August 9, 2011
Public Draft

Economic Sustainability Plan for the Sacramento-San Joaquin Delta

Delta Protection Commission

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

THIS IS A DRAFT DOCUMENT

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

Some figures and tables are under development. Citations and references are incomplete and being developed on a constant basis.

Draft Executive Summary

Economic Sustainability Plan for the Sacramento–San Joaquin River Delta

The Sacramento-San Joaquin River Delta is a unique place of economic, environmental, historic and cultural significance. The land and water resources of the Delta support significant agricultural and recreation economies, and the Delta also has an important role as an infrastructure hub for water, energy and transportation. The region's rich history boasts of bustling, river-based commerce before the automobile age, and its cultural uniqueness includes the only rural town in America build by early Chinese immigrants. As the largest estuary on the west coast of the Americas, the Delta also is a place of striking natural beauty and ecological significance that is struggling with serious environmental degradation problems. Although surrounded by growing cities, the Delta remains a highly-productive agricultural area with rural charms, landscapes, and waterscapes not found elsewhere in California.

In recent years, there has been great concern over increasing environmental degradation in the Delta and over court decisions that reduced the quantity of water delivered to southern California through the state and federal water project intakes in the south Delta to protect endangered fish. Combined with additional concerns about the stability of the Delta's levee system, these concerns led the California legislature to pass the Delta Reform Act of 2009. The Act created the Delta Stewardship Council and charged it with developing a Delta Plan to achieve the coequal goals of "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem."

Recognizing the potential impact of the Delta Plan on the people and economy of the Delta, the Delta Reform Act stated that the coequal goals of water supply reliability and restoring the Delta ecosystem "shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place." Among the measures to address this goal, the Delta Protection Commission was tasked with developing this Economic Sustainability Plan to inform the Delta Stewardship Council's development of the Delta Plan.

The concept of economic sustainability and the objective to "protect and enhance the unique cultural, recreational, natural resources, and agricultural values of the California Delta as an evolving place," can be interpreted in different ways. In economic terms, there is near consensus that a minimum requirement is to maintain the economic value of the entire Delta economy in the future. The Fifth Staff Draft of the Delta Stewardship Council's Delta Plan uses a stronger definition of economic sustainability where growth in one sector is not a substitute for deterioration in another area. Specifically, the Fifth Staff Draft Delta Plan defines performance measures for economic sustainability as maintaining or increasing gross revenues in each of three key sectors: agriculture, recreation, and ecotourism/agritourism. In addition, there is broad

agreement that this objective requires the protection of the cultural and historical heritage and the long-term economic viability of the Delta's historical Legacy Communities.

This Economic Sustainability Plan measures the key elements of the Delta economy, considers strategies to enhance the economy, and the impacts of several important proposals for the Delta Plan on the region's economic sustainability. There are a number of proposals and strategies that promote both economic sustainability in the Delta and the coequal goals for the state such as strengthening the Delta's levee and emergency response systems. However, the assessment also finds that some of the current proposals, most notably water conveyance tunnels that could move 15,000 cubic feet per second of fresh water from the Sacramento river around the Delta, would have large economic costs and risks for the Delta and are clearly in conflict with the legislative requirement to "protect and enhance" the value of the Delta.

The Economy and Infrastructure of the Delta: Baseline, Trends, and Strategies for Improvement

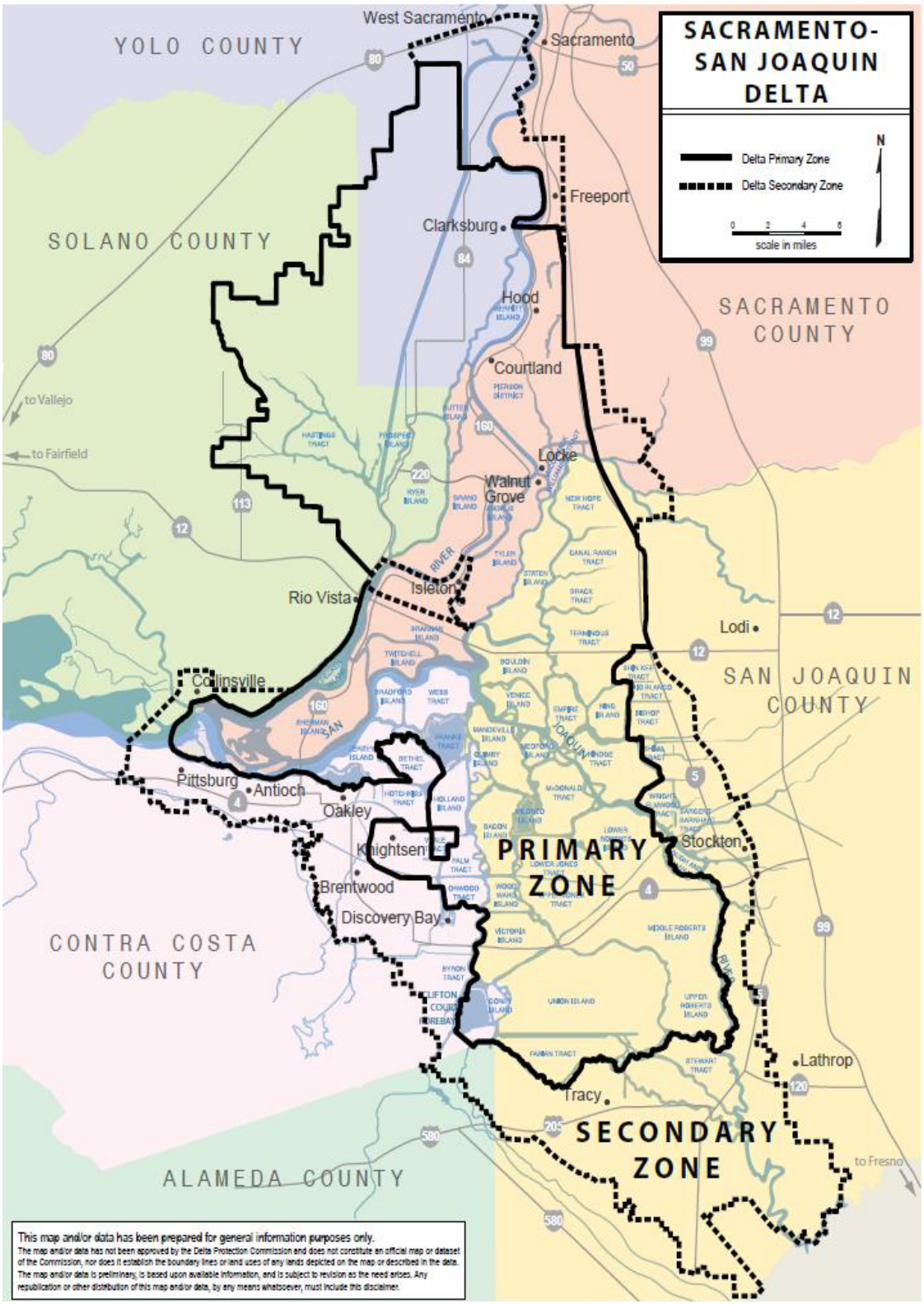
The boundaries of the Legal Delta are shown in Figure 1. The Delta Protection Act of 1992 defined the Delta boundaries including the Primary and Secondary Zone and created the Delta Protection Commission, charging it with developing a Land Use and Resource Management Plan for the Primary Zone. The majority of the Delta's 738,000 acres of land is in the rural and agricultural Primary Zone. The population of the Primary Zone is approximately 12,000 and has remained steady in the nearly 20 years since the passage of the Delta Protection Act.

The Legal Delta including both the Primary Zone and Secondary Zone, contains significant portions of five counties, Contra Costa, Sacramento, San Joaquin, Solano and Yolo, and a small rural corner of Alameda County. The Delta includes parts of several large cities including Antioch, Pittsburg, Stockton, Sacramento, Tracy, and West Sacramento. The legal Delta has a population of 571,000, according to the 2010 Census, which has increased by about 200,000 people—more than 50 percent—in the 20 years since the 1990 Census. All of the population growth, and virtually all of the Delta's urbanized land, is located within the Delta's Secondary Zone.

The Delta's economy, like its population, is primarily urban and service oriented. However, the Delta Reform Act of 2009 and the Delta Protection Act of 1992 are primarily concerned with the natural resources of the Delta and the economic activity sustained by those resources such as agriculture and outdoor recreation. In addition, the resources of the Delta support significant water, energy and transportation infrastructure that serve the Delta, regional and state economies, and an important commercial and recreational salmon fishery throughout the state.

The Primary Zone economy is export-oriented and creates jobs and income far in excess of the population and workforce that resides in the Primary Zone. The Secondary Zone and the counties surrounding the Delta supply the Primary Zone economy with a workforce, services, manufacturing, and transportation that add value to the agricultural, energy and other resource-based output of the Delta. This section looks more closely at the baseline, trends, and strategies for enhancing the agriculture, recreation, tourism, and infrastructure services of the Delta economy.

Figure 1 Map of Primary and Secondary Zones of the Sacramento–San Joaquin Delta



Delta Agriculture

Agriculture is the dominant land use in the Delta. Farmland makes up about two-thirds of the area of the Delta, and nearly 80 percent of all Delta farmland is classified as Prime Farmland, the highest quality designation given by the California Farmland Mapping and Monitoring Program. In contrast, less than 20 percent of all farmland in California is Prime Farmland.

