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First Administrative Draft Economic Sustainability Plan for the Sacramento-San Joaquin Delta

Delta Protection Commission

Public comments are welcome on the First Administrative Draft Economic Sustainability Plan for the Sacramento-San Joaquin Delta. Please submit your comments to: espcomments@pacific.edu

THIS IS A PRELIMINARY DRAFT DOCUMENT

This document is under development; chapter content will be added and further revisions made as research and consultation continues.

Figures and tables are under development; additions and revisions will be made on an ongoing basis.

This draft has not been subject to technical review, grammatical editing, and style editing at this stage as these are continuing.

In addition, citations and references are being reviewed and developed on a constant basis.

Some sections are incomplete and remain work in progress.

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Chapter 1: Introduction

The Delta is at a crossroads. There has been significant environmental deterioration in the Delta and many have raised concerns about the status of the levee system and its implication for the reliability of water exports from the Delta and flood protection within the Delta. Recent legislation and planning processes are considering long-range changes that would have profound implications for the economy and people of the Delta. In response to those concerns, the Delta Reform Act of 2009 tasked the Delta Protection Commission with developing an economic sustainability plan.

THIS CHAPTER IS UNDER DEVELOPMENT

Since a key purpose of this Economic Sustainability Plan is to inform the Delta Plan under development by the Delta Stewardship Council, this report analyzes the impact of key policies being considered for the plan on the economic sustainability of the Delta. The policy proposals can be grouped into four categories: 1) Water Conveyance, 2) Habitat Creation, 3) Levees, and 4) Land Use Regulation. The report also considers many aspects of economic sustainability in the Delta that are unrelated to these water policy proposals, and makes specific recommendations in the areas of flood protection, recreational investment, agricultural sustainability and other areas mentioned in the authorizing legislation.

The goals of the Economic Sustainability Plan are as follows:

- Provide a thorough enumeration of the baseline and trends for the Delta economy.
- Assess the linkage between the Delta economy and the regional and state economy.
- Provide the most complete available assessment of the condition of Delta levees.
- Assess the reliability of economic analysis in key studies influencing Delta policy debates.
- Develop a vision for economic sustainability of Delta legacy communities.
- Create a detailed model of the effects of water policy proposals on Delta agriculture.
- Assess the effect of water policy proposals on the recreation and tourism economy, other economic sectors, local government services, and key Delta infrastructure.
- Integrate the findings into a general set of economic sustainability recommendations and strategies for the Delta.
- Integrate the findings into a specific set of recommendations on the issues under consideration by the Delta Stewardship Council for the Delta Plan.

Many of these goals are research and analytical analysis to support Delta decision making. The last two goals that integrate these findings into specific recommendations for policy and economic development make up the economic sustainability plan.

Limitations of the Plan

While the goals of the report are lengthy, there are a few related issues that are outside the scope of this assessment. As an economic sustainability plan, the focus of the report is the long-run prospects of on-going economic activities, not short-term impacts from investments or events. In addition, the assessment is limited to the economic impacts in the Delta region and the impact of activities that originate or primarily take place within the Delta. Thus, it is important to emphasize the following two limitations.

1. *The report does not assess short-run economic impacts of proposed capital spending.*

   Many of the policy proposals evaluated in the report, including levee upgrades, isolated water conveyance facilities, and habitat restoration projects involve billions of dollars in capital investment. The construction activity for these investments would create a substantial short-run burst of economic activity in the Delta region, creating local jobs and income. Although these short-run impacts are not part of our economic sustainability assessment, other reports may address these issues in the future. We caution readers that the regional economic impacts of a capital investment are not necessarily proportional to the size of the expenditure, as different projects have very different cost compositions, varying levels of local expenditures, and therefore highly variable regional impacts.

2. *The report is not a comprehensive cost-benefit analysis of Delta policy proposals*.

   Many of the policy proposals evaluated in this report, especially new water conveyance facilities, have costs and benefits that extend far outside the Delta. In addition, many of the proposals have environmental impacts which are not valued in this report. This report assesses the effect of the various proposals on the Delta economy which is an important input to a comprehensive cost-benefit analysis. In a few places, out-of-Delta impacts are considered when they have implications for the operation of in-Delta assets that could affect water quality, flood control and other important factors for the Delta economy. Despite the comprehensive scope, this report is not a complete cost-benefit assessment and is therefore not sufficient to conclude whether any of the proposed policies are optimal from a statewide perspective.

Geographic Focus of the Study:

The Delta Protection Commission and the legislation that called for this study is primarily focused on protecting and enhancing the natural resources of the Delta and the primary zone. As such, the report focuses on the primary zone of the Delta and city of Isleton, and within the secondary zone focuses on industries that are directly related to the Delta's natural resources such as water based recreation and agriculture. Because the population of the secondary zone is now fifty times larger than the primary zone, a broad economic study of the legal Delta would be too focused on the urban service economy. We do review the basics of the urban services within Secondary Zone, and the interaction of the Primary and Secondary Zones, but do not focus on them.

The legal Delta, both primary and secondary, includes portions of several counties and cities and does not conform well to the usual boundaries that define economic data and models. This creates several challenges for this project, and we do our best to approximate the legal Delta boundaries with Census block groups, tracts, zipcodes, and geocoded establishment data when available. However, the boundaries of what constitutes the primary zone or a given community can change based on the data source being utilized. We have tried to be clear throughout the report regarding the definitions, but readers should be aware that variations in data reported throughout reflect the differences in data sources and the challenges of working with data for a rural area that spans five counties.

Organization of the Report

There are three parts of the report that follow this Introduction. Part 1 is critical background and overview information. Part 1 includes a broad overview of economic and demographic data for the Delta; an assessment of the current state of Delta levees, emergency response, and financial resources to improve the levees; a review of key laws and land use plans and how they interact in the Delta; and finally a review of some key studies that have supported key policy proposals.

Part 2 analyzes specific industry sectors in the Delta, the baseline and trends of these industries, and the expected effects of various policy proposals. Part 2 also includes two cross-cutting chapters that explore the future of Legacy Communities and the sustainability of local government services. Finally, Part 3 summarizes the key findings in the previous sections and integrates the findings into a set of recommended strategies and policies to support economic sustainability in the Delta. Thus, Part 3 would make up the Economic Sustainability Plan.

Part One: Background and Context for the Economic Sustainability Plan

Chapter 2: Overview of the People and Economy of the Delta

This chapter provides an overview of the key demographic and economic conditions and trends in the Sacramento-San Joaquin Delta, including detailed information for both the Primary and Secondary Zones. The chapter is intended to provide baseline information to support the creation of an Economic Sustainability Plan for the Delta.

THIS CHAPTER IS UNDER DEVELOPMENT

The analysis focuses primarily on data-driven results and information based primarily on a variety of government data sources, as documented throughout. To the extent possible, the findings rely on the most up-to-date and geographically-refined data available, including block-level data from the 2010 Decennial Census. It is important to note the analysis relies on a variety of disparate data sources with differing geographic reporting areas (see Appendix). The detailed data and calculations documenting the findings presented herein are also provided (See Appendix).

1 Overview

This section highlights key socioeconomic indicators for the Primary, Secondary, and Legal Delta. Overall, the data review suggests that the Delta is a relatively diverse, growing, and economically integrated region that in many respects is out-performing the State as a whole. However, within this larger context, the Delta's Primary Zone functions as a distinct sub-region with a demographic and economic trajectory that differs in many ways from both the region and State. Although most of these differences stem from the more rural and sparsely populated nature of the Primary Zone, some are indicative of a less diversified and underperforming economy. The key indicators underlying these conclusions are summarized below.

- **Population Growth**: While the Legal Delta has experienced relatively robust population growth over the last 20 years, increasing by about 54 percent since 1990 compared to 25 percent State-wide, the Primary Zone population has remained essentially unchanged. The impressive growth rate of the Legal Delta is largely attributable to its position on the urban fringe, in the "path of growth" of large metropolitan areas in Northern California. However, the Primary Zone does not appear to be participating in this regional or State-wide growth, in part because it lacks the public infrastructure and services necessary to support it and in part because of land use regulations facing new development. In particular, the Central Delta (south of Walnut Grove and including the SR12 corridor east of Rio Vista) has contracted since 2000, with total population falling by approximately 230 people, a decrease of over 5 percent.

- **Age, Race, and Ethnicity**: While the Legal Delta is made up of a relatively young and racially and ethnically diverse population, the Primary Delta is older and predominantly white and non-Hispanic. Approximately 43 percent of the Legal Delta's population describe themselves non-White and approximately 80 percent are younger than 55 years of age, similar to the 39 percent and 79 percent State-wide, respectively. In contrast, only about 28 percent of Primary Zone residents describe themselves as non-White and about 34 percent are 55 years or older (compared to about 21 percent State-wide). The Primary Zone's below-average household size (with about 65 percent of households containing fewer than three people compared to about 54 percent State-wide) is consistent with the older age profile, suggesting a relatively high share of households without children. Demographic trends in the larger Legal Delta reflect birth and migration patterns emanating from Northern

California's "gateway" urban centers, but these patterns that appear to be having less of an impact on the Primary Zone. Since 2000, the age distribution of the population in the Legal Delta has not changed dramatically, likely due to an influx of younger population in the Secondary Zone. In contrast, the age distribution in the Primary Zone has shifted older, with people age 55 and up accounting for a significantly greater share of the population, up from about 21 percent in 2000 to 34 percent today.

- **Jobs and Employment**: While the Legal Delta has enjoyed employment gains in recent years, corresponding with increased urbanization and its role as an expansion area for Northern California's urban centers, the Primary Zone appears to have lost jobs. However, when the volatile agricultural employment changes (likely due to contract labor trends) are excluded from the analysis, the Primary Zone also added jobs, particularly in Manufacturing and Construction.

- **Economic Drivers**: While the Legal Delta possesses a relatively diversified and stable economy, with no one sector accounting for more than 13 percent of employment, the Primary Zone is a highly resource-driven economy with a heavy reliance on agriculture and to a lesser degree recreation-related sectors. The Legal Delta's four top employment sectors, retail, education, health care, and accommodations and food services, account for about 45 percent of all jobs, with a relatively equal distribution among each. In contrast, in the Primary Zone agriculture alone makes up about 45 percent of total employment.

- **Export Sectors**: Exports represent a key measure of a region's economic base because they bring new money into a region instead of recirculating existing income. While the proportion of economic output represented by exports in the Legal Delta is relatively high compared to the State as a whole (33% versus 24% in California), the Sacramento River Corridor appears to be distinctly export-oriented, with exports making up approximately 64% of output.

2 The People of the Delta

The demographic attributes and unique capacities of Delta residents will have important implications on the regions' economic development prospects. This section explores the demographic conditions and trends in the Delta, focusing on such factors as population growth, age, education, household characteristics, labor force participation, and commute patterns. The analysis distinguishes between the Delta's Primary and Secondary Zones. A more detailed discussion of these trends for selected "Legacy Communities" is provided separately.

2.1 Demographic Conditions and Trends

2.1.1 Population

There has been significant population growth within the Legal Delta since 1990, almost entirely attributable to the expanding urban areas contained within the Secondary Zone. Specifically, the Secondary Zone contains an estimated 560,000 residents according to the 2010 Decennial Census, up from about 360,000 in 1990, a 56 percent increase (the State as a whole increased by 25 percent during this period). In contrast, the Census reports roughly 12,000 residents living in the Primary Zone in 2010, about the same number as 20 years ago.[1] Currently, the population within the Primary Delta represents about 2 percent of the Legal Delta's total and this proportion appears to be shrinking.

[1] Note that changing Census boundaries limit the precision of block-level trend analysis.

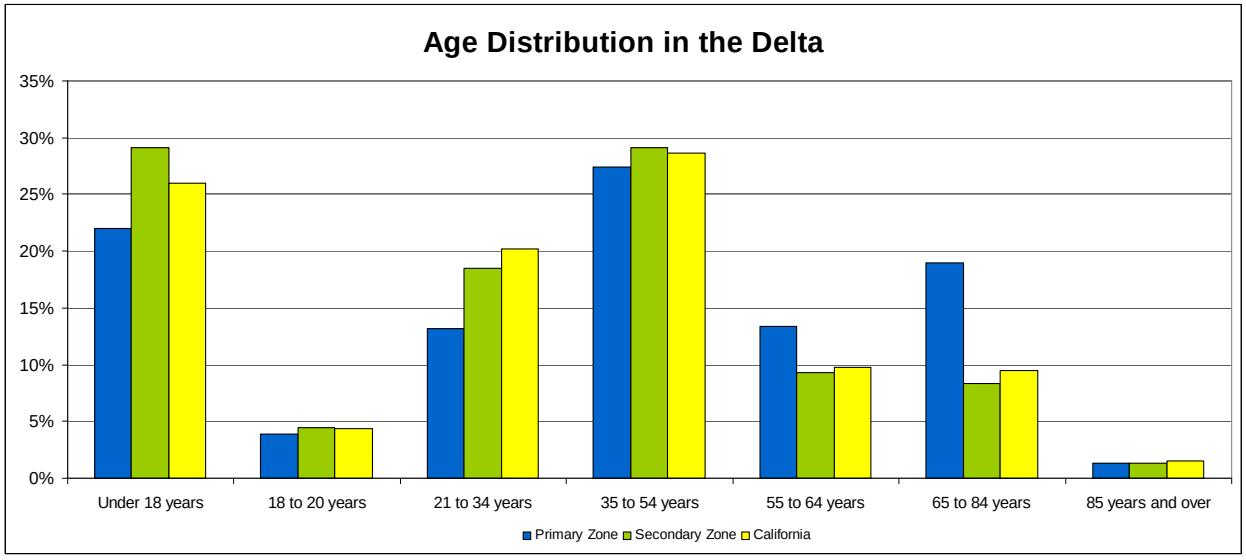
Given that the Primary Zone land area represents about 67 percent of the total Legal Delta land area, it is differentiated as a highly rural and sparsely populated area surrounded by relatively fast growing urban areas in or adjacent to the Secondary Zone.[2] A variety of inter-related factors are preventing growth in the Secondary Zone from spreading to the Primary Zone, most notably, but not limited to, regulatory prohibitions, lack of public infrastructure, and economic feasibility. The relatively fast growth in the Secondary Zone, in turn, is largely attributable to its role in accommodating "spill-over" growth from large, land constrained urban centers in the San Francisco, Sacramento, and Stockton Metropolitan Areas.

2.1.2 Age and Household Composition

Overall, the age and household composition of the resident population in the Legal Delta is very similar to California as a whole, albeit with slightly younger and larger families. Specifically, almost half of the population (47 percent) is in the 21 to 54 year age group, the prime income generating cohort, mirroring the State (49 percent). The Legal Delta has a slightly higher proportion of youth than California as a whole, with about 29 percent below 18 years (compared to 26 percent Statewide). In addition, about 72 percent of all households in the Legal Delta contain families (i.e., relatives) and 49 percent contain three or more people, compared to 68 percent and 46 percent, respectively, for the State as a whole.

The age and household composition of residents in the Primary Zone is indicative of a region characterized by older individuals without children living in relatively small households. For example, the Primary Zone population in the 21 to 34 years age group comprises only 13 percent of the total population (compared to 20 percent in California) while population in the 65 to 84 years age group makes up 19 percent of total population (compared to 9 percent in California). Meanwhile, about 65 percent of the households contain two or fewer people, compared to 54 percent state-wide. Combined, these data suggest a resident population with lower household consumption (small households without kids) and income generation (retirees) than both the Legal Delta and State.

Figure 1 Age Distribution in the Delta



[2] Based on an estimated 491,592 acres in the Primary Zone and 243,798 acres in the Secondary Zone (Framework Study).

2.1.3 Race and Ethnicity

The population of the Primary Zone is generally Caucasian, with residents identifying themselves as white making up approximately 72 percent of the population. About 8 percent of the Primary Zone population reports being of Asian descent. The relatively urbanized Secondary Zone is somewhat more diverse, with greater shares of the population identifying themselves as Asian (13 percent) and African American (11 percent). By comparison, the California population is about 61 percent white, 12 percent Asian, and 6 percent African American.

Approximately 27 percent of the Primary Zone population and 30 percent of the Secondary

Figure 3 Race in the Primary Zone

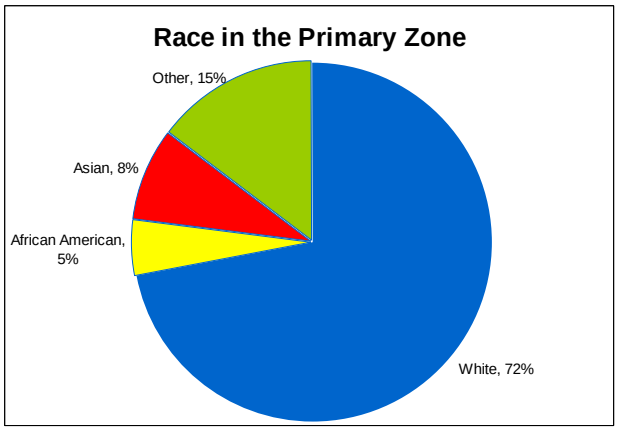
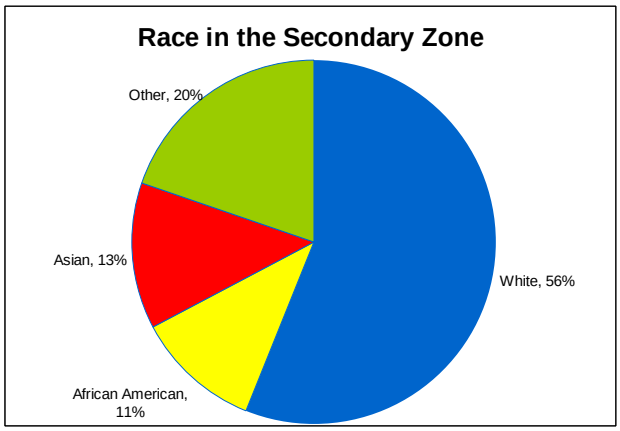


Figure 2 Race in the Secondary Zone



Zone populations report being of Hispanic origin, smaller shares of the total population than in California overall, where Hispanics make up roughly 36 percent of the population.

2.1.4 Educational Attainment

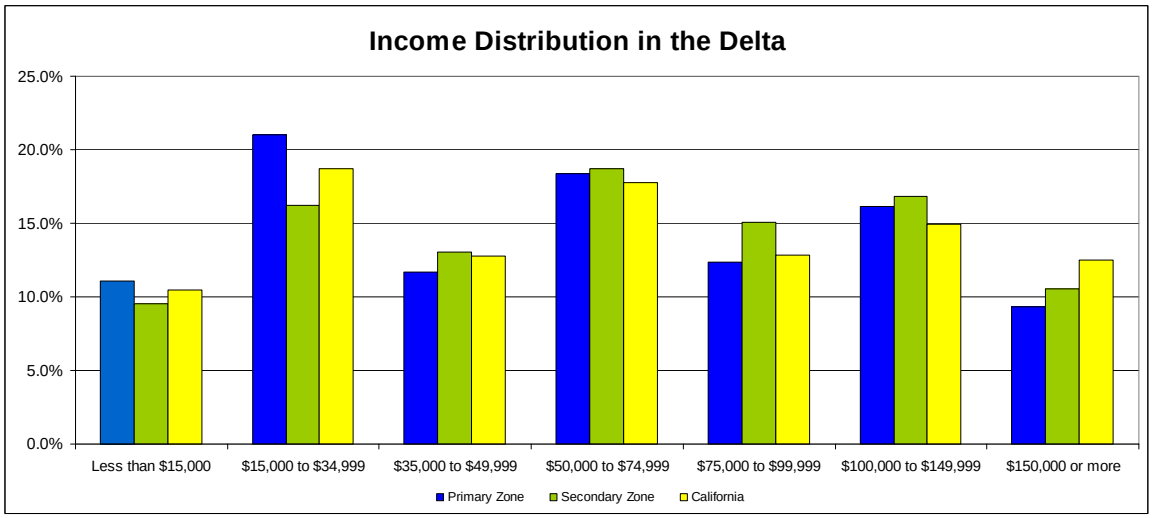
In general the residents of the Legal Delta are slightly less educated than the State as a whole, with several caveats. For example, about 32 percent of Legal Delta residents have successfully obtained some form of post-secondary (higher) education degree, compared to 37 percent State-wide. However, the Legal Delta has fewer high school drop-outs than the State overall, at 17 percent compared to 20 percent. Interestingly, the Primary Zone appears to have slightly higher education levels than the Secondary Zone with 34 percent completing post-secondary training and 8 percent holding a graduate or professional degree (compared to 31 percent and 6 percent, respectively, in the Secondary Zone). The Primary Zone's slightly higher education levels are likely partially linked to its older and whiter demographic.

2.1.5 Income

The household income distribution in the Primary Zone is generally similar to California overall. While a slightly greater proportion of Primary Zone households have a total household income of less than $35,000 (32 percent versus 29 percent in California), a greater proportion of Primary Zone households have income between $35,000 and $150,000 (59 percent versus 58 percent in California). A greater share of California's households earn more than $150,000, explaining the higher average household income in California. Household incomes in the

Secondary Zone are more concentrated in the $50,000 to $150,000 range, as compared with the Primary Zone and California overall.

Figure 4 Income Distribution in the Delta



2.2 Housing Trends

2.2.1 New Development

Despite the lack of population growth, there has been some residential development in the Primary Zone. The number of housing units increased by about 10 percent, from approximately 4,500 to nearly 5,000, between 1990 and 2010. The discrepancy between population and housing growth may be indicative of declining household size, increased vacancies, second-home construction (e.g., vacation homes), or a combination of these factors. By comparison, the Secondary Zone gained more than 66,000 net new housing units during this same period, an increase of nearly 50 percent, a slightly slower growth rate than population. This trend is consistent with the above-average household size in this region.

2.2.2 Ownership

Approximately 74 percent of the occupied housing units in the Primary Zone are inhabited by owners. While this is significantly greater than in California overall, where only about 58 percent of homes are owner-occupied, this is generally consistent with home ownership rates observed in more rural areas where multifamily housing is scarce. In the Secondary Zone, which is more urban, owner-occupied housing units make up about 66 percent of occupied housing units.

2.2.3 Foreclosures

Given the Secondary Zone's position on the urban fringe of several large metropolitan areas, it is particularly vulnerable to the sub-prime-led foreclosure crisis that disproportionately hit a number of California communities of this nature. Data concerning foreclosures occurring between May 2010 and April 2011, obtained from RealtyTrac, substantiate this trend. These data show that the Secondary Zone has a foreclosure rate of 9.8 percent, compared to only 4.2 percent in the Primary Zone. Also, the foreclosure rate in the Secondary Zone is notably higher than the five-county region (8.5 percent) and the State (5.8 percent).

2.3 Labor Force Participation and Commute Patterns

Consistent with the older age profile of Primary Zone residents, only about 54 percent of the population is in the labor force (employed or seeking work), with many residents of the Primary Zone likely having retired. The unemployment rate for the Primary Zone is relatively healthy, with slightly lower unemployment (as a percentage of labor force) than in California, according to data from 2005 through 2009. In the Secondary Zone, a greater share of the population is in the workforce (64 percent) and unemployment is higher (10 percent), which is fairly consistent with California overall.

It is also interesting to note that the Legal Delta has a low ratio of jobs to workers compared to the Primary Zone. Despite this fact, workers and residents in both the Legal Delta and Primary Zone have relatively complex commute patterns which suggest that residents generally work elsewhere. In the Primary Zone, roughly 90 percent of employed residents work elsewhere. For example, the employed residents of the Primary Zone commute to Stockton (15 percent), Sacramento (7 percent), Galt (4 percent), Lodi (3 percent), Elk Grove (3 percent), and Rio Vista (3 percent). Employed residents of the Secondary Zone work in Stockton (17 percent), Antioch (6 percent), Sacramento (5 percent), and Tracy (4 percent), and other locations.

Employed residents of the Primary Zone consist primarily of construction (11.5 percent), health care (9.9 percent), educational services (9.7 percent), retail trade (9.3 percent), and agricultural workers (9.1 percent). Of the employed Primary Zone residents, approximately 64 percent are employed by for-profit enterprises, 20 percent are employed by government entities, 9 percent are self-employed, and 7 percent are employed by not-for-profit organizations. The employed residents of the Secondary Zone are less concentrated in agriculture (1.3 percent), construction (9.0 percent), and educational services (7.6 percent) and more concentrated in health care (12.7 percent) and retail trade (12.4 percent).

Together the labor force participation and commute patterns suggest that Primary Zone workers commonly out-commute to jobs in construction, health care, and education while the in-commuters occupy lower skilled jobs in agriculture and manufacturing. Despite a healthy ratio of jobs to residents, the Primary Zone serves as a “bedroom community” for professionals commuting to Stockton, Sacramento and other nearby urban areas.

3 Baseline Economic Conditions and Trends

An effective Economic Sustainability Plan for the Delta must be based on a solid understanding of the economic conditions and key drivers. Consequently, to further assess economic development trends, this analysis evaluates employment, output, and trade flow trends in the Delta to ascertain economic fundamentals and growth prospects. The analysis draws on a variety of data sources and relies on common economic development tools and metrics, including location quotients and export-orientation analysis.

3.1 Employment Growth by Sector

According to data from the Bureau of Economic Analysis (BEA), there are 1.826 million jobs in the five-county region that intersects the Delta (Contra Costa, Sacramento, San Joaquin, Solano, and Yolo counties). Overall, nearly 23 percent of employment in the region is categorized as proprietor employment (i.e., self-employed), including nearly 38 percent of the farm employment.

BEA's comprehensive employment data are unavailable for the Primary Zone of the Delta. However, the US Census Bureau, through its Local Employment Dynamics-Longitudinal Employer-Household Dynamics (LED-LEHD) program, provides data within unique geographies such as the Delta zones but excludes most self-employed workers. Adjusting the LED-LEHD estimate upward to account for the additional share of employment reported by BEA in the five-county region, this analysis estimates that there are roughly 206,00 jobs in the Legal Delta. In addition, the LED-LEHD reports approximately 4,360 jobs in the Primary Zone which suggests total employment of nearly 6,500 jobs (approximately 3 percent of the Legal Delta) after the adjustment for undercounting.

In terms of growth, employment in the Legal Delta has been growing with 2009 employment up slightly (about 2 percent) from 2002, despite significant declines associated with the "Great Recession." This exceeds the growth rate in the five-county region, which experienced a 1 percent job gain during this period. Although more recent job growth in the Legal Delta has been negative, it did achieve high rates of job growth in the Information and Other Services sectors between 2002 and 2009.[3,4] In terms of absolute job growth, Health Care and Social Assistance jobs were the most significant contributor to employment growth, followed by Other Services.[5]

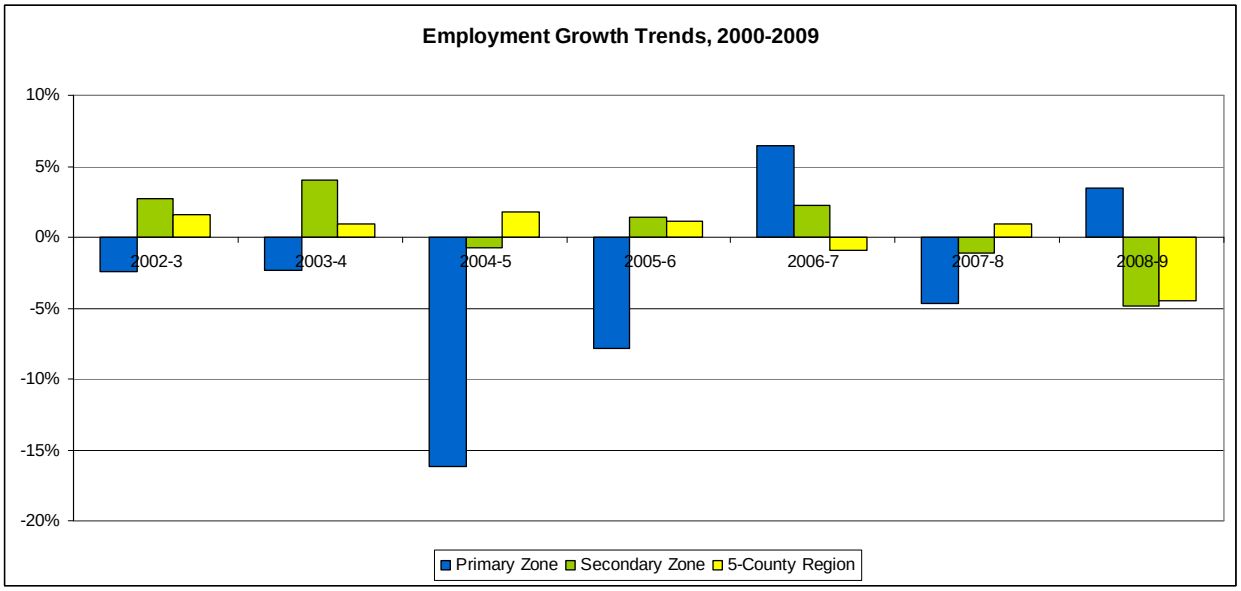
By comparison, employment data for the Primary Zone indicate the region has declined, with 23 percent fewer jobs in 2009 compared to 2002. According to these data, the Agriculture, Forestry, Fishing, and Hunting industry shed nearly 3,000 during this time period, though it is important to note that localized employment swings in this industry are common because place of work is generally tied to a payroll/accounting office location rather than agricultural fields. Excluding agricultural employment, the Primary Zone enjoyed significant employment gains between 2002 and 2009. The most significant employment gains in the Primary Zone occured in the Manufacturing industry, which added 841 jobs (unadjusted) between 2002 and 2009, according to LED-LEHD data.

[3] The Information sector comprises establishments engaged in the following processes: (a) producing and distributing information and cultural products, (b) providing the means to transmit or distribute these products as well as data or communications, and (c) processing data. (BLS)

[4] The Other Services (except Public Administration) sector comprises establishments engaged in providing services not specifically provided for elsewhere in the classification system. Establishments in this sector are primarily engaged in activities, such as equipment and machinery repairing, promoting or administering religious activities, grantmaking, advocacy, and providing drycleaning and laundry services, personal care services, death care services, pet care services, photofinishing services, temporary parking services, and dating services. (BLS)

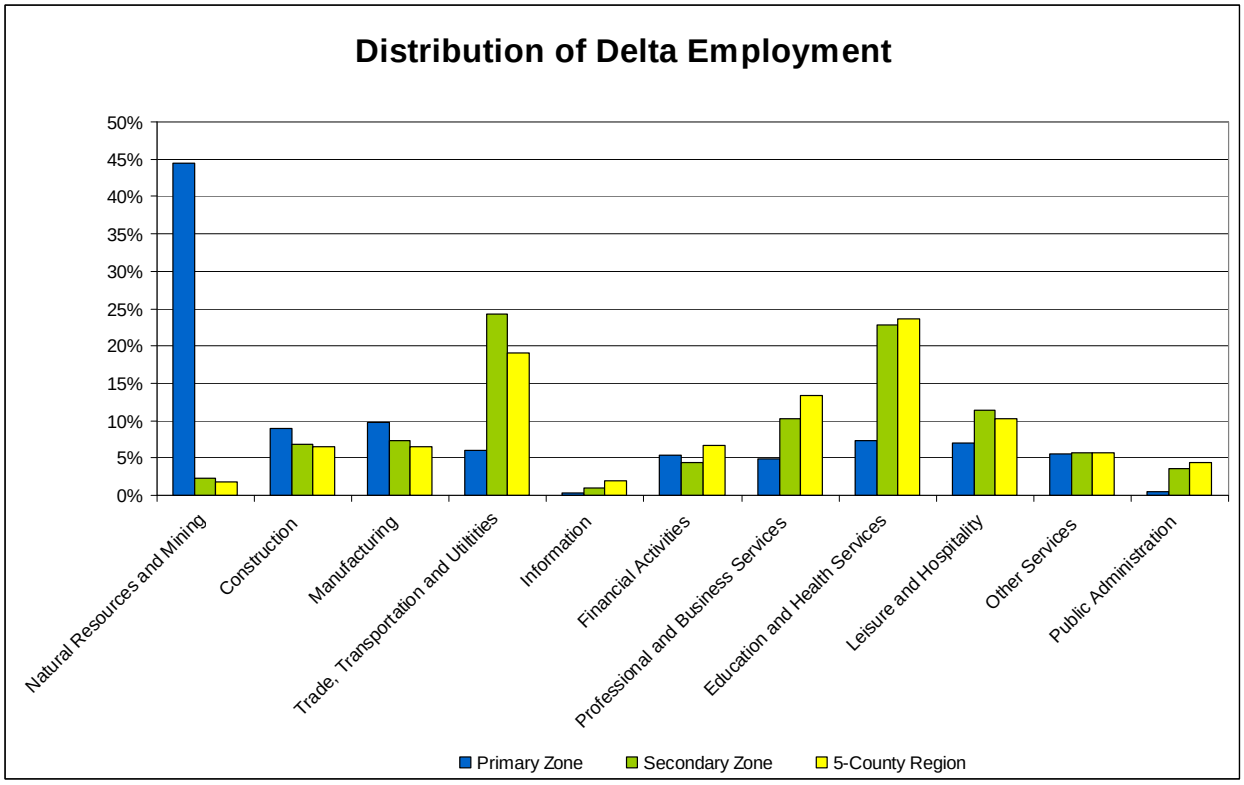
[5] The Health Care and Social Assistance sector comprises establishments providing health care and social assistance for individuals. (BLS)

Figure 5 Employment Growth Trends, 2000-2009



Overall, the Legal Delta appears to have a relatively balanced level of employment across a number of sectors, in sharp contrast to the Primary Zone. Specifically, four sectors, retail (13 percent), education, (12 percent), health care & social service (10 percent) and accommodations & food services (9 percent), have averaged about 43 percent of total jobs between 2000 and 2009. A range of other employment sectors have accounted for over half of all employment but each with less than 9 percent of the total.

Figure 6 Distribution of Delta Employment



Even with the reported decline in agricultural jobs, employment in the Primary Zone of the Delta remains highly concentrated in this sector, which accounts for nearly 45 percent of all jobs. Over the seven-year period from 2002 to 2009, agriculture has accounted for more than 50 percent of total employment in the region. Other important industries include Manufacturing and Construction, which account for 10 and 9 percent of Primary Zone jobs, respectively. Together, these three industries comprised over 60 percent of Primary Zone jobs. Recreation-related industries, which generally include Retail; Arts, Entertainment, and Recreation; and Accommodation and Food Services account for roughly 9 percent of jobs in the Primary Zone.

3.2 Location Quotient Analysis

Location quotient analysis is a commonly-used method to identify strengths in a local economy. The technique identifies concentrations in a local economy relative to a larger reference economy. In this analysis, the location quotient compares the distribution of employment by industry to determine if there are industries that comprise a greater proportion of employment in the local economy relative to the larger regional economy. Specifically, this analysis compares the employment composition of the Legal Delta relative to employment in the five-county region.

The location quotient analysis points to relatively high employment concentrations in the following sectors:

- Agriculture, Forestry, Fishing, and Hunting[6]
- Transportation and Warehousing[7]
- Wholesale Trade[8]

Given the importance of agriculture in the Primary Zone, the Economic Sustainability Plan includes a focused analysis of this sector. The location quotient analysis also highlights important linkages to transportation and warehousing and wholesale trade.

3.3 Export Orientation

IMPLAN, a regional economic model that describes economic relationships between industries, is a valuable tool for evaluation of trade and exports in the Delta. This analysis relies on data from IMPLAN to consider the degree to which specific Delta industries are export-oriented, thereby bringing new money into the regional economy. A key measure of a region's economic base is the amount or percentage of economic activity, services, or sales that are exported. Exports bring new dollars into an economy rather than recirculating existing dollars.

Since IMPLAN data is only available at the zip code level, which are not perfectly consistent with Delta boundaries, particularly in the Primary Zone, a variety of geographies are considered. Based on this analysis, exports represent about 33 percent of total output in the Legal Delta, compared to 24 percent in the State as a whole. This compares to 64 percent in the

[6] The Agriculture, Forestry, Fishing and Hunting sector includes establishments primarily engaged in growing crops, raising animals, harvesting timber, and harvesting fish and other animals from a farm, ranch, or their natural habitats. (BLS)
[7] The Transportation and Warehousing sector includes industries providing transportation of passengers and cargo, warehousing and storage for goods, scenic and sightseeing transportation, and support activities related to modes of transportation. (BLS)
[8] The Wholesale Trade sector comprises establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. (BLS)

Sacramento River Corridor. These data suggest that economic output in the Delta is heavily biased towards producing goods and services for consumption elsewhere. Not surprisingly, agriculture is highly export-oriented sector with exports accounting for 83 percent of total output in this sector in the Sacramento River Corridor. However, utilities and manufacturing are also export-driven industries which appear to account for a relatively large proportion of total value added in the Delta.

Chapter 3: Review of Key Policies and Planning Processes

Shortly after statehood in 1850, California started studying its water resources. From the early 1900s, plans were developed to move water from the water rich north to the water poor south and providing irrigation water for the San Joaquin Valley. These plans have been implemented and have been controversial, creating friction between the north and south of California. Since the late 1970's regional governance of the Delta, hub of the California water system, has been implemented at the local, regional and State level. The current governance proposal retains local control over most actions, retains the State Delta Protection Commission with limited authority over some local land use decisions, and introduces the new Delta Stewardship Council as coordinator of all State level programs including water quality, water supply, habitat enhancement, public access and recreation, and land use.

THIS CHAPTER IS UNDER DEVELOPMENT

Water Conveyance

By 1919, a statewide water development project proposed moving Sacramento River water through the San Joaquin Valley and over the Tehachapis to Southern California. The 1931 plan to implement this project was approved in a very controversial 1933, $170 million bond act. Due to the poor economic climate of the Depression, the federal government took over construction of the project. A second series of bills were passed in the late 1950s to expand the state water project and voters approved another very contentious bond act in 1960 [California Water Resources Development Bond Act]. In the early 1980s controversy heated up again over legislation to construct a peripheral canal to convey water around the Delta to the export pumps. The project was rejected by the voters in June 1982. The campaign was described as "the largest north south ballot split ever seen in California".

Several years of drought followed by downturns to Delta fisheries led Governor Pete Wilson and Secretary of the Interior Secretary Bruce Babbit to bring State and federal agencies to a joint process to address California and Delta water issues through the CALFED process in 1994. The CALFED project resulted in a Record of Decision in 2000 which included multiple actions needed to address water and ecosystem management in the Delta and its watershed.

The state legislature established a state oversight body, the California Bay-Delta Authority. The policy group was disbanded, and CALFED was folded into the State's Resources Agency. In 2006, the Governor and Legislature appointed a cabinet committee and a Delta Vision Blue-Ribbon Task Force to advise the cabinet committee. In 2007 the task force presented its Delta vision and in 2008 prepared a strategic plan. In late 2009, the Governor and Legislature enacted a package of laws to implement the recommendations creating the new Delta Stewardship Council, a Delta Conservancy, and modified the legislation authorizing the Delta Protection Commission, among other actions.

Governance

In the early 1970's as agricultural lands in the Delta counties came under pressure for development from residential and other users, the five Delta counties came together to develop a regional strategy for future development of the Delta. The Delta Area Planning Council (DAPC) created through a Memorandum of Understanding and funded by the Counties, adopted a plan for the region which supported agricultural and recreational land uses. Funding for DAPC dwindled in the late 1980s and interest in State level planning and coordination increased in the late 1980s.

In 1992, after State studies and hearings about the need to plan for the future of the Delta and the protection of its critical natural resources, the Legislature approved the Delta Protection Act of 1992 authored by Senator Patrick Johnston. The Act created a Delta Protection Commission with membership from State agencies, local counties and cities, and Delta water agencies. The Commission was charged with preparing a land use and resource management plan for the Primary Zone of the Delta, the agricultural and open space lands and waterways in the inner core of the Delta. Lands in cities and slated for development were not included in the Commission's jurisdiction. The Commission was granted limited appeal authority over local government actions and no authority over State or federal agencies or their programs or projects.

1 County General Plans and the Delta

General Plans, first authorized in 1927, must now include seven elements: Land Use, Open Space, Conservation, Housing, Circulation, Noise, and Safety. Each General Plan is a comprehensive long-term plan for the physical development of the county or city serving as a "blueprint" for development. More specific guidance is outlined in each county or city's zoning code; zoning codes are required to be in conformance with General Plans. Each of the counties with lands within the Legal Delta support agriculture, wildlife habitat, and recreation on Primary Zone lands. The unincorporated communities in the Primary Zone each have their own community plans/special area plans: Clarksburg in Yolo County, and Courtland, Locke and Walnut Grove in Sacramento County. The City of Isleton is the only incorporated city in the Primary Zone and has its own General Plan. Local government general plans do not apply to State or federal projects.

After the Delta Protection Commission adopted its original Land Use and Resource Management Plan for the Primary Zone of the Delta, each County and City was required to ensure that its General Plan was consistent with the Commission's Plan. All of the County and City General Plans covering the Primary Zone of the Delta were determined to be consistent with the Commission's Plan.

1.1 Contra Costa County

Contra Costa County has adopted an Urban Limit Line; the Delta Primary Zone is outside the urban limit line due to flood hazards, soil subsistence, lack of infrastructure, and lack of services. The areas to the north and east are designated Delta Recreation and Resources areas and portions of the Primary Zone are designated General Agriculture. The Urban Limit Line will be reviewed in 2016.

1.1.1 General Plan (2005)

Contra Costa County has a program to maintain a specific ratio between developed land and open space land within the County. The ratio, as adopted by the voters in November 1990 is 65% of the County to be preserved for agriculture, open space, wetlands, parks and other non-urban uses and 35% may be developed for urban development. The Delta is within the area to remain in open space and low intensity uses.

The Contra Costa General Plan designates most Delta islands and nearby tracts as a special "Delta Recreation and Resources" designation. The designation recognizes the location in the 100 year flood plan, the limited services, the value as agricultural land, wildlife habitat, and for low intensity recreation. In these areas, the County allows agricultural uses; and with a use

permit, recreation uses such as marinas, hunting clubs, campgrounds, and other outdoor recreation; minimum parcel size is 20 acres. Publicly-owned park land and all golf courses are designated “Parks and Recreation”. Transportation and utility corridors are designated “Public Facilities”. Water areas uses include docks, boating, and fishing. Publicly-owned land, wetlands, tidelands, and areas of significant ecological resources are designated “Open Space”. The areas west of Veale and Hotchkiss Tracts are designated “Agricultural Land”. The existing parcels are mostly between 10 and 50 acres. Jersey Island is designated Public/Semi-Public and has been used for disposal of treated wastewater.

Policy 3-54 requires all management and development actions in the Primary Zone to be consistent with the goals, policies and provisions of the Land Use and Resource Management Plan for the Primary Zone of the Delta.

1.1.2 East County Area Plan.

An Area Plan has been adopted for East Contra Costa County (1985) which includes: Holland, Palm, Orwood tracts, and Coney Island. Uses allowed include public and private outdoor recreation, equestrian facilities, wind energy systems, single family residences on larger lots, quarries, oil and gas wells, pipelines and transmission lines, vet/kennels, and public uses.

1.2 Sacramento County

The County has an urban limit line; the Delta is outside the urban limit line. There are several unincorporated communities within the Primary Zone with residential and commercial development. There are scattered areas of residential development along waterways. County decision makers are advised by the Delta Municipal Advisory Council made up of Delta residents.

1.2.1 General Plan (1993, currently being updated).

The Sacramento County General Plan was adopted in December 1993. The General Plan defines areas of future growth in the county; these areas are out of the Delta. The December 9, 1992 Land Use Diagram showing the Urban Service Boundary does not pass west of I-5. The Land Use Diagram shows most of the Delta area as Agricultural Cropland. Areas of low density residential use (1 to 12 dwelling units per acre) are located in the existing communities of Hood, Courtland, Locke, and Walnut Grove. Small areas are identified for Intensive Industrial and Extensive Industrial use south of Walnut Grove, along Twin Cities and River Roads, and near Hood. The Diagram shows Recreational uses at the north tip of Sherman Island, Brannan island State Park, eastern portion of Andrus Island, the shoreline west of Isleton and the area between the Delta Cross Channel and Locke. Several areas are identified as Natural Reserves including Lost Slough, Sherman Island Wildlife Area, the west tip of Grand Island, Stone Lakes, Delta Meadows, and the levees along Snodgrass, Sevenmile, and Steamboat Sloughs.

The December 9, 1992 Agricultural Element of the General Plan promotes protection of agricultural land, requires mitigation to provide in-kind protection when agricultural land is developed, promotes 300 to 500 foot wide buffers between agriculture and non-agricultural uses; and sets minimum parcel sizes of 40 acres for Soil Classes I and II and 80 acres for Soil Classes III and IV.

The County does not accept applications to amend the Land Use diagram from Recreational or Agricultural Cropland to any residential category, commercial and office, or industrial use unless

the site is in the established Delta communities of Hood, Courtland, Locke, or Walnut Grove, or is a small expansion which supports the agricultural and recreational economies of the Delta.

The Open Space Element outlines strategies to protect critical open space resources of the County including acquisition of key areas and implementation programs to secure permanent open space, thus fixing the urban service boundary, and establishment of open space linkages (natural land corridors).

The Conservation Element protects key resources including water and soil. Development is to be diverted from prime or soils of statewide importance; conversion of more than fifty acres of prime or statewide importance farmland is deemed to have a significant environmental effect under the California Environmental Quality Act (CEQA); and no golf courses are allowed on prime lands outside the urban service area boundary.

Issues currently under consideration in the updated General Plan include revitalization of commercial corridors, a new Economic Development Element, analysis of future growth within the Urban Policy Area and the Urban Service Boundary, and Smart Growth principles.

1.2.2 The Delta Community Area Land Use Plan.

The Delta Community Plan (1983) designates most of the Delta as permanent agricultural land in 80, 40, and 20 acre parcels. Agricultural residential parcels are one and two acres. The communities of Hood, Courtland, and Walnut Grove are identified as locations for future residential development and commercial growth; residential development in the agricultural areas is discouraged.

Some water-covered areas are designated Delta Waterways and some as natural areas (Dolan Island, waterways near the tip of Sherman Island, portion of Sevenmile and Snodgrass Sloughs, and the South Fork of the Mokelumne River), scenic areas (Steamboat, Sutter, and Georgiana Slough), and restricted areas (Steamboat, Snodgrass, and Sevenmile Sloughs).

The area around Stone Lakes, much of Snodgrass Slough, the Delta Meadows area, the southwest tip of Grand Island, and Brannan Island State Park are designated Recreation Reserve. The islands at the tip of Sherman Island are designated Recreation with a Flood overlay.

Special Plans have been prepared for the communities of Courtland, Hood, Locke, Walnut Grove, and Ryde and for the Lower Andrus Island Special Planning Area. These communities are the residential, commercial, processing, and retail centers in the Delta and have water and sewage treatment facilities, and fire protection. These plans are codified in special zoning codes for Walnut Grove (1989) and Locke (2005).

Sacramento County is currently evaluating new Winery, Farm Stand, and Farm Stay Ordinances to set standards for agricultural industries and to promote agricultural tourism and to provide new economic development opportunities. The winery ordinance would allow small wineries in the agricultural (AG) zones, and large wineries in the AG-160, AG-80 and AG-20 zones. The farm stand ordinance will allow sales locations in AG zones where food products are grown. The farm stay ordinance will facilitate the operation of farm stays, expand the understanding of the role of agriculture in the County and provide farmers with an opportunity to diversify income potential. No more than six guest rooms would be allowed per farm stay operation.

1.3 San Joaquin County

San Joaquin County promotes future growth within the existing cities and existing unincorporated communities. Three future new communities are identified; none are in the Primary Zone, although Mountain House is directly adjacent to the Primary Zone, south of Old River. A small portion of Thornton, at the intersection of I-5 and Walnut Grove-Thornton Road in the Secondary Zone, is planned for Freeway Service Commercial. There are no unincorporated communities in San Joaquin County's portion of the Delta Primary Zone. The closest is the large recreational development at Tower Park, which includes some permanent residents.

1.3.1 General Plan (1992, currently being updated)

The General Plan recognizes that the County will grow substantially in the future, but states that rural areas will accommodate minimal growth because open space and agricultural preservation are paramount in these areas. The County General Plan Map designates most of the Delta as General Agriculture. The waterways and channel islands are designated "Resource Conservation". The General Plan recognizes the Delta as an area of international importance and a major recreational, wildlife, agricultural and economic resource.

There are two regional parks and one area designated commercial recreation at Terminous (Tower Park). Commercial Recreation is defined as major development of at least 100 acres with potential of more than 500 people on a site. The General Plan allows smaller areas of commercial recreation in agricultural areas because of specific location needs, such as direct access to natural resources. Typical uses include: marinas, recreational vehicle parks, and golf courses. Commercial Recreation areas outside communities must have a public wastewater treatment system serving the entire planned area. Recreational values of the Delta are to be protected. Along the waterways, opportunities should be provided for bank fishing, boating, water skiing, hiking, bicycling, horseback riding, picnicking, and nature study.

Waterway development and development on Delta islands, in the plan, is to protect the natural beauty, the fisheries, wildlife, riparian vegetation, and the navigability of the water. Development on the Delta islands is limited to water-dependent uses, recreation, and agricultural uses.

The Open Space policies state that the Resource Conservation designation shall be used to protect significant resource areas and areas with serious development constraints, such as the Delta, should be predominantly maintained as open space. Policies also designate several Delta roads as scenic routes.

Agricultural Lands make up the majority of the Delta in San Joaquin county. The General Agriculture designation addresses areas where soils are capable of producing a wide variety of crops; parcel sizes are large enough to support commercial agricultural activities; where there is an existing commitment to commercial agriculture under the Williamson Act contracts; and with capital investments. Density of development in the General Agriculture designation throughout the County is a maximum of one primary dwelling unit per 20 acres; additional dwelling units for farm employee housing and farm labor camps may be permitted. Minimum parcel sizes are 20 to 40 acres where irrigation water is available; 80 to 160 acres where water is not available for irrigation.

Uses allowed in the General Agriculture designation including crop production, feed and grain storage and sales, aerial crop spraying, and animal raising and sales. Additional activities such

as resource recovery, dairy and canning operations, stockyards, and animal feed lots and sale yards require permits. There shall be no further fragmentation of land designated for agricultural use, except parcels for home sites may be created, provided that the General Plan density is not exceeded; a parcel may be created for a use granted by permit in the AG zone. Non-agricultural land uses at the edge of agricultural areas shall incorporate adequate buffers (e.g. fences and setbacks) to prevent conflicts with adjoining agricultural operations.

1.4 Solano County

Development in Solano County is directed by County and City policies into the existing cities (Vacaville, Fairfield, Rio Vista, Vallejo, Suisun City, Dixon, and Benicia). Much of the land in the Primary Zone is above sea level and distant from the sloughs and rivers that provide riparian water for agriculture. There is also very little recreational development in the Primary Zone in Solano County. Portions of Prospect Island are designated Open Space: Marsh.

An orderly growth initiative, Proposition A, passed in 1984, prohibits the Board of Supervisors from changing the General Plan designation on Agricultural lands, except in very limited circumstances. The voters adopted Measure T in 2008 which extends the Orderly Growth Initiative through 2028.

1.4.1 General Plan (2008)

Delta lands are designated Intensive Agriculture, if irrigated, and Extensive Agriculture, if not irrigated. Irrigated land is 80 acre minimum parcel, or 40 acre minimum parcel for highly productive areas (orchard or vineyard). Unirrigated land is 160 acre minimum parcel size. The parcel sizes are based on the concept of “farmable unit”, defined as the size of parcels a farmer would consider leasing or purchasing for different agricultural purposes.

The General Plan calls for protection of wetlands and riparian vegetation that are critical habitats formation and retention of parcels of sufficient size to preserve valuable wetlands, and protection of these lands from impacts of development.

The General Plan emphasizes the preservation of agricultural resources, opportunities for value added agricultural activities, and agritourism, all to enhance agricultural economic viability.

1.4.2 City of Rio Vista

Within the current boundary of the Primary Zone, the April 1990 General Plan proposed uses included: airport, sewage treatment plant, heavy commercial/light industrial uses, and landfill. These uses would be directly adjacent to agricultural uses in the Primary Zone. In addition, the 1990 General plan proposed uses show a new State freeway outside the City’s sphere of influence and within the Primary Zone of the Delta.

1.5 Yolo County

About half of the Yolo County lands within the Primary Zone are in the Yolo Bypass, a flood basin which is part of the federal flood control project between Collinsville and Red Bluff. The Yolo Bypass is west of the Port of Sacramento Deep Water Ship Channel and bounded by a levee generally located along the Yolo County-Solano County boundary. The eastern portion of Yolo County includes the unincorporated community of Clarksburg, Merritt Island and agricultural lands in Reclamation districts 999 and 307.

1.5.1 2030 Countywide General Plan (2009).

The General Plan designates Delta lands as A-1, Agricultural General Zone, and A-P, Agricultural Preserve for lands in Williamson Act contracts. AG policies are very protective of agricultural uses. New residential, suburban, commercial and industrial uses are prohibited, unless directly related to, and incidental to agriculture. Residential uses in agricultural areas are limited to farm owners or employees, on lands unsuited for agricultural use, or clustered.

The General Plan includes an Agriculture and Economic Development Element in support of agriculture, the primary economic driver of Yolo County. The chapter identifies wine grapes as the largest single crop in the fruit and nut category and describes the 64,640-acre Clarksburg appellation with ten wineries and 11,000 acres of vineyards. The chapter describes the key elements supporting agriculture: soil, important farmlands, water, crops and agricultural infrastructure. The element supports compatibility with the Delta Plan (AG-6.1-4) and seeks to support and enhance the existing rural economy. The section on economic development emphasizes tourism and describes how services for tourists will also benefit local residents, and supports expansion of tourism "in a manner consistent with Yolo County's agricultural and open space emphasis".

1.5.2 Clarksburg General Plan.

A special plan has been prepared for the community of Clarksburg. The plan outlines areas for new residential growth, although the community has no community water or sewage disposal systems. No significant intensification of commercial and residential land use is proposed. The Plan includes an urban limit line.

1.5.3 Clarksburg Agricultural District

In 2008, a new 40,000 acre agricultural district was adopted for Clarksburg supporting wine grape growing, agricultural tourism, river and Delta related tourism, a historic mill site with boutique wineries, and creation of one wine appellation to include Clarksburg and Merritt Island Appellations. While this area is only 9% of the County's active farmland, it produces almost 22% of the total value of the County's top five crops. The County is considering an array of possible tools that could be applied within the district including new regulatory standards, marketing assistance, lowering fees, allowing additional on-site housing, and designating economic focus points. The overlay district supports agricultural business development and expansion including processing, commercial sales and agricultural tourism. The County is evaluating agricultural commercial and agricultural industrial sites in the Clarksburg area of about 100 acres.

2 Delta Protection Commission Land Use and Resource Management Plan:

In the 1980s, the State Lands Commission prepared a study of the Delta and its challenges. Subsequently the State Senate created a Delta Subcommittee to survey stakeholders and issue a report. Senator Patrick Johnston undertook a two year legislation drafting process that culminated in passage of the Delta Protection Act of 1992 (Act). The Act established the Delta Protection Commission (DPC), a State entity to plan for and guide the conservation and enhancement of the natural resources of the Delta, while sustaining agriculture and meeting increased recreational demand. The Act defines a Primary Zone, which comprises the principal jurisdiction of the Delta Protection Commission, the largely agricultural, water, and open space areas in the center of the Legal Delta. The Secondary Zone is the area outside the Primary Zone and within the "Legal Delta (Water Code Section 12220)"; the Secondary Zone is not within the planning area of the Delta Protection Commission.

The Act requires the DPC to prepare and adopt and thereafter review and maintain a comprehensive long-term Resource Management Plan for land uses within the Primary Zone of the Delta (Plan). The Plan is to set forth a description of the needs and goals for the Delta and a statement of the policies, standards, and elements of the Resource Management Plan. Within 180 days of the adoption of the Plan or any amendments by the Commission, all local governments shall submit proposed amendments to their general plans to the DPC. The amendments are to ensure that local government general plans are consistent with the Plan. The Plan applies to land uses, not to water supply or water quality, and generally addresses local government issues and actions, not those of State or federal agencies. After adoption of the Plan, local government actions could be appealed to the Delta Protection Commission for review of consistency with the Land Use Plan. The Delta Protection Commission has no authority over State or federal agency projects or programs.

