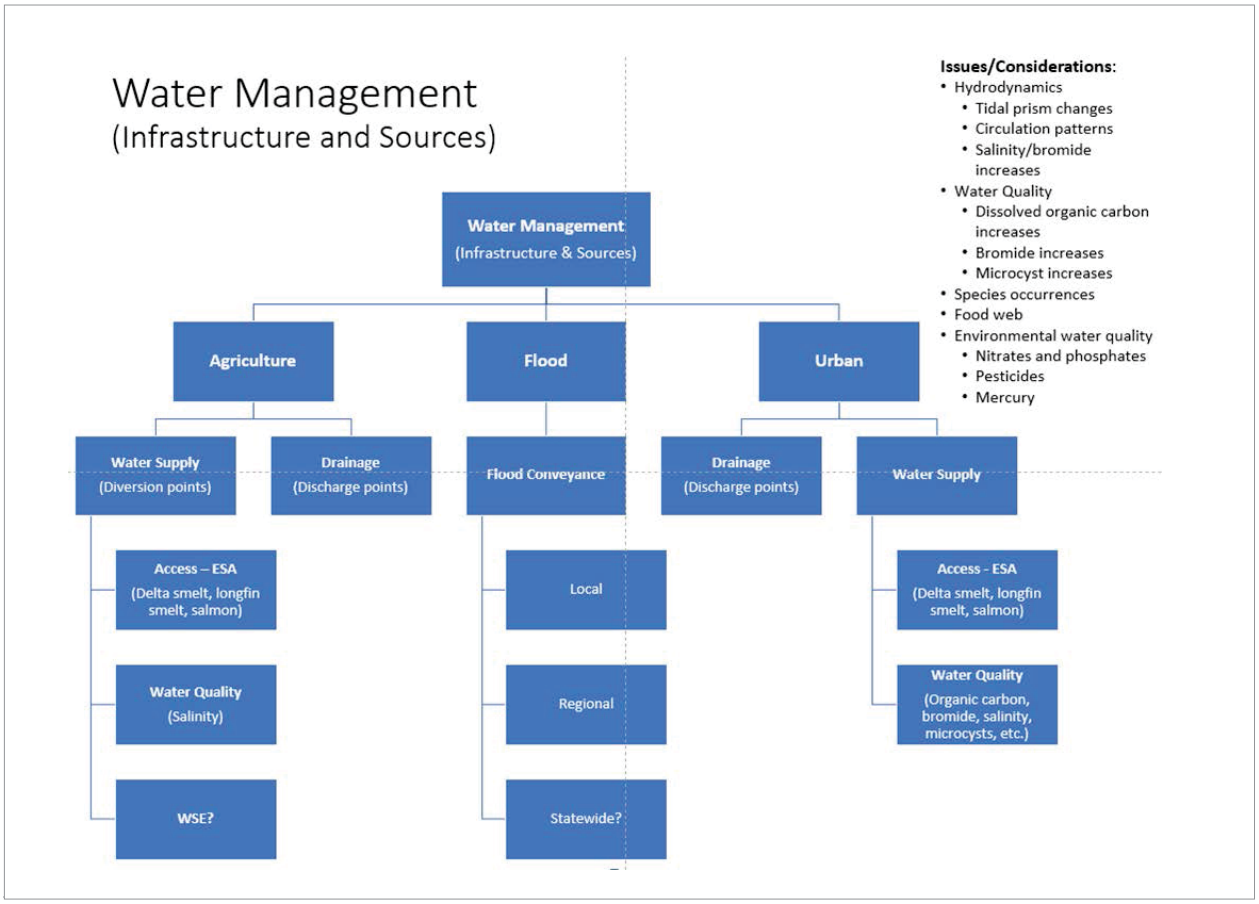
- Protected lands (CPAD)
- Parcels – Williamson Act lands
- Elevation

Water Management

There are three components to Water Management in the CSC: water supply, drainage, and flood conveyance systems. Water supply and drainage infrastructure are linked through agriculture activities during the dry season, and drainage and flood infrastructure are linked during the wet season. Water supply reliability is influenced by access to source water and the quality of the source water for the intended end use.

The CSC provides water supply for surrounding agriculture via reclamation districts and individual diversions; and urban uses serving public drinking water to approximately 500,000 people in the North Bay-Delta region (Napa and Solano Counties) through the State Water Project North Bay Aqueduct (NBA) diversion in Barker Slough. Reliable access to water supplies is challenged by regulatory concerns regarding take of endangered species (ESA) at diversions and ability to meet standards for beneficial use due reduced source water quality. Increased tidal marsh habitat alters the hydrodynamic characteristics of the CSC. Changes to transport mechanisms such circulation patterns and tidal excursion in and out of the CSC can exacerbate degradation of source water quality for agriculture, urban, and ecosystem needs. ***Figure 3-1*** depicts the major topics and issues related to water management in the CSC.

Figure 3-1 Water Management Topics and Issues



PROCESS AND PARTICIPANTS

Shortly after the November 2016 kickoff meeting, the technical support team worked with SCWA, RD 2068, and Solano County representatives to discuss the water management system elements in or influenced by the Cache Slough Complex, and to identify key data sets potentially relevant to those elements. Potentially relevant data sets on water supply and drainage infrastructure, regional water quality, regional surface water flows, fish populations, zooplankton, and phytoplankton were then acquired, integrated, and presented to the full CSC stakeholder group at the January 2017 meeting. The stakeholders determined at this meeting that complete time series data on water quality, fish populations, zooplankton, and phytoplankton was not necessary in Phase 1. Therefore, only spatial data covering locations of water supply and drainage system components and monitoring locations for regional water quality, regional surface water flows, fish populations, zooplankton, and phytoplankton were included in the Phase 1 key data. Monitoring program locations data were used as is, while the diversion and drainage infrastructure data was refined through expert sub-group meetings and subsequent quality assurance / quality control work. The expert sub-group for water management infrastructure data included Thomas Pate (SCWA), David Okita (CNRA), Roberta Goulart (Solano County), Mike Hardesty (RD2068). After review and acceptance by this group, the final set of key spatial data was loaded into MapTerra and presented back to the full CSC group at the April 2017 meeting.

KEY DATA SETS

The following table summarizes the key water supply system data sets used in Phase 1. ***Figure WS-1*** is a map that overlays some of the key water supply system data illustrating how integrated data for the CSC can be used to facilitate discussions about potential land use changes in the CSC.

Name	Description	Source
Intakes and Drains	Represents irrigation intake and drain infrastructure in the Cache Slough region including the North Bay Aqueduct. Contains data from SCWA, RD 2068, eWRIMS gis database, Delta Vision, and aerial photo interpretation. Interior intakes and drains convey water within diked lands only; they are not directly connected to a slough.	WWR 2013; SCWA, FlowWest 2017
USGS Stations	USGS streamflow monitoring stations	USGS 2017
EMP Discrete Water Quality Monitoring Stations	DWR Environmental Monitoring Program (EMP) historic and active water quality monitoring locations. Includes phytoplankton, benthic, as well as other water quality constituent sampling. http://www.water.ca.gov/bdma/meta/	CDWR 2017
EMP Zooplankton Monitoring Stations	DWR Environmental Monitoring Program (EMP) historic and active zooplankton monitoring locations. http://www.water.ca.gov/bdma/meta/zooplankton.cfm	CDWR 2017
CDEC Stations	DWR California Data Exchange Center (CDEC) locations of regional streamflow and water quality monitoring.	CDWR 2017
Juvenile Fish Monitoring Program Locations	USFWS Juvenile fish monitoring locations. https://www.fws.gov/lodi/juvenile_fish_monitoring_program/jfmp_index.htm	USFWS 2017

PRELIMINARY BASELINE CONDITION ASSESSMENTS

The water management system in CSC includes extensive and extremely valuable water supply infrastructure that must coexist with sensitive and protected ecosystems. Endangered Species Act (ESA) and water quality

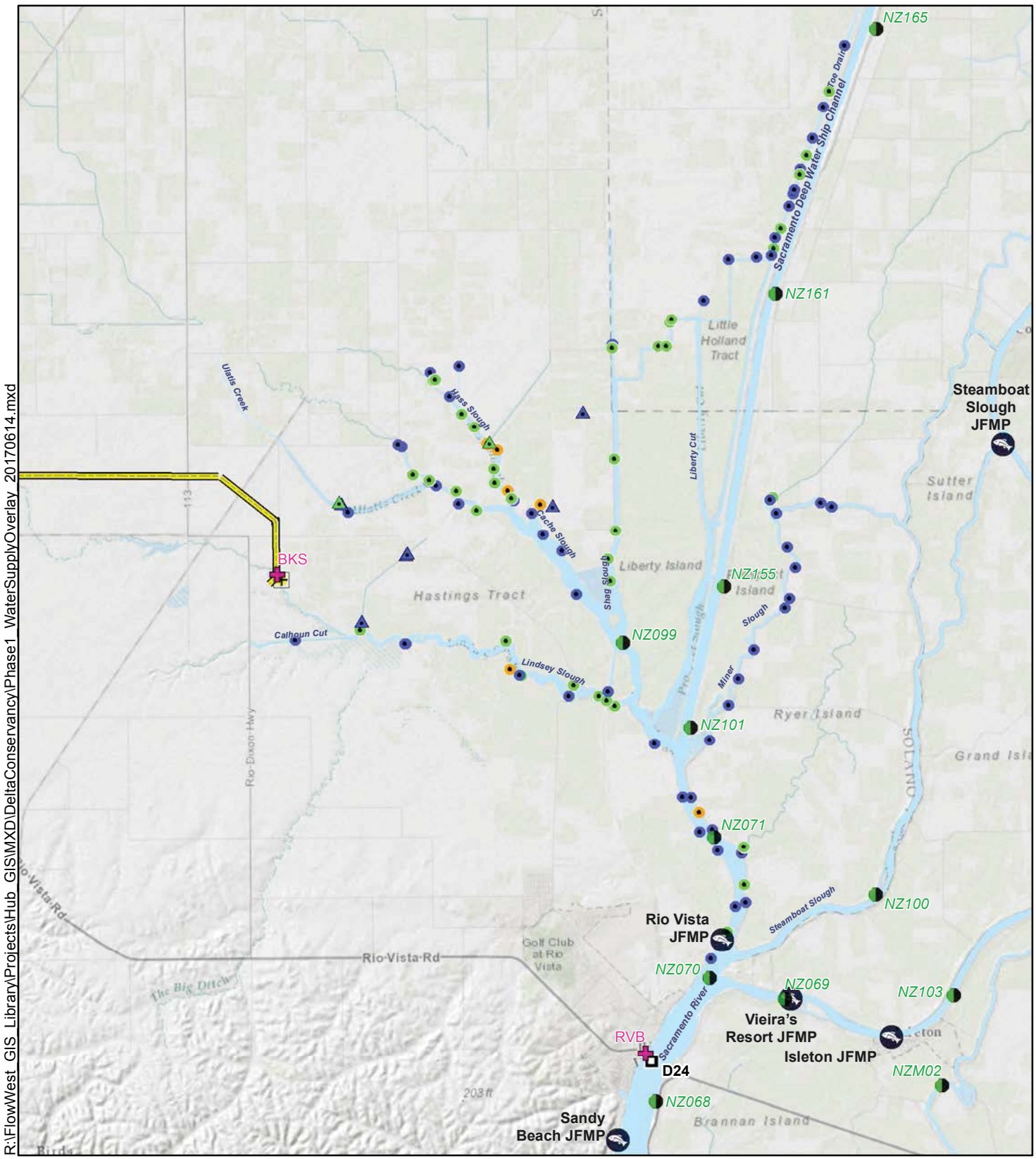


Figure WS-1: Water Supply and Water Quality Overlay

0 2.25 4.5 Miles

- Historic Zooplankton Monitoring
- Juvenile Fish Monitoring (JFMP)
- CDEC Water Quality
- Historic EMP WQ Station
- Municipal/Industrial Intake
- Drain
- Intake
- Dual
- Interior Intake
- Interior Drain
- North Bay Aqueduct

N

Data Sources
Plankton Monitoring - CDWR IEP 2017
JFMP Locations - USFWS 2017
CDEC Locations - CDWR 2017
EMP Discrete Water Quality - CDWR 2017
North Bay Aqueduct - Stillwater, WWR 2013
Intakes and Drains - Stillwater, WWR 2013; FlowWest 2017

concerns influence water management throughout the entire CSC during all seasons. Salmon and smelt populations are expected to increase in the CSC and in the Yolo Bypass immediately upstream as ecosystem projects are implemented in the CSC and the surrounding region. As this occurs, the water quality drivers for the aquatic ecosystem, which include primary production, organic carbon, nitrates, phosphates, pesticides, and mercury, in addition to increasing populations of listed fish species, increase the likelihood of further conflicts between diversions for water supply and enforcement of ESA and water quality regulations.

The North Bay Aqueduct (NBA), a regional municipal water supply serving Napa and Solano, is located near the center of the CSC and is extremely sensitive to landscape conversion from agricultural to tidal marsh due to the increased potential for organic carbon generation that typically occurs in tidal marshes. In addition to dissolved organic carbon, water quality drivers for the municipal water supply system are bromide and *Microcystis*. The NBA diversion in Barker Slough currently experiences operational restrictions due to the presence of Delta and Longfin smelt. Taken together, these conditions make it likely that ecosystem restoration land use changes in the CSC could pose new municipal water supply challenges if not implemented with careful planning.

Agricultural water supplies in the CSC at the District and individual scale are also influenced by water quality, with the primary drivers for agricultural use being salinity and invasive aquatic vegetation. In addition to dealing with CSC water quality conditions, the North Delta Water Agency must guarantee prescribed water supplies and water surface elevations under its contract with the State, both of which are influenced by hydrodynamics and source water conditions. Agricultural water management in the CSC is further complicated by the fact that interior drainage systems (i.e., within agricultural fields separated from channels or sloughs) are intermingled with water supply delivery systems.

Challenges already facing the complex CSC water supply system could be exacerbated by the hydrodynamics in the CSC and the surrounding region that are influenced by tides and flood flows. Ecosystem restoration in the CSC and surrounding region that increases the area of marsh habitat will change the amplitude and energy transfer associated with tidal flow into and out of the CSC. This could be particularly evident during the dry season when the CSC experiences net upstream flow conditions, and during flood flows when backwater from Yolo Bypass creates a hydraulic plug at the mouth of Lindsey Slough.

IDENTIFICATION OF DATA GAPS

Several important data gaps surrounding water management were identified in Phase 1. First, there are several hydraulic / hydrodynamic modeling analyses for the CSC and surrounding region at different stages of completion. More detailed evaluations of the impacts of ecosystem land use changes in the CSC will require an integrated set of output data from these studies covering the full range of existing hydrologic conditions and potential future conditions (e.g., with climate change). In addition, complete data on the interior (i.e., field level) irrigation and drainage systems for the entire CSC will eventually be required to evaluate more site-specific implications of potential ecosystem land use changes.

OTHER DATA SETS CONSIDERED (DETAILED METADATA IN APPENDIX E)

- Modified National Hydrography Dataset
- Reclamation districts

Flood Management

PROCESS AND PARTICIPANTS

The process for developing the flood management system data was the same as for the water supply system data. The expert sub-group for flood management data included Thomas Pate (SCWA), David Okita (CNRA), Roberta Goulart (Solano County), Mike Hardesty (RD2068), and Eric Nagy (Larsen Wurzel & Associates)

KEY DATA SETS

The following table summarizes the key flood management system data sets used in Phase 1. ***Figures FI-1*** and ***FI-2*** are maps that overlay some of the key water supply system data to illustrate how integrated data for the CSC can be used to facilitate discussions about changing land uses in the CSC.

Name	Description	Source
Interior Drainage	This dataset was created to describe and analyze the movement of surface water throughout the Cache Slough Complex Conservation Assessment (CSCCA) project area and adjacent upland watersheds. Wetlands and Water Resources (WWR) added five descriptive attribute fields (detailed in the metadata abstract) to the USGS's National Hydrography Dataset (NHD), removed certain water sources for cartographic purposes, and clipped to the boundary of the DHCCP Planning Counties (Alameda, Contra Costa, Sacramento, San Joaquin, Solano, Sutter, and Yolo).	WWR 2013
Regional Watersheds	Created by Wetlands and Water Resources (2013) for the Cache Slough Conservation Assessment. Watershed unit boundaries based on the national Watershed Boundary Dataset (WBD); funded by NRCS, EPA, and USGS (http://nhd.usgs.gov/wbd.html). WBD polygons were further sub-divided, and boundaries altered, by WWR to correspond with CSCCA levee dataset, NHD hydrology lines, SCWA Watershed data (2006) and topographic features.	WWR 2013
Regional Levees	This dataset represents the crest of levees within the Cache Slough project boundary. It was originally created based on an existing layer showing levee centerlines in the region and a 2007-2008 LiDAR DEM (Stillwater, WWR 2013). Modified to add "significant levee remnant" along Liberty Island based on flood management subgroup input (FlowWest 2017).	Stillwater, WWR 2013; FlowWest 2017
CVFPP State and Locally Preferred Options	Defines the various actions proposed under both the State Recommended and Locally Preferred options of the Central Valley Flood Protection Plan as outlined in the 2017 Draft Update (State Recommended) and the 2016 Basin Wide Feasibility Study (Locally Preferred).	CDWR 2017

PRELIMINARY BASELINE CONDITION ASSESSMENTS

The CSC is in a pivotal location for flood management in the region. This has been recognized in ongoing Central Valley Flood Protection Plan (CVFPP) work documented in State and locally preferred plans for the regional flood management system. Stakeholders in Phase 1 agreed that the locally preferred plan should initially govern with respect to planning for ecosystem enhancement land use changes in the CSC. Existing and potential future conditions in the Yolo Bypass described in the locally preferred CVFPP plan are extremely important for CSC planning around ecosystem restoration land use changes because they will change the conveyance of water to and through the CSC region. Similarly, ecosystem restoration land use changes in the region will typically reduce conveyance capacity as hydraulic roughness increases with implementation of ecosystem enhancements. CSC planning must also consider that some agricultural uses are incompatible with seasonal inundation. Further, because the interior drainage and flood management systems in the CSC are intermingled with water supply systems, increased flood conveyance through the Yolo Bypass could degrade wet season source water quality to the NBA.