Corn and alfalfa occupy the greatest acreage in the Delta, whereas processing tomatoes and wine grapes generate the most crop revenue. Tomatoes and wine grapes have even greater importance to the regional economy because these two crops are tightly linked to high value-added manufacturing in the region. Asparagus and pears are historically high-value crops in the Delta and continue to be significant contributors although acreage of both has decreased. The majority of pumpkins and blueberries grown in California come from the Delta and reflect the variety of products. Total agricultural revenues in the Delta were estimated at $755 million in 2009, including $662 million in crop revenue and $93 million from animals and animal products.

Nearly 80 percent of Delta farmland is used for lower-value field and grain crops, pasture, and grazing lands. These lands are important to supporting animal agriculture in the Delta and the larger region, most notably the dairy industry. Animal agriculture is less prevalent in the Delta than in other areas of the San Joaquin Valley, but milk is still the fifth most valuable agricultural commodity produced in the Delta, and animal production generates about 12 percent of Delta farm revenue. In contrast, milk is the most valuable agricultural product in San Joaquin County and many nearby areas, and the Delta is an important source of local feed.

High-value vineyards, truck, and deciduous crops generate close to 70 percent of crop revenue in the Delta on about 20 percent of the Delta's farmland, and account for 80 percent of the economic impact of Delta agriculture when value-added manufacturing such as canneries and wineries are included. Like other areas in the Central Valley, Delta agriculture is expected to continue to trend towards higher-value crops over time, increasing the contribution of Delta agriculture to the regional economy.

The economic impact analysis estimates that Delta crop and animal production has an economic impact of roughly 9,000 jobs, $635 million in value added, and $1.3 billion in output in the five Delta counties. Across all of California, the economic impact of Delta agriculture is approximately 12,000 jobs, $761 million in value added, and $1.5 billion in output.[1]

Including canneries and wineries dependent on Delta crops, the total economic impact of Delta agriculture increases to roughly 14,000 jobs, $1.1 billion in value added, and nearly $2.8 billion in economic output in the five Delta counties. In addition, Delta agriculture has an economic impact of nearly 23,000 jobs, over $1.9 billion in value added, and over $4.6 billion in economic

[1] The economic impact analysis of agriculture, recreation and tourism utilizes the IMPLAN model to calculate what are commonly known as the "ripple" effects on other industries such as the purchase of inputs in the local economy and local consumer spending supported by the income. Jobs are reported as annual monthly averages and will vary by season. Value added measures total regional income generated by the activity and is comparable to gross domestic product. Output sums the total revenue of enterprise which is higher than the value added or income created by the enterprise.

output in California. Additional details and analysis of Delta agriculture can be found in Chapter 6 of the Economic Sustainability Plan.

Delta Recreation and Tourism

Recreation is an integral part of the Delta economy, generating roughly 12 million visitor days of use annually and approximately $250 million dollars visitor spending in the Delta each year. Of the roughly 12 million visitor days spent in the Delta each year, approximately 8 million days are for resource-related activities (e.g., boating and fishing), 2 million days are for right-of-way-related and tourism activities (e.g., bicycling and driving for pleasure), and 2 million days are for urban parks-related activities (e.g., picnicking and organized sports).

Boating and fishing have the biggest economic impact, and are estimated to generate nearly 80 percent of the recreation and tourism spending in the Delta, including significant expenditures on lodging, meals, supplies, marina services, and fuel. Spending by visitors to the Delta generates roughly 2,700 jobs, $152 million in value added, and $284 million in economic output in the five Delta counties. Across all of California, the economic impact of Delta recreation is approximately 5,000 jobs, $324 million in value added, and $600 million in output.

Despite significant population growth in the market area, the available data suggests that boating and fishing activity in the Delta has grown little in the past 20 years. Boat registrations, employment at marinas and boating-related industries, and the number of marinas are about the same as a decade ago, and the comments of focus group participants in the industry corroborate the observation. This trend could reflect concerns about water and fishing quality and the poor economy, but also reflect broader trends in boating and fishing participation across the nation.

While boating and water recreation will remain the largest piece of the Delta recreation industry, land-based activities such as agritourism, wine tasting, wildlife watching, historic and cultural tourism, bicycling and driving for pleasure are likely to drive future growth in Delta recreation. The majority of visitors to the Delta are from Northern California, an area with great population growth potential but also with nearby locations with successful land-based recreation and tourism economies that compete with the Delta. The residents of a dozen counties around the Delta represent the principal market for future growth in Delta visitation. This market area has a population of approximately 11.9 million people, and projections indicate this figure could grow by about 50 percent or 5.7 million people by 2050.

Because of slow expected growth in boating recreation and the relatively small base of land-based tourism in the Delta, we project Delta recreation and tourism will grow more slowly than the regional population. If resource quality and recreational facilities are maintained so that the Delta retains its current level of competitiveness as a recreation destination, visitation could increase by 3.4 million visitor days and in-Delta spending could increase by nearly $80 million, roughly 35 percent, over 40 years.

It is important to recognize that even this level of growth requires improvement and reinvestment in the quality of the resource, recreation facilities, and expansion of tourism-related enterprises in the Delta to serve increased levels of visitation. Some changes proposed for the Delta's physical and regulatory environment could negatively affect this growth, whereas other changes and an effective recreation enhancement strategy could boost visitation.

A potential plan for the enhancement of recreation in the Delta centers on five location-based strategies: specific waterways, points of interest, focal point complexes, natural habitat areas, and urban edge areas that surround the Delta. Recreation development in the Delta should be coordinated, consistent, branded, and marketed. A National Heritage Area could be an effective means to brand and coordinate strategies to enhance resource-based recreation, agritourism, and historical and cultural tourism. Additional details on recreation and tourism enhancement strategies are in Chapters 8 and 11 of the Economic Sustainability Plan.

Delta Infrastructure Services

The Delta is a critical infrastructure hub for the regional and state economy. While the Delta's importance to the state water system is well-known, its importance to energy, transportation, and in-Delta municipal and industrial water supplies is less appreciated. As discussed in Chapter 4 and mapped in Appendix C, all of these infrastructure services are vulnerable to floods, earthquakes, and sea-level rise, and require the continued maintenance and enhancement of the Delta's levee system.

The Delta is an important energy resource for California. The Delta contains the largest natural gas production field in California, as well as its largest natural gas storage facility below McDonald Island in the Central Delta. In addition to heating and cooking, natural gas fuels the majority of California's electricity supply, and natural gas power plants in the five Delta counties, many within the legal Delta, produce 20 percent of California's natural gas-powered electricity. Major electricity transmission lines, gasoline and jet fuel pipelines cross the Delta, and wind and solar resources are being studied for further development. Taken together, the Delta's contribution to the state's energy network is comparable to its contribution to the state water system.

The Delta also contains increasingly important parts of the inter-regional transportation network that supports the regional and in-Delta economy. As east-west transportation corridors to the north and south of the Delta become increasingly congested and constrained, the demand for through-Delta transportation is growing rapidly. The ports of Stockton and Sacramento are focal points of regional economic development and rely on through-Delta shipping channels. The Ports' marine highway project will increase and diversify the water freight that moves through the Delta, and relieve air pollution and traffic in the region. Traffic data shows large increases on highways in the secondary zone, as well as through the middle of the Primary Zone on Highway 12, and smaller but significant increases on state highways 4 and 160 in the Primary Zone. Through-Delta railways are also an important link in the transportation system.

The Secondary Zone of the Delta and the surrounding counties also draw a significant portion of their municipal and industrial water supplies from the Delta. Changes to Delta water quality—whether an increase in salts or organic carbon—have important effects on urban water supplies in and around the Delta. Significant deterioration of in-Delta water quality could increase water treatment costs by tens of millions of dollars each year and require hundreds of millions of dollars in capital investment in advanced treatment facilities for utilities serving Delta urban areas.

Four Key Issues for Economic Sustainability in the Delta

The Delta Levee System

Since the early 20th century, the current-day Delta levee system provides flood control that allows productive agricultural and urban uses of land, channels water for urban and agricultural uses, protects critical infrastructure, and creates a desirable setting for boating and water-based recreation in an environment unique in California. The levee system is the foundation on which the entire Delta economy is built. Therefore, a sustainable Delta economy requires a sustainable levee system.

To support the Economic Sustainability Plan, an up-to-date map of Delta levees was created. This map serves as the basis for an updated tabulation of levee lengths, which shows that in the Legal Delta, there are just under 1,000 miles of levees, of which 380 miles are project levees constructed by the U.S. Army Corps of Engineers (USACE), and an additional 63 miles are urban non-project levees, as defined by recent State legislation. Subtracting from the total the urban levees and levees in the north and south Delta that are primarily flood-control levees leaves around 650 miles of core levees, which protect lands below sea level in the Primary Zone of the Delta. Of these core levees, 193 miles are project levees that are primarily located along the Sacramento River. The remaining approximately 460 miles of core levees need to be maintained and enhanced by the State and the local reclamation districts.