The Primary Zone of the Delta includes approximately 500,000 acres of waterways, levees and farmed lands extending over portions of five counties: Solano, Yolo, Sacramento, San Joaquin and Contra Costa. The peat soil in the central Delta and the mineral soils in the higher elevations support a strong agricultural economy. The Delta lands currently have access to the 1,000 miles of rivers and sloughs throughout the region for irrigation water. These waterways provide habitats for many aquatic species and the uplands provide year-round and seasonal habitats for amphibians, reptiles, mammals, and birds, including several rare and endangered species. The area is extremely popular for many types of water and resource-related recreation including fishing, boating, hunting, wildlife viewing, water-skiing, swimming, hiking, and biking.

The goals of the Plan are to "protect, maintain, and where possible, enhance and restore the overall quality of the Delta environment, including but not limited to agriculture, wildlife habitats, and recreational activities; assure orderly, balanced conservation and development of Delta land resources and improve flood protection by structural and nonstructural means to ensure an increased level of public health and safety."

The Plan was drafted, reviewed, and adopted by the Commission on February 23, 1995. The policies of the Plan were adopted as regulations in December 2000. To ensure that the Plan remained current, the DPC established a Planning Advisory Committee (Committee) that began meeting in September 2008. The Committee, which represented a broad spectrum of Delta interests, met over several months and prepared draft revisions to the Plan in December 2008. The revisions were presented at public workshops throughout the Delta and to the Delta Protection Commission in March 2009. After holding multiple public hearings, the revisions to the Plan were adopted on February 26, 2010.

The Plan consists of three sections: Part I, the Introduction; Part II, elements; and Part III, program implementation. Each element includes an introductory discussion which provides the framework from which the goals and policies are derived. Policies are the directions for action the local governments must embrace and support through local General Plans. The elements address Land Use, Agriculture, Natural Resources, Recreation and Access [including Marine Patrol, Boater Education and Safety Programs], Water, Levees, and Utilities and Infrastructure.

Legislation passed in 2009 modified the membership of the Delta Protection Commission and added new tasks including preparation of a Delta Economic Sustainability Plan for submittal to the Delta Stewardship Council.

3 Delta Reform Act of 2009 and the Delta Stewardship Council Delta Plan

Since 1991 the Governor's office has directed State agencies to work together and with federal agencies to identify problems and possible solutions to Delta issues, largely focused on ensuring water supplies for export to the Central Valley, Southern California, and the Bay Area. Cabinet secretaries were convened as the Governor's Water Council, Club Fed provided coordination on Delta water issues, and CALFED was created by the Bay-Delta Accord, all resulting in the Record of Decision (ROD) adopted in 2000 outlining a plan of action for the Delta and its watershed. A new agency, the California Bay Delta Authority was created by the Legislature to implement the ROD, reorganize, and then move to within existing State agencies. A new planning process was authorized by the Governor in 2006 under the Delta Vision Blue Ribbon Task Force and in 2009 a suite of legislation, including the Sacrament-San Joaquin Delta Reform Act of 2009, was signed into law that modified the Delta Protection Commission, created the Delta Conservancy, and created the Delta Stewardship Council.

3.1 Sacramento-san Joaquin Delta Conservancy

The 2009 suite of legislation created the Conservancy to act as a primary state agency to implement ecosystem restoration in the Legal Delta and to support environmental protection and the economic well being of Delta residents. The Conservancy can also fund projects in the Suisun Marsh, west of the Legal Delta. Tasks assigned to the Conservancy include:

1. Protect and enhance habitat and habitat restoration.
2. Protect and preserve Delta agriculture and working landscapes.
3. Provide increased opportunities for tourism and recreation.
4. Promote Delta legacy communities and economic vitality in the Delta in coordination with the Delta Protection Commission.
5. Increase the resilience of the Delta to the effects of natural disasters such as floods and earthquakes, in coordination with the Delta Protection Commission.
6. Protect and improve water quality.
7. Assist the Delta regional economy through the operation of the Conservancy's program.
8. Identify priority projects and initiatives for which funding is needed.
9. Protect, conserve, and restore the region's physical, agricultural, cultural, historical, and living resources.
10. Assist local entities in the implementation of their habitat conservation plans and natural community conservation plans.
11. Facilitate protection and safe harbor agreements under the federal Endangered Species Act of 1973 and the California Endangered Species Act for adjacent land owners and local public agencies.
12. Promote environmental education.

The Conservancy is governed by a board consisting of 11 voting members and two non-voting members [state senate member and state assembly member], and ten Liaison Advisors representing local, state, and federal environmental and economic interests in the Delta. Members are appointed by each of the five Delta county boards of supervisors, by the governor, and by the California Senate and Assembly. The Liaison Advisors are appointed by their respective agencies or organizations.

The Conservancy adopted an interim strategic plan in January 2011, and will adopt a final strategic plan by January 2013.

3.2 Delta Reform Act of 2009

The Delta Reform Act of 2009 (SB X7 1, Steinberg) includes multiple actions and programs. The Act establishes the seven member Delta stewardship Council and directs completion of its Delta Plan by January 1, 2012.

In addition, the Council is to appoint an independent Science Board, engage the federal government, recommend Delta instream flow needs, and start Delta ecosystem restoration projects. The Act also requires improved reporting of water diversions and uses; imposes penalties for those violating water rights laws; improves monitoring and reporting to the State Water Board, authorizes the State Water Board to initiate statutory adjudications, requires appointment of a Delta Watermaster, and expands water rights fee authority.

The Act sets a statewide target of 20% reduction in urban per capita water use by 2020 and requires agricultural water supplies to prepare and adopt water management plans by 2012.

The Act creates a new Sacramento-San Joaquin Delta Conservancy for the Delta and the Suisun Marsh. In addition, the Act reconstituted the Delta Protection Commission and required preparation of a regional economic sustainability plan.

The Act moves the State toward a groundwater basin monitoring program by 2012. The Act requires the State Water board to develop new flow criteria for the Delta ecosystem to protect public trust resources, and to develop a schedule to complete instream flow studies for the Delta watershed by 2012 and for rivers and streams outside the Sacramento River watershed by 2018.

3.3 Delta Stewardship Council Delta Plan

The primary responsibility of the Delta Stewardship Council is to develop, adopt, and implement by January 1, 2012, a legally enforceable, comprehensive, long-term management plan for the Sacramento-San Joaquin Delta and the Suisun Marsh—the Delta Plan—that will achieve the coequal goals of “providing a more reliable water supply for California and protecting, restoring and enhancing the Delta ecosystem” and does this “in a manner that protects and enhances the unique cultural, recreational, natural resource and agricultural values of the Delta as an evolving place”.

The Stewardship Council is to achieve the following objectives:

> (a) Manage the Delta’s water and environmental resources and the water resources of the State over the long term.
>
> (b) Protect and enhance the unique cultural, recreational, and agricultural values of the Delta as an evolving place.
>
> (c) Restore the Delta ecosystem, including fisheries and wildlife, as the heart of a healthy estuary and wetland ecosystem.
>
> (d) Promote statewide water conservation, water use efficiency, and sustainable water use.
>
> (e) Improve water quality to protect human health and the environment consistent with achieving water quality objectives in the Delta.
>
> (f) Improve the water conveyance system and expand statewide water storage.

(g) Reduce risks to people, property, and State interests in the Delta by effective emergency preparedness, appropriate land uses, and investments in flood protection.

(h) Establish a new governance structure with the authority, responsibility, accountability, scientific support, and adequate and secure funding to achieve these objectives.

3.4 The 2012 Delta Plan (Delta Plan)

The Delta Plan is to be a long-term management plan and will be updated every five years. Some elements of the Delta Plan will have regulatory effects. Any plan, project, or program that meets certain criteria will be subject to regulations included in the Delta Plan, and the project proponents must certify consistency with the Delta Plan.

The Delta Plan will include a series of non-regulatory recommendations to be considered by other agencies, the Legislature, or the governor.

The Delta Plan will present a view of the diversity of the water supply system and its components, including demands for water and how water is currently used, together with the need for an improved Delta ecosystem. The planning time frame is year 2100, using monitoring and adjusting of decisions—"adaptive management"—informed by the best available science.

Additional components of the Delta Plan include emergency response plans for each of the Delta counties and for the State and federal water projects, the Delta Protection Commission's *Economic Sustainability Plan* for the Delta, and the Department of Parks and Recreation's *Delta Recreation Plan* (released May 2011). A proposed financing plan will also be included in the Delta Plan; legislative action will be required to implement a financing plan.

The Delta Plan will also includes regulatory policies and recommendations for actions that will contribute to enhanced water supply reliability, reduce reliance on the Delta, help restore the Delta ecosystem, reduce flood risk, and improve the collection of water use data and other information that will guide the next Delta Plan update.

For the current draft of the Delta Plan, see http://deltacouncil.ca.gov/

4 Bay Delta Conservation Plan

The Bay Delta Conservation Plan (BDCP) is a voluntary program and plan being prepared by a Steering Committee of local water agencies, environmental and conservation organizations, state and federal agencies, and other interest groups. The BDCP is being developed in compliance with the Federal Endangered Species Act (ESA) and the California Natural Communities Conservation Planning Act (NCCPA) and will, when complete, provide the basis for the issuance of endangered species permits for the operation of the state and federal water projects for the next 50 years.

The multi-stakeholder Habitat Conservation Plan/Natural Communities Conservation Plan process has been under way since 2006 and has the dual purpose of achieving greater reliability to the water supplies through an improved Delta export water conveyance system, and required recovery of threatened and endangered species in the Delta. The Bay Delta Conservation Plan is expected to be completed by 2012.

The over 1,100 page draft addresses impacts to eleven species of fish; six species of mammals; twelve species of birds; two species of reptiles; three species of amphibians; eight species of invertebrates and 21 species of plants. The draft is extensive and in-depth; for the aquatic species, the draft addresses multiple stressors including: habitat loss and modification, food

limitations, altered flows, passage impediments and barriers, water quality, entrainment, predators, illegal harvest, stranding, and dredging. To address the identified stressors will require creation of thousands of acres of aquatic habitat and possibly construction of multiple new intakes in the North Delta and movement of export water around the Delta to the conveyance canals.

The current draft is available on the BDCP web site:
http://baydeltaconservationplan.com/BDCPPlanningProcess/DocumentsAndDrafts.aspx

5 Conclusions

Water in California is extremely valuable to all factors of society and the environment, and a key element to agriculture, industry, and urban growth. Northern California is the source of the majority of the State's total water supply and has protested the continued projects and programs to export water to the San Joaquin Valley and Southern California cities. For almost 100 years, the process has continued with the current situation reflecting the current role of California's waterways as the conveyors of fresh and waste waters to and from agricultural and urban users, declines in native fisheries, rise in number and population of exotic aquatic species, and expenditure of millions of dollars to study, debate, and discuss the reasons why, the implications, and possible solutions to the identified conflicts and problems. Technological advances in treatment of wastewater, treatment of source water, modern irrigation technology, water recycling, water capture, replenishment of groundwater basins, enhanced use of computers and electronic monitoring, and other creative techniques have helped the State's population and economy grow despite limited and variable water sources.

Chapter 4: Flood Control and Public Safety

The history of the Delta levees is relatively well-known (Thompson, 1957; Mount and Twiss, 2005; DRMS, 2009; DSC Flood Risk White Paper; 2010; Zuckerman, 2011) and is not repeated in its entirety here. Some of the levees in the Delta are flood control project levees, built by the Federal government and turned over to the State for maintenance, but most of the Delta levees were built and are maintained by local reclamation districts. The State has also passed responsibility for maintenance of most of the project levees to the local reclamation districts.

THIS CHAPTER IS UNDER DEVELOPMENT

All the Delta levees that are currently being maintained are shown in Figure 7 and are listed in Table 1&2. For comparison a reconstruction of the historic Delta based on Atwater (1982) is shown in Figure 8. It may be seen from Figure 8 that the historic Delta contained no large expanses of open water, but instead was comprised of a dendritic system of channels and sloughs that traversed generally marshy terrain. Natural levees were created along the edges of major waterways that were overtopped only in high water events and supported riparian and even upland vegetation. When the modern Delta was created by diking and dredging in the late nineteenth century and very early twentieth centuries, some of the man-made levees were constructed over the natural levees, but many were not. Those waterways that were created by dredging clearly do not have bordering levees that were founded on natural levees. In many other cases the modern levees were not sited directly over the natural levees. Sketches developed by KSN illustrating the history of development of both the dredger cuts and other modern levees are shown as Figures 9 and 10

It is well known that many of the Delta islands have subsided since they were first diked so that most of the land surfaces within these islands are now below sea level. However, the rates of subsidence have decreased markedly in recent years. That issue is discussed subsequently in Section 1.3.2. Reasonably current land surface elevations interpreted from DWR's 2007 lidar surveys are shown in Figure x1. These elevations are referenced to mean sea level in 1929, some 5 inches below present day mean sea level. It may be seen that the mostly deeply subsided land is about 30 feet below sea level, but very little land is more than 20 feet below sea level. The subsidence has, of course, been restricted to the areas of the western and central Delta that are underlain by peat and there are extensive areas to the north and the south within the legal Delta that have not been impacted by subsidence.

Figure 7 Currently Maintained Levees in the Delta

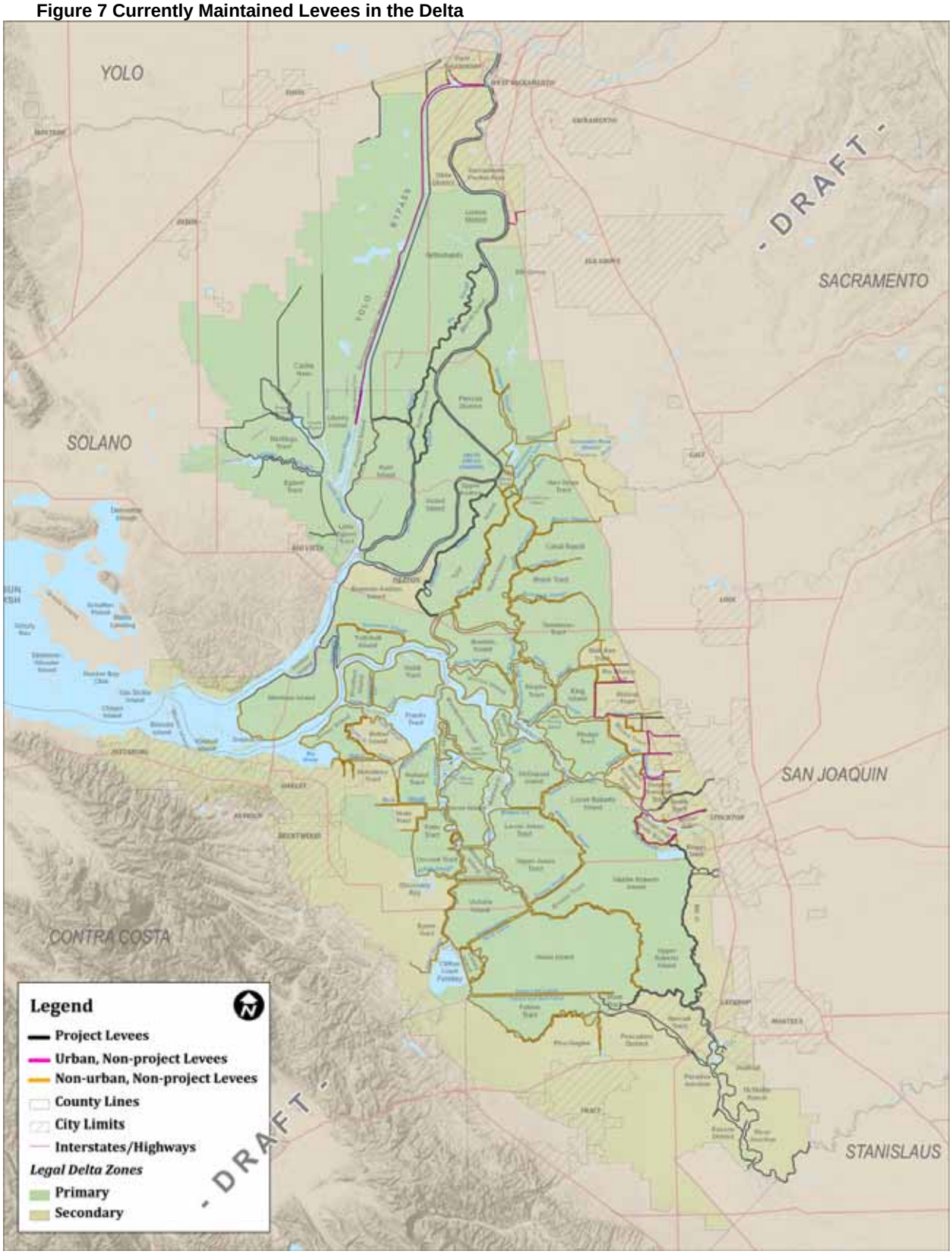
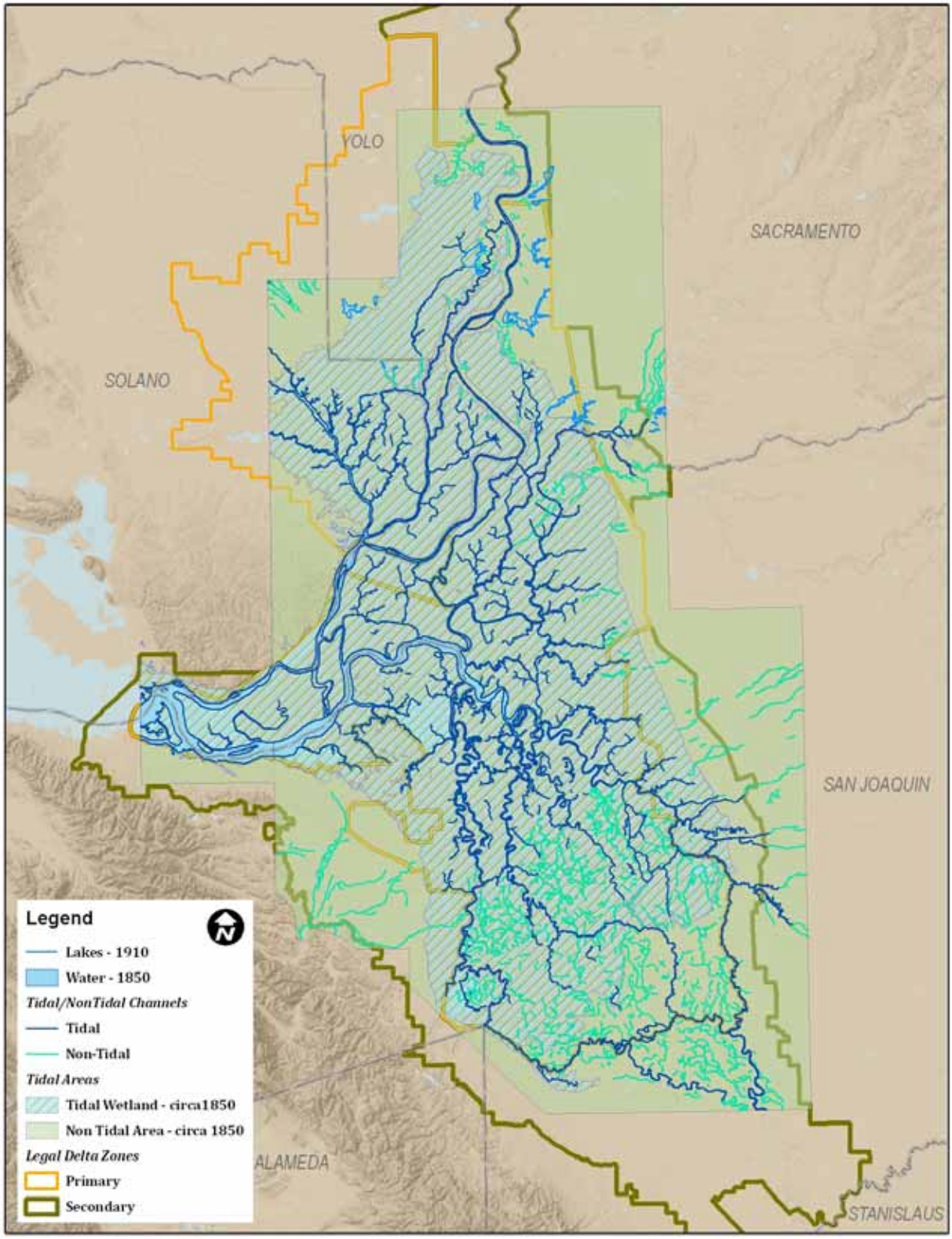


Figure 8 Historic Geography of the Delta based on Atwater (1982)



It should also be noted at the outset there is a significant disconnect between the popular impression that there are some 1,100 miles of Delta levees, all in poor condition, with the result that there is a high probability of widespread failures due to any or all of flooding, earthquakes or sea-level rise (ref. DWR Draft Framework, 2011: DSC Flood Risk White Paper, 2010) and the reality, which is that while some Delta levees need improvement, many miles of the Delta levees are in quite good condition. This reality can easily be checked by touring the Delta by boat. Even without survey measurements, it is evident that while the condition of the levees is variable, many levees appear to have adequate freeboard and, at least by casual inspection, appear to be quite robust. Casual inspection is, of course, inadequate to ensure that these levees are, and will remain, in good condition but there are existing programs to maintain and improve the levees and these can be further strengthened. These initiatives are discussed later in this chapter.

Only the levees within the legal Delta that are currently being maintained and are candidates for further improvement are shown in Figure 7. Levees such as those around Liberty Island and Prospect Island, which lie within the Yolo Bypass and the levees around the McCormack-Williamson Tract, which have always been height limited and are slated for removal, for example, are not shown. With the removal of levees that are not being maintained and dry-land levees, the total length of the Delta levees is just under1000 miles. If levees in the north and south Delta which are primarily flood control levees and are not critical to water quality or conveyance are excluded, the total length falls to less than 700 miles. The division of these levees into project, non-project urban and other non-project levees and their significance is explained subsequently.

This chapter is divided into three sections. The first section categorizes the different types of Delta levees, sums up the number of miles of levee in each category, and makes a qualitative assessment of their present condition. The second section addresses the three broad options that are available to reduce the risk of damage resulting from levee breaches, where risk is loosely defined as the product of the probability of a failure and the consequences of that failure. In an ideal world, an economic analysis of these alternatives would lead to optimizing the appropriate investments, but that is difficult or impossible, as discussed subsequently, and is, in any case, beyond the scope of the present study. The third section addresses in more detail the costs of pursuing those strategies.

Figure 9 Modern Levees

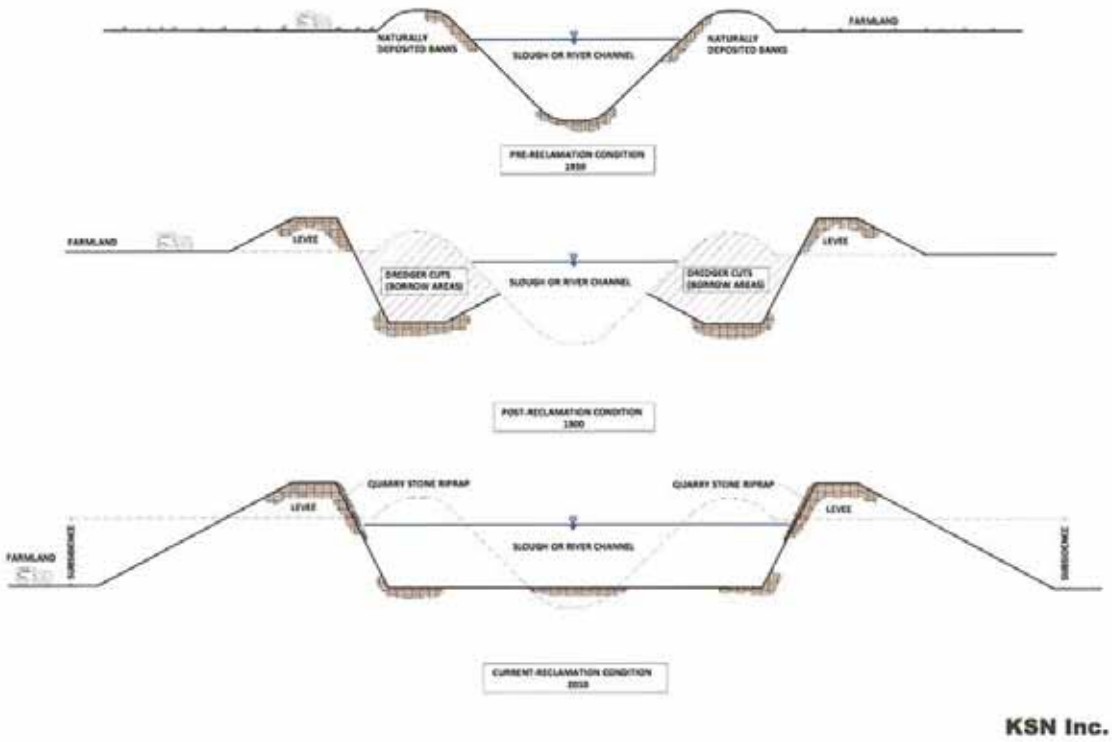


Figure 10 Historic Dredger Cut Levees

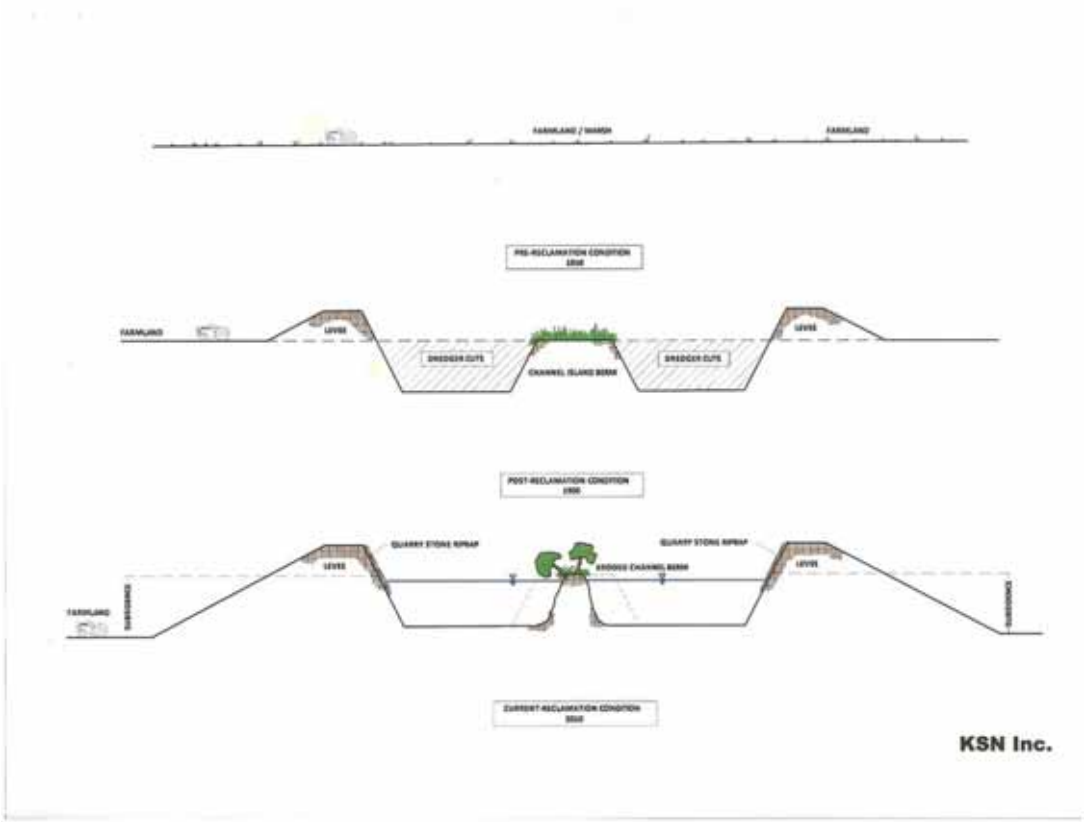


Table 1 Delta Levees (Part 1 of 2)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
District	**Reclamation**	**This Study based on DWR DFM**						**Core Levees**	
Number	**District**	**Project**	**NP-NU**	**Urban NP**	**Total**	**NP-NU PL-84-99**	**Total**	**Project**	**NP-NU**
556	Andrus Island	11.2	0.0	0.0	11.2		11.2	11.2	0.0
2126	Atlas Tract	0.0	2.3	0.0	2.3				
2028	Bacon Island	0.0	14.3	0.0	14.3		14.3	0.0	14.3
	Bear Creek	3.3	0.0	0.0	3.3				
	Bethel Island	0.0	11.5	0.0	11.5		11.5	0.0	11.5
2042	Bishop Tract	0.0	1.6	6.5	8.1				
404	Boggs Tract	4.0	0.6	0.6	5.1				
756	Bouldin Island	0.0	18.0	0.0	18.0		18.0	0.0	18.0
2033	Brack Tract	0.0	10.9	0.0	10.9		10.9	0.0	10.9
2059	Bradford Island	0.0	7.4	0.0	7.4		7.4	0.0	7.4
317/407	Brannan-Andrus	17.5	10.1	0.0	27.6		27.6	17.5	10.1
800	Byron Tract	0.0	9.5	0.0	9.5	9.5	9.5	0.0	9.5
2098	Cache Haas	10.9	0.0	0.0	10.9				
2086	Canal Ranch	0.0	7.5	0.0	7.5		7.5	0.0	7.5
2117	Coney Island	0.0	5.5	0.0	5.5		5.5	0.0	5.5
2111	Dead Horse Is.	0.0	2.6	0.0	2.6		2.6	0.0	2.6
2137	Dutch Slough	0.0	4.1	0.0	4.1				
536	Egbert Tract	10.6	0.0	0.0	10.6				
813	Ehrheart	1.8	3.9	0.0	5.6				
2029	Empire Tract	0.0	10.5	0.0	10.5		10.5	0.0	10.5
773	Fabian Tract	0.0	18.8	0.0	18.8	18.8	18.8	0.0	18.8
2113	Fay Island	0.0	1.6	0.0	1.6				
1002	Glanville Tract	0.0	8.1	0.0	8.1				
765	Glide	1.7	0.0	0.0	1.7				
3	Grand Island	28.7	0.0	0.0	28.7		28.7	28.7	0.0
2060	Hastings Tract	15.6	0.0	0.0	15.6				
999	Holland Land	32.2	1.0	0.0	33.2		33.2	32.2	1.0
2025	Holland Tract	0.0	11.0	0.0	11.0		11.0	0.0	11.0
799	Hotchkiss Tract	0.0	6.7	0.0	6.7				
830	Jersey Island	0.0	15.5	0.0	15.5		15.5	0.0	15.5
2038/2039	Jones Tract	0.0	18.4	0.0	18.4	18.4	18.4	0.0	18.4
2085	Kasson	6.3	0.0	0.0	6.3				
2044	King Island	0.0	9.1	0.0	9.1	9.0	9.1	0.0	9.1
369	Libby McNeil	1.0	3.0	0.0	4.0		4.0	1.0	3.0
1608	Lincoln Village	0.0	0.6	3.3	3.9	0.6			
307	Lisbon	6.6	0.0	0.0	6.6				
	Maint Area 9	12.6	0.0	1.5	14.1				
2027	Mandeville Island	0.0	14.3	0.0	14.3		14.3	0.0	14.3
2030	McDonald Island	0.0	13.7	0.0	13.7	13.7	13.7	0.0	13.7
2075	McMullin	7.4	0.0	0.0	7.4				
2041	Medford Island	0.0	5.9	0.0	5.9		5.9	0.0	5.9
150	Merritt Island	17.7	0.0	0.0	17.7		17.7	17.7	0.0
2107	Mossdale 2	4.3	0.0	0.0	4.3				
17	Mossdale Tract	15.8	0.0	0.0	15.8				
1007	Naglee Burke Tract	0.0	9.5	0.0	9.5				
348	New Hope Tract	0.0	17.4	0.0	17.4		17.4	0.0	17.4
2064	Palm-Orwood Tract	0.0	14.4	0.0	14.4		16.5	0.0	16.5
2095	Paradise	4.9	0.0	0.0	4.9				
Sub-Total Table 1		**213.9**	**289.1**	**11.9**	**514.9**	**70.0**	**360.7**	**108.4**	**252.3**

Table 2 Delta Levees (Part 2 of 2)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
District	**Reclamation**	**This Study based on DWR DFM**						**Core Levees**	
Number	**District**	**Project**	**NP-NU**	**Urban NP**	**Total**	**-NU PL-84-**	**Total**	**Project**	**NP-NU**
2058	Pesadero Tract	6.6	2.4	0.0	9.0				
2104	Peters	6.8	0.0	0.0	6.8				
551	Pierson District	6.8	7.3	0.0	14.1	7.3	14.1	6.8	7.3
2090	Quimby Island	0.0	7.0	0.0	7.0		7.0	0.0	7.0
755	Randall	1.8	0.0	0.0	1.8				
2037	Rindge Tract	0.0	15.8	0.0	15.8		15.8	0.0	15.8
2114	Rio Blanco Tract	0.0	3.6	2.7	6.3				
2064	River Junction	9.7	0.0	0.0	9.7				
524/544/	Roberts Island	16.4	34.1	0.0	50.5		50.5	16.4	34.1
	Rough/Ready Island	0.0	0.0	5.5	5.5				
501	Ryer Island	20.2	0.0	0.0	20.2		20.3	20.3	0.0
2074	Sargent Barnhart	1.8	2.5	2.9	7.2	2.5			
341	Sherman Island	9.6	9.8	0.0	19.4		19.6	9.6	9.8
2115	Shima Tract	0.0	7.3	7.0	14.3				
	Shin Kee Tract	0.0	3.1	0.0	3.1				
1614	Smith Tract	5.9	1.0	3.4	10.3	1.0			
2089	Stark	2.8	0.9	0.0	3.7	0.9	3.7	2.8	0.9
38	Staten Island	0.0	25.4	0.0	25.4		25.4	0.0	25.4
2062	Stew art Tract	12.2	0.0	0.0	12.2				
349	Sutter Island	12.4	0.0	0.0	12.4		12.4	12.4	0.0
548	Terminous Tract	0.0	23.1	0.0	23.1		23.1	0.0	23.1
1601	Tw itchell Island	2.5	9.3	0.0	11.8		11.9	2.5	9.4
563	Tyler Island	12.1	11.5	0.0	23.6		23.7	12.1	11.6
1	Union Island	1.1	28.8	0.0	29.9	28.1	29.9	1.1	28.8
2065	Veale Tract	0.0	5.6	0.0	5.6				
2023	Venice Island	0.0	12.4	0.0	12.4		12.4	0.0	12.4
2040	Victoria Island	0.0	15.1	0.0	15.1		15.1	0.0	15.1
554	Walnut Grove	0.9	2.9	0.0	3.8		3.2	0.9	2.9
2094	Walthall	3.2	0.0	0.0	3.2				
2026	Webb Tract	0.0	12.9	0.0	12.9		12.9	0.0	12.9
828	Weber	0.0	0.6	1.7	2.3	0.6			
900	West Sacramento	15.0	1.6	28.5	45.1	1.6			
2096	Wetherbee	0.2	0.0	0.0	0.2				
2072	Woodw ard Island	0.0	8.9	0.0	8.9		8.9	0.0	8.9
2119	Wright-Elmw ood Tract	0.0	7.1	0.0	7.1				
2068	Yolano	8.8	0.0	0.0	8.8				
	Yolo Bypass Unit 4	4.2	0.0	0.0	4.2				
744	Rec District	3.9	0.0	0.0	3.9				
673	Rec District	0.2	0.0	0.0	0.2				
2137	Dutch Slough	0.0	4.1	0.0	4.1				
Sub-Total Table 2		**165.0**	**264.3**	**51.7**	**481.0**	**42.0**	**309.8**	**84.9**	**225.4**
Sub-Total Table 1		**213.9**	**289.1**	**11.9**	**514.9**	**70.0**	**360.7**	**108.4**	**252.3**
GRAND TOTAL		***378.9***	***553.4***	***63.6***	***996.0***	***112.0***	***670.5***	***193.2***	***477.2***

1 Status of Delta Levees

The various categories of and standards for Delta levees have also been described elsewhere (Betchart, 2008; Flood Risk White Paper, DSC, 2010) but they are restated here for completeness.

1.1 Categories of Levees

Project Levees

Project levees are levees that were constructed by the US Army Corps of Engineers (USACE) as part of Federal-State flood control projects and were turned over to the State for operations and maintenance. The State has in turn generally passed on the responsibility for routine maintenance to local reclamation districts, although the Paterno decision confirmed the State's continued basic liability with respect to these levees. Delineation of project levees and the names of the local maintenance agencies are provided in the State Plan of Flood Control Descriptive Document (2010). Project levees within the Delta are also shown in Figure 7. These levees were built to standards that generally exceed the PL 84-99 criteria described below.

Urban Levees and Associated Studies

Recognizing the need for higher levels of flood protection, the major urban areas in the Sacramento – San Joaquin Valley have each formed a Joint Powers Authority (JPA) for the purpose of implementing levee improvements, in part using funds from the DWR Early Implementation Program. Three of these JPAs overlap the legal Delta – West Sacramento Area Flood Control Agency (WSAFCA), Sacramento Area Flood Control Agency (SAFCA), and San Joaquin Area Flood Control Agency (SJAFCA).

Prompted by the Paterno Decision and SB 5, DWR is undertaking a major investigation of both riverine and Delta levees that is divided into two components, the Urban Levee Evaluations (ULE), and the Non-Urban Levee Evaluations (NULE) (Inamine et al, 2010). These evaluations include detailed site investigations and some analyses and are intended to inform the CVFPP as to the likely level of effort that will be required for final design and the construction of improvements. Those levees within the legal Delta that are included in ULE and NULE are shown in Figure x2, superimposed on the mapping of project and non-project levees. Some of these DWR designated urban levees are project levees and some are not. Because there are special requirements for urban levees, as well as special sources of funding for improvements, the non-project urban levees are also identified in Figure 7.

Other Special Levees

The Eight Western Islands

The eight western islands and tracts have been identified by the State as being critical to water quality in the Delta as they provide a buffer against salt water intrusion and their importance will only grow if sea level rises at a faster rate. These islands are identified in Figure x3

Levees with Public Roads

The islands that are surrounded by levees that support public roads are shown in Figure x4.

Levees that Protect Major Highways
The islands that include major highways that are protected by levees are shown in Figure x5.

Levees that Protect the BNSF Railroad
The islands crossed by the BNSF railroad are shown in Figure x6. Although BNSF does not contribute to the maintenance of the levees that protect the railroad, they are reportedly suing the State for losses sustained in the 2004 flooding of Upper Jones Tract.

Levees that Protect Water Supply pumping Plants and Pipelines
The islands that house water supply pumping plants and pipelines are shown in Figure x7. These include the Mokelume Aqueduct of East Bay Municipal Utility District (EBMUD), the Contra Costa Water District pumping plants and pipelines, the Solano County Water Agency Barker Slough intake, the new City of Stockton intake and pipeline, and the Banks and Jones pumping plants of the SWP and the CVP. EBMUD makes annual contributions to the reclamation districts that protect the Mokelume Aqueduct and was instrumental in $35m of bond monies being earmarked for the improvement of levees that protect the aqueduct.

Levees Bordering the Deep-water Ship Channels
Although the deep-water ship channels to the Ports of Stockton and West Sacramento generally have negative effects on the Delta ecosystem, they do make several important contributions. They help reduce truck traffic through and around the Delta and improve air quality, as well as being local economic drivers for West Sacramento and Stockton. The islands that form the borders of the deep-water ship channels are shown in Figure x8

Levees Bordering the Principal Paths for Through-Delta Water Conveyance
Starting at the Delta Cross Canal, just north of Walnut Grove, there are two principal paths for the conveyance of water from the Sacramento River to the export pumps in the south Delta – one basically follows the north fork of the Mokelume River and then the Old River, and the other follows the South Fork of the Mokelume and then Middle River. As presently planned, there would continue to be some through Delta conveyance even after the completion of the new north Delta intakes envisioned by the Bay Delta Conservation Plan (BDCP) and in any case new conveyance facilities will not be completed for many years, if ever, so that maintenance of these conveyance paths is important and the water exporters and DWR have undertaken various studies to protect them and/or restore them as quickly as possible following any disruption. The islands adjacent to these paths are shown in Figure x9.

Levees Protecting Natural Gas Production and Storage Facilities and Pipelines
The islands housing natural gas production and storage facilities and pipelines are shown in Figure x10. The facility of most significance is the PG&E storage facility on McDonald Island. PG&E contributes something like 90 percent of the funds to the local reclamation district and has been committed to maintaining superior levees around the island since the failure that occurred in 1982.

Levees Protecting Electric Power Transmission Lines and Substations
The islands that are crossed by electric power transmission lines or house major substations are shown in Figure x11. Of perhaps equal importance these days are fiber-optic communication cables but their locations are proprietary and they are not shown.

Levees that Protect Sewage Treatment Plants
Island containing sewage treatment plants are shown in Figure x12.

Levees that Protect Legacy Communities
The islands that contain legacy communities are shown in Figure x13. Flood protection for legacy communities in the Delta involves several special considerations. The legacy communities are primarily, but not exclusively, protected by project levees that exceed the PL 84-99 geometric standard. However, all these towns have either been or are in the process of being remapped into the 100-year floodplain by FEMA. Having a levee system certified is not based on meeting the PL 84-99 levee standard, but instead is based on meeting the requirements of Section 65.10 of the National Flood Insurance Program (NFIP). These regulations must be met in order to be mapped outside the floodplain and include a multiple criteria which require a level of engineering analysis that far exceeds typical reclamation district budgets. Thus it appears that flood insurance costs in the legacy communities will rise dramatically and this will discourage growth and investment in the legacy communities unless special measures are taken.

Levees that Protect Conservation Easements
On many Delta islands there are conservation easements which protect habitat considered to be of value to wildlife. Islands containing such conservation easements are shown in Figure x14

Summary

As may be seen in Table 1&2, a total of just under 1000 miles of levees are currently being maintained within the legal Delta. But of these 443 miles are either project or urban levees and if these levees are subtracted from the total of 996 miles, there are only 553 miles that need to be maintained and perhaps improved by the State and the Reclamation Districts.

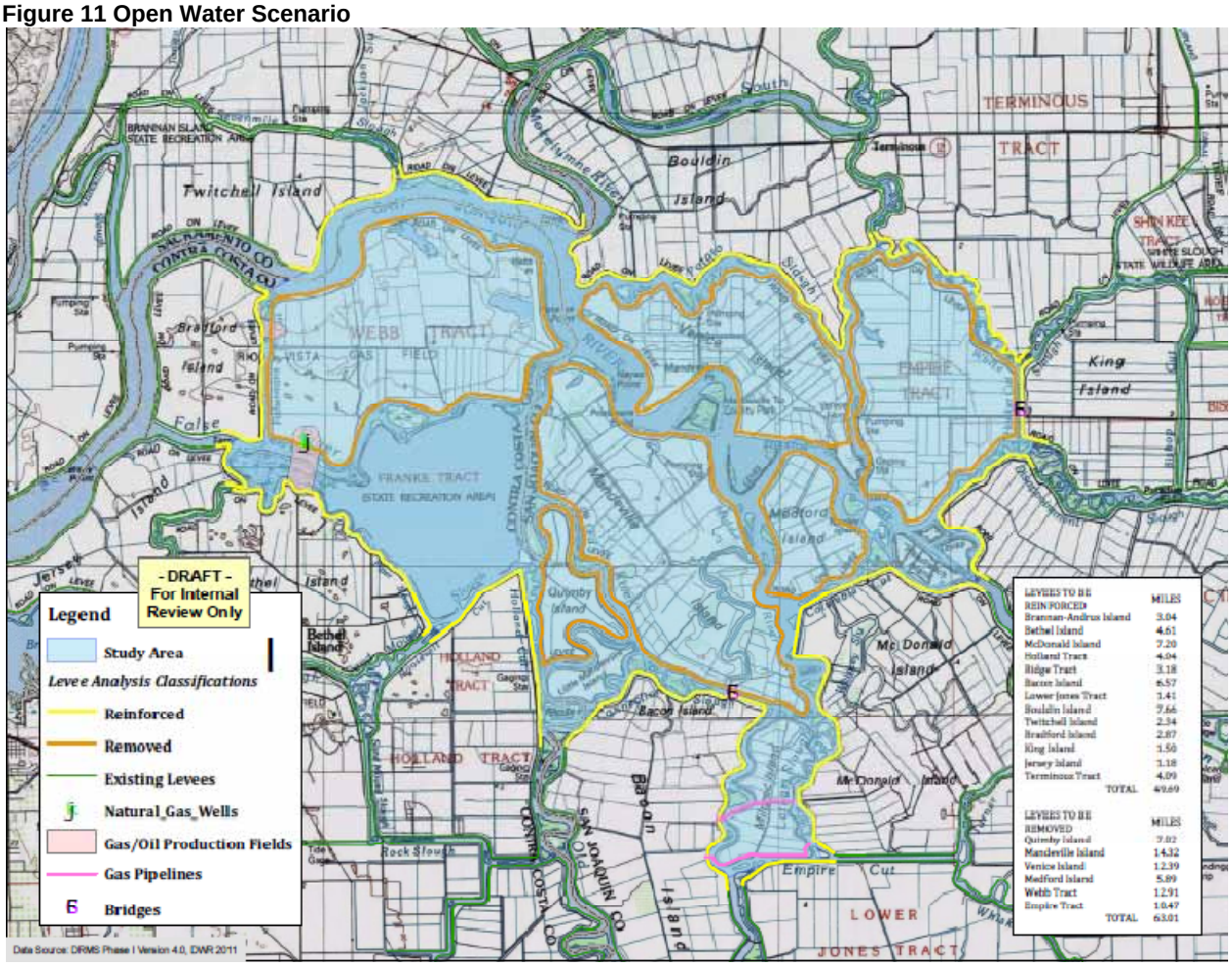
Further, if urban areas and levees that are primarily flood control levees in the north and south Delta are excluded from the total count, there are only 670 miles of levees in what might be called the core of the Delta. Of these 193 miles are project levees leaving only 477 miles that need to be maintained and perhaps improved by the State and the Reclamation Districts. Of this sub-set, well over 100 miles already exceed the PL 84-99 standard that is discussed below, leaving some 370 miles in need of improvement to the PL 84-99 standard. As discussed subsequently, much of the funding needed for these improvements is already in the pipeline so that within several years it will be possible to assert that most Delta levees are in relatively good shape, in contrast to the frequent assertion that there are 1100 plus miles of Delta levees that are in poor condition and on the verge of failure. This is not so say that the project and urban

levees do not have issues. They do, with respect to encroachments penetrations and vegetation amongst other things, however there are different mechanisms for dealing with these issues and the project and urban levees are fundamentally flood control levees rather than levees that are key to protecting water quality and the conveyance of water through the Delta and protecting and enhancing the Delta as a place.

All of the islands shown in Figures x3 to x14 which have levees protecting infrastructure or critical facilities of one form or another, are superimposed in Figure x15. An alternate view of the importance of the Delta levees to protecting valuable infrastructure is provided by plotting the major infrastructure identified by the Delta Risk Management Strategy (DRMS) study, as shown in Figure x16. It may be seen that the Delta is literally criss-crossed by major infrastructure critical to the economy of Northern California. The replacement cost of this infrastructure is not known with any precision, but DRMS estimated that the asset value of the infrastructure within the MHHW line was over $6b in 2005 dollars, and over $3b excluding residential and commercial real estate. If Delta levees are not maintained, then the cost of relocating this infrastructure around the Delta would be very substantially greater.

The only islands that have been relatively free of major infrastructure are Webb, Venice, Empire, Medford, Mandeville and Quimby, although the City of Stockton is close to completing major water supply facilities on Empire Tract. As discussed elsewhere, Suddeth et al. (2010) and Mount (2011) have proposed that consideration be given to converting these islands to open water. The merits and economics of that proposal are discussed further in Chapter 5 but these six islands and the levees that would surround the resulting inland sea are shown in Figure 11. The total length of the levees around the six islands is 63 miles and the total length of the surrounding levees that would have to be improved to a higher standard to deal with higher wave heights and seepage is approximately 50 miles. If Webb Tract, which is one of the eight western islands called out for its importance to protecting against salinity intrusion is omitted from the list, the length of the levees removed would drop to 50 miles. But, the length of levees that would need to be improved would still remain at approximately 50 miles.

Figure 11 Open Water Scenario



1.2 Levee Standards

A detailed discussion of the various standards that might apply to Delta levees was given by Betchart (2008). For our purposes this can be simplified to the following five.

Hazard Mitigation Plan (HMP)

The Hazard Mitigation Plan or HMP standard is a simple geometric levee standard that was devised by FEMA in order to establish minimum requirements for federal disaster relief. It provides for a 16-foot crown width, a 1-foot freeboard above the 100-year water surface elevation, minimum 1.5 to 1 waterside slopes, and minimum 2 to 1 landslides slopes. Most existing Delta levees generally meet this standard, but because Delta levees built of or over peat are subject to on-going settlement, there is continuing argument over how literally this standard should be interpreted. The current regulatory position is stated in an MOU signed in February 2010 between Cal EMA and FEMA as discussed by Betchart (2011). However, notwithstanding its importance to disaster-relief funding, Delta engineers do not consider the HMP standard to be adequate and the reclamation districts are generally working towards full compliance with the higher PI 84-99 standard. While there are some miles of levees that pending further improvement waver around the HMP standard, there are only about 50 miles

that fall below HMP at present and even those levees fall short only by about a foot of elevation. While levee standards are generally thought of in engineering terms and vegetation on levees is discouraged, the treatment of levee vegetation is critical in the Delta (and elsewhere in California) where preservation or restoration of riparian habitat is an important goal. Vegetation management guidelines for local, non-project Delta levees that were adopted in 1994 require that the crown and the landside slope and a ten-foot strip along the landside toe must be cleared of visually obstructive vegetation except that mature trees may be retained. All vegetation except for grasses must be removed from the top five feet of the waterside slope. The guidelines suggest that naturally growing vegetation below the cleared area should be pruned or removed only to the extent necessary to insure levee safety and inspectability.

Public Law (PL) 84-99

Among other items, Public Law 84-99 allows the Corps of Engineers to rehabilitate flood protection systems during a disaster. In order to qualify, the flood system must have already been enrolled into the Corps' Rehabilitation and Inspection Program. In 1987, the Sacramento District of USACE established Delta-specific standards for levees to qualify for rehabilitation under PL 84-99. This standard adds a stability requirement to what is otherwise principally a geometric standard. It provides for a crown width of 16 feet, freeboard of 1.5 feet over the 100-year water surface elevation, a minimum waterside slope of 2 to 1, and landside slopes that vary as a function of the depth of peat and the height of the levee such that the static factor of safety on slope stability is not less than 1.25. Very approximately, the landslide slope can be 2 to 1 for levee heights no greater than 5 feet, can be 3 to 1 for levee heights no greater than 10 feet, can be 4 to 1 for levee heights no greater than 20 feet, and has to be 5 to 1 for levee heights in the order of 25 feet or greater. Alternately, the minimum factor of safety can be achieved by construction of a landside toe berm. While this standard does not explicitly address earthquake loadings, the flatter slopes and/or landslide berms that are required for levees built over peat means that they are fundamentally less likely to suffer major distress as a result of earthquake loadings. They may deform but they are unlikely to fail. This results in the perhaps odd situation that levees in the western and central Delta, which overlie peat, have wider cross-sections and are likely to be less susceptible to damage in earthquakes than levees in the north and south Delta which overlie more sandy soils, even those levees also tend to be composed of more sandy soils and thus might be expected to be more susceptible to liquefaction, if saturated. While the Delta-specific PL 84-99 standard includes no specific guidelines on vegetation, it is assumed that the Corps national standards on levee vegetation, which basically ban all significant vegetation on both land and watersides, apply unless a specific variance from those standards is obtained. This question is currently the subject of a significant debate between the State of California and USACE with the State arguing for the positive engineering and environmental benefits of vegetation on the waterside slopes of levees. The State's position is indicated by the proposed provisions for urban levees which are noted below.

Sacramento District (SPK)

While not directly applicable to Delta levees, the Geotechnical Levee Practice of the Sacramento District of USACE (designated SPK) has some relevance because it informs both the Urban and Non-Urban Levee Evaluation programs and the DWR Urban Levee Design

Criteria that are presently being developed. This Practice calls for a minimum crown width of 20 feet for main line levees and minimum water and land side slopes of 3 to 1. Existing levees, with landside slopes as steep as 2 to 1, may be retained in rehabilitation projects if their historic performance has been satisfactory. This move to 3 to 1 slopes is driven by maintenance issues as much as slope stability and seepage issues. The Practice also suggests minimum requirements for geotechnical investigations and analyses. Although the Practice describes recommended standard practice, it also makes it clear that the responsible engineers should use appropriate judgment as a function of site specific conditions and experience and unfortunately this aspect of the Practice is commonly overlooked.

Urban Levee Design Criteria (ULDC)

DWR was directed by SB 5 to develop appropriate standards for "urban levees" and version 4 of the Interim Levee Design Criteria for Urban and Urbanizing Areas in the Sacramento – San Joaquin Valley was published in December 2010. These criteria are now being finalized as the Urban Levee Design Criteria which will eventually become a State regulation. The ULDC is generally consistent with the SPK Practice and has the same geometric requirements. However, the ULDC goes much further in defining required practice in a number of other areas including seismic loadings, encroachments, penetrations and vegetation. With regard to vegetation the draft ULDC language generally prohibits vegetation in accordance with the USACE national policy but allows woody vegetation on portions of the waterside slope and riverbank or berm for a newly constructed levee if a specially designed waterside planting berm is added or the levee section is otherwise widened. In the case of the repair or improvement of existing levees, the draft ULDC language allows tress and other vegetation to be preserved over the long term if they provide important or critical habitat or erosion protection, soil reinforcement or sediment recruitment. In order to mitigate possible adverse effects of roots, where feasible the overall width of the levee should be widened landward by at least 15 feet or an effective root or seepage barrier shall be installed within the upper 10-15 feet below the levee crown. For other levees with pre-existing vegetation the UDLC requires inspection and thinning in accordance with the Central Valley Flood System Improvement Framework. It is suggested that these provisions are generally applicable to Delta levees.

Proposed Delta Levees Standard

With the exception of the ULDC, which addresses design and/or quick repair of levees for 200-year return period earthquakes, none of the above standards explicitly address seismically-resistant design, or design for greater than 100-year water surface elevations and possible sea level rise. The 1983 Delta Levees Investigation (see below) did suggest that Delta levees should be designed for 300-year water surface elevations but that suggestion apparently went nowhere. Although updated estimates of water surface elevations from the Central Valley Flood Protection Plan are still pending, it is commonly believed that water surface elevations in much of the Delta are strongly influenced by tides and that 300 or even 500-year water surface elevations are only a foot or two higher than 100-year elevations. Pyke (2011) has in fact suggested that an appropriate standard for the design of Delta levees might be to design for 500-year flood and earthquake loadings. Contrary to some previous opinions, we believe that the marginal cost of designing to such a standard over the cost of complying with the Delta-

specific PL 84-99 standard is quite small. Indeed, levees in the western and central Delta which overlie peat and meet the Delta-specific PL 84-99 standard, might already meet this higher standard. As an example, the cross-section of a proposed seismically resistant levee taken from a report by Hultgren-Tillis Engineers (HTE) for Reclamation District 2026 (Webb Tract) is shown in Figure x17. Even when assuming that some liquefaction might occur both in the embankment and the foundation, this study indicates that deformations would be limited by the addition of a landslide buttress, as shown in the figure. This design was estimated to cost approximately $2m per mile in 2009. Because Webb Tract is being considered for use as a water storage facility by Delta Wetlands, HTE also looked at more elaborate designs which included either or both of a slurry trench wall or an internal drain but those designs added no more than $5m per mile to the incremental cost. By comparison, Suddeth et al. (2008) cited a cost of $45m per mile from the DRMS Preliminary Strategies Report.

A key feature of the design shown in Figure x17 is the wide crest. Some reclamation districts are already planning for or are constructing improved levees with a 22-foot crown width, adequate for a 2-lane sealed road. Wider crests not only provide a more robust levee but also allow for more efficient emergency response. Levees with wider crests are also the most economical way to provide for possible sea-level rise. While it is the policy of the State to plan for 55 inches of sea-level rise by the year 2100, the probability of that magnitude of sea-level rise is actually very small, in the order of 1 in 10,000 to 1 in 100,000. Therefore, it makes no sense to construct levees today to those elevations, but the provision of a wider crest today is in effect a triple play; providing a more robust levee immediately, allowing more room for flood-fighting or emergency response following earthquakes, and allowing a choice of methods for raising the crest elevation in the event of actual sea-level rise. Well, really a quadruple play, since it also allows for retaining or planting vegetation on the waterside of the levee.