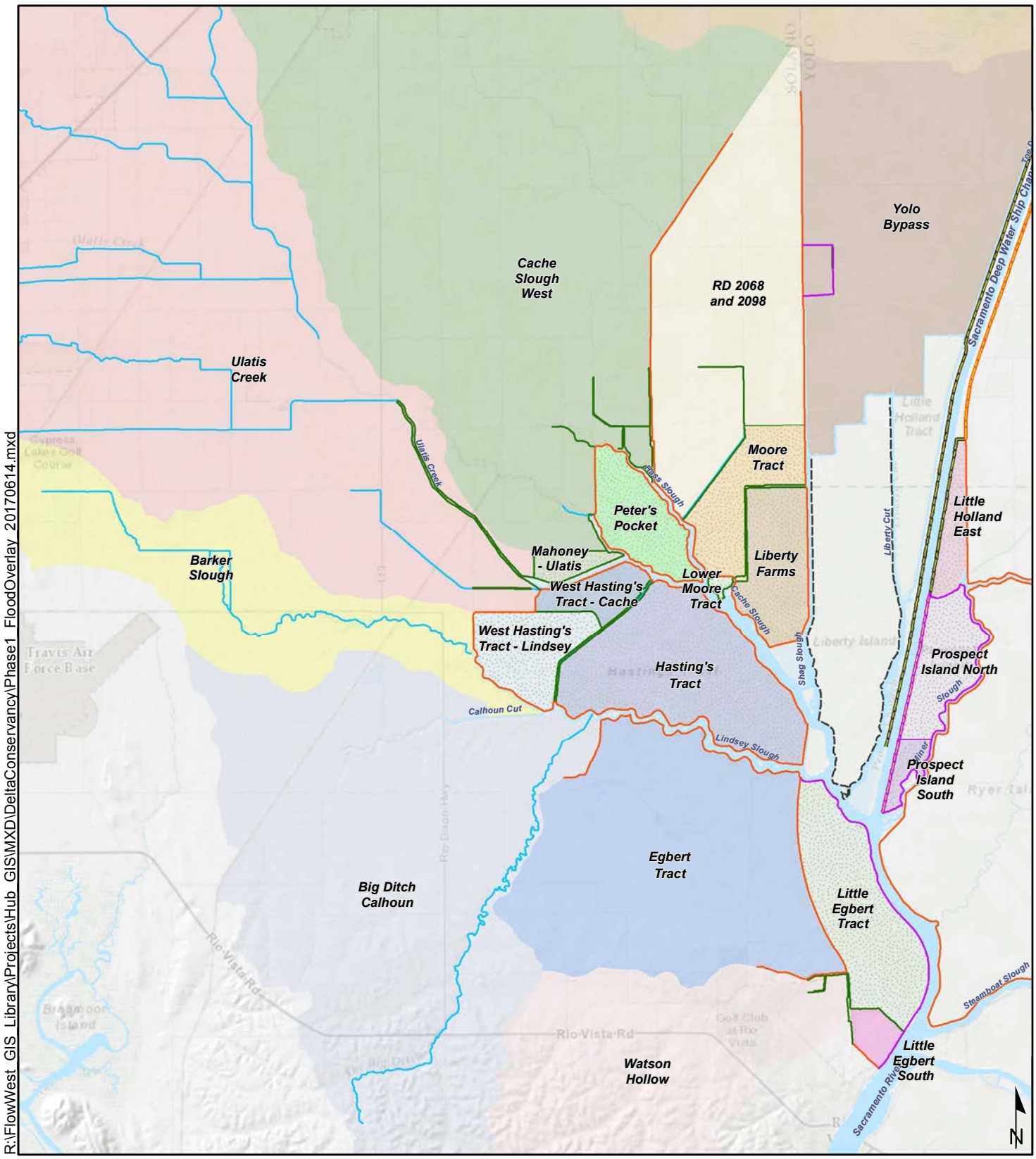


Figure FI-1: Flood Management Overlay

0 2.25 4.5 Miles

- Primary Waterbody
- Name Watersheds

Project Levees

- Significant Levee Remnant
- Federal Project
- Federal Project and Navigation

Non-Project Levees

- Non-Project
- Non-Project - Navigation
- Non-Project Restricted Height
- Non-Project Restricted Height - Navigation

Data Sources

Watersheds - WWR 2013

Levees - Stillwater, WWR 2013; FlowWest 2017

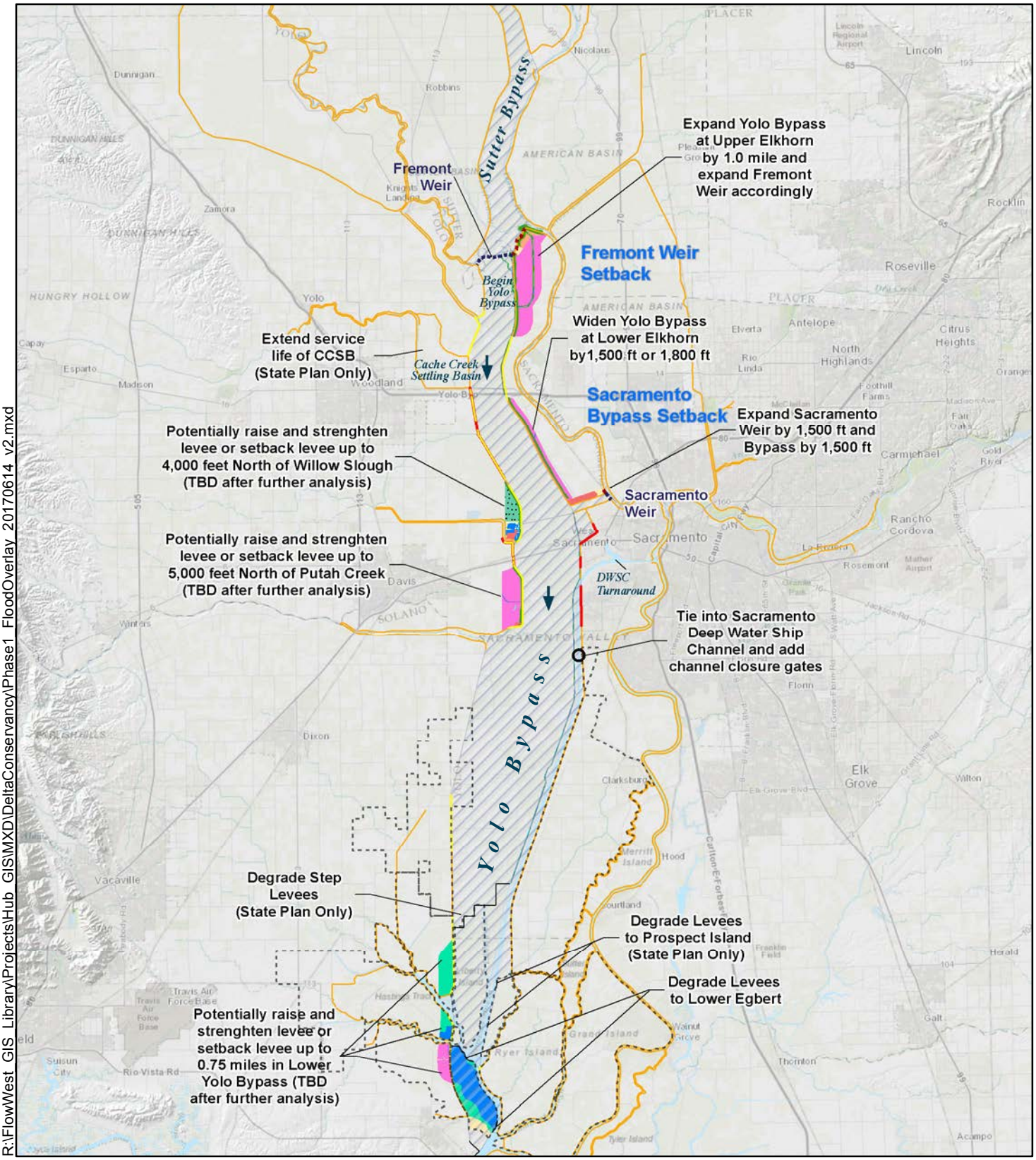


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Figure FI-2: CVFPP State and Local Plans Overlay

- Reclamation Districts
- Freeboard Raise
- Improvements Required
- Weir Expansion
- Alternative Features
- SPFC Levees

- *Cropland and Pasture*
- *Rice (Floodplain Agriculture)*
- *Annual Grassland*
- *Native Perennial Grassland*
- *Oak Savannah*
- *Freshwater Marsh (non-tidal)*
- *Freshwater Marsh (tidal)*
- *Seasonal Wetland*
- *Riparian Forest*
- *Riparian Scrub*
- *Other Natural*
- *Developed*
- *Water*

0 5 10 Miles

N

Data Sources
CVFPP Plans - DWR 2017

IDENTIFICATION OF DATA GAPS

Stakeholders in Phase 1 identified a variety of data gaps that could provide a more resolved picture of the flood management system in the CSC. Similar to the water quality system, an integrated set of hydraulic / hydrodynamic modeling data (focused on high flow conditions) is required. The expert sub-group for flood management data also identified complete interior levee and drainage network data, Dixon RCD 1997 flood extent data, and Solano County Office of Emergency Services flood emergency access / egress data as potentially helpful. Finally, data on flood operations and maintenance, flood easements (likely developed from local expert knowledge as no comprehensive database exists, and data from the Corridor Management Framework describing the flood management system would also be of value to future planning.

OTHER DATA SETS CONSIDERED (DETAILED METADATA IN APPENDIX F)

- Reclamation districts
- FEMA floodplains

Ecosystem

PROCESS AND PARTICIPANTS

An initial round of ecosystem data layers was compiled from previous efforts, including the Delta Landscapes Project and the Cache Slough Conservation Assessment and reviewed to determine if they met the data inclusion criteria (see above). Priority layers were presented by San Francisco Estuary Institute staff to the full work group on March 10th, where initial concerns related to data gaps, quality, and relevance were identified. Data were further refined by an ecosystem sub-group that met on April 4th to validate key data layers, including a draft of high potential ecosystem areas. Participants in this sub-group meeting included representatives from Yolo County (Doug Brown, Douglas Environmental), California Department of Fish and Wildlife (Christina Sloop), California Natural Resources Agency (David Okita), Delta Science Program (Martina Koller), Delta Conservancy (Campbell lngram, Beckye Stanton), FlowWest (Bethany Hackenjos), The San Francisco Estuary Institute (Sam Safran, Tony Hale, Pete Kuhanen), and The Catalyst Group (Charles Gardiner).

KEY DATA SETS

Below are described the key data sets from the ecosystem subject area. ***Figures Eco-1*** and ***Eco-2*** are maps that overlay some of the key Ecosystem data illustrating how these layers can help to identify critical areas for ecosystem function and resilience.

Habitat types: These layers show the historical (ca. 1800) and contemporary (ca. 2007) habitat type distribution in the Cache Slough area and larger Delta region. It is important to understand habitat distribution and extent because physical habitat loss and alteration is one of the primary stressors to native species in the Delta and a principal cause of regional ecosystem decline. Mapping habitat types is a simple way to assess their quantitative loss and a critical component of ecosystem conservation (which, in turn, is a complement to species-level conservation). The historical layer is provided not to provide a blueprint for restoration efforts, but to broadly understand the kinds of habitat types historically supported within the Cache Slough region, how these habitats were connected, and how habitat extent and distribution have changed over time. This information can be used to inform ecosystem restoration efforts moving forward.

The layers were originally compiled for the Delta Landscapes project (SFEI-ASC 2014). The historical habitat type map was taken from the Sacramento-San Joaquin Delta Historical Ecology Investigation (Whipple et al. 2012). The modern habitat type map is a compilation of several spatial datasets detailing Delta vegetation and land use, with each vegetation type crosswalked to the historical habitat types. The majority of the modern map was derived from fine-scale vegetation mapping produced in 2007 by the CA Department of Fish and Wildlife Vegetation Classification and Mapping Program. The habitat types identified in these layers have been crosswalked to a number of contemporary classification schemes (including California Terrestrial Natural Communities, the National Wetlands Inventory Classification System, the USFWS Riparian Mapping System and the Hydrogeomorphic Wetland Classification System), which increases their relevance for a variety of user groups.

Elevation: This layer shows land surface elevations in the Cache Slough Complex, which have been categorized in a way that is relevant to ecosystem restoration planning. Specifically, the layer depicts 5 ft elevation bands above and below the area currently situated at intertidal elevation. This is the approximate area that would be inundated today between an average lower-low tide (MLLW, 2.1 ft NAVD88 and an average higher-high tide (MHHW, 6.4 ft NAVD88) without levees and therefore could potentially support tidal wetlands given present-day sea-levels. Areas less than 5 ft above MHHW are characterized as being within the "sea-level rise zone," since they could potentially be situated within tidal elevation range and support tidal wetlands by 2100 (the National Research Council predicts up to 4.6 ft of sea-level rise by that year). Sea levels are expected to continue rising beyond 2100, however, so areas less than 10 ft above current MHHW, which are characterized as being within the "upland zone," could also one day be situated within the tidal elevation range. Until then, the upland zone could support terrestrial habitat types and non-tidal wetlands. The layer also distinguishes areas that are situated at subtidal elevations (below MLLW; either shallow sub-tidal, mid-subtidal, and deep-subtidal) and are either already permanently inundated, or would be without levees. These various categories relate broadly to the different kinds of restoration actions that should be considered in different areas.

The elevation data is from a 2012 CA Department of Water Resources data set that combines the best available topographic and bathymetric elevation data from 21 individual surveys. MLLW and MHHW elevations were determined for the Cache Slough Complex by cbec, inc., eco engineering.

Channel network: These layers shows the historical (ca. 1800) and contemporary (ca. 2007) channel network in the Cache Slough area and larger Delta region. Importantly, the layer distinguishes dendritic channels from looped and fluvial channels. Dendritic channels support unique physical and ecological conditions but have been disproportionately lost from the Delta over time. The layers were originally compiled for the Delta Landscapes project (SFEI-ASC 2014).

Marsh patch size and nearest neighbor distance: These layers show marsh patches in the Cache Slough region and quantify (1) the size of each patch and (2) the distance from each patch to the nearest "large" patch, a measurement of connectivity. These layers are important because large and connected marshes tend to have higher habitat value than small and isolated marshes. Larger marshes are more likely than smaller marshes to support higher densities of key species, support a mosaic of marsh features, buffer native wildlife from nonnative predators, and have well developed tidal channel networks. Wildlife in more isolated marshes is less likely to successfully disperse to new habitat (an important part of many species' life histories). Isolated marshes are also less likely to be re-colonized

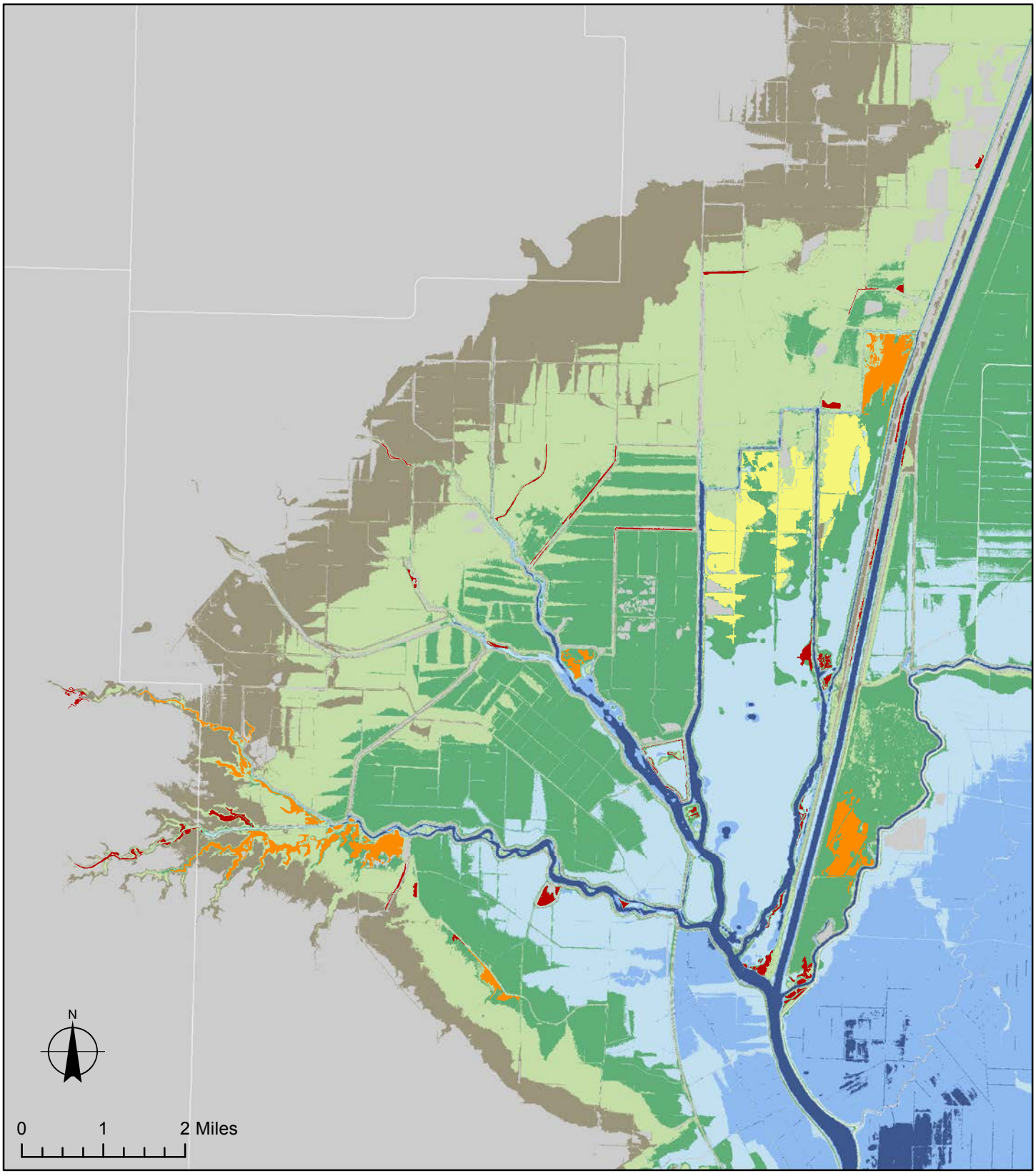


Figure Eco-1: Ecosystem Overlay

Marsh patch size class (ha)

- 0-10
- 10-100
- 100-1,000

SF Bay and Delta DEM (continuous 10m topo-bathy)

- Deep subtidal elevation: >10 ft below MLLW (<-7.9 ft NAVD88)
- Mid subtidal elevation: 5-10 ft below MLLW (-2.9 to -7.9 ft NAVD88)
- Shallow subtidal elevation: 0-5 ft below MLLW (2.1 to -2.9 ft NAVD88)
- Intertidal elevation: MLLW to MHHW (2.1 to 6.4 ft NAVD88)
- SLR zone (Current upland; future intertidal): 0-5 ft above MHHW (6.4 to 11.4 ft NAVD88)
- Upland elevation: 5-10 ft above MHHW (11.4 to 16.4 ft NAVD88)