Of this 460 miles of levees, only about 50 miles clearly fall below FEMA's Hazard Mitigation Plan (HMP) "standard" and 100 miles or more are already at or about the Corps of Engineers Delta-specific PL 84-99 standard. It has been the goal of the State and federal governments, working through the Department of Water Resources (DWR), the U.S. Army Corps of Engineers (USACE), and the local reclamation districts, to meet the PL 84-99 standard since 1982 when DWR and USACE produced a joint report on the Delta levees which recommended the basis for this standard. If effectively used, funds currently in the pipeline should bring the Delta levees close to achieving this goal. When these funds have been expended, more than $698 million will have been invested in improvements to the Delta levees since 1973. These improvements have created significantly improved Delta levees through modern engineering and construction, making obsolete the historic data that is still sometimes used for planning or predicting rates of levee failure.

Three approaches can help all jurisdictions and planners further reduce the risks resulting from the failure of the Delta levees. These approaches are: (1) build even more robust levees, (2) improve both regular maintenance and monitoring and flood-fighting and emergency response following earthquakes, and (3) improve preparedness for dealing with failures after they occur. With regard to the first approach, the big question with respect to the core Delta levees is not whether they should be improved to the Delta-specific PL 84-99 standard. Instead, the key question is whether in order to support and enhance various in-Delta, regional, State and federal interests they should be improved to a higher standard in order to address hazards posed by not only floods, but also earthquakes and sea-level rise. Our conclusion is that these improvements would be advantageous not only for flood control and protection against earthquakes and sea-level rise, but because they also would allow for planting vegetation on the

water side of the levees—an essential component of Delta ecosystem repair. These further-improved levees would have wider crowns to provide for two-way traffic and could easily be further widened at selected locations to allow the construction of new tourist and recreational facilities out of the statutory floodplain. Improvement of core levees to this higher standard would cost in the order of $1 to 2 billion, a significant sum but much less costly than other estimates. Chapter 4 contains further detail regarding funding sources, the assessment of Delta levees, and evaluation of strategies.

Delta Water Quality and Supply

Water quality and quantity is essential to the three key components of the Delta economy: agriculture, recreation, and infrastructure services. As discussed in Chapter 6, the impact of increased salinity on Delta agriculture is already apparent in many areas, and further deterioration would have very large costs. Surveys of Delta boaters have identified water quality as being the most important area of improvement to increase the quality of Delta recreation. Similarly, lower water quality increases costs for municipal and industrial water supplies in the Delta, and creates a financial burden for Delta households and businesses. Much like levees, adequate water quality and quantity is a necessary foundation for a sustainable Delta economy.

Water quality and quantity is the largest impact of many of the proposed changes to the Delta. Proposed changes in conveyance that might lower water quality, particularly in the South Delta, could have adverse impacts on all parts of the Delta economy. Conversely, there would be positive effects if state agencies were to require greater “environmental flows” in the San Joaquin River, Sacramento River, and through the Delta as a whole. Likewise, tighter controls on both urban and agricultural waste water will have positive effects.

In addition to water quality, the Delta economy depends on the availability and right to use sufficient quantities of water. In-Delta use of water is small compared to upstream diversions and water exports from the state and federal projects in the south Delta, and unlike these other diversions, in-Delta water use has not increased in recent decades. Thus, protection of adequate fresh water flows and in-Delta water rights is critically important to economic sustainability.

The Present and Future Contribution of Agriculture, Recreation, and Tourism

Agriculture is the main economic driver in the Delta, generating five to six times the regional economic impact of recreation and tourism. However, recreation and tourism has the most growth potential. Research for this plan found that a dollar of crop production in the Delta has nearly double the regional employment and income impacts of a dollar of recreation and tourism spending in the Delta. This result is important for economic sustainability since many proposals to change the Delta would reduce agricultural production while potentially increasing recreation and tourism. Even using the weakest definitions of economic sustainability that would allow growth in one sector to offset decline another, the projected growth in Delta recreation spending over the next 40 years would only be equivalent of 5 percent of the current economic impact of Delta agriculture on the five Delta counties. Thus, economic sustainability requires the value of Delta agriculture to be sustained and enhanced in the future.

The lower economic impact of recreation and tourism spending is because fuel and retail purchases dominate expenditures for the types of recreation and tourism that are currently available in the Delta. Although these are local expenditures, the goods are typically produced elsewhere have relatively low multiplier effects on the regional economy. While recreation trips to the Delta are a significant contributor to the Delta economy and are expected to increase, increasing the economic impact of tourism spending requires increasing spending per trip to the Delta and the local economic impact of spending that does occur. This requires diversification through new investment in high value-added, land-based tourist services that generate more local income and jobs than retail and fuel expenditures. A successful strategy would require significant new investment in hospitality enterprises within the Delta, and also stimulate investments needed to sustain and enhance the large existing economy associated with Delta boating. This is a difficult challenge given the market and regulatory constraints of operating in the Delta.

This plan offers some tactics to support this strategy, but it is important to have realistic expectations of the growth potential. In the baseline scenario, recreation and tourism spending is projected to grow about $80 million, 30 percent over the next 40 years. Successful efforts to expand and enhance tourism and recreation experiences could consequently increase this by another $30 million. However, increasing day trips for wildlife viewing and other ecologically-based activities is unlikely to generate significant increases to in-Delta economic activity, especially without new investment in services that encourage longer visits and overnight stays.

On the agricultural side, supporting the high-value processing tomato and wine grape crops is critically important to the regional economy because of the local value-added manufacturing industries associated with these crops, and the potential for significant growth in local winery capacity and direct sale of product. The baseline projection developed for this plan predicts that an additional 10 percent of Delta agricultural land will shift towards these higher-value crops over the next few decades, creating a significant boost to the regional economy. However, these crops are generally considered to be less wildlife friendly, and significant expansion could conflict with ecological restoration goals in the Delta.

Sustainable Legacy Communities: Where the Challenges and Strategies Come Together

Economic opportunities and constraints facing the Delta's Legacy Communities mirror those in the broader Primary Zone. The current economies of the Legacy Communities are agriculturally based providing support services and limited workforce housing for the Primary Zone's largest industry as well as some housing for retirees and service and professional workers who commute into nearby urban areas such as Sacramento. Despite the current base in agriculture and rural bedroom and retirement communities, much of the revitalization strategies for Legacy Communities are based on growing their appeal as destinations for recreation and tourism. This includes promoting the emerging agritourism sector—including wine and local foods—as an economic development theme.

However, a strict and multi-layered regulatory framework places limits on economic development opportunities within the Delta's Legacy Communities. The aging and occasionally sub-standard building stock needs improvement, potentially utilizing redevelopment of existing

buildings and/or a limited amount of new development in order to accommodate visitor- and local-serving enterprises. New investment is especially important because the existing base of hospitality- and tourism-related enterprises is very limited and insufficient to attract and capture significant tourist activity. The most developed recreation and tourism enterprises in the Delta are campgrounds and marinas that serve water-based recreation; these are mostly located outside the Legacy Communities and often outside the Primary Zone.

An already burdensome regulatory environment has been made significantly worse by the recent remapping of FEMA flood zones. All of the Legacy Communities along the Sacramento River have either been or are in the final process of being remapped into the 100-year floodplain. This designation requires elevation of new and substantially remodeled existing structures 10 feet or more above ground level, making most new construction, additions and major renovations financially infeasible. Many stakeholders are concerned that the flood zone designation will cause the Legacy Communities to slowly wither away. It is clear that the economic sustainability of the Legacy Communities is dependent on levee and flood-control investments as well as other strategies to address the constraints of flood zone designation.

Despite these challenges, the Legacy Communities have significant historical, cultural, and economic values and the potential to become attractive destinations for visitors and more prosperous, higher quality of life for residents. Chapter 11 includes more detailed visions and strategies for Legacy Communities, including case studies of Walnut Grove, Locke, and Clarksburg.

Impact of Water Supply and Ecosystem Restoration Proposals on the Delta Economy

Current proposals for new water supply and ecosystem restoration projects have serious implications for economic sustainability in the Delta. The isolated conveyance and habitat proposals are mostly being developed in the Bay Delta Conservation Plan (BDCP), and the Economic Sustainability Plan relies on the November 2010 draft of the BDCP to describe the proposals. In addition, new proposals regarding Delta levees, land-use regulation, and economic development have been made by the Delta Stewardship Council, Department of Water Resources, the Public Policy Institute of California, and the Delta Vision Strategic Plan.

Isolated Conveyance

The BDCP proposes a pair of water conveyance tunnels to divert water from the Sacramento River in the North Delta and convey it around the Delta to the state and federal export pump in the South Delta. The current proposal would have a diversion capacity of 15,000 cubic feet per second, and five water intakes and associated pumping facilities along the Sacramento River. Of all the current proposals, the isolated conveyance imposes the largest cost and the most risk for the Delta economy. The largest impacts are due to the water quality effects of reducing freshwater flows, but the new conveyance facility would also eliminate high-value farmland and disrupt the rural character of the North Delta with large industrial development.

The reduction in through-Delta conveyance of fresh water is expected to increase salinity in the South Delta. The extent of salinity increases is unknown at this time, and it depends on the

operation of the facility, among other factors. Under currently proposed operating criteria, the water-quality impacts of isolated conveyance could result in an annual loss of between $20 million and $65 million in agricultural production in the South Delta. In addition, the land footprint of the conveyance is estimated to generate an additional $10 million to $15 million in annual agricultural losses, mostly in the North Delta. The risk of even higher losses is great, because the immense $12 billion to $15 billion capital cost is to be entirely paid by the sale of water conveyed through the facility, and will undoubtedly generate extreme pressure to change operations and increase the amount of fresh water conveyed through the canal. In this case, agricultural losses in the Delta would rise significantly, possibly as high as $200 million per year.