1.3 Clarification of Some Basic Issues with Regard to Delta Levees

1.3.1 Variability

Because of their location in the Delta and their history of construction, Delta levees have rather variable foundation conditions and composition. This makes it difficult and expensive to conduct detailed geotechnical engineering investigations and analyses. Although the DRMS report refers to a large number of soil borings that have been conducted, most of these are older borings that have little value with respect to engineering properties because insufficient testing was carried out. However, the lack of hard engineering data on the composition and properties of the levees is not as critical as one might think because the levee system has in fact been proof loaded for 100 years or more. Use of what is called the “observational method” is a well-recognized procedure in geotechnical engineering that is particularly applicable when the engineer is faced with uncertain foundation condition and variable material properties. In this case the record shows that although there were many levee failures in earlier years, the majority of those resulted from overtopping. Improved flood management, in addition to other improvements in the levees, has significant reduced the rate of failure. Thus, today’s levees, which retain water 24 hours a day, are demonstrably able to withstand normal tidal and typical

flood loadings regardless of their variability. There is seepage through these levees, but that is acceptable as long as the seepage is controlled. Another basic principle in geotechnical engineering is that you don't need to stop all seepage, you just need to control the seepage.

One of the variables associated with Delta levees is the depth of peat. The depth of peat under the levees is not necessarily the same as the depth of peat that remains in the center of the islands. This second number is now much lower as a result of loss of peat due to oxidation and erosion. However, the loss of peat under the levees themselves has been limited. Figure x18 shows peat thicknesses in the vicinity of the levee toe that were estimated by DRMS in 2005.

Although one should be wary of talking about a typical Delta levee section, the cross section of the existing levee shown in Figure x17 is likely typical of many levees in the western and central Delta where the man-made levees are not constructed over natural levees and the height of the levee as seen from the land side is the result of subsidence of the land surface rather than the building up of the levees. As can be seen in this cross section, the bulk of the levee is actually composed of peat rather than fill. That is both good and bad. As discussed below it is good because peat is not susceptible to liquefaction and might be expected to perform well in earthquakes, howeve,r peat is relatively weak and very compressible so that placement of any additional fill must be handled very carefully. The other two kinds of levee section that might be referred to as typical apply to those levees built on top of natural levees, as shown in Mount and Twiss (2005), and those levees in the north and south Delta that generally consist of more sandy materials constructed on sandy foundations. The depositional history and geology of the sands that underlie the Delta has been studied in detail by Shlemon and Begg (1972) and Atwater (1982). While they are variable in origin, as discussed in Section 1.3.3 below, these sands generally provide a good foundation for any structures that they support and the common suggestion that Delta levees are founded on poor materials or "quicksand" is less than accurate.

1.3.2 Vulnerability to tides and floods

Obviously the Delta levees have some vulnerability to more extreme tides and floods and particularly adverse combinations of these two loadings. However, it should be noted that there were no significant Delta levee failures in the 1997 flood, said to be a 100-year or greater flood. That, of course, was partly due to widespread failure of levees upstream from Stockton which reduced the maximum water surface elevations in the Delta. But, this type of relief should also be component of a planned flood management system so that there is a limit to the hazard posed not only to Delta levees, but to the levees protecting Sacramento and Stockton, as well. High water elevations resulting from tides and floods can also be seen days or weeks in advance so that appropriate emergency measures can be taken. The probabilities of failure due to overtopping that are calculated in DRMS appear to be inconsistent with these realities.

1.3.3 Impacts of subsidence and sea level rise

Land subsidence in the Delta is real but its continuing significance is often overstated. The historic subsidence due to oxidation and erosion of the peat has been well documented by

Mount and Twiss (2005). As noted by Mount and Twiss, the post 1950 subsidence rates were reduced by 20 to 40 percent from early rates as a result of better farming practices. But, although they recognized that subsidence rates will slow further due to depletion of organic material and the continuation of better land use practices, they still used the upper bound of this range in making projections going forward to 2050. Interpretation of the 2007 DWR lidar data by MBK Engineers, as reported in comments to the Delta Stewardship Council by the Central Valley Flood Control Association (2011), suggest that over the last 30 years little if any, subsidence has occurred in areas that are currently above 10 feet below sea level. In fact, problems associated with subsidence such as impaired drainage, are only occurring on lands currently below minus 12 to 15 feet below sea level. MBK's studies indicate that only about 96,000 acres or 14 percent of the area of the Delta lies below minus 12 feet and that only 57,000 acres or 8 percent of the total area lies below minus 15 feet. It is therefore misleading to suggest that continued subsidence is a Delta-wide problem.

Further, subsidence of even several additional feet has little impact on the stability and seepage issues associated with levees that are already 20 to 30 feet high on the land side. Likewise, although sea-level rise of 5 feet would have some impact on the stability and seepage issues associated with the current levees, it would have little consequence for levees improved to the suggested Delta standard and, of course, even less consequence for sea level rise that is consistent with a 1 in 500 probability.

1.3.4 Vulnerability to earthquakes

It is also true that the Delta levees have some vulnerability to earthquakes but this has in recent years been much overplayed in the media and political debates. Regrettably, this perception is also perpetuated in more official publications such as the Delta Stewardship Council's Flood Risk White PaperThat white paper generally demonstrates a less than deep understanding of the issues. For instance, it is pointless to cite a DWR 1992 report (that is not listed in the references) and to include a chart from it as Figure 5.5. On the other hand, the seismic risk portion of DRMS was relatively well done and the results shown in Figure 5.14 can serve as a useful starting point for an intelligent discussion of earthquake-induced failure of levees. Figure 5.14 indicates that the 100 year return period peak ground acceleration (pga) in the Delta ranges from 0.1 to 0.2g in firm soils. The phenomenon of liquefaction is generally cited as the greatest contributor to the hazard faced by the delta levees and this level of acceleration is lower than that which has been observed to trigger liquefaction in hydraulically-placed dams and sand fills. Further, the examples of liquefaction-induced failures that are shown in Figures 5.8 to 5.13 are of questionable relevance. The subsurface conditions in the Delta are unique and unlike those of the case histories shown in these figures. In the Delta there are two different kinds of soils that may be susceptible to liquefaction. One is the topmost sand layer that underlies the peat. This, relatively thin, layer typically shows low penetration resistances and may be considered by some experts to be susceptible to liquefaction, however, these natural deposits are quite old, predating the formation of the peats, and others experts would argue that this reduces the probability of liquefaction considerably. The other kind of soil that is susceptible to liquefaction is hydraulically placed clean sand that has been dredged from the main river channels and placed in adjacent levees without compaction. The actual extent of

these materials is unclear and it may be that these materials are sufficiently well drained that most of the excess pore pressures that are generated by earthquake shaking would quickly dissipate so that any deformations would be limited. Thus, a fair summary would be that the risk of failure of Delta levees due to earthquake shaking cannot be dismissed but that further detailed studies are required to determine whether it rises to significant levels. A third possible source of loose sands is the natural levees that underlie some of the present-day levees. However, the extent of this condition is believed to be limited. As noted already, from a geotechnical engineering point of view, the sands that underlie the Delta can, with the possible exception of the top ten feet, be characterized as dense to very dense, and, contrary to popular opinion, actually constitute a good foundation. Meticulous work by Drexler et al. (2009) indicates that the oldest peat deposits are in the order of 7,000 years old so that the underlying sands are at least this old. That age, when combined with the penetration resistances cited by HTE in their report on Webb Tract, suggest that even the surficial sands are not particularly susceptible to liquefaction. Even under the 500-year return period ground motions estimated in DRMS, which range from 0.2 to 0.4g in firm soils, significant or widespread deformations from any of these three kinds of sands should not be expected. The repeated showing of photos of levee deformations sustained in the Kobe and Christchurch earthquakes, which had higher ground motions and levees founded on very loose and recent alluvial soils, are simply not applicable to the Delta, except to make the point that levees do not necessarily breach and release water, even when they are quite badly deformed.

In fact, to the extent that the Delta levees are largely composed of peat, they may be expected to perform better than levees in general under earthquake loadings. Because of the unusual fibrous nature of peat, not only is it expected not to lose strength under earthquake loadings, but it also might be expected to attenuate ground motions with peak accelerations in the order of 0.2g or more.

1.3.5 Sunny day failures

As with floods and earthquakes, the real risk of “sunny-day” failures also appears to have been much exaggerated. Again, the Flood Risk White Paper prepared for the Delta Stewardship Council perpetuates myths generated by DRMS and othersThe White Paper cites numbers from DRMS in spite of the fact that the IRP cautioned against taking DRMS numbers at face value. And the number cited of a levee breach due to causes other than flood or earthquake of once every 10 years is inconsistent with the recent actual performance. In fact there have been three major “sunny day” failures in the last 30 years, the 1980 failure of Lower Jones Tract, the 1982 failure of McDonald Island and the 2004 failure of Upper Jones Tract, not inconsistent with one failure every ten years, however the first two of these resulted from operation of the PG&E gas storage facility under McDonald Island . Thus, the true rate of sunny day failures due to unknown causes is less than once every 30 years. Further, improvements in systems for monitoring the internal condition of levees, as discussed in Section 2.2, should allow more prompt discovery of dangerous conditions in the future and further reduce the probability of sunny day failures.

1.3.6 Summation of failure mechanisms

As suggested by the discussion in the previous paragraphs, there are a number of factors that make it very difficult to precisely quantify the probabilities of single or multiple levee breaches in a given window.

The first is simply the variability of the existing levee system. Without expending an enormous effort to investigate the existing levees in great detail, it is not possible to calculate the fragilities that are needed for a formal risk analysis with sufficient accuracy to be meaningful. The time and money that would have to be expended on such investigations can be better spent by proceeding immediately with common-sense solutions.

The second factor is that a levee is not necessarily breached when the design flood is exceeded. Improvements to Delta levees are currently designed to accommodate water surface elevations resulting from a combination of tides and flooding that have a mean recurrence interval of 100 years – that is, a 100 year flood. These designs typically provide 1 foot of freeboard above that water surface elevation. But that does not mean that the levees in question might be expected to fail one in every 100 years, or that they have an annual probability of failure of 1 percent. It is likely lower than that, although it could in some circumstances, be greater. If the 100 year water surface elevation is predicted correctly, and assuming a simple Poissonian distribution, the probability of that water surface elevation being exceeded in 100 years is actually 63 percent. Current designs usually provide for 1.5 feet of freeboard. If there has been no settlement of the levee crown and there are no waves, overtopping would thus have an even lower probability of occurrence. But since settlement is inevitable and wave action likely, then the real probability of overtopping becomes a function of how effective monitoring and flood-fighting are as water surface levels approach the design value. Additionally, a well-designed levee, with well-established vegetation, can withstand some overtopping without a breach occurring. In an idealized world, all the levees would be free of penetrations and low spots and all be built to consistent elevations. Therefore, theoretically, if one levee overtops, then many levees would overtop and there would be multiple flooded islands. In reality, all levees are not equal. There is a greater chance that the ones with the most defects might be breached, but that can also be minimized by appropriate allocation of flood-fighting resources.

Similar, but greater, uncertainties impact whether there is a levee breach following an earthquake. In the first place, even if a levee is specifically designed for a certain level of loading, the levee does not necessarily fail in the sense that specified deformation are exceeded if that level of loading is exceeded. Geotechnical engineering design calculations normally err on the conservative side, so that if a formal design for earthquake loadings has been undertaken, the levee can be expected to deform less than the design criteria should the design earthquake loading actually occur. There is also uncertainty in the accuracy of the design loading itself. Some comment on that question is included in the discussion of DRMS in Section 1.4.2. But, regardless of the amount of deformation and cracking that occurs under earthquake

loadings, the probability of first overtopping and then failure, is a complex function of the water surface elevations at the time of the earthquake and when repairs can be implemented. Thus, one of the considerations in the new Urban Levee Design Criteria, which require that if certain provisions are not met, the design has to allow for expeditious repairs. In fact, following an earthquake it might be possible to implement a variety of temporary measures, as well as permanent repairs. Some of these are discussed in Section 2.2. Such measures represent an extension of conventional flood-fighting to cover earthquakes as well.

This discussion leads to the conclusion that rather than trying to calculate precisely the relative risks faced by the various islands in the Delta and using that to prioritize funding a much greater effort should be made to educate the Delta community and other interested parties, as to the real vulnerability of the levees in a qualitative way, rather than a quantitative way, so that appropriate strategies can be developed to manage these risks. A range of possible strategies is discussed in Section 2. It also suggests that a the continuation of a standards-based approach could be more practical and effective than moving to a risk-based approach. A risk-based design approach is fine in theory, but in practice it is unworkable if it cannot be done with sufficient accuracy. To be useful as a planning and design tool, risk-based analyses have to take into account all of the uncertainties in the design and construction of levee improvements, as well as the human and organizational factors involved in flood-fighting and emergency response following earthquakes. That is quite a challenge and it is likely that the judgment of experienced engineers on these issues will provide more reliable answers for the foreseeable future. However, risk-based approaches might provide a good tool for evaluating progress in reducing the combined risks to Delta levees. In practice, as well as in academic settings, such analyses can also be helpful in identifying the factors that make the greatest contribution to risk so that measures can be taken to reduce their relative contribution.

1.3.7 Regulatory Issues

In addition to the physical challenges faced in the Delta, there are also manmade challenges that result from excessive bureaucracy and the politics surrounding these issues. Some of these are noted in this section.

Dredging

The Delta was largely created by dredging and for many years maintenance dredging was carried out which aided flows and navigation as well as providing a source of fill for improving the levees. However, a surfeit of regulations has essentially brought dredging to a halt in the last 10 to 20 years. By some counts as many as 19 separate permits have to be obtained in order to dredge in the Delta. As a result of the additional expense that is generated by this regulatory process borrowing on land is now the preferred alternative as a source of levee material. However, dredging is still required for maintenance and deepening of the deep-water ship channels. In addition, dredging is likely to be required to maintain some of the other waterways, could be used for selected levee improvements, and will definitely be required for the major ecosystem restoration activities that are now planned for the Delta. The Sacramento District, USACE, is presently in the middle of an EIR process for deepening the Sacramento channel to 35 feet and is in a pre-EIR process for deepening the Stockton channel to 40

feet. These projects will generate 20-30 and 40-50 million cubic yards of spoils respectively. The Corps pays for the digging but the ports are responsible for stockpiling and /or disposal of the dredged material. Historically the ports have charged end-users $1 per cubic yard for dredged material. If planned in advance, dredged material can be moved hydraulically at low cost for up to about 8 miles from the point of dredging. The water quality associated with this material is actually quite good and is in fact better than the water quality under the islands which is adversely affected by the presence of the peat. In addition to the possible use for reclaiming flooded islands or improving levees, this dredged material, if spread out over agricultural land, would both slow the loss of peat and improve water quality. USACE and other agencies are also embarked on a multi-year Long Term Management Strategy for Dredged Material in the Delta, the Delta LTMS, http://www.deltaltms.com/. The goal of the LTMS is to develop a one stop permit shop. Each agency (Fed, State & Local) would still be legally mandated to issue individual permits. The "shop" would consolidate that process by having well-defined permit recipes that if met, will allow for the issuance of each individual permit. This model exists in the Bay and it has been successful primarily because the revenues are there (from the shipping industry) and there are a sufficiently large number of projects to support full time agency involvement. That has resulted in workable standards and processes that can be used to secure permits. Unfortunately, the Delta LTMS suffers from funding limitations and has shown little progress. But dredging is a good example of the kind of activity in the Delta for which there needs to be one-stop permitting as discussed below.

Vegetation

Whether or not to allow vegetation, at least on the waterside of levees, is a vexed question that is the subject of much debate both within USACE and between USACE, DWR and other agencies. Following Hurricane Katrina, USACE has been insisting on strict implementation of their current national levee vegetation policy which prohibits woody vegetation on levees. Most fish and wildlife agencies are opposed to this policy. The situation is particularly acute in California where needed levee improvements have been blocked because levee vegetation provides critical habitat for species that are protected under both the State and Federal Endangered Species Acts. To their credit, DWR has been pushing back on this new USACE policy and took the lead in setting up the California Levees Roundtable. The Roundtable effort was able to negotiate a temporary Central Valley Flood System Improvement Framework agreement. Intelligent provisions regarding levee vegetation are also included in the draft ULDC standard. However, in the Delta there is a need to go further since appropriate vegetation on the waterside of levees is a critical element of the Delta ecosystem restoration. Future Delta levee improvements should be undertaken with this in mind. An example of how vegetation can be provided at a relatively low marginal cost is shown in Figure x19.

Bureaucracy

Although many fine people work for both DWR and USACE, they are frustrated by what some observers see as the overly rigid organization of USACE and the ever-changing and less than optimally effective organization of DWR. Further, the difficulty of getting DWR and USACE on the same page, let alone the many other agencies that are involved in the Delta, is a real impediment to getting anything accomplished in a timely fashion. Far too much time and money

is spent on multi-year studies like DRMS or the Delta LTMS that accomplish little or nothing of value. Looking back in time, the joint USACE-DWR study that led to Bulletin 192-82 was an excellent study, but it has since been repeated three or four times and that has only served to delay achieving the goals set forth in that report. Nonetheless, those goals are now close to being achieved 30 years later by bringing all Delta levees up to the Delta-specific PL 84-99 standard, which is an offshoot of the standard proposed in Bulletin 192-82. It is critical that the next round of improvements, to a the proposed Delta levees standard that addresses earthquakes, possible sea-level rise and vegetation of the water side of the levees, be implemented in ,say, the next five years, rather than taking another 30 years. If funding were in place, that effort could in fact begin immediately. It does not require another joint USACE-DWR study or studies of the kind that have been proposed in the draft DWR Framework or that are currently being proposed in the staff drafts of the Delta Plan.

Lack of one-stop permitting

There is a clear need for a one-stop permitting agency for activities in the Delta such as dredging, levee construction, restoration of the flooded islands and other eco-system improvement activities. The responsible agency would obviously need to coordinate with the many existing agencies that have a finger in the Delta, but creation of a one-stop permitting process would elimination unnecessary delays and costs in making the necessary improvements to the physical Delta. There is also a need for unified Delta emergency management and levee improvement entities but that is discussed elsewhere in this report.

1.4 Previous Studies of Delta Levees

1.4.1 Delta Levees Investigation, DWR Bulletin 192-82, and associated studies

In 1976 the legislature directed DWR to prepare a plan for the preservation of the Delta levees. After a joint study with USACE, a definitive plan for the improvement of all Delta levees was completed six years later. The plan was published as Bulletin 192-82 and recommended a levee standard similar to the current Delta-specific PL 84-99 standard. The forward to this report is reprinted as Figure x20. At that time, it was estimated that improvement of all levees to the proposed Bulletin 192-82 standard would cost $930m if implemented immediately. However, financing was never put in place and this study, like so many others, became a part of the history of studies with no consequences. A similar study, called the CALFED Levee Rehabilitation Study, was later conducted as part of the CALFED program in 1999. That study estimated that the cost of improving all the Delta levees to the PL 84-99 standard ranged from a low estimate of $367m to a high estimate of $1051m. The successor to these studies is the USACE Delta Islands and Levees Feasibility Study, which is an on-going effort in collaboration with DWR. The proposed total USACE budget for this study is $6m and DWR is contributing the DRMS study, which also cost $6m, as their contribution. Unfortunately, the rate at which USACE funds are being made available is insufficient to allow meaningful progress.

1.4.2 Delta Risk Management Strategy and Comments Thereon

AB 1200 (authored by John Laird, the current Secretary for Natural Resources) required that DWR evaluate the potential impacts on water supplies derived from the Delta based on 50,100, and 200-year projections for each of the following possible impacts: subsidence, earthquakes, floods, climate change & sea level rise, or a combination of the above. This resulted in the Delta Risk Management Strategy (DRMS), http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/.

DRMS was conducted for the Department of Water Resources (DWR) by a team of consultants led by URS Corporation and Jack R. Benjamin & Associates. The study reportedly cost $6m. Originally, the study was intended to have two phases. The first phase was an assessment of the then current (2005) risks to the Delta and the second phase was supposed to be a projection of future risks assuming various scenarios. However, because of the great volume of critical comments that were received on the draft Phase One report, the effort in responding to them cut into the available funding for Phase Two. The Phase One report was finally released in 2009, but the truncated Phase Two report has not been released at the time of this writing. The stated purpose of the study, the participants, and a summary of the Phase One results are provided in the Executive Summary, available on the web site, that was prepared by DWR.

The DRMS Phase One report was extensively reviewed, including a review by an independent review panel (IRP) assembled by the Cal-Fed Science Program. The reviews, which were generally quite critical of the study, are too voluminous to even summarize but it is of some value to quote the IRP review. That review (http://calwater.ca.gov/science/drms/drms_irp.html) concluded that "the revised DRMS Phase 1 report is now appropriate for use in DRMS Phase 2 and serves as a useful tool to inform policymakers and others concerning possible resource allocations and strategies for addressing risks in the Delta". But the IRP then went on to say: “This conclusion, however, is subject to some important caveats. First, the IRP cautions users of this revised DRMS Phase 1 Report that future estimates of consequences must be viewed as projections that can provide relative indicators of directions of effects, not predictions to be interpreted literally. Second, anyone using the results of the DRMS scenarios must be aware that ecosystem effects are not fully captured in the analysis ..”

The IRP was correct in concluding that DRMS developed a good framework for assessing risks to the Delta levees, but that one should be wary of taking the results literally. Unfortunately, the DRMS effort had data gaps that were drawn to DWR’s attention but never filled, as acknowledged in the note on page 1-1 of the report. It is well known that lack of data and knowledge in this kind of study tends to drive the estimates of fragilities down, and the risks up. Further, continuing improvements have been made to at least some Delta levees under the subventions program since 2005, so the DRMS results are already out-of-date. In addition, some of the failure probabilities, such as the over 7% annual failure probability attached to the Brookside subdivision in Stockton, are obviously incorrect and can only be explained by the use of decades old data. However, notwithstanding its limitations, the numerical results from DRMS are widely quoted by those who want, for various reasons, to paint a pessimistic picture of the Delta.

In addition to the misuse of the DRMS results by a variety of people, USGS personnel made a deceptive presentation at the February 2011 meeting of the Delta Stewardship Council. The USGS staff who made this presentation were wrong on at least two key issues. First, they criticized the DRMS report by stating that only firm soil attenuation relationships were used. Drs McCann and Salah-Mars, co-principal investigators for DRMS have responded to this criticism (letters to USGS and DSC). It is clear that as a first, logical step, DRMS used firm soil attenuation relationships, but then in a second step, they conducted both equivalent linear and nonlinear analyses of the response of the local soil conditions and levees.

A second major error in the USGS presentation was the statement that "we are less sophisticated at retrofitting levees for earthquake risks as we are at retrofitting buildings". Well qualified geotechnical engineers have worked on evaluating the earthquake hazard to levees around San Francisco and San Pablo bays since at least 1977. These levees protect both homes and landfills that contain varying amounts of toxic waste. Neither the Bay Conservation and Development Commission (BCDC) nor the multiple agencies that regulate landfills will accept even low probabilities of levee failure and in some cases quite sophisticated analyses have been performed. As to whether it is easier to retrofit a levee or a building structure, it should be almost self-evident that making a levee robust to withstand earthquake shaking is a lot simpler than retrofitting or even designing a new building or bridge structure to be robust.

2 Emergency Management Strategies

There are three basic ways that the risk posed to the Delta levees by floods and earthquakes can be addressed. One is to simply make the up-front investment to improve the existing levees so that they are more robust; a second is to make the preparations in advance for improved flood-fighting and/or emergency repairs following an earthquake so that breaches do not occur; the third is to make preparations in advance for repair of breaches and the draining of any flooded islands if breaches do occur so that the consequences are minimized. These three approaches are discussed in more detail in the following sections.

2.1 Improving the robustness of the existing levees

This is the standard approach to reducing risk. Invest up-front in making everything more robust. Without detailed analysis it seems elementary that essentially all Delta levees should be improved to the Delta-specific PL 84-99 standard. If the marginal cost of making further improvements to further reduce the risk due to floods, earthquakes and sea-level rise is tolerable, then those improvements should likely be made in accordance with a new Delta levees standard. These levees would not necessarily be "earthquake proof" but they would reduce the probability of single or multiple failures from any cause to quite low levels, in the order of 1 percent per year or less. Levees improved to this new Delta standard would also provide wider crests allowing two-way traffic to deal with emergencies. Levees built to this wider Delta standard would also allow emergency borrowing of materials from landsides toe-berms to restore the crests of any levees that slump as a result of earthquakes.

2.2 Improving flood-fighting and/or emergency repairs after earthquakes

As discussed above in Section 1.3.5, few if any levee failures actually occur without warning. There is normally a few days to a few weeks warning of flood events. Earthquakes occur without warning but the consequences of even a moderate to large earthquake that affects the Delta are more likely to be some slumping rather than immediate breaches. Even sunny day failures may be preceded by signs of trouble. Investments in emergency preparedness and modern investigative techniques to head off failures of any kind would appear to be a winning investment. Studies or plans to date regarding emergency preparedness have principally been concerned with coping with failures and these are addressed in the following paragraph, but improved Federal, State, County and community co-ordination is equally important in preventing failures. Notwithstanding improvements in coordination that are currently being worked on, the suggestion made elsewhere that responsibility for emergency-response planning and levee improvements be turned over to a Delta-region authority with an appropriate funding base appears to have great merit.

Some of the measures that could be taken to improve this aspect of emergency response are:

- Create stockpiles of the newer types of temporary means for raising levees such as “Aquatubes” or “Aquafences”. These allow for temporary increases in the levee height when a particularly severe flood threatens, or after an earthquake. These devices can quickly raise the crest of a levee over much greater lengths than can be accomplished with conventional sandbags.
- Create stockpiles of appropriate materials to deal with enhanced seepage and the means to transport them quickly to any point in the Delta.
- Set in place plans and procedures for emergency repairs to levees following an earthquake. This might include borrowing from landside toe-berms as suggested above.
- Use newer technology such as that developed at the University of Texas at Austin by Professor Kenneth Stokoe for monitoring highway and airfield pavements, to conduct periodic inspections of the levees. This technique senses small changes in the levee such as those caused by rodent burrowing and thus flags locations that require more detailed inspection.
- Install simple fiber-optic cables at the toes of levees as suggest by Professor Jason de Jong of UC Davis in order to sense deformations. Again, this technique flags locations that require more detailed inspection and, in the event of an earthquake or terrorist activity, would immediately identify trouble spots for emergency managers and national security personnel.

2.3 Improving repair of breaches and draining of flooded islands

Efforts to improve emergency response planning are currently under way on at least three levels as discussed below. These may include some elements of the kind of emergency response discussed in the previous section but the main DWR effort places much more emphasis on repair of breaches and restoration of water exports following assumed multiple failures as in an earthquake.

2.3.1 High Level Coordination

In response to SB 27, the California Emergency Management Agency, Cal EMA, organized a Delta Multi-Hazard Coordination Task Force. Since funding was never provided by the legislature, this task force operated on limited funding to develop a draft report that recommends that $11.5m be allocated for various planning studies and that a permanent emergency response fund of $50-150m be established. Some of the recommended planning efforts appear to overlap with DWR-USACE activities that are already under way.

2.3.2 DWR Emergency Planning

The current DWR studies were initiated by the Metropolitan Water District of Southern California (MWD) who, commencing in February 2006, undertook a study of two options for minimizing the interruption of exports resulting from a hypothetical fifty levee breaches, twenty flooded islands scenario. The pre-event scenario involved advance construction of levee and river flow barriers to block salt water from entering the south Delta in a major emergency. It was estimated to cost $330-485m. The post-event strategy allowed saltwater to enter the entire Delta followed by the creation of an emergency freshwater pathway to the export pumps. The cost estimate for this strategy was about $50m for pre-positioning of materials with an ultimate cost of perhaps $200m. MWD then elected in April 2007 to pursue the second alternative in association with the State Water Contractors and DWR using funds from propositions 84 and 1E to the maximum extent possible.

By January 2008 DWR was reporting on progress on the adopted strategy. At that time, contracts had been signed for the delivery of 240,000 tons of rock to three stockpiles in Rio Vista, Hood, and the Port of Stockton by June 2008. A planned second phase would have increased the quantity of rock at each location and added additional “breach closure materials”.

That work has now apparently been subsumed into the development of a broader DWR plan which is intended to guide DWR’s activities during an emergency. This plan includes three components:

(a) In association with USACE, development of a GIS-based flood contingency maps and associated data;

(b) Development of strategies for minimizing the delay in restoring fresh water to the export pumps. This included advanced modeling of salinity intrusion and risk assessments. Although no results have been officially reported, it is understood that these studies suggest that the Delta flushes out more rapidly than had previously been expected, and that exports could be resumed in a maximum of 6 months, but more likely in a shorter period, even if multiple islands have been flooded.

(c) Definition of the roles and responsibilities of DWR emergency response personnel and coordination with other agencies.

There is also some work being done on further development and implementation of emergency response facilities in the Delta but the details of this are unclear. While this program of studies is being undertaken by unusually competent consultants and will make a useful contribution, one still has to question whether such as study should be based on the faulty premise that up to twenty islands might fail as a result of earthquake shaking. Even if significant deformations were sustained by the levees on up to twenty islands, as discussed previously the probability than more than a few of these would fail must be quite low.

2.3.3 County Level Planning

Work is believed to be continuing on various County emergency response plans but these are more oriented to public safety than to repair of levee breaches and de-watering of flooded islands.

2.3.4 Summary

While progress is being made on all three fronts, much of the DWR effort appears to be inappropriately directed at a very low probability scenario – a scenario that has been promoted, by at least some parties, in order to provide a justification for the construction of a peripheral canal or other isolated conveyance. Curiously, these MWD supported studies now appear to be contradictory to their goals since the doomsday scenario is turning out to be less of a risk as initially thought. While the current round of planning should be completed, much more emphasis should be given to the issues raised by Baldwin (2011). These comments include the suggestion that a regional emergency response agency is required and that the regional emergency response agency should place much more emphasis on the issues discussed in Section 2.2 above regarding preparation for flood-fighting and emergency response following earthquakes.

3 Levee Improvement Strategies and Funding

Commencing in 1973 funding has been provided by the State of California to assist the Delta reclamation districts under two programs.

The Delta Levees Maintenance Subventions Program provides financial assistance to local levee maintaining agencies for the maintenance and rehabilitation of non-project levees in the Delta. It is authorized in the California Water Code, Sections 12980 thru 12995. It has been in effect since passage of the Way Bill in 1973 which has been modified periodically by Legislation since then. The intent of Legislature, as stated in the Water Code, is to preserve the Delta as much as it exists at the present time. A summary of expenditures under the subventions program is included as Table 3. As discussed below the amounts for FY 2008-9 and 2009-10

are still in the pipeline and have not actually been expended. But, including these years, the State has provided $147m against a local share of $118 for a total of $265m.

Table 3 Delta Levee Subventions Maintenance Program State & Local Cost Sharee 1973-2010

	STATE						
Fiscal Years	Maintenance Reimburs.	Priority 1	Priority2	Priority 3	Total Reimburs.	Local Share	**Sub-Total**
	(1)	(2)	(3)	(3)			
	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	**$1,000**
1973-74	200				200	272	472
1974-75	175				175	483	658
1975-76	-				-	-	-
1976-77	190				190	395	585
1977-78	175				175	486	661
1978-79	175				175	323	498
1979-80	-				-	-	-
1980-81	-				-	-	-
1981-82	1,421				1,421	2,091	3512
1982-83	1,334				1,334	1,929	3263
1983-84	1,384				1,384	3,803	5187
1984-85	1,817				1,817	2,279	4096
1985-86	1,335				1,335	1,628	2963
1986-87	1,736				1,736	2,097	3833
1987-88	1,882				1,882	1,501	3383
1988-89	1,295	3,705			5,000	4,371	9371
1989-90	1,913	3,407			5,320	8,668	13988
1990-91	1,610	3,689			5,299	8,404	13703
1991-92	2,266	159			2,425	10,449	12874
1992-93	1,823				1,823	4,244	6067
1993-94	1,774	2,916	376	15	5,081	2,070	7151
1994-95	2,371	2,770			5,141	2,233	7374
1995-96	1,449	2,097			3,546	1,602	5148
1996-97	1,758	1,790			3,548	2,158	5706
1997-98	4,432	2,647			7,079	2,974	10053
1998-99	3,412	1,738			5,150	2,341	7491
1999-00	3,085	3,194	58		6,337	2,715	9052
2000-01	4,954	3,053	55		8,062	3,371	11433
2001-02	3,777	1,784			5,561	2,515	8076
2002-03	3,554	1,446			5,000	4,666	9666
2003-04	4,029	1,996			6,025	6,102	12127
2004-05	4,698	1,227			5,925	6,476	12401
2005-06	5,364	358			5,722	4,220	9942
2006-07	4,485	1,505			5,990	6,647	12637
2007-08	5,645	8,503	2,148		16,296	6,210	22506
2008-09	6,810	4,515	545		11,870	4,799	16669
2009-10	7,254	2,131	41		9,426	3880	13306
	89,582	**54,630**	**3,223**	**15**	**147,450**	**118,402**	**265,852**

(1) Excess maintenance over the maintenance cap and DFG costs are included in the maintenance.
(2) Priority 1 includes HMP and Bulletin 192-82 work.
(3) Priority 2 is priority 1 excess cost over $100,000 per mile cap. Priority 3 is land use changes

The Delta Levees Special Flood Control Projects provides financial assistance to local levee maintaining agencies for rehabilitation of levees in the Delta. The program was established by the California Legislature under SB 34, SB 1065, and AB 360. The Special Projects program is authorized in the California Water Code, Sections 12300 thru 12314. This program initially focused on flood control projects and related habitat projects for eight western Delta Islands--

Bethel, Bradford, Holland, Hotchkiss, Jersey, Sherman, Twitchell and Webb Islands--and for the Towns of Thornton and Walnut Grove but in 1996 was extended to the rest of the Delta. A summary of expenditures under the special projects program is included as Table 4. Again, the funds for FY 2008-9 and 2009-10 have not yet been expended. The figure for FY 2009-10 includes $35m specially designated by the legislature for improvements to the five islands that protect the Mokelume Aqueduct. The expenditures for FY 2007-9, 2008-9 and 2009-10 are larger than previously because of bond funding approved by the voters in propositions 84 and 1E. Through FY 2009-10 a total of $238m has been expended or committed through the special projects program.

Table 4 Delta Levee Program Special Projects State Expenditure 1989-2010

Fiscal Year	Planning & Engineering	Levee Construction	Habitat Enhancement	Total Expenditures
1989-1990	$15,000	$0	$0	$15,000
1990-1991	$5,210,000	$810,000	$0	$6,020,000
1991-1992	$709,400	$4,085,000	$0	$4,794,400
1992-1993	$668,500	$4,148,000	$0	$4,816,500
1993-1994	$140,000	$6,318,054	$0	$6,458,054
1994-1995	$300,505	$1,896,518	$0	$2,197,023
1995-1996	$30,000	$1,419,370	$0	$1,449,370
1996-1997	$513,618	$4,117,720	$0	$4,631,338
1997-1998	$609	$3,201,434	$0	$3,202,043
1998-1999	$0	$2,233,787	$4,035,000	$6,268,787
1999-2000	$80,555	$1,994,673	$4,009,134	$6,084,362
2000-2001	$199,613	$4,183,526	$3,837,381	$8,220,520
2001-2002	$0	$1,333,548	$1,138,797	$2,472,345
2002-2003	$800,985	$6,645,234	$6,961,843	$14,408,062
2003-2004	$95,979	$704,381	$1,118,243	$1,918,603
2004-2005	$188,044	$2,408,507	$972,500	$3,569,051
2005-2006	$553,989	$8,510,163	$446,193	$9,510,345
2006-2007	$922,127	$8,209,557	$59,500	$9,191,184
2007-2008	$1,606,681	$18,449,127	$144,000	$20,199,808
2008-2009	$4,115,986	$18,608,588	$0	$22,724,574
2009-2010	$2,346,311	$91,274,764	$6,117,538	$99,738,613
Totals:	**$18,497,902**	**$190,551,951**	**$28,840,129**	**$237,889,982**

Note: Funds for projects in FY 2008-2009 and FY 2009-2010 have been encumbered but in most cases have yet to be released due to recent, state-wide budgetary uncertainty.

Thus the total investment in Delta levees since these programs began will be $503m once the last two years of funding are released and this is reflected in the generally improved condition of the levees. It should also be noted that over time the levees have failed and then been repaired at their weakest points so that overall the present levee system is more robust than it was formerly. Also, with the cessation of dredging there has been increased placement of rock rip-rap on the water side of the levees. Taken together these three observations mean that historic

data on the rate of levee breaches is no longer relevant and should not be regurgitated in current reports and discussions.

While some reports suggest that the funds allocated to the Delta in Propositions 84 and 1E were $275m and $500m, for a total of $775m, other reports give a lower number of $340m for Proposition 1E, for a total of $615m. In the three fiscal years to date, $37m has been spent or committed on the subventions program and $143m on special projects for a total of $180m. It is unclear how much of the bond funding has been diverted to other purposes and how much remains available for levee improvements.

However, the funds that are more immediately in the pipeline include the special project funding of $22m for FY 2008-9 and $100m for FY 2009-10, for a total of $122m from DWR, plus $195m from USACE through the CALFED Levee Stability Program. The USACE funding was authorized by the CALFED Bay Delta Authorization Act of 2004 which provided for USACE participation in the then CALFED program.

Improvement of Delta levees from at or about the HMP standard to the Delta-specific PL 84-88 standard costs in the order of $1-2m per mile, the biggest variable being whether suitable borrow material is available on-island or whether it has to be trucked or barged from adjacent islands. With the funds that are in the immediate pipeline and the remaining bond funds, all the Delta levees can easily be improved to meet the Delta-specific PL 84-99 standard. Indeed, if expenditure of the bonds funds had not been delayed by State spending freezes and other issues, this standard would be generally met already. In any case, within a few years the Delta levees will be in relatively good shape as opposed to being fragile or pitiful, descriptions that have previously been applied by participants in the Delta levees debate. This is not to say that some continuing funding would not be necessary to ensure that 100 percent of the critical levees meet the PL 84-99 standard and to take care of unexpected settlements, but this would require no more than, say, $50m per year.

Improvement of critical non-project and non-urban levees to a higher Delta specific standard that will provide 200-year plus protection for floods, earthquakes and sea level rise and incorporate ecologically friendly vegetation on the water side is more difficult to estimate precisely. After improvement to the Delta-specific PL 84-99 standard, levees that do not contain saturated loose sands may come close to meeting this standard although they would still benefit from wider crowns. Amongst other things, the additional width makes planting on the water side, which is desirable for a number of reasons and may be required by the Delta Plan, much more feasible. Determination of which levees do require additional improvement will require more detailed studies but this can be done more economically than has been the case in ULE and NULE. Prioritization of further improvements is relatively straightforward and does not require risk analyses or cost-benefit studies. All the islands shown in Figure x23 are relatively high priority. These further improvements might cost in the order of an additional $2-3m per mile. If it assumed that this improvement is required over 300 miles of non-project and non-urban levees, the total cost might be as low as $1b. However, for general planning and budgeting purposes it might be desirable to use a higher number like $2b. The main point is

that it is a number like $1-2b rather than $50b. The biggest variable in these estimates is whether or not suitable fill is available on the same island or has to be trucked or barged in. That in turn is both a function of the availability of the materials and the cooperation of the landowners as on-island borrowing may take some land out of agricultural production. The above estimates assume a combination of on and off-island borrow sources. If only on-island borrow is used these cost might be reduced by as much as 50 percent. Alternately, if the regulatory impediments to dredging in the Delta are resolved, good quality fill material could be obtained for a cost in the order of that for on-island borrow. While there are other potential uses for the dredge spoils that will results from either deepening of the deep-water ship channels or from maintenance dredging, their use for levee improvements would provide a means to keep the cost of those improvements down. These figures also assume that design and construction are executed by the local reclamation districts. If managed directly by DWR or USACE, these costs should be multiplied by a factor of as much as 2 or 3. It should be noted that these costs are much less than those being faced for the improvement of urban levees which have to deal with encroachments and penetrations and where there is no land available for widening the levees. This has resulted in the widespread use of deep-cutoff walls that are installed through the existing levees. In addition there are significant bureaucratic issues which add to the cost, especially when there are very many landowners that have to be dealt with. This results in the "soft costs" being as much as 50 percent of the actual construction costs on these projects. Although the possible need to take a strip of agricultural land on the Delta islands and to move existing drainage channels, siphons and pumps are still issues, the cost implications are very much smaller and only a relatively small number of landowners have to be accommodated.

As noted previously there are special considerations for levees that protect the legacy communities in the Delta. Detailed estimation of the likely cost of improving those levees awaits policy decisions that have not yet been made.

Improved inspections and planning and positioning for flood-fighting and emergency response following earthquakes, which would contribute very significantly to a reduce risk of losses, would be well covered by an annual budget of $50m. As noted previously, it is very desirable that there be a single agency responsible for these activities.

There are three potential sources of funding from within the Delta for maintenance, improvements and emergency response: (1) the traditional funding from the landowners, who also make in kind contributions to inspection and maintenance; (2) the owners of the infrastructure that passes through the Delta – as noted previously EBMUD and PG&E do make contributions to the upkeep of the levees that protect their factlities, but many other owners get a free ride; and (3) the agencies that convey water through the Delta. The DSC has proposed the creation of a new agency, the Delta Flood Risk Management Assessment District, with fee assessment authority, but regardless of whether it is that entity or some other entity, it would be beneficial for the control of funding to pass from DWR to a more Delta-specific entity once the present bond funding is exhausted. It wpould also be entirely reasonable that the State and Federal Governments also contribute funding to this entity. If it is the policy of the State to protect and enhance the Delta because that is judged to be of benefit to the entire State, then

the State should be prepared to back that up with funding that might, for instance, be directed primarily to widening levees so that they can accommodate vegetation on the water side. Outside its operation of the Central Valley Project, the Federal government has interests and obligations that include the continuing downstream effects of hydraulic mining on Federal lands, navigable waterways and national economic security.

Chapter 5: Review of Economics in Influential Delta Studies

The Delta Protection Commission requested an independent review of the economic analysis in studies that are having a major impact on key policy discussions. Three studies are of particular importance: 1) PPIC Comparing Futures Report (2008) that recommended a peripheral canal, 2) Delta Risk Management Strategy Phase 1 Report (2009), and 3) the Suddeth, Mount, and Lund (2010) levee decisions study that recommends large numbers of Delta islands be permanently flooded.

THIS CHAPTER IS UNDER DEVELOPMENT

1 Summary of Findings

A. PPIC Comparing Futures Report (2008)[9]

- Errors and limitations in the analytical framework bias results in favor of peripheral canal.

1) Does not utilize the conventional, scientifically accepted present discounted value approach to evaluating investments. In particular, their unconventional approach ignores the financially significant 10-25 year time to build a canal when costs are incurred without benefits.

2) Only evaluates benefits in a single distant year when benefits are at a peak due to an assumed 100% loss in ability to export water from south Delta. Even if one accepts the assumption that water exports are eventually cut by 100%, a conventional present discounted value approach would properly account for the fact that benefits start small and grow over time.

3) Inexplicably, market values for fishery improvements are ignored.

4) Non-market values for fisheries are also ignored because these techniques are "too controversial".

5) Because the framework does not place an economic value on fisheries, their structure only allows them to recommend a policy that is best on both environmental/fishery and economic/water supply criteria. Although their analysis did not find the required dominant strategy for a scientific conclusion, the authors presented their endorsement of a peripheral canal as a scientific conclusion rather than a subjective opinion.

- Various assumptions exaggerate costs of reduced water exports, especially to urban users, and bias results in favor of peripheral canal. (See Appendix F of Comparing Futures for most of these assumptions).

1) Overestimated urban water scarcity by using an extremely high projections of population growth of 65 million in 2050, and justifying it with a reference to Department of Finance projections which were actually less than 60 million, not 65 million. They later revealed that their source was Landis and Reilly (2003)[10], a study that assumed the 2000 population was nearly 1 million higher than the 2000 Census and was based on DOF projections from the 1990s. DOF projections are notoriously high, and virtually all Census based forecasts put the California population at 55 million in 2050, and some updated projections are now below 55 million since the Census 2010 results were

[9] http://www.ppic.org/main/publication.asp?i=810
[10] Landis and Reilly (2003), "How will we grow?" http://escholarship.org/uc/item/8ff3q0ns#page-27

released. Assuming 10 million additional urban water customers has significant impacts on the cost of reducing Delta water exports.

2) Overestimates cost of water recycling as an urban alternative. Their calculations assumed recycled wastewater would cost urban areas $1,480 per acre foot (2008$), even though other PPIC reports from the same time period cited costs of $600 af, and a range of $300-$1300 af around the same time.[11] Rather than using current cost estimates to calibrate their model, the authors utilized outdated cost estimates from the 1990s, and inflated them to 2008 dollars using an unrelated construction cost index.

3) Although less significant than the water recycling overestimate, Comparing Futures also overestimates cost of desalination as an urban alternative. Their calculations assumed desalinated water would cost urban areas $2,072 per acre foot (2008$), even though other PPIC reports from the same time period cited cost range of $500-900af for brackish desalination and $900-2500 af for seawater desalination. Rather than using current cost estimates to calibrate their model, the authors utilized outdated cost estimates from the 1990s, and inflated them to 2008 dollars using an unrelated construction cost index.

4) Since they are modeling 2050 costs, the high cost assumptions for water recycling and desalination are an implicit assumption that technology inexplicably goes backwards over the next 40 years, despite recent and expected future cost savings in both technologies from new research and development.

5) Urban water scarcity costs are also exaggerated by ignoring conservation which many believe is the least costly source of urban water supply. They use old estimates of urban water demand without making any allowance for gains already made in reducing urban demand with new technologies or accounting for expected new conservation.

6) For agriculture, they exaggerate the costs of water scarcity on San Joaquin Valley agriculture using the same models that incorrectly projected 90,000 lost jobs from the 2009 drought. Based on the 2009 drought episode, their costs of agricultural water scarcity are a minimum of three times and more likely six times too high.

7) Simple calculations show results are highly sensitive to these assumptions, and that their results are unlikely to hold under more realistic assumptions.[12]

- Other Issues

1) The current costs of isolated conveyance are much higher than they assumed for a peripheral canal, although the authors can't be blamed for changing cost estimates.

2) Their analysis did not show a peripheral canal was best <u>on both</u> criteria, so the strong recommendation of a peripheral canal was not scientifically supported by their own framework. It is a subjective value judgment that placed a low value on fishery and other improvements.

3) Authors have not demonstrated the results are robust to alternative, more realistic data assumptions despite multiple requests.

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[11] See PPIC reports, California Water Myths (2009) and Water for Growth (2005).
[12] For an example with a few parameters, see http://forecast.pacific.edu/articles/peripheral%20canal%20PPIC%20review.pdf

B. Delta Risk Management Strategy (DRMS) Phase 1[13]

- Phase I study was sharply criticized, and independent reviewers warned that results only indicated directions of risks and numerical predictions should not be taken literally.
- Economic loss calculations in the report critically depend on the failure probabilities in DRMS that are considered too high by virtually all experts.
- In-Delta flood loss costs are exaggerated. Some examples:

1) Overly high flood risk is matched with high-value properties. For example, the Sargent-Barnhart tract is the Stockton Brookside neighborhood, which was developed in 1990 with over 200 year flood protection from modern levees as recently confirmed by DWR FloodSafe program maps. However, DRMS estimates the island has over 7% probability of flooding, 3rd highest of all Delta islands based on old data. DRMS uses current economic asset data to repeatedly flood the over $1 billion in real estate assets in Stockton's most expensive neighborhood.

2) Billions of dollars in South Sacramento real estate is defined as inside the Delta 100 year flood plain, when those properties are both outside the Delta and were recently removed from the 100-year floodplain due to levee improvements.

3) High-risk flooded islands are assumed to be rebuilt just as they were originally and are repeatedly flooded in the simulations. Complete rebuilding is unlikely for behavioral and policy reasons, exaggerating the losses.

- Losses from water export disruptions are exaggerated.

1) The analysis assumes that water managers would not employ several strategies to r educe the costs of temporary water shortages.

2) New analysis done for the BDCP and DWR shows that the exports pumps would be disabled for a much shorter period of time than estimated in DRMS.

- Although the costs from DRMS were exaggerated, it has been made worse by frequent misuse and misinterpretation of results by others, including the Department of Water Resources and the PPIC. For example, the majority of the estimated losses are in-Delta, yet they are often portrayed as losses from water deliveries.

III. Suddeth, Mount and Lund (2010) Levee Decisions Study[14]

- Unlike the peripheral canal analysis by the same authors, this report evaluates levee investments with the present discounted value approach that explicitly considers the lack of benefits while costs are incurred during the building period. The framework is correct, but is notably inconsistent with the framework they used to evaluate the peripheral canal in the 2008 Comparing Futures report. Thus, they are evaluating levee investments with a much tougher framework than they used to evaluate a peripheral canal.
- Utilizes the high levee failure probabilities from the DRMS study which leads to what the recent National Academy of Sciences review of the BDCP refers to as "error propagation."
- Utilizes very low values for Delta farmland ($2500 per acre) that are substantially lower than current market values for Delta farmland ($6000 per acre) that already include a significant discount for flood risk and levee costs. An argument could be made that the correct value for

[13] http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/phase1_information.cfm
[14] http://watershed.ucdavis.edu/pdf/Suddeth-Mount-et-al-2010-SFEWS.pdf

the analysis of rebuilding after flood would be comparably productive farmland without flood risk which sells for $8,000 to $12,000 per acre in the region.

- Underestimates the cost of reinforcing downwind islands when levees fail.
- Underestimates the infrastructure cost of island failures, although they do consider major transportation infrastructure and indicate western islands critical to water conveyance.
- The most recent, published version of the paper does illustrate results under some more realistic alternatives for land values and other parameters that significantly reduce the number of island that are "optimum" to leave flooded.
- The very expansive open water scenarios with twenty or more permanently flooded islands are clearly not economically optimal as the authors (none of whom are economists) claim.
- We use an alternative scenario run by the authors with more realistic property and infrastructure values as the basis for our six-island open water scenario in the next part of the report. These six islands were relatively free of major infrastructure or permanent residents, produce lower-value crops, and are therefore more realistic to consider.

2 Conclusion

All of these influential reports have serious problems, and have incorrectly influenced decision makers towards alternatives that do not support economic sustainability in the Delta. In the case of the PPIC, it is important to note that two recent developments have provided real world demonstrations of the inaccuracy of the models we criticize above. The first episode was the 2009 drought. The negative impacts of the drought, particularly on San Joaquin Valley agriculture, was wildly overestimated by UC-Davis/PPIC affiliated researchers using some of the same models used to justify the peripheral canal in the 2008 *Comparing Futures* study.[15] In addition, many water agricultural water exporters and some urban water exporters such as the San Diego Water Authority are now doubting whether an isolated conveyance is a good investment for them, a development that would not occur if the PPIC's peripheral canal analysis were accurate since PPIC author's calculated and have been quoted as saying that water exporters would be willing to pay up to $25 billion for a peripheral canal. With water exporters balking at costs that are half that level, it is clear that our claim that the PPIC exaggerated the value of a peripheral canal to water exporters is most likely correct.

Furthermore, when viewed in their entirety including reports not reviewed above, recent reports by the PPIC and UC-Davis researchers affiliated with the PPIC show a consistent bias against the Delta that contrasts with the independent and impartial reputations of their institutions. A few examples of anti-Delta bias are below:

- Ignoring the construction time period and not using present discounted value approach when evaluating the peripheral canal, while imposing a much tougher standard that accounts for the lack of benefits during the construction period and present discounted value approach when evaluating investments in repairing breached levees.
- In the Delta, they did not calculate economic impacts from lost agricultural production such as lost jobs when evaluating increased Delta salinity from isolated conveyance[16] and they called

[15] There is no weblink or reference to these reports anymore, because the UC-Davis researchers have withdrawn the erroneous modeling and removed the study from their website.

[16] See Delta Dilemmas (http://agecon.ucdavis.edu/extension/update/issues/v10n4.pdf) or the 2007 PPIC report, Envisioning Futures. If being fair and unbiased, the UC-Davis researchers would have applied their 50 jobs per $1million agricultural employment multiplier that they were using in many studies of

up to $200 million in Delta losses "notable for costs that it did not show." However, similar studies at the same time of San Joaquin Valley agriculture described similar losses as very severe economic costs, and applied huge estimates of job loss.

- The 2009 Water Myths report, the "No Villians" section notably leaves out Delta farmers and residents while casting south of Delta farmers, urban users, and environmentalists in a positive light.
- Incredibly, the 2009 Water Myths report labels water subsidies to Central Valley Project farmers a myth, while denouncing "large" subsidies for Delta farmers levees. The reality is that Delta farmers have historically paid much larger cost shares (50%) for levee improvements through subventions, and that these levees upgrades provide benefits to many groups other than the farmers, including water exporters. In contrast, the interest subsidies for the Central Valley Project are much larger than the levee subventions program, and provide purely private rather than statewide benefits.
- When modeling losses to urban and agricultural Delta water exporters, the PPIC uses assumptions from the high-range of available values for nearly all choices including water recycling, desalination, and population growth. In contrast, when modeling the decision of whether to rebuild Delta levees, they assume very low values of cost such as $2500 per acre for Delta cropland and leave out several types of infrastructure costs.

The Delta Protection Commission should recommend that the Stewardship Council become less reliant on the analysis of the PPIC and UC-Davis analysts, and seek out more impartial and accurate sources when it comes to economic analysis. In addition, the Stewardship Council should sponsor more economic and social research through the science program to develop a broader array of sources and knowledge to support the important economic decisions that will be part of future updates to the Delta Plan.

south of Delta agriculture at the same time. At up to $200 million in losses, a fair, unbiased and consistent analysis would have said their salinity modeling showed that up to 10,000 jobs could be lost in the Delta.

Part Two: Analysis of Key Economic Sectors in the Delta

Chapter 6: Framework for Analysis

Chapters 7-12 are an analysis of key components of the Delta economy: agriculture; recreation and tourism; infrastructure; other economic sectors including services, transportation, and development; and an integrated analysis of local government services and the Delta's legacy communities. In this chapter, we discuss the framework that will be utilized for the analysis, and we define the scenarios for policy choices that will be made in the Delta in four key areas: water conveyance, habitat enhancement, levee and flood control investment, and land use regulation.

THIS CHAPTER IS UNDER DEVELOPMENT

Each of these chapters will follow a common framework. First, there will be a data driven description of the current baseline and trends for the sector that may include reference to other key reports on the sector. Second, we will discuss the likely outcomes for the economic sector under the baseline policy scenario, and develop recommendations that might improve economic sustainability under the baseline scenario. Finally, we will evaluate the positive and negative impacts of alternative policy choices on economic sustainability in each area. Some topics, such as taking land out of agricultural production, are suited for a detailed quantitative analysis. Other topics, such as how the creation of tidal marsh could affect Delta tourism and recreation, will necessarily rely on more qualitative analysis and expert opinion. In some chapters, there will be discussion of additional issues or proposals. For example, the recreation chapter will discuss the potential effects of National Heritage area designation, and a recent recreation plan developed by California State Parks.

1 Baseline Scenario

The baseline analytical scenario is the vision that includes few major policy changes. However, it is not a "status quo" scenario as some significant human and environmental changes are likely in the Delta between now and 2050. Population growth will continue in the Delta counties, some agricultural land will be developed in the secondary zone within city boundaries, an expected foot of sea-level rise is likely to affect water salinity and flood risk, tertiary treatment investments will become operational at most municipal wastewater plants discharging into the Delta and improve water quality, and significant investment in levees will occur with already approved bond funds and other sources.

As discussed in Chapter 2, the population of the region surrounding the Delta is growing and is expected to continue growing. The 2010 Census found the population in the 5 Delta counties was 3,767,312 and grew at a 1.4% annual rate over the decade, slightly faster than the 1% annual growth rate for the state of California. By 2050, the Business Forecasting Center at the University of the Pacific projects the 5 county population will be 6.1 million based on the 2010 Census results. Higher projections from the California Department of Finance, most recently updated in 2007, put the 2050 population at 6.9 million. The 13 county primary market for recreational users will grow from its current population of 9.5 million to between 13 and 15 million by 2050. Despite this growth, the population of the primary zone of the Delta has remained steady, and is projected to remain constant in the baseline scenario. In contrast, the secondary zone will continue to experience significant growth within the boundaries of its incorporated cities.