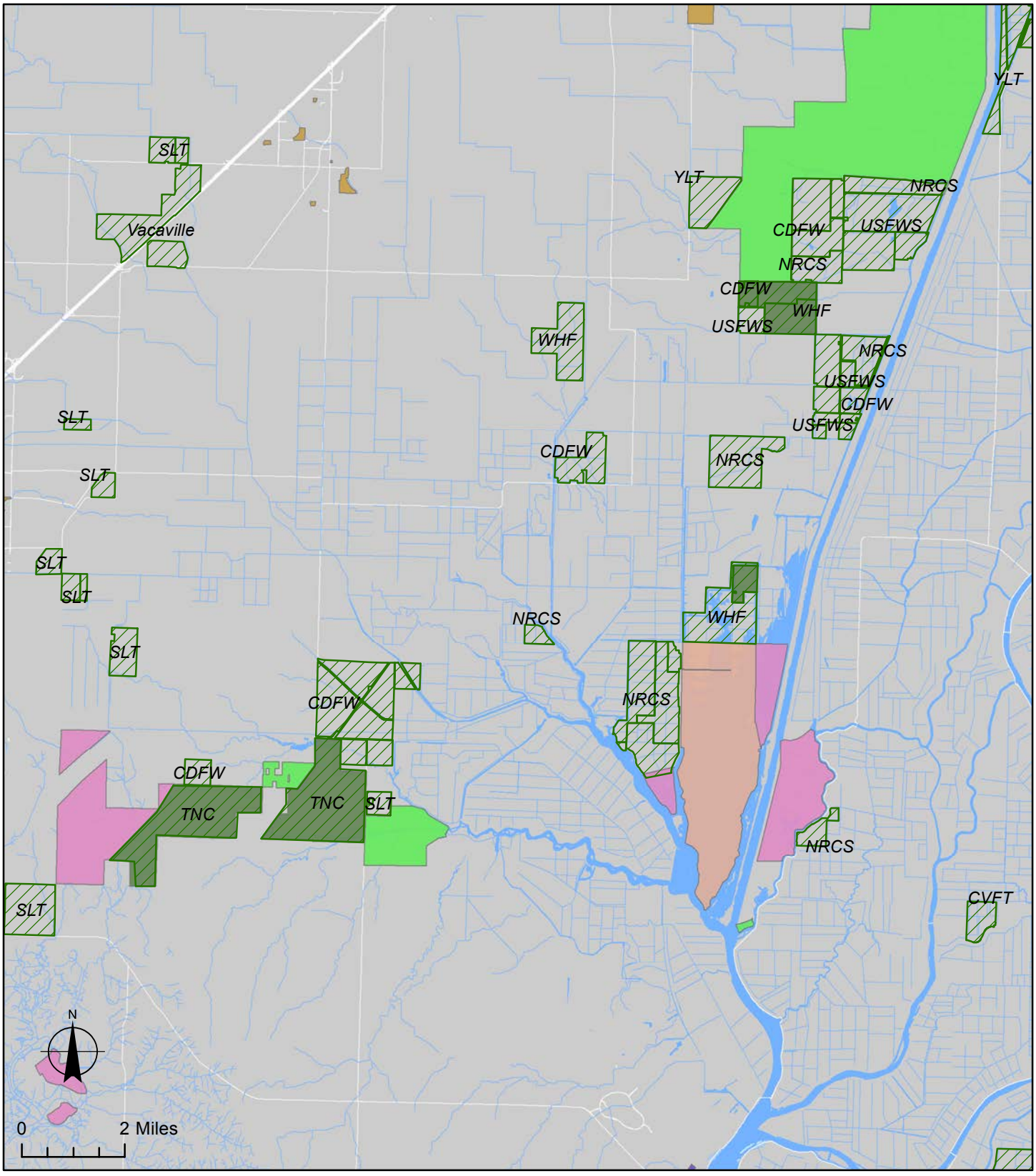


Figure Eco-2: Protected Lands and Conservation Easements Overlay

Protected Lands (CPAD_2016b)

- Conservation Area
- Private Conservation
- Recreation Area
- Private Recreation or Education
- State Resource Management Area
- National Public Lands
- National Wildlife Refuge
- Local Park
- Historic or Cultural
- Other or Unknown

Conservation Easements (CCED_2016)

by wildlife after disturbance events. In the long run, isolated and small populations can lose genetic diversity. The layers were originally compiled for the Delta Landscapes project (SFEI-ASC 2014).

PRELIMINARY BASELINE CONDITION ASSESSMENTS

Habitat types: A detailed description of both historical and existing natural communities and land cover can be found in the Fish Restoration Program Cache Slough Complex Conservation Assessment Volume 1 Characterization Report. A review of the habitat type data layers shows that prior to Euro-American settlement of California in the 1800s the Cache Slough region was dominated by tidal freshwater emergent wetlands, which covered the majority of what is now Liberty Island, the Cache Haas Area, Peter's Pocket, Hastings Tract, Egbert Tract, and Little Egbert Tract. These tidal wetlands graded into extensive seasonal wetlands and vernal pool complexes at their upland edge, creating wide and continuous transition zones. Embedded within the tidal marshes were the dendritic tidal channel networks of Lindsey and Cache sloughs. Today very little of the historical extent of these natural habitat types remains. Sizeable areas of tidal wetlands do exist at the north end of Liberty Island and the upstream end of Lindsey Slough, though these marshes are small by historical standards. Upland habitats associated with the Jepson Preserve also exist at Lindsey Slough, creating one of the best remaining examples of a continuous marsh-terrestrial transition zone in the contemporary Delta. Elsewhere the modern Cache Slough area also features sizeable areas of annual grasslands and managed wetlands. Due to the subsidence and subsequent flooding of Liberty Island, the area of open water in the Cache Slough areas has nearly doubled since the historical period. This change, coupled with the loss of marshes, has led to a pronounced decrease in the ratio of marsh to open water.

Elevation: A detailed description of surface elevations in the study areas can be found in the Fish Restoration Program Cache Slough Complex Conservation Assessment Volume 1 Characterization Report. Approximately 9,000 acres of diked lands exist at intertidal elevations and could thus potentially support tidal emergent wetlands at existing sea-levels. This area includes most of Liberty Farms, Moore Tract, Hastings Tract, and large parts of Egbert Tract. Minimally subsided diked areas (less than 5 ft below MLLW elevation) areas include the lower parts of Peter's Pocket, Hastings Tract, and Egbert Tract. Minimally subsided areas could potentially support tidal marshes through targeted reverse-subsidence efforts. Finally, at least 12,000 acres are situated in the sea-level rise zone (less than 5 ft above MHW) and could potentially be situated within tidal elevation range and support tidal wetlands by 2100. Over the short-term, these lands could support terrestrial and non-tidal wetland habitats, and contribute to the formation of continuous tidal-terrestrial transition zones.

Channel networks: Historically, both Cache Slough and Lindsey Slough had a pronounced dendritic form, with as many as six orders of branching tidal channels. Both channel networks have been simplified over time, to 3-order networks with an order of magnitude fewer individual channel reaches (measured from node to node). That said, the sloughs can still be considered blind channels, a channel form that generates unique physical and ecological conditions that have been lost from most other parts of the Delta.

Marsh patch size and nearest neighbor distance: There has been significant marsh habitat loss and fragmentation in the Cache Slough area since the historical period; while the marsh in Cache Slough was once part of a single large patch (more than 100,000 acres in size), there are now many small patches. However, the marshes of Liberty Island are currently among the largest remaining in the Delta and the area supports two of the three marsh patches larger than 100 ha in size (an important ecological threshold).

Envisioning a "complete" ecosystem for Cache Slough: Historically, the habitat types in the Cache Slough region formed a continuous transition from aquatic habitats, such as dendritic tidal sloughs through tidal marsh at the lowest elevations, to tidal perennial wetland habitats at intermediate elevations, to terrestrial habitats such as seasonal wetlands at higher elevations. These key components and the connectivity between them provided coherent ecosystem function for a wide range of wildlife and many other ecosystem services. While much of this connectivity and many of these components have been lost, there remains high potential, particularly in this region, to re-establish and connect a modified landscape that would be able to provide some of these functions (i.e., a complete ecosystem).

IDENTIFICATION OF DATA GAPS

Protected Areas: A complete picture of protected areas (including easements) and the nature of their protection, ownership, and access is important for further analysis. A number of layers were assessed and included in MapTerra regarding this need (including CPAD and CCED), however additional local review and input would be beneficial. A "Conservation Lands" layer that has undergone local review was previously developed for the Bay Delta Conservation Plan. This layer will be included with other protected lands data layers for future work.

Ecosystem benefits of agricultural lands: Agriculture experts raised the point that ecological benefits from wildlife-friendly agriculture were not displayed in a mapping layer. This is an impact relevant to ecosystem health and connectivity that the subgroups have yet to identify a suitable layer to represent.

Synthesizing CNDDB data clarifying species specific data: Although there is a push for a holistic ecosystem approach to conservation and restoration proposed in this effort, it can still be helpful to identify specific species will benefit from the different types of habitat and their interconnectedness. A large amount of this information is located within SFEI's *A Delta Renewed* report, however they have not been specifically called out within the mapping layers.

OTHER DATA SETS INCLUDED (DETAILED METADATA IN APPENDIX G)

- Historical Channels
- Modern Channels
- Historical Habitats
- Modern Habitats
- Cache Slough Complex Conservation Assessment Natural Communities
- Historical Marsh Patch Size
- Modern Marsh Patch Size
- Historical Nearest Large Marsh Distance
- Modern Nearest Large Marsh Distance
- Inundation Historical
- Inundation Modern
- Zooplankton Stations
- USFWS JFMP Locations
- Delta Vegetation (CDFW VegCAMP ds292)
- EcoRestore Restoration Sites September 2016
- Bird Strike Area

Other Land Use and Infrastructure

DATA VALIDATION PROCESS AND PRIORITIZATION

Data validation and prioritization was conducted within larger group meetings and did not utilize subgroup experts. The selection of layers was based on general discussion and requests for data to provide context or that were particularly relevant to more than one Subject Area. Many of these layers included legal boundary designations, protected lands, and existing infrastructure such as roads and cities.

KEY DATA SETS

Below are described the key data sets from the Other Land Use and Infrastructure data category. ***Figure Ot-1*** is a map that overlays some of these key data that are important to multiple subject areas.

Legal and Planning Boundaries: Legal and planning boundaries to help provide some context and restriction on the analysis. These layers included the Legal Delta Boundary, Conservation Zone 1, and the Cache Slough Restoration Opportunity Areas (ROA) from the Bay Delta Conservation Plan. These layers were particularly helpful in providing different scales to assess opportunities and constraints between Subject Areas for Cache Slough.

City limits, Urban Areas and Roads: US Census MAF/TIGER databases for both roads and urbanized areas. This information is important to provide context for the surrounding developed areas and to identify important connections between infrastructure that helps maintain the complex systems that humans rely on for economic growth and recreation.

Recreation Facilities: Recreation Facilities were represented by a layer downloaded from the Delta Protection Commission to further highlight how recreationalists utilize the area, highlighting another important use of Cache Slough.

OTHER LAYERS WITH OVERLAP

This more general data category includes layers that were important to multiple topic areas and thus could not be assigned to one subject alone. The two largest examples of this are Protected Areas and Elevation. One will find additional description of commonly shared layers within the Appendices at the end of the report and in other topic areas that found them particularly important.

Protected Areas: Protected Areas are mainly described by the most recent versions of the California Protected Areas Database (CPAD 2016b) and the California Conservation Easement Database (CCED 2016).

Elevation: Elevation Data was represented by a 2012 CA Department of Water Resources data set that combines the best available topographic and bathymetric elevation data from 21 individual surveys. MLLW and MHHW elevations were determined for the Cache Slough Complex by cbec, inc., eco engineering (cbec 2010). This dataset and how it was symbolized is described in more detail within the Ecosystem portion of Section 3.

PRELIMINARY BASELINE CONDITION ASSESSMENTS

For a complete baseline condition assessment of the region please refer to the "Cache Slough Complex Conservation Assessment" (CSCCA) Existing Conditions Report.

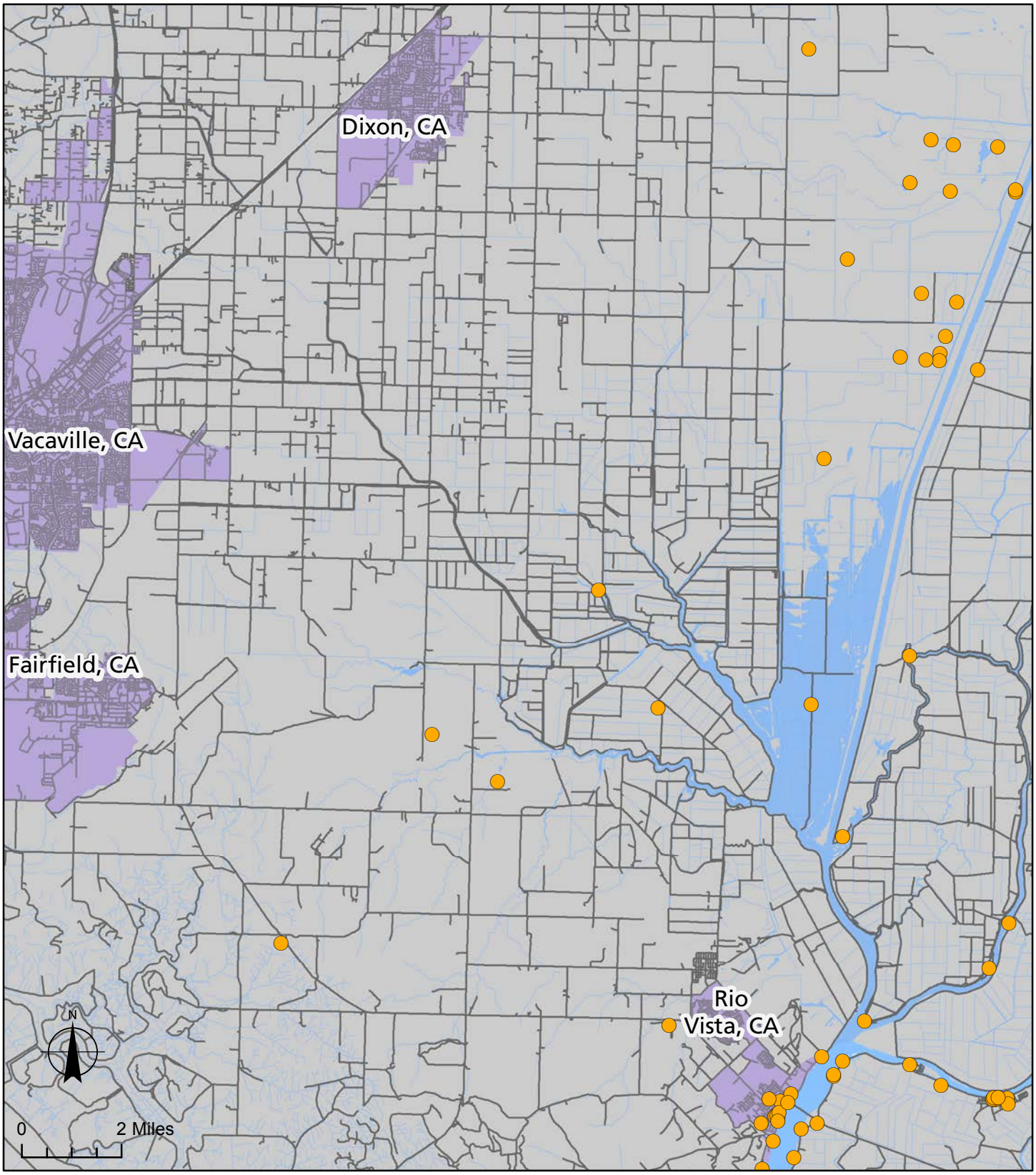


Figure Ot-1: Other Land Use and Infrastructure Overlay

Recreation Sites

County Roads

Urban Areas

OTHER DATA SETS INCLUDED (SEE APPENDIX H)

For additional information and a full list of layers used for the Other Land Use and Infrastructure topic area, please see Appendix H at the end of this report.

- Legal Delta Boundaries
- Solano Unincorporated Zoning
- Cache Slough Restoration Opportunity Areas (ROA)
- Conservation Zone 1 (BDCP)
- Groundwater Basins
- Conservation Easements (CCED 2016)
- Protected Lands (CPAD Units 2016)
- NRCS Environmental Easements
- Access Closed Restricted Unknown
- Elevation
- National Land Cover Database 2011
- Urban Areas
- Railroads
- Roads
- Parcels
- Recreation Facilities
- California Oil & Gas Wells

Data Integration and Visualization

The approach within Phase 1 was focused on bringing in a number of key data sets to start to represent the interest and priorities for each topic area. This approach allowed for powerful analysis when integrating layers from different topic areas. The aggregation of different knowledge areas afforded occasions for new insights as well as highlighted areas of potential opportunities and tension.

Some examples of resulting insights were:

- The present management of uplands and wetlands highlights a current conflict between mandated erosion control measures and sediment supply needs. There is an opportunity to align management of sediment erosion to provide a needed sediment supply for wetland creation and maintenance in the face of sea level rise.

- Agriculture is a complex system with connections outside the region, just as an ecosystem depends of connections that extend beyond the region. This system was characterized by interdependent relationships and a critical mass of sufficient regional services. For example if low valued pastoral lands are removed, it may have a detrimental effect to the wider cattle grazing system in the area. Jim Allan also mentioned during the presentation of the LESA analysis that market forces would help to correct for some change in land use to meet system needs.

- The North Bay Aqueduct is in the middle of a high-priority ecosystem restoration area. This presents both an obstacle and opportunity for restoration interests. The intake for the Aqueduct poses a possible hazard for some wildlife, however the amount of high-priority ecosystem restoration opportunities in the area may provide a big enough justification for investment for moving the intake. This is an example of a problem that might be avoided or sensitively mitigated.
- The potential high-priority restoration area is very close to Travis Air Force Base. Bird strike data and zone layers must be examined as they may impact and be impacted by adjacent restoration.

Furthermore, through the combination of data and subject experts together, the group identified a number of data and knowledge gaps to be addressed moving forward:

- Restoration occurring too close to an intake could increase endangered species populations, which could conflict with intake operations. This highlights the need of proximity analysis for marsh restoration planning and water intakes.
- Agriculture practices provide ecosystem services through wildlife-friendly agriculture, seasonally based ecosystem services, and boundary tree canopy. These positive impacts on ecosystem resiliency and function are not yet represented by collected data layers.
- It is critical to define what we are measuring and how we measure restoration and agricultural preservation success. There is a real need for clear metrics.
- Long-term changes relative to climate change effects and other drivers.