Isolated conveyance is also expected to negatively affect recreation and tourism in the Delta. By reducing reverse river flows in the south Delta, the conveyance is expected to benefit some fish species, and this could potentially benefit fishing and its associated economy. However, the negative effects of conveyance on recreation are expected to be larger as the reduction in water quality in the south and central Delta will have negative effects on boating. In addition, the noise and visual impacts of pumping facilities on the Sacramento River is anticipated to have large negative impacts on efforts to enhance recreation and tourism along a strategic stretch of the Sacramento River between in the heart of its historic Legacy Communities. Overall, the conveyance could generate as much as a 10 percent reduction in recreation and tourism.

Finally, the isolated conveyance is expected to also negatively affect infrastructure services in the Delta. Water quality declines would increase treatment costs for in-Delta municipal and industrial supplies. In addition, isolated conveyance could reduce the State's commitment to restoring Delta levees, putting energy, transportation, and other key infrastructure at greater risk.

Habitat Proposals

The November 2010 draft BDCP includes 19 habitat enhancement proposals. The Economic Sustainability Plan assesses the impact of the four proposals that would affect large amounts of Delta land, and therefore have the largest potential impacts on the Delta economy: Yolo Bypass Fisheries Enhancements, Lower San Joaquin River Floodplain Restoration, Tidal Habitat Restoration, and Natural Communities Protection. All of these four proposals have negative impacts on Delta agriculture, although the magnitude and range of effects vary widely. Impacts on recreation and infrastructure services are a mix of positive and negative.

Yolo bypass fishery enhancements proposed in the draft BDCP would require flood easements or fee simple acquisition of between 24,000 and 48,000 acres of farm and rangeland in Yolo County. More frequent flooding could reduce agricultural output by $1 to $5 million annually and increase costs of controlling undesirable vegetation. Improved fisheries would benefit recreation, but there could be negative impacts on hunting clubs in the area. The project would provide flood control benefits to the Sacramento area, but could negatively affect downstream urban water supply intakes. Yolo County is working with the state and BDCP on options that could reduce the negative impacts on local agriculture.

As proposed in the BDCP, lower San Joaquin River Floodplain Restoration would affect approximately 10,000 acres of high-value farmland in the South Delta, resulting in up to $20 million in lost agricultural revenue. The project would provide valuable flood protection, and has the potential to benefit recreation if designed to accommodate recreational uses. Local landowners have worked with environmental groups to develop an alternative flood bypass proposal that would substantially expand the capacity of the existing flood bypass at Paradise Cut. This alternative proposal would reduce the impacted farmland to 2,000 acres while still providing significant flood control and habitat enhancements.

The proposal to create 65,000 acres of tidal marsh in the Delta and the Suisun Marsh has the largest potential impact on the Delta economy. Agricultural revenue losses are estimated to be between $18 and $77 million annually with the majority of impacts in the south Delta. The low range of agricultural costs occurs if restoration efforts are more concentrated in Suisun Marsh and the west Delta. Tidal marsh in the south Delta was evaluated as having the largest negative effects with recreation and municipal water supplies incurring significant negative impacts in addition to agriculture. Similar concerns surround tidal marsh restoration in the Cache Slough area although the negative impacts are lower than creating a south Delta tidal marsh. In contrast, tidal marsh restoration in Suisun Marsh and the west Delta is thought to have positive impacts on Delta water quality and therefore Delta economic sustainability.

The BDCP's Natural Communities proposal involves the acquisition of "wildlife friendly" agricultural easements on 32,000 acres and converting 8,000 acres of rangeland to native grasslands. Even though it would presumably involve easement purchases from willing sellers, this strategy could have large negative economic impacts on the Delta if it is used to reduce higher-value and permanent crops such as vineyards in favor of lower-valued "wildlife friendly" crops. Thus, a preliminary estimate of the potential loss to agricultural revenue is $5 to $43 million with the wide range resulting from uncertainty regarding the implementation strategy. Increasing wildlife viewing opportunities should be positive for recreation and tourism, although it is unlikely to generate significant new spending. The impacts on infrastructure services would be minimal.

Open Water Proposals

The PPIC, Department of Fish and Game, and others have proposed creating larger areas of open water in the Delta through intentional breaching of levees or not repairing levees in the event of a failure. The Economic Sustainability Plan considers a flooded six-island area of open water in the Central Delta that has been proposed by UC-Davis researchers as a starting place for discussion of open water in the Delta that is less extensive than other proposals they have made to flood 20 or more islands. It is argued that the deeply subsided islands in the Central Delta are not worth protecting with levees because they grow low-value crops and do not contain major roads and other significant physical infrastructure.

In contrast to conveyance and habitat proposals in the BDCP, lost agricultural revenue from flooding these six islands is among the smallest concerns, amounting to a roughly $12 million annual loss in crops. Larger concerns have been raised around the impact of open water in the Central Delta on infrastructure services and recreation. Submerged islands increase organic

carbon in Delta water, increasing costs for municipal and industrial water supplies, especially the City of Stockton's new intake on Empire Tract. Increased waves and seepage on levees surrounding water will increase the cost of maintaining and improving adjacent levees, and, as discussed in Chapter 4, these costs are comparable to the cost of improving and maintaining the existing levees. This proposal would also eliminate levees that protect the Stockton Deepwater Ship Channel that serves the growing Port of Stockton. An open water area would increase silting and dredging costs, and it would affect navigation of ships through the narrow deepwater channel. Finally, the open water scenario is in the most popular area for Delta boating, and it is expected to have major negative impacts by eliminating the wind-protected channels that attract boaters to the Delta. Forty percent of Delta marinas, including some of the largest, surround the proposed open-water area and will be exposed to a variety of negative impacts.

Regulation Proposals

There is widespread agreement that the resources of the Delta need to be protected, and that it should remain a rural and predominantly agricultural area. Regulation plays a role in this protection, and the Delta Protection Commission's Land Use and Resource Management Plan already creates an additional regulatory check on development compared to other rural, unincorporated regions in California. There is significant concern that the Delta Stewardship Council's proposed regulation of "covered actions" will create additional costs and uncertainty for investment in the Delta, and work against its goal to enhance the Delta. It would be best for the Delta economy if the Stewardship Council did not add additional layers of regulation, approvals, and potential appeals. At minimum, the DSC should expand its list of exemptions to include investment in agricultural, recreation, and tourism enterprises, especially around the Legacy Communities.

Delta Vision Economic Development Strategies

Although most of the Delta Vision Strategic Plan is focused on water supply and ecosystem restoration, it was also the source of several proposals to enhance "Delta as a Place" and economic development. The analysis in the ESP identifies the National Heritage Area and Delta Investment Fund as the most promising strategies generated in Delta Vision. A National Heritage Area could be an effective means to brand and coordinate strategies to enhance resource-based recreation, agritourism, and historical and cultural tourism. The proposed Delta Investment Fund would be a useful tool to implement the strategy in an effective and coordinated way.

Recommended Actions for Economic Sustainability

The following actions are recommended. All of these actions and strategies are consistent with economic sustainability in the Delta and the coequal goals of increased water supply reliability and ecological restoration.

- **Improve core, non-project Delta levees to the PL 84-99 standard by 2015 using the existing Delta levee subventions and special project programs.** This engineering

standard has been developed and supported by numerous studies, is attainable with current bond funds, and consistent with the intended use of the bonds California voters passed in 2006. Achieving this goal will increase water supply reliability, and will leverage the substantial benefit of federal support from the Army Corps of Engineers in the event of future levee failures. (Chapter 4)

- **Improve many Delta Levees beyond the PL 84-99 that addresses earthquake and sea-level rise risks, improve flood fighting and emergency response, and allow for vegetation on the water side of levees to improve habitat.** Upgrades beyond PL 84-99 are the appropriate place to consider implementing island-by-island life-cycle cost-benefit analyses. Improvement of most core Delta levees to this higher standard would cost $1 to $2 billion. While this is a longer-term program, planning should be initiated immediately. (Chapter 4)

- **Transfer responsibility for coordination of regional emergency management and response and recovery to a regional agency.** The regional agency should place much more emphasis on preventative maintenance and inspections, flood-fighting, and emergency response. The Delta Protection Commission should consider taking on this role.

- **Maintain or enhance the value of Delta agriculture.** The contribution of agriculture to the economy of the Primary Zone is irreplaceable, and it is also very important to the Secondary Zone and regional economy. While some modest loss in agricultural acreage may be unavoidable, it is possible to maintain and enhance the value of Delta agriculture if current trends towards higher value crops continue. The requirement to protect the value of Delta agriculture must be part of any habitat, water supply or development plans. The fifth draft of the Delta Plan under development by the Delta Stewardship Council includes maintaining and enhancing Delta agricultural revenues as a performance measure.

- **Initiate a process to streamline local, State, and federal regulations and permitting.** Overlapping layers of regulatory oversight in the Delta create uncertainty and costs that discourage private investment needed for economic sustainability.

- **The Delta Stewardship Council should not increase regulation of "covered actions" for industries it is trying to enhance in the Delta.** Exemptions should be made for needed investments in agriculture, recreation, and tourism.