For the four policy choices, the baseline scenario is as follows. The baseline scenarios are not recommended policy choices, but simply represent the most logical starting place for the analysis. Baseline conditions could be recommended for some policy choices, but not others.

- *Baseline Water Conveyance*: Through Delta Conveyance. Under this scenario, water would continue to be conveyed to the south Delta pumps through Delta channels. The level of water diversions would be constrained to less than 5 million acre feet per year in compliance with the current biological opinions.
- *Baseline Habitat Conservation Measures*: None. None of the habitat conservation measures outlined in the BDCP drafts would be implemented in the baseline scenario. The positive and negative impacts of each of the major conservation measures will be assessed individually in the other scenarios.
- *Baseline Flood Control: All levees upgraded to PL 84-99*. As discussed in Chapter 4, the upgrade of most Delta levees to PL 84-99 standards is a reasonable expectation with currently identified resources and on-going maintenance. Most levee breaks would be repaired to original conditions and islands restored. Unincorporated towns in the Delta primary zone would remain in the 100-year flood plain, significantly constraining development. Urban areas in the secondary zone such as West Sacramento would successfully achieve 200-year flood protection status in accordance with current plans.
- *Baseline Land Use Policy: Current Policy.* Delta Protection Commission guidelines remain in place over the primary zone, and land use planning and regulation would remain under the jurisdiction of local governments. The Delta Stewardship Council does not take an active regulatory role in regards to Delta land use.

2 Isolated Conveyance Scenario

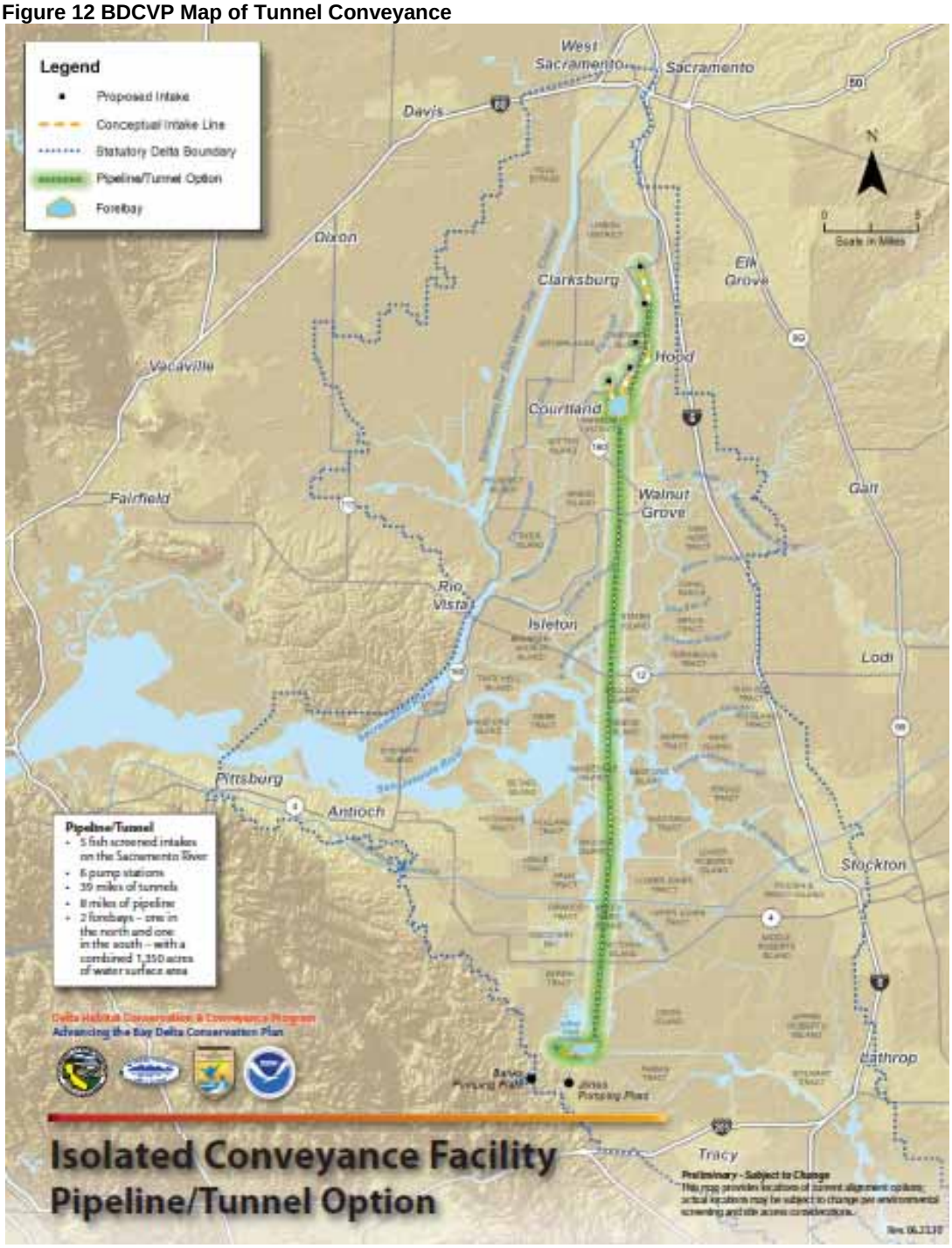
The leading proposal for new water conveyance facilities in the Delta is a 15,000 cfs (cubic feet per second) tunnel extending from the Sacramento River near Hood to the CVP and SWP pumps near Tracy. The facility would include a pair of 34 mile long, 33 ft. diameter tunnels running between a new intermediate forebay near Courtland to a new forebay adjacent to the existing Clifton Court Forebay near Tracy. Five new water intakes would be built along the Sacramento River between Clarksburg and Courtland, and another 13 miles of pipeline would be required to convey water from the five intakes to the intermediate forebay. Each of the five intakes and the intermediate forebay would have pumping plants with a combined 210 MW electrical load.[17]

According to the operational criteria described in the latest BDCP documents, the new conveyance would increase average water exports from the Delta in 2025 from 4.7 maf with through Delta conveyance under the existing biological opinions to 5.4 to 5.9 maf. There would be little change in water exports during dry years, but increased water deliveries during wet years and greater variation in the levels of water exports between years.

The isolated tunnel conveyance facility would have a number of impacts on the Delta. Salinity of Delta waters would increase with a tunnel conveyance, particularly in the Western and Southern Delta. Although the footprint of a tunnel is significantly less than a surface canal, it will still consume roughly 8,000 acres, mostly agricultural land in Sacramento and San Joaquin counties. The new intake facilities will significantly alter the shoreline of the Sacramento River between Clarksburg and Courtland.

[17] For more details on the tunnel conveyance, see the December 2010 report, "Highlights of the Bay Delta Conservation Plan," pages 32-37, and section 3.4.2.1 of the November 18, 2010 "Progress Report on the Bay Delta Conservation Plan." Both reports are available at http://baydeltaconservationplan.com/Home.aspx.

Figure 12 BDCVP Map of Tunnel Conveyance



While alternative sizing and other options for water conveyance are reportedly under development and consideration, none of these options have been described in sufficient detail for this analysis. Thus, the tunnel conveyance described in the most recent BDCP is the only alternative to through Delta conveyance that will be considered in this report. As alternatives such as a smaller 3,000 cfs isolated conveyance facility are developed in more detail, additional analysis would be warranted.

Financing Isolated Conveyance: Potential Risks for Delta Communities and Taxpayers

This call out box is incomplete, but will include a discussion of the probable impact on rates for the customers of water contractors. Although impacts on customers of the state and federal water projects are outside the scope of this report, the financial assessment of the isolated conveyance is of critical importance to economic sustainability in the Delta.

Inadequate financing could create serious problems such as 1) pressure to increase water exports from the Delta beyond agreed upon limits to create revenue for debt service, 2) pressure to divert funds from Delta mitigation, habitat improvement, and flood control programs, 3) public subsidies that divert general tax revenues from other public needs, 4) increased pressure for transfers of water from San Joaquin Valley agriculture to urban customers that could adversely affect the San Joaquin Valley agricultural economy over and above losses to Delta agriculture, and 5) the risk of a costly stranded asset that unnecessarily burdens water ratepayers for decades.

he discussion will describe three concepts: a) Ability to Pay (Financial Feasibility) – average cost analysis, b) Optimal choice for Water Exporting Regions – marginal cost analysis, vs. c) Optimal Choice for the State: benefit-cost analysis. The discussion will be based on actual numbers being used in BDCP and by exporters such as the Metropolitan Water District, San Diego Water Authority and Central Valley Project agricultural users.

3 Habitat Conservation Scenarios

In addition to isolated water conveyance, the BDCP proposes 18 additional conservation measures. Similar conservation measures are under consideration by the Delta Stewardship Council for the Delta Plan, and some of these measures are also included in the Ecosystem Restoration Program proposed by the Department of Fish and Game. In this report, we use the draft BDCP descriptions of the conservation measures, because they are more detailed and thereby better suited to the analysis.

The individual conservation measures could have negative or positive impacts on different aspects of the Delta economy. Our analysis will not examine all 18 measures, but focus on 5 major proposals that would change the current use of 1,000 acres or more of Delta land or impact at least 10 linear miles of shoreline.[18] For simplicity, the measures will be considered individually rather than as a package at this initial stage. The five major conservation measures include:

- *Yolo Bypass Fisheries Enhancements*: Requires 22,000 to 48,000 acres in new flowage easements. More frequent flooding and improved fish passage in the Yolo bypass will benefit fish, but will impact agricultural production.
- *San Joaquin River Floodplain Restoration:* Creation of new seasonally inundated floodplain habitat along San Joaquin River between Vernalis and Stockton using setback levees. Approximately 10,000 acres of land would be in the new floodplain.
- *Tidal Habitat Restoration:* Up to 65,000 Acres in agricultural land converted to tidal habitat in designated zones throughout the Delta. This scenario requires breaching levees and restoring subsided islands to shallow water habitat. If fully implemented, this strategy would affect the

[18] For details on the conservation measures, see the December 2010 report, "Highlights of the Bay Delta Conservation Plan," and the November 18, 2010 "Progress Report on the Bay Delta Conservation Plan." Both reports are available at http://baydeltaconservationplan.com/Home.aspx.

most agricultural land and have the highest capital costs. Preliminary cost estimates are $1.5 billion or more than $23,000 per acre of tidal marsh created.

- *Natural Communities Protection:* There are several elements to this conservation measure including the acquisition of 8,000 acres of rangeland for conversion to natural grasslands, acquiring agricultural easements or purchases on 32,000 acres that would be restricted to "wildlife friendly" agriculture, and the conversion of 700 acres of rangeland to vernal pools and alkali wetlands.
- *Channel Margin Habitat:* 20 linear miles of North Delta waterways would be altered with setback levees and shallow water habitat along the river.

4 Levee Scenarios

Investment in levees and other flood control measures could be more or less than described in the baseline scenario. Some have proposed creating large expanses of open water habitat in the Delta through the intentional flooding of Delta islands or an explicit policy of not repairing islands when and if they flood in the future. On the other hand, an increased level of levee investment within the primary zone of the Delta could bring some areas to 100-year or 200-year levels of flood protection and allow increased opportunities for economic development. These two scenarios are not mutually exclusive. For example, reduced levee investment in some less populated locations could be combined with increased investment in more populated areas near Delta legacy communities. Our analysis defines plausible scenarios of low and high levee investment, and discusses their implication for various aspects of the Delta economy.[19]

Six Island Open Water Scenario

There have been proposals to transform large expanses of the Delta to open water. Proponents argue that open water could provide environmental benefits to native fishes, and that it isn't cost effective to repair or upgrade levees around most Delta islands. The most expansive proposals would transform 20 or more Delta islands to open water, and are illustrated in the "eco-friendly" Delta map in a recent report from the Public Policy Institute of California.[20] As discussed in an earlier chapter, the analysis underlying these proposals understates the benefits and overstates the costs of maintaining Delta islands. In addition, this strategy faces substantial legal and political hurdles that make the more expansive open water scenarios exceedingly unlikely. A very expansive open water scenario is clearly incompatible with economic sustainability in the Delta, and we see little point in evaluating it in detail.

However, a smaller open water scenario is likely to be considered as a possible component of the Stewardship Council's Delta plan and is more economically, legally, and politically viable. A smaller scenario is illustrated in a recent letter from Jeff Mount to the Delta Stewardship Council, and in Figure 9 of the Suddeth, Mount and Lund (2010) paper.[21] Most notably, the

[19] A number of the habitat conservation measures evaluated in the scenarios could have significant positive or negative effects on flood control within the Delta. In addition, some have argued that the open water scenario is a conservation measure. These issues will be considered in a subsequent chapter on public infrastructure services.

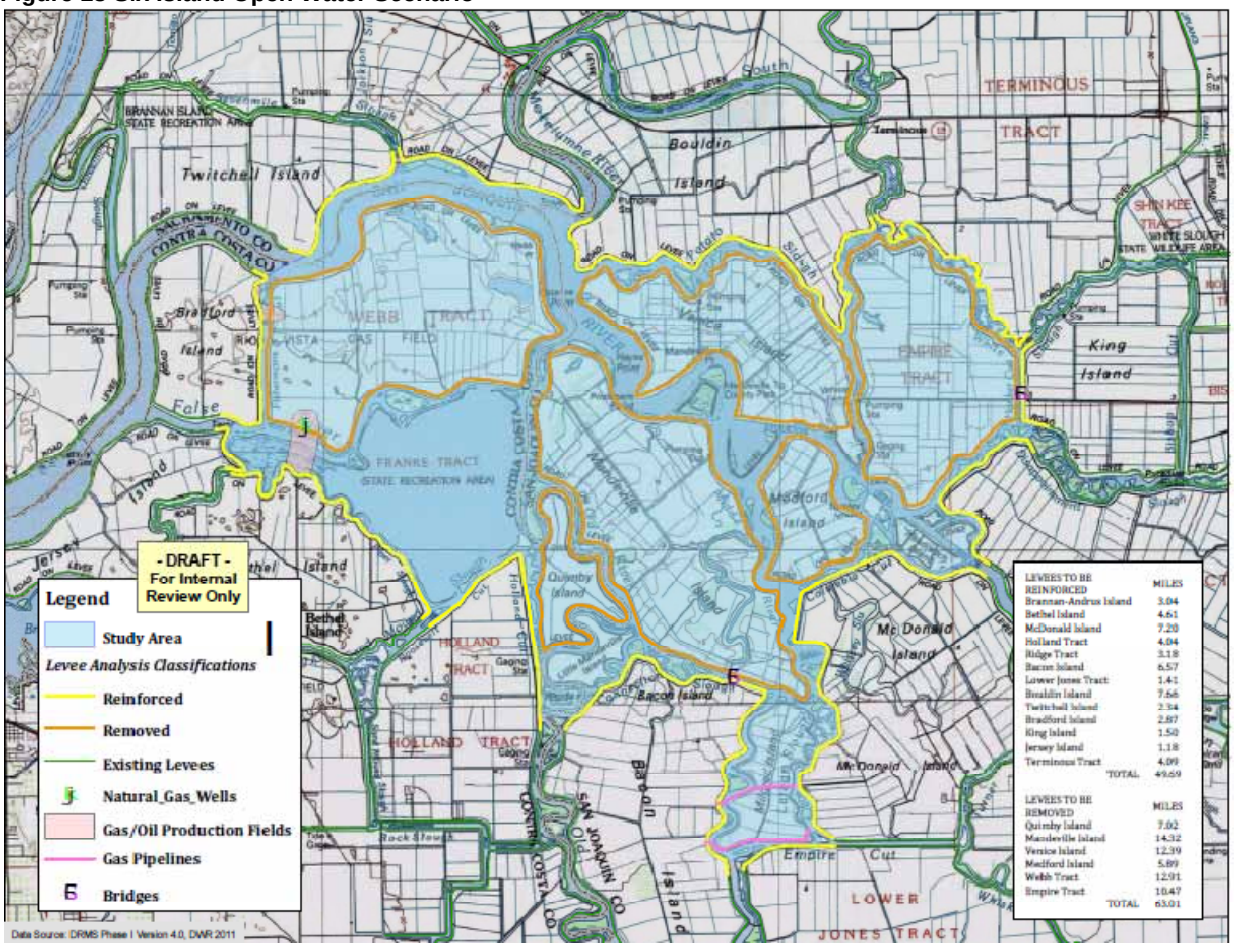
[20] See Figure 5.3, page 220 of "Managing California's Water: From Conflict to Reconciliation." (http://www.ppic.org/main/publication.asp?i=944) and Figure 4 of "Levee Decisions and Sustainability for the Sacramento-San Joaquin Delta." http://watershed.ucdavis.edu/pdf/Suddeth-Mount-et-al-2010-SFEWS.pdf

[21] See http://dscstage.calwater.ca.gov/sites/default/files/documents/files/Jeffrey_Mount_010711_0.pdf and Figure 9 of "Levee Decisions and Sustainability for the Sacramento-San Joaquin Delta." http://watershed.ucdavis.edu/pdf/Suddeth-Mount-et-al-2010-SFEWS.pdf

figures illustrate six islands in the Central Delta as open water. These islands are the most attractive candidates for open-water habitat because they are contiguous, very sparsely populated, mostly grow low-value agricultural crops, and are not crossed by completed major infrastructure such as highways, railroads or natural gas pipelines. However, Empire Tract has major infrastructure currently under construction as it is the location for the intake and a significant section of pipeline for the City of Stockton's $217 million Delta Water Supply Project.[22] This infrastructure was not considered in the UC-Davis/PPIC studies, and adding the value of this infrastructure to the framework would almost certainly take Empire Tract out of consideration as well. Some other studies place Webb Island in the group of western islands critical for protecting through Delta water exports from salinity, and thus Webb islands' levees may also be considered major infrastructure.

While the lack of physical infrastructure and population substantially reduces the cost of permanent flooding compared to nearby islands like Bouldin, McDonald, and Empire, eliminating these islands would still entail significant economic costs. These costs would include but are not limited to the elimination of about 10,000 acres of farmland and some recreational facilities, increased dredging costs for the Stockton Deepwater Ship Channel, and significant reinforcement of nearly fifty miles of adjacent levees that would be subject to increased pressure from waves and under seepage.

Figure 13 Six Island Open Water Scenario



[22] http://www.deltawatersupplyproject.com/

Increase to Urban Levees in Targeted Areas

In this scenario, areas surrounding legacy communities or other strategically targeted areas, would have levees upgraded beyond the PL 84-99 standard to offer 100-year flood protection and allow non-urban levels of development and investment that could be consistent with the rural character of the Delta. Although costly, this scenario could reduce some of the constraints on economic development within the Delta, and allow for a more sustainable future for Delta legacy communities.

5 Regulatory Scenarios

In these scenarios, we take a first pass at envisioning how adjustments to the land use regulatory framework could affect economic sustainability in the Delta. The 3rd draft of the Delta Plan under development by the Delta Stewardship Council envisions expanded land use regulations in the legal Delta to support the co-equal goals of water supply reliability and ecosystem restoration. In contrast, some of the Delta counties are interested in reducing the restrictions in the current Delta Protection Commission guidelines in concert with increased flood control investments.

Increased Land Use Regulation (Delta Stewardship Council Proposal)

Increasing the regulatory power of the Delta Stewardship Council could affect economic sustainability in the Delta. As the Stewardship Council's third draft plan is written, any proposed investment in the legal Delta outside the existing spheres of influence of incorporated cities would be regulated by the Delta Stewardship Council if it were to take place in a location that is a potential location for a conservation measure or water conveyance facility in the future. Compared to the current regulatory framework, the proposal would increase the level of regulation in the primary zone and expand the regulatory reach of state agencies in the Delta into most of the secondary zone. The policy would restrict and increase the cost of property improvements for many Delta residents, businesses, and local governments beyond that experienced in other areas of the state making the Delta a comparatively less attractive area for new investment.

Specifically, the 3rd draft of the Stewardship Council's Delta Plan states (Chapter 3, page 35, **bold emphasis added**):

> However, in some cases, actions taken by local or State agencies are "covered actions" as defined in Water Code section 85057.5. **The State or local agency proposing to carry out, approve, or fund a "covered action" certifies the consistency of the covered action with the Delta Plan and files a certificate of consistency with the Council.** A certificate of consistency may be appealed to the Council within 30 days, alleging that the proposed covered action is not consistent with the Delta Plan…
>
> Only certain activities qualify as covered actions, and the Act establishes both criteria and exclusions. This Delta Plan further clarifies what is and is not a covered action. As an example, routine levee maintenance by a reclamation district in the Delta would not be a covered action because it is statutorily excluded. Also, an addition to a house in an incorporated city would likely not be a covered action because it would not appear to have a significant impact on the Delta. However, a new intake for water supply from the Delta, development of a

subdivision in a Delta floodplain that does not meet exclusion criteria in the Act, or establishing a new tidal marsh area are likely to be covered actions.[23]

This Delta Plan incorporates and builds upon existing state policies where possible, with the intention of meeting the Act's requirements without establishing an entirely new set of policies. For example, Delta Plan regulatory policies on reducing flood risk incorporate recent California legislation that requires upgrades to levees protecting urban areas.

In other cases, Delta Plan regulatory policies seek to prevent actions that may preclude the future implementation of projects that meet the requirements of that Act, such as the acquisition of floodplain area for construction of a new bypass or restoration of certain lands uniquely suited to habitat. Similarly, the Delta Plan includes regulatory policies to protect floodplains and floodways until studies are completed by the Department of Water Resources.

Reduced Land Use Regulation in and around Legacy Communities

While the trend is towards increasing regulation at the state level, some local governments around the Delta are interested in reducing regulation to promote economic development. The signs of stagnation within existing communities are thought by some to be caused by excessive regulation that discourages new investment. One mechanism proposed for reducing regulation is to shift some of the Delta Legacy Communities from the Primary to the Secondary zone, a change that would require an act of the state legislature. Some small adjustments may also be accomplished through revisions to the Delta Protection Commission's Land Use and Resource Management Plan.

In addition to the Delta Protection Commission Plan and County General Plans, it is important to note that all of these areas have been remapped into the FEMA 100-year flood zone, or are in the process of being added to the 100-year flood zone. Thus, reduced regulation would have little impact unless it was combined with increased flood control investments and technical evaluations to achieve designation for 100-year flood protection or potentially 200-year urban flood protection in the designated area. The increased development opportunities could generate resources to help finance flood control and other infrastructure investments in Legacy Communities, but are unlikely to be self-financing at a scale that is consistent with the rural character of the Delta. Thus, the analytical chapters will consider the increased flood control and reduced land use regulation scenarios as a package rather than individually.

[23] There are specific exemptions for land in the Secondary Zone that are consistent with a sustainable communities strategy or where a notice of determination was filed by September 30, 2009. For a more detailed list see Water Code section 85057.5.

Chapter 7: Agriculture

THIS CHAPTER IS UNDER DEVELOPMENT

1 Current Status and Trends

1.1 Mapping Delta Agriculture

Delta agriculture is part of a complex and constantly changing landscape, and thus presents many challenges to precise measurement. Over the past few years, studies and data collection by a range of state and federal agencies have yielded results which provide a detailed overview of the Delta's diverse agricultural backdrop. The use of empirical techniques such as satellite imaging, digitization of farm records, field surveys, and public review have accumulated a wealth of information pertinent to policymaking. None of the data sources described below is complete in itself, but in leveraging them collectively we attempt to create the best available picture of the Delta agriculture and its broad role in the Delta economy.

1.1.1 Land Use Data

Field Borders

Due to California law requiring full reporting of agricultural pesticide use, each Delta county collects information from farmers on all crop fields in which pesticide applications are conducted. Through the use of geographic information system (GIS) software, four of the Delta counties digitally map that data to form a mosaic of agricultural fields within their borders. This data is extremely useful, as it provides recent data on fields intended for actual use and harvest, and includes specific information on the crops each land manager intends to grow in the coming year. This data enables our analysis of Delta agriculture at an extremely granular level, that of the individual crop field. Approximately 90% of Delta acreage in our study is represented at this level. One challenge presented by this data is that though the vast majority of crop fields have some form of pesticide application, the small percentage that do not is not included and must be estimated by other means.

National Agricultural Statistics Service

For the two counties which do not digitally map their field borders, we rely on satellite remote sensing data captured and made available by the National Agricultural Statistics Service (NASS). The data collected by this agency is applied in a wide range of agricultural applications, and the accuracy of the methods used to determine crop type is quantified in detail. Though less accurate than direct field borders reporting, this data allows us to locate agriculture not permitted for pesticide use, in addition to providing a means to survey Delta land not covered by field borders.

Farmland Mapping and Monitoring Program

For estimates of total farmland acreage we employ GIS data collected by the California Farmland Mapping and Monitoring Program (FMMP). This state program uses a combination of satellite imagery, public review, and field surveys to produce a complete map of the state's

agricultural lands. We also leverage FMMP maps by making use of their categorization of grazing land. Though grazing land is not actively farmed, it is sometimes incorrectly captured in the NASS data as active pastureland, and by more closely examining areas marked by FMMP as grazing land we are able to eliminate such errors.

National Agriculture Imagery Program

Public satellite imagery provided by the National Agriculture Imagery Program is used to resolve major inconsistencies between the previously described data sources. While it is impossible to eliminate the more minute discrepancies, for large acreage areas in which conflicts are noted NAIP photos allow us to look directly at the area in question and ascertain into what land use category a parcel should be attributed.

1.1.2 Revenues, Profits, and Costs Data

County Crop Reports

In order to determine aggregate revenues from Delta crop production, we use crop yield and price figures published in each county's annual crop report. Though the values used in reporting are collected through a variety of sources and represent average yields for the entire county, they offer the most practical means of determining total revenues from Delta agriculture. Where possible, we have also consulted outside sources to obtain more accurate values for Delta-specific agriculture. These sources are described below.

University of California Cost and Return Studies

The University of California Cooperative Extension prepares extremely detailed studies on the costs and returns associated with establishing and maintaining various crops in different regions of the state. Where available, we have used these studies conducted in Delta regions to calculate various costs and profits expected from different agricultural operations in the Delta region.

1.2 Crop Categories

In order to facilitate presentation and analysis of Delta agriculture, it is necessary for us to categorize crops into a limited number of discrete categories. In addition to enabling the use of econometric techniques for forecasting future land use, these categories allow for the broader overview of Delta agriculture presented in the tables and maps throughout this report. Examples of major Delta crops from each category are outlined in Table 5 below.

Table 5 Crop Category Examples

Deciduous	*Pear, Almond, Walnut, Cherry*
Field	*Corn, Safflower, Dry Beans*
Grain	*Wheat, Oats, Barley*
Pasture	*Alfalfa, Pastureland*
Truck	*Tomato, Asparagus, Potato, Blueberry*
Vineyard	*Grapes*

1.3 Delta Agricultural Acreage

Total Farmland Acreage

All agricultural production in the Delta is dependent on high-quality farmland able to support it. Adequate soil quality, moisture, and temperatures are just a few of the characteristics necessary to support sustainable high yields. FMMP mapping uses a tiered system of farmland categories which provide a comprehensive view of agriculture suitability around the Delta. Since FMMP surveys are updated every two years, they also allow observation of the continuing effects of urban growth and expansion on agricultural farmland. The table and figure below offer a snapshot of Delta farmland in 2008, the most recent year from which FMMP maps are currently available. The total size of available farmland in the Delta is 500, 383 acres, with almost 80% of the total acreage designated in the FMMP's top tier of "Prime Farmland."

Table 6 Total Farmland Acreage, 2008

County		Class	
San Joaquin	267,741	Prime Farmland	396,554
Sacramento	71,722	Farmland of Statewide Importance	33,360
Yolo	54,644		
Solano	53,509	Unique Farmland	29,525
Contra Costa	49,685	Farmland of Local Importance	40,944
Alameda	3,082		
Total	**500,383**	**Total**	**500,383**

Harvested Acreage and Crop Allocation

Our analysis places the total size of Delta agriculture at 423,491 acres. Acreage includes all irrigated crops and pastureland, but excludes grazing land. Table 7 depicts the total acreage of each crop category by county, as well as totals for the entire Delta. Table 8 depicts the largest crops by total acreage.

Table 7 Delta Agricultural Acreage, 2010

Crop Class	*San Joaquin*	*Sacramento*	*Yolo*[1]	*Solano*[1]	*Contra Costa*[2]	*Alameda*[2]	TOTAL
Deciduous	7,127	6,902	816	486	1,426	82	**16,839**
Field	86,673	24,393	8,118	11,663	13,319	5	**144,171**
Grain	19,579	5,518	5,806	8,407	10,056	2,263	**51,629**
Pasture	51,976	14,992	16,034	30,557	15,850	1,008	**130,417**
Truck	37,788	3,482	3,519	1,258	215	4	**46,266**
Vineyard	10,477	8,295	9,194	1,528	1,074	1	**30,569**
TOTAL	**213,620**	**63,582**	**43,487**	**53,899**	**41,940**	**3,363**	**419,891**

[1] Pasture acreage adjusted using NASS estimates.

[2] NASS data used due to lack of recorded field borders.

Figure 14 FMMP Delta Farmland Coverage

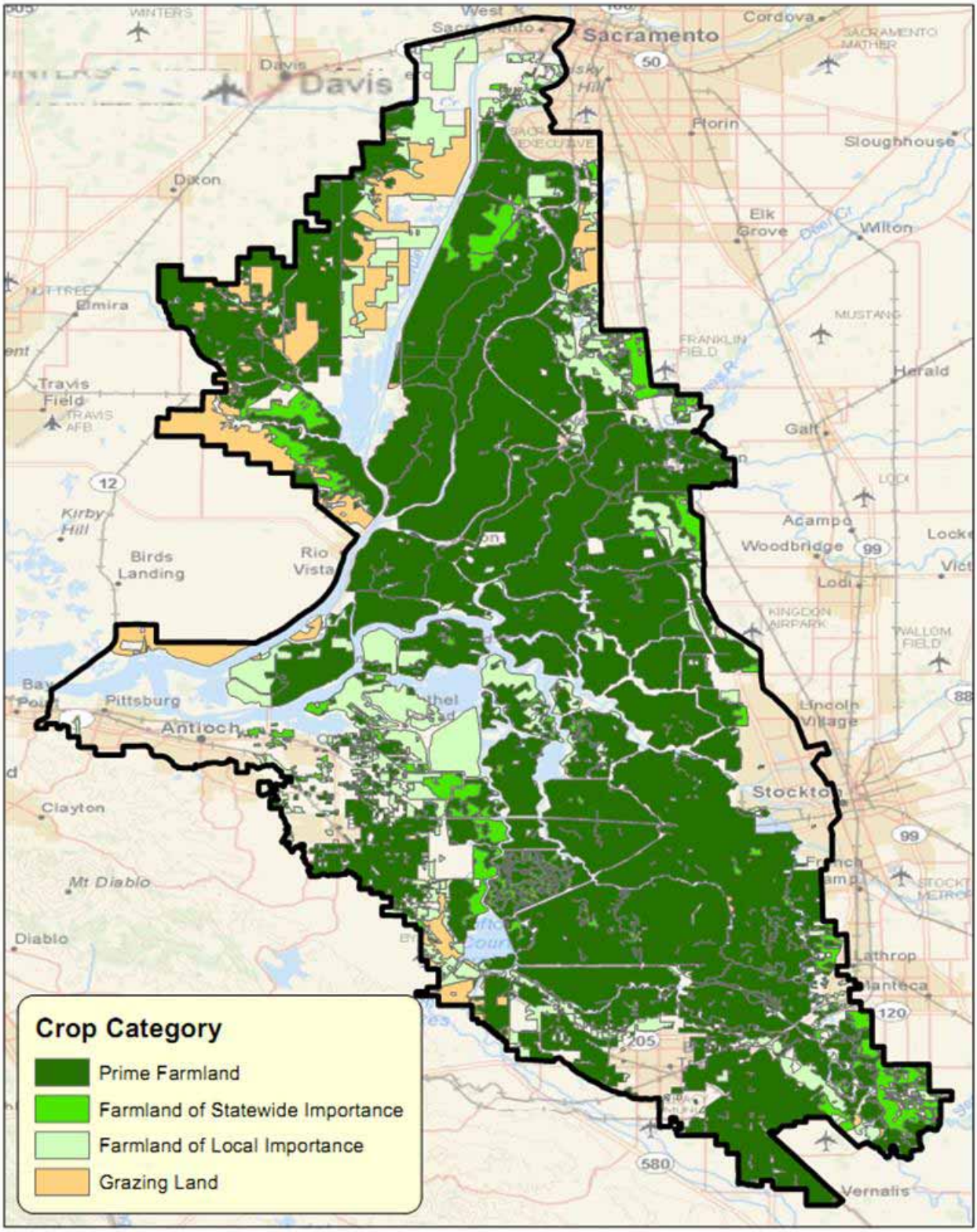


Figure 15 Agricultural Land Cover, 2010

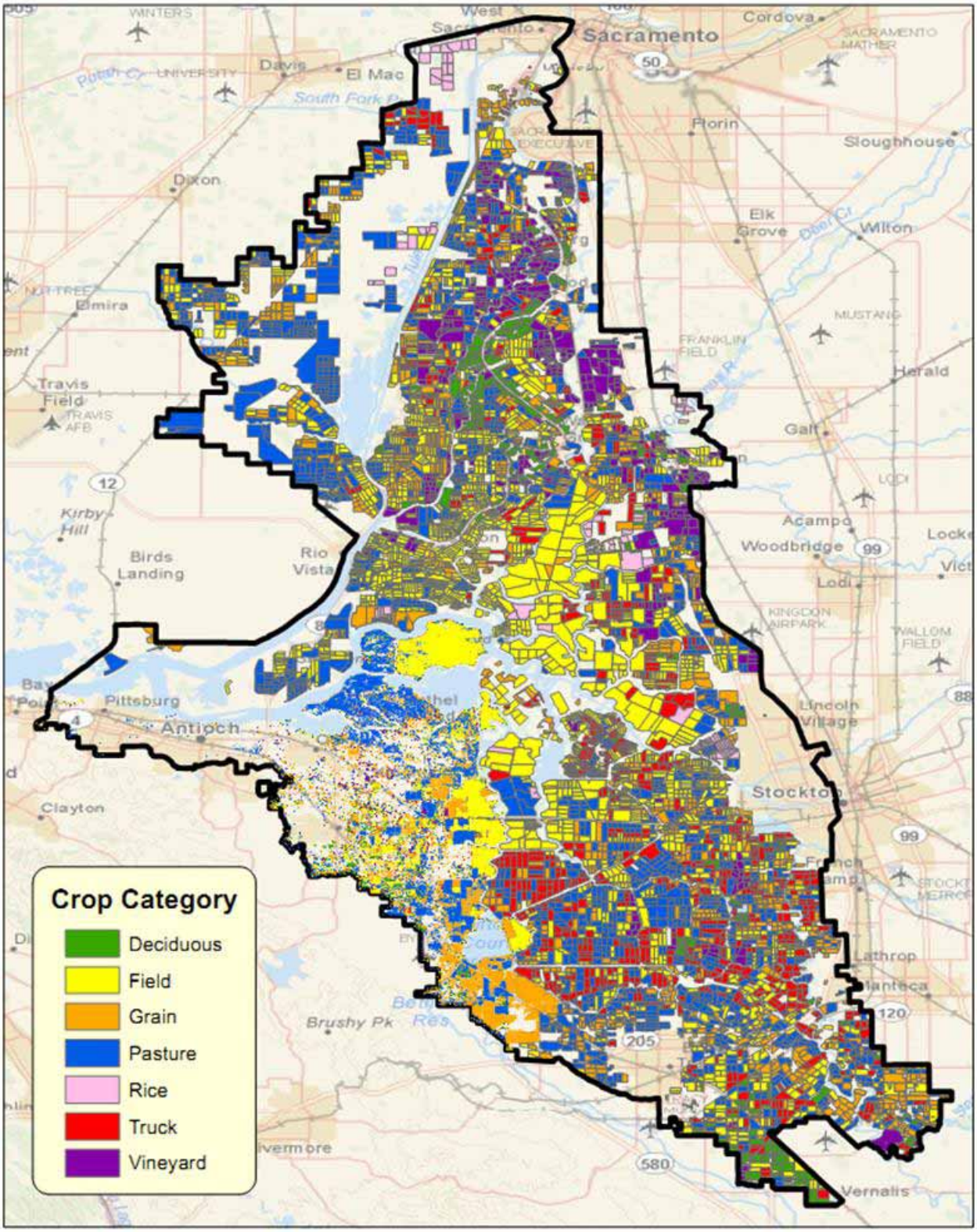


Table 8 Top 20 Delta Crops by Acreage, 2009

	Crop	Acreage	Value
1.	Corn	105,362	$92,975,715
2.	Alfalfa	91,978	$66,027,076
3.	Processing Tomatoes	38,123	$117,242,615
4.	Wheat	34,151	$17,549,215
5.	Wine Grapes	30,148	$104,990,142
6.	Oats	15,847	$4,195,540
7.	Safflower	8,874	$3,312,014
8.	Asparagus	7,217	$50,050,037
9.	Pear	5,912	$36,746,649
10.	Bean, Dried	5,493	$3,990,318
11.	Rice	4,874	$6,822,488
12.	Ryegrass	4398	$1,061,436
13.	Cucumber	3,737	$7,866,553
14.	Potato	3,353	$28,605,465
15.	Almond	3,121	$8,776,101
16.	Sudangrass	3,025	$1,398,634
17.	Walnut	2,512	$9,453,874
18.	Pumpkin	2,103	$7,926,038
19.	Watermelon	1,717	$7,953,590
20.	Cherry	1,486	$11,490,843

1.4 Delta Agricultural Revenues

Using our acreage analysis described above, we are able to calculate total Delta agriculture revenues by multiplying the acreage of each individual crop by the yield and unit price reported in county crop reports. This produces a total of $660 million dollars in revenues from Delta agriculture in 2009. Tables 9 and 10 depict total revenue by crop category in each county and the top Delta crops in terms of revenue.

Table 9 Delta Agricultural Revenues, 2009 (in $1000s)

Crop Class	*San Joaquin*	*Sacramento*	*Yolo*	*Solano*[1]	*Contra Costa*[2]	**TOTAL**
Deciduous	25,118	41,738	3,345	1,347	8,667	**80,215**
Field	65,453	17,164	4,860	9,331	19,327	**116,135**
Grain	14,539	2,775	1,618	4,615	288	**23,835**
Pasture	46,801	5,902	5,753	8,113	3,084	**69,653**
Truck	217,491	19,148	11,570	3,389	13,871	**265,469**
Vineyard	32,099	28,474	32,718	5,042	6,657	**104,990**
TOTAL	**401,501**	**115,201**	**59,864**	**31,837**	**51,894**	**660,297**

[1] Crop value calculations use 2010 field borders acreage.

[2] Values include all reported county crop report acreage due to lack of reported field borders.

Figure 16 Average Revenues per Acre

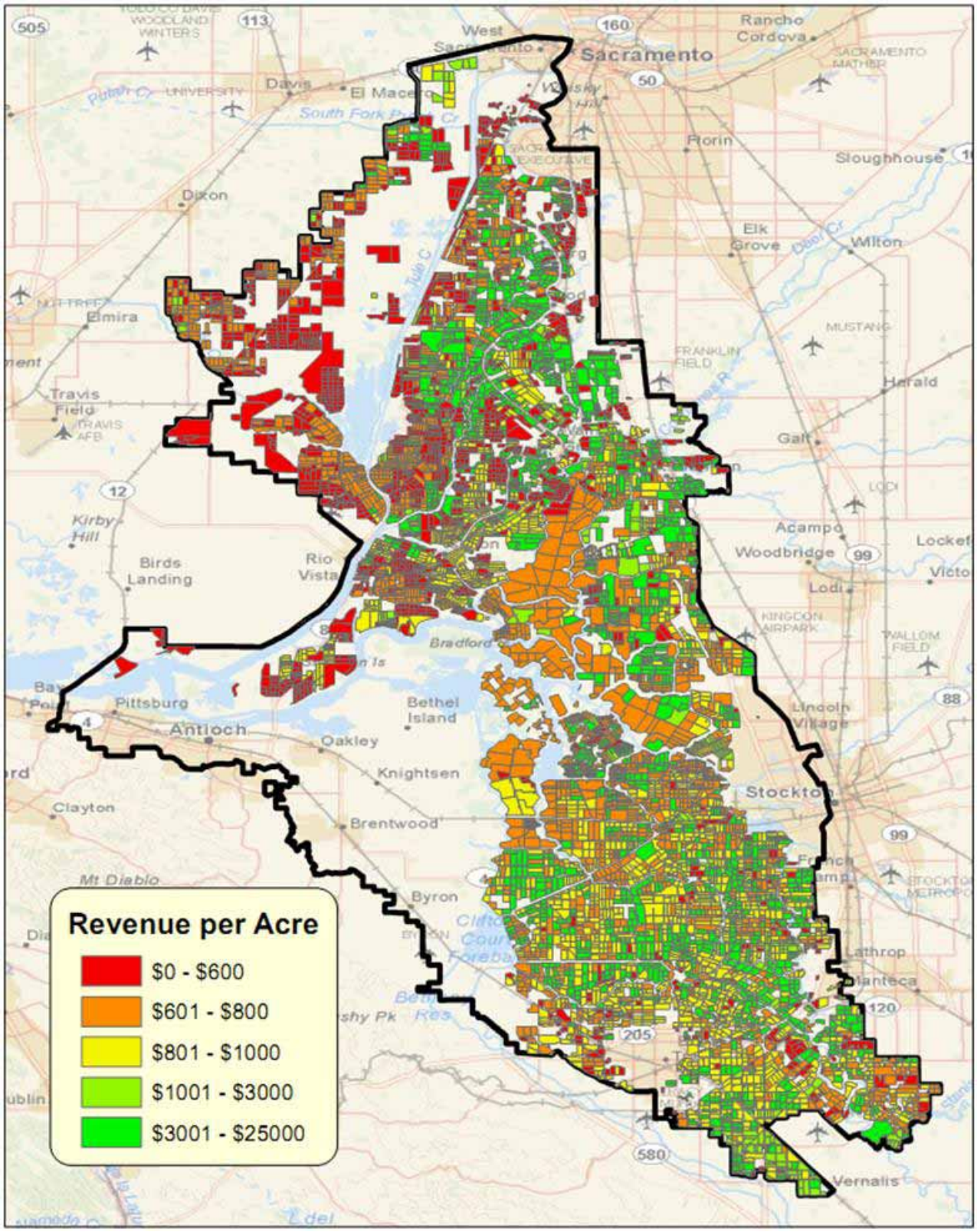


Table 10 Top 20 Delta Crops by Value, 2009

	Crop	Value	Acreage
1.	Processing Tomatoes	$117,242,615	38,123
2.	Wine Grapes	$104,990,142	30,148
3.	Corn	$92,975,715	105,362
4.	Alfalfa	$66,027,076	91,978
5.	Asparagus	$50,050,037	7,217
6.	Pear	$36,746,649	5,912
7.	Potato	$28,605,465	3,353
8.	Blueberry	$25,255,917	1,097
9.	Wheat	$17,549,215	34,151
10.	Cherry	$11,490,843	1,855
11.	Almond	$8,776,101	3,121
12.	Walnut	$9,453,874	2,902
13.	Watermelon	$7,953,590	1,717
14.	Pumpkin	$7,926,038	2,104
15.	Cucumber	$7,866,553	3,529
16.	Rice	$6,822,488	4,874
17.	Pepper	$6,247,592	1,289
18.	Apple	$4,455,826	846
19.	Oat	$4,195,540	15,847
20.	Bean, Dried	$3,990,318	5,493

2 Outcomes and Strategies Under Baseline Conditions

2.1 Long-run Forecasted Land Allocation

We employ a multinomial logit model to forecast future land allocation conditional on its current allocation and other exogenous variables, including soil quality, salinity, temperature, slope, and field size. The model generates estimates the probability of observing a given crop type in each specified field over a long-term time horizon. It is trained on a dataset of over 6,000 individual crop fields for which we have annual crop data for each year from 2006 through 2010.

Table 11 Long-run Land Allocation Forecast

	Deciduous	Field	Grain	Pasture	Truck	Vineyard
Current Land Allocation	4.01%	34.34%	12.30%	31.06%	11.02%	7.28%
Forecasted Land Allocation	4.90%	26.17%	10.04%	30.09%	21.57%	7.23%
Land Allocation Change	+0.89%	-8.16%	-2.26%	-0.97%	+10.55%	-0.05%
Relative Crop Change	+22.12%	-23.77%	-18.37%	-3.11%	+95.76%	-0.73%
Acreage Change at 2010 Production Levels	+3,725	-34,269	-9,484	-4,056	+44,304	-223

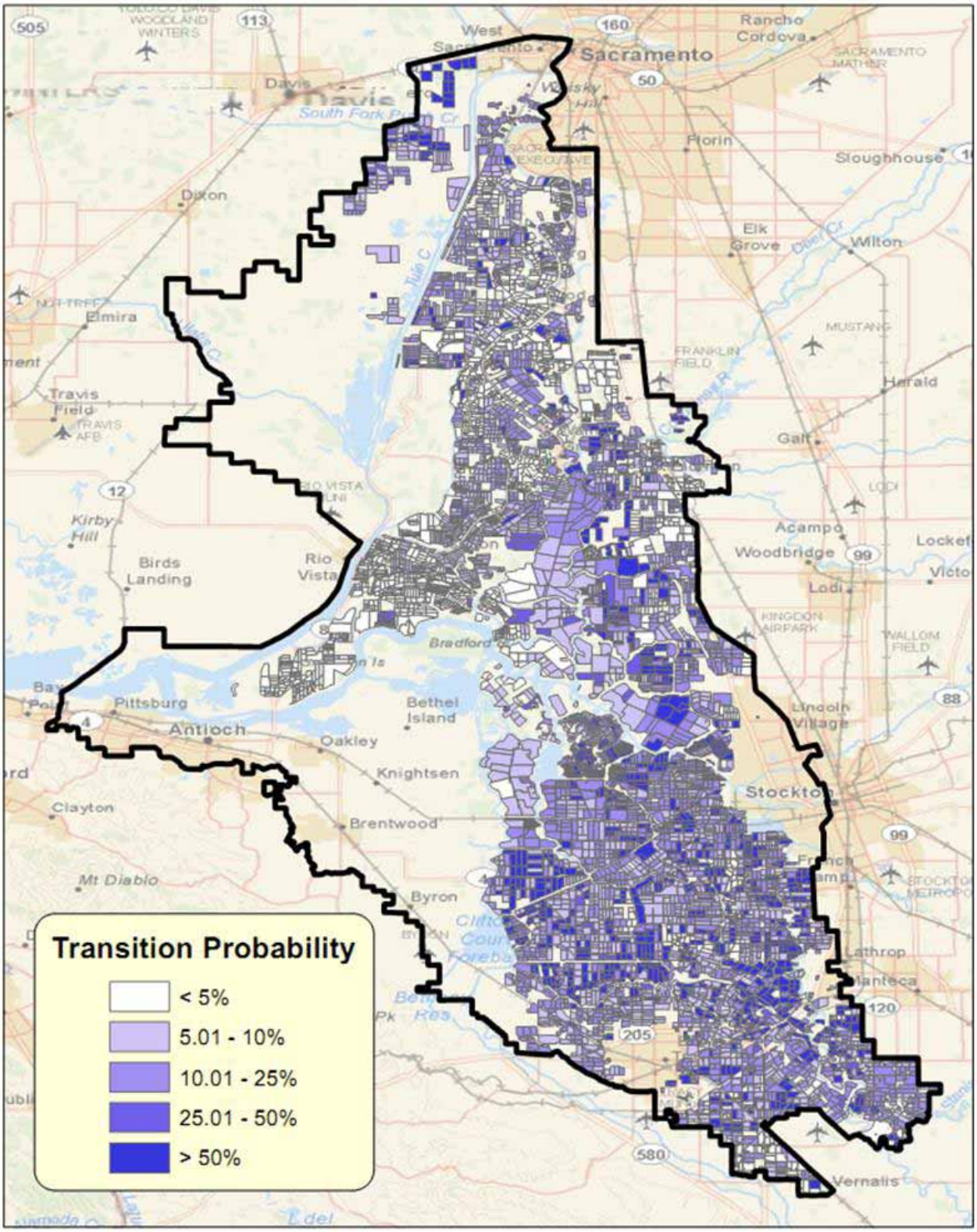
The preliminary results of our long-run land allocation forecast are contained in Table 11 above. Significant growth is predicted in truck and deciduous crops, with the largest decline among field and grain crops. This indicates a trend towards increased planting of high-value crops, which would lead to an estimated $114 million increase in total agriculture revenue assuming current crop category mix and 2009 prices. Forecasted revenue changes are illustrated in Table 12 below.

Table 12 Long-run Agricultural Revenue Forecast

Crop Category	Current Revenue ($1,000s)	Forecasted Revenue ($1,000s)	Revenue Change ($1,000s)
Deciduous	80,215	88,939	+8,724
Field	116,135	82,996	-33,139
Grain	23,835	19,730	-4,105
Pasture	69,653	83,295	+13,642
Truck	265,469	395,627	+130,158
Vineyard	104,990	104,659	-331
TOTAL	**660,297**	**775,246**	**+114,949**

A map depicting field-level transition probabilities to truck crops is shown in Figure 17 on the following page. The map includes the individual transition probabilities of each field for which we have sufficient field borders data. Most predicted future truck crops are located in the southern end of the Delta, which very few predicted in the western region near the inlet to the bay. This is largely explained by greater salinity levels in the western Delta that adversely impact the yields of processing tomatoes and other common truck crops.

Figure 17 Probability of Long-run Transition to Truck Crops



3 Impact of Policy Scenarios

3.1 Salinity Impacts of Isolated Conveyance Facilities

The introduction of isolated conveyance facilities is expected to significantly impact salinity levels, particularly in the Western and Southern Delta. Rising salinity levels would lead to decreased yields for many sensitive crops, and alter the future agriculture landscape of the Delta. Overall, the changes brought on by increasing salinity would we expected to have a starkly negative effect on Delta agricultural revenues. The maps from previous sections reveal that many of the highest value crops are concentrated in the south Delta, and under current conditions acreage of those crops is expected to increase, bringing greater economic benefits to the Delta region. However, these crops also tend to be the most sensitive to increases in salinity, and thus the most vulnerable to the water quality changes brought on by the introduction of isolated conveyance facilities.

Incorporating measurements of salinity throughout the Delta as an exogenous variable in our model allows us to capture the marginal impacts on crop choice of changes in salinity. We can then use these observations to predict how the agricultural composition of the southern Delta would change if it was subjected to salinity levels comparable to those in the western Delta, or any other scenario of changing water quality. We can then use our calculations of crop value to estimate impacts on agricultural revenues resultant of potential changes.

3.1.1 Salinity Data

For the purposes of our baseline salinity modeling, salinity data has been collected for over 50 sites in the Delta region. Our analysis of salinity impacts requires the creation of a variable representing average salinity on an annual basis. Through information gained in a working group and further consultation with Delta farmers, we decided to use a value for the average salinity observed between the months of May – August, a time period in which sensitive crops are most vulnerable to salinity changes in the Delta. Salinity is represented using measures of electroconductivity, in units of micro Siemens per centimeter.

Our modeling also requires the ability to map salinity values to each individual crop field. In order to predict these values, we average salinity measurements across all observation sites in a three mile radius of each crop field. For fields without multiple monitoring stations within that radius, we take the measurement value of the nearest station. We are thus able to generate standardized estimations of salinity for fields throughout the Delta using a replicable technique. A map of the salinity observation stations used as inputs is depicted in Figure 18, and the sources of the station data are described below.

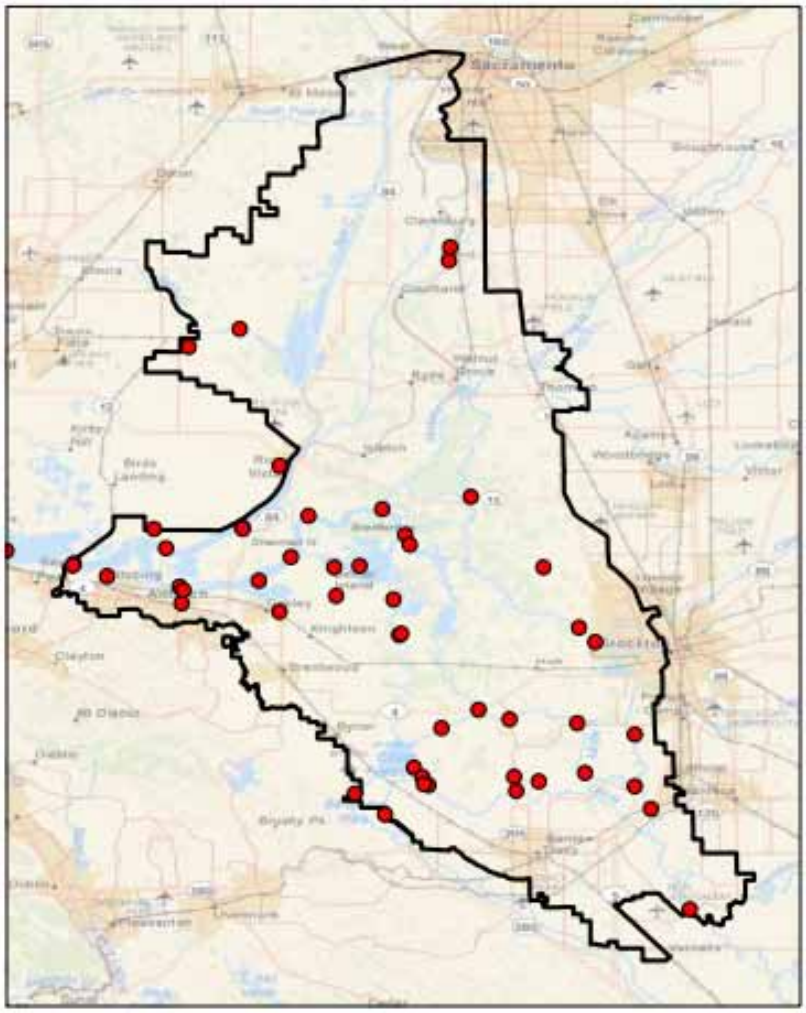
Interagency Ecological Program (IEP)

The IEP samples discrete water quality data at 19 sites throughout the Delta. The sites are chosen in an attempt to represent the major inflows and outflows of the Delta, with new data sampled monthly. All reported observations undergo a detailed quality assurance process prior to being made publicly available. Sampling sites are mapped in GIS using longitudinal and latitudinal coordinates provided by the IEP.

California Data Exchange Center (CDEC)

Additional salinity data is collected from 45 Delta water monitoring stations reported through the CDEC. The sites are maintained by a variety of organizations, including the California Department of Water Resources, the US Bureau of Reclamation, and the US Geological Survey. The sites are sampled daily, and the monthly average is taken based on reported daily values.

Figure 18 Salinity Observation Stations



3.1.2 Salinity Modeling

For preliminary trials, we have established scenarios of increased salinity in the southern Delta regions, comprising fields within BDCP conservation zones 6 through 9. In reality, salinity would not increase uniformly across the region, and future iterations of the model with improved data from DSM2-QUAL projections or another source would generate more precise results. However, the current predictions in Table 13 below give a rough estimate of the magnitude of agricultural revenue impacts associated with potential salinity increases.

Table 13 Forecasted Crop Distribution Changes from Increasing Delta Salinity

Salinity Increase Over Baseline	Forecasted Crop Allocation						Annual Crop Revenues ($1,000s)
	Deciduous	Field	Grain	Pasture	Truck	Vineyard	
0%	4.90%	26.17%	10.04%	30.09%	21.57%	7.23%	775,246
50%	4.90%	28.05%	11.70%	30.24%	18.59%	6.52%	720,082
100%	4.84%	29.76%	13.55%	30.02%	15.93%	5.90%	669,658
200%	4.55%	32.53%	17.72%	28.68%	11.62%	4.90%	584,056

As seen in the above table, truck and vineyard crops are expected to decline significantly under increased salinity scenarios. The converted farmland acreage would most likely be used for field and grain crops, as their proportion of total crop production is expected to rise significantly. Overall, this indicates a large shift from high-value truck and vineyard crops to low-value field and grain crops should salinity levels rise in the south Delta. This shift has significant revenue impacts on Delta agriculture, as total agricultural revenues are forecasted to decline $55 million annually under a 50% salinity increase, and as much as $191 million under a tripling of south Delta salinity levels. These losses would be further amplified by decreased downstream revenues generated by local canneries, wineries, and other processing facilities.