SECTION 4: Major Topics and Issues

The Cache Slough Planning Project work group reviewed and discussed issues during eight three-hour meetings as described in Section 2 and shown in Figure 2-1. The work group reviewed data and information about the historical and current resources and land uses in the CSC. These displays and discussions helped the group develop a shared understanding of the resources and management activities in the CSC with potential to inform development of an acceptable collaborative long-term multi-benefit planning plan for the CSC that balances ecosystem enhancement with other beneficial uses within the region. This section describes the major topics and issues identified and discussed by the work group. The findings and conclusions through Phase 1 and the issues for consideration in Phase 2 are described in Section 5.

Phase 1 Purpose and Charter

Purpose and Charter. The work group began by reviewing and confirming the project purpose and discussing the potential for a project charter. The work group agreed that formal adoption of a project charter by governing bodies of the participating organizations would not be done for Phase 1 due to the short timeline to identify data, information, and major issues. The charter was accepted by the group as a project overview that could help describe Phase 1. The Project Overview is included in Appendix B.

Management Questions. Through Phase 1, the work group identified and discussed the major issues and questions to be addressed by the project. The management issues began with the four core topic areas (agriculture, flood management, water supply, and ecosystem) and focused on the potential adverse impacts of landscape changes over time in each of these four management areas. The group offered additional management issues for consideration related to future conditions, governance, and the collaborative process. As discussions continued, the work group identified an overarching management objective and initial enhancement and compatibility mechanisms that should be explored further. The preliminary management objective is the following:

> *Through the mid- and long-term planning horizon, achieve sustainable multi-beneficial uses in the Cache Slough Complex that improve ecosystem function, flood management, water supply reliability, and agricultural and economic viability.*

The draft high-level management issues and questions for further discussion and refinement in Phase 2 are included in Appendix C.

Phase 1 Outcome. A significant ongoing discussion topic was what information would ultimately be included in the Phase 1 scope, and what would be included in a potential Phase 2. The work group reviewed and discussed the historical ecology for the CSC and ecosystem approaches and principles to understand potential high value ecosystem enhancement areas and compatibility and conflicts with other land uses. However, this report does not document a restoration vision or specific opportunity areas. The work group agreed that further discussion and analysis are needed in Phase 2 to develop an ecosystem enhancement vision and opportunity areas, in the context of current agriculture, flood management, water supply, and other beneficial uses to be incorporated into a Cache Slough Regional Plan.

Project Scale and Level of Detail

Project Study Area. The work group discussed the project study area. The work group agreed that the planning and analysis focus for the project is the CSC while recognizing that each of the topic areas has critical functional and operational connections to the region beyond the CSC and the legal Delta (see the study area map in Appendix D).

Level of Detail. Throughout Phase 1, the work group explored the range of impacts and considerations between landscape level and project- or parcel-level planning. The work group was particularly sensitive to potential landowner and public reaction to mapping data and information that might portray a predetermination of alternate future land uses. Wherever possible, data and information was collected and developed at the parcel or site-specific detail. As described in Section 3, through review and discussion the work group identified a short list of the most important datasets for landscape-level planning in Phase 2. Further discussion and refinement of short- and long-term scenarios for landscape-level planning, mapping, and communication are needed in Phase 2.

Participation, Engagement, and Communications

Work Group Participation. The participating organizations and individuals were consistently and constructively engaged throughout Phase 1. The work group identified the need for a better bridge between State agencies/programs and local interests to foster a constructive forum for engagement from local landowners and other related State and Federal programs, such as the Central Valley Flood Protection Plan, Fish Restoration Program, and the biological opinions for the State and Federal water systems.

Local Outreach. Through Phase 1, outreach to local landowners was managed by Solano County directly and through the LESA modeling process. This LESA process engaged local landowners to infuse local knowledge and local values into land protection and agricultural programs. The work group acknowledged the importance of incorporating the LESA analysis and engaging local landowners more directly into work group discussions during Phase 2.

Data Sources and Accuracy

Major Resource Categories. As described in Section 3, the work group identified, reviewed and validated datasets and information relevant to the landscape-level planning for the CSC. The work group began with three primary topic areas (agriculture, water management, and ecosystem). Through the review and discussion, the work group settled on five categories of data and information:

- Agriculture and LESA (e.g., soils, crops, water rights, Williamson Act, and irrigation infrastructure)
- Flood Management (e.g., levees and drainage systems)
- Water Supply and Water Quality (e.g., intakes and monitoring locations)
- Ecosystem (e.g., habitats and protected areas)
- Other Land Use and Infrastructure (e.g., recreation, roads, and energy infrastructure)

Inclusion Criteria. The work group discussed and agreed on five data inclusion criteria as described in Section 3.

Data Review and Validation. Through the data review process described in Section 3, the work group and subgroups of subject matter experts reviewed proposed datasets, provided updates and corrections, and identified a list of datasets most applicable and relevant for each topic area. These datasets were included in MapTerra for access and review by all work group participants.

Relationship to Other Programs and Activities

The work group discussed and acknowledged the important relationships among this Cache Slough Planning Project and other Federal, State, and local planning, implementation, and regulatory compliance programs. The major programs and issues to discuss and address through Phase 2 include the following:

Central Valley Flood Protection Plan. How will decision-making regarding the State preferred plan, the local preferred plan, and the conservation strategy influence and align with Cache Slough restoration and agricultural sustainability planning? How will future flood operations affect land uses in the study area?

EcoRestore. How will the EcoRestore projects affect local land uses? What can be learned from these impacts and benefits to inform mid- and long-term multi-beneficial use planning?

Fish Restoration Program. How can the data and objectives regarding actions to comply with water export biological opinions be considered and incorporated into multi-beneficial use planning?

Delta Conservation Framework. How can multi-beneficial use planning in the CSC align with and inform the CDFW Delta Conservation Framework?

Yolo Bypass Corridor Management Framework. What can Cache Slough multi-beneficial use planning learn from the Corridor Management Framework and how can the two be compatible?

County General Plans and Solano Habitat Conservation Plan. How can Cache Slough multi-beneficial use sustainability planning inform and incorporate agricultural sustainability strategies in the Solano and Yolo County general plans and the Solano Habitat Conservation Plan?

Cumulative Impacts. How can the cumulative effects of land use changes and other resource management actions be considered and addressed?

Ecosystem Potential

Localizing Ecosystem Principles. In meetings 2 and 5, the work group reviewed and discussed ecosystem principles and approaches for the CSC. The ecological planning approach and principles were presented by the San Francisco Estuary Institute based on the 2016 report *Delta Renewed: A Guide to Science-Based Ecological Restoration in the Sacramento-San Joaquin Delta* and prior reports on the historical Delta ecology and changes over time. As the work group reviewed the specific application of ecological principles to the CSC, the group acknowledged the high degree of sensitivity regarding mapping potential enhancement areas at this preliminary planning stage; local landowners perceive ecosystem enhancement opportunity areas as targeted areas for land acquisition. The group agreed that it is premature to publish any ecosystem enhancement opportunity area mapping as part of the Phase 1 report.

Integration Opportunities. The work group used a hypothetical ecologically based approach for CSC to explore the potential compatibility and conflict issues with other topic areas. The hypothetical ecological enhancement potential was developed by an ecosystem subgroup that identified restoration zones based on a set of preliminary metrics, such as elevation and historical ecology. From this review, the work group refined the management issues and questions and identified potential integration opportunities. The preliminary mapping exercise helped the work

group discuss and understand where objectives and regulatory processes could align better to provide multiple benefits. For example, current regulations control sediment runoff from farm activities, but sediment movement is needed to maintain wetlands—an opportunity for environmental benefits from reduced regulatory requirements in specific areas.

Protection and Assurances for Affected Landowners and Resources

Impacts of Ecosystem Enhancements. A significant topic throughout the work group discussions was the impact of land use changes on the other topic areas in the CSC—particularly concerns about impacts on agriculture from ecosystem enhancement programs and other State planning for flood management and local and regional agriculture and urban water supply reliability. Specific impacts identified to date include loss of agricultural land, impacts on adjacent landowners, reductions in agricultural productivity and impacts on the regional economy and agricultural systems. Similar impacts were identified for water supply, including direct impacts to water supply diversion facilities and potential impacts on diversion operations due to changes in water quality and populations for regulated species. Ecosystem enhancement actions have the potential for adverse impacts on the flood management system (e.g., direct effects on flood facilities and operations, maintenance, repair, rehabilitation, and replacement activities) as well as potential compatible actions (e.g., setback levees can increase habitat and flood capacity).

Protection and Assurances. The issues and concerns about protection of and assurances for agriculture, water supply and drainage infrastructure operations and maintenance, and flood management infrastructure operations and maintenance, influenced every aspect of the Phase 1 discussions. For example, land ownership changes (from private to public ownership) could affect funding for flood and drainage system operations and maintenance. While the work group did not identify any specific protection and assurance measures, the group discussed how Phase 2 could develop and incorporate protections and assurances into an overall multi-beneficial use plan for the CSC. Using water supply intakes as an example, the planned Phase 2 data and visualization will help identify potential protections and assurances, such as the following:

- Which intakes can be fixed in place (retrofits)?
- Other ways to address conflicts (consolidation, relocation, etc.).
- Assurances or protections to reduce or avoid impacts.
- Who pays for capital and O&M costs?

Phase 2 Purpose, Scope, and Schedule

In the final three meetings of Phase 1, the work group had a wide-ranging discussion of the purpose, outcomes, and approach for Phase 2. The key points included the following:

Trust Building. The work group process and discussions helped all participants better understand the perspectives and interests of others, which helped recognition of common ground and remaining disagreements. In general, these discussions helped strengthen mutual respect and relationships among participants and identified opportunities to continue discussions on critical topics in Phase 2.

Data-driven Approach. The data collection, review, and mapping efforts of Phase 1 helped the group see and understand the resources and systems in the CSC and how they might change in the future. Preliminary work to overlay those data helped the work group identify impacts and opportunities that might inform an integrated strategy.

Strategy or Plan. The work group discussed the potential outcome of Phase 2 and the potential commitments required for that outcome. Specifically, the group discussed the potential benefits and timeframes of a long-term strategy that sets a direction, with implementation principles and assurances, versus an adaptive plan that establishes regulatory commitments and local certainty, such as the Yolo Bypass Corridor Management Framework and Suisun Marsh Plan. As noted below, this issue is an important early topic for discussion and agreement in Phase 2.

Certainty and Assurances. As noted above, developing protection and assurances is a significant topic for discussion. The work group discussed several mechanisms for Phase 2 to address this important topic. Potential policy solutions to provide protection and assurances for compatibility issues and conflicts could be considered in these three categories:

- Prescribed programs to resolve as many conflicts between all the topic areas of ecosystem, flood, land use, and water supply.
- Prescribed regulatory and financial assurances to address remaining conflicts.
- Mechanisms to address cumulative impacts and procedural tools to address adaptation and unintended consequences.

SECTION 5: Conclusions and Recommendations

Findings and Conclusions

This section summarizes the major findings and conclusions from Phase 1 and a recommended approach for Phase 2.

Collaborative Process

The Phase 1 collaborative process supported substantial progress among the participants as they developed working relationships and increased shared understanding of the CSC, participant perspectives, and the issues to address in Phase 2. The work group process also allowed for group insight into potential opportunities, resource compatibility, and policy approaches to address impacts and conflicts as described below.

The work group identified the following strengths and successes of Phase 1 of the Cache Slough Planning Project process:

- There was a shared commitment among all the agencies and stakeholders to come to the table and collaborate.
- The group learned from each other.
    - The diversity of participants brought a variety of perspectives.
    - All disciplines were represented (agriculture/land use, flood management, water supply, and ecosystem).
- The group developed a shared understanding and made progress on identifying data needs.
    - Available data and data gaps.
    - Data accuracy and validation.
    - Data needs for Phase 2
- The smaller breakout groups of subject matter experts were valuable for validating the data.
    - Data identification and validation were more accurate.
    - Conversations enabled a deeper dive into the data and process.
    - Discussions resulted in more confidence about the data and process.
- Deadlines helped move the group forward, but also constrained discussion of controversial or foundational issues.
    - Topical focus of each meeting helped participants understand each issue and other perspectives.
    - Initial visual displays helped participants see integration issues, although many acknowledged the need for further deliberation to understand complexity and integration better.

    - Some fundamental issues were unresolved due to the short timeframe, so would become part of a Phase 2 effort.

- Initial insights into the data and issues arose from the collaborative process, which helped the group identify problem areas and opportunities that were not readily obvious.

Data and Information Display and Visualization

Identifying, collecting, and visualizing data and information helped the work group focus discussion, identify data gaps and errors, and develop insights. The following are some of the preliminary insights developed through the Phase 1 collaborative display and visualization process.

Agriculture as a System. Agriculture in Cache Slough functions as a system, and is an integral part of a much larger agricultural system of land management activities. Regional agriculture functions as part of a system of supporting infrastructure and markets. Sustainable agriculture also requires continued access to reliable water supplies and flood protection be maintained. As a result, if agricultural lands go out of production there are direct, as well as indirect and induced impacts to the systems. The story of agriculture cannot be told well through existing data sources (most data were incorrect, much was too broad and some data (especially crop data) changes over time as agriculture is a dynamic system, and so narrative became an important element of the process. Two studies were commissioned to help value agricultural lands and to begin to consider what the direct and indirect impacts to agriculture would be with conversion of lands to other uses. The studies identified information gaps that could be addressed in a Phase 2 process.

Other Resources as Systems. The important CSC resources—flood management, water supply and water quality, ecosystem function, transportation, energy facilities, and the recreation economy—each function as part of management and delivery systems that extend beyond the CSC. Integrated planning for the CSC will need to consider these resources locally and regionally with benefits and consequences within and beyond the CSC.

Additional Data, Information, and Mapping. From the visual displays, the work group identified additional needs in several topic areas, including:

- Mapping wildlife friendly agriculture and capturing the ecosystem value of these areas.
- Considering future scenarios—determine the time horizons and forecast future conditions for land use, water demands, sea level rise, infrastructure, and other issues.

Opportunity Insights. The work group identified several preliminary opportunities resulting from the integrated approach to resource management. The work group also acknowledged that the mapping might help identify areas where the impacts or mitigation expense would make ecosystem or flood management actions unreasonable, thus focusing attention on more viable opportunities. The following are preliminary examples identified, subject to further discussion and evaluation in Phase 2:

- A coordinated regional multi-benefit plan could justify expense of consolidating intakes and/or moving the Northbay Aqueduct (as compared with the current project-by-project approach).
- Sediment is needed to build and maintain wetland habitats and farmers are regulated to control sediment

in their runoff that could otherwise improve ecological conditions.

- Multi-benefit flood risk reduction projects, can be consistent with other land uses such as agriculture and ecosystem benefits, particularly when sited and designed according to a regional restoration and agricultural sustainability plan / strategy.
- Historical ecology may help identify areas where ecosystem enhancement can be more productive in the region, thus reducing the area needed for establishing functional habitat.

Phase 2 Goals and Approach

A scope of work may be prepared for a Phase 2 approach that will continue a collaborative process to develop a Cache Slough Regional Plan. The following are the important issues for consideration during Phase 2.

Key Issues for Phase 2

The Phase 1 work group process identified the following important issues that could be addressed in Phase 2. Participants will continue to confer on development of a proposed Phase 2 scope of work.

Continue to Refine Management Issues. The management questions will help inform and guide planning efforts. Important management issues for early discussion in Phase 2 are the governance mechanisms for implementing assurances and commitments and the timing and resources for implementation. The Phase 2 evaluation of land use changes and infrastructure modifications will further refine the management issues and questions. The draft management issues and questions are included in Appendix C.

Continue Data Collection, Validation, and Visualization. The mapping and overlay process will inform work group discussions and deliberation on a strategy or plan. Additional data collection and analysis is needed in all topic areas to inform an integrated approach. Example data and information needs include the following:

- Agricultural systems – markets and infrastructure.
- Flood and water supply operations.
- Ecosystem value from agriculture
- Regional economic benefits and losses.

Develop a Regional Strategy or Plan. Using the enhanced analysis, mapping, and visualization, the work group would develop an integrated multi-beneficial use plan that is locally supportable. An iterative planning and analysis process will identify opportunities, benefits, and impacts for each topic area.

Identify Protection and Assurances. As noted above, the mechanisms and governance for protecting or mitigating impacts to important resources is a critical topic for Phase 2. Achieving a locally-supported multi-beneficial use plan will depend on building trust, negotiating options, and securing commitments from the State and local government, and potentially the Federal government.

Phase 2 Participation. For Phase 2, additional participation is needed from State agencies (DWR FloodSAFE), Federal agencies [Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (USFWS)], and local landowners.

Phase 2 Timing and Schedule. The lead participants must develop and agree on a schedule that maintains momentum to develop a plan and allows time for deliberation and development of assurances and commitments among the participants.

Phase 2 Decision-making. Phase 2 will include important and challenging discussions among local, regional, and State organizations regarding ecosystem enhancement opportunities, land use compatibility, benefits, impacts, protections, and assurances. The participating agencies, organizations, and stakeholders should revisit the project charter and develop specific work group discussion and decision-making procedures.

Determine Need for Plan Adoption. Phase 2 will develop a plan and consider if the plan should be adopted and if so, by whom. Plan adoption could trigger requirements for environmental review of the plan and further negotiation of permits. Environmental review would be included in Phase 3 and would likely require funding from other sources.

Other Recommendations

Additional Funding. The comprehensive regional planning anticipated in Phase 2 could provide collaborative discussions and agreements that would benefit a wide array of agencies and stakeholders. The participants agreed that additional funding sources for comprehensive planning in Phase 2 should be sought.