- **An existing agency should be designated to manage and implement economic sustainability efforts in the Delta.** The agency would ensure that strategic actions, such as marketing efforts and recreation enhancements, are implemented in a systematic, efficient, and consistent fashion throughout the Delta. The Delta Protection Commission should consider taking on this role.

- **Create a Delta and/or Legacy Communities "brand" to enhance awareness.** The agricultural products, attractions, and communities of the Delta should be marketed strategically in order to raise the stature of the region and encourage added visitation.
- **Designate the Delta as a National Heritage Area (NHA).** This recommendation is contingent on the outcome of the Delta Protection Commission feasibility study. The NHA could be an effective tool for marketing and branding the Delta and implementing the recreation and tourism enhancement strategy.
- **The Delta Investment Fund should be established and used strategically to implement the recreation and tourism enhancement strategies.** Funding for planning and development of focal point complex areas and catalyst features, especially those close to Legacy Communities, should be a high priority.
- **Develop measurable targets for recreation and tourism and agricultural sustainability, and track performance over time.** A key first step is to improve data on recreation and tourism use with an updated visitor survey and additional primary data collection that is repeated at five-year intervals. This data is crucial for future recreation planning and marketing. Agricultural data is more available but needs to be consistently collected and compiled over time.
- **Create flood bypass and habitat improvements in the Yolo bypass, McCormack-Williamson Tract, and the lower San Joaquin River near Paradise Cut.** In all cases, the BDCP and State interests should work collaboratively with local stakeholders to minimize negative economic impacts and develop effective mitigation. In the lower San Joaquin River, an alternative proposal developed collaboratively with local stakeholders is recommended as an alternative to the more expansive and costly plan outlined in the draft Bay Delta Conservation Plan (BDCP). These ecological and flood-control investments should be designed with appropriate facilities to enhance recreational opportunities.
- **Improve water quality and freshwater outflow in the Delta.** In addition to ecosystem benefits, this goal improves agriculture, recreational boating and fishing, and in-Delta municipal and industrial water supplies.

The following proposed actions to further the coequal goals are not recommended because they conflict significantly with economic sustainability. These proposed actions all had significant negative impacts on all three key components the Delta economy evaluated in the plan: agriculture, recreation and tourism, and infrastructure services.

- **A 15,000 cubic feet per second isolated water conveyance facility is inconsistent with economic sustainability**. This project would have significant negative effects on all aspects of the Delta economy. There are unacceptably high risks surrounding the financial feasibility, environmental impacts, and operations of the project. There are many alternative options for increasing water supply reliability, and the large cost of isolated conveyance could drain resources that could support the state policy of reducing reliance on water exports from the Delta.

- **Tidal marsh in the south Delta is inconsistent with economic sustainability.** Tidal marsh in the south Delta eliminates a large amount of high-value agricultural land and would affect water quality in ways that are negative for recreational, municipal, industrial, and agricultural uses.
- **A large area of open water in the Central Delta caused by the permanent flooding of several contiguous islands is inconsistent with economic sustainability.** Although the agricultural value of these deeply subsided islands does not justify levee investments, this strategy would cause significant harm to recreation, and negatively affect water quality for in-Delta municipal and industrial uses through increased levels of organic carbon, and increase flood risks on adjacent islands.

Finally, the plan discusses a number of additional potential actions that require further study and development. These are mostly medium-term strategies that could be consistent with Delta economic sustainability and the coequal goals. However, there are significant concerns or uncertainties regarding their impact on the Delta economy that must be further researched and addressed before they can be recommended in the plan. These potential actions include proposals for smaller capacity water conveyance such as a 3,000 cfs tunnel, moving water supply intakes for conveyance downstream into the west Delta, proposals for enhanced through-Delta conveyance such as Delta corridors, extensive use of wildlife-friendly agricultural easements as described in the BDCP, tidal marsh in the west Delta and Cache Slough, and subsidence-reversal agriculture on private lands.

In conclusion, the recommended strategies in the Economic Sustainability Plan show that it is possible to sustain and enhance the Delta economy while making significant progress towards the coequal goals of increased water supply reliability and ecosystem restoration.

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Chapter 1: Introduction

The Sacramento-San Joaquin River Delta is a unique place of economic, environmental, historic and cultural significance. The land and water resources of the Delta support significant agricultural and recreation economies, and the Delta also has an important role as an infrastructure hub for water, energy and transportation. The region's rich history boasts of bustling, river-based commerce before the automobile age, and its cultural uniqueness includes the only rural town in America build by early Chinese immigrants. As the largest estuary on the west coast of the Americas, the Delta also is a place of striking natural beauty and ecological significance that is struggling with serious environmental degradation problems. Although surrounded by growing cities, the Delta remains a highly-productive agricultural area with rural charms, landscapes, and waterscapes not found elsewhere in California.

In recent years, there has been great concern over increasing environmental degradation in the Delta and over court decisions that reduced the quantity of water delivered to southern California through the state and federal water project intakes in the south Delta to protect endangered fish. Combined with additional concerns about the stability of the Delta's levee system, these concerns led the California legislature to pass the Delta Reform Act of 2009. The Act created the Delta Stewardship Council and charged it with developing a Delta Plan to achieve the coequal goals of "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem."

Recognizing the potential impact of the Delta Plan on the people and economy of the Delta, the Delta Reform Act stated that the coequal goals of water supply reliability and restoring the Delta ecosystem "shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place." Among the measures to address this goal, the Delta Protection Commission was tasked with developing this Economic Sustainability Plan to inform the Delta Stewardship Council's development of the Delta Plan.

The Legislature established the following guidelines for the Economic Sustainability Plan in the Delta Reform Act of 2009.

The economic sustainability plan shall include information and recommendations that inform the Delta Stewardship Council's policies regarding the socioeconomic sustainability of the Delta region. (b) The economic sustainability plan shall include, but not be limited to, all of the following:

(1) *Public safety recommendations, such as flood protection recommendations.*
(2) *The economic goals, policies, and objectives in local general plans and other local economic efforts, including recommendations on continued socioeconomic sustainability of agriculture and its infrastructure and legacy communities in the Delta.*
(3) *Comments and recommendations to the Department of Water Resources concerning its periodic update of the flood management plan for the Delta.*
(4) *Identification of ways to encourage recreational investment along the key river corridors, as appropriate.*

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. Many of the most

significant proposals for the Delta are being developed in the Bay Delta Conservation Plan (BDCP). 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 including economic development recommendations in the 2008 Delta Vision Strategic Plan.

Thus, in addition to the goals stated in legislation, the following goals have also been established as critical to developing information and recommendations to support economic sustainability in the Delta.

- Provide a thorough analysis of the baseline and trends for key sectors of 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.
- 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 involve new research and analysis to support Delta decision making. The last two goals integrate these findings into specific recommendations for policy and economic development and make up the economic sustainability plan.

In order to be adopted into the Stewardship Council's Delta Plan, the recommendations in the Economic Sustainability Plan must be consistent with the coequal goals of improving water supply reliability and protecting, restoring, and enhancing the Delta ecosystem. The legislature also stated that the "coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place." Thus, the economic sustainability plan can provide important guidance on evaluating whether proposed actions to satisfy the coequal goals are consistent or conflict with the objective protecting and enhancing the Delta.

The concept of economic sustainability and the objective to "protect and enhance the unique cultural, recreational, natural resources, and agricultural values of the California Delta as an evolving place," can be interpreted in different ways. In economic terms, there is near consensus that a minimum requirement is to maintain the economic value of the entire Delta economy in the future. The Fifth Staff Draft of the Delta Stewardship Council's Delta Plan uses a stronger definition of economic sustainability where growth in one sector is not a substitute for deterioration in another area. Specifically, the Fifth Staff Draft Delta Plan defines performance measures for economic sustainability as maintaining or increasing gross revenues in each of three key sectors: agriculture, recreation, and ecotourism/agritourism. In addition, there is broad agreement that this objective requires the protection of the cultural and historical heritage and the long-term economic viability of the Delta's historical Legacy Communities.

Limitations of the Plan

While the list of goals is 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 ongoing 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.