The forecasted shifts in crop distribution are intuitive, as they reflect the salt sensitivity of the dominant Delta crops in each crop category. Processing tomatoes, the dominant truck crop in the Delta, are salt-sensitive, as are wine grapes. Both are expected to decline, while more salt-tolerant grain and field crops are expected to increase their acreage. Pasture crops range in their sensitivity to salt, and a decline in moderately-sensitive alfalfa crops may be balanced out by an increase in more tolerant clovers and grasses. Deciduous crops are largely salt-sensitive but are mainly located outside of areas in which isolated conveyance facilities would have major salinity impacts.

3.2 Loss of Agricultural Value from Habitat Conservation Scenarios

As outlined in Chapter 6, this report seeks to address impacts of five major conservation measures (CMs) proposed by the BDCP. An extremely precise examination of agriculture impacts is not currently possible due to the lack of specificity provided in the BDCP as to where lands would potentially be conserved or restored. The best spatial approximation of targeted areas is provided by the BDCP's delineation of Conservation Zones and Restoration Opportunity Areas (ROAs) for which conservation investments are proposed. By replicating the spatial extent of these zones and analyzing the agricultural landscape of each, we estimate the impacts on agriculture each conservation measure would entail.

Table 14 below illustrates the total agricultural acreage and average revenue generated by crops fields in each of the BDCP's conservation zones. In addition, a list of the conservation measures with significant impacts in each conservation zone is provided. A map of Delta crop fields and their associated conservation zone is included in Figure 19.

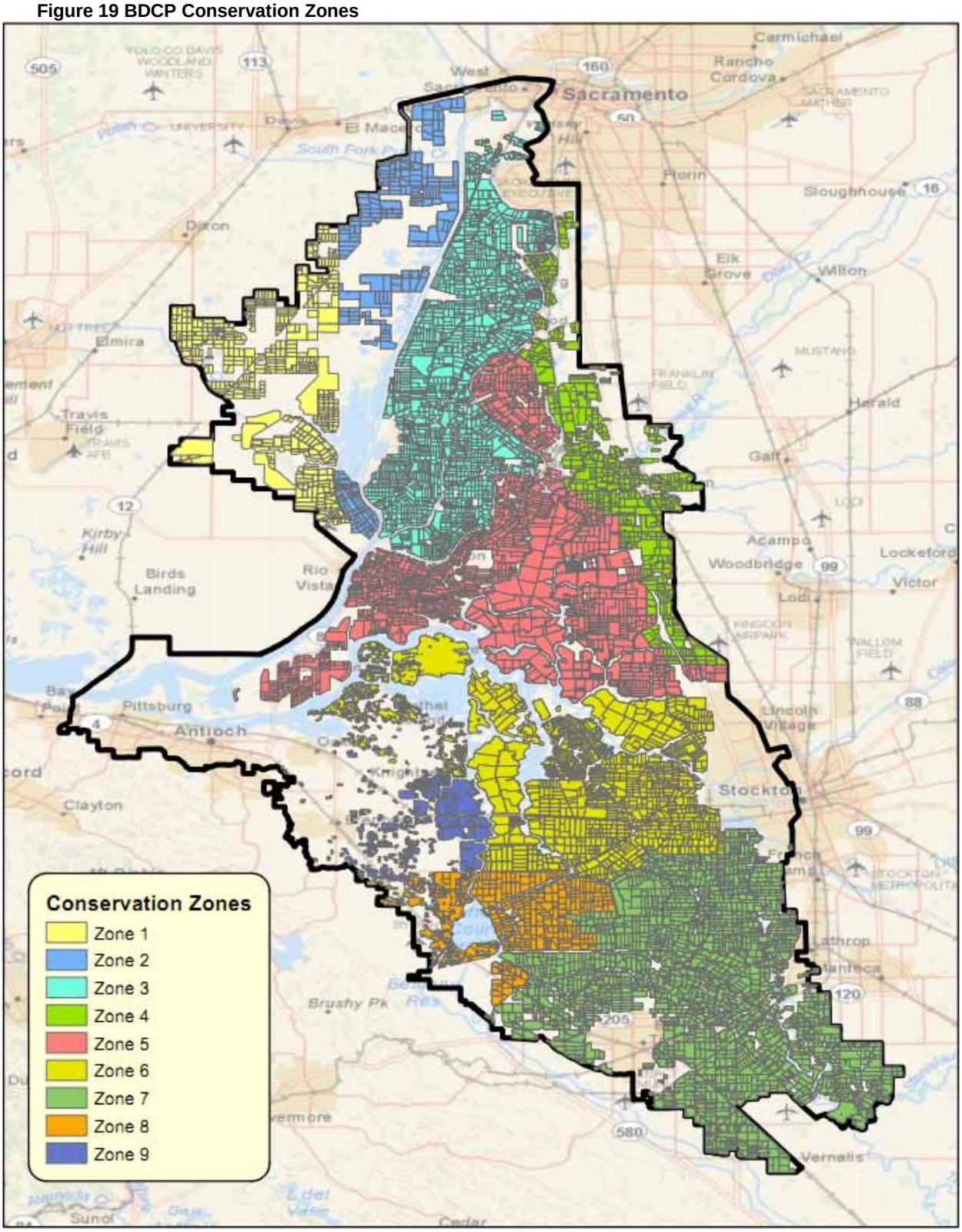
Table 14 Agricultural Composition of BDCP Conservation Zones

Conservation Zone	Agricultural Acreage (2010)	Revenue per Acre (2009)	Relevant Conservation Measures
1	31,030	$463	CM3, CM4
2	14,064	$802	CM2, CM3, CM4
3	59,011	$1,474	CM6
4	26,441	$2,075	CM3, CM4, CM6
5	75,239	$1,838	CM3, CM4, CM6
6	71,219	$1,885	
7	89,716	$1,823	CM3, CM4, CM6
8	27,595	NA	
9	15,809	NA	

3.2.1 Conservation Measure 2: Yolo Bypass Fisheries Enhancement

Major impacts on agriculture from CM2 will come from the potential acquisition of lands through fee-title or conservation and flood easements. The largest source of revenue in the affected conservation zone comes from rice fields located along the northern region of the Yolo Bypass. In addition, preservation of those rice fields would help achieve conservation targets for the giant garter snake outlined in Conservation Measure 3. The high acreage of low-value pastureland and rangeland in conservation zone 2 mean land use change enforced by CM2 would likely have lower revenue impacts than other measures, and the protection of valuable rice habitat would yield additional benefits through preservation of giant garter snake habitat.

Figure 19 BDCP Conservation Zones



3.2.2 Conservation Measure 3: Natural Communities Protection

CM3 requires the acquisition of 32,000 acres in "wildlife friendly" agricultural easements. This forms a significant proportion of the estimated 420,000 acres of agricultural land acreage in the Delta, as 7.6% of land are would need to be regulated under various easements. While some specific targets are cited in the BDCP, the general outline of site selection methodology is not sufficient to currently identify with certainty which agricultural areas may be most affected. The average revenue per acre in each conservation zone presented in Table 16 provides a rough idea of the regions in which land use changes may have the most significant revenue impacts.

Table 15 below provides a more detailed overview of acreage revenue for Delta crops. The average revenue per acre of all Delta agriculture is $1755, while the median is much lower, at $818. This disparity indicates the necessity of taking into account crop distribution in the conservation site selection process in order to mitigate negative economic impacts. In addition, higher revenue crops such as processing tomatoes and wine grapes tend to have the largest downstream revenues, and their per acre revenue is thus an underestimate of total economic benefit to the region.

Table 15 Agricultural Revenue Distribution

Quartile	Revenue per Acre (2009)
25%	$653
50%	$818
75%	$3,000
100%	$23,378
Mean	**$1,755**

3.2.3 Conservation Measure 4: Tidal Habitat Restoration

Of the major conservation measures addressed in this report, CM4 has the most clearly defined geographic areas and restoration targets. The agricultural fields contained in each ROA are shown in Figure 20, with their acreage and value in each region depicted in Table 16 below. The BDCP outlines various restoration targets to be achieved over the next 40 years, with a final target of 65,000 restored acres. In addition, there are minimum values for acreage in each of the four ROAs which must be restored, as shown in Table 16.

Figure 20 BDCP Restoration Opportunity Areas

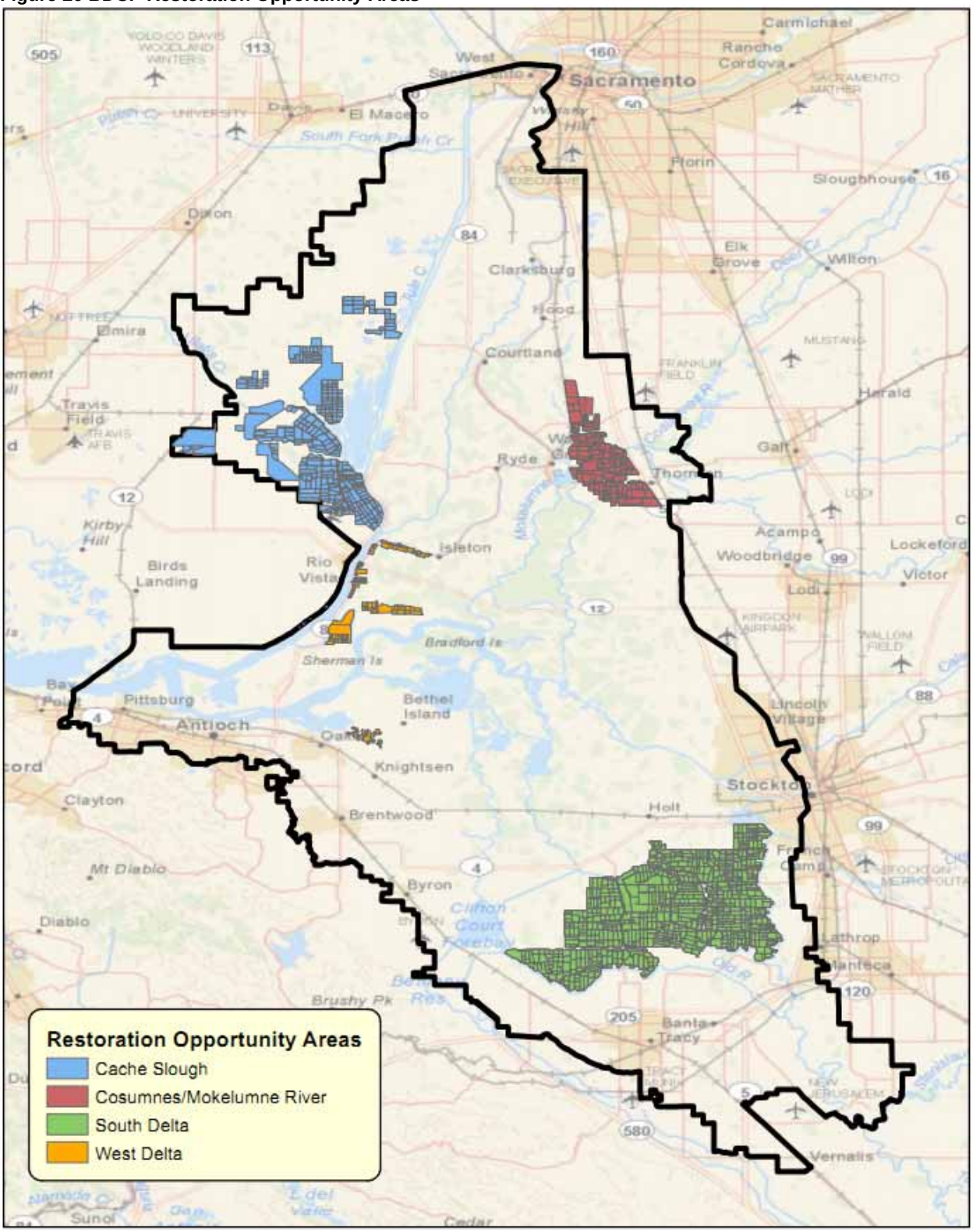


Table 16 Agricultural Composition of BDCP Restoration Opportunity Area

Restoration Opportunity Area (ROA)	Total Acreage	Agricultural Acreage (2010)*	Minimum Restoration Target (Acres)	Revenue per Acre (2009)
Cache Slough Complex	49,167	19,854	5,000	$491
Cosumnes/Mokelumne River	7,805	7,840	1,500	$2,175
South Delta	39,969	34,914	5,000	$2,151
West Delta	6,178	2,587	2,100	$1,279
TOTAL	**103,119**	**65,195**	**13,600**	**$2,014**

*Values may be slightly inflated due to large fields centered within the ROA which extend past its borders.

As can be seen in Table 16, in some regions even the minimum restoration targets will require the acquisition of land currently used in crop production. In addition, both the Cosumnes/Mokelumne River ROA and the South Delta ROA are centered in some of the highest revenue agricultural areas of the Delta. The Cosumnes ROA is largely composed of vineyards which easily generate over $3,000 in revenues per acre annually, not including their downstream economic impacts. The South Delta ROA is likewise composed mainly of alfalfa and processing tomatoes, which also have significant downstream impacts.

Overall, on average agricultural land contained within the ROAs generates $2,014 per acre annually. Even if site selection takes the establishment of high-value crops into account, significant acreage of high-value crops would need to be converted in order to meet even the minimum 10-year restoration target. Meeting the 65,000 acre target set for year 40 would mean a drastically altered agricultural landscape within the ROAs. Even assuming a third of the conservation targets could be achieved on non-agricultural land, at average revenue levels achievement of CM4 would entail over $85 million in losses from direct agricultural revenues per year, almost 13% of the Delta total.

Compared to the other conservation measures, CM4 entails by far the largest necessary direct impacts on Delta agricultural production. The BDCP currently states that the majority of these targeted lands will be determined “based on land availability, biological value, and practicability considerations.” The absence of agricultural impacts from the described methodology is a notable omission considering the potential implications for the Delta economy.

3.2.4 Conservation Measure 5: San Joaquin River Floodplain Restoration

CM5 calls for the restoration of 10,000 acres of seasonally inundated floodplain habitat over a 40-year period, with 1,000 acres restored in the first 15 years. No specific regions are outlined, though the BDCP notes that “the most promising opportunities for large-scale restoration are in the south Delta along the San Joaquin River, Old River, and Middle River channels…” These areas fall almost entirely within conservation zone 7, which is largely occupied by high-value alfalfa and tomato crops and has an average per acre revenue of $1,823. In addition, the identified areas are almost entirely in agricultural production, and a large proportion of the restored floodplain would almost certainly affect land currently in production. Assuming just half

of the restored floodplain is achieved through conversion of south Delta agricultural lands, approximately $9 million in annual direct revenue would affected. The BDCP does indicate that restored floodplains will be managed to allow for continued agricultural use, and effective management would thus ensure that revenue losses from affected lands are minimized.

3.2.5 Conservation Measure 6: Channel Margin Habitat

CM6 requires that twenty miles of Delta waterways be altered to provide additional variable water depth habitat. The BDCP states that such enhancements may be accomplished through modification to the outboard side of levees or by setting back levees in the designated zone. If setback levees are used, they would to some degree cut into established crop fields grown near waterway edges. However, the amount of acreage affected would be minimal and have little impact on Delta agricultural revenues.

3.3 Loss of Agricultural Value from Flood Control Scenarios

Of the two flood control scenarios discussed in Chapter 6, the only scenario with direct impacts on Delta agriculture is the five island open water scenario. The impacts can be quantified simply by looking at the agricultural farmland currently in production on each island. If the five islands were flooded, over 10,000 acres would be lost, with a corresponding loss of around $8.4 million dollars in direct revenues per year. The islands are largely composed of low-value field crops, with average revenue per acre significantly below that of the Delta as a whole. A summary of the affected islands is depicted below in Table 17.

Table 17 Five Island Agricultural Composition

Island	Agricultural Acreage (2010)	Total Revenue (2009)	Revenue per Acre (2009)
Mandeville	2,345	$2,198,583	$1,117
Medford	365	$279,797	$715
Quimby	629	$487,720	$776
Venice	2,587	$2,008,844	$765
Webb	4,469	$3,467,869	$776
TOTAL	**10,395**	**$8,442,813**	**$969**

4 Economic Impact of Delta Agriculture

The previous sections focused on the value and composition of crop production in Delta agriculture. To calculate the economic impact of agriculture in the Delta, we need to consider two additional areas: 1) the value of animal agriculture in the Delta, and 2) the output of local food and beverage manufacturing who are located in the region because of Delta crop output.

4.1 Animal Production in the Delta

Animal and animal product output in the Delta is more difficult to estimate than crop production. It is clear that the Delta is not as oriented towards crop production as many other areas in the Central Valley, although a significant amount of its crop production is alfalfa and field crops that are consumed by animal enterprises outside the Delta. Other reports by the Department of Water Resources and the Delta Stewardship Council White Papers have estimated animal related output in the Delta at about $90 million per year, significantly less than crop production. Our estimates are very similar. We used enterprise data from Dun and Bradtreet and NETS to identify dairy, cattle, and other animal production enterprises located within the legal Delta and compared it to the total number in the counties. We then applied the percentage of animal enterprises in each county located in the Delta to the total animal production in the crop reports for each of the five Delta counties. We estimate $93 million in animal output as shown in Table 18.

Table 18 Animal Output in the Delta

Animal Output	Value
Cattle	$24,097,110
Sheep, Poultry, other livestock	$3,160,977
Milk	$64,322,406
Wool	$94,628
Apiculture	$1,712,879
Total Animal and Animal Products	**$93,388,000**

4.2 Local Source Dependent Food and Beverage Manufacturing

Food and beverage manufacturing is an important economic sector in California and the five Delta Counties. Some of that manufacturing only exists in the region because of local farm outputs, whereas other enterprises are located in the region to serve local consumers are for other reasons. To be conservative, we only use food and beverage manufacturing where we can establish a clear and strong link to local production. We examined geographic distribution of food manufacturing relative to local production throughout the state, as well as the import of grains and other crops into the state from other regions. We determined that many of the agriculture-related manufacturing enterprises in the five counties such as grain milling, snack foods, cereal manufacturing, pet food, cheese manufacturing, animal slaughtering, breweries, and ethanol production can't be strongly attributed to the presence of Delta agriculture. Similarly, although Delta crops are definitely consumed in large quantities by Dairies outside the

Delta, these dairies also use grain and alfalfa transported significant distances and could increase the use of these imported feeds if necessary, although at higher cost. Thus, we conservatively do not attribute any dairy production outside the legal Delta to Delta agriculture.

However, two important regional industries can be strongly linked to local production: fruit and vegetable canning and pickling, and wineries. These local industries are heavily supported by the Delta's two highest value crops, processing tomatoes and wine grapes. Delta wine grapes are roughly 5% of California production by both weight and value. The prices are similar to state averages, much higher than other areas of the Central Valley but much lower than premier growing areas such as Napa and Sonoma. Winery capacity in the Delta and the five Delta counties is small relative to local production, but Napa and Modesto winery capacity is very high relative to local production. The data and interviews with local producers support that Delta wine grape production is supporting significant winery output in nearby Napa County. Cannery production capacity in the five Delta counties is much stronger than winery compared to local output, although some local production is likely supporting a large cluster of processing facilities in adjacent Stanislaus County. Using state and regional production shares of processing tomatoes and other fruits and vegetables commonly canned and pickled, we estimate $722 million of output from the fruit and vegetable canning, pickling, and drying industry in the five county Delta region is dependent on Delta agriculture. Using state and regional shares of wine grape production from the Delta, we estimate $181 million of winery output in the five Delta counties is dependent on Delta wine grapes, and $541 million of winery output in adjacent counties is sourced from the Delta, mostly Napa.

4.3 Economic Impact Estimates

We utilize the IMPLAN 3 model calibrated to 2008 regional and statewide economic data to estimate the overall economic impact of Delta agriculture. As we have done in previous studies of the impact of water supply reductions on south of Delta agriculture, and following a methodology initially proposed by UC-Davis agricultural economists, we have adjusted the default IMPLAN production functions to account for the unusually high use of contract labor in California agriculture. We adjusted the production functions to ensure that virtually all (97%) of the output of the agricultural service sector is utilized by the regional agriculture industry, a methodology that yielded accurate predictions of employment effects in 2009.

For the five county economic impact model, Delta agricultural production, and Delta dependent food processing and winery production was distributed across IMPLAN production sectors according to Table 19. To avoid double counting impacts, we netted out any indirect and induced agricultural production impacts from the food processing and winery industries. The total five county economic impacts are displayed in Table 20. Delta agriculture supported 13,700 jobs, $1.11 billion in value-added, and $2.77 billion in output.

For the California economic impact model, we added in the additional $541 million of Delta dependent winery production from adjacent counties into the totals from Table 19. The economic impact rises from this extra production, and also because the indirect and induced effects grow when accounting from the purchase of inputs and spending income on a statewide rather than five county basis. Table 21 shows that across the state of California, Delta agriculture supports nearly 23,000 jobs, over $1.9 billion in value added, and over $4.6 billion in output.

Table 19 Agriculture Related Output Used for the 5 County IMPLAN model

Industry	Output Value (millions $)
3 Vegetable and melon farming	238.9
4 Fruit farming	191.7
5 Tree nut farming	20.1
10 All other crop farming	69.7
11 Cattle ranching and farming	27.2
12 Dairy cattle and milk production	64.3
14 Animal production, except cattle and poultry and eggs	1.8
54 Fruit and vegetable canning, pickling, and drying	722
72 Wineries	180.5

Table 20 Economic Impact of Delta Agriculture on 5 Delta Counties

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	5,465	$237,501,354	$507,262,180	$1,605,036,480
Indirect Effect	5,685	$269,323,135	$383,743,710	$796,612,528
Induced Effect	2,560	$116,080,527	$215,710,160	$367,500,362
Total Effect	**13,709**	**$622,905,032**	**$1,106,716,150**	**$2,769,149,432**

Table 21 Economic Impact of Delta Agriculture on California

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	6,872	$316,894,592	$612,684,000	$2,098,397,336
Indirect Effect	10,354	$543,196,268	$793,868,280	$1,652,235,400
Induced Effect	5,590	$280,485,258	$506,257,120	$892,533,692
Total Effect	**22,816**	**$1,140,576,112**	**$1,912,809,300**	**$4,643,166,560**

Chapter 8: Recreation and Tourism

The Delta is a significant natural place in California; a mixture of meandering rivers, sloughs, back bays, shipping channels, small communities, historic sites, and agricultural islands with farm markets and wineries. It is huge in scale, covering over half a million acres, with about 60 islands and over 650 linear miles of waterways and channels.

THIS CHAPTER IS UNDER DEVELOPMENT

The Delta is the linkage between the San Francisco Bay area and the Central Valley. It is surrounded by cities and urbanizing areas, some of which have historic roots at the edge of the Delta and its two primary rivers, the Sacramento and the San Joaquin.

So what does the Delta, this unique setting, mean to the approximately 12 million people who live within close proximity? Most do not see it primarily as a water source for the state, or as a rich biological resource, or as an important agricultural production area; although it is all of these. For most, the Delta is best known for the special recreation opportunities found there.

The Delta is a place to slow down and relax, to taste earth's bounty, and to leave the urban areas behind. It is California's boating paradise, one of its most important fishing and waterfowl hunting resources, a place with rich natural habitats for bird watching and nature study, and a scenic place to meander, explore by boat or car, and get lost.

Nearby residents visit virtually everyday, generating a total of roughly 12 million visitor days of use annually and a direct economic impact of more than a quarter of a billion dollars in spending. Recreation is an integral part of the Delta, complementing its multiple resources and contributing to the economic vitality of the region.

1 Current Status and Trends

1.1 Understanding 'Delta as Place' Today

Defining "The Delta" as a place and as a recreation destination is a difficult task. Unlike other well-know water recreation destinations, such as Lake Tahoe or Shasta Lake, the Delta is highly varied in its physical attributes and diverse in its recreation offerings. It is not a single entity, easily conceived in its entirety. Rather, it covers a vast and varied landscape that is viewed and accessed from disparate activity points.

Extending more than 50 miles from north to south, the Delta is sometimes a wide river, though more often it is a network of narrow channels and sloughs. It presents itself from two distinct vantage points, each of which represents a completely different character. One view is from the water of the rivers, where the landscape is often confined by tall levee edges and riparian vegetation, with distant mountains seen beyond. From this perspective, there is little "land side" context; only immediate water surfaces, a nearby river edge, and, perhaps, a view in the far distance. There is almost no visibility of the land beyond the levees, the vast agricultural fields that surround the Delta. The other view of the Delta is the one seen from the roads and levees. Similarly, the view from land largely precludes the water environment. It is only from levee top roads and bridges where the waterways of the Delta are revealed. For those on land, the predominant visual character is defined by the agricultural landscape, existing in isolation from the hidden waterways that surround it.

This setting creates a place of mystery and paradox; it is a region that can be unapproachable and unapparent to visitors. For those who do not already know and visit the Delta, it can be a place that exists in name alone. Many people drive through the Delta without a clear sense of being in it or where it begins and where it ends.

To the visitor, what defines the Delta? In such a vast and disparate environment, the recreation destination is often a network of smaller recreation locations, each one suited to a different type of activity. To windsurfers, the open and windy waters of the larger channels near Brannan Island and Rio Vista might define the Delta. To sailors coming up from San Francisco Bay, this same area, extended up and down river and tied to protected deeper channels and coves, might characterize the Delta. Water skiers and wake boarders might define the Delta by its protected narrower and straighter channels to the south, near Discovery Bay. Fishermen will be attracted to other aspects of the Delta, with differing characteristics, as varied as the fish they are seeking. So, too, kayakers, canoeists, pleasure cruisers, birders, hunters and others on the water, each seeking an aspect of the Delta specific to their interests and pursuits, will define the Delta in their own specific terms. From thicket-edged slough, to narrow rock-faced channel, to spreading open waterway, the Delta has many faces.

Recreationists from the landside may see a completely different Delta place. Shoreline fishermen share the environment seen by those on the water and from the few recreation sites on land, such as campgrounds and picnic areas. Hunters working fields and the edges of sloughs might never see open waterways as they seek game. For the vast majority of visitors to the Delta who never reach the water's edge, the landscape will be essentially one of agricultural fields, levee roads with river views, and the occasional interaction with a legacy community where they can get out of their cars and engage the place on foot. Here, and at wineries and produce outlets, the touring visitor can experience the special landscape and cultural heritage of this prime agricultural area and its rich character.

1.2 Existing Physical Conditions

1.2.1 Resource and Facility Analysis

1.2.1.1 Existing Facilities

Where do people go to recreate in the Delta? People seek out a wide variety of recreation experiences throughout the Delta. A major theme, however, is that primarily they go to private enterprises, including marinas, restaurants, retail establishments, wineries, and farm stands. Public recreation facilities exist, but they are limited and many are natural resources based restricted use areas, such as the Department of Fish and Game's Wildlife Areas and Stone Lakes National Wildlife Refuge. Private nonprofit organizations, such as The Nature Conservancy and Solano Land Trust, also provide recreation opportunities, generally related to habitat areas.

1.2.1.2 Private Facilities

Marinas are a common Delta access point for water recreation. Of the 95 marinas surveyed in 2001 as part of *The 2002 Sacramento-San Joaquin Delta Boating Needs Assessment*[24], 92 were private and three were public facilities. Of the 92 private facilities, 87 were open to the public and five were private membership-based yacht clubs. These 92 private marinas provided a number of facilities to the Delta boater, including boat slips, launch ramps, parking, restrooms,

[24] DBW 2002

picnic facilities, camping sites pumpouts, and fuel stations. Current data regarding business establishments in the Delta indicate that the number of marinas has not changed significantly since the early 2000s. Figure 21 provides a map of recreation zones and Figure 22 show recreation facilities. Table 22 summarizes all facilities by recreation zone with additional information about these zones.

Table 22 Summary of Facilities and Resources by Recreation Zone[25]

	Recreation Zones						
	Northern Delta Gateway (North)	Bypass (Northwest)	Delta Hub (Central)	Delta Breezeway (West)	San Joaquin Delta Corridor (East)	Southern Delta Reaches (South)	Total
Linear Miles of Contiguous Waterways	61	58	132	152	122	110	635
Number of Marinas	8	1	12	56	13	5	95
Boat Slips	988	76	1,271	5,990	2,786	563	11,674
Transient Tie-Ups	20	18	69	115	69	18	309
Launch Ramps	3	1	9	27	11	4	55
Marina Parking Spaces	522	38	918	4,826	1,989	432	8,725
Day-Use Picnic Sites	40	0	52	183	26	23	324
Camp/RV Sites	54	0	247	1,501	327	53	2,182
Fuel Stations	3	0	7	28	12	6	56

The other major private facilities are the numerous private hunting clubs located in the Delta, typically associated with agricultural lands. Very little information exists on the numbers of these facilities, or the number of hunters that utilize them. In a 1997 survey, the Delta Protection Commission identified 23 private hunting facilities, most in Yolo County. Conversations with hunters indicate that there are many more formal and informal hunting clubs located throughout the Delta.

Private non-profit organizations, such as The Nature Conservancy and the Solano Land Trust, also provide for some public recreation on facilities that they manage. The Cosumnes River Preserve, which includes lands owned by both public and not-for-profit organizations, such as Bureau of Land Management, Department of Fish and Game (DFG), Department of Water Resources (DWR), The Nature Conservancy (TNC), Ducks Unlimited, Sacramento County, and the State Lands Commission, has a Visitor Center with picnic areas, interpretive displays, restrooms, and three designated hiking trails and allows bird watching, photography, hiking, and paddling.

Additional private facilities include those catering to Delta-as-a-Place recreationists and tourists, including restaurants, agricultural stands, and wineries. A recent study found 25 attractions/historic places, 17 farmers markets and nine wineries/tasting rooms (Figure 23).

[25] Taken from DBW 2002, Table 2-1, Page 2-5

Figure 21 Delta Recreation Zones

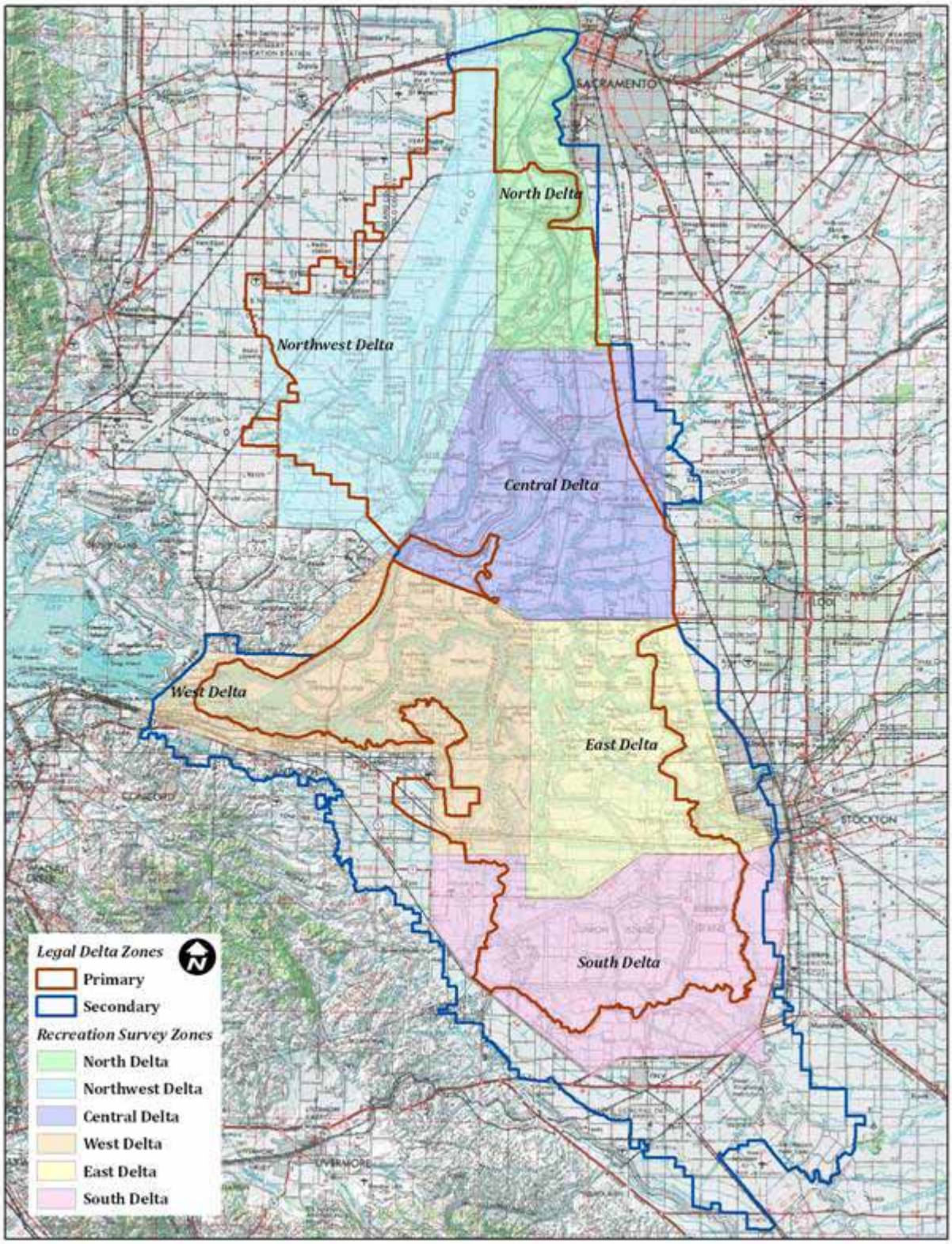


Figure 22 Delta Recreation Facilities

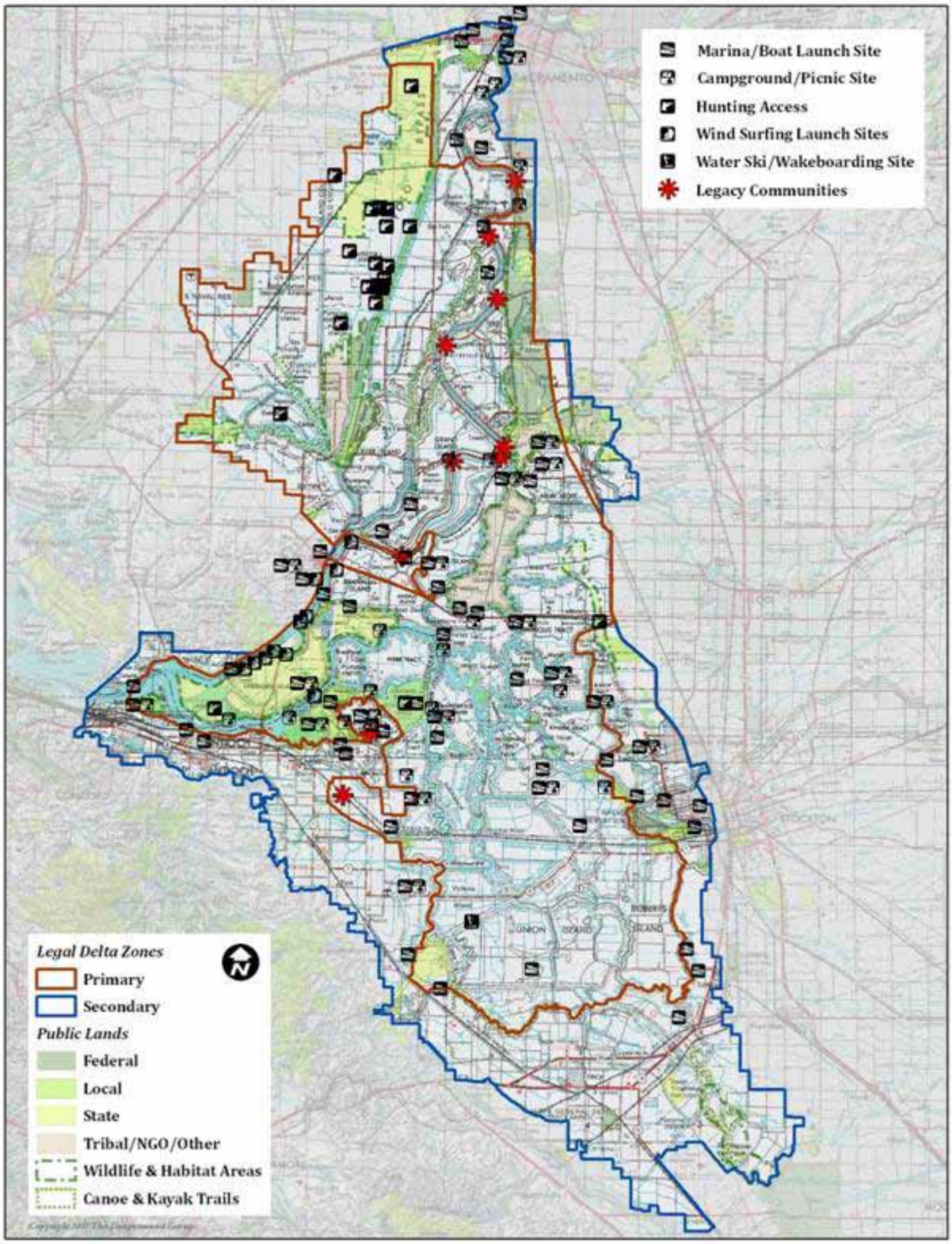
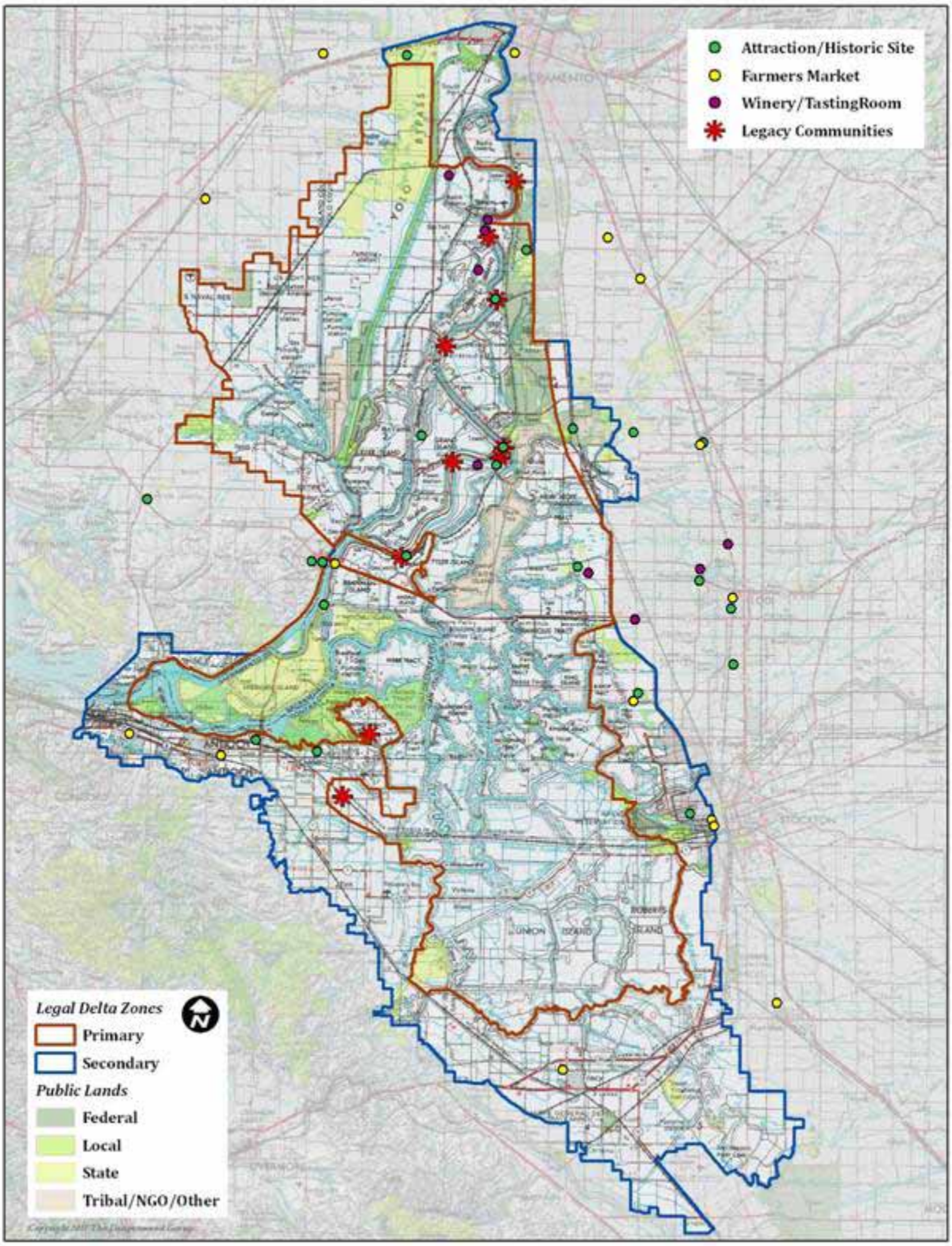


Figure 23 Delta Tourism Facilities



1.2.1.3 Public Facilities

There are a number of publicly owned lands in the Delta, covering almost 40,000 acres. A percentage of these lands are open to public recreation access, including hiking, day use, fishing, hunting, and wildlife viewing. Stone Lakes National Wildlife Refuge is the largest public facility, with 6,200 service-managed acres within its 18,000 acre boundary, but provides limited public access in the form of waterfowl hunting, guided hikes, special events, bird watching, and canoe/kayak tours. Brannon Island State Recreation Area provides some of the best public facilities in the Delta, including three group picnic sites, 300 general picnic sites, 78 miles of non-motorized trails, grassy areas, a campground with 102 developed sites, and six group camping sites[26]. The Department of Fish and Game owns and manages a number of Wildlife Areas, including Acker Island, Lower Sherman Island, Sherman Island, Woodbridge Ecological Reserve, and Yolo Bypass Wildlife Area. These facilities provide for a variety of activities, from bird watching tours to hunting, fishing, wildlife viewing, and education.

A number of public access trails exist or are in development, including the American Discovery Trail, Mokelumne Coast-to-Crest Trail, and the Great Delta Trail. These trails currently support or will provide public access for a variety of recreation activities, including hiking and biking. Additionally, State Highway 160 is a designated State Scenic Highway.

There are also a number of local and regional parks within the Delta, including those provided by the Cities of Tracy, Stockton, and Lathrop, the Counties of Sacramento, San Joaquin and Yolo, and regional providers such as East Bay Regional Parks District. Figure 22 above presents some of these public facilities.

1.2.1.4 Recreation Enterprises in the Delta

Using data concerning business enterprises in the Delta, industry categories that describe the economic activity attributable to recreation and tourism were identified. Nearly 100 business enterprises within the Primary Zone are recreation-related, as presented in Table 23. In the Secondary Zone, there are nearly 1,500 recreation-related enterprises, though many businesses are likely providing for broad urban and non-local recreation opportunities, in addition to serving Delta recreation.

Table 23 Data for Recreation related Enterprises within the Legal Delta in 2008

	Primary Zone	Secondary Zone
Industry	Number of Establishments	Number of Establishments
Boat Building	1	19
Recreational Vehicle Dealers	0	4
Boat Dealers	8	30
Scenic and Sightseeing	0	2
Performing Arts, Spectator sports, and Related Industries	4	208
Museums, Historical Sites, and Similar Institutions	1	16
Amusement, Gambling, and Recreation Industries (inc. Marinas)	34	255
Accommodation	22	148
Food Services and Drinking Places	26	778
Total	96	1,460
Source: NETS; UOP		

[26] This site is on the State Parks closure list and may be closed to public access as of July 1, 2012.

1.2.1.5 Physical Constraints

There are several physical constraints related to Delta recreation which are detailed in *The Aquatic Recreation Component of the Delta Recreation Strategy Plan*[27]. These constraints impact current facilities and recreation access and include:

- Sediment accumulation in channels and waterways/shallow water;
- Water gates, screens, and barriers;
- Invasive aquatic vegetation that congests waterways;
- Waterway obstructions such as snags, submerged debris, and floating objects;
- Water quality;
- Highly sensitive habitat areas which restrict public access;
- Private lands with restricted public access/agriculture-recreation conflicts;
- Lack of boating destinations, particularly beach frontages; and
- Lack of shore fishing access and boat launches.

Sediment accumulation in channels, waterways, and marinas. Sediment deposits and siltation affect both Delta waterways and marinas. For instance, silt can accumulate from three to eight feet in a given year at marina facilities along the Sacramento River. Sedimentation has led to the closure of marinas and boating facilities in severely clogged channels.

The stringent regulations and lengthy, complex permit requirements for dredging silt out of channels and marinas burdens the marina owner or boating facility operator. Marina operators have stated that dredging-related regulations should be streamlined or better coordinated among regulatory agencies to provide marina owners more flexibility in the removal of silt materials. In addition, channel dredging for levee maintenance is currently being slowed by the same regulation/permitting constraints.

Water Gates, Screens, and Barriers. The Delta Cross Channel and gates, located in Walnut Grove, is an important link for recreational boaters. Although originally built just for water management, it allows, when open, for direct access to some of the most popular areas in the Delta. In recent years, it has been open most days per year, but operation periods are variable and boaters typically do not know in advance whether it will be open or not. It addition, its dimensions do not allow for use by larger boats or sailboats. In spite of its limitations, the Delta Cross Channel has been beneficial to recreational boaters.

Invasive Aquatic Vegetation. Two non-native plants that have invaded the Delta are water hyacinth and *Egeria densa*. Water hyacinths float on the surface as well as root along shorelines, while *Egeria densa* is a subsurface water weed. By the 1980's severe infestations of water hyacinth had clogged navigation channels and marinas, creating problems for marina owners, safety hazards for boaters, and issues for the native ecosystem. *Egeria densa* forms dense, submerged mats of vegetation, which can accentuate the process of siltation (discussed above), can be dangerous for swimmers, and can create operational problems for boaters. DBW has primary responsbility for removing water hyacinth and *Egeria densa*, though the program is underfunded compared to the magnitude of the problem.

Waterway Obstructions. Prior studies have repeatedly cited water obstructions as a significant problem for boaters. The Franks Tract area has been identified as an especially dangerous area

[27] DPC 2006, pp. 56-69

for boating because it was once a levee-protected island and now, although returned to open water, is shallow and obstructed by submerged levees and vegetation debris.

Snags, debris, and floating logs in the river and sloughs are very dangerous to boaters throughout the Delta. Until about twenty years ago, US Army Corps of Engineers was responsible for keeping the waterways clear but no longer provides that service. The responsibility has fallen to local county sheriffs' departments, which lack the manpower, proper equipment, and funding to adequately provide obstruction removal services and to remove the seasonal "crop" of flotsam that follows winter high water flows.

Water Quality. Surveys of boaters utilizing the Delta have frequently revealed Water Quality as the top or one of the top mentioned concerns or issues. In a survey conducted as part of the *Sacramento-San Joaquin Delta Boating Needs Assessement*[28], 74 percent of large boat owners and 79 percent of small boat owners identified Water Quality as an attribute of concern in the Delta. Concerns associated with Water Quality included risks or perceived risks related to body contact, possible sewage contamination, aquatic weeds, and water clarity.

Boating Destinations. Surveys of boaters also have found a high desire for more boat-in destinations within the Delta[29]. These requests tend to take three different forms:

1. Major boat-in, mooring, and camping attractions, such as the Delta Meadows;
2. Numerous smaller day-use areas with restrooms, picnic, and beach facilities; and
3. Additional convenience docks adjacent to Legacy Communities, such as that established adjacent to Walnut Grove.

These facilities can create problems for adjacent agricultural interests. If implementation of such new areas is contemplated, they should be placed adjacent to public lands or in areas that avoid the incidence of trespass, vandalism, and other conflicts.

Highly Sensitive Habitat Areas. There are several existing proposals (e.g. Delta Plan, Ecosystem Restoration Program, etc.) to expand and enhance habitat areas in certain waterways and islands. Conflicts can occur between recreational boating and habitat interests, depending on the boating activity, speed, motor, seasons, and frequency. Additionally, conflicts may result if the public is precluded from any recreational access in these proposed restored habitat areas.

1.3 Existing Operations Condition

There are several operations condition issues and constraints that were also described in *The Aquatic Recreation Component of the Delta Recreation Strategy Plan*[30]. A summary of the potential operational constraints discussed include:

- User group conflicts;
- Water management related constraints; and
- Regulation and law enforcement issues.

Most of these issues are compounded by the lack of an overall responsible agency throughout the entirity of the Delta, due to the overlapping jurisdictions of several counties and cities.

[28] DBW 2002, p. 4-23
[29] DBW 2002, p. 3-12 – 3-14
[30] DPC 2006, pp. 56-69

The diversity of boating activities in the Delta, from high-speed wakeboarding and personal water craft (PWC) usage to fisherman and non-motorized craft (e.g. canoe, kayak) results in conflicts between some user groups. Such conflicts are normally just a lack of common courtesy, rather than citable offenses. However, when one responsible entity manages water recreation use, basic rules and regulations can be established to avoid conflicts. A single responsible entity or common set of regulations does not generally exist in the Delta, with the exception of "No Wake Zones" adjacent to marinas. In addition, marine patrol is fractured between ten different agencies over five counties. Safety laws are the primary concern, along with enforcement of pollution laws, speed violations, negligent operators, equipment violations, lack of life jackets, alcohol consumption, and poaching.

Another serious and common problem is trespass on private property. Frequently, trespass violations stem from recreationists' misunderstanding of what property is public and what is private. Clear signage, however, does not deter those who desire to use a specific area.

The lack of jurisdictional coordination, with no single agency ultimately responsible for management, has left an absence of adequate, coordinated waterway maintenance and security in order to enforce regulations and control user group conflicts. Additionally, there is a lack of information sources about the Delta to assist recreation users who are unfamiliar with the Delta.

The regulatory structure in the Delta is complex, with local, state, and federal regulatory agencies imposing many overlapping layers of law on private businesses. Many of these policies and plans are summarized in Chapter 3. In many cases, regulations that are set to protect the Delta environment also inhibit the functioning of recreation related businesses. One example is the number of agencies that have input into the permitting process required to dredge the marina. Those can include up to three federal agencies, seven state agencies, and three local agencies and the process can take upwards of two years[31].

Other primary issues and operational risks that affect recreation and its economic potential include aging marinas and other infrastructure, lack of dredging, threatened public parks closures, continued lack of public funding for law enforcement and operations and maintenance of public facilities, development encroachment, flood and earthquake risk, rising sea level, water conveyance management changes, and increasing traffic.

1.4 Visitation and Demand

1.4.1 Defining Market Area

In order to describe the economic impact of recreation on the Delta economy, the Market Area for Delta recreationists needs to be defined. Where do people who recreate in the Delta primarily come from? Delta Counties? Surrounding Counties? Southern California? The western region of the US? Beyond?

In *The Sacramento-San Joaquin Delta Boating Needs Assessment,* which included the most recent survey taken of Delta recreationists, the concepts of the Delta Primary and Secondary Market Areas were introduced[32]. A survey of statewide registered boat owners found that 77% of respondents who reported they had recently boated in the Delta resided within approximately 75 miles of the Delta. This area was designated as the Primary Market Area for the Delta and

[31] DPC 2006, p. 59
[32] DBW 2002, p. 6-4 - 6-6

included the counties of Alameda, Calaveras, Contra Costa, Marin, Napa, Sacramento, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, Solano, and Stanislaus. The study further defined a Secondary Market Area which represented the point of origin of another 8% of all Delta boating trips. The Secondary Market Area includes the counties of Amador, Colusa, El Dorado, Lake, Mariposa, Mendocino, Merced, Monterey, Placer, San Benito, Sonoma, Sutter, Tuolumne, and Yolo. Combined, the Primary and Secondary Market Areas represent approximately 85% of all Delta boating visitors (Figure 24).

Although this concept was developed for boating recreation, it is applicable to Delta recreation as a whole. While some visitors to the Delta do come from Southern California, out-of-state, and international locations, the majority of visitors are from Northern California. These visitors represent the focal market for Delta recreation growth opportunities in the future. Population statistics and trends for the Market Area are presented in Table 24. Activity participation numbers and demand models will focus on this area. In summary, the total Market Area had a population estimate of approximately 12 million in 2010, with projections of 17.7 million by 2050.

Table 24 Population projections for the Primary and Secondary Market Areas

	2010	2020	2030	2040	2050
Market Area Population (millions)	12.0	13.4	14.9	16.3	17.7
Growth Rate		12%	11%	9%	8%
Source: Global Insight Forecast Calibrated to the 2010 Census Results					

When thinking about the Market Area for Delta recreation, it is also important to consider the other recreation areas that are competing for participants and their dollars. Within Northern California, competition is strong. Residents of the Market Area have several different natural resource-oriented destinations that they could visit. Boaters can visit several reservoirs throughout Northern California, including Shasta Lake, Lake Oroville, and Folsom Lake, or can recreate on the Bay. Anglers can fish in the numerous reservoirs, but also the streams and rivers feeding those lakes and reservoirs, such as the Feather River, American River, and Sacramento River. People visiting historic or cultural areas can also visit Old Sacramento, Gold Country, or San Francisco. Wine tourists can visit Napa, Sonoma, or Foothill wineries. Other recreation and tourist destinations in Northern California include the Monterey Bay area, San Francisco Bay area, the Sierras, and north coast Redwoods.

Figure 24 Delta Market Area and Competing Regions

1.4.2 Statewide Recreation Survey/Study Summaries

In order to present an update on the current status and overall trends of recreation and tourism in the Delta, a multitude of sources are reviewed, ranging from the United States Fish and Wildlife Service to the Delta Protection Commission publications. Unfortunately, no one study or survey is available that presents a complete picture on current recreation and tourism visitation and economic impact in the Delta. Below summary information from relevant studies is presented.

1.4.2.1 State Parks Surveys Recreation Demand Overview

State Parks completes a *Survey on Public Opinions and Attitudes on Outdoor Recreation in California* approximately every five years to comply with federal grant regulations and to "provide a comprehensive view of the outdoor recreation patterns and preferences of

Californians"[33]. This survey instrument represents the best, most recently available data on recreation preferences of Californians.

Statewide demand and participation rates for a sample of specific recreation activities that occur in the Delta are listed in Table 25. The most popular activities by participation rates are walking for fitness and pleasure, picnicking, and driving for pleasure, followed by visiting outdoor nature museums, attending outdoor cultural events, and visiting historic or cultural sites. The activities which enjoy the highest participation rates (e.g. people who participate, participate more often) are walking for fitness or pleasure, bicycling on paved surfaces, wildlife viewing, outdoor photography, driving for pleasure, and bicycling on unpaved surfaces and trails. State Parks also breaks down participation rates by region, but these regions do not overlap well with our defined market area. Thus, only statewide data is reported.

Table 25 Summary of 2008Survey of Public Opinions and Attitudes on Outdoor Recreation in California Demand and Participation Rates for Selected Activities Statewide in California

Activity Type	Participation Rate	Average Annual Participation in Days
Walking for fitness or pleasure	74%	73
Bicycling on paved surfaces	36 %	38
Wildlife viewing, bird watching, viewing natural scenery	46%	27
Outdoor Photography	33%	26
Driving for pleasure, sightseeing, driving through natural scenery	60%	22
Bicycling on unpaved surfaces and trails	16%	20
Hunting	4%	17
Day hiking on trails	47%	16
Sail boating	6%	14
Fishing – freshwater	21%	13
Swimming in freshwater lakes, rivers and/or streams	31%	10
RV/trailer camping with hookups	11%	9
Motor boating, personal watercraft	15%	9
Visiting historic or cultural sites	55%	8
Picnicking in picnic areas	67%	7
Attending outdoor cultural events	56%	7
Camping in developed sites with facilities	39%	7
Visiting outdoor nature museums, zoos, gardens or arboretums	58%	6
Paddle sports	15%	5

1.4.2.2 US Fish and Wildlife Service

The US Fish & Wildlife Service *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation – California* presents findings from a survey completed every five years to measure the importance of wildlife-based recreation. The survey indicates that in 2006, approximately 7% of the total population in California participated in either hunting or fishing activities, while 21% of the population participated in wildlife watching. The results of the survey are summarized in Table 26. Both participation rates and average annual days of participation per year are lower than the State Parks survey, which may be due to differing methodologies. USFWS also collects information on average trip expenditures.

[33] State Parks 2009

Table 26 Summary of 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Activities in California by Residents and Nonresidents

Activity Type	Participation Rate	Average Annual Days of Participation	Average trip expenditures per day per participant (2006$)
Fishing (Anglers)	6%	11	$62
Hunting (Hunters)	1%	12	$68
Wildlife Watching (Away From Home Participants)	21%	16	$44

1.4.2.3 State Registration and License Numbers

Another source of potential recreation demand is through State registration and license numbers. These numbers represent actual numbers, rather than estimates of participation rates, and can help predict potential demand.