Appendices

Appendix A – Phase 1 Participants

Appendix A ***Cache Slough Restoration Planning*** ***Contact List and Participation***

Contact	**Company**	11/7/16	12/16/16	1/13/17	2/10/17	3/10/17	4/14/17	5/19/17	6/9/17
Genevieve Taylor	Ag Innovations						X		
Lauren Hastings	CA Delta Stewardship Council							X	
Jeff Juarez	CA Delta Stewardship Council		X	X	X		X		
Ron Mercer	CA Delta Stewardship Council								
Brooke Jacobs	CA Department of Fish and Wildlife	X	X	X				X	
Christina Sloop	CA Department of Fish and Wildlife		X	X	X	X	X	X	
Gina Van Klompenburg	CA Department of Fish and Wildlife						X	X	
Carl Wilcox	CA Department of Fish and Wildlife	X		X	X	X	X		
Dennis McEwan	CA Department of Water Resources								
Michael Perrone	CA Department of Water Resources			X	X	X			
Dan Riordan	CA Department of Water Resources								
Tim Smith	CA Department of Water Resources				X	X	X	X	
Kris Tjernell	CA Natural Resources Agency								
David Okita	California ECO RESTORE	X	X	X	X	X	X	X	
Karen Kayfetz	Delta Science Program								
Martina Koller	Delta Science Program		X	X	X	X	X	P	
John S. Currey	Dixon RCD	X	X	X	X		X	X	
Bethany Hackenjos	FlowWest		X	X	X	X	X		
Emanuel Rodriguez	FlowWest			X					
Mark R. Tompkins	FlowWest	X	X	X	X	X	X	X	
Eric Nagy	Larsen, Wurzel & Associates			X	X			P	
Wendy Rash	Natural Resources Conservation Service				X				
Melinda Terry	North Delta Water Agency								
Bryan Busch	Reclamation District No. 2068	X	X			X			
Mike Hardesty	Reclamation District No. 2068	X	X	X	X	X	X	X	
Campbell Ingram	Sacramento-San Joaquin Delta Conservancy	X	X	X	X	X		X	
Beckye Stanton	Sacramento-San Joaquin Delta Conservancy	X	X	X	X	X	X	X	
Julie Beagle	San Francisco Estuary Institute	X							
Robin Grossinger	San Francisco Estuary Institute		X						
Tony Hale	San Francisco Estuary Institute	X			X	X	X	X	
Pete Kauhanen	San Francisco Estuary Institute	X	X	X	X	X	X	X	
Sam Safran	San Francisco Estuary Institute			X	X	X	X	X	
Jim Allan	Solano County				X			X	
William Femlen	Solano County	X			X				
Nedzlene Ferrario	Solano County							X	
Roberta Goulart	Solano County	X	X	X	X	X	X	X	
Peter Miljanich	Solano County	X	X	X					
Skip Thomson	Solano County								
Thomas Pate	Solano County Water Agency	X	X	X	X	P	P	X	
Roland Sanford	Solano County Water Agency		X	X	X	X	X		
Tracy Ellison	Solano Land Trust				X				
Chris Rose	Solano RCD	X	X			X	X		
Kim Webb	U.S. Fish & Wildlife Service								
Brett Milligan	University of California, Davis		X	X	X	X	X	X	
Dennis Chambers	Yolo County								
Jim Provenza	Yolo County								
Richard Reed	Yolo County								
Elisa Sabatini	Yolo County								
Douglas K. Brown	Yolo County/Douglas Environmental	X	X	X	X	X	X	X	
Heather Nichols	Yolo County RCD	X							
Count		19	21	23	26	21	22	22	0

CACHE SLOUGH RESTORATION PLANNING

PROJECT OVERVIEW

Version: Draft 2.0

December 9, 2016

Purpose of Project

The project purpose is to develop a restoration strategy for the Cache Slough Complex (CSC) that identifies areas for habitat restoration and projects that would be eligible for Proposition 1 funding. Through engagement in a collaborative planning process among local, state, and federal agencies and interests, a locally-supportable vision and strategic planning approach will be developed that considers multiple land use plans and processes focused in the CSC, reduces potential conflicts between those uses, and identifies opportunities for a landscape-level integrated approach. This regional planning effort will complement already-ongoing collaborative work among local, state and federal agencies in the larger Yolo Bypass/Cache Slough (YBCS) Region; and build on and further develop efforts by the local partners in the Corridor Management Framework (CMF).

A collaborative partnership of agencies currently consisting of the Delta Conservancy, Solano County, Solano County Water Agency, Reclamation District 2068, and Yolo County have prepared a scope to develop a vision for the CSC with a consensus on implementable projects, programs, and potential agreements to achieve regional goals and objectives. Additional local stakeholders, including representatives from the agricultural community, reclamation and resource conservation districts, and other local, regional, state and federal government agency representatives, may participate in this collaborative partnership as it develops further. Science subject matter experts may also be consulted for technical support. Outreach to local stakeholders will be led by the local partner agencies.

The YBCS is a key area of public focus for many short- and long-term planning processes, including federal and state programs to improve regional flood management and advance habitat restoration activities to mitigate for the state and federal water projects operations, preserve declining endangered species in the Sacramento-San Joaquin Delta, and incorporate improvements to the regional flood management system. The CSC is located at the downstream end of the YBCS and is an integral part of the regional landscape, hydrology, and hydraulics. Existing land uses in the region are primarily agriculture, local and regional flood protection, terrestrial and aquatic habitat, and water supply for local agriculture and regional municipal and industrial needs. The CSC can be affected by actions further up in the YBCS, such as modification to the flood management system and habitat restoration, among other activities.

These land uses will be analyzed, individually and collectively, to identify a suite of multi-objective solutions and strategies that, if implemented, could ensure effective science-based restoration efforts that would be realized with the least possible impact on existing and potential future land uses and with local support. The primary objective is to identify habitat restoration opportunities, while preserving agriculture, other land uses and infrastructure, flood management objectives, and the operation and maintenance of existing water resources infrastructure located in the CSC. The collaborative process is designed to foster trust and support among project participants and local landowners for workable restoration strategies in the CSC.

The purpose of Phase 1 of this project is to take an initial and rapid review of existing data and information to determine what may be opportunities and what additional information or analysis may be necessary to develop a mutually agreeable restoration strategy. The expectation is that the group will work together in a series of facilitated meetings, with support from data integration and management experts to complete Phase 1 of the work within a period of approximately 6 months.

Project Objectives

Assemble and prepare relevant data sets

The group will work together to identify readily available data sets and information to be integrated for analysis. The group will also identify missing information or data gaps.

Conduct additional agricultural analysis

Solano County will conduct analysis using the California Agricultural Land Evaluation and Site Assessment Model (LESA) and will present initial findings to the group as soon as possible.

Overlay information to determine initial opportunity areas

The group will review integrated data and information to determine where restoration opportunities exist relative to all other land uses and constraints. The group will determine if there is collective support for developing and sharing an initial high level framework based on analysis of all readily available information.

Develop Phase 2 scope of work

The group will work collaboratively to identify additional information and analysis requirements and next steps for completing a restoration strategy. This will include tools, tasks, costs and timeline.

Prepare final report

The group will prepare a final report that summarizes progress to date and next steps. The report contents and how widely it is shared will be based on the progress made by the group and will be determined by consensus.

Roles and Responsibilities

The Delta Conservancy will assist the Facilitator (Catalyst) with meeting coordination and logistics, manage project contracts and participate in the planning process.

The Facilitator will coordinate, facilitate and summarize meetings and assist with a project final report (content to be determined by the group).

The Planning Partners (Delta Conservancy, Solano County, Solano County Water Agency, Reclamation District 2068, and Yolo County) will guide the planning process to include outreach to additional stakeholders and general oversight of the process.

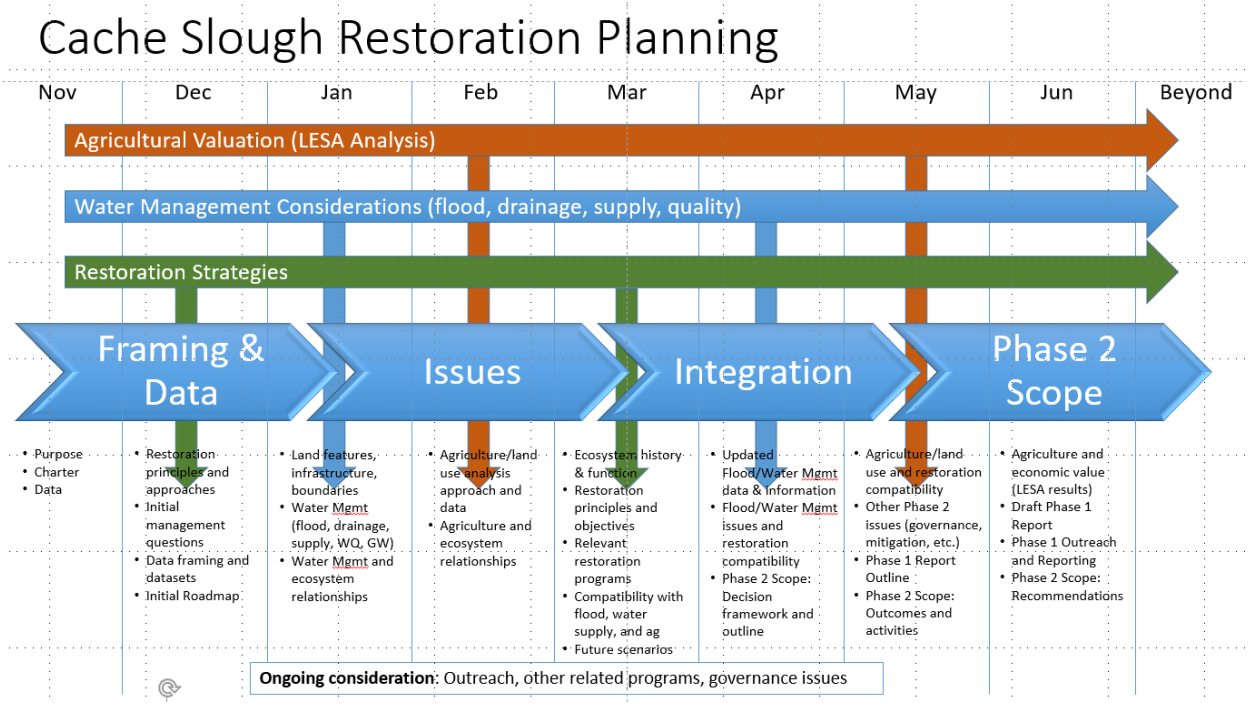
The Technical Resources team, led by SFEI and FlowWest, will support the integration of information into readily accessible visual formats that will allow the participants to efficiently conduct collaborative analysis. The Delta Science Program and other science specialists will provide additional review and input.

All participants will provide information that should be considered in the analysis and participate in the collaborative discussions. All participants will work to define the final output of the project, a final report, and a description of next steps and a scope of work for Phase 2. The initial Phase 1 participants list is included as Attachment B.

Timeline

This Phase 1 effort is intended to take approximately 6 months. The Phase 1 roadmap and timeline is included as Attachment A. The group will meet regularly, at least monthly, to make as much progress as possible within 6 months and will continuously assess the project schedule.

Attachment A – Project Roadmap



Attachment B – Initial Participant List

Planning Partners

Sacramento-San Joaquin Delta Conservancy

- Campbell Ingram, Executive Officer
- Beckye Stanton, Sr. Env. Scientist

Solano County

- Skip Thompson, Supervisor
- Roberta Goulart
- Jim Allan, Agricultural Commissioner
- Peter Miljanich
- William Femlen

Solano County Water Agency

- Roland Sanford, General Manager
- Thomas Pate, Principal Water Resources Engineer

Reclamation District 2068

- Mike Hardesty
- Bryan Busch

Yolo County

- Jim Provenza, Supervisor
- Dennis Chambers, Chief Deputy Agricultural Commissioner
- Richard Reed, Supervisor's Deputy, Dist. 4
- Elisa Sabatini, Natural Resources Analyst
- Doug Brown, Douglas Environmental

Other Local Agencies

Dixon RCD

- John S. Currey, District Manager

North Delta Water Agency

- Melinda Terry, Manager

Solano RCD

- Chris Rose, Executive Director

Yolo County RCD

- Heather Nichols, Executive Director

Other State and Federal Agencies

CA Natural Resources Agency

- Kris Tjernell, Special Asst. for Water Policy
- David Okita, California ECO RESTORE

CA Delta Stewardship Council

- Lauren Hastings, Adaptive Management Science Advisor
- Jeff Juarez, Associate Environmental Planner

CA Department of Fish and Wildlife

- Carl Wilcox, Regional Manager
- Brooke Jacobs

CA Department of Water Resources

- Dennis McEwan, Branch Chief, Mitigation and Restoration Branch
- Michael Perrone, Special Projects Coordination
- Dan Riordan

U.S. Fish & Wildlife Service

- Kim Webb, Project Leader

Technical Resources

FlowWest

- Mark R. Tompkins, Principal and Founder
- Bethany Hackenjos

San Francisco Estuary Institute

- Robin Grossinger, Resilient Landscapes Program Director, Senior Scientist
- Tony Hale, Environmental Informatics Program Director
- Sam Safran
- Pete Kauhanen

University of California, Davis

- Brett Milligan, Assistant Professor

Facilitation and Process Design

The Catalyst Group

- Charles Gardiner, Principal
- Linadria Porter, Project Manager

Cache Slough Complex Restoration Planning

Initial High-level Management Issues and Questions

Objective: Through the mid- and long-term planning horizon, achieve land uses in the Cache Slough Complex that improve ecosystem function, flood management, water management, and agricultural and economic sustainability.

Agriculture/Land Use

Objective: Maintain and increase the agricultural productivity of the Cache Slough Complex and the value of other existing land uses, such as recreation.

1. What is the level of productivity for the regional economy, assessments, and tax revenues of lands in the study area?
2. How could changes in land use adversely affect the agricultural economy?
    - Loss of farmed acreage
    - Disruption or interruption to water supply or drainage infrastructure
    - Disruption of transportation access
    - Seepage impacts on farming activities
    - Increased regulatory burden on farm activities
    - Other?
3. What are the opportunities to enhance the agricultural economy?
    - New income sources: incentive programs for wildlife-friendly agriculture, carbon credits, reverse auctions (e.g. “pop-up wetlands”)
    - Increased provision of ecosystem services: wild crop pollinators, natural pest control
    - Expansion of mutually beneficial management practices
4. Which agricultural lands might be most compatible with multi-benefit uses (e.g., flood management, restoration, and/or recreation)?
5. What are the opportunities to maximize recreation (by incorporating new recreational opportunities and/or connecting to existing recreational facilities?)

Water Supply

Objective: Minimize supply disruptions and maximize water quality for water users.

6. What are the use locations and quality needs for water supply in and near the Cache Slough Complex?
7. How could changes in land use improve or adversely affect water supply and water quality?
    - Changes in water quality due to new aquatic habitats
    - Disruption or interruption to water supply infrastructure
    - Increased populations of important fish species near intakes resulting in diversion restrictions
    - Changes in stage resulting from changing tidal prism
    - Other?
8. How can restoration, flood management, and water be managed together to maximize benefits?

Flood Management

Objective: Minimize loss of life and economic damage in the Cache Slough Complex caused by flood events and maximize compatibility with other land uses.

9. What are the flood and drainage management needs for the Cache Slough Complex and surrounding areas?

10. How could changes in land use adversely affect flood and drainage management?
    - Disruption of flood and drainage infrastructure
    - Changes in flood channel capacity
    - Other?
11. How can restoration and flood management be managed together to maximize benefits?
    - Increased flood storage capacity
    - Floodplain restoration to reduce flood stage and attenuate peak discharge

Ecosystem

Objective: Increase ecosystem function, habitat connectivity, and resilience of native wildlife.

12. What habitat types and environmental conditions are the highest priority and most appropriate for restoration in the plan area?
13. What physical processes and attributes are necessary and/or desirable to have in potential restoration lands?
14. What connectivity considerations are important for ecosystem health?
15. What are the restoration and mitigation needs for planned changes in flood management, water supply management, land development, etc.
16. What lands provide the best opportunity for restoration?

Future Conditions

Objective: Identify and develop reasonable forecasts of future conditions to support informed decision-making.

17. What are the future scenarios (timeframe and conditions) that should be considered in Phase 2?
    - For example, which lands, infrastructure, operations, and natural systems are most vulnerable to climate change over the long-term (from extended droughts, increased flood flashiness, sea-level rise, changes in salinity)?
18. What models and tools best support understanding of future scenarios?

Governance

Objective: Maximize governance coordination and minimize procedural barriers to achieving economic, ecosystem, and water and flood management objectives.

19. What governance considerations enhance or impede valuable, compatible opportunities?
20. What principles and mechanisms will guide restoration planning and implementation (including mitigation approaches)?
21. What enforceable assurances, mitigation measures, or policy decisions are available to protect current and future land/water uses?

Collaborative Process

Objective: Use trusted, accurate information to support informed decisions about a long-term strategy for the Cache Slough Complex.

22. How can the process ensure that data and information is the best available, current, accurate, and trustworthy?
23. How will this process foster support and acceptance by participants and landowners?

Appendix D – Agriculture Layers Metadata

Land Capability Class (CacheSloughSoil_LandCapability.shp)

Land Capability Classification collected from NRCS access database table "component"

Field: "nirrcap"
Non-irrigated land capability derived by combining broadest land classification category (nirrcapcl) with second level land classification category (nirrcapscl)

Field: "irrcap"
Irrigated land capability derived by combining broadest land classification category (nirrcapcl) with second level land classification category (nirrcapscl)

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, 2e. The letter e shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by w, s, or c because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. These units are not given in all soil surveys.

Credits
Source data from NRCS SSRGO database
www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_053627
Shapefile created by Bethany Hackenjos (FlowWest) on 2/8/2017

Use limitations
There are no access and use limitations for this item.

Delta Crop Map, Permanent Crops (Delta_Landuse_06162016.shp)

Description
Delta Landuse dataset for the extent of the Delta Boundary. Delineated on the Pleiades Image from July 13-14, 2015. The dataset is a comprehensive landuse for the period of July 13-14 2015 and also contains information on agricultural classes for spring 2015. Major assumption of

this dataset is that the native vegetation is grouped into 5 level 2 categories and are grouped into 3 DWR native categories.

Permanent Crops: Citrus/Subtropical, Vineyards, and Other Deciduous.

Credits
Land IQ

Use limitations
No use limitations

Irrigated Lands (irr_lands.shp)

Description
Irrigated lands layer developed during the 2016 Cache Slough Land Evaluation and Site Assessment Study. Delivery and drainage infrastructure spatial data was not available during the model development process. As a proxy for actual mapped infrastructure in the Cache Slough Complex, we developed an irrigated lands layer, assuming if these lands are classified as irrigated or have the potential to be irrigated, the infrastructure to do so is in place. The first draft of this layer was developed by assigning irrigated status by land use type per the 2015 Delta Land Use spatial data. A draft map of the irrigated lands layer was then reviewed by stakeholders
and several parcels were adjusted in the shapefile based on their feedback on irrigated versus non-irrigated status. The field represented irrigated status in the master input file is IRR, where a ‘1’ indicates the parcel is or can be irrigated and a ‘0’ indicates it does not.

Credits
FlowWest (2017)
Anna Constantino (aconstantino@flowwest.com)

Cache Slough Regional LESA Scores (ls_1000_w2.tif)

Description
The Cache Slough regional LESA score layer was developed during the Cache Slough Land Evaluation and Site Assessment (LESA) Study. This raster was made by calculating the LESA score for each parcel in the Cache Slough LESA study area, and then transforming those results into a 1000-ft pixel raster (image) layer. The stakeholders who participated in the Cache Slough LESA model development process are comfortable sharing regional LESA scores at this scale. The LESA score thresholds developed during the study are as follows: for LESA scores (pixel values) greater than or equal to 80, agriculture significance is "Very High"; for LESA scores from 65-70, agriculture significance is "High"; for LESA scores from 40-64, agriculture significance is "Moderate"; for LESA scores less than 40, agriculture significance is "Low."

Please see 2016 Cache Slough Land Evaluation and Site Assessment Study technical memo at *LINK TO TM* for more information.