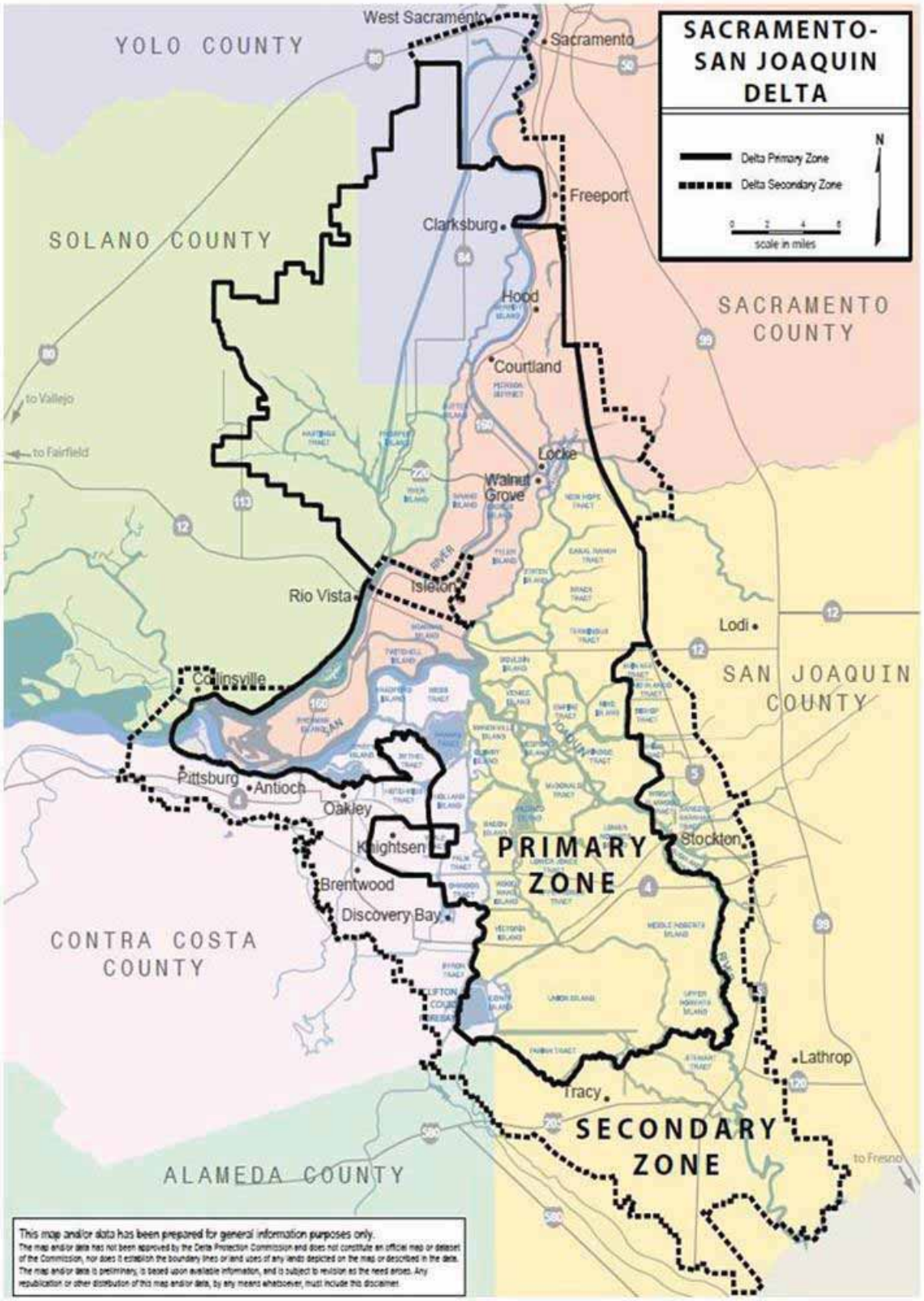
2. *The report is not a comprehensive cost-benefit analysis of Delta water conveyance options*.

   New water conveyance facilities are probably the most significant single proposal for the Delta. As the work plan for this project was developed, the main proposal in the BDCP was a 15,000-cfs tunnel conveyance, but the process was being opened up to consider a much broader variety of options to improve the reliability of conveyance. The 15,000-cfs tunnel remains the leading proposal and is the only alternative to through-Delta conveyance examined in this report due to the infeasibility of analyzing so many alternatives and the lack of detailed descriptions for the alternatives. In addition, all of the water conveyance proposals have costs and benefits that extend far outside the Delta. This report assesses the effect of the tunnel conveyance on the Delta economy, which is an important input to a comprehensive cost-benefit analysis with a statewide focus. In a few places, out-of-Delta impacts are considered when they have implications for the operation of in-Delta assets such as water conveyance that could have important implications for the Delta economy.

Geographic Focus of the Study

The boundaries of the Legal Delta are shown in Figure 1. The Delta Protection Act of 1992 defined the Delta boundaries including the Primary and Secondary Zone and created the Delta Protection Commission, charging it with developing a Land Use and Resource Management Plan for the Primary Zone. The majority of the Delta's 738,000 acres of land is in the rural and agricultural Primary Zone. The population of the Primary Zone is approximately 12,000 and has remained steady in the nearly 20 years since the passage of the Delta Protection Act.

Figure 1 Map of the Primary and Secondary Zones of the Sacramento San Joaquin Delta



Source: Delta Protection Commission. Accessed 2011-06-30

The Legal Delta including both the Primary Zone and Secondary Zone, contains significant portions of five counties, Contra Costa, Sacramento, San Joaquin, Solano and Yolo, and a small rural corner of Alameda County. The Delta includes parts of several large cities including Antioch, Pittsburg, Stockton, Sacramento, Tracy, and West Sacramento. The legal Delta has a population of 571,000, according to the 2010 Census, which has increased by about 200,000 people—more than 50 percent—in the 20 years since the 1990 Census. All of the population growth, and virtually all of the Delta's urbanized land, is located within the Delta's Secondary Zone.

The Delta's economy, like its population, is primarily urban and service oriented. However, the Delta Reform Act of 2009 and the Delta Protection Act of 1992 are primarily concerned with the natural resources of the Delta and the economic activity sustained by those resources such as agriculture and outdoor recreation. In addition, the resources of the Delta support significant water, energy and transportation infrastructure that serve the Delta, regional and state economies, and an important commercial and recreational salmon fishery throughout the state.

Chapter 2 of this report gives an overview of the entire Delta economy and socio-economic trends. Detailed study is reserved for the resource related industries and sectors that could be significantly affected by the Delta Reform Act: agriculture, recreation and tourism, and the infrastructure services that depend on the levees, land and water resources of the Primary Zone. Despite the urban nature of the Secondary Zone, it has important economic linkages with the Primary Zone and its resources.

The Legal Delta, both primary and secondary, includes portions of several counties and cities and do not conform to the usual boundaries that define economic data and models. This creates several challenges for this project, and an effort was made to approximate the Legal Delta boundaries with Census block groups, tracts, zip codes, 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. The report authors have tried to be clear throughout the report regarding the definitions, but readers should be aware that variations in data reported reflect the differences in data sources available in a rural area that spans five counties.

Organization of the Report

There are three parts of the report that follow this Introduction. Part One presents critical background and overview information. Part One 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 available to improve the levees; and a review of key laws and land-use plans and how they interact in the Delta.

Part Two analyzes specific industry sectors in the Delta, the baseline and trends of these industries, and the expected effects of various policy proposals. Part Two also includes a cross-cutting chapter that explores the future of Legacy Communities. Part Three summarizes the key findings of the previous sections and integrates the findings into a set of recommended strategies and policies to support economic sustainability in the Delta.

Part One: Background and Context for the Economic Sustainability Plan

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

1 Overview and Key Findings

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.

The analysis focuses primarily on data-driven results and information based primarily on government data sources, which are 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 A). The detailed data and calculations documenting the findings presented in this chapter are also provided (see Appendix A).

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 profile 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 statewide, the Primary Zone population has remained essentially unchanged. The impressive growth rate of the Legal Delta is largely attributable to its position on the fringe of large metropolitan areas in Northern California. However, the Primary Zone does not appear to be participating in this regional or statewide growth, in part because it lacks the public infrastructure and services necessary to support robust growth and in part because there are restrictive land-use regulations on new development. In particular, the Central and Southern Delta (south of Walnut Grove and including the SR12 corridor east of Rio Vista) has contracted since 2000, with total population falling by approximately 500 people, a decrease of roughly 6.5 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 as non-White and approximately 81 percent are younger than 55 years of age, similar to the 39 percent and 79 percent statewide, respectively. In contrast, only about 25 percent of Primary Zone residents describe themselves as non-White and about 62 percent younger than 55 years of age. The Primary Zone's below-average household size (with about 70 percent of households containing fewer than three people compared to about 54 percent statewide) 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 growing urban centers, but these patterns 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

because of an influx of younger people 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 24 percent in 2000 to 38 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. 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, agriculture alone makes up about 45 percent of total employment in the Primary Zone.

- **Export Sectors**: Exports represent a key measure of a region's economic base because they bring new money into a region instead of re-circulating 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 percent versus 24 percent in California), the Sacramento River Corridor is distinctly export-oriented, with exports making up approximately 64 percent of output.

2 The People of the Delta

The demographic attributes and unique capacities of Delta residents will have important implications for the region's 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 Delta 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.

The Primary Zone encompasses about 67 percent of the Legal Delta's total land area. It is a highly rural and sparsely populated area surrounded by relatively fast-growing urban areas in or

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

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 regulatory prohibitions, lack of public infrastructure, and economic feasibility. The relatively fast growth in the Secondary Zone 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.