1.4.2.3.1 Registered Vessels

In California, owners of any sail powered vessels over eight feet in length and any motor-driven vessel (regardless of length) that is not documented by the U.S. Coast Guard must register their boat with the Department of Motor Vehicles (DMV). Vessels propelled solely by oars or paddles (e.g. kayak, canoes) do not have to be registered. In 2010, statewide, DMV reported 810,008 vessel registrations. As registrations are also reported by county, the Primary and Secondary Market Areas can be highlighted. In 2010, there were 214,163 vessels registered within the Primary Market Area and an additional 103,408 within the Secondary Market Area[34].

1.4.2.3.2 Resident Sport Fishing

In 2009, 1,179,312 Resident Sport Fishing licenses statewide were issued by the Department of Fish and Game[35]. It is difficult to identify licenses by county, as DFG reports figures based on the county in which the license was sold, not by the origin county of the purchaser. However, DFG required all anglers who fished within the tidal influences of the Bay-Delta and downstream of dams within the watershed, to purchase a Bay-Delta Sport Fishing Enhancement Stamp from 2004 - 2009. In 2009, 284,641 anglers purchased that stamp. Although a portion of anglers who purchased that stamp may have only fished upstream of the Delta, those numbers seem to provide a general magnitude snapshot of anglers in the Delta (i.e., approximately 275,000 anglers recreated in the Delta in 2009). Using this number, combined with estimates from both USFWS and State Parks, that anglers fish, on average, 12 days per year, approximately 3.3 million fishing activity days in the Delta in 2010 results.

1.4.2.3.3 Hunting

In 2009, the State issued 1,056,556 Game Bird Hunting Licenses and 1,683,445 general hunting licenses, which is approximately 6% of the adult California population. The hunting percentage tracks well with demand numbers from State Parks. There is not a way to directly relate these licenses to the Market Area.

1.4.3 Delta Specific Recreation Survey/Study Summaries

There are several Delta specific studies that have been completed over the past 20 years regarding recreation. Those are summarized below.

[34] http://www.dbw.ca.gov/PDF/VesselReg/Vessel10.pdf
[35] http://www.dfg.ca.gov/licensing/

1.4.3.1 Sacramento-San Joaquin Delta Boating Needs Assessment

As part of *The 2002 Sacramento-San Joaquin Delta Boating Needs Assessment*[36], California boat owners were surveyed regarding their preferences and facility needs for boating in the Delta. The survey group was broken down into owners of Large Boats (equal to or greater than 26' in length) and Small Boats (less than 26' in length). In this statewide survey, 52% of all owners of large boats had boated in the Delta, with 68% of those having been in the previous two years. Conversely, only 40% of all small boat owners had been boating in the Delta, with 61% of those having done so in the two previous years.

Combined with the survey information, the 2002 study also completed a demand forecast analysis of annual boating related visitor days, estimated at 6.4 – 6.6 million in 2000 with a projected growth to 8 million by 2020.[37] This survey information provides the best estimate of boating-related recreation activity days in the Delta. However, it does not estimate the amount of expenditures for the boaters in the Delta. And, while boating and companion activities (fishing from a boat, swimming from the boat, etc.) represents one of the highest percentage of existing recreation uses in the Delta, it is not a full picture of all recreation.

1.4.3.2 Sacramento-San Joaquin Delta Recreation Survey

In 1997, State Parks published the *Sacramento-San Joaquin Delta Recreation Survey,* which separately surveyed boat owners and licensed anglers regarding their use of the Delta resources and how much money they spent recreating in the Delta.

The survey found that 23.5% of registered boat owners in California recreated in the Delta, spending an average of $11.75 outside the Delta and $17.20 inside the Delta (1996 dollars), a total of $28.95 per day per person. The survey also found 23% of licensed anglers in the state fish in the Delta, spending an average of $15.91 outside the Delta and $13.57 inside the Delta (1996 dollars), a total of $29.48 per day per person. The top five other recreation activities that boaters indicated they participated in included (in order of preference), sightseeing, viewing wildlife, fishing from shore, picnicking, and walking for pleasure. The top five non-fishing activities which anglers engaged in while in the Delta were sightseeing, boating, viewing wildlife, swimming and walking for pleasure.

1.4.4 Delta recreation and tourism visitation estimates

There are very few actual counts of visitor attendance in the Delta. Those that exist are limited and only represent a fraction of what is estimated to be the actual visitor count. Visitation numbers that do exist are presented in Table 27.

[36] DBW 2002
[37] DBW 2002, Table 6-11

Table 27 Summary of Actual Visitation to the Delta

Site	Numbers
Brannon Island SRA (day use, 2009)	88,459
Brannon Island SRA (camping, 2009)	36,069
Delta Meadows State Park (day use, 2009)	18,933
Delta Meadows State Park (camping, 2009)	2,155
Franks Tract SRA	24,305
Stone Lakes National Wildlife Refuge (USFWS) (approx.)	7,000
Lower Sherman Island (DFG) (approx.)	5,000
White Slough Wildlife Area (DFG) (approx.)	12,000
Yolo Basin Wildlife Area (USFWS) (approx., includes student tours)	30,000
Sherman Island (Sacramento County)	25,000
Hogback Island Fishing Access (Sacramento County)	10,800
Clarksburg Boat Launch (Yolo County)	1,713
Belden's Landing (Solano County)	15,642
Sandy Beach Park (Solano County)	100,611
Dos Reis Park (San Joaquin County)	25,815
Mossdale Crossing Regional Park (San Joaquin County)	23,630
Oak Grove Regional Park (San Joaquin County)	84,058
Westgate Landing (San Joaquin County)	10,283
Isleton Crawdad Festival (approx.)	200,000
Rio Vista Bass Derby and Festival (approx.)	12,000
Totals	726,480
Sources: State Parks 2010, personal communications	

1.4.5 Visitation Estimates by Recreation Activity Types

As actual visitor counts are lacking, visitation must be estimated. One way to estimate visitation is by looking at overall participation estimates based on survey data, such as that collected by State Parks. These participation estimates can then be related to the market area population to derive estimates. However, participation rates vary over time as recreation activities become more or less popular.

Section 1.4.2.1 presented information regarding participation in selected activities that occur in the Delta from the most recent State Parks *Survey on Public Opinions and Attitudes on Outdoor Recreation in California.* As this survey has been taken approximately every five years, it is also a useful tool in looking at activity participation rate changes over time. In general, the activity types in which Californians participate and the level of participation has varied over time in specific activities, such as freshwater fishing, backpacking, wildlife viewing, sports, swimming in a pool, etc. Over various surveys, State Parks has changed specific categories, ranging from 42 activity categories in 1992, to 55 in 2002, and 39 in 2008. It is difficult to track trends in individual activity categories due to changes in survey methodologies and questions. However, the percentage breakdown between three broad clusters of recreation activities has tended to remain relatively constant.

Resource related recreation includes that which occurs in both natural and historic resource related areas, including state and national parks, forest service lands, nature areas, reservoirs, rivers, the ocean, mountains, etc. Types of resource related recreation include wildlife viewing, hunting, fishing, boating, hiking, beach activities, camping, skiing, snowboarding, and swimming

in lakes, rivers, and the ocean. Since 1992, approximately 25 – 30% of all recreation has been resource related in California.

Urban Parks related recreation includes those activities that generally take place in developed parks, such as using play equipment, swimming in a pool, using open turf areas, golf, tennis, and team sports. Since 1992, urban parks related recreation has represented approximately 16 – 23% of all recreation activity days.

Right of Way/Tourism related recreation represents the largest levels of participation over time and includes jogging, walking, bicycling on paved surfaces, driving for pleasure, off-highway vehicle use, and other road and trail based recreation. Since 1992, this type of recreation has represented approximately 48-58% of all activity days in California, with walking for fitness and pleasure generally the highest ranked activity, by both percentage of participants and number of days participating.

In the Delta, there is some level of use in each of the three recreation categories: ***Resource related***, ***urban parks related***, and ***right-of-way/tourism related***. As one of the more unique resource attraction areas in the state, it is only logical that primary uses would be for natural and historic related activities. These include all variety of boating, camping, nature study/bird watching, hunting, and fishing. As described above, an estimate of 6.4 million boating visitor days per year (including fishing from a boat) was completed in 2000[38]. As part of the study, projections were made that this use would grow by 1% a year, but with the recent recession's impact on motor boating in particular, the 2000 count likely reflects today's usage level. None of the remaining activities have had Delta-only surveys or counts, but from review of known visitation to specific sites, data regarding permits and licenses, it is estimated that these remaining uses account for roughly 1.5 million visitor days of use annually. When combined with boating, this gives a total of approximately **8 million *resource related*** visitor days of use per year.

The cities bordering the Delta have taken advantage of the Delta's waterways and scenic resources by locating both resource related facilities and standard city parks on the edges of the Delta. For instance, Garcia Bend Park in Sacramento combines boat launching, bank fishing, and levee-top trails with picnicking, organized sports, children's play, and informal park day uses. Stockton has located its largest city park and a major recreation-related redevelopment area adjacent to Delta waterways. There are approximately 300 acres of urban park and recreation areas bordering Delta resources located in the various communities which surround the Delta. On average throughout California, urban parks receive approximately 10,000 visits per acre per year. Estimated conservatively, **2 million** visitor days of ***urban parks related*** use occur within the primary and secondary zones.

Driving for pleasure in the Delta is very popular and is a prime example of the ***right of way/tourism related*** recreation use. This recreation category also includes bicycling, hiking, and walking. The winding roadways, interesting bridges, scenic views of the waterways and agriculture, Legacy Communities, and historic structures all contribute to its visual appeal. The ability to buy fresh fruits and vegetables straight from the grower, visit a winery and sample their product, stop and pickup a freshly made deli sandwich or an ice cream at a 50 year old grocery store, all add another dimension to the experience. To many, the resources are part of the charm; the historical town of Locke, the wildlife preserves, or even the beautiful oak trees hanging over the roadway.

[38] DBW 2002

There have not been any use participation estimates or surveys for this recreation activity in the Delta. However, the total participation in driving for pleasure in the Market Area can be estimated at 192 million annual participation days (note that driving for pleasure is frequently combined with other recreation activities). As discussed above, the Market Area has a number of competing destinations including Monterey/Santa Cruz, Bay Area, Coast, Redwoods, Wine Country, Gold Country, Central Valley farmlands, and the Sierra Nevadas. Driving for pleasure and associated activities (e.g., visiting historic sites and farm stands, etc.) in the Delta generates significant visitation. ***Right-of-way related*** recreation is estimated at approximately **2 million visitor days** per year.

Combining the above estimates (8 million resource related and 2 million right-of-way related) would result in a total of 10 million annual visits in the Delta, plus 2 million in urban parks around the edge. In the 1990's the State Department of Parks and Recreation estimated an annual use of 12 million days in the Delta. Given our calculations, the 12 million visits per year is probably a reasonable working number until additional survey research and primary data collection is performed.

1.4.6 Visitation Estimates based on Demand Estimates

Visitor estimations can be tested based on population numbers, using estimates of demand and participation rates. In summary, first, participation rates for various Delta activities were determined. Using these participation rates and estimates for activity days of participation from State Parks (described above) and adjusting for multiple activities in a day, demand numbers, expressed as visitor days, for the Market Area can be estimated. Following that, a determination of what percentage of the market the Delta will capture versus other recreation opportunity areas available to the Market Area is made. These estimates result in a range of 8.2 – 15.2 million recreation visitor activity days per year in 2010. In the appendix, the model for demand based participation is presented.

These recreation activities can also be broken down into the categories described above: ***Resource related***, ***urban parks related***, and ***right-of-way/tourism related***. The urban parks related category was not included in these estimates, which was previously estimated to be another 2 million activity days per year. ***Resource related*** activities result in a range of 4.5 – 10.7 million activity days per year, while ***right-of-way/tourism related*** activities result in a range of 1.7 to 2.5 million activity days per year. These ranges are similar in magnitude to those discussed above and are summarized in Table 28.

Table 28 Summary of Visitation Estimates to the Delta

Type	Estimate of Visitor Days (2010) (millions)		
Activity Type Estimates		Estimate	
Resource Related		8.0	
Right-of-way Related		2.0	
Urban Parks Related		2.0	
Total		12.0	
Demand Based Estimates	Low Estimate	Medium Estimate	High Estimate
Resource Related	4.5	7.6	10.7
Right-of-way Related	1.7	2.1	2.5
Urban Parks Related	2.0	2.0	2.0
Totals	8.2	11.7	15.2
Sources: U.S. Census, State Parks 2009, The Dangermond Group, EPS			

1.5 Economic Impact/Benefits

1.5.1 The Economic Impact of Recreational Boating and Fishing in the Delta

As a follow-up to the 1997 State Parks survey, Goldman et. al produced a report on *The Economic Impact of Recreational Boating and Fishing in the Delta*[39]. Using data from the 1997 survey on number of anglers and registered boat owners and their reported expenditures, Goldman et al estimated the expenditures of registered boaters at $247 million, generating $445 million in total output, $183 million in income, $279 million in value added, and 8,058 jobs within the Delta region. For licensed anglers, expenditures totaled $186 million, generating $336 million in total output, $138 million in income, $209 million in value added, and 6,152 jobs. The authors note that the impacts from boating and fishing can not be aggregated, as many boaters fished, and many anglers boated. The authors also note that these numbers do not include the many other recreationists who participate in Delta based activities, such as driving for pleasure, non-registered boaters (i.e. kayaks, canoes, etc.), non-licensed anglers, hunters who do not boat, etc., and so is not a complete picture of the economic impacts of Delta recreation.

1.5.2 Current Economic Impact Model

The economic impact of Delta recreation is assessed based on estimated visitation levels and trip-related spending. As described in Section 1.4, it is estimated that the Delta currently supports approximately 7.6 million resource-related visitor days and 2.1 million right-of-way/tourism days (market demand-based estimates). This analysis estimates that average per-day expenditures for the resource-related and right-of-way/tourism recreation activities range from about $27 to $76 (2011$) depending on the activity type, of which about $13 to $34 is spent in the Delta. Based on these per-day spending levels and the estimated Delta visitation, the direct economic impact of resource-related and right-of-way/tourism recreation is estimated at approximately $251 million.

This visitation-based economic impact estimate focuses on resource-related recreation, including boating, fishing, hunting, and other activities (e.g., wildlife viewing), and right-of-way/tourism activities, including hiking, biking, driving for pleasure, and cultural activities. The analysis does not account for activities at the urban fringe, including urban park recreation (e.g,

[39] Goldman et. al 1998

team sports, etc.). Resource-related and right-of-way/tourism activities are believed to account for the majority of economic impacts of recreation occurring in the Delta.

The economic impact of the Delta is calculated by multiplying activity-specific visitor days by per-day expenditure estimates. A visitor day is defined to be a day at a recreation site by a single person doing any and all activities. While visitors may participate in multiple activities, the analysis defines a primary activity to avoid double counting visitors. The analysis relies on the distribution of visitation by primary activity shown in Table 29.

Table 29 Estimated Resource-Related and Right-of-Way/Tourism Visitation to the Delta by Activity

Activity	Visitor Days	% of Total
Boating, Fishing, and Camping	6.4 Million	66%
Hunting	500,000	5%
Other Resource-Related & ROW Activities	900,000	9%
Driving for Pleasure & Tourism	1.9 Million	20%
Total Delta	9.7 Million	100%

Sources: Sacramento-San Joaquin Delta Boating Needs Assessment (2000); The Dangermond Group
Note: Activity categories reflect similarities in economic spending patterns.

The analysis relies on average expenditures reported by boaters (including anglers), hunters, and recreationists participating in wildlife-associated activities to estimate spending in the Delta. Specifically, the analysis uses spending data from the Sacramento-San Joaquin Delta Recreation Survey (1997) and the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (1996 and 2006). The analysis considers expenditures outside and inside the Delta, based on boating and fishing expenditure patterns reported by the Sacramento-San Joaquin Delta Recreation Survey. Daily spending estimates from the Sacramento-San Joaquin Delta Recreation Survey are updated to reflect real spending increases observed by the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation between 1996 and 2006. The analysis assumes that resource-related and some right-of way activities (e.g., biking and hiking) spending is generally consistent with expenditure patterns reported for wildlife viewing trips in the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Driving for Pleasure spending is also based on National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, though these data are adjusted to reflect lower levels of spending on lodging and recreational activities for driving-for-pleasure visits. All spending estimates are inflated to 2011 dollars using the Bureau of Labor Statistics Consumer Price Index (CPI).

Table 30 Estimated Per-Day Visitor Expenditure by Activity (2011$)

	Expenditure Outside Delta	Expenditure Inside Delta	Total Expenditure
Boating, Fishing, and Camping			
Accommodation	$2.76	$5.25	$8.00
Food	$5.25	$8.34	$13.58
Supplies	$8.76	$11.34	$20.10
Other	$3.99	$5.46	$9.45
Total	$20.75	$30.38	$51.13
Hunting			
Accommodation	$12.30	$9.06	$21.36
Food	$3.88	$3.92	$7.80
Supplies	$20.21	$14.24	$34.45
Other	$5.70	$6.93	$12.63
Total	$42.08	$34.15	$76.24
Other Resource-Related & ROW Activities			
Accommodation	$6.31	$4.65	$10.97
Food	$6.38	$6.45	$12.83
Supplies	$6.04	$4.25	$10.29
Other	$1.45	$1.77	$3.22
Other	$20.19	$17.12	$37.31
Driving for Pleasure & Tourism			
Accommodation	$1.58	$1.16	$2.74
Food	$6.38	$6.45	$12.83
Supplies	$6.04	$4.25	$10.29
Other	$0.73	$0.88	$1.61
Total	$14.72	$12.75	$27.47

Sources: Sacramento-San Joaquin Delta Recreation Survey (1997); National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (1996 and 2006)

Note that "Accommodation" includes spending at camp sites.

The analysis estimates direct economic impacts from resource-related and right-of-way/tourism recreation by multiplying activity-specific visitor days by the per-day expenditure estimates. Current direct impacts are estimated at $251 million inside the Delta (2011$), as shown in Table 31.

Table 31 Estimated Direct Delta Recreation Trip Spending Impacts by Activity (2011$)

	Expenditure Inside Delta
Boating, Fishing and Camping	
Accommodation	$33,572,432
Food	$53,354,167
Supplies	$72,570,711
Other	$34,928,893
Total	$194,426,203
Hunting	
Accommodation	$4,529,863
Food	$1,960,232
Supplies	$7,119,652
Other	$3,466,659
Total	$17,076,407
Other Resource-Related & ROW Activities	
Accommodation	$4,186,801
Food	$5,805,212
Supplies	$3,827,270
Other	$1,592,472
Total	$15,411,754
Driving for Pleasure and Tourism	
Accommodation	$2,209,700
Food	$12,255,447
Supplies	$8,079,791
Other	$1,680,942
Total	$24,225,881
Resource-Related and ROW/Tourism Total	
Accommodation	$44,498,796
Food	$73,375,059
Supplies	$91,597,423
Other	$41,668,967
Total	$251,140,245

While visitor spending occurs in a wide-variety of categories, the bulk of visitor spending is likely to occur at recreation, accommodation, restaurant/bar, food/beverage, and gas station/convenience businesses. Table 32 maps the $251 million in spending into more specific expenditure categories that are used for the economic impact analysis with IMPLAN. Comparing these expenditure levels with total Delta area revenue estimates for these industries shows that Delta recreation and tourism generates a very large share of sales for these industries. For example, our estimates show that Delta recreation accounts for 92% of other accommodation spending in the legal Delta region, 47% of hotel and motel spending, and 7% of restaurant and bar spending. As an additional reasonableness check, we compared these expenditure levels to the establishment data for the legal Delta from the NETS database. We found the level of spending was 42% of other amusement and recreation industry revenues in the legal Delta, a category that includes marinas and golf courses, 71% of total accommodation industry revenues, and 19% of food service and drinking places. These ratios seem high,

Table 32 Estimated Direct Delta Recreation Trip Spending by IMPLAN sectors

Hotels and motels	$	26,699,278
Other accommodations (i.e. campgrounds)	$	17,799,518
Food services and drinking places	$	63,364,613
Retail - Food and beverage stores	$	28,153,123
Retail – Gasoline	$	65,485,709
Retail - Sporting goods, hobby, book and music	$	7,969,036
Other amusement and recreation industries (i.e. marinas)	$	34,806,041
Retail - General merchandise	$	6,862,926

Table 33 summarizes the economic impact of recreation on the 5 county Delta region as modeled with Implan. Delta recreation and tourism supports about 2,700 jobs in the region including nearly 1,100 in restaurants and bars, 268 in hotels and motels, and 263 jobs at marinas. These jobs provide about $90 million in labor income, and a total of $152 million in value added to the regional economy. Based on a descriptive analysis of job location in the Delta in earlier chapters, it appears that the majority of these jobs are located in the secondary zone.

Table 33 Economic Impact of Delta Recreation and Tourism on 5 Delta Counties

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	1,953.5	$52,553,680	$86,648,100	$166,731,376
Indirect Effect	395.2	$20,301,232	$34,425,490	$64,612,876
Induced Effect	367.2	$16,665,778	$30,962,200	$52,752,976
Total Effect	2,715.9	$89,520,688	$152,035,800	$284,097,216

Table 34 shows the statewide impacts of Delta recreation and tourism. For these impacts, we estimate an additional $200 million in recreation related spending outside the Delta for supplies and travel. Statewide, Delta recreation and tourism supported nearly 5,000 jobs and $325 million in value added.

Table 34 Economic Impact of Delta Recreation and Tourism on California

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	3,143.6	$93,460,048	$154,608,500	$289,795,104
Indirect Effect	859.6	$50,102,816	$85,391,670	$161,296,176
Induced Effect	932.4	$46,813,804	$84,487,100	$148,968,112
Total Effect	4,935.6	$190,376,672	$324,487,300	$600,059,392

1.6 Trends

The current status in Delta recreation shows a place of diverse recreation experiences, with approximately 12 million annual visitors, having an economic impact on the region of over $250 million. Yet, this recreation mecca is also suffering from economic conditions, physical and operational constraints, pressures on water supply, regulations that restrict development, and other internal and external issues. So, what do current trends inform us about recreation potential over the next 50 years?

One way of trying to estimate recreation use over the next 50 years is to look back in time. Fifty years ago, (1950's), virtually all the recreation activities that people do now, they did then. User survey data exists going back a little over 50 years. There are approximately 35 different outdoor recreation activities identified by State Parks with data collected nearly every five years

over the 50 year period. Most of the activities track their growth with population, but some are decreasing in percentage of the total, while others have increased.

As discussed previously, the one factor that is relatively constant is the percentage breakdown between the three broad clusters of recreation activities discussed above: ***Resource related***, ***urban parks related***, and ***right-of-way/tourism related***., i.e. 20% (16-23%) of activities take place in urban developed parks and golf courses; 50% (48-58%) are right-of-way related, including jogging, walking, bicycling, and driving for pleasure; and the remaining 30% (25-30%) occur in natural and historic resource related areas including state and national parks, forest service lands, nature areas, reservoirs, and rivers. These percentages have remained relatively constant over time, regardless of demographic changes. Another rather constant factor to consider is that approximately 70-80% of the total recreation use is simple, close to home, and with very little expenditure required for special equipment.

Therefore, it is anticipated that the outdoor recreation uses we find today will still exist, that the predominance of the activities will be simple, close to home, and require little expenditures, and that around 20% of the use will be developed urban park related, 50% right-of-way related, and 30% resource related.

In the Delta, the present uses are highly related to the availability of private facilities. Most of the boating and fishing activities rely upon private marinas, even though the activities occur on public waterways. Most of the hunting in the Delta also occurs at private hunting clubs. Most Delta-as-a-Place destinations are related to wineries, farm stands, and commercial establishments in the Legacy Communities.

What is important to realize is that as one looks to the future, the Delta will likely become even more important for these types of uses by the expanding populations encircling it. Elsewhere, close-by outdoor recreation opportunities are rapidly disappearing. But the combination of land use protections, flood vulnerability, and rich agriculture land provide the likelihood that California's Delta will still remain relatively unchanged in coming years.

Developed local and state resource related recreation areas in the Delta are quite limited, when compared against other areas in the state. Most public lands are nature and wildlife reserves, supporting nature study and bird watching and, in some cases, hunting, but their public access facilities are either secondary to their mission or still primarily in the planning stages. They appear to have capacity to accommodate increased use over time. Some urban parks have been developed along the edges of the Delta, primarily in Stockton.

Another way to look at trends is through latent (i.e., unmet) demand revealed by survey data. State Parks survey data reports on latent demand by activity category[40]. They found the top five activities that adults would like to participate in more often were:

1. Walking for fitness or pleasure,
2. Camping in developed sites,
3. Bicycling on paved surfaces
4. Day hiking on trails
5. Picnicking in picnic areas

All of these activities take place in the Delta and could represent an opportunity for growing visitation if facilities were available and attractive.

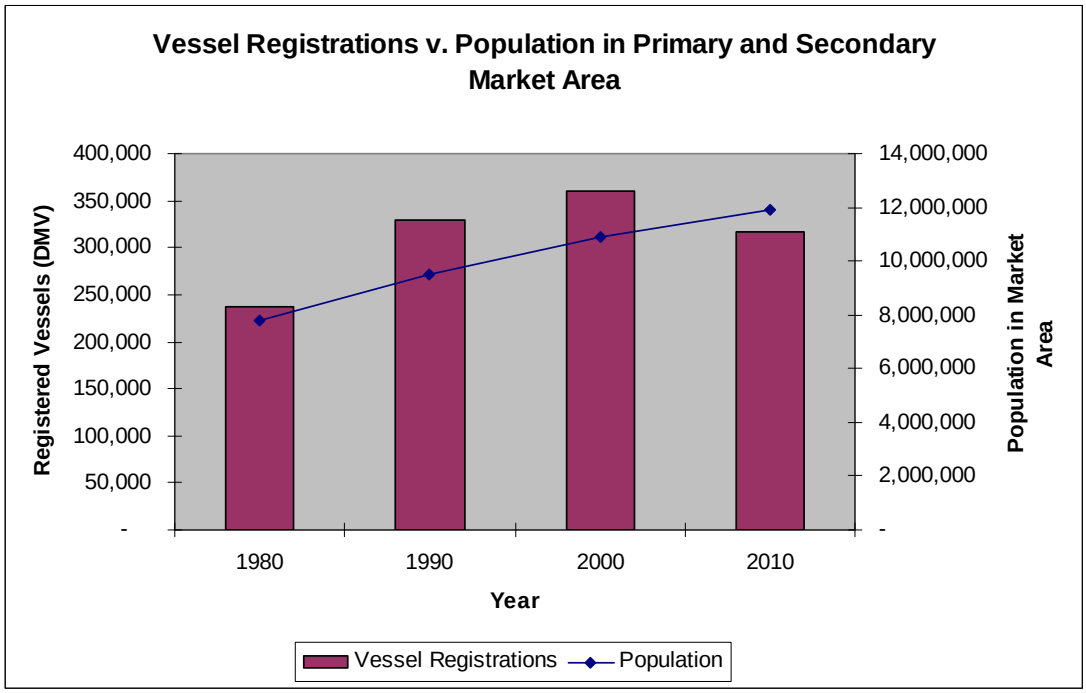
[40] State Parks 2009, p. 36

USFWS reported on trends since 1996 in fishing, hunting, and wildlife viewing. Fishing has declined 36% since 1996, while hunting has declined 45% (though is flat since 2001)[41]. Conversely, away-from-home wildlife watching is up 23% since 1996. These data seem to represent a trend away from consumptive recreation (i.e. hunting, fishing) and towards non-consumptive wildlife recreation (i.e. bird watching, nature photography, etc.). Recreational programming and facilities in the Delta should respond to this trend.

Section 1.2.4.1 above highlighted current (2010) boat registration numbers. Vessel registrations are down substantially since 2000 in both the State and the Primary and Secondary Market Area. In 2000, Vessel Registrations were at 902,447 statewide, and 359,541 in the Market Area, compared to 2010 numbers of 810,008 statewide and 317,571 in the Market Area. These numbers represent a decrease of 11% statewide and 13% in the Market Area. Table 35 below shows the trends in boat registrations versus population over the past 40 years in the Market Area.

While boat registrations were increasing at a faster pace than population growth through the 1980's, they have been increasing at a slower pace than population growth since then, and as mentioned above, decreasing overall since 2000. As boating is the dominant recreational activity in the Delta, these trends indicate that motorized and sail boating may be declining with population growth over the next 50 years.

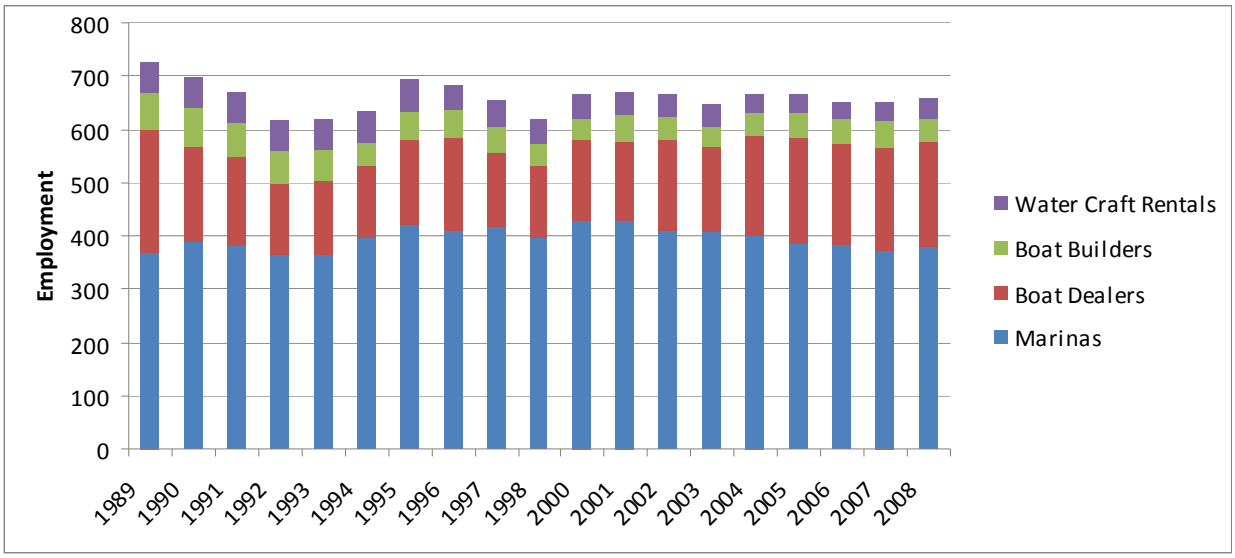
Table 35 Vessel Registration v. Population in Primary and Secondary Market Area, 1980-2010



Available business enterprise based data also reveal stagnation in the Delta's recreation economy. Over the past 20 years, employment in marina enterprises has been relatively flat, with little growth. In 1990, the database counts 95 marina related establishments, 90 in 2000, and 93 in 2009. Likewise, employment by water-based recreation related establishments has remained relatively constant over the past 20 years, as demonstrated by Table 36.

[41] USFWS 2006

Table 36 Employment in Legal Delta for Water-based Recreation Sectors, 1980-2009



Other external or societal trends that could affect the present recreation use and demand over the next 50 years are:

- Physical changes to the Delta related to habitat restoration and water deliveries, which will likely result in increased habitat acres and water surfaces with a potential decline in agriculture acreage;
- Increasing population and development growth surrounding the Delta forming a larger urban ring around significant portions, with probable exceptions for valuable, healthy near-urban ecosystems and productive agricultural lands;
- Increasing population seeking out various forms of outdoor resource related recreation, increasing the significance of the Delta as a contrast to local urbanization;
- An increasing interest in maintaining close-to-urban agriculture to supply fresh fruits and vegetables;
- Increasing concerns over “nature deficit disorder” among young people and greater interest in youth access to meaningful natural experiences;
- Health concerns, such as obesity, and the need for more exercise activities;
- Demands for right-of-way related recreation, such as trails, bicycling, and driving for pleasure, increasing at rates faster than the population rate due to loss of other open spaces to urbanization;
- Continued decline of existing facilities unless new capital investments;
- Traditional Delta recreation activities, such as boating, fishing, swimming, camping, picnicking, wildlife viewing, and hunting, subject to land and water configurations and facilities, continuing at rates approximately equal to population increases (some will be higher, and others lower, but overall should be approximately the same).

1.7 Key Findings

- The Sacramento/San Joaquin Delta is an area where a diversity of recreation experiences is very evident; from the thrill of a speeding personal watercraft to the relaxation of canoeing or boat cruising through a winding tree covered channel, from hunting game birds to the quiet observation of a flock of sand hill cranes, from studying the early history of Chinese workers to the tasting of local wines.

- While there are a percentage of visitors to the Delta who come from elsewhere, the majority of visitors are from Northern California and these visitors represent the focal market for Delta recreation growth opportunities in the future and define the Market Area for this study. The total Market Area had a population estimate of approximately 12 million in 2010, with projections of 17.7 million by 2050.
- Based on demand models, recreation visitation for 2010 is estimated to be approximately **8 million *resource related*** (e.g. boating, fishing) visitor days of use per year, **2 million *urban parks related*** (e.g. golf, picnic, turf sports), and **2 million *right-of-way related*** (e.g. bicycling, driving for pleasure) recreation visitors/year. The **total number** of activity days is conservatively estimated at approximately **12 million/year**.
- Employment in recreation-related economic sectors within the Primary Zone has been relatively flat over the past 20 years.
- The principle changes and trends that could affect the present recreation use and demand over the next 50-90 years are: physical changes to the Delta; increasing population and development growth; increasing agri-tourism; and the likely desire for closer to home recreation.
- The current direct spending in the Delta region from ***resource-related*** and ***right-of-way/tourism related*** trips are estimated at roughly **$250 million inside the Delta (2011$)**. Additional economic impacts associated with urban recreation are not quantified, but are likely significant.
- Delta recreation and tourism supports about **2,700 jobs in the five Delta Counties**. These jobs provide about $90 million in labor income, and a total of $152 million in value added to the regional economy.
- Delta recreation and tourism supports nearly **5,000 jobs across all of California**, and contributes about $325 million in value added.

2 Outcomes and Strategies Under Baseline Conditions

The prior section discussed the current status of recreation in the Delta, including existing facilities, and estimates for existing visitation and economic impacts. There was also a short discussion on current trends. In this section, a plan is developed for a strategy for economic sustainability for Delta recreation and tourism.

A recreation plan generally brings together four main topic areas: opportunities and constraints, principles and goals, physical strategies, and operational strategies. This section will follow that standard while taking into account assumptions for baseline conditions described above in Chapter 6.

2.1 Opportunities and Constraints

There are many current and future potential opportunities and constraints to recreation potential in the Delta. Several existing opportunities and constraints, both physical and operational, were described in Sections 1.2 and 1.3. Below we expand upon those that would have the most significant impacts on future planning scenarios.

2.1.1 Constraints

2.1.1.1 Limited Access and Visibility

The Delta is a recreation landscape of two faces; one seen from the water and the other experienced largely from a car or in one of the Legacy Communities. For all its hundreds of

miles of waterways, the waters of the Delta can be only accessed in a relatively few places. Dotted with private marinas and few public parks, boats can only reach Delta waters from these boat slips and ramps, as well as from private docks and remote put-in spots outside the Delta. Similarly, there are relatively few landside recreation facilities that offer camping or picnicking and overnight hospitality options are relatively few.

The Delta landscape on the inland side is equally limited to visitors. With few communities, parks, trails and public destinations, the vast land area for the most part is accessible only through the windshield.

2.1.1.2 No Distinct Delta Identity

For the same reason the Delta lacks a distinct identity as place, it lacks both an operational and marketing identity. Unlike a known brand like “Tahoe”, “Delta” lacks brand recognition and any significant sense of critical mass in the minds of visitors. For all its beauty, allure, and recreational diversity, the Delta functions as a largely underutilized destination, unknown to many in the larger Bay Area and the state, and not easily discoverable to those who do not already know and use the area.

2.1.1.3 Two Contrasting Physical Environments

The Delta comprises two contrasting physical environments that bump against one another, sometimes harmoniously and sometimes in conflict. Many agricultural islands, hidden from the waterways by levees, lie significantly below river level. This physical, visual, and land use juxtaposition makes the edge between the two environments problematic and limits access to waterways.

Boating use occurs on public waterways that abut, for the most part, privately owned agricultural or residential property. It is the natural inclination of boaters to occasionally beach their boats and access the shoreline, which can result in trespass and potential damage to private property. Boat wakes can damage levees. Levees, subject to erosion, are often lined with armor, which discourages landing by boaters and precludes shoreline recreation use other than incidental bank fishing by “land side” fishermen. The resulting environment allows for boat passage but virtually no shoreline recreation use in these areas, a significant deterrent to expanded boating use. Aesthetic values of unvegetated riprap levees are low, further diminishing their appeal.

2.1.1.4 Private Marina Limitations

Most boat access to Delta waterways is provided through private marinas and boat launch ramps; state and local public launch facilities are provided to a limited degree. There are relatively few opportunities for overnight stays for boaters without self-contained facilities. Over the years, the private marina market has adjusted to provide for the demand for boat storage slip space, which is the primary revenue source for marina operators. Launch ramps and parking space for trailered boats is generally available in limited supply at marinas as boat launch revenues generally are not a significant revenue source and land for parking is limited above the levees.

Marinas face siltation of their boat basins, and costs and regulatory hurdles to maintenance are significant. Many marinas and resorts are aging and suffer from deferred maintenance, diminishing their appeal to new users.

A further limiting factor to increased use by visitors trailering boats to the Delta is its “hidden” quality. Boat put-in locations are often not easily seen and must be sought out by the first-time

visitor. Many facilities are located in out-of-the-way locations. Further, given the narrow spaces many marinas occupy, with parking and roadways built atop narrow levees, launching and parking maneuvers can be challenging, even for experienced operators. Boating use has tended to be relatively local in nature and therefore primarily a day use activity, which limits economic activity generated by recreation.

2.1.1.5 Other Facility Limitations

In addition to private marinas that only offer slip rentals, launching, and related services, some private resorts offer camping and day use facilities. Resorts of this kind are limited and revenue potentials run at a tight margin. There are limited state and local parks that also offer similar facilities, however, such landside recreation amenities are relatively rare in the Delta.

Traditionally, in the Delta, recreation improvements have been largely provided by the private sector and public investment in land and facilities has been small. Declining public recreation budgets have contributed to declining maintenance and facility quality and no schedule for expanded development. State and local agencies have developed multiple plans for expanding Delta recreation that have remained unfunded for many years. The most recent plan by State Parks, *Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh*, states that no funding is available for implementation and the largest State Park in the Delta, Brannon Island State Recreation Area, is currently on the proposed closure list.

2.1.1.6 Waterway Concerns

An additional constraint to expanded boating use in the Delta is its geography. By its nature, a labyrinth of waterways that lack obvious navigational landmarks, the unfamiliar boater can easily become lost. Although increasing use of GPS devices reduces this risk, many inexperienced boaters continue to be reluctant to tackle Delta navigation.

Similarly, Delta waterways can be unpredictable in depth and contain unseen underwater hazards that can discourage the uninitiated boater. Snags, sandbars, and submerged levees are common hazards that can catch the casual boater.

Water quality is also an issue to some boaters and shoreline users in the Delta. With limited clarity and concern over water quality, some are deterred from engaging in water contact in the Delta. Velocity of currents further makes swimming more hazardous in some locations. Many boat owners avoid saline water and salt water intrusion could render increasing areas of the Delta off limits to these boaters. Invasive aquatic plants, including water hyacinth and *Egeria densa*, further reduce access and appeal to boaters and fishermen by impeding navigation and damaging motorized boats.

2.1.1.7 Regulatory Environment

While most local jurisdictions, including counties and cities, have policies that encourage recreation in the Delta, they also have regulations which preclude new development. So, while protecting the atmosphere of the Delta-as-a-Place, these same policies also inhibit economic growth and sustainability. Additionally, several state and federal agencies have regulatory authority over changes to Delta facilities. For instance, permits for a new marina or even a marina upgrade may require input from the local county, the State Department of Boating and Waterways, Delta Protection Commission, State Lands Commission, Reclamation Board, State Department of Fish and Game, Regional Water Quality Control Board, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and National Marine Fisheries Service. These many

layers of regulations are, at best, costly, time consuming, and confusing, and, at worst, completely prohibitive to new recreation developments or enhancements.

2.1.2 Opportunities

In spite of the many constraints facing future Delta recreation economic sustainability, current market area population growth trends and the size and variety of physical amenities can still provide for many future opportunities.

2.1.2.1 Increasing Demand

By 2050, population growth in the counties surrounding the Delta is projected to grow by 50-60%. As population and gasoline prices increase, there will be a growing focus on recreation opportunities close to population centers. Increasingly, the Delta, where land use regulations will severely limit construction and growth, will become a primary source of open space and recreation activity for the greater northern California region.

Boating access and landside recreation opportunities today will be inadequate to accommodate this growing demand. Similarly, interest and demand for agri-tourism will create demand for expanded overnight visits to Legacy Communities and the growing wine region.

Increasingly, recreation and agri-tourism will grow together, fueling the interest in the Delta and reinforcing its emerging identity as 'place'. A synergy between agriculture and recreation will create new opportunities for visitation and economic activity in the Delta.

By attracting visitors to Legacy Communities and expanding recreation access to waterways and land side recreation improvements, potential negative economic impacts on agriculture from increased tourism and recreation can be minimized by increasing and focusing recreation uses and activities.

2.1.2.2 Physical Capacity

Current levels of boating and fishing use falls far short of the physical capacity of the Delta for recreation. Within the great size and diversity of Delta waterways, there is significant capacity on most Delta waterways for additional boating use in the future. Population growth will expand the demand for all forms of recreation in the Delta. The waterways themselves have the capacity for significantly expanded boating use that can be accommodated through expanded points of access and land and water-based facilities. These facilities in many cases would require conversion of land from other uses.

Nearly all public lands that have been acquired in recent years within the Delta have been set aside as wildlife habitat but provide little or no public recreation use or access. There may be significant opportunities to include public use that would be compatible with habitat management objectives.

Renewed funding for agency recreation plans, if available, could provide a significant expansion of access and facilities that could boost recreation use.

2.1.2.3 Delta-as-a-Place

The Delta must be a better-defined destination for the visitor. Increased programming, special events, festivals, and marketing have the capacity to significantly increase visitation and recreation use Delta-wide. Linking the vitality and tourist appeal within Legacy Communities

would boost overall Delta recreation and attract a new segment of visitors to the Delta. Joint marketing of events in these communities tied to “farm trail”, “wine trail”, and “boat trail” tourism would be a further means of increasing visitation and economic activity. These steps, adjunct to traditional Delta recreation enhancements, would boost the identity of the Delta as a destination with multiple attractions and enhance Delta branding and recognition.

Efforts to enhance the identity of place might further include features to identify and establish gateways and edges to the Delta that reinforce its unique landscape character, particularly along the primary east-west highway corridors.

2.1.2.4 Market Area Development

Continuing population growth along Delta edge communities will provide a further boost. Adding to Delta recreation attractions, urban improvements such as those built by the City of Stockton over the last few years along their waterfront will provide capacity for new visitors to participate in leisure activities. This trend could continue as communities, such as Tracy, complete planned development towards the Delta. Recreation corridors, with trails connecting urbanized areas on the periphery of the Delta, could contribute to buffer zones between urbanized areas and the Delta and provide additional recreation opportunities.

Development of Delta edge and cross-Delta trails, connection of open space areas and capturing land and water views within the Delta can further add to the growing fabric of Delta recreation and access and the capacity to accommodate additional visitors.

2.1.2.5 Future Prominence

As growth in the region and the state expands over the coming decades, the Delta can emerge as a recreation resource of increasing value and appeal and its prominence as a destination will expand accordingly. Increasing water-oriented recreation demand and the associated demand for land-side recreation activities will combine with the growing appeal of agri-tourism and locally grown food and wine to reinforce the identity of the Delta as a unique and desirable recreation destination for the northern California region. The largely overlooked “bounty at the doorstep” represented by the Delta as a diverse recreation resource will become an important destination in the coming years.

2.2 Principals and Goals

Principles and goals have been established to guide development of planning scenarios for future Delta recreation. These principles and goals were developed to minimize current constraints and to take advantage of current and future opportunities. Plans were developed with these principles and goals at the forefront. These guidelines include:

- Avoid developing recreation facilities within high flood risk areas or areas inaccessible during emergency events.
- Avoid conflicts with vital habitat resources.
- Respect and protect agriculture areas. Avoid locating recreation sites in areas that would create conflicts with agriculture and instead site, when possible, in more compatible areas, such as around the edges of the legal Delta, in combination with Legacy Communities, and expanding existing areas.
- Respect and protect hunting activities by avoiding spatial and/or timing conflicts with other activities.

- Create positive park, open space, and trail edges that buffer the Delta from encroaching urban and suburban areas.
- Encourage both commercial and public recreation facilities, including marinas, food service, overnight accommodations, as well as standard community park developments, within or on the edge of Legacy Communities and existing recreation areas.
- Develop appropriate visitor serving and access facilities at wildlife areas providing nature study, bird watching, and environmental education, as well as interpretive signage to educate the public about the natural resources values of the Delta and their need for protection.
- Recognize private enterprise's primary role in providing recreation facilities and encourage and facilitate appropriate expansion to keep up with increasing populations.
- Support programs to assist existing private recreation providers, such as loan funds, coordinating marina dredging permitting, and helping respond to sea level changes.
- Recognize the multiplicity of public agencies and non-profit entities which provide recreation in the Delta and encourage coordination in planning for, and provision of, recreation opportunities.
- Utilize State Parks "Base Camp", "Gateway" and "Adventure" concepts, as described in their *Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh,* which encourages the concentration of new facilities within and near existing recreation areas, while developing and enhancing the attractiveness of points of interest in appropriate locations throughout the Delta[42].
- Promote the creation of recreation destinations as focal points of the Delta. Such multi-interest complexes should each incorporate one or more Legacy Communities, marina resorts, public and private recreation base camp areas, natural wildlife areas, and trails. The complexes should be based upon existing community values and highlight existing Delta and community resources.
- Encourage the creation of settings for private enterprise development through the development of ancillary public facilities such as trails, event venues, and community docks.
- Advocate for overnight extended stay within or adjacent to the Delta through program offerings, multiple points of interest, and desired accommodations.
- Increase the public's awareness of the Delta as a desirable recreation destination through better clarity and ease of discovery, marketing, and promotional scale events.
- Identify and develop appropriate opportunities for small boat-in day use areas, as well as larger Delta Meadows-scale destinations for boaters. Such areas should provide basic facility needs, as well as opportunities for multiple recreation activities.
- Develop appropriate locations throughout the Delta for a network of hard surface non-motorized, multi-use trails, as well as boat trails for both motorized and non-motorized craft.
- Ensure appropriate and coordinated response to operational issues including exotic aquatic vegetation control, boater safety enforcement, maintenance, derelict boat removal, boating hazard control, etc.
- Provide additional on-shore access facilities for shore fishing and boat launching.

2.3 Recreation Enhancement Strategy

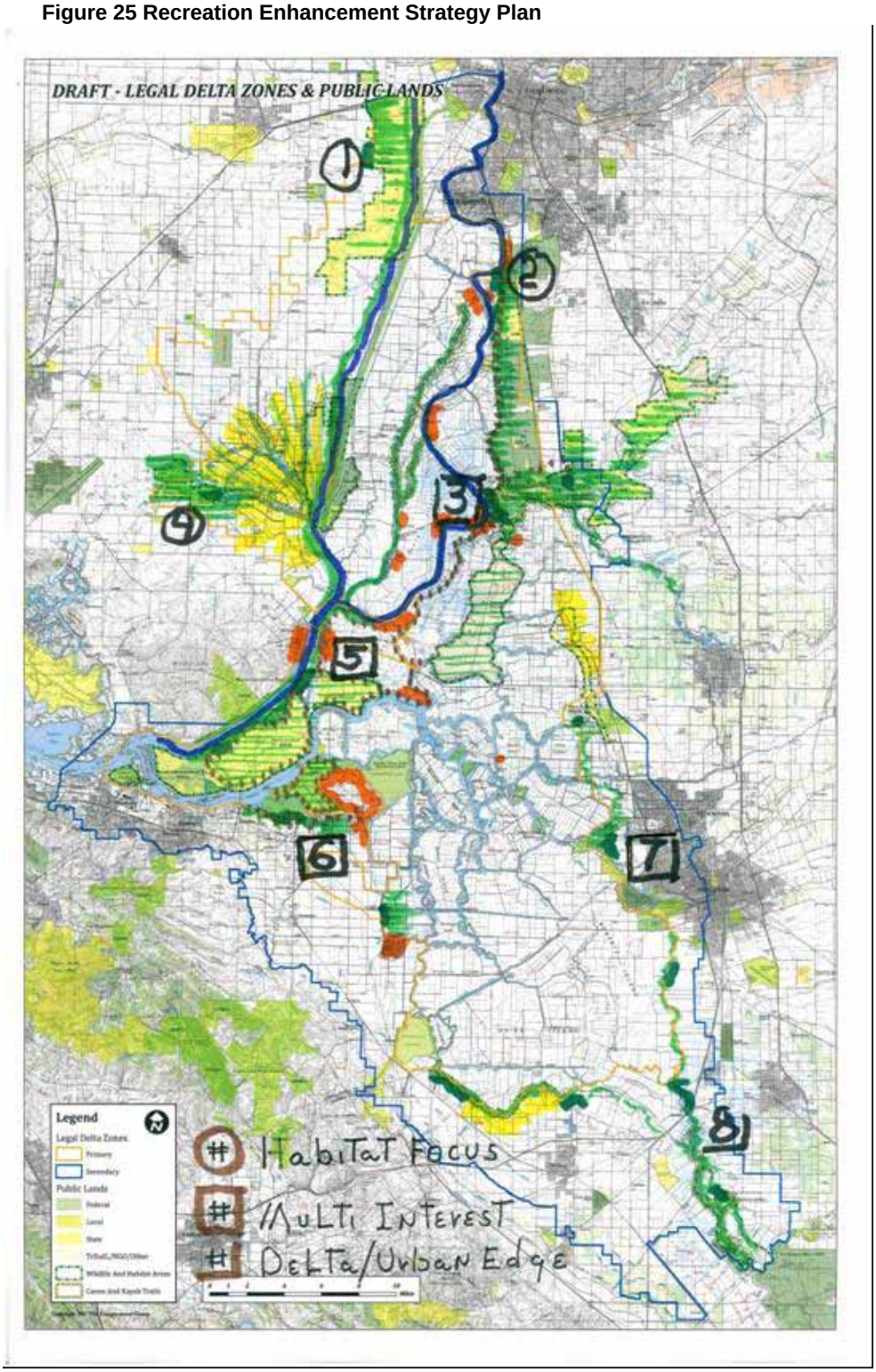
The future growth of recreation in the Delta is proposed to be based upon the principles and goals previously discussed, and a recommended recreation enhancement strategy consists of five location based concepts (See Figure 25).

- Delta waterways

[42] State Parks 2011.

- Dispersed small points of interest and activity areas
- Focal point destinations (activity bases)
- Natural habitat areas
- The edges of existing and emerging urban areas that surround the Delta

Figure 25 Recreation Enhancement Strategy Plan



2.3.1 Delta Waterways

The primary location for recreation in the Delta is, of course, the waterways. These waterways themselves are very diverse - narrow, wide, tree-lined or channelized, windy or quiet. Boaters have, over time, selected areas for their specialty activities, such as windsurfing, waterskiing, cruising, paddling, etc. Specialty needs are associated with most of these diverse activities.

The Delta Protection Commission's 2006 *Aquatic Recreation Component of the Delta Recreation Strategy Plan* is still very applicable. It recognized the existing use areas, access points, and marinas, and provided recommendations regarding their enhancement, refurbishment, and expansion. In addition, the report recommended three priority new enhancements to the existing situation.

It recommends that non-motorized boating trails be established in six different locations on waterways where habitat values are primary and where such use would not conflict with power boating activities. A second recommendation is that major boat-to destinations, similar to Delta Meadows, be established in other parts of the Delta. Further study is required to determine where these might be appropriate, but four possible areas are provided. The third recommendation was that smaller boat-in day-use areas with adequate facilities be established in appropriate locations throughout the Delta. Suggested ingredients for these areas, as well as location criteria are provided within the report, but no specific locations are identified.

As described in the prior opportunities section, capacity of the waterways is such that increased use can be accommodated. The recommendations, therefore, are anticipated to accommodate future boating demands and changing use patterns for many years to come.

2.3.2 Dispersed Points of Interest

The existing setting and primary value of the Delta is its diversity of interesting features, which are dispersed throughout its vast landscape. These features grant the Delta particular interest because they contrast from the surrounding urban and even rural agriculture landscapes. Examples are the small Legacy Communities, winding waterways, passing ocean-going vessels, bridges and ferries, etc.

This charming sense of place should be protected, enhanced, and expanded. Key specific elements are the scattering of 95 marinas; most clustered but many in solitary, strategic locations, the direct sale of agricultural products, as well as the Legacy Communities. Overall, this aspect has come to be referred to as Delta-as-a-place. The sheer number and diversity of things to see and do is a valuable feature.

The expansion, over time, of additional areas will primarily be accomplished through private enterprise responding to opportunities such as farm markets, wineries, art galleries, restaurants, etc. On the public side, a past study by the Department of Water Resources[43] also identified approximately 40 small day-use, launching, and fishing access locations that were economically viable but which were never developed.

[43] DWR 1981

Specifying the location of the small private enterprise dispersed points would likely be a disservice and, instead, policies should be developed to encourage appropriate facilities in non-conflicting locations.

2.3.3 Focal Point Destinations

Companion with this dispersal of points of interest and activities throughout the Delta, it is proposed that four focal point destination complexes be developed. They would each consist of a suite of synergistic destinations or features found in the rest of the Delta.

One of the primary values added by these recreation destination focal points will be the ease of attracting and capturing new visitors to the Delta. Basically, creating a "there-there" that is easy to find. Once "there", visitors can be directed to the other dispersed attractions or facilities. The complexes will also add value through the potential to create economically viable locations for various private enterprise activities.

Three locations have been identified that have an existing combination of natural areas, parks, small and Legacy Communities, marina complexes, historic features, and trail potentials. They are focused around 1) Walnut Grove/Locke/ Cosumnes Reserve, 2) Brannan Island/Rio Vista/Isleton, and 3) Bethel Island/Jersey Island/Big Break. In addition, an emerging complex along the edges of Stockton also has the potential to be a significant focal point.

More specifically, the first focal point area centered on Locke/Walnut Grove is proposed to also include Ryde, Cortland, and Hood, as well as the Stone Lakes Preserve, Delta Meadows, the Cosumnes Preserve, and Staten Island. Additional public facilities should include day-use and camping facilities at Delta Meadows, events venues, further improvements/restorations at Locke, and appropriate wildlife viewing/nature study opportunities. The entire complex could be knit together with a network of trails. The proposed historic railway connection between Old Sacramento and Hood could also provide an important critical mass addition. Chapter 13 discusses some strategies for the Legacy Communities, but further evaluations could be made of additional features and activities that could assist in creating viable settings for private enterprise opportunities.

The second focal point area centered around Brannan Island/Rio Vista is proposed to also include Isleton, the emerging Delta Discovery Center and Farmer's Market, and the marina complex around the junction of the San Joaquin and Old Mokelumne Rivers. The proposed habitat areas on Twitchell and Sherman Islands, the Sacramento County Regional Park on Sherman Island, and Brannan Island State Recreation Area, could be knit together with the communities and marinas with a network of trails. Development of additional features to create settings for private enterprise should again be evaluated.

The third focal point area centered around Bethel Island should include its marina and business establishment complex, Big Break Regional Park, and natural lands conversion of Jersey Island. These areas could again be tied together and enhanced with trails.

The fourth focal point along Stockton's edge is of a different character, and does not include a Legacy Community or a major existing natural landscape feature. The planning and emerging development for the area, however, clearly create a unique Delta related focal point area. The recent designation of the westerly portion of Wright-Elmwood Tract as open space provides the opportunity for additional park, trail, and habitat restoration improvements.