Credits
Date created by FlowWest: 5/16/2017

Source: FlowWest per the Cache Slough LESA Study

Contact Information: Anna Constantino; aconstantino@flowwest.com

Use limitations
There are no access and use limitations for this item.

Recreation Sites (DPC_Sites_2005_2016_3Counties.shp)

Description
A point feature class that represents locations of recreational sites within and near the CA Delta. the sites include marinas, dry storage facilities, campgrounds, boat access, launches, marine services, restaurants, museums, service providers,,etc.

Credits
Tawn Daniel, GIS Student Assistant, State Parks
Sacramento-San Joaquin Delta Recreation and Tourism Inventory 2015
Downloaded by FlowWest 2017 from Delta Protection Commission

Use limitations
For reference purposes only.

Conservation Easements (CCED_3counties.shp)

Description
The California Conservation Easement Database (CCED) inventories mainly privately owned lands that have been protected through conservation or open space easements. A separate database (CPAD – the California Protected Areas Database) tracks open lands owned outright ("in fee") by public agencies and nonprofits. This data set's primary purpose is to support multi-jurisdictional planning and assessment projects, at scales ranging from counties or parts of counties to the entire State of California. CCED should not be used as the basis for official regulatory, legal or other such governmental actions – these types of uses require official land records from county recorders or easement holding agencies in the area of focus.

Conservation easements are legal restrictions created by a contract between a landowner and a qualified agency or organization that are usually based on limiting the future uses of a property to those compatible with open space, conservation, farming or other defined uses. Such easements reduce or remove development opportunities on these lands. The California Conservation Easement Database (CCED) inventories such easements held in perpetuity or for at least 10 years by public and nonprofit organizations. This release of CCED includes most conservation easements, but is incomplete for two

large easement holders, the Calif. Dept. of Fish & Wildlife and the California Rangeland Trust. Data sources for CCED include easement holding organizations and records from the Calif. Wildlife Conservation Board (WCB) and the Bay Area Open Space Council - note that all easements in California are officially filed with the relevant County Recorder's office and are public records data. CCED is an element in the National Conservation Easement Database (NCED).

Credits

CCED is made available without charge for a wide range of uses, for example, use by government agencies in planning and operations, use by private consultants in the development of plans and analyses, use by non-profit organizations and educational institutions for strategy, research, planning, management and other functions. While agencies, organizations, individuals and businesses may distribute free of any charges copies of the data, any such replication must include this disclaimer and require user to review the provisions therein.

This dataset was released on December 2016 by GreenInfo Network.

Protected Lands (CPAD_2016b_Holdings.shp)

Description

CPAD is suitable for a wide range of planning, assessment, analysis and display purposes. CPAD should not be used as the basis for regulatory, legal or other specific governmental actions. Read the CPAD Data Disclaimer for more information.

The California Protected Areas Database (CPAD) contains data on lands owned in fee by governments, non-profits and some private entities that are protected for open space purposes. Data includes all such areas in California, from small urban parks to large national parks and forests, mostly aligned to assessor parcel boundaries. Data is collected by Holdings (parcels) which are aggregated to Units (commonly named areas within a county) and Super Units (commonly named areas generally).

Credits

This dataset was released on December 15, 2016 by GreenInfo Network.

Use limitations

All users must review the CPAD Data Disclaimer before using the dataset - CPAD is generally available to any user.

Public Access on Protected Lands (Access_ClosedRestrictedUnknown.shp)

Description

Conservation Areas with No Public Access, Restricted Public Access, and Unknown Access in Solano, Yolo, and Sacramento Counties For use in Cache Slough Restoration Planning (FlowWest, Delta Conservancy 2017)

Created with Union of California Conservation Easement Database (CCED 2016) and California Protected Lands (CPAD 2016). AccessCalculated from "pubaccess" (CCED 2016) and "ACCESS_TYP" (CPAD 2016) fields for only No Public Access, Restricted Public Access, and Unknown AccessAll other AttributesSee metadata fro CCED 2016 and CPAD 2016

Credits
FlowWest 2017

Parcels - Williamson Act Lands (Parcels.shp)

Description
County Parcel Boundaries, Williamson Act Parcels

Credits

Solano County 2014

Appendix E – Water Supply and Water Quality Layers Metadata

Cache Slough Complex Intakes and Drains (CSCCA_IntakesDrains_Rev1.shp)

Description
This point shapefile contains data from several sources, with varying levels of spatial accuracy. Original source data was provided to WWR by cbec, and contained data from SCWA, RD 2068, eWRIMS gis database, Delta Vision, and aerial photo interpretation. Additional features were added by WWR in 2013 based on 2012 NAIP and Google earth aerial imagery. Further revised by SCWA on 3/10/2017.

Credits
cbec 2012, WWR 2013, SCWA 2017, FlowWest 2017

USGS Stations (USGS_Selected_20170111.shp)

Description:
USGS streamflow monitoring locations in the vicinity of the Cache Slough Complex

Credits:
USGS 2017

EMP Discrete Water Quality Monitoring Stations (DiscreteWQ_Stations.shp)

Description

Discrete water quality monitoring is one element of the Bay-Delta Monitoring and Analysis Section (BDMA) conducted by DWR and USBR with assistance from DFG and the USGS under the Interagency Ecological Program (IEP) umbrella. The BDMA also monitors water quality with a set of continuously recording automated stations, and it has complementary phytoplankton, zooplankton and benthic macro-invertebrates monitoring elements. The overall objective of the water quality monitoring program is to provide information for water resource management in compliance with flow-related water quality standards set forth in the series of Water Right Decisions described above. These decisions permit the USBR and DWR to appropriate water for operation of the CVP and the SWP. In return, the two agencies are required to monitor the effects of diversions and flow manipulations resulting from project operations and ensure the compliance with existing water quality standards. Another objective of the BDMA water quality monitoring is to provide abiotic information relevant to the interpretation of the results of the

Credits
Link: http://www.water.ca.gov/bdma/meta/discrete.cfm
Contact Information: Program Manager: Shaun Philippart
Lead Contact: Shaun Philippart
Department of Water Resources
Division of Environmental Services
3500 Industrial Blvd, West Sacramento, CA 95691
(916) 375-4825
shaun.philippart@water.ca.gov

Use limitations
There are no access and use limitations for this item.

EMP Zooplankton Monitoring Stations (Zooplankton_Stations.shp)

Description:
Geographic coverage of the IEP EMP zooplankton sampling sites ranges from San Pablo Bay east through the upper estuary including Suisun Bay, Suisun Marsh, the lower Sacramento River upstream to Decker Island, the San Joaquin River upstream to Stockton, and the southern Delta to Old River. A total of 89 sites have been sampled at various times during the life of the project. However, on no survey were all stations sampled. Currently, 20 fixed stations and between 2 and 4 floating entrapment zone stations (where bottom electrical conductivity is 2 and 6 millisiemens per centimeter) are sampled monthly.

Shapefile of Historic and Active stations built by FlowWest using excel table located here http://www.water.ca.gov/bdma/meta/zooplankton/data.cfm

Credits
Zooplankton Data:
DWR
Lead Contact: April Hennessy

California Department of Fish and Wildlife
Bay Delta Region
2109 Arch Airport Rd, Suite 100, Stockton, CA 95206
(209) 234-3665
April Hennessy

Shapefile created by FlowWest 2017

Use limitations
There are no access and use limitations for this item.

CDEC Stations (CDEC_Selected_20170111.shp)

Description:
DWR California Data Exchange Center (CDEC) locations of regional streamflow and water quality monitoring.

Credits:
CDWR 2017

Juvenile Fish Monitoring Program Locations (USFWS_JFMP_Locations.shp)

Description:
The original objective of the Delta Juvenile Fish Monitoring Program in the 1970's and 1980's was to monitor effects of water projects in the Delta on abundance, distribution and survival of juvenile fall run Chinook salmon in the lower Sacramento and San Joaquin Rivers and the San Francisco Estuary. This objective was broadened in the 1990's to include relative abundance and distribution of all races of juvenile Chinook salmon. In 2001, the program objectives were broadened further to reflect the value of gathering information on non-salmonid species. Species information at times has also been recorded for jellyfish and crustaceans spp. that are encountered as well.
General category of data collected: Native and non-native species of fish found within the San Francisco Estuary and lower Sacramento and San Joaquin Rivers.
Geographic range of current field work: There are currently fifty-eight (58) beach seine sites located on the Lower Sacramento and San Joaquin Rivers, North, Central and South Delta and San Francisco Bay (Table 2; Figure 1). Three (3) boat trawling stations are also regularly sampled (Table 3; Figure 1). These are located at Sherwood Harbor on the Sacramento River, Chipps Island in Suisun Bay and Mossdale Crossing County Park on the San Joaquin River. In addition, special studies have been conducted throughout the years (i.e., Liberty Island, Delta Cross Channel, VAMP, Six Year Study, etc).
Each sampling site is designated by a Station Code which displays the abbreviations of the body of water sampled (Table 1), the number of miles from the mouth of the river or bay, and

the orientation within the sample site (e.g., site AM001S is 1 mile from the mouth of the American River on the south bank).

Source: USFWS
Link: https://www.fws.gov/lodi/juvenile_fish_monitoring_program/jfmp_index.htm
Stations, latitude, and longitude from Juvenile Fish Monitoring Program (JFMP) .

Use limitations
There are no access and use limitations for this item.

North Bay Aqueduct (NorthBayAqueduct.shp)

Description
Location of North Bay Aqueduct (NBA) - pipeline that delivers water from Barker Slough to Cordelia Forebay. Location and extent of North Bay Aqueduct is approximate and should be used only for cartographic purposes.

Credits
WWR 2013

Reclamation Districts (RDs_CSCCA.shp)

Description
This delineation represents the twelfth major revision of this dataset from 10/19/2009, after the eleventh revision of this dataset from 8/13/2009, after the tenth major revision of this dataset from 3/2008, after the ninth major revision of this dataset from 12/2006, after the eighth revision from 6/2006, after the seventh revision from 3/2006, after the sixth revision from 2/2006, after the fifth major revision from 1/2005, the fourth major revision from 10/2004, the third major revision from 6/2003, the second version from 10/2002, and after the first version produced by Office of Emergency Services during the 1997 floods. It was recognized that certain district boundaries in that GIS coverage were inaccurate, which prompted DWR Delta Levees Program to undertake an improvement of the entire dataset beginning in May of 2001.

There are undoubtedly improvements which can be made to this dataset. Comments and improvements should be forwarded to DWR Delta Levees Program (Joel Dudas) 916-651-7002 for synthesis.

Credits
DWR: Joel Dudas

Use limitations
This is not a dataset which should be used for legal delineations. It is purely intended for general location of district boundaries.

Interior Drainage, Modified National Hydrography Dataset (CSCCA_NHDLines_WWRmod_20130628.shp)

Description
This dataset was created to describe and analyze the movement of surface water throughout the Cache Slough Complex Conservation Assessment (CSCCA) project area and adjacent upland watersheds. WWR staff added five descriptive attribute fields (detailed in the metadata abstract) to the USGS's National Hydrography Dataset (NHD), Clipped to the boundary of the DHCCP Planning Counties (Alameda, Contra Costa, Sacramento, San Joaquin, Solano, Sutter, and Yolo).

Credits
See dataset specific metadata.

Use limitations
This shapefile represents a subset of the master Cache NHD dataset (CacheHydrology_NHDLines_WWRmod_20130628). No edits to feature geometry were made by WWR, however, certain water sources were removed entirely from the dataset to facilitate cartographic representation. As such, this dataset should not be used for anything other than map cartography - for any sort of Cache NHD analysis use CacheHydrology_NHDLines_WWRmod_20130628.
Acknowledgment of the originating agencies would be appreciated in products derived from these data.

Regional Watersheds (CSCCA_Watersheds.shp)

Description
Created by WWR in June 2013. Watershed unit boundaries based on the national Watershed Boundary Dataset (WBD); funded by NRCS, EPA, and USGS (http://nhd.usgs.gov/wbd.html). WBD polygons were further sub-divided, and boundaries altered, by WWR to correspond with CSCCA levee dataset, NHD hydrology lines, SCWA Watershed data (2006) and topographic features. Specific edits include the following:

Levee centerlines were used to define watershed boundaries for areas completely surrounded by levees. This includes the units of Hasting's Tract, Liberty Farms, Little Egbert South, Little Egbert Tract, Little Holland East, Lower Moore Tract, Mahoney - Ulatis, Moore Tract, Peter's Pocket, Prospect Island North, Prospect Island South, West Hasiting's Tract - Cache, and West Hasting's Tract - Lindsey. These units were delineated independently from the WBD polygons.

The boundary between Egbert Tract and Watson Hollow was digitized by WWR to account for a low ridge and ditch/levee infrastructure that directs surface water toward different outflow points. The primary drain for Egbert Tract is near its northeast corner, while Watson Hollow drains through the channel separating Little Egbert Tract and Little Egbert South.

The WBD polygon boundary bordering the Ulatis Creek and Barker Slough watersheds was altered to correspond to the SCWA Barker Creek watershed boundary in the NW corner of their shared border. The SCWA Barker Creek watershed boundary more accurately mapped creek and channel hydrology in that area.

The northern edge of the RD 2068 and 2098 watershed is only partially defined by a levee centerline. The boundary follows an old railroad grade at its northernmost extent. This grade has several aqueducts and is not impermeable to surface flows.

WBD watershed metadata as follows: "The Watershed and Subwatershed hydrologic unit boundaries provide a uniquely identified and uniform method of subdividing large drainage areas. The smaller sized 6th level sub-watersheds (up to 250,000 acres) are useful for numerous application programs supported by a variety of local, State, and Federal Agencies. This data set is intended to be used as a tool for water-resource management and planning activities, particularly for site-specific and localized studies requiring a level of detail provided by large-scale map information. The dataset will be appended to a larger seamless nationally consistent geospatial database as other states complete their portion of the watershed boundary dataset.

This data set is a complete digital hydrologic unit boundary layer to the Subwatershed (12-digit) 6th level for the entire United States. This data set consists of geo-referenced digital data and associated attributes created in accordance with the "FGDC Proposal, Version 1.0 - Federal Standards For Delineation of Hydrologic Unit Boundaries 3/01/02"(http://www.ftw.nrcs.usda.gov/huc_data.html). Polygons are attributed with hydrologic unit codes for 4th level sub-basins, 5th level watersheds, 6th level subwatersheds, name, size, downstream hydrologic unit, type of watershed, non-contributing areas and flow modification. Arcs are attributed with the highest hydrologic unit code for each watershed, line source and a metadata reference file."

Credits
USGS, WWR, SCWA

Use limitations
There are no access and use limitations for this item.

CVFPP State and Locally Preferred Options

Description:
Multiple shapefiles of proposed levee modifications, plan features, and future habitat types provided by CDWR. Defines the various actions proposed under both the State Recommended and Locally Preferred options of the Central Valley Flood Protection Plan as outlined in the 2017 Draft Update (State Recommended) and the 2016 Basin Wide Feasibility Study (Locally Preferred).

State Recommended Option: Map 3-3 from CVFPP 2017 update

Locally Preferred Plan: Option 5 from 2016 BWFS

Credits
CDWR 2017

Regional Levees (CacheSloughComplex_Levees.shp)

Description
Updated 12/20/2013 WWR - Seepage field added (low, med, high). Seepage data provided as part of West Delta Level 2-II Geomorphic Assessment (DWR 2010)
Levee extent extracted from CSCCA_LeveeElevations.mdb (Stillwater 2013 and DWR 2013), see below for geodatabase metadata:
This dataset represents the crest of levees within the Cache Slough project boundary. It was created based on an existing layer showing levee centerlines in the project boundary and a 2007-2008 LiDAR DEM.

Credits
Sebastian Araya Senior GIS analyst Stillwater Sciences 2013, DWR 2013, WWR 2013

Use limitations
This layer is intended exclusively for levee elevation analysis over the 2007-08 LiDAR. The levee alignment has been forced to follow the crowns (ridges) as interpreted by the LiDAR grid, and as such it is subject to the same accuracy limitations of the LiDAR.

FEMA Flood Hazard (S_Fld_Haz_Ar)

Description
Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.

The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30. Moderate flood hazard areas, labeled Zone B or Zone X (shaded) are also shown on the FIRM, and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood. The areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled Zone C

or Zone X (unshaded).BACKGROUND Flood hazard maps, also known as Flood Insurance Rate Maps (FIRMs), are important tools in the effort to protect lives and properties in communities across the nation. By showing the extent to which areas of a community and individual properties are at risk for flooding, these flood maps help residents and business owners make better financial decisions about protecting their property. However, flood risks are dynamic and can change over time. Water flow and drainage patterns can be altered dramatically due to surface erosion, land use, and natural forces. As a result, flood maps for those areas may no longer accurately portray the current flood risks. Consequently, the Federal Emergency Management Agency (FEMA) has been updating the nation's flood maps using the latest data gathering and mapping technology and new flood maps are being issued nationwide. UNDERSTANDING ZONE D The level of flood risk is indicated on the flood map by a letter. For example, flood zones labeled with the letters B, C or X represent moderate- and low-risk areas. Flood zones identified by the letters A or V represent high-risk areas, known as Special Flood Hazard Areas (SFHAs). On some flood maps, there may also be a zone labeled with the letter D. The Zone D designation is used for areas where there are possible but undetermined flood hazards, as no analysis of flood hazards has been conducted. The designation of Zone D is also used when a community incorporates portions of another community's area where no map has been prepared. Flood insurance is available in Zone D and property owners should be encouraged to purchase it. However, flood insurance is not federally required by lenders for loans on properties in these zones. Although these areas are often undeveloped and sparsely populated when designated as Zone D, lenders may become aware that new development in such areas has increased the possibility of property damage from flooding. Consequently, they may require coverage as a condition of their loans, even though it is not federally required. Flood insurance rates for properties in Zone D are commensurate with the uncertainty of the flood risk.

Credits
FEMA 2017

Use limitations
There are no access and use limitations for this item.

Appendix G – Ecosystem Layers Metadata

Historical Channels (Channel_polylines_historical)

Description
Spatial data developed by SFEI-ASC for the Delta Landscapes Project. Published in the 2014 report "A Delta Transformed: A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta." Includes the primary habitat type (polygon) and channel (polyline) datasets for both the historical and contemporary Sacramento San-Joaquin Delta. Not intended for public release/distribution.

These layers were developed by the Resilient Landscapes Program of the San Francisco Estuary Institute-Aquatic Science Center for the Delta Landscapes Project. They are presented and analyzed in the report "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta" (SFEI-ASC 2014), which is available online at http://www.sfei.org/projects/delta-landscapes. These files are not currently intended for public release--we ask that you contact SFEI-ASC staff if you wish to use, cite, or distribute the data further. Since these layers are only intended for limited release, detailed metadata have not been generated. Instead, field aliases are used to help identify the purpose of each field. Please refer to the full report (cited below) for the methods and sources used to develop the layers:

San Francisco Estuary Institute-Aquatic Science Center (SFEI-ASC). 2014. A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta. Prepared for the California Department of Fish and Wildlife and Ecosystem Restoration Program. A Report of SFEI-ASC's Resilient Landscapes Program, Publication #729, San Francisco Estuary Institute-Aquatic Science Center, Richmond, CA.