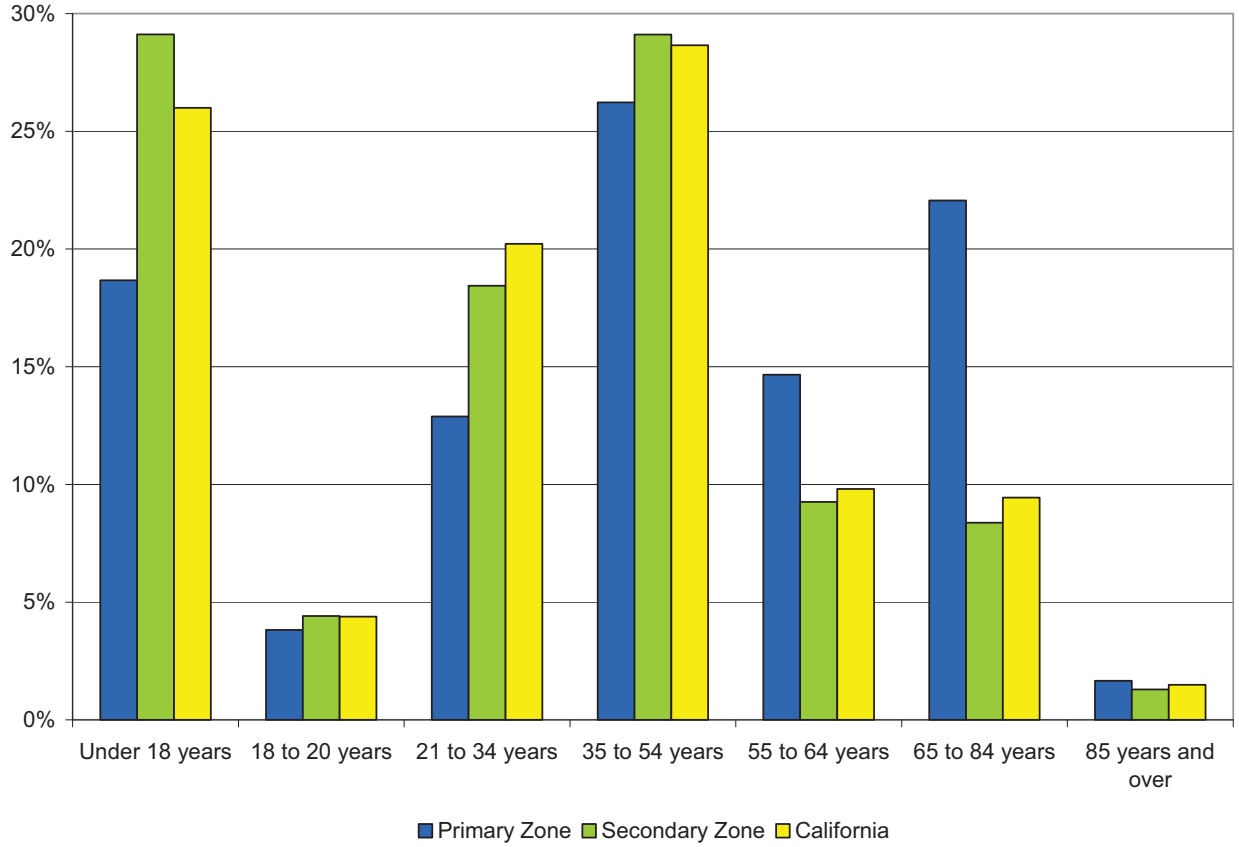
2.1.2 Age and Household Composition

Overall, the age and household composition of the resident population in the Legal Delta is similar to California as a whole, albeit with slightly younger and larger families. 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 populated by older individuals without children living in relatively small households. 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 22 percent of total population (compared to 9 percent in California). Meanwhile, about 70 percent of the households contain two or fewer people, compared to 54 percent statewide. 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.

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

Figure 2 Age Distribution in the Delta

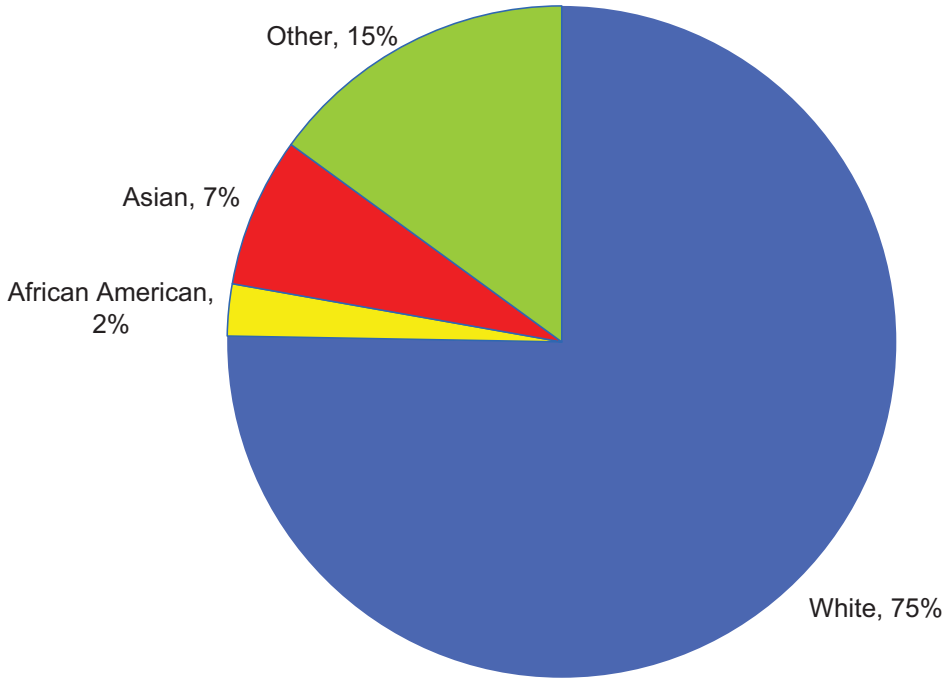


Source: 2005-9 American Community Survey, Census Bureau

2.1.3 Race and Ethnicity

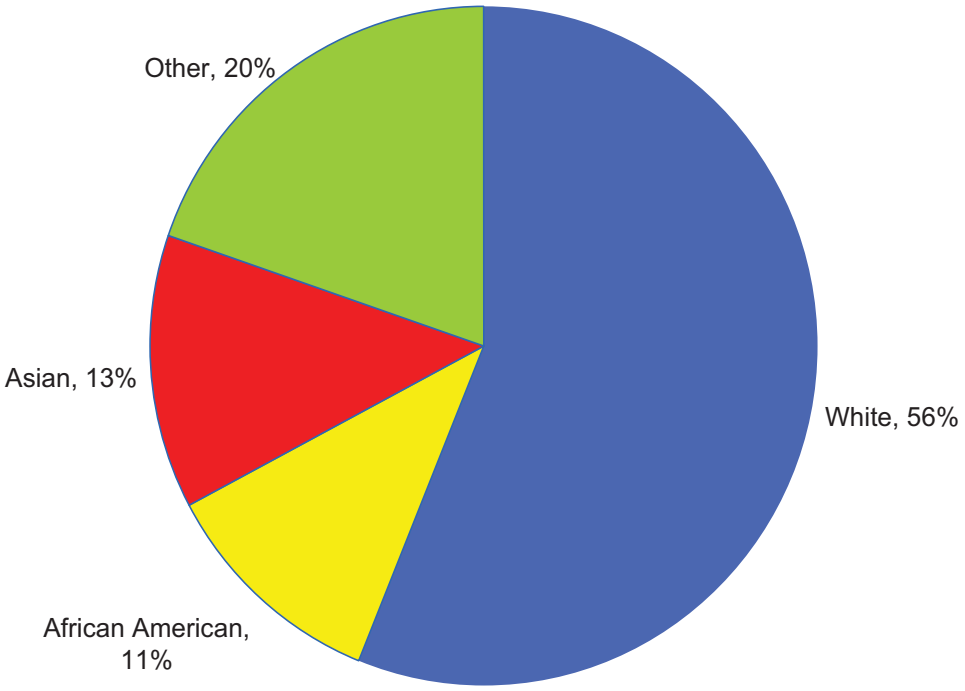
The population of the Primary Zone is generally Caucasian, with residents identifying themselves as White making up approximately 75 percent of the population. About 7 percent of the Primary Zone population reports being of Asian descent. The relatively urbanized Secondary Zone is somewhat more diverse, 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.

Figure 3 Race in the Primary Zone



Source: 2005-9 American Community Survey, Census Bureau

Figure 4 Race in the Secondary Zone



Source: 2005-9 American Community Survey, Census Bureau

Across all race categories, approximately 26 percent of the Primary Zone population and 30 percent of the Secondary 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.