2.3.4 Natural Habitat Areas

A fourth location based concept is the association of appropriate visitor access to natural habitat areas within and on the edges of the Delta. Three existing natural habitat areas have the potential of providing expanded environmental education and nature appreciation opportunities. They are the Jepson Prairie/Calhoun Cut area at the head of Cache Creek, the Yolo Basin Wildlife Area east of Davis, and the Stone Lakes State Park and U. S. Fish and Wildlife Reserve. These three areas, in combination with the previously identified areas associated with the focal point areas are all important assets of the greater Delta. They all have the need for improved visitor access and interpretive facilities, tailored to their individual circumstances.

2.3.5 Delta/Urban Edges

The final location based concept is the establishment of Delta serving and urban recreation areas, as well as natural habitat zones around the edges of the Delta between adjacent urban areas. This concept will unfold over time from Stockton around to Antioch and Bethel Island, including the north edge of Tracy and Lathrop, and in selected locations such as Rio Vista and Suisun City. It is recommended that criteria be developed to assist in locating this interface zone in an area that would optimize its value for habitat enhancement with periodic park nodes and interconnecting trails.

The most obvious areas to locate this open space corridor would be to build upon the natural and riverine resource values of the San Joaquin River from Stockton to and through Lathrop, and from Lathrop to the Clifton Court Forebay along Old River. Companion habitat restoration and floodway areas should occur so as to create an integrated whole.

2.4 Potential operational solutions

As discussed above regarding opportunities and constraints, one of the largest operational constraints is that there currently exists no “Delta” brand or overall marketing strategy. In general, the average potential visitor within the Market Area has to overcome a number of barriers in order to recreate in the Delta – it’s hard to see, there’s no central entry and focal point with information and activities, and facilities are sparse, spread out, and hard to access.

In order to take advantage of expected population growth and trends toward more resource based recreation, private enterprise owners will need assistance in marketing, development, funding, permitting, and understanding the myriad of regulations which control operations and development in the Delta. Currently, there are a number of organizations which are trying to overcome these barriers, such as Discover the Delta Foundation and the Delta Chamber of Commerce. But, they are small, underfunded, and limited in scope.

The Delta is in need of a well-funded “facilitator” organization that can readily and easily assist visitors access the Delta’s many charms, help brand and label the Delta, and support the economic development of private visitor serving businesses. This organization could help form and organize “wine tours”, “farm tours”, and “boat tours”. It could operate visitor centers or kiosks at entry points to the Delta. It could develop and install “Delta” signage. It could operate a website and social media linking potential visitors to activities, festivals, and facilities. It could offer training and professional development support for local businesses and serve as a clearinghouse for funding opportunities for those businesses, from marinas to farms to bed and breakfasts to restaurants to antique shops. It could link the boating organizations to the fishing organizations to the wine organizations to the farm stands to the tour operators to overnight

accommodations to allow visitors to easily assemble weekend or week long itineraries to take advantage of all the Delta offers.

There are many types of organizations which could fill this void; non profit organizations, public agencies, public/private partnerships, and others. For example, the Delta Protection Commission is currently investigating the feasibility of a National Heritage Area and what that designation might mean for the Delta. The Discover the Delta Foundation has built a farmer's market/information center at the junction of routes 160 and 12, and has plans for a visitor's center. They may be able to partner with others expand this concept to other gateway areas. A Joint Powers Authority could be developed by Delta counties, cities, and public agencies which own or operate recreation areas in the Delta to provide one stop visitor information services, similar to the "311" number system operated by the City of Sacramento.

The matrix below presents a listing of potential facilitator organizations and the criteria that could be used to evaluate which organization could best move forward in this role. One particular organization is not recommended at this point, but the baseline scenario assumes that such an organization will be developed and made operational within the next ten years. Theoretically, any of the options could be assisted through funding from future Delta projects.

Table 37 Delta Recreation Facilitator Opportunities and Constraints Matrix

	Potential Facilitator						
	Existing Local Control/ No central authority	Non Profit Organization	State Parks	Delta Protection Commission	National Heritage Area	Public/Private Partnership (funded by local assessment e.g. Downtown partnership)	Delta Economic Development Joint Powers Authority (cities, counties, public agencies)
Criteria							
Public/ Private	Both	Private	Public	Public	Public	Private	Public
Funding Potential	As exists	Fundraising potential	Limited	Limited	Matching federal funds	Assessment District on local businesses	Funded by partner agencies…limited
Existing Operation	Yes	No	Yes	Yes	No	No	No
Existing Mission	Yes	No	Partial	Partial	No	No	No
Allow for central marketing of Delta	No	Yes	No	Maybe	Yes	Yes	Yes
Produces stability/ encourages facility growth/ improvements	No	Yes	No	Maybe	Yes	Yes	Maybe
Help alleviate use conflicts	No	Maybe	No	Maybe	Maybe	Maybe	Yes
Can promote/ produce additional festivals/ special events	Yes	Yes	Maybe	Maybe	Yes	Yes	Yes
Can identify and establish gateways	Yes	Yes	Maybe	Yes	Yes	Yes	Yes
Act as clearing- house for information for private entrepreneurs	No	Yes	No	Yes	Yes	Yes	Yes

2.5 Visitation Potential

A market demand based model of visitation for current conditions was described above. This model is based on population, participation rates, activity days, and market capture rates. The same model can be used to predict ranges of visitors in the future, making adjustments to

participation rates and market demand capture rates based on the principles and assumptions discussed above, as well as general recreation trends that may influence recreation participation rates in the future that were also discussed above.

General assumptions regarding recreation trends in the future include:

- Market Area population will increase by approximately 50-60%.
- Approximately 20% of the future recreation use will be developed urban park related, 30% right-of-way related, and 50% resource related.
- There is a trend away from consumptive recreation (i.e. hunting, fishing) and towards non-consumptive wildlife recreation (i.e. bird watching, nature photography, etc.).
- There will be an increasing trend towards agri-tourism.
- Gas prices will continue to increase, with a trend towards recreation closer to home.
- Boating trends will shift towards non-motorized boats (i.e. more canoe/kayaks).
- The proposed Great Delta Trail will be completed.

Predicted trends in Delta specific recreation categories are presented in Table 38.

Table 38 Predicted Trends in Delta Specific Recreation Categories under Baseline Conditions

Activity Type	Trends	Impact to Participation Rates	Impact to Market Capture Rates
Resource Related			
Boating – Motor, personal watercraft	Increasing gas prices more local demand uncertainties in water quality	Reduce	Flat
Sailboating	Increasing gas prices more local demand uncertainties in water quality	Flat	Flat
Paddle sports (canoe, kayak, etc.)	Increasing gas prices more local demand uncertainties in water quality facilitates non-consumptive wildlife viewing, increasing exercise	Increase	Flat
Fishing	Trends away from consumptive recreation Water quality uncertainties	Reduce	Flat
Hunting	Trends away from consumptive recreation	Reduce	Flat
Swimming	Uncertain water quality	Flat	Flat
Wildlife Viewing/Outdoor Photography	Trends toward non-consumptive recreation Baseline – no additional habitat areas, limited public investments	Increase	Flat
Camping	More local demand	Flat	Flat
Right-of-Way/Tourism Related			
Day hiking	Trail build out will increase local opportunities	Flat	Increase
Bicycling	Trail build out will increase local opportunities	Flat	Increase
Driving for pleasure	More local demand Established competitive areas overcrowded already	Flat	Increase
Historic/cultural/agricultural tourism	More local demand More private enterprises Established competitive areas overcrowded already	Flat	Increase
Urban Parks Related			
Day Use/Sports	More local demand	Flat	Increase
Local/Edge Facilities	Meet population growth demands	Flat	Increase

2.6 Economic Potential

2.6.1 Recreation Spending

As quantitative visitation projections are developed, the associated economic impact will be evaluated using the established spending data.

2.7 Key Findings

- By attracting visitors to Legacy Communities and expanding recreation access to waterways and land side recreation improvements, potential negative impacts on agriculture from increased tourism and recreation can be minimized by focusing recreation uses and activities.
- The future growth of recreation in the Delta consists of five location based concepts:
  - Delta waterways, specialized by boating type;
  - Dispersed small points of interest and activity areas, such as marinas, farmer's markets, wineries, restaurants;
  - Focal point complexes, such as Legacy Communities or Bethel Island/Jersey Island/Big Break;
  - Natural habitat areas; and
  - The edges of existing and emerging urban areas that surround the Delta, such as Stockton, Tracy, and Lathrop.
- A significant operational constraint for future growth in recreation demand is that there currently exists no "Delta" brand, overall marketing strategy, or significant scale focal point area. In general, the average potential visitor within the Market Area has to overcome a number of information gaps in order to recreate in the Delta – it's hard to see, there's no central entry point with information and activities, and facilities are sparse, spread out, and hard to access. A "facilitator" organization should be encouraged and developed.

3 Impact of Policy Scenarios

Four possible policy scenarios are qualitatively evaluated as to their primary elements and their potential positive and negative impacts on recreation.

3.1 Policy Scenarios Impacts on Recreation potential

3.1.1 Assumptions under all scenarios

In Chapter 6, different policy scenarios were presented on which to base analysis for future economic impacts. Although not explicitly discussed, we assume that the purpose of any of the scenarios other than the baseline is to achieve the stated purpose of the Delta Reform Act and that the policies would achieve the co-equal goals of water conveyance and habitat protection. Thus, under all scenarios, we assume explicitly that:

- Water quality in the Delta will improve overall (though salinity intrusion may still be a factor).
- Fisheries will be improved.
- The project will be mitigated appropriately (suggestions to follow in later sections) for potential impacts to recreation, the Legacy Communities, and the economic sustainability of the Delta.

3.1.2 Isolated Conveyance Scenario

In Chapter 6, the Isolated Conveyance Scenario was described including the following Delta impacts:

- Five new water intakes would be built along the Sacramento River between Clarksburg and Courtland.
- A new forebay of would be constructed near Courtland where water from the five intakes would be collected and then pumped into an isolated conveyance pipeline under the Delta, extending to a new afterbay near the Clifton Court Forebay.
- Land would be removed from agriculture for the intake-pumping stations and the forebay and afterbay.
- Approximately 8,000 acres of agricultural land would be utilized in Sacramento and San Joaquin Counties with the footprint of the isolated conveyance.

This scenario would have a number of impacts on existing and future recreation uses, some potentially positive and others negative, including the following:

- Since the water intakes would be upstream from the confluence of the Sacramento and San Joaquin Rivers, it is expected that salinity in the water at the confluence of the two rivers and further south will increase. Water quality would decrease in the resulting stagnant waterways. This change in water salinity and quality will likely impact fishing, boating, and hunting in the lower Delta.
- Moving the intake of fresh water to the north will likely have a beneficial impact on fisheries by allowing a more natural outflow of the remaining water out to sea.
- The pumping intake stations will introduce an “industrial” quality to approximately 10 miles of the Sacramento River. This will create significant visual impacts to this rural scenic stretch of river. In addition, the sound and night lighting related to these facilities will impact the existing Legacy Communities. Together these impacts will reduce the Delta-as-a-place character and the value of the Delta as a tourism destination.
- The loss of agricultural lands will probably decrease hunting opportunities.

3.1.3 Habitat Conservation Scenario

The Habitat Conservation Scenario was described in Chapter 6 with impacts resulting from the following project elements:

- More frequent flooding and improved fish passage along 22,000 to 48,000 acres in the Yolo Bypass, improving fisheries, but impacting agriculture.
- Creating approximately 10,000 acres of new floodplain along the San Joaquin River using setback levees.
- Restoring tidal habitat on up to 65,000 acres in agricultural land throughout the Delta.
- Natural Communities Protection, including converting 8,000 acres of rangeland to natural grasslands, restricting 32,000 acres of agriculture to “wildlife friendly” practices, and converting 700 acres of rangeland to vernal pools and alkali wetlands.
- Restore approximately 20 miles of channel margin along North Delta waterways through setback levees and shallow water habitat.

The number of potential impacts on future recreation from this scenario may include:

- Increased wildlife viewing/photography and paddle sports and other nature associated recreation, if restored habitat areas also include public access facilities.
- Increased fishing due to better fisheries.
- Boating overall will increase with increased habitat and water quality.
- General tourism is uncertain, as the effect on Legacy Communities is unclear.
- Camping would increase to support increasing nature related recreation, if new sites and successful synergies can be established.

- The conversion of agricultural lands to habitat will decrease hunting opportunities and private facilities, but increase hunting opportunities in public habitat lands. Nevertheless, this will most likely result in an overall decrease in hunting.
- Specifics regarding channel margin improvements are not described. Potential conflicts could be:
    - reducing or eliminating windsurfer access,
    - creating use restrictions on other forms of boating,
    - elimination of State and County park facilities with access to the river,
    - restrictions regarding shore fishing, and
    - others.

Most of these impacts can be avoided or mitigated through appropriate design.

- Creating the larger acreage (50,000± acres) of tidal marsh at the south end of the Delta could have devastating effects on salinity in the South Delta, as well as creating strong currents in the channels leading to this area. Both would have significant impacts on boating and fishing. In addition, likely impacts on agriculture lands could reduce hunting opportunities.
- Details regarding the San Joaquin River floodway are not described. If adequate in width, it could accommodate natural vegetation, trails, and recreation opportunities similar to the American River Parkway, in addition to agriculture. If limited in carrying capacity, it could be restrictive regarding these recreation elements as is the Sacramento bypass between Davis and West Sacramento.

3.1.4 Flood Control Scenario

The Flood Control Scenario was described in Chapter 7 with two general scenarios:

- Flooding six central Delta islands: Webb, Venice, Empire, Mandeville, Medford, and Quimby, and leaving them in open water.
- Increasing levee upgrades, including around the Legacy Communities.

The number of potential impacts on future recreation from the flooded island scenario may include:

- The winding, protected, freshwater channels and waterways are the primary appeal of the Delta to boaters. Substituting a large open body of water at this proposed location will severely impact the existing boating use, but have very little offsetting use. The existing use categories in this area are fishing, water skiing, personal watercraft use, speed boating, house boating, cruising, and, to a limited degree, windsurfing. A large open body of water would have severe negative effects on all these users. The open water area could be more conducive to sailing. There are a number of factors, however, that will minimize this as a potential substitute use:
    - Sail boat densities on the water are lower;
    - The flooded islands, if similar to existing flooded islands, will have water hazards, snags, and partially submerged debris, making them dangerous to less knowledgeable boaters;
    - Most Delta boaters are from the Bay area, where sailing is far superior and closer;
    - Those boaters in the Bay area who choose to sail are already adequately served, with local marinas which, at present, are not fully occupied;
    - Those boaters in the Sacramento Metro area who enjoy sailing are primarily berthed at Folsom Lake, which has more favorable winds and higher water quality than will the six island area; and
    - The average sailboat is far more expensive than the average boat found in the Delta.
- Approximately 40% of all the marinas in the Delta are clustered around this potential area and another 5% along the San Joaquin River from Pittsburg to Antioch, resulting in a disproportionally negative impact to overall existing facilities.

- This open water will have unknown changes to fisheries which will impact anglers.
- The elimination of hunt clubs on those islands will reduce hunting.

The number of potential impacts on future recreation from the increased levee upgrade scenario may include:
- Better protection of marinas in those areas, though, at the same time, loss of waterside access areas;
- Increased investment in Legacy Communities, resulting in more right-of-way/tourism activity; and
- Unknown changes to fisheries.

3.1.5 Regulatory Changes Scenario

Proposed regulatory changes are not known at this time. The following potentials could have a negative effect on recreation.
- Regulations against water, sewer, and building developments would make it very difficult for both existing and new enterprises to either locate within the Delta or to respond to changing market demands. This could adversely affect park expansions, marinas, and related resorts, as well as Legacy Communities, wineries, and direct sale of agriculture products, most likely creating further stagnation in recreation and tourism visitation.
- Blanket prohibitions against further development within the Secondary Zone could have an unfavorable impact on the park and recreation values around the edges of the Delta. Some development already exists within the zone and it would create a hodgepodge edge. In the southern Delta, the most favorable edge locations would be in association with the San Joaquin and Old River channels, somewhat inside the Primary Zone.
- Continuing and/or increasing restrictions and regulations on dredging and vegetation controls in and around marinas could have significant impacts on such recreation providers.
- The reduction or removal of land use, historic preservation and agriculture protection regulations could affect the scenic values of the Delta and subsequent tourism use.

3.1.6 Policy Scenarios Impacts Summary

Table 39 presents a summary of predicted potential impacts to recreation and tourism by the policy scenarios described above.

Table 39 Predicted Trends in Major Recreation Categories under Policy Scenarios Conditions

	Policy Scenarios				
Activity Type	Isolated Conveyance	Habitat Conservation	Flood Control - Islands	Flood Control – Increased Levees	Regulatory Changes
Resource Related					
Boating	Decrease	Increase	Decrease	Flat	Decrease
Fishing	Increase	Increase	Decrease/Flat	Flat	Flat
Hunting	Decrease	Flat/Decrease	Decrease	Flat	Flat
Wildlife Viewing/Outdoor Photography	Decrease	Increase	Flat	Flat	Flat
Camping	Decrease	Increase	Decrease	Flat	Flat
Right-of-Way/Tourism Related	Decrease	Flat	Flat	Increase	Decrease
Urban Parks Related	Flat	Increase	Flat	Increase	Decrease
Overall	Decrease	Increase	Decrease	Flat	Decrease

3.2 Impact Analysis and Mitigation Potential

An evaluation was made as to the probable scale of negative and positive impacts from various actions described in the scenarios.

3.2.1 Negative Impacts

The following lists the four most negative potential impacts on recreation in descending scale:

1. *Six Island Flooding*. This could potentially reduce boating use by 30-50% in the Delta. The combination of the creation of a large tidal marsh at the south end of the Delta with this scenario element could increase and aggravate this negative impact.

2. *Intake & Pumping Stations – Clarksburg to Courtland.* This scenario element, if placed along the river at this location, could seriously impact the Delta-as-a-Place recreation and tourism in this primary entry and destination area in the Delta. It is estimated that it could reduce such use by 25-30%.

3. *Salinity Increases in Central & South Delta.* This impact is likely if all water pumped from the Delta is removed in the north end. Both boating and fishing use would likely be impacted by at least 10-15%.

4. *Large Tidal Marsh in South Delta.* A large scale tidal marsh would likely affect salinity and current in the waterways leading to the south end, affecting boating and fishing, as well as loss of hunting areas. Negative impacts on these three uses would likely be in the 5-10% range.

3.2.2 Positive Impacts

Some of the elements to certain scenarios could have a positive influence on recreation use:

1. *Fishing Enhancements*. The various fishing enhancements proposed in the habitat conversion and isolated conveyance scenarios is expected to help restore fisheries and fishing use, potentially in the 10-25% range.

2. *Wildlife Viewing/Nature Study*. The proposed expansion of natural preserves and wildlife friendly agriculture would increase the opportunities for such uses, and could increase the use level for this activity by 20-30%. (This use level currently exists at a small number and would result in a smaller visitor increase than fishing enhancements.)

3. *Delta-As-A-Place Enhancement.* The increase in wildlife viewing opportunities will likely have a synergistic effect on the Delta-as-a-place visitation. Estimated increases in benefits could be in the 5% range.

3.2.3 Potential Mitigation Measures

Some of the mitigation measures that present themselves from this evaluation and prior sections of the report are:

1. *Isolated Conveyance.* Move the conveyance intake facilities and also plan a dual conveyance system that would send some of the water through the Delta at times that would

minimize damage to fisheries and maintain water quality in central and south Delta during low flow conditions.

2. *Flood Control.* Plan against catastrophic flooding through operable barriers and the protection and repair of levees. Priority should be the protection of infrastructure, Legacy Communities, and south Delta islands.

3. *Recreation Enhancement Plan.* Develop and implement a recreation enhancement plan as outlined in the report including:
   - Creating urban/Delta interface zones in logical locations that can provide multiple open space and recreation benefits.
   - Facilitating increased tourism through wineries, direct sale of agriculture, revitalization of Legacy Communities, and properly developed, maintained (and open) public facilities.
   - Assisting private recreation providers through variety of means.
   - Improving water quality.

3.3 Economic Benefits/Projections

As quantitative visitation projections are developed, the associated economic impact will be evaluated using the established spending data.

3.4 Key Findings

- Different future scenarios may have overall positive and negative effects to different recreation sectors, with Habitat Conservation potentially having the most positive affect and Isolated Conveyance the most overall negative effect. Insights under development will focus on potential impacts from future scenarios and how recreation can adapt to potential changing conditions.

Chapter 9: Infrastructure

There is a range of infrastructure in the Delta supporting economic sustainability within the region and linking the Delta to surrounding regions and beyond. This chapter examines a selection of that infrastructure with identified importance from analysis of available databases, literature, and consultation with key stakeholders from Sacramento-San Joaquin Delta communities. Accordingly, five broad categories of infrastructure: 1) Water Resources Infrastructure 2) Flood Management Systems 3) Transportation Infrastructure 4) Electricity Infrastructure, and 5) Information and Communication Systems are reviewed and analyzed within the framework detailed in Chapter Six.

THIS CHAPTER IS UNDER DEVELOPMENT

1 Delta Water Resources Infrastructure

1.1 Water Supply Systems

1.2 Waste Water Treatment Systems

2 Delta Flood Management Systems

3 Delta Transportation Infrastructure

3.1 Shipping

3.2 Road Transport

3.3 Rail

4 Delta Energy Infrastructure

4.1 Natural Gas Infrastructure

4.2 Electricity Generation Systems

4.3 Electricity Distribution Systems

Chapter 10: Other Key Economic Sectors

As Chapter 2 made clear, agriculture and to a lesser extent recreation and tourism are economic drivers of the predominantly rural Delta primary zone. However, our analysis of the Delta's economy has also identified several existing clusters as well as other important sectors in the primary zone with significance for the Delta's future economic sustainability. In this chapter we analyze these sectors, identify means to enhance their contribution, and consider impacts to these sectors from the alternative policy choices. Throughout focus is upon the primary zone with discussion of the secondary zone and surrounding areas limited to sectors with key Delta linkages.

THIS CHAPTER IS UNDER DEVELOPMENT

1 Existing Clusters in the Delta

1.1 Construction

1.2 Drilling Oil and Gas Wells

1.3 Real Estate and Rental Leasing

2 Other Important Sectors in the Delta

2.1 Supermarkets and Grocery Stores

2.2 Health Care

2.3 Transportation

2.4 Professional and Business Services

Chapter 11: Local Government Services in the Delta

The challenges associated with provision of local government services are enhanced in the Delta where traditional budgetary resources are constrained by land use restrictions. In this context we examine a couple of key local government services in detail: 1) Law enforcement and 2) Educational services. These specific services are then contrasted with an integrated discussion of local government fiscal systems in the primary zone of the Delta. Following the analytical framework, baseline trends are complemented with strategies to enhance delivery of these services. The chapter concludes with a discussion of impacts associated with the policy proposals on local government services.

THIS CHAPTER IS UNDER DEVELOPMENT

1 Law Enforcement and Emergency Response Services

2 Educational Services

3 Local Government Services' Fiscal Impacts

Chapter 12: Legacy Communities

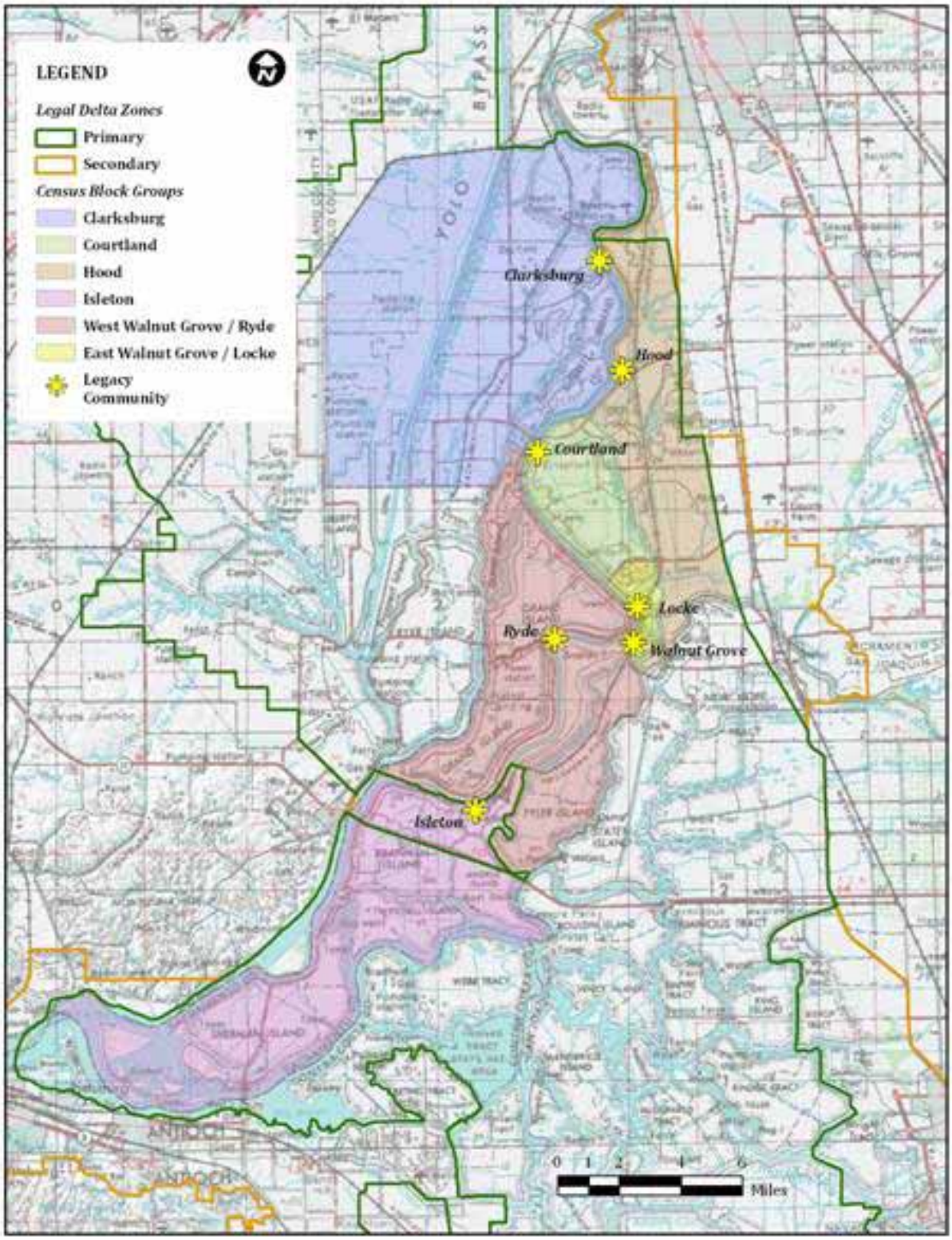
Communities in the California Delta have existed to support recreation and agriculture and, until recently, have been economically sustainable in their own right. However, demographic, economic, and land use trends have changed these towns considerably—some to the extent that visible signs of underutilization and urban decay are prevalent. When considering the ongoing viability of each of the Delta communities, it is important to understand past, current, and anticipated land uses and development capabilities coupled with demographic trends and observation.

THIS CHAPTER IS UNDER DEVELOPMENT

For purposes of the Economic Sustainability Plan (ESP), Clarksburg and Walnut Grove/Locke have been chosen to serve as prototypes for the rest of the communities. The strategic action plans for Clarksburg and Walnut Grove/Locke identify specific implementation actions, responsible partners and implementers, funding requirements, potential funding sources, and priority projects/programs so the "legacy" of these communities can live on. Aspects of these action programs will also be applicable to other Delta Legacy Communities, and it is anticipated that the ESP will assist in creating a framework in which all communities of the Delta will prosper.

For each Legacy Community, a vision and strategy for implementation is presented to the reader and accompanies a qualitative historical and community character narrative. Aspects of the narratives include strategies for economic development and land use, tourism, preservation and enhancement of existing community character, as well as the notion of creating "legacy" as a brand that can aid in economic development and enhanced regional community identity. Elements of the vision and strategy include quality historic preservation, urban design goals and objectives, infill development parameters, recreational facilities (particularly as they pertain to water), cohesive, branded interpretive opportunities, historical significance, and overall interpretation of the built environments), site assembly, marketing, business recruitment/retention, coordination efforts with other communities or organizations (in particular, SACOG), and other elements focused on the specific needs of Clarksburg, Walnut Grove, and Locke.

Figure 26 Legacy Communities and Census Block Group Boundaries



1 Current Status and Trends

1.1 Clarksburg

Clarksburg is unique in that it is the only Yolo County community in the Delta Primary Zone. As such, Yolo County's General Plan addresses it as a distinct place that, if developed, would be done so in a manner consistent with other communities in Yolo County. At 35 square miles, the "Clarksburg Peninsula" is recognized as an official appellation by the American Vintner's Association and a leader in the production of Chardonnay grapes.

Yolo County's General Plan states this: The vision of Yolo County is to remain an area of active and productive farmland and open space. Both traditional and innovative agricultural practices will continue to flourish in rural settings, while accommodating the recreational and tourism needs of residents and visitors. Communities are envisioned to be kept separated and individual through the use of working agricultural landscapes, while remaining connected by a network of riparian hiking trails, bike paths, and transit. While more families will call the cities and towns home, they will live in compact neighborhoods that are friendly to pedestrians and bicyclists and are located within easy access to stores and work. Some limited new growth will be allowed, and infill and more dense development in older developed areas will be encouraged, bringing improved infrastructure (e.g., roads, sewer, water, drainage) to rural small communities, where service does not presently exist or is inadequate. By implementing this vision, Yolo County can grow and prosper in a way that reflects its unique values.

Yolo County also sets forth policies and goals specific to Clarksburg:

> In January 2008, Yolo County established the Clarksburg Agricultural District to explore ways to encourage agricultural business development and expansion. The Clarksburg Agricultural District encompasses both the federally recognized Clarksburg wine appellation and the West Sacramento Enterprise Zone. While the land in this district makes up only 9 percent of Yolo County's active farmland, it produces almost 22 percent of the total value of Yolo County's top five crops. Yolo County is considering an array of possible tools that could be applied in the district, such as relaxing regulatory standards and level of service standards; subsidizing marketing efforts; lowering building permit fees; allowing additional on-site housing; and designating specific economic focus points where shipping, processing, trade, and other services would be centrally located. This element contains policies and actions encouraging the similar use of agricultural districts in other areas of Yolo County, where appropriate.

1.1.1 History

Clarksburg was settled in stages dating back as early as the 1850s, when Merritt Island was first cleared and developed for agricultural uses. Postal authorities first established a post office in 1876 as "Clarksburgh" and changed the name to "Clarksburg" in 1893. The town was named after Robert C. Clark, who settled there in 1849. In the 1920s, the New Holland Land Company began subdividing the tracts in the area and formally established Clarksburg as an unincorporated community in Yolo County. The community is now largely centered on two churches, a market and wine deli, a library and volunteer fire department, and three schools.

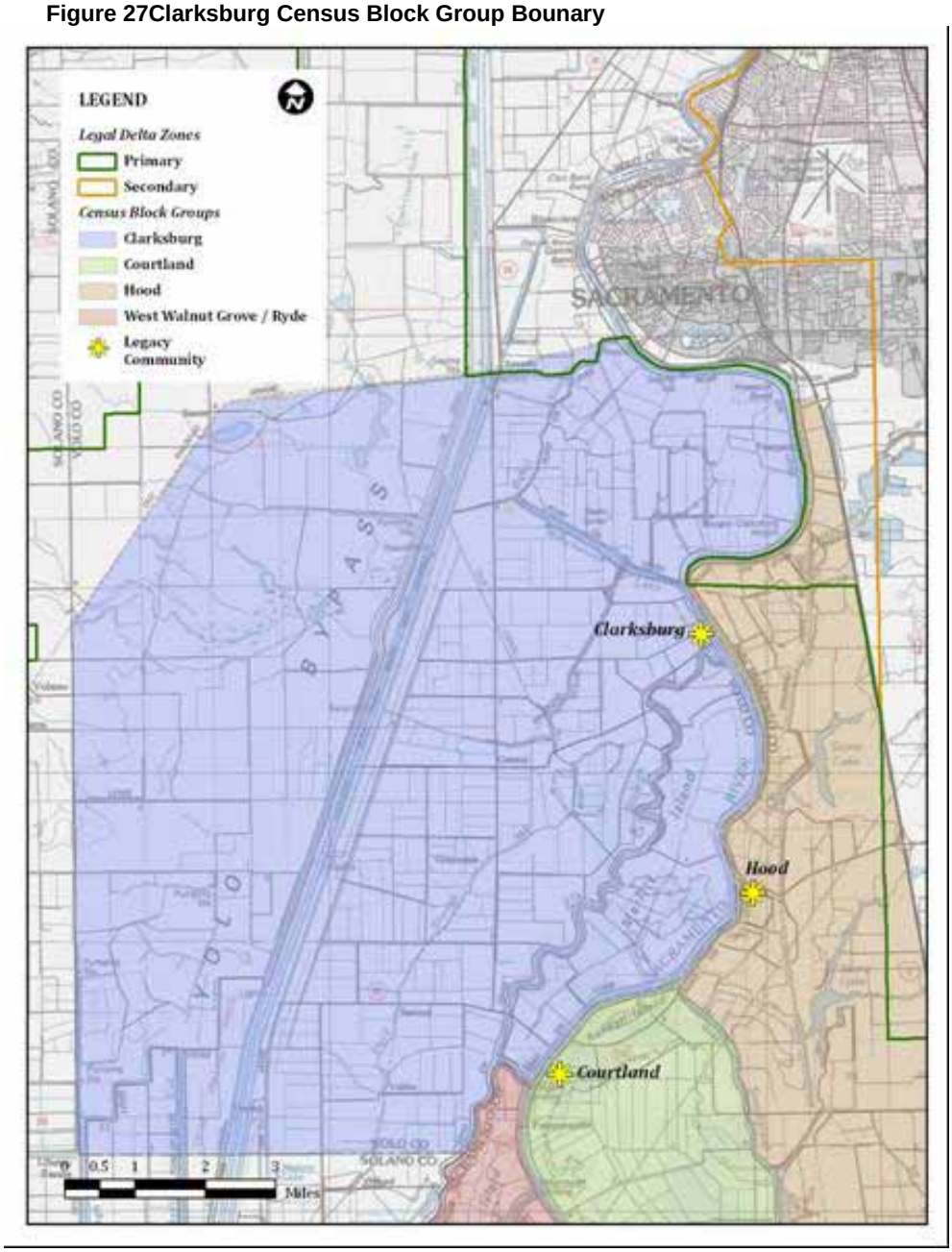
The 1930s era Old Sugar Mill (which closed in 1988) is now the center of development activity and houses a budding wine tasting and production facility and events center. The portion of Sacramento County directly across the Sacramento River from Clarksburg is considered part of the community in large part because of an old ferry crossing that existed during the 1920s and the character of the developed and natural landscapes that span the river. The businesses that exist in and around Clarksburg are mostly involved in supporting the agricultural concerns of the area. Agricultural commodities include wine grapes, alfalfa, and tomatoes.

Architect William Raymond Yelland designed buildings in Clarksburg, including several homes, the Clarksburg Community Church, and the Sugar Mill. W.R. Yelland is most noted for his Arts and Crafts and Storybook Houses built during the 1920s and 1930s.

1.1.2 Socio-Economic Context

The ESP Team has evaluated the socio-economics of Clarksburg based on various data sources that originate from the U.S. Census. Census data for Clarksburg is available for Census Block Group Numbers 061130104001 and 061130104002, which form the geographic boundary shown in Figure 27 below. Although this boundary may differ from some other political or locally accepted definitions of Clarksburg, it is the best socio-economic information available for the purposes of this analysis.

Figure 27Clarksburg Census Block Group Bounary



Generally, the ESP Team has weighed data attributes of each of the Legacy Communities against those of the broader "Legal Delta," which will allow for comparison and contrast to show how each of these communities resemble or differ from the larger context of the Delta Region. Other working papers include similar information for other geographic areas (such as the Primary and Secondary Zones, as well as California as a whole). The detailed tables supporting the information in this section are included in tables in the Appendix of this report.

Population and Households 2010

According to the latest US Census Bureau American Community Survey estimates, there are approximately 1,330 residents and 489 households residing in Clarksburg, which is likely very similar to the population base that was present a decade ago. The lack of growth in Clarksburg comports with the Yolo County General Plan designations for the area, which has allocated minimal growth over the next 20 years. Of course, new planning initiatives could be brought forth for approval; however, the denial of the residential component of the Old Sugar Mill development proposal in 2007 does not bode well for any significant residential growth. It is probably safe to assume that Clarksburg will remain at or near its current size in terms of population and households for the foreseeable future, unless major changes in land use policy, flood protection options, and market conditions occur.

The Housing Element of the Yolo County General Plan seeks to ensure the compatibility of new discretionary housing units with applicable, properly adopted policies of the Land Use and Resource Management Plan of the Delta Protection Commission. Policies directly pertaining to Clarksburg include these:

- Provide affordable housing and farm worker housing in the Clarksburg Region, consistent with the Land Use and Resource Management Plan.
- Advocate for amendment of the Delta Protection Act or Delta Protection Commission Land Use and Resource Management Plan as necessary and appropriate to encourage development of limited new or improved infrastructure to serve existing and affordable housing and other appropriate development in Legacy Communities like Clarksburg that are treated differently by the Delta Protection Commission.
- Encourage developers to have neighborhood meetings with residents and staff early as part of any major development pre-application process.
- Encourage utility and service providers to pursue available funding sources for development of new infrastructure and upgrades to existing systems to serve affordable housing.
- Encourage use of the State density bonus law for affordable housing, senior housing, childcare facilities, and other special needs groups, as allowed.
- Encourage development of large rental and for-sale units (containing four or more bedrooms) that are affordable for very-low- and low-income households.

Age

The age distribution of residents in Clarksburg indicates a population that is similar to the Legal Delta overall but with fewer young children and a much higher proportion of older residents. As shown in Table 40, Clarksburg's population in the under-18 age group is only 18 percent of the population (compared to 29 percent in the Legal Delta), and the population in the 65 to 84 years age group is 19 percent (compared to 9 percent in the Legal Delta).

Table 40 Clarksburg Population Age Distribution, 2005/2009

Item	Clarksburg		Legal Delta	
	Amount	%	Amount	%
Under 18 years	233	17.5%	168,518	28.8%
18 to 20 years	47	3.5%	25,710	4.4%
21 to 34 years	257	19.3%	106,932	18.3%
35 to 54 years	376	28.3%	169,813	29.0%
55 to 64 years	168	12.6%	55,114	9.4%
65 to 84 years	249	18.7%	51,453	8.8%
85 years and over	0	0.0%	7,641	1.3%
Total Population	**1,330**	**100.0%**	**585,181**	**100.0%**

"clarksburg_age"

Source: 2005-2009 American Community Survey 5-Year Estimates.

Race and Ethnicity

The residents of Clarksburg are generally Caucasian, with residents identifying themselves as "White alone" making up approximately 64 percent of the population (which is significantly higher than the 42 percent in the Legal Delta). Only 4 percent of the Clarksburg population reports being "Asian alone," which is the next highest racial category (as compared to nearly 13 percent in this category for the Legal Delta).

Approximately 30 percent of the Clarksburg population reports being of Hispanic origin, which is almost exactly the same percentage as reported for the entire Legal Delta. This is a smaller share of the population than in California, where Hispanics make up roughly 36 percent of the population. See Appendix for more information.

Educational Attainment

The educational attainment of the Clarksburg population is largely in line with that of the rest of the Legal Delta, as demonstrated in Table 41. Clarksburg does, however, show a slightly lower percentage of residents having completed high school (or GED) than the Legal Delta overall. However, Clarksburg residents are more likely to have completed post-secondary, higher education than the Legal Delta.

Table 41 Clarksburg Educational Attainment (Population 25 years and older), 2005/2009

Education Level Attained	Clarksburg		Legal Delta	
	Amount	%	Amount	%
Population (25 yrs and over)	**875**	**100.0%**	**359,018**	**100.0%**
No high school diploma	181	20.7%	61,684	17.2%
High school graduate/GED/Some College	401	45.8%	184,237	51.3%
Associates degree or higher	68	7.8%	32,978	9.2%
Bachelor's degree or higher	145	16.6%	56,796	15.8%
Graduate or professional degree	80	9.1%	23,323	6.5%

"clarks_edu"

Source: 2005-2009 American Community Survey 5-Year Estimates.

Household Income

The household income distribution in Clarksburg is generally similar to the larger context of the Legal Delta, as shown in Table 42. A slightly larger proportion of Clarksburg households have a total household income less than $35,000 (28 percent versus 26 percent in the Legal Delta), and a smaller proportion of Clarksburg households have a household income between $35,000 and $150,000 (52 percent versus 63 percent in the Legal Delta). A significantly greater share of Clarksburg residents earn more than $150,000 (20 percent, as opposed to 10 percent in the Legal Delta), indicating that while blue collar in nature, Clarksburg does indeed contain some wealth and high-net-worth residents.

Table 42 Clarksburg Houshold Income Distribution, 2005/2009

	Clarksburg		Legal Delta	
Annual Income	Amount	%	Amount	%
Total Households	**489**	**100.0%**	**194,248**	**100.0%**
Less than $15,000	52	10.6%	18,641	9.6%
$15,000 to $34,999	86	17.6%	32,006	16.5%
$35,000 to $49,999	84	17.2%	25,172	13.0%
$50,000 to $74,999	85	17.4%	36,381	18.7%
$75,000 to $99,999	24	4.9%	29,047	15.0%
$100,000 to $149,999	61	12.5%	32,586	16.8%
$150,000 or more	97	19.8%	20,415	10.5%
Average Household Income	**$81,654**		**$79,231**	

"clarks_income"

Source: 2005-2009 American Community Survey 5-Year Estimates.

Housing

Approximately 63 percent of the housing units in Clarksburg are occupied by their owners. This is slightly lower than the Legal Delta (at 66 percent); however, it is greater than the trend in California overall, where only about 58 percent of homes are owner-occupied. This dynamic is consistent with home ownership rates observed in more rural areas where multifamily housing is scarce.

Resident Commute Patterns

Although 18 percent of Clarksburg residents work in Clarksburg, most commute to work elsewhere. The labor force residing in Clarksburg commutes to various locations throughout Northern California, most notably, the City of Sacramento, at 17 percent of total.[44]

Current Employment by Sector

The labor force residing in the Clarksburg area is dominated by the agriculture industry, at nearly 25 percent of employment, as shown in Table 43. The next largest industries are manufacturing (15.5 percent), finance and insurance (14.8 percent), and construction (14.4

[44] According to the US Census Bureau, OnTheMap and LEHD Origin-Destination Employment Statistics, 2009.

percent). Of employed Clarksburg residents, approximately 70 percent are employed by for-profit enterprises, 15 percent are employed by government entities, 14 percent are self-employed, and only 2 percent are employed by not-for-profit organizations.

Table 43 Clarksburg Employed Labor Force by Industry, 2009

Industry	Clarksburg		Legal Delta	
	Amount	%	Amount	%
Agriculture, forestry, fishing and hunting	135	24.7%	4,095	1.6%
Mining, quarrying, and oil and gas extraction	0	0.0%	261	0.1%
Construction	79	14.4%	23,250	9.1%
Manufacturing	85	15.5%	20,540	8.1%
Wholesale trade	0	0.0%	7,772	3.0%
Retail trade	13	2.4%	31,275	12.3%
Transportation and warehousing	0	0.0%	12,787	5.0%
Utilities	12	2.2%	2,845	1.1%
Information	8	1.5%	6,199	2.4%
Finance and insurance	81	14.8%	13,428	5.3%
Real estate and rental and leasing	0	0.0%	6,497	2.5%
Professional, scientific, and technical services	10	1.8%	13,059	5.1%
Management of companies and enterprises	0	0.0%	158	0.1%
Admin. and support and waste mgmt svcs	0	0.0%	12,688	5.0%
Educational services	23	4.2%	19,645	7.7%
Health care and social assistance	36	6.6%	32,037	12.6%
Arts, entertainment, and recreation	8	1.5%	4,144	1.6%
Accommodation and food services	0	0.0%	14,262	5.6%
Other services, except public administration	32	5.9%	12,513	4.9%
Public administration	25	4.6%	17,687	6.9%
Total Employment	**547**	**100.0%**	**255,142**	**100.0%**

"clarks_emp"

Source: 2005-2009 American Community Survey 5-Year Estimates.

Employment Trends

As described above, Clarksburg employment is dominated by the agriculture industry. According to estimates from the U.S. Census American Community Survey, the agriculture industry (which also includes forestry, fishing, and hunting) is by far the largest sector, at 25 percent of total jobs in Clarksburg, although this allocation has fluctuated substantially in recent years. Table 44 shows the change in employment by sector in Clarksburg from 2002 to 2009.[45] This data indicates that total employment increased overall between 2002 and 2009; however, this growth is characterized by large fluctuations in a few key industries, such as the agriculture, forestry, fishing, and hunting industries, which reportedly shed nearly 150 jobs during this time period.[46]

The construction industry has demonstrated substantial change as well, increasing from just 25 employees in 2002 to 104 employees in 2009. This likely is due to one or two major construction projects moving in or out of Clarksburg, or by a construction business'

[45] From Local Employment Dynamics-Local Employment and Household Dynamics (LED-LEHD) employment data.

[46] It is important to note that local employment swings in this industry are common because employment is often tied to designated accounting/payroll offices rather than agricultural fields. In addition, major changes in the construction industry have occurred throughout the Sacramento region in recent years, and a substantial portion of the growth in this sector may have been tempered.

headquarters location being moved to the area.[47] Manufacturing has also shown a very aggressive growth rate in recent years, growing from almost no employees in this sector in 2002 to more than 150 employees in 2009, which likely is due to the prolific expansion in wine production (such as at Bogle Vineyards and at the Old Sugar Mill).

Other sectors in Clarksburg make up a very small proportion of overall employment and have remained relatively steady over the past 8 years, with the exception of educational services, which has 40 jobs (2009) but has shed 31 jobs since 2002. This likely is due to a combination of scholastic funding cuts and changes at the local school district, which converted the local elementary school into a middle school, and construction of portable facilities on adjacent land to facilitate a charter elementary school.

Table 44 Clarksburg Employment, 2002-2009

Industry (NAICS)	2002	2009	Nominal Growth 2002 - 2009	Avg. Ann. Growth Rate
Agriculture, Forestry, Fishing and Hunting	335	186	(149)	-8.06%
Mining, Quarrying, and Oil and Gas Extraction	0	3	3	n/a
Utilities	0	1	1	n/a
Construction	25	104	79	22.59%
Manufacturing	2	154	152	85.99%
Wholesale Trade	0	2	2	n/a
Retail Trade	0	5	5	n/a
Transportation and Warehousing	14	2	(12)	-24.27%
Information	0	0	0	n/a
Finance and Insurance	0	0	0	n/a
Real Estate and Rental and Leasing	0	3	3	n/a
Professional, Scientific, and Technical Services	1	6	5	29.17%
Management of Companies and Enterprises	0	2	2	n/a
Admin. & Support, Waste Mgmt. and Remediation	0	1	1	n/a
Educational Services	71	40	(31)	-7.87%
Health Care and Social Assistance	0	9	9	n/a
Arts, Entertainment, and Recreation	1	1	0	0.00%
Accommodation and Food Services	0	7	7	n/a
Other Services (excluding Public Administration)	13	2	(11)	-23.46%
Public Administration	5	10	5	10.41%
Total	**467**	**538**	**71**	**2.04%**

"clarksburg"

Source: US Census Bureau LED/ LEHD

Some of the largest employers in Clarksburg include Bogle Vineyards (which employs approximately 60 workers in Clarksburg[48]) and the River Delta Unified School District (which has approximately 30 employees in Clarksburg[49]). Bogle Vineyards has been a key stakeholder in the business community and a regional success story, having grown considerably since its modest beginnings in 1979 to now shipping more than one million cases of wine per year. Largely because of a favorable pricing strategy and high quality product, the company has weathered the recession very well and is undergoing a major expansion of its processing

[47] Indeed, Hoover's Dunn & Bradstreet (2010) has reported that six small construction companies opened in Clarksburg during this time period.
[48] According to Bogle company representatives.
[49] According to Hoover's Dunn & Bradstreet enterprise data, 2010.

facilities. The company has stated that it intends to hire approximately 20 more employees in the next 2 to 3 years as this facility is constructed.

Overall, it is interesting to note that although significant changes in key industry sectors have occurred over the past 8 years, the changes have not yielded significant changes in total employment in Clarksburg. In fact, overall, Clarksburg has demonstrated more than 2.0 percent average annual change in employment, which is a healthy rate of growth. It appears that jobs have generally shifted from one industry (agriculture) to others (construction and manufacturing).[50]

Employee Commute Patterns

Clarksburg employees travel from throughout the region, most notably from Sacramento, Elk Grove, West Sacramento, and Rio Vista. Clarksburg residents make up the largest single category of residence for Clarksburg employees. Although only 17 percent of Clarksburg workers actually live in Clarksburg, this is relatively high compared to other Legacy Communities.

1.1.3 Opportunity Sites

There are some "opportunity sites" in Clarksburg that occupy key geographic locations in the town, have important adjacencies/connections, or for some other reason(s) deserve further evaluation as part of an economic strategy. Land development is significantly constrained in the Legacy Communities by both flood protection and regulatory issues. Moving forward, as these issues are evaluated and resolved, certain parcels may have particular merit for future development, for recreational and tourist-related activities, for local-serving goods and services, or for future agricultural processing facilities. First and foremost, these sites should have adequate infrastructure to serve them, including adequate flood protection, sewer, water, and roadway access. In addition, these sites should have good visibility, ideally both from the land, as well as the water.

Some of Clarksburg's more prominent sites that may have merit for future development are listed below.

1. The Old Sugar Mill has been an important and highly visible—albeit controversial—component to Clarksburg's continued change and evolution of the region into a wine-related destination. The project was originally conceived as a mixed use village that would incorporate 125 residential dwelling units and significant commercial and industrial space on the former sugar beet processing site. Although this project gained approval by Yolo County, it was not approved by the Delta Protection Commission and the residential portion of the site was never constructed. Today, the Sugar Mill is home to state of the art wine production facilities, six microwineries, and the facility hosts many events throughout the year, including weddings, concerts, fundraisers, etc.

   The Sugar Mill project is important to Clarksburg in a variety of ways and speaks to the economic development potential of the area. The proposal presents evidence that a developer was willing to take significant financial risk to invest in Clarksburg and supports the notion that significant economic development potential exists in this region; however,

[50] It is important to note that local employment swings in agriculture are common because employment is often tied to designated accounting/payroll offices rather than agricultural fields. In addition, the construction industry has undergone significant changes in recent years and the growth in this sector may be tempered.

this potential is hindered by a variety of factors (be they political, regulatory, environmental, or infrastructure-related).

Nonetheless, the Old Sugar Mill is operating successfully today and presents an opportunity to build on Clarksburg's status as a tourist destination. Efforts to support this and similar efforts should be strongly considered in concert with the various regulatory agencies and local community members.

2. Yolo County has identified approximately 100 acres of ag-industrial land in the Clarksburg Area plan. Approximately half of this acreage has already been allocated for Bogle Winery's processing facility expansion in the central portion of the district. Other areas around Clarksburg have been posited to absorb the remaining acreage, although no formal arrangements have been made.

3. The former agricultural processing facility located at the northwest corner of Riverview Drive and Clarksburg Road may present an additional opportunity for development in Clarksburg because its location is picturesque, well-served by vehicle access, adjacent to the river, and well-located in its connection to the Old Sugar Mill project, as well as to town. Other sites throughout the Clarksburg area may present similar opportunities for development once the larger issues of flood control, market conditions, and regulatory control have been improved or resolved.

1.1.4 Infrastructure Constraints

There are certain specific infrastructure constraints in Clarksburg that limit the community's development/redevelopment and economic development options. The following items require additional research, documentation, analysis, and strategic considerations in future versions of this analysis:

- Water and sewer. [insert discussion based on info from County or other sources]
- Flood protection. [insert narrative based on discussions with team engineers]
- Telecommunications (mostly internet access).
- Roadways.
- Waterway access (lack of public docks).

1.1.5 Vision/Toolkit/Strategic Action Plan

The following items are to be included in Clarksburg's strategic action plan, which will be defined in greater detail in future versions of the ESP:

- Based on the Clarksburg General Plan, any growth should be directed towards infill and replacement development in the existing Clarksburg town area.
- Promote wine grape growing and establish as the primary economic development theme of the community.
- Promote the enhancement and business development of establishments like the Old Sugar Mill, implementing wayfinding signage and accessibility accommodations to the site, primarily signage and complete streets. Enhancements should be consistent with the character of the Clarksburg town area.
- Establish local crushing, fermentation, bottling, and storage capacity.
- Promote tourism, including farm stays.
- Promote farm stands and the sale of locally produced agricultural products.

- Review land use policies for visitor-serving facilities.
- Establish and promote Enterprise Zone benefits.
- Study the potential for additional docking and transient boat accommodation between Clarksburg and Netherlands Avenues along South River Road. If more docking facilities are created, implement a wayfinding system to lead visitors to river-facing shops and the Old Sugar Mill.
- Encourage the establishment of basic support services for tourists and visitors: restrooms, community-themed convenience markets akin to the one that exists, and landside 'parks' or other places to eat and rest while ashore.
- Work with active nonprofits/community groups to implement economic strategies and community initiatives.
- Encourage cooperation between Yolo and Sacramento Counties to create a regional brand that includes Clarksburg and celebrates its tie to the Sacramento River and budding legacy as an acclaimed wine grape-growing region.
- Modifications and enhancements to the Clarksburg community should maintain and enhance agricultural and recreational resources that are already in place.

1.2 Walnut Grove/Locke

Although they are located nearly adjacent to each other, Walnut Grove and Locke are distinctively unique communities, even though they are clearly connected in terms of the populations, services, employment linkages, etc. This section describes the historical and socio-economic context of these communities.

1.2.1 Walnut Grove History

Established in 1850 by John W. Sharp, Walnut Grove is one of the earliest settlements along the Sacramento River. Sharp journeyed west from Ohio with his young family and chose the site of Walnut Grove because of the abundant walnut and oak forests in the area. The town quickly prospered as an agricultural center, riverboat stop (the forests were timbered for steamboat firewood), and a major shipping port by 1865 for agricultural produce and fish, with the Bartlett Pear as its primary product. By 1870, it was a thriving town full of small businesses (many owned by the Sharp family), a school, post office, and Union Guard Armory.

After Sharp's death in 1880, the heirs sold a large portion of the estate to Alex Brown and his son, Alex. The Brown family subsequently became heavily involved in the commercial life of the community, operating a general store, hotel, an asparagus packing house, and the well-known Bank of Alex Brown. Because of the demands for rich agricultural land, its size stayed compact but has the distinction of being the only river town along the Sacramento River to occupy both banks.

Ferry service operated for many years between parts of town on either side of the river until the first bridge was opened in 1916. The bridge, since replaced by a modern span, was the first cantilevered counter-weight bascule drawbridge constructed west of the Mississippi River. It was officially opened by the Governor of California, who traveled with various dignitaries to Walnut Grove on the gubernatorial yacht.

As early as 1914, a large Japanese community lived in Walnut Grove. About 67 Japanese-owned businesses (with names and addresses) are listed in the Nichi-Bei Nenkan (Japanese American Yearbook) of 1914, including one tofu shop: Sakai Tofu-ya.

The community was racially segregated until the start of World War II. Only Whites were allowed to own homes on the west side of the river. Even on the east side, the Asians

separated into a Japanese section and a Chinese section. There were two elementary schools (a “White” school and Walnut Grove Oriental Elementary) until the Japanese were forcibly moved out of the area at the start of World War II. Then, the two elementary schools (up to Grade 8) were combined. Students were bussed to Courtland for high school until that school became identified as an earthquake hazard.

The California Alien Land Law of 1913 prohibited “aliens ineligible for citizenship” (i.e., all Asian immigrants) from owning land or property but did permit 3-year leases. The law affected the Chinese, Indian, Japanese, and Korean immigrants and had a significant impact on development patterns and land use in Walnut Grove and Locke. The law was invalidated in 1952 by the Supreme Court of California as a violation of the equal protection clause of the 14th Amendment to the United States Constitution.

The Chinese residents were immigrants from two different areas from the Guangdong (Canton), China, Delta Region. The Chung Shan people resided in Locke, while Walnut Grove was populated by immigrants from Toi Shan County in China. During the Sino-Japanese War in the 1930s, the Walnut Grove-Locke-Isleton area was a prime target for visiting Chinese government VIPs to raise funds for the Chinese government.