For additional information, please contact any of the following individuals: Sam Safran (sams@sfei.org), Julie Beagle (julieb@sfei.org), Robin Grossinger (robin@sfei.org).

Credits

San Francisco Estuary Institute, "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta", 2014.

Modern Channels (Channel_polylines_modern)

Description

Spatial data developed by SFEI-ASC for the Delta Landscapes Project. Published in the 2014 report "A Delta Transformed: A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta." Includes the primary habitat type (polygon) and channel (polyline) datasets for both the historical and contemporary Sacramento San-Joaquin Delta. Not intended for public release/distribution.

These layers were developed by the Resilient Landscapes Program of the San Francisco Estuary Institute-Aquatic Science Center for the Delta Landscapes Project. They are presented and analyzed in the report "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta" (SFEI-ASC 2014), which is available online at http://www.sfei.org/projects/delta-landscapes. These files are not currently intended for public release--we ask that you contact SFEI-ASC staff if you wish to use, cite, or distribute the data further. Since these layers are only intended for limited release, detailed metadata have not been generated. Instead, field aliases are used to help identify the purpose of each field. Please refer to the full report (cited below) for the methods and sources used to develop the layers:
San Francisco Estuary Institute-Aquatic Science Center (SFEI-ASC). 2014. A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta. Prepared for the California Department of Fish and Wildlife and Ecosystem Restoration Program. A Report of SFEI-ASC's Resilient Landscapes Program, Publication

#729, San Francisco Estuary Institute-Aquatic Science Center, Richmond, CA.

For additional information, please contact any of the following individuals: Sam Safran (sams@sfei.org), Julie Beagle (julieb@sfei.org), Robin Grossinger (robin@sfei.org).

Credits

San Francisco Estuary Institute, “A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta”, 2014.

Historical Habitats (Habitat_types_historical)

Description

This layer shows the habitat types in the Delta circa the year 1800. It was developed from hundreds of historical maps, photographs, and texts by the San Francisco Estuary Institute as part of the "Sacramento-San Joaquin Delta Historical Ecology Investigation." The dataset classifies the historical Delta into 17 habitat types, the majority of which are based on modern classification systems. Readers should refer to the linked historical ecology report for detailed methods on defining and mapping each habitat type.

The version of the map displayed here is taken from the San Francisco Estuary Institute's Delta Transformed report. The only difference from the original layer is that some classifications were lumped to facilitate comparison with the Modern Habitats layer.
The historical Delta was characterized by a complex and extensive marshland matrix. Broad corridors of riparian forest snaked down into the marsh along major rivers and distributaries. Seasonal wetlands and vernal pools lined the periphery of the north Delta. Willow thickets were interspersed throughout the tules in the central Delta. In the south Delta, tidal wetlands graded into non-tidal wetlands across a long, heterogeneous fluvial-tidal interface.

Credits

San Francisco Estuary Institute, “A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta”, 2014.

Modern Habitats (habitat_types_modern)

Description

The Modern Delta Habitats Types map layer is a compilation of several spatial datasets detailing Delta vegetation and land use, with each vegetation type crosswalked to the historical habitat types. This layer is a version of the Modern Habitat Type map published in the report A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta (Delta Transformed) (SFEI-ASC 2014). It has been slightly modified for public posting on EcoAtlas. The original layer was developed to facilitate comparison with the Historical Habitat Type map published in the report Sacramento-San Joaquin Delta Historical Ecology Investigation (Whipple et al. 2012). To accomplish this, SFEI-ASC staff first compiled the best available datasets on Delta vegetation and natural communities, then cross-walked the classification schemes utilized by each of these layers to the historical habitat type classification scheme developed by Whipple et al. (2012).

Due to modifications for public posting of the layer, the area of the various habitat types will not precisely match those calculated in the Delta Transformed report. Also, since this layer was compiled from multiple sources, it represents Delta habitat types at multiple points in time. It is meant only to capture broad changes in the extent and distribution of habitats since the historical period (ca. 1800) and not to represent the Delta at any one moment in time. The source imagery used to develop each dataset may differ from the year it was published.

Sources referenced in the "Source" field include: (1) CDFG Delta VegCAMP 2007 - Vegetation and land use classification and map of the Sacramento-San Joaquin River Delta (Hickson and Keeler-Wolf 2007); (2) CDFG CVRMP 2012 - Mapping Standard and Land Use Categories for the Central Valley Riparian Mapping Project (GIC 2012); (3) WWR CSCCA Natural Communities 2013 - An unpublished natural communities dataset developed for the Cache Slough Complex Conservation Assessment (a combination of sources compiled by Wetlands and Water Resources, Inc.); and (4) SFEI 2013 Supplemental Mapping - Areas digitized and classified by SFEI-ASC staff from Bing aerial photographs accessed in 2013.
For a detailed description of the layer's sources, development, accuracy, and cross-walking methods, refer to the Delta Transformed report on pages 14-15 and 77-78. For definitions of the habitat types, refer to pages 18 and 98-101.

For more information contact rlandscapes@sfei.org.

Credits

San Francisco Estuary Institute, "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta", 2014.

Cache Slough Complex Conservation Assessment Natural Communities (CacheSuisunDelta_NatCom_CSCCA)

Description

Natural Communities data compiled from three sources: Delta Plan, Cache Slough Conservation Assessment, and BDCP data. These component datasets are composites of other smaller datasets. The data source (Source_1, 2, and 3) attributes identify the source of vegetation classifications and polygon boundaries as well as the data modification history, to the extent known by WWR in December of 2013. Input datasets' natural communities classifications are found in the NatCom_Sub field, while the NatCom field aggregates like community types into broad classifications based on cover type and hydrology.
Hydro and Sub_Hydro data was developed by WWR 2011 & 2013 and is based on BDCP tidal slough geometry, elevation analysis, and landscape geomorphology analysis.

See dataset in MapTerra for additional breakdown of the source datasets.

Credits:
Data was compiled by Jeff Schlueter and Stephanie Bishop of WWR 2013-2014. Credit for component data varies by data source and is included in metadata description.

Historical Marsh Patch Size (Habitat_types_historical)

Description

This layer shows marsh patches in the historical (ca. 1800) Delta, color-coded by their size. The layer is derived from data compiled by the San Francisco Estuary Institute for the Delta Transformed report. Please refer to that report for more detailed information on how the layer was developed and analyzed (pages 50-51 and 89-90).
Since 1800, the total area of marsh in the Sacramento-San Joaquin Delta has been reduced by more than 97% (from 193,000 ha to 4,000 ha). Although the number of individual patches has increased over time (due to marsh fragmentation), today's marshes are, on average, several hundred times smaller than they were historically.

The small size of today's remaining marshes limits important physical and ecological processes. Large marsh patches, for example, are more likely than small patches to have well-developed channel systems and a range of physical and ecological features. Across their full extent, large marsh patches often display variability in patterns of inundation, vegetative structure, and geomorphic setting. The size of a marsh matters for the animals that live in it: Spautz and Nur (2002) observed that Black Rails were more frequently detected in marshes greater than 100 ha. Today, only three marsh patches larger than 100 ha remain in the Delta (compared with 14 historically). Even today's largest patches—those at Liberty and Sherman islands—are not very big by historical standards. In the year 1800, the largest patch was more than 100,000 ha and spanned most of the south and central Delta. The map of modern conditions shows that there are hundreds of tiny marsh patches scattered throughout the Delta. By examining it closely, it becomes clear that most of these patches are fringing marshes along channels or the tips of former large marsh islands. These scattered remnants were cut off by the excavation of levees and widening of channels over a century ago.
To group individual areas mapped as marsh into ecologically-relevant units, discrete marsh polygons were lumped into marsh "patches" if they were located within 60 m of one another. This distance is derived from the rule set for defining intertidal resident rail (e.g. Black Rails) patches developed by Collins and Grossinger (2004), which was based on the best available data on rail habitat affinities and dispersal distances.

Credits

San Francisco Estuary Institute, "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta", 2014.

Modern Marsh Patch Size (habitat_types_modern)

Description

This layer shows marsh patches in the modern Delta, color-coded by their size. The layer is derived from data compiled by the San Francisco Estuary Institute for the Delta Transformed report. Please refer to that report for more detailed information on how the layer was developed and analyzed (pages 50-51 and 89-90).
Since 1800, the total area of marsh in the Sacramento-San Joaquin Delta has been reduced by more than 97% (from 193,000 ha to 4,000 ha). Although the number of individual patches has increased over time

(due to marsh fragmentation), today's marshes are, on average, several hundred times smaller than they were historically.

The small size of today's remaining marshes limits important physical and ecological processes. Large marsh patches, for example, are more likely than small patches to have well-developed channel systems and a range of physical and ecological features. Across their full extent, large marsh patches often display variability in patterns of inundation, vegetative structure, and geomorphic setting. The size of a marsh matters for the animals that live in it: Spautz and Nur (2002) observed that Black Rails were more frequently detected in marshes greater than 100 ha. Today, only three marsh patches larger than 100 ha remain in the Delta (compared with 14 historically). Even today's largest patches—those at Liberty and Sherman islands—are not very big by historical standards. In the year 1800, the largest patch was more than 100,000 ha and spanned most of the south and central Delta. The map of modern conditions shows that there are hundreds of tiny marsh patches scattered throughout the Delta. By examining it closely, it becomes clear that most of these patches are fringing marshes along channels or the tips of former large marsh islands. These scattered remnants were cut off by the excavation of levees and widening of channels over a century ago.
To group individual areas mapped as marsh into ecologically-relevant units, discrete marsh polygons were lumped into marsh "patches" if they were located within 60 m of one another. This distance is derived from the rule set for defining intertidal resident rail (e.g. Black Rails) patches developed by Collins and Grossinger (2004), which was based on the best available data on rail habitat affinities and dispersal distances.

Credits

San Francisco Estuary Institute, "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta", 2014.

Historical Nearest Large Marsh Distance (Habitat_types_historical)

Description

This layer characterizes the connectivity of marshes in the historical Delta (ca. 1800). Specifically, it quantifies the distance each marsh patch was from a large (>100 ha) marsh patch. If a marsh patch is greater than 100 ha in size, it is assigned a distance to a large patch of 0 m. The layer is derived from data compiled by the San Francisco Estuary Institute for the Delta Transformed report. Please refer to that report for more detailed methodology and more information (pages 52-53 and 89-90)
Continuous marsh habitat is essential for dispersal, foraging, gene flow, and resilience to disturbance for marsh wildlife populations. Marsh patches in the modern Delta are now more isolated from one another than they once were, fragmenting populations of marsh wildlife. Historically, all marsh patches were within 1.62 km of a large (>100 ha) marsh, with the average distance to a large patch being 0.29 km (SD = 0.40 km). In the modern Delta, the average distance to a large patch is 19.3 km (SD = 11.08 km)—two orders of magnitude farther—with a maximum distance of 61.4 km. Wildlife in small, isolated patches are less likely to disperse successfully. Populations that are lost from these patches due to catastrophic or stochastic events are less likely to be re-established due to low re-colonization rates. In the long run, isolated and small populations can lose genetic diversity.

Credits

San Francisco Estuary Institute, "A Delta Transformed: Ecological Functions, Spatial Metrics, and

Landscape Change in the Sacramento-San Joaquin Delta", 2014.

Modern Nearest Large Marsh Distance (habitat_types_modern)

Description

This layer characterizes the connectivity of marshes in the modern Delta. Specifically, it quantifies the distance each marsh patch is from a large (>100 ha) marsh patch. If a marsh patch is greater than 100 ha in size, it is assigned a distance to a large patch of 0 m. The layer is derived from data compiled by the San Francisco Estuary Institute for the Delta Transformed report. Please refer to that report for more detailed methodology and more information (pages 52-53 and 89-90)
Continuous marsh habitat is essential for dispersal, foraging, gene flow, and resilience to disturbance for marsh wildlife populations. Marsh patches in the modern Delta are now more isolated from one another than they once were, fragmenting populations of marsh wildlife. Historically, all marsh patches were within 1.62 km of a large (>100 ha) marsh, with the average distance to a large patch being 0.29 km (SD = 0.40 km). In the modern Delta, the average distance to a large patch is 19.3 km (SD = 11.08 km)—two orders of magnitude farther—with a maximum distance of 61.4 km. Wildlife in small, isolated patches are less likely to disperse successfully. Populations that are lost from these patches due to catastrophic or stochastic events are less likely to be re-established due to low re-colonization rates. In the long run, isolated and small populations can lose genetic diversity.

Credits

San Francisco Estuary Institute, "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta", 2014.

Inundation Historical (DeltaInundationHistorical)

Description

This layer shows the approximate maximum extent of inundation in the historical (ca. 1800) Delta broken down by type (please see below for definitions of the different inundation types). The layer is derived from data compiled by the San Francisco Estuary Institute for the Delta Transformed report. Please refer to that report for more detailed information on how the layer was developed and analyzed (pages 38-39 and 89)

By comparing the past and present, it is apparent that the Delta has shifted from a mosaic of subtidal, tidal, and seasonally or episodically flooded habitats to a landscape where most of the aquatic habitat is permanently subtidal. Historically, fish utilized abundant periodically available habitat for spawning, rearing, additional food resources, and refuge from predators. Specific floodplain-associated species in the Delta included Sacramento perch, thicktail chub, Sacramento splittail, and juvenile Chinook salmon. Today, likely in part due to habitat losses, two of these species can no longer be found in the Delta—Sacramento perch are locally extirpated and thicktail chub are globally extinct.

Although all types of inundation have decreased in extent over time, altered flow regimes, artificial levees, and drainage systems have effectively eliminated the seasonal long-duration flooding that

persisted for months at a time in the historical Delta. Contemporary inundation associated with the Yolo Bypass and Cosumnes River floodplain is more akin to the shallow, seasonal short-term flooding that was common to the seasonal wetlands of the historical Delta. This has important consequences for species like Sacramento splittail whose life-history strategies require longer periods of sustained inundation (and potentially enables alternate rearing strategies for juvenile salmon).

See dataset in MapTerra for additional information about fields.

Credits

San Francisco Estuary Institute, "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta", 2014.

Inundation Modern (DeltaInundationModern)

Description

This layer shows the approximate maximum extent of inundation in the modern Delta broken down by type (please see below for definitions of the different inundation types). The layer is derived from data compiled by the San Francisco Estuary Institute for the Delta Transformed report. Please refer to that report for more detailed information on how the layer was developed and analyzed (pages 38-39 and 89)

By comparing the past and present, it is apparent that the Delta has shifted from a mosaic of subtidal, tidal, and seasonally or episodically flooded habitats to a landscape where most of the aquatic habitat is permanently subtidal. Historically, fish utilized abundant periodically available habitat for spawning, rearing, additional food resources, and refuge from predators. Specific floodplain-associated species in the Delta included Sacramento perch, thicktail chub, Sacramento splittail, and juvenile Chinook salmon. Today, likely in part due to habitat losses, two of these species can no longer be found in the Delta—Sacramento perch are locally extirpated and thicktail chub are globally extinct.

Although all types of inundation have decreased in extent over time, altered flow regimes, artificial levees, and drainage systems have effectively eliminated the seasonal long-duration flooding that persisted for months at a time in the historical Delta. Contemporary inundation associated with the Yolo Bypass and Cosumnes River floodplain is more akin to the shallow, seasonal short-term flooding that was common to the seasonal wetlands of the historical Delta. This has important consequences for species like Sacramento splittail whose life-history strategies require longer periods of sustained inundation (and potentially enables alternate rearing strategies for juvenile salmon).

See dataset in MapTerra for additional information about fields.

Credits

San Francisco Estuary Institute, "A Delta Transformed: Ecological Functions, Spatial Metrics, and Landscape Change in the Sacramento-San Joaquin Delta", 2014.

Zooplankton Stations (Zooplankton_Stations)

Description

The zooplankton monitoring program is one element of the Environmental Monitoring Program (EMP) conducted under the Interagency Ecological Program (IEP) umbrella. The EMP also includes monitoring of water quality, benthos, and phytoplankton. Mysid shrimp and zooplankton are important food organisms for larval, juvenile, and small fishes, including delta smelt, juvenile salmon, striped bass, and small splittail. Initiated to investigate the population trends of pelagic organisms consumed by young striped bass, the original Neomysis-Zooplankton Project sought to determine the annual and seasonal population levels of Neomysis mercedis, other mysids, and various zooplankton taxa in order to assess the size of the food resource for fishes. The study also seeks to detect the presence of exotic species recently introduced to the estuary, to monitor the distribution and abundance of these exotics, and to determine their impacts on native species.

Geographic coverage of the sampling sites ranges from San Pablo Bay east through the upper estuary including Suisun Bay, Suisun Marsh, the lower Sacramento River upstream to Decker Island, the San Joaquin River upstream to Stockton, and the southern Delta to Old River. A total of 89 sites have been sampled at various times during the life of the project. However, on no survey were all stations sampled. Currently, 20 fixed stations and between 2 and 4 floating entrapment zone stations (where bottom electrical conductivity is 2 and 6 millisiemens per centimeter) are sampled monthly.

October 2015
Link: http://www.water.ca.gov/bdma/meta/zooplankton.cfm

Credits

Environmental Monitoring Program, “Zooplankton Stations” October 2015.

USFWS JFMP Locations (USFWS_JFMP_Locations)

Description

Stations, latitude, and longitude from Juvenile Fish Monitoring Program (JFMP) .
The original objective of the Delta Juvenile Fish Monitoring Program in the 1970’s and 1980’s was to monitor effects of water projects in the Delta on abundance, distribution and survival of juvenile fall run Chinook salmon in the lower Sacramento and San Joaquin Rivers and the San Francisco Estuary. This objective was broadened in the 1990’s to include relative abundance and distribution of all races of juvenile Chinook salmon. In 2001, the program objectives were broadened further to reflect the value of gathering information on non-salmonid species. Species information at times has also been recorded for jellyfish and crustaceans spp. that are encountered as well.

General category of data collected: Native and non-native species of fish found within the San Francisco Estuary and lower Sacramento and San Joaquin Rivers.
Geographic range of current field work: There are currently fifty-eight (58) beach seine sites located on the Lower Sacramento and San Joaquin Rivers, North, Central and South Delta and San Francisco Bay (Table 2; Figure 1). Three (3) boat trawling stations are also regularly sampled (Table 3; Figure 1). These are located at Sherwood Harbor on the Sacramento River, Chipps Island in Suisun Bay and Mossdale

Crossing County Park on the San Joaquin River. In addition, special studies have been conducted throughout the years (i.e., Liberty Island, Delta Cross Channel, VAMP, Six Year Study, etc).
Each sampling site is designated by a Station Code which displays the abbreviations of the body of water sampled (Table 1), the number of miles from the mouth of the river or bay, and the orientation within the sample site (e.g., site AM001S is 1 mile from the mouth of the American River on the south bank).

Credits

USFWS

Link: https://www.fws.gov/lodi/juvenile_fish_monitoring_program/jfmp_index.htm

Delta Vegetation (CDFW VegCAMP ds292)

Description

Vegetation and land use are mapped for the approximately 725,000 acres constituting the Legal Delta portion of the Sacramento and San Joaquin River Delta area. Vegetation mapping is to sub-alliance to super-alliance level (based on the National Vegetation Classification Standard, see http://biology.usgs.gov/npsveg/nvcs.html); land use is mapped to Anderson Level 2 classification (see http://landcover.usgs.gov/pdf/anderson.pdf). The map classification is based on a vegetation classification derived from field data collected in summer and fall of 2005 produced by the Vegetation Classification and Mapping Program of the Department of Fish and Game. The 2002 Stockton, Sacramento, and Delta High Resolution (1-foot) Orthoimagery and 2005 NAIP (1-meter) orthoimagery served as the base. Natural vegetation comprises approximately 17% of the Delta study area, 65% is agriculture and pasture, 10% is urban/other and 8% is open water.
An assessment found that the accuracy of this map was nearly 89%.

Credits
Aerial Information Systems, Inc. for California Department of Fish and Game, Vegetation Classification and Mapping Program.

EcoRestore Restoration Sites September 2016 (EcoRestore_Restoration_Sites_September2016)

Description
Current EcoRestore projects as of 9/15/2016. Parcel/property boundaries shown; actual project footprints may differ. Acreages are in square meters, unless otherwise noted. All locations are approximate and subject to change. Please continue to check EcoRestore's website (http://resources.ca.gov/ecorestore/) for the most up to date information.

Credits
EcoRestore September 2016

Bird Strike Area (bird_strike_area)

Description

This zone is the Bird Strike Hazard Zone for Travis Air Force Base from the 2015 Final Travis Air Force Base Land Use Compatibility Plan:
http://www.co.solano.ca.us/depts/rm/boardscommissions/solano_county_airport_land_use_commission/documents.asp
See Figure 4 for the Bird Strike Hazard Zone and the Outer Perimeter.

Credits
County of Solano, Department of Resource Management, ESA, "Travis Air Force Base Land Use Compatibility Plan", October 8, 2015.

Appendix H – Other Land Use and Infrastructure Layers Metadata

Legal Delta Boundaries (legal_delta_UTMz10)

Description
Delta boundary version 2002.4. Delineates the legal Delta established under the Delta Protection Act (Section 12220 of the Water Code) passed in 1959. This boundary file has been reviewed by a variety of relevant professionals and is considered to be accurate. The exact accuracy is somewhat uncertain, but can be considered acceptable for mapping at 1:24000.

The original topographic maps containing the drawn delta border were scanned from the Department of Water Resources. Images were registered to 1:24,000 USGS DRG's in ArcView (ESRI) utilizing imagewarp extension. The Delta boundary was digitized from the registered images. Accuracy within acceptable 7.5 Minute USGS map accuracy standards (1:24000 scale).

The original legal boundary maps obtained from the Delta Protection Commission were compiled by DWR Land & Right of Way sometime in the early 1980's. They were based from the legal description in section 12220 of the Water Code, with ambiguities in the Code addressed by the individuals involved in the mapping project at that time. One revision was made to the original maps in the vicinity of Point Pleasant, and is the only difference between this and the 4.2001 version of the legal Delta boundary Arc/INFO coverage.

Credits

Jason Schwenkler
Project Manager
Geographical Information Center
1st and Orange Streets
Chico, California 95929-0425
530 898-5969 office
530 898-6781 fax
schwenkl@gic.csuchico.edu

Joel Dudas
Department of Water Resources
Delta Levees Program
PO Box 942836
Sacramento, CA 94236-0001

Solano Unincorporated Zoning (zoning)

Description
This digital representation of the official hard copy map was completed and reviewed by the Solano County Resource Management Department on March 29, 2006.

This digital representation has not been officially adopted by the Solano County Board of Directors and has no legal standing.

Solano County Resource Management Zoning Designations as Amended through Ordinance #1670, adopted February 7, 2006.

Credits

Solano County Resource Management Department

Cache Slough Restoration Opportunity Areas (ROA) (i07_ICF_ROA_12)

Description
The data layer has been developed to aid preliminary BDCP habitat conservation planning efforts. This data is not to be distributed to any third party and is for CONSULTANT ONLY. It is a DRAFT BDCP internal document and is NOT TO BE DISTRIBUTED.

This data layer has been generated as a tool to aid preliminary BDCP habitat conservation planning efforts. Using the feature class provided by SAIC (ROAs_10122010_DRAFT), ICF adjusted a portion of the West Delta ROA located on the west side of the Sacramento River bank. The ROA was reduced to within 100 feet of the shoreline.

Credits

Bay Delta Conservation Plan

ICF 2012, SAIC 2008-2010

Conservation Zone 1 (BDCP) (i07_ICF_SAIC_ConservationZones_0512)

Description
The data layer has been developed to aid preliminary BDCP habitat conservation planning efforts. This data is not to be distributed to any third party and is for CONSULTANT ONLY. It is a DRAFT BDCP internal document and is NOT TO BE DISTRIBUTED.

This data layer has been generated as a tool to aid preliminary BDCP habitat conservation planning

efforts.

Credits

Bay Delta Conservation Plan

Groundwater Basins (I08_B118_CA_GroundwaterBasins)

Description

Bulletin 118 defines the recognized groundwater basins and subbasins throughout the State of California. The Bulletin 118 document provides information on these basins/subbasins and the nature and extent of groundwater occurrence and management within the State. The Bulletin 118 dataset makes the geographic locations and extent of the 517 basins/subbasins publically available, for use in external mapping/GIS applications.

The dataset is a feature class showing the boundaries of 517 groundwater basins and subbasins as defined by the California Department of Water Resources as last modified by the Basin Boundary Emergency Regulation adopted on October 21, 2015. The file is in ESRI geodatabase format and is intended for use with compatible GIS software. Groundwater basins are represented as polygon features and designated on the basis of geological and hydrological conditions - usually the occurrence of alluvial or unconsolidated deposits. When practical, large basins are also subdivided by political boundaries, as in the Central Valley. Basins are named and numbered per the convention of the Department of Water Resources. The associated data are considered DWR enterprise GIS data, which meet all appropriate requirements of the DWR GIS Spatial Data Standards. DWR makes no warranties or guarantees, either expressed or implied, as to the completeness, accuracy or correctness of the data, nor accepts or assumes any liability arising from or for any incorrect, incomplete or misleading subject data. The official DWR GIS Data Steward for this dataset is Brett Wyckoff, who may be contacted at 916-651-9283, or at brett.wyckoff@water.ca.gov. Comments, problems, improvements, updates, or suggestions should be forwarded to the official GIS Data Steward as available and appropriate.

Credits

California Department of Water Resources, October 21, 2015

Conservation Easements (CCED 2016) (CCED_3counties)

Description

The California Conservation Easement Database (CCED) inventories mainly privately owned lands that have been protected through conservation or open space easements. A separate database (CPAD – the California Protected Areas Database) tracks open lands owned outright (“in fee”) by public agencies and nonprofits. This data set's primary purpose is to support multi-jurisdictional planning and assessment projects, at scales ranging from counties or parts of counties to the entire State of California. CCED should not be used as the basis for official regulatory, legal or other such governmental actions – these types of uses require official land records from county recorders or easement holding agencies in the area of focus.

Conservation easements are legal restrictions created by a contract between a land owner and a qualified agency or organization that are usually based on limiting the future uses of a property to those

compatible with open space, conservation, farming or other defined uses. Such easements reduce or remove development opportunities on these lands. The California Conservation Easement Database (CCED) inventories such easements held in perpetuity or for at least 10 years by public and nonprofit organizations. This release of CCED includes most conservation easements, but is incomplete for two large easement holders, the Calif. Dept. of Fish & Wildlife and the California Rangeland Trust. Data sources for CCED include easement holding organizations and records from the Calif. Wildlife Conservation Board (WCB) and the Bay Area Open Space Council - note that all easements in California are officially filed with the relevant County Recorder's office and are public records data. CCED is an element in the National Conservation Easement Database (NCED).

Credits

CCED is made available without charge for a wide range of uses, for example, use by government agencies in planning and operations, use by private consultants in the development of plans and analyses, use by non-profit organizations and educational institutions for strategy, research, planning, management and other functions. While agencies, organizations, individuals and businesses may distribute free of any charges copies of the data, any such replication must include this disclaimer and require user to review the provisions therein.

This dataset was released on December 2016 by GreenInfo Network.

Protected Lands (CPAD Units 2016) (CPAD_2016b_Holdings)

Description

CPAD is suitable for a wide range of planning, assessment, analysis and display purposes. CPAD should not be used as the basis for regulatory, legal or other specific governmental actions. Read the CPAD Data Disclaimer for more information.

The California Protected Areas Database (CPAD) contains data on lands owned in fee by governments, non-profits and some private entities that are protected for open space purposes. Data includes all such areas in California, from small urban parks to large national parks and forests, mostly aligned to assessor parcel boundaries. Data is collected by Holdings (parcels) which are aggregated to Units (commonly named areas within a county) and Super Units (commonly named areas generally).

Credits

This dataset was released on December 15, 2016 by GreenInfo Network.

NRCS Environmental Easements (NRCS_Easements)

Description

Centroids were calculated from the easement boundary. If the easement is a multipart polygon, the centroid is for the group of polygons.
NRCS Easements Centroids and Polygons for NRCS Easement Programs. See http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/ for more information.Disclaimer: The spatial easement boundaries are not a representation of the legal easement boundary and should not be used for any purpose beyond general planning. NEST Data Date: October 21, 2016 Service Date: November 22, 2016

Credits

Steven Nechero. USDA NRCS NGMC

Access Closed Restricted Unknown (Access_ClosedRestrictedUnknown)

Description

Conservation Areas with No Public Access, Restricted Public Access, and Unknown Access in Solano, Yolo, and Sacramento Counties

For use in Cache Slough Restoration Planning (FlowWest, Delta Conservancy 2017)

Created with Union of California Conservation Easement Database (CCED 2016) and California Protected Lands (CPAD 2016).

Access

Calculated from "pubaccess" (CCED 2016) and "ACCESS_TYP" (CPAD 2016) fields for only No Public Access, Restricted Public Access, and Unknown Access

All other Attributes

See metadata for CCED 2016 and CPAD 2016

Credits

FlowWest 2017

Elevation (sfbaydelta_10m_topobath)

Description

This layer depicts 5 ft elevation bands above and below the area currently situated at intertidal elevation (mapped with dark green). The area currently situated at intertidal elevation is the approximate area that would be inundated today between an average lower-low tide (MLLW, 2.1 ft NAVD88 and an average higher-high tide (MHHW, 6.4 ft NAVD88) without levees. Areas less than 5 ft above MHHW (mapped with light-green) are characterized as being within the "SLR Zone," which stands for "sea-level rise zone," since they could be situated within tidal elevation range by 2100 (the National Research Council predicts up to 4.6 ft of sea-level rise by that year). Sea levels are expected to continue rising beyond 2100, however, so areas less than 10 ft above high tide (mapped with brown), which are characterized as being within the "Upland zone," could also one day be situated within the tidal elevation range. The light-blue, medium-blue , and dark-blue areas are situated at subtidal elevations (below MLLW) and are either already permanently inundated, or would be without levees.

The underlying elevation data is from a 2012 CA Department of Water Resources data set (available http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/modelingdata/DEM.cfm), which combines the best available topographic and bathymetric elevation data from 21 individual surveys. MLLW and MHHW elevations were determined for the Cache Slough Complex by cbec Eco Engineers and published in a 2010 report titled BDCP Effects Analysis: 2D Hydrodynamic Modeling of the Fremont Weir Diversion Structure(http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/2D_Hydrodynamic_Modeling_of_the_Fremont_Weir_Diversion_Structure_with_average_Westside_tributary_flows.sflb.ashx). The National Research Council sea-level rise prediction mentioned above was published in a 2012 report titled Sea-Level Rise for the Coasts of California, Oregon, and Washington (https://www.nap.edu/catalog/13389/sea-level-rise-for-the-coasts-of-california-oregon-and-washington). Care should be taken when using this layer outside of the Cache Slough Complex, since the tidal datums used to characterize the different elevation ranges are specific to Cache Slough.

Note that there is a known issue with the elevations of Prospect Island, which are generally lower than indicated here. More accurate elevation data for Prospect Island are available in this report (http://www.water.ca.gov/environmentalservices/docs/frpa/CSCCA_Vol1_DRAFT_11-17-15_Low_Res.pdf) (see Figure 2-4 on page 2-7).

Credits

The elevation data is from a 2012 CA Department of Water Resources data set that combines the best available topographic and bathymetric elevation data from 21 individual surveys. MLLW and MHHW elevations were determined for the Cache Slough Complex by cbec, inc., eco engineering (cbec 2010).

National Land Cover Database 2011 (nlcd2011)

Description

The 2011 National Land Cover Database (NCLD) produced by the Multi-Resolution Land Characteristics Consortium (MRLC) is a map of land cover classified into 16 classes with a spatial resolution of 30 meters. This dataset was developed using unsupervised spectral image classification of the Landsat Enhanced Thematic Mapper Plus (ETM+) circa 2011 satellite imagery.

For more information on NLCD: http://www.mrlc.gov/.

Credits

U.S. Geological Survey, 2011

Urban Areas (UrbanAreas_TIGER2016)

Description

In order for others to use the information in the Census MAF/TIGER database in a geographic information system (GIS) or for other geographic applications, the Census Bureau releases to the public extracts of the database in the form of TIGER/Line Shapefiles.

The TIGER/Line shapefiles and related database files (.dbf) are an extract of selected geographic and cartographic information from the U.S. Census Bureau's Master Address File / Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER) Database (MTDB). The MTDB represents a seamless national file with no overlaps or gaps between parts, however, each TIGER/Line shapefile is designed to stand alone as an independent data set, or they can be combined to cover the entire nation.

After each decennial census, the Census Bureau delineates urban areas that represent densely developed territory, encompassing residential, commercial, and other nonresidential urban land uses. In general, this territory consists of areas of high population density and urban land use resulting in a representation of the "urban footprint." There are two types of urban areas: urbanized areas (UAs) that contain 50,000 or more people and urban clusters (UCs) that contain at least 2,500 people, but fewer than 50,000 people (except in the U.S. Virgin Islands and Guam which each contain urban clusters with populations greater than 50,000). Each urban area is identified by a 5-character numeric census code that may contain leading zeroes.

Credits

U.S. Census Bureau, 2016

Railroads (Rail_13)

Description

The Rail line feature class represents all rail alignments segmented by milepost as listed in the California Regional Timetable 20.

The purpose of the data is to represent the rail network using available reference data and information contained in the California Region Timetable 20. The Rail feature class contains alignment for passenger and freight railroad lines, including commuter rail and heavy rail. The Rail feature class allows for the selection of all passenger, commuter, recreational, freight, and shortline rail alignment in California with the exception of BART.

Credits

Caltrans, Division of Transportation Planning

Roads (Roads_Delta_TIGER2016)

Description
In order for others to use the information in the Census MAF/TIGER database in a geographic information system (GIS) or for other geographic applications, the Census Bureau releases to the public extracts of the database in the form of TIGER/Line Shapefiles.

The TIGER/Line shapefiles and related database files (.dbf) are an extract of selected geographic and cartographic information from the U.S. Census Bureau's Master Address File / Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER) Database (MTDB). The MTDB represents a seamless national file with no overlaps or gaps between parts, however, each TIGER/Line shapefile is designed to stand alone as an independent data set, or they can be combined to cover the entire nation.

The All Roads Shapefile includes all features within the MTDB Super Class "Road/Path Features" distinguished where the MAF/TIGER Feature Classification Code (MTFCC) for the feature in MTDB that begins with "S". This includes all primary, secondary, local neighborhood, and rural roads, city streets, vehicular trails (4wd), ramps, service drives, alleys, parking lot roads, private roads for service vehicles (logging, oil fields, ranches, etc.), bike paths or trails, bridle/horse paths, walkways/pedestrian trails, and stairways.

Credits

U.S. Census Bureau, 2016

Parcels (Parcels)

Description
County Parcel boundaries

Credits

Solano County 2014

Recreation Facilities (RD2068FacilitiesCounty_20160602)

Description

A point feature class that represents locations of recreational sites within and near the CA Delta. Clipped to include only Yolo, Solano, and Sacramento Counties for use in Cache Slough Restoration Project (FlowWest, Delta Conservancy 2017). The sites include marinas, dry storage facilities, campgrounds, boat access, launches, marine services, restaurants, museums, service providers,etc.

Credits

Tawn Daniel, GIS Student Assistant, State Parks

Sacramento-San Joaquin Delta Recreation and Tourism Inventory 2015

Downloaded by FlowWest 2017 from Delta Protection Commission

California Oil & Gas Wells (AllWells_201701)

Description

California Statewide oil and gas wells dataset as of January 17, 2017.

The California Department of Conservation, Division of Oil, Gas and Geothermal Resources publishes a GIS feature class of well locations across the state for use by the public. This shapefile is the same as the data displayed in the Division's WellFinder application (http://maps.conservation.ca.gov/doggr/index.html) as of July 6, 2016. This shapefile is provided in geographic coordinates on the North American Datum of 1983. A partial description of the attributes contained in this feature class is listed on the WellFinder application's Help system (see entity and attributes section in this metadata). Geothermal wells have been excluded from this shapefile.The DOGGR Wells layer in WellFinder is also available as a WFS service at http://spatialservices.conservation.ca.gov/arcgis/rest/services/DOMS/DOMS_Wells/MapServer/WFSServer?/.Well Attributes: API Number, Well Number, Well Status, GIS Symbol, Operator Code, Operator Name, Lease Name, Field Name, Area Name, District, County, Section, Township, Range, Base Meridian, Latitude, Longitude, Elevation, Total Depth, Redrill Footage, Redrill Cancel Flag, Location Description, Comments, GIS Source Code, Dry Hole, Confidential Well, Directionally Drilled, Hydraulically Fractured, BLM Well, EPA Well, Spud Date, Completion Date, Abandoned Date

NOTE: The well status codes are as follows:

A = active

I = idle

P = plugged

U = unknown

C = cancelled

B = Buried-Idle

Credits

Division of Oil, Gas and Geothermal Resources