The principal activities in the Walnut Grove Chinese community were farm laborer lodging and operating illegal gambling houses and Chinese restaurants. These services were primarily for migrant farm workers from the Philippines. “Whites” were not allowed to enter for fear they were police.

In the early 1930s, Walnut Grove was a thriving community until a fire destroyed the Chinese section in about 1935. Walnut Grove reached its peak in the 1930s and 1940s, and a daily shuttle operated by the Ow family carried Chinese to and from San Francisco. It also took orders for merchandise from San Francisco. The route started in Courtland with stops at Locke, Walnut Grove, and Isleton and returned nightly.

Sugar beet growing was active into the late 1940s. There were two locations where trucks unloaded beets, filling Southern Pacific railroad cars bound for Sacramento for processing. Asian women worked in fruit packing houses throughout the Delta area (such as Locke, Walnut Grove, Ryde, and Isleton), while men worked in the fields.

The separation in ownership between land and building led to substantial deterioration in the building stock. In the late 1960s a rent dispute arose over funding of sewer improvements in lieu of land rent, which eventually led to a rent strike and subsequent purchase of what is now know as the Delta Estates. Eighty percent of the acquisition financing came from government funding sources.

The Sacramento Housing and Redevelopment Agency (SHRA) began working in the Delta in the mid- to late 1970s, initially assisting the Delta Estates in financing capital improvements. By the early 1980s, SHRA had established a Redevelopment Project Area and assisted the Walnut Grove Homeowners and Merchants Association (WGH&MA) in additional land acquisitions to unite land and buildings. Once the land was purchased from the original families and S.P. Railroad and subdivided and transferred to individual building owners, SHRA in concert with the WGH&MA began an aggressive revitalization program, which included the construction of curbs, gutters and sidewalks, a park, a fire station, parking lots, sewer and water improvements, a community boat dock, and initiated a Commercial Revitalization Program, which included commercial loans, grants, façade rebates, and technical assistance to the Walnut Grove Area Chamber of Commerce. The Redevelopment Project Area expired in 2004, and SHRA has since reduced its involvement in the area.

1.2.2 Locke History

Locke was founded in 1915 after a fire broke out in the Chinese section of Walnut Grove. The Chinese who lived in that area decided it was time to establish their own town and formed a committee of Chinese merchants. They approached land owner George Locke and inquired if they could build on his land. An agreement was reached, the town was laid out by Chinese architects, and industrious building ensued, leading to founding of "Lockeport," later "Locke," and by 1920, the town stood essentially as it appears now. At its peak, 600 residents and as many as 1,500 people occupied the town.

In 1990, Locke was designated a National Historic Landmark because of its unique status as the only town in the United States built exclusively by the Chinese for the Chinese. Locke is the last remaining rural Chinatown in the United States. It was built at the turn of the century, at a time when California law prohibited Chinese from owning property. The town was built on land owned by a local farmer named George Locke. Although the Alien Land Act law was repealed in 1952, the underlying land was never subdivided by subsequent owners. As a result, the residents who owned their buildings (many passed down from the original Chinese families) never had an opportunity to own the land on which their homes and businesses stood. Without land ownership, they could not borrow conventional mortgages to preserve their buildings. Recognizing the cultural value of the community and the disinvestment caused by split ownership (land/buildings), in the early 1980s the SHRA invested in protecting the community from fire and continued deterioration. Fire retardant was applied to building exteriors, propane was replaced with electric systems, and buildings were structurally stabilized.

In 2000, SHRA bought the underlying land from the Hong Kong–based company that owned it. SHRA then began a 4-year process to turn the town back to its inhabitants. The most threatened buildings were stabilized, and the failed septic system was replaced with a new sewer system (assisted by a grant from the U.S. Department of Agriculture). Because all the buildings were wood and at extreme risk of fire, the State Historic Preservation Office required the installation of a fire suppression sprinkler system, which has been completed.

In total, more than $3 million in federal Community Development Block Grant (CDBG) and Economic Development Initiative (EDI) funds were spent on these activities. Additional financial assistance was provided by the California Department of Parks and Recreation and the Save America's Treasures program, each of which provided a grant to begin rehabilitation of the town's historic Boarding House into a Visitor and Cultural Center, which was completed in 2008 and serves to tell the history of Chinese immigrants in California and the Delta.

The most difficult part of the project, however, was the effort to create an ongoing town governance structure that would balance the needs of the building owners and residents, the Chinese cultural and historic groups, governmental entities, and the historic preservation community. All these groups had intense interest in the outcome, and many had different goals and objectives. SHRA, with the use of outside consultants, architects, historic preservationists, and others, developed a plan that would manage these competing interests.

In the end, a nonprofit organization, the Locke Management Association (LMA), was created. Membership of the board was balanced between building owners, government representatives, and representatives of local Chinese cultural groups, with no group having a majority. All the common area land in the town was granted by the SHRA to the LMA for their future use and control. As a condition of receiving land from the SHRA, all the buyers signed various documents limiting the use of the buildings, imposing historic architectural requirements, instituting a right of first refusal for descendants of the original settlers to purchase buildings as

they become available, and agreeing to a set of by-laws and Covenants, Conditions, and Restrictions governing future management of the town.

On December 14, 2004, the SHRA turned over ownership of the now subdivided land to the building owners in an emotional ceremony that received widespread publicity. With this action, the Historic Town of Locke, listed on the National Register of Historic Places and a National Historic Landmark, now had a chance to be saved for future generations.

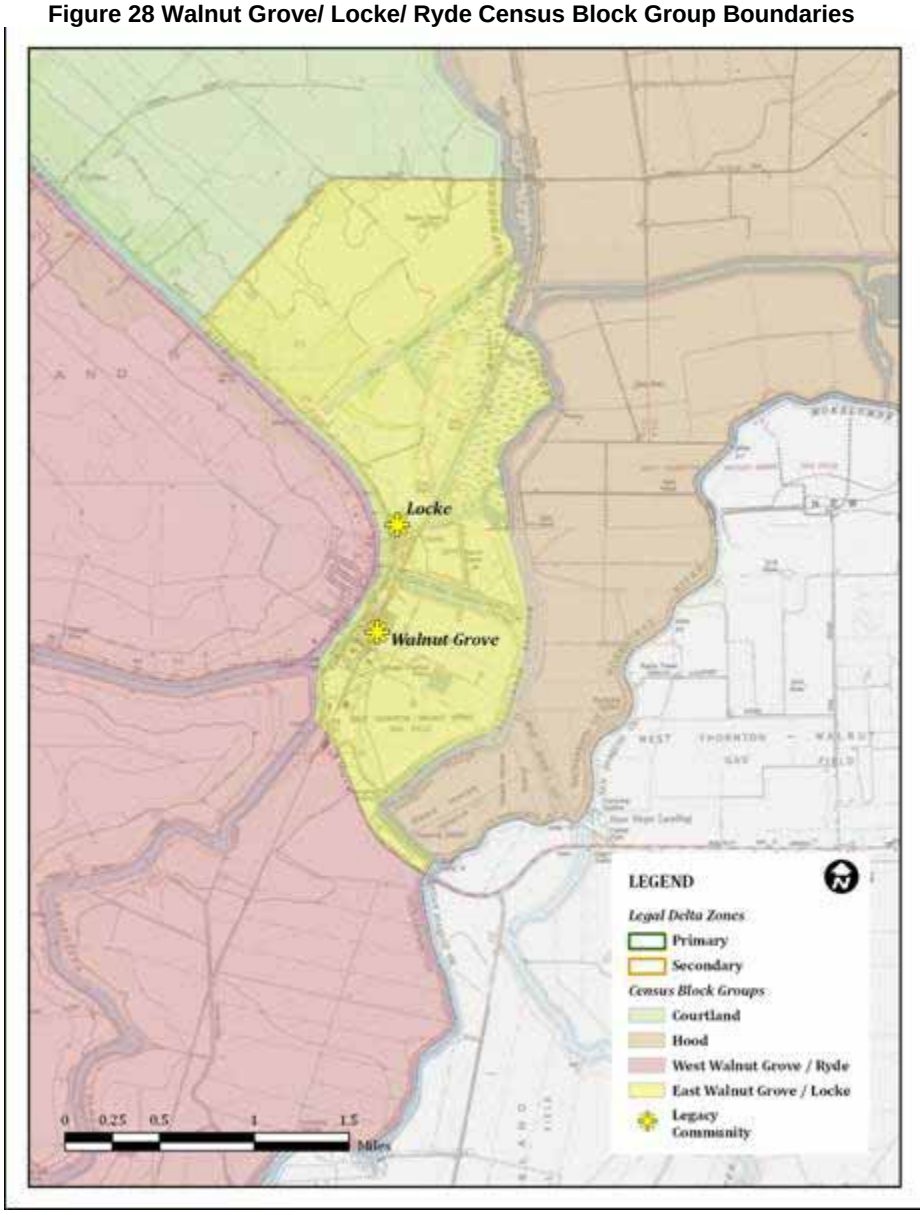
In 2008, the Locke Boarding House, a national historic landmark, opened as a Visitor and Cultural Center to retain and interpret the rich history of Chinese immigrants in California and the Delta for future generations.

1.2.3 Walnut Grove/Locke Socio-Economic Context

The ESP Team has evaluated the socio-economics of Walnut Grove and Locke based on various data sources that originate from the U.S. Census Bureau. Census Bureau data concerning detailed socio-economic factors for Walnut Grove/Locke are available at the Census Block Group level, and comprises the area shown in Figure 28 below. The U.S. Census Bureau data does not distinguish between Locke and Walnut Grove in the American Community Survey socio-economic data set as these communities are comprised of a single U.S. Census block group. Therefore, the socio-economic information shown below is referred to as "East Walnut Grove/Locke," although it is recognized that these two communities have distinct socio-economic, business environment, and cultural attributes. This data issue is further complicated by the fact that the U.S. Census Bureau considers the residents and employees located in the western portion of Walnut Grove (i.e., Clampett and Great Isle Estates) to be included in a large block group that also includes the Ryde area, as shown in Figure 28 below. Although this geography is not ideal, the ESP provides the best data available for the purposes of characterizing these communities. The Consultant Team has also conducted interviews and site visits in each of the Legacy Communities and has attempted to temper any data-related issues that exist with information gleaned through interviews, personal observations of the site, document review, and other sources.

Generally, the ESP Team has compared data attributes of each of the Legacy Communities with those of the broader Legal Delta, which will allow for comparison and contrast to show how each of these communities resemble or differ from the larger context of the Delta Region. Other working papers include similar information for other geographic areas (such as the Primary and Secondary Zones, as well as California as a whole). The detailed tables supporting the information in this section are shown in Appendix.

Figure 28 Walnut Grove/ Locke/ Ryde Census Block Group Boundaries



Population and Households

The Census Bureau's American Community Survey data indicates that there are approximately 916 residents and 364 households in Walnut Grove/Locke, and 1,293 residents and 511 households in West Walnut Grove/ Ryde. The age distribution of residents in these communities indicates a population that is similar to the Legal Delta overall, although it is characterized by a slightly older population on average, and it shows with a significantly higher proportion of residents in the 55 to 64 age category. Population in the under-20 age group is only 26.8 percent of population in East Walnut Grove/ Locke and 19.5 percent in West Walnut Grove/ Ryde (compared to 33.2 percent in the Legal Delta), and population 55 years and older is 26.3 percent in Walnut Grove/ Locke and 36.1 percent in West Walnut Grove/ Ryde (compared to 19.5 percent in the Legal Delta). Compared to the state overall, a population that is older in composition is a common trait to Legacy Communities throughout the Delta.

Table 45 Walnut Grove/ Locke/ Ryde Population Age Distribution, 2005/2009

Item	E. Walnut Grove/Locke		W. Walnut Grove/Ryde		Legal Delta	
	Amount	%	Amount	%	Amount	%
Under 18 years	232	25.3%	252	19.5%	168,518	28.8%
18 to 20 years	14	1.5%	56	4.3%	25,710	4.4%
21 to 34 years	120	13.1%	103	8.0%	106,932	18.3%
35 to 54 years	309	33.7%	415	32.1%	169,813	29.0%
55 to 64 years	166	18.1%	194	15.0%	55,114	9.4%
65 to 84 years	56	6.1%	273	21.1%	51,453	8.8%
85 years and over	19	2.1%	0	0.0%	7,641	1.3%
Total Population	**916**	**100.0%**	**1,293**	**100.0%**	**585,181**	**100.0%**

"walnut_age"

Source: 2005-2009 American Community Survey 5-Year Estimates.

Race and Ethnicity

The population of East Walnut Grove/Locke contains a very high concentration of Asian residents, with residents identifying themselves as “Asian alone” making up approximately 38.4 percent of the population (which is significantly higher than the reported 12.6 percent in the Legal Delta). The data indicate that 21.2 percent of the East Walnut Grove/Locke population report being “White alone,” which is the next highest racial category (as compared to nearly 41.7 percent in this category for the Legal Delta).

Approximately 40 percent of the East Walnut Grove/Locke population reports being of Hispanic origin, which is almost exactly the same percentage as reported for the entire Legal Delta, as well as a higher share of the population than in California overall, where Hispanics make up roughly 36 percent of the population.

On the other side of the Sacramento River in West Walnut Grove/ Ryde, the race and ethnic composition is quite different. Only 3.2 percent of residents in West Walnut Grove/ Ryde identify as “Asian alone,” and 56.4 percent identify as “White alone.” Approximately 31 percent of the West Walnut Grove/ Locke population reports being of Hispanic origin (as compared to approximately 40 percent in East Walnut Grove/ Locke and in the Legal Delta).

Educational Attainment

The educational attainment of the residents of East Walnut Grove/Locke is much less favorable than that of the rest of the Legal Delta. Of this population, 26.5 percent does not have a high school diploma, as compared to 17.2 percent in the Legal Delta. There are no residents of East Walnut Grove/Locke that reported having a graduate degree or higher, as compared to 6.5 percent in the Legal Delta. On the other hand, East Walnut Grove/Locke does have a much higher proportion of residents with bachelor’s degrees, at 28.2 percent, as compared to 15.8 percent for the Legal Delta.

The educational attainment of residents of West Walnut Grove/ Ryde is also quite different from that of East Walnut Grove/ Locke. Only 13.5 percent of these residents do not possess a high school diploma, while 30.4 percent have achieved a bachelor’s degree or higher.

Table 46 Walnut Grove/ Locke/ Ryde Educ. Attainment (Pop. 25 yrs & older), 2005/2009

Education Level Attained	E. Walnut Grove/Locke		W. Walnut Grove/Ryde		Legal Delta	
	Amount	%	Amount	%	Amount	%
Population (25 yrs and over)	**634**	**100.0%**	**948**	**100.0%**	**359,018**	**100.0%**
No high school diploma	168	26.5%	128	13.5%	61,684	17.2%
High school graduate/GED/Some College	260	41.0%	376	39.7%	184,237	51.3%
Associates degree or higher	27	4.3%	117	12.3%	32,978	9.2%
Bachelor's degree or higher	179	28.2%	288	30.4%	56,796	15.8%
Graduate or professional degree	0	0.0%	39	4.1%	23,323	6.5%

"walnut_edu"

Source: 2005-2009 American Community Survey 5-Year Estimates.

Household Income

At $28,000 on average, the household incomes in East Walnut Grove/Locke are much lower than the overall Legal Delta and by far the lowest of all Legacy Communities. More than 45 percent of households in East Walnut Grove/Locke report an income less than $15,000, as compared to 9.6 percent in the Legal Delta. A slightly larger proportion of East Walnut Grove/ Locke households have a total household income of $35,000 to $49,000 (22 percent versus 13 percent in the Legal Delta), but a much smaller proportion of Clarksburg households have income between $50,000 and $100,000 (21.4 percent versus 33.7 percent in the Legal Delta).

The income distribution in West Walnut Grove/ Ryde is considerably more affluent as compared to East Walnut Grove/ Locke. For example, the average household income of the West Walnut Grove/ Ryde is $92,000 on average, as compared to under $80,000 in the Legal Delta. More than 26 percent of West Walnut Grove/ Ryde households earn more than $150,000 per year, as compared to just over 10 percent in the Legal Delta.

Table 47 Walnut Grove/ Locke/ Ryde Household Income Distribution, 2005/2009

Annual Income	E. Walnut Grove/Locke		W. Walnut Grove/Ryde		Legal Delta	
	Amount	%	Amount	%	Amount	%
Total Households	**364**	**100.0%**	**511**	**100.0%**	**194,248**	**100.0%**
Less than $15,000	164	45.1%	29	5.7%	18,641	9.6%
$15,000 to $34,999	43	11.8%	120	23.5%	32,006	16.5%
$35,000 to $49,999	79	21.7%	72	14.1%	25,172	13.0%
$50,000 to $74,999	52	14.3%	65	12.7%	36,381	18.7%
$75,000 to $99,999	26	7.1%	12	2.3%	29,047	15.0%
$100,000 to $149,999	0	0.0%	77	15.1%	32,586	16.8%
$150,000 or more	0	0.0%	136	26.6%	20,415	10.5%
Avg Household Income	**$28,532**		**$92,169**		**$79,231**	

"walnut_income"

Source: 2005-2009 American Community Survey 5-Year Estimates.

Housing

Approximately 57 percent of the housing units in East Walnut Grove/Locke are occupied by their owners. Although this is consistent with statewide averages, this is lower than the Legal Delta (which reports 66 percent). This likely reflects the fact that these areas are among the few in the Legacy Communities that have a fair stock of multifamily housing and affordable/workforce

housing. On the other side of the river in West Walnut Grove/ Ryde, over 70 percent of homes are owner-occupied.

Resident Commute Patterns

The residents of East Walnut Grove/Locke primarily work outside of Walnut Grove/Locke. The East Walnut Grove/Locke area is tied with the City of Sacramento as the two places with the highest proportion of place of work for Walnut Grove/Locke residents, each at 9 percent. The next highest categories are Stockton (6 percent) and West Sacramento and San Jose (3 percent each). Other cities on the list include San Francisco, Pleasanton, Fresno, and Arden-Arcade (in Sacramento), demonstrating that Walnut Grove/Locke residents must travel significant distances in some cases to work in larger metropolitan areas.

In West Walnut Grove/ Ryde, the commute patterns are similar, with 15 percent of residents working locally (in the Ryde/ Walnut Grove area), and eight percent commuting to the city of Sacramento. Other notable place-of-work destinations for these residents include Stockton and Rio Vista.

Current Employment by Sector

Similar to the other Legacy Communities, the labor force that resides in East Walnut Grove/Locke is heavily influenced by the agriculture industry, although administration and support of waste management services is the largest industry sector, at more than 34 percent of total employment (as shown in Table 49). Interestingly, nearly 90 percent of the employees in this industry sector are female. Agriculture, forestry, fishing, and hunting comprise more than 31 percent of employment (as compared to less than 2 percent for the Legal Delta). The next largest industries are educational services (9.1 percent); professional, scientific, and technical services (7.5 percent); information (7.3 percent); and manufacturing (6.7 percent). Of employed East Walnut Grove/Locke residents, approximately 75 percent are employed by for-profit enterprises (which is higher than the average for the Legal Delta, at 68 percent) and nearly 15 percent are self-employed (which is more than twice the rate for the Legal Delta).

The West Walnut Grove/ Ryde labor force is comparable to other Legacy Communities in that most residents work in the agriculture sector, which accounts for more than 20 percent of employment. Other significant industries are education (12.5 percent), real estate (12.1 percent), public administration (11.4 percent), and health care (10.1 percent).

Table 48 Walnut Grove/ Locke/ Ryde Employed Lobar Force by Industry, 2005/2009

Industry	E. Walnut Grove/Locke		W. Walnut Grove/Ryde		Legal Delta	
	Amount	%	Amount	%	Amount	%
Agriculture, forestry, fishing and hunting	118	31.7%	127	20.7%	4,095	1.6%
Mining, quarrying, and oil and gas extraction	0	0.0%	0	0.0%	261	0.1%
Construction	12	3.2%	47	7.7%	23,250	9.1%
Manufacturing	25	6.7%	13	2.1%	20,540	8.1%
Wholesale trade	0	0.0%	10	1.6%	7,772	3.0%
Retail trade	0	0.0%	32	5.2%	31,275	12.3%
Transportation and warehousing	0	0.0%	0	0.0%	12,787	5.0%
Utilities	0	0.0%	0	0.0%	2,845	1.1%
Information	27	7.3%	7	1.1%	6,199	2.4%
Finance and insurance	0	0.0%	34	5.5%	13,428	5.3%
Real estate and rental and leasing	0	0.0%	74	12.1%	6,497	2.5%
Professional, scientific, and technical services	28	7.5%	9	1.5%	13,059	5.1%
Management of companies and enterprises	0	0.0%	0	0.0%	158	0.1%
Admin. and support and waste mgmt svcs	128	34.4%	39	6.4%	12,688	5.0%
Educational services	34	9.1%	77	12.5%	19,645	7.7%
Health care and social assistance	0	0.0%	62	10.1%	32,037	12.6%
Arts, entertainment, and recreation	0	0.0%	0	0.0%	4,144	1.6%
Accommodation and food services	0	0.0%	13	2.1%	14,262	5.6%
Other services, except public administration	0	0.0%	0	0.0%	12,513	4.9%
Public administration	0	0.0%	70	11.4%	17,687	6.9%
Total Employment	**372**	**100.0%**	**614**	**100.0%**	**255,142**	**100.0%**

"walnut_emp"

Source: 2005-2009 American Community Survey 5-Year Estimates.

Employment Trends

As described above, employment in Walnut Grove, Locke, and Ryde is heavily influenced by the agriculture industry, although this sector is not necessarily the largest employer in these towns. According to estimates from the U.S. Census Bureau LED/ LEHD, the agriculture industry (which also includes forestry, fishing, and hunting) now only comprises approximately 20 percent of total jobs in East Walnut Grove/Locke and West Walnut Grove/ Ryde (2009); however, as recently as 2002, this sector accounted for 58 percent. As has been observed in other Legacy Communities and throughout the Delta in general, employment swings in this industry are common—especially in small geographic areas—because employment is often tied to an accounting/payroll office rather than agricultural fields.

Table 50 shows the change in employment by industry for East Walnut Grove/Locke and West Walnut Grove/ Ryde (combined) from 2002 to 2009. This data indicates that the total employment in Walnut Grove/Locke has remained relatively steady, but has decreased overall by 26 jobs between 2002 and 2009.

Table 49 Walnut Grove/ Locke/ Ryde Employment 2002-2009[51]

Industry (NAICS)	2002	2009	Nominal Growth 2002 - 2009	Avg. Ann. Growth Rate
Agriculture, Forestry, Fishing and Hunting	509	170	(339)	-14.50%
Mining, Quarrying, and Oil and Gas Extraction	0	1	1	n/a
Utilities	0	11	11	n/a
Construction	37	180	143	25.36%
Manufacturing	6	128	122	54.83%
Wholesale Trade	47	38	(9)	-2.99%
Retail Trade	41	77	36	9.42%
Transportation and Warehousing	4	16	12	21.90%
Information	3	2	(1)	-5.63%
Finance and Insurance	13	19	6	5.57%
Real Estate and Rental and Leasing	0	8	8	n/a
Professional, Scientific, and Technical Services	22	26	4	2.42%
Management of Companies and Enterprises	0	9	9	n/a
Administration & Support, Waste Management and Remediation	0	27	27	n/a
Educational Services	33	42	9	3.51%
Health Care and Social Assistance	11	21	10	9.68%
Arts, Entertainment, and Recreation	8	13	5	7.18%
Accommodation and Food Services	121	36	(85)	-15.90%
Other Services (excluding Public Administration)	19	30	11	6.74%
Public Administration	8	2	(6)	-17.97%
Total	**882**	**856**	**(26)**	**-0.43%**

"wglockeryde"

Source: US Census Bureau LED/ LEHD

Similar to Clarksburg, the construction and manufacturing industries have demonstrated significant fluctuations in employment but have been growing overall since 2002. Transportation/ warehousing, administration/ support waste management and remediation, and retail trade have shown significant gains in recent years as well, which may be due to a combination of industry growth, new business strategies, and differentiation of the Lyman Company, which is the largest employer in East Walnut Grove/Locke, employing more than 20 employees in the local area and more than 200 throughout Northern California. The Lyman Group, which is an agriculture chemical sales and supply firm, contains several different arms under the Lyman Group umbrella. The Lyman Group has been in Walnut Grove for more than 50 years and has endured many changes to the local economies and the agricultural industry itself.

Some of the other large employers in East Walnut Grove/Locke include the River Delta Unified School District (with 30 reported employees), Tony's Place restaurant, Amistad Freight Service, Meyer and Cook Insurance, and Boon Dox Liquor Store. The largest employers in West Walnut Grove/ Ryde are Wilcox Brothers farming equipment, the Ryde Hotel, MacCormack Farms, and Salman Ranch.[52]

[51] Note that this table represents the *aggregate* employment of the E. Walnut Grove/ Ryde and W. Walnut Grove/ Locke block groups.
[52] According to Hoover's Dunn & Bradstreet enterprise data, 2010.

Employee Commute Patterns
East Walnut Grove/Locke employees travel from throughout the region, most notably from Sacramento, Elk Grove, Galt, Stockton, Lodi, and various other locations. Only approximately 4 percent of East Walnut Grove/Locke workers actually live in East Walnut Grove/Locke. The breakdown for West Walnut Grove/ Ryde demonstrates a similar pattern, although a higher proportion (13 percent) of these workers live locally.

1.2.4 Opportunity Sites

There are some opportunity sites in Walnut Grove/Locke that may require further evaluation as part of an economic strategy. Sites to be evaluated in greater detail include these:

- Main Street in Walnut Grove is composed of generally small, compact, one-story buildings with minimal setbacks that provide the proper scale for an inviting, walkable commercial district that could be both local and tourist serving. While this small commercial area is not thriving, new businesses are moving in incrementally as older failing businesses move out, and this area presents a key opportunity for future visitor- and local-serving commercial, such as cafes, bars, and shops, particularly related to sports and recreation. A geotechnical analysis of the levee adjacent to Downtown Walnut Grove is required to determine the extent and type of redevelopment that can be accommodated.
- The Locke boathouse is the largest single building in Locke and dominates the view-shed from State Route 160. Because of its bulky nature, it creates a de-facto barrier to Locke from the water. The boathouse could be modified to allow for more visitor-serving uses or temporary boat parking. This would allow for additional visitorship from users coming from the water in addition to providing more space for motorists to park when launching their boats from this point.
- Locke Community Garden. Located east or behind the developed part of Locke, lies a former community garden site that could be rehabilitated and provide an opportunity for a farm stand with for-sale produce to residents and tourists, and potentially a sustainable source of food for residents. Management of this site would need to be undertaken by the LMA.
- While there are several other potential opportunity sites in Locke and Walnut Grove, these represent just a few potential sites that the ESP Team has become aware of. Larger issues that preclude development from a historic preservation, regulatory, permitting, and flood control perspective must be solved for any meaningful development to occur in these areas. Further, an emphasis must be placed on quality preservation/restoration of building stock, assuring that investments that are made are worthwhile and enduring.

Chapter 8, Delta Recreation and Tourism discusses 'focal point complexes' that identify an existing combination of natural areas, parks, small and legacy communities, marina complexes, historic features, and trail potentials. Walnut Grove/Locke (and by extension the Cosumnes Preserve) are one of these complexes.

The focal point area centered on Locke/Walnut Grove is proposed to also include Ryde, Cortland, and Hood, as well as the Stone Lakes Preserve, Delta Meadows, the Cosumnes Preserve, and Staten Island. Additional public facilities should include day-use and camping facilities at Delta Meadows, events venues, further improvements/restorations at Locke, and appropriate wildlife viewing/nature study opportunities. Evaluations should be made of the five legacy communities for additional features and activities that could assist in creating viable settings for private enterprise opportunities, thereby contributing to the economic sustainability of each community.

1.2.5 Infrastructure Constraints

There are certain specific infrastructure constraints in Walnut Grove/Locke that limit the community's development/redevelopment and economic development options. The following items require additional research, documentation, analysis, and strategic considerations in future versions of this analysis:

- Telecommunications (mostly internet access).
- Roadways.
- Flood protection.

1.2.6 Vision/Toolkit/Strategic Action Plan

The following items are to be included in Walnut Grove/Locke's strategic action plan, which will be defined in greater detail in future versions of the ESP:[53]

- Based on the Walnut Grove/Locke Special Planning Area document, any growth should be directed towards infill and replacement development in the existing Walnut Grove/Locke town area.
- Promote only high quality building rehabilitation.
- Preserve the integrity of Locke and create opportunities for interpretation.
- Promote recreation and agricultural support as the primary economic development theme of the community.
- Promote tourism, including day use, camping, fishing, and hunting.
- Promote farm stands and the sale of locally produced agricultural products.
- Establish a Walnut Grove/Locke brand consistent with the Delta brand.
- Consider and evaluate Enterprise Zone benefits.
- Encourage the establishment of basic support services for tourists and visitors: restrooms, community-themed convenience markets akin to the one that exists, and landside 'parks' or other places to eat and rest while ashore.
- Work with active nonprofits and the Delta Citizens Municipal Advisory Council to implement economic strategies and community initiatives.
- Modifications and enhancements to the Walnut Grove/Locke community should maintain and enhance agricultural and recreational resources that are already in place.

1.3 Other Legacy Communities

The communities of Hood, Ryde, Courtland, and Isleton are important members of the Legacy Community framework. While many of these communities share common attributes (such as a connection to the waters of the Delta and a strong influence from the agricultural industry), each is distinctly unique in its composition, history, economy, and texture. This section includes historical, demographic, and socio-economic information for each of these communities, which can be used to inform planning efforts and provide context to their respective places in the Legacy Community system. This section describes the historical and socio-economic context of these communities. The detailed tables supporting the information in this section are included in Appendix.

[53] This list is preliminary and not intended to be exhaustive.

1.3.1 Isleton

Isleton was founded in 1874 by Josiah Pool. Being on the Sacramento River, Isleton briefly benefited from the gold rush as it swelled in population and businesses, only to shrink again to its present small size once the prospectors left the area.

Over time, Isleton has changed in many ways. It was once a sizable, thriving town on the Sacramento River that conducted commerce using the river as the primary means of transportation. Miners bound for the gold country journeyed from San Francisco up the Sacramento River. As people moved to the area, the need for commodities provided the opportunity to farm, and Isleton became a hub of agricultural activity. Levees throughout the Delta were constructed as a by-product of deepening river channels, much of which was done by the Chinese who settled and built colonies in existing towns (such as Isleton).

Today, Isleton is home to approximately 1,676 residents, making it the largest of the Legacy Communities.[54] Isleton is characterized by an older population than the rest of the Legal Delta and than California in general, with 38 percent of residents being over the age of 55 (as compared to less than 20 percent for the Legal Delta).

The population of Isleton is primarily Caucasian, with 74 percent of residents identifying themselves as "White alone" (which is significantly higher than the 42 percent who identify this classification in the Legal Delta).

The educational attainment of Isleton residents is similar to that of the rest of the Legal Delta, although there is some nuance at the high and low ends of the spectrum. Of this population, 20 percent does not have a high school diploma, (as compared to 17.2 percent in the Legal Delta), 53 percent are high school graduates with some college (as compared to 51 percent in the Legal Delta), and 26 percent have an associates degree or higher (as compared to 32 for the Legal Delta).

The household income of the Isleton population is generally lower than the rest of the Legal Delta. More than 37 percent of households in Isleton report an income less than $35,000, as compared to just 26 percent in the Legal Delta overall. The average household income in Isleton is approximately $57,000, as compared to nearly $80,000 in the Legal Delta.

The largest industry category of employment for Isleton residents is construction (at 18 percent), followed closely by accommodations and food service (at 15 percent). Other prominent sectors include educational services at 11 percent, transportation/ warehousing at 10 percent, and manufacturing, also at 10 percent.

The largest employers in Isleton are Universal Forest Products, CFJ Properties, Tower Park Marina, American Golf Corporation, and the River Delta School District.[55]

1.3.2 Ryde

The Ryde Hotel, which is the main focus and essentially the entire commercial portion of the town, was built in 1927 at the peak of prohibition. It was an opulent establishment, complete with beauty salon and barbershop, which served as a riverboat way station. It was also rumored to be a bordello, and the lower level included a speakeasy, which allegedly contained a trap door in the floor that opened to reveal a tunnel running under the road to a hidden doorway at the river's edge. Speculation mixed with fact generated a good amount of notoriety that

[54] The population and demographic estimates in this section are from the US Census for Block Group number 060670098001, as shown in Figure 1.
[55] According to Hoover's Dunn & Bradstreet enterprise data, 2010.

brought with it a certain cachet, and the Ryde Hotel attracted celebrities of all types, including President Herbert Hoover, local and state politicians, movie stars, and mobsters. In later years, the hotel became a boarding house for the men and women who built the Delta levees and pioneered the area's thriving agricultural industry.

The Ryde area now contains a modest population of just fewer than 1,300 residents.[56] Similar to most of the Legacy Communities, Ryde is characterized by an older population than the rest of the Legal Delta and than California in general. More than 36 percent of Ryde residents are over the age of 55 (as compared to under 20 percent for the Legal Delta). Ryde counts very few young adults as residents, as only 8 percent of the population falls within this age category, as compared to more than 18 percent for the Legal Delta.

The population of Ryde consists mostly of Caucasian residents, with 56 percent of residents identifying themselves as "White alone" (as compared to 42 percent, which identify this classification in the Legal Delta). The population of Ryde is significantly more educated than most of the Legacy Communities and the Legal Delta overall. Of this population, more than 30 percent has a bachelor's degree or higher, as compared to under 16 percent for the Legal Delta.

The household income of the Ryde population is significantly higher than the rest of the surrounding area, at $92,000 on average, as compared to under $80,000 in the Legal Delta and under $56,000 in Isleton and Hood. More than 26 percent of Ryde households earn more than $150,000 per year, as compared to just more than 10 percent in the Legal Delta.

The residents of Ryde primarily work outside the community in which they live (although 10 percent do live and work in Ryde). Eight percent of Ryde residents work in Sacramento, and 5 percent work in Walnut Grove. Other cities such as Stockton, Rio Vista, Elk Grove, and Roseville are places where Ryde residents travel for employment.

Ryde is similar to other Legacy Communities in that most residents work in the agricultural field, which accounts for more than 20 percent of employment. Other significant industries are education (12.5 percent), real estate (12.1 percent), public administration (11.4 percent), and health care (10.1 percent).

Time-series analysis based on the U.S. Census LED-LEHD employment data by industry for Ryde shows that total employment has grown modestly in recent years and has added 62 jobs from 2002 to 2009. Agriculture is by far the largest industry, although it has shed more than 130 jobs during this period. Absorbing agriculture's losses and growing at a rapid pace is the construction industry, which added more than 133 jobs in this period. Manufacturing is another growing sector and has added nearly 100 jobs in Ryde over the past 7 years. The largest employers in Ryde are Wilcox Brothers farming equipment, the Ryde Hotel, MacCormack Farms, and Salman Ranch.[57]

1.3.3 Courtland

Courtland was established in 1872 and named after Courtland Sims, son of James V. Sims, a landowner who opened a steamer landing in the community in 1870. Today, Courtland houses a population of just fewer than 500 residents. Courtland has a similarly aged population as compared to the rest of the Legacy Communities; more than 43 percent of the community's residents are over the age of 55 (as compared to less than 20 percent for the Legal Delta).

[56] Please note that the Ryde socio-economic figures in this section include the population for western Walnut Grove, as shown in Figure 1 and described elsewhere in this report.
[57] According to Hoover's Dunn & Bradstreet enterprise data, 2010.

In terms of ethnic and racial composition, Courtland is very distinct as compared to the rest of the Legal Delta, in that it is primarily a Hispanic community. More than 65 percent of Courtland's population has identified itself as Hispanic, as compared to just 30 percent in the Legal Delta overall.

In terms of educational attainment, Courtland reports significantly poorer results than the rest of the Legacy Communities and the Legal Delta overall. Nearly 34 percent of Courtland's population does not have a high school diploma (as compared to 17 percent for the Legal Delta overall). Only approximately 22 percent of Courtland's population has an associate's degree or higher, whereas more than 31 percent of the Legal Delta's population have reached this educational milestone.

At approximately $73,000, the average annual household income of Courtland falls just below the overall average for the Legal Delta. This is lower than the household income observed in Ryde, but is significantly higher than both Hood and Isleton.

Similar to other Legacy Communities, most Courtland residents work outside the community in which they live (although 5 percent do work in Courtland). Most Courtland residents work in Sacramento (7 percent), Elk Grove (5 percent), San Francisco (4 percent), Walnut Grove (4 percent), and other outlying locations (as far away as San Jose and Santa Clara).

Courtland differs from most Legacy Communities in that most residents do not work in the agricultural field; instead, education is the largest category of employment, which accounts for more than 20 percent of local residents. Other significant industries are wholesale trade (23.7 percent), transportation and warehousing (12.6 percent), and agriculture (8.7 percent).

U.S. Census LED-LEHD employment data by industry for Courtland indicates that total employment has declined modestly in recent years and has shed 35 jobs from 2002 to 2009. Agriculture is the largest industry, although it has lost a significant amount of jobs recently. Growing sectors include construction and manufacturing. The largest employers in Courtland are Greene & Hemly Farms, Delta Breeze Farming, and Barry's Machine.[58]

1.3.4 Hood

The community was named in 1910 after William Hood, chief engineer of the Southern Pacific Railroad. Hood is the smallest of the Legacy Communities and has a population of just 276 residents. Although most Legacy Communities have a significant share of retirees and older residents, Hood is characterized by a much older population base than any of these communities. More than 62 percent of Hood's population is over the age of 55, as compared to just 20 percent in the Legal Delta.

Hood's racial and ethic composition is primarily Caucasian, with nearly 97 percent of its population identifying as "White alone." Hood's educational attainment statistics are more-or-less in line with the rest of the Legal Delta, although Hood shows slightly fewer residents that are college educated and slightly more that do not have a high school diploma. The average income of Hood is very low, at just more than $54,000 (as compared to $79,000 for the Legal Delta).

Most employed residents in Hood work in Sacramento (21 percent) or Stockton (9 percent). Other prominent cities include Roseville, Lodi, Elk Grove, Rancho Cordova, Woodland, and San Francisco. Only 3 percent of Hood residents actually work in Hood.

[58] According to Hoover's Dunn & Bradstreet enterprise data, 2010.

Hood is similar to Courtland in that most residents do not work in the agricultural field; instead, health care and social assistance is the largest category of employment, which accounts for more than 23 percent of local residents. Other significant industries are wholesale trade and manufacturing (with 15.3 percent each) and educational services (8.2 percent).

Time-series analysis of the US Census LED-LEHD employment data by industry for Courtland shows that total employment in Hood has actually increased fairly substantially recently and has added 88 jobs from 2002 to 2009. Growing sectors include manufacturing and professional services and health care. The largest employers in Hood are Gateway Pacific Contractors, Affholder Construction, and Cavanaugh Café.[59]

2 Impact of Policy Scenarios

The Legacy Communities will no doubt be impacted significantly by the potential policy changes that have been described throughout this report. This section briefly evaluates some of the larger issues and impacts that could arise from changes in water conveyance, conservation measures, flood control/levee scenarios, and regulatory scenarios.

2.1 Water Conveyance

Water conveyance impacts on the Legacy Communities have the potential to be significant; however, these impacts are likely to be indirect. For example, changes in the flow of the river caused by the proposed 15,000 cfs isolated conveyance project could result in substantial changes in the salinity of Delta waters. This change in salinity could have serious consequences for agriculture (as discussed elsewhere in this report), which is a prime economic driver for the Legacy Communities. Reductions in agricultural output could have serious consequences for employment and wealth creation in these communities.

In addition, the pumping facilities and associated buildings themselves will likely have a considerable visual and noise impact on the spatial environment near the Legacy Communities by inhibiting access to waterways and diminishing its recreational appeal and potential future growth as a tourist destination. Although the exact location, method, and size of conveyance facilities have not yet been determined, proposals have been brought forth that would place substantial facilities along the Sacramento River between Clarksburg and Walnut Grove, which would occupy many acres of prime farmland and consume a large quantity of viable shoreline along the river.

It is not yet known what impacts conveyance facilities will have on water level in the main channel of the river or on downstream channels. Pumping stations will impact quality of life across the river from them, the types of fishing and hunting that can occur in the main channel, as well as around Delta islands as water levels will likely decrease. However, lower water levels may have positive impacts on passive landside recreation activities.

2.2 Conservation Measures

Potential conservation measures, which are evaluated in this report, include the Yolo Bypass Fisheries Enhancement, San Joaquin River Floodplain Restoration, Tidal Habitat Restoration, Natural Communities Protection, and Channel Margin Habitat projects. These and other conservation measures have the potential to impact the Legacy Communities by altering the agricultural and recreational industries that are the region's key economic drivers. Conversion of farmland to habitat would surely limit agricultural output, thus negatively impacting jobs and wealth creation in the Legacy Communities. Some of this economic loss could be mitigated by

[59] According to Hoover's Dunn & Bradstreet enterprise data, 2010.

additional recreational activity provided by new habitat areas (such as kayaking, birdwatching, etc.); however, these types of recreational users have different spending patterns than current visitors.

2.3 Levee Scenarios

Many different options and strategies to provide adequate flood protection in the Delta will certainly have direct impacts on the Delta's growth and economic development capability for the future, as discussed throughout this chapter and elsewhere in this report. Because the lack of adequate flood protection is a hindrance on new development, and potentially hampers economic activity in the Legacy Communities, finding the adequate funding for any such flood protection option is a pressing (and complex) issue. The Legacy Communities are so small in terms of their population and employment base that spreading the high cost of flood protection across the local economic base is highly likely to be infeasible; therefore, finding unique and strategic methods to spread the cost burden among other regional and statewide stakeholders should be evaluated in detail.

2.4 Regulatory Scenarios

The ESP Team has considered three main regulatory scenarios (with decreasing levels of regulatory oversight). These scenarios and their likely implications are outlined below.

Regulatory Scenario 1: Communities remain as they are with few land use policy changes, likely resulting in further decline and lack of investment.

- Influenced primarily by flood plain delineations.
- Local control over land use is complicated by uncertainties regarding DPC influence.
- Communities can be redeveloped on a small-scale, parcel-by-parcel basis, which will take a long time.

Regulatory Scenario 2: Outside investment is encouraged as new markets for goods and services servicing recreation, hunting, fishing, and tourism are developed in Legacy Communities.

- Regulatory oversight is eased.
- A 'Delta' brand is developed, particularly relative to recreation and wine.
- Economic development supports agriculture and tourism.
- Seasonal support enterprises are developed to service recreation and tourism: small boat access, RV parks, camping, fishing access, and a regional trail system for non-motorized off-road circulation.
- Services and infrastructure increase and are provided where needed.
- Workforce housing is developed so labor for these industries can be sustainably housed in the communities.
- Walnut Grove and Locke are ideal candidates for workforce housing because sewer and water infrastructure are in place and capacity is not a hindrance.
- NIMBY forces will be at work as housing is contemplated, and some Legacy Communities do not desire change.
- Streamlined entitlement processes need to be facilitated.

Regulatory Scenario 3: Encourage Planned Unit Developments that allow for an expansion of housing stock and agriculture-supporting industrial/commercial uses, particularly in Clarksburg and east Walnut Grove.

- Scale of projects would need to be economically viable.
- Community support and political will is required.
- Services and infrastructure need to be provided.
- Levee maintenance assessments and other financing would require further evaluation.

3 Conclusion

This paper sets a contextual setting for the Legacy Communities and includes a discussion of many of the significant issues/threats and ideas/opportunities for future economic development. Some of the broad conclusions that have emerged include these:

- Agriculture is the main economic driver of the Legacy Communities and will continue to be for some time. Efforts to sustain and nurture this industry are important, and initiatives or policies that negatively impact this key sector should be minimized.
- As conveyance comes on line and land uses change from agriculture intensive to recreation intensive, Legacy Communities will need to morph into more self-sufficient, self-contained places to live and work. Sustaining these communities economically and ecologically will be key to their long-term viability and longevity.
- Agri-tourism is an emerging sector and has great potential for the Legacy Communities, allowing them to leverage their most prominent assets while contributing to branding of the Delta as a whole.
- Amenities in the Delta are substantial (including views, access to water, history, culture, etc.); however, it lacks a critical mass and a means for communities to coalesce around common themes or economic drivers. The Delta Region is vast, and many potential users do not know where to begin their Delta experience, what the Delta consists of, what their options are, etc. Marketing the Delta as a region with the Legacy Communities as an inter-related set of recreational and tourist "hubs" is a method to help promote the Delta and begin to create some critical mass.
- Key visitor amenities are needed. Lodging, restaurants, cafes, parking, public restrooms, and landside picnic areas are absent or lacking. Efforts should be taken to allow such uses to develop as the market will allow. Easing development restrictions through policy changes is one method to do so. Other methods include the consideration of interpretive art in the communities to enhance physical spaces and further tell the Delta story.

4 Summary of Major Findings

Several issues, trends, conclusions, and recommendations emerged during the period of analysis, and this section highlights these items among key theme areas.

Agriculture as Industry and Tourism Driver

- Agriculture is a major economic driver of the Legacy Communities and will continue to be so in the future. Efforts to sustain and nurture this fragile industry are important, and initiatives and policies that could damage this key sector should be minimized.
- Over the last 25 years, the Clarksburg Region has emerged as a premier Chardonnay-producing area, and the Clarksburg appellation is coming into its own as a high-quality wine grape-growing region. There is considerable interest from public and private sectors in capitalizing on this as an economic engine for industry and tourism.
- The wine-making industry is hindered by state and local land use policies, causing much of the commodity to be hauled out of the region for packing, crushing, and further processing. This action defies the notion of sustainability from economic and ecological

perspectives in addition to local jurisdiction land use policy. Conversely, nearly all agricultural inputs come from outside the Delta Region.

- Wines, vineyards, slow food, and the "loco-vore" movement were commonly cited as a means of economic development, particularly as agriculture has shifted to different commodities.
- The notion of community connectivity to agriculture is becoming a dominant force in planning, economic development, and sustainability as it pertains to land use and ecology. Furthering this effort, SACOG has prepared a Rural Urban Connections Strategy assessing current conditions in the Greater Sacramento Region, citing innovations here and elsewhere. Prepared in May 2010, this assessment can provide further documentation and ideas for ways forward in the effort to connect people more closely with the food they eat.

Tourism and Recreation

- Agri-tourism is an emerging sector and has great potential for the Legacy Communities, allowing them to leverage their most important productive assets in a field that is poised for growth.
- The Legacy Communities benefit from some fantastic amenities (including access to prime navigable waterways, numerous recreational activities, history, culture, etc.); however, it lacks a critical mass. The Delta Region is spread out in such a way that many potential users do not know where to begin their Delta experience or what their options are. Marketing the Delta as a region and the Legacy Communities as an inter-related set of recreational "hubs" is one method that can help to elevate the stature of the Delta in the public eye and begin to create critical mass.
- Eco-tourism is an emerging business trend throughout the Delta. The Legacy Communities could serve as home bases for such businesses.
- Nonresidents frequent the Delta only from May through October, creating a "season" on which businesses sustain themselves.
- Wayfinding and Delta branding signage were cited as ways to guide land and waterside tourists to points of interest and places to spend money. Currently, visitors from land or water are not guided in any way as to where to go, where to park, or what offerings are made by merchants and other business enterprises.
- Fishing remains a viable recreational activity; however, fisheries, along with supporting businesses and land uses, have diminished over the years, and anecdotal observations indicate that land-based tourism is an important growth area.
- Dock facilities adjacent to Legacy Communities could enhance the region's attraction as a recreational alternative to other areas. Such facilities would need to be linked to the communities by safe and accessible routes in addition to wayfinding or interpretive signage.
- Contrary to the goal of increased tourism, public access to many of the Delta's waterways has been restricted, thereby reducing fishing and boating options, each of which have positive economic impacts.

Retail and Lodging

- By improving the lodging, retail, and entertainment options in the Legacy Communities through targeted infill activity (in the proper scale for these communities), a greater proportion of consumer spending can be captured.
- While most of the Legacy Communities offer some sort of grocery shopping option, most establishments are small and lack comprehensive offerings typically found in modern supermarkets. Convenience and deli options are relatively plentiful, but grocery and household items are expensive and lacking in options. While there is a local customer

base, regional and national chain stores exist within a relatively short drive of each of the communities. Although there is recognition and appreciation for the notion of "shopping local," this is not practical for many residents seeking discount items.

- Lodging establishments are few. The Ryde Hotel provides an up-market venue, but owners say that occupancies are directly related to on-property events. Comments from stakeholders referenced a lack of "high-end" accommodations. The addition of new and compelling accommodations and visitor amenities has the potential to increase the length of stay and visitor spending in the Legacy Communities.
- Previous economic studies have indicated that bed and breakfasts and farm stays are viable options, particularly in the Clarksburg area. Yolo and Sacramento Counties' zoning codes are supportive of these uses; however, State agencies overarch these policies, often times trumping them.

Permitting Policies and Regulatory Framework

- The development process is hindered by a variety of factors, including a strict and multilayered regulatory framework. Community stakeholders have repeatedly cited the challenges to obtaining building and use permits for various endeavors. Fees, delays, and indeterminate flood control policies have been cited by many as the biggest deterrent to applicants and a considerable hindrance to the economic activity throughout the Delta.

Flood Protection

- The lack of adequate flood protection in the Legacy Communities is a major hindrance to economic development. The Legacy Communities are so small in terms of their population and employment base that spreading the high cost of flood protection across the local economic base is highly likely to be infeasible; therefore, finding unique and strategic methods to spread the cost burden among other regional and statewide stakeholders should be evaluated in detail. Although resolving this issue is extremely complex and difficult to settle, making significant strides is of vital importance in terms of enhancing economic sustainability in the Delta.

Transportation

- While all the Legacy Communities are served by county and state roadways, none of the roads are "complete," offering bike or pedestrian facilities. Further, many local residential and business streets are incomplete, with some presenting accessibility and safety concerns.
- A lack of pedestrian options, including wayfinding signage, foot paths, and walking trails, hinders the ability to navigate around the Legacy Communities.
- There is no taxi service in the Delta. This impacts boaters who may arrive at a waterside facility and desire to travel to an inland destination.
- Public transportation exists but is limited and not well publicized. Shuttle services have been contemplated between Delta attractions, but would need to be privately operated, with no proposals being put forward to date.
- Cycling is popular in the Delta but is considered somewhat unsafe because of narrow, winding roads and unmarked bike lanes.
- Motorcycling is equally popular but, in many cases, is at cross purposes with cycling. Parking for motorcycles, particularly in Locke, is an issue that needs to be addressed in concert with historic preservation goals and objectives.
- Bus tours come to various Legacy Communities, particularly Locke, but there is no place for them to park.

Land Use and Existing Building Stock

- The quantity of vacant or underutilized buildings leads stakeholders to desire a serious recruitment and retention effort to create destination retail and dining and recreation-based experiences.
- Legacy Communities offer a unique sense of place and history that can be capitalized on for economic development and interpretive purposes.
- Development and redevelopment efforts ought to be directed to areas already built. Most stakeholders felt there was enough land under development, and vacant buildings and lots could be repurposed to address current market needs. However, matters concerning flood control were cited as impediments to such repurposing.
- Legacy Communities' cultural assets are, with the exception of Locke, generally under-appreciated and, if properly branded, can be capitalized on as economic stimuli and catalysts for community development/redevelopment.

Housing

- Housing options in the Legacy Communities are limited. Although some stakeholders were not interested in additional public housing of any type, several acknowledged there needed to be a limited increase in workforce housing to keep farm workers in communities, thereby adding to the economic base/vitality of each town. There was consensus that growth boundaries be considered for each Legacy Community consistent with current or future flood prevention measures.

Festivals and Community Celebrations

- It is generally accepted that these activities are positive, community building, and good for business, but they are one-day events that really do not contribute to long-term economic sustainability for Legacy Communities.
- While not festivals, Farmers' Markets are being held near Rio Vista by the Discover the Delta Foundation. As a means of economic development, markets could be rotated through Legacy Communities on a regular schedule.

Part Three: Integration and Recommendations

Chapter 13: Key Findings and Recommendations

This initial summary of findings will be greatly expanded in future drafts as additional research, incomplete report sections, public outreach, and integration continues to progress. Future drafts will also include an integrative discussion of findings that identifies cross-cutting issues and links them to specific recommendations. Consult the individual chapters for supporting details, and additional findings and analysis.

THIS CHAPTER IS UNDER DEVELOPMENT

- **Delta agriculture supports 13,700 jobs, $1.1 billion in value-added, and nearly $2.8 billion in economic output in the five Delta counties.** In addition, Delta agriculture supports nearly 23,000 jobs, over $1.9 billion in value-added, and over $4.6 billion in economic output in the state of California. (chapter 7)

- **Delta recreation and tourism supports 2,700 jobs, $152 million in value-added, and nearly $284 million in economic output in the five Delta counties.** In addition, Delta recreation and tourism generates over 4,900 jobs, $324 million in value-added, and $600 million in economic output in the state of California. (chapter 8)

- **Delta agriculture supports 5 times more jobs, and 7 times more value-added (income) than Delta recreation and tourism.** While recreation is an important supporting economic sector and adds to the Delta's unique quality of life, it is unrealistic to expect that recreation and tourism could replace agriculture as the Delta's economic driver. (chapters 7 and 8)

- **All available indicators for Delta recreation suggest Delta tourism has been flat for one to two decades before the onset of the recession.** Regional population growth is an opportunity, but does not by itself guarantee growth in Delta recreation and tourism. Delta boating and fishing increased rapidly in the 1980s and previous decades, but has slowed since. Improved water quality and new investment in recreation facilities and hospitality enterprises are essential to growing recreation and tourism in the Delta. (chapter 8)

- **Improving the visibility and recognition of the Delta as a place will benefit Delta tourism and agriculture.** The Delta Protection Commission should complete its feasibility assessment of National Heritage Area designation. (chapter 8)

- **Delta levees are critical to economic sustainability.** The Delta levee system protects critical water, energy, and transportation infrastructure for the state and regional economy, and supports all aspects of the Delta economy. (chapter 4)

- **Delta levees are in better condition than often portrayed, but still need investment.** As opposed to frequent reports that cite over a thousand miles of "fragile" levees in need of billions in repairs, there are actually about 370 miles of Delta levees that need roughly $500 million in investment to reach appropriate standards. This goal could be reached with strategic use of existing bond funds. (chapter 4)

- **Population trends in the primary zone are relatively flat, but uneven across regions**. North Delta population increased over the past decade, whereas South and East

areas of the primary zone declined in population. In contrast, the secondary zone population is increased 25% between 2000 and 2010. (chapter 2)

- **Residents of the primary zone are significantly older than comparable areas.** Twenty percent are 65 years of age or older. (chapter 2)

- **The current capacity of Delta tourism infrastructure and enterprises is insufficient to capture significant income from increased visitation.** Increased regulation of "covered actions" in the Delta could inhibit investment in tourism related industries. (chapter 8)

- **Implementing the November/December 2010 draft of the Bay Delta Conservation Plan would be devastating to the Delta economy.** It would cause a 20-40% decline in Delta agriculture, and could decrease Delta recreation and tourism. (chapters 7 and 8)

- **If operated as proposed in the draft BDCP, isolated conveyance would decrease Delta agricultural production by about $50 million, and would have a negative impact on tourism development and the rural quality of life.** If a large isolated conveyance were operated to maximize water supplies, south Delta salinity could triple and agricultural production losses could increase to $200 million. The higher scenario illustrates the risk of a large capacity conveyance to the Delta since there will be financial and political pressure to increase exports to high levels. (chapters 7 and 8)

- **The BDCP proposal to create 65,000 acres of tidal marsh habitat would reduce annual agricultural production by $84 million, and generate little if any compensating tourist spending.** The $84 million annual loss in agricultural production assumes targeted land acquisition to minimize impacts, and annual losses could exceed $100 million if agricultural encroachment is not minimized. A lower acreage goal would enable better targeting to minimize agricultural impacts. (chapter 7)

- **Enhanced flood bypasses and other draft BDCP conservation proposals reduce Delta agriculture production by $10 million or less, and have higher potential benefits to recreation and tourism.** Some conservation measures could support economic sustainability in the Delta if carefully implemented. (chapters 7 and 8)

- **Several influential studies of Delta issues have significant errors in economic analysis.** Various PPIC reports that have overly influenced decision makers about the Delta economy, economics of the peripheral canal, and investment decisions in Delta levees. (chapter 5)

Chapter 14: Recommended Strategies and Policies for Economic Sustainability

THIS CHAPTER IS UNDER DEVELOPMENT