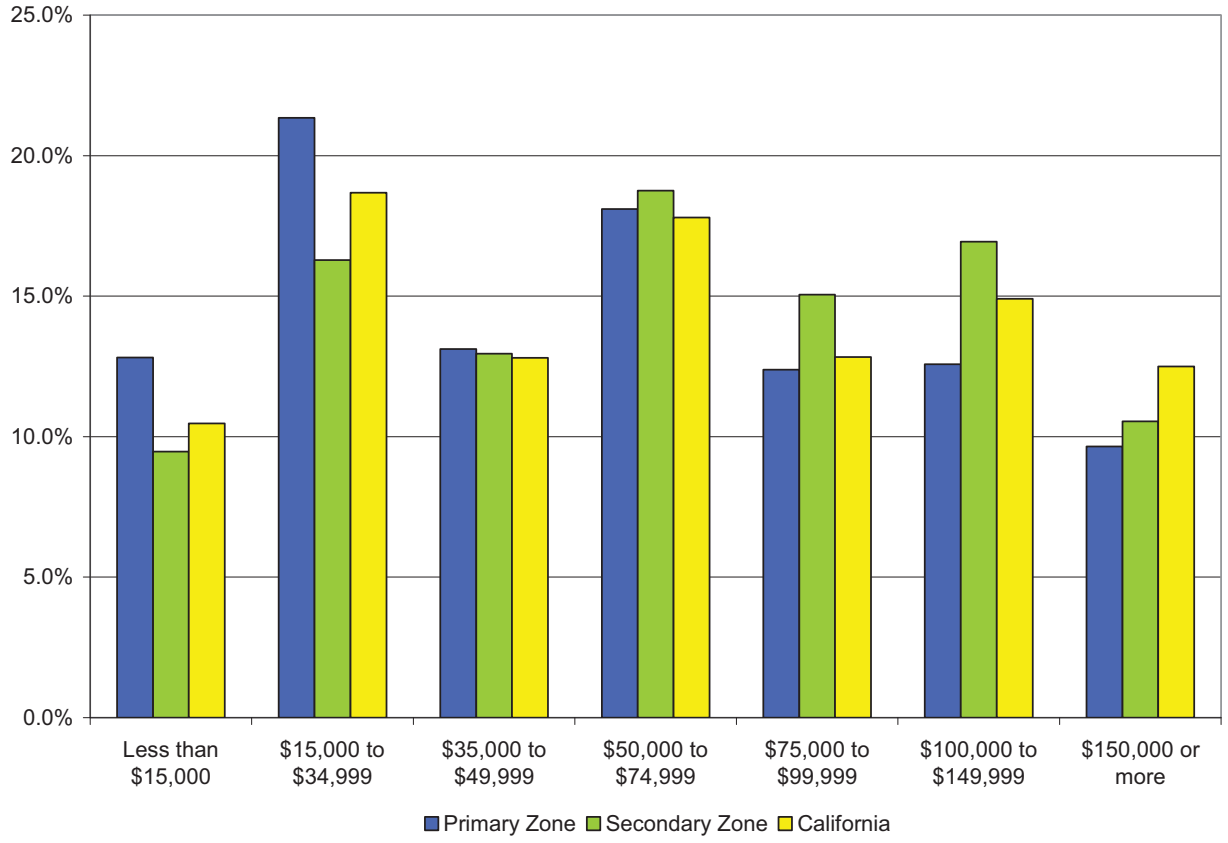
2.1.4 Educational Attainment

In general the residents of the Legal Delta are well educated compared with Californians as a whole, with several caveats. For example, the Legal Delta has fewer high school drop-outs than the State overall, at 17 percent compared to 20 percent. However, about 32 percent of Legal Delta residents have successfully obtained some form of post-secondary (higher) education degree, compared to 37 percent statewide. Interestingly, the Primary Zone has slightly higher education levels than the Secondary Zone with 36 percent completing post-secondary training and 9 percent holding a graduate or professional degree (compared to 31 percent and 6 percent, respectively, in the Secondary Zone).

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 (34 percent versus 29 percent in California), a similar proportion of Primary Zone households have income between $35,000 and $100,000, compared to California overall. A greater share of California's households earn more than $100,000, 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 5 Income Distribution in the Delta



Source: 2005-9 American Community Survey, Census Bureau

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. Between 1990 and 2010, the number of housing units increased by about 10 percent, from approximately 4,500 to nearly 5,000. The discrepancy between population and housing growth generally reflects declining household size, increased vacancies, and second-home construction (e.g., vacation homes). 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 71 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 rental 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 edge of several large metropolitan areas, it was particularly vulnerable to the sub-prime-led foreclosure crisis that disproportionately hit a number of California communities on the urban fringe. 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

Only about 54 percent of the Primary Zone population is in the labor force (employed or seeking work), and approximately 24 percent of the zone's residents are above retirement age. The unemployment rate in the Primary Zone (7 percent) is slightly lower than in California (8 percent), according to data from 2005 through 2009. In the Secondary Zone, a greater share of the population is in the workforce (64 percent), which is fairly consistent with California overall. However, unemployment in the Secondary Zone is higher (10 percent) than in the Primary Zone and California, according to data from 2005 through 2009.

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 the Primary Zone have relatively complex commute patterns, which suggest that residents generally work elsewhere. In the Primary Zone, roughly 88 percent of employed residents work outside of the Primary Zone. For example, the employed residents of the Primary Zone commute to Sacramento (6 percent), Stockton (6 percent), Rio Vista (3 percent) and San Francisco (3 percent). The employed residents of the Secondary Zone work in Stockton (14 percent), Sacramento (7 percent), San Francisco (4 percent), Antioch (4 percent), and other locations.

The employed residents of the Primary Zone work primarily in agriculture (12 percent), education (11 percent), construction (10 percent), and health care (8 percent). Of the employed Primary Zone residents, approximately 63 percent are employed by for-profit enterprises, 20 percent are employed by government entities, 10 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 (9.1 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 education, construction, and health care, 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 in the Delta

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, there are 1.826 million jobs in the five-county Delta region (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 farm employment.

The Bureau of Economic Analysis's comprehensive employment data are unavailable for the Primary Zone of the Delta. However, the U.S. 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 the Bureau of Economic Analysis in the five-county region, this analysis estimates that there are roughly 200,000 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.

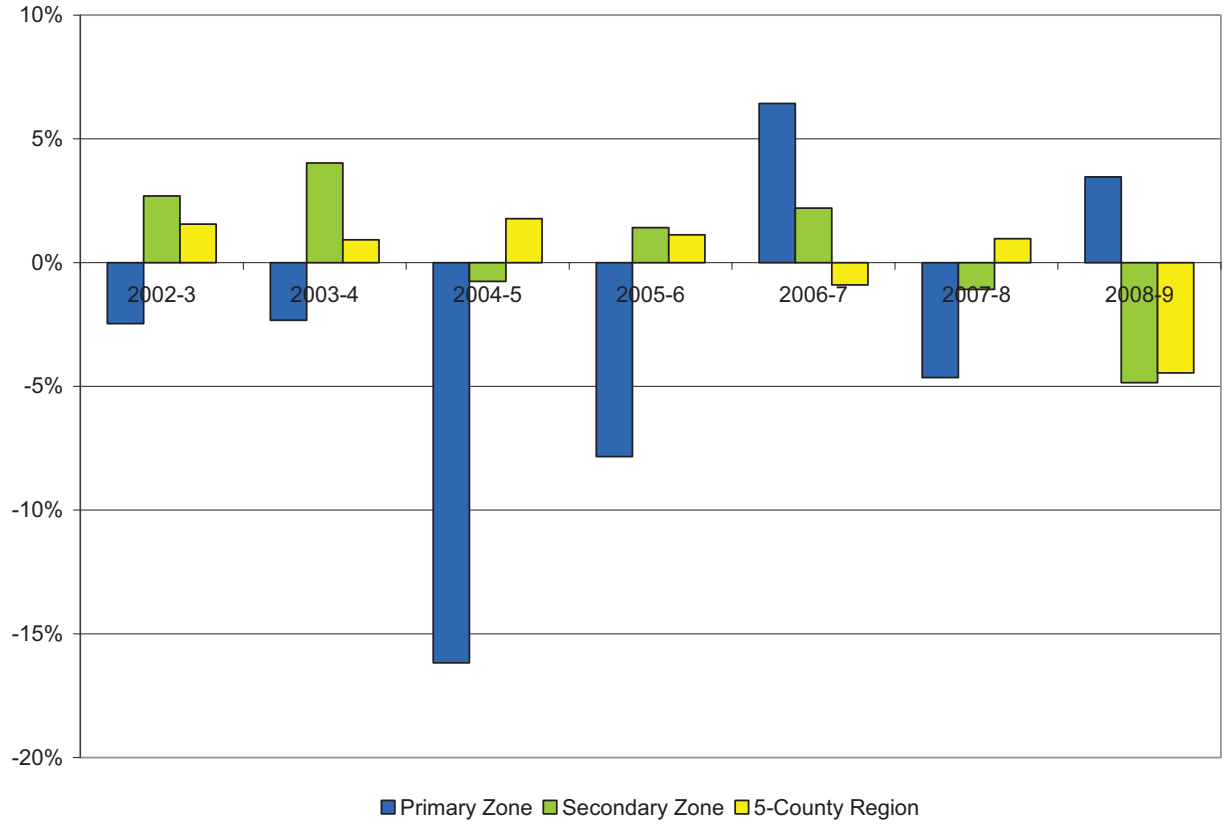
Employment in the Legal Delta has been growing, with 2009 employment up slightly (about 2 percent) from 2002, despite significant declines associated with the "Great Recession." This exceeds the growth rate in the five-county region, which experienced a 1 percent job gain during this period. Although 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 jobs in the region have declined, with 23 percent fewer jobs in 2009 compared to 2002. According to LED-LEHD data, the category of agriculture, forestry, fishing, and hunting shed nearly 3,000 jobs during this time period, though it is important to note that localized employment swings in this industry are

[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 (NAICS). Establishments in this sector are primarily engaged in activities, such as equipment and machinery repairing, promoting or administering religious activities, grant making, advocacy, and providing dry cleaning 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)

common because place of work is generally tied to a payroll/accounting office location rather than agricultural fields.[6] Excluding agricultural employment, the Primary Zone enjoyed significant employment gains between 2002 and 2009. The most significant employment gains in the Primary Zone occurred in the manufacturing industry, which added 841 jobs between 2002 and 2009, according to LED-LEHD data.[7]

Figure 6 Employment Growth Trends, 2002-2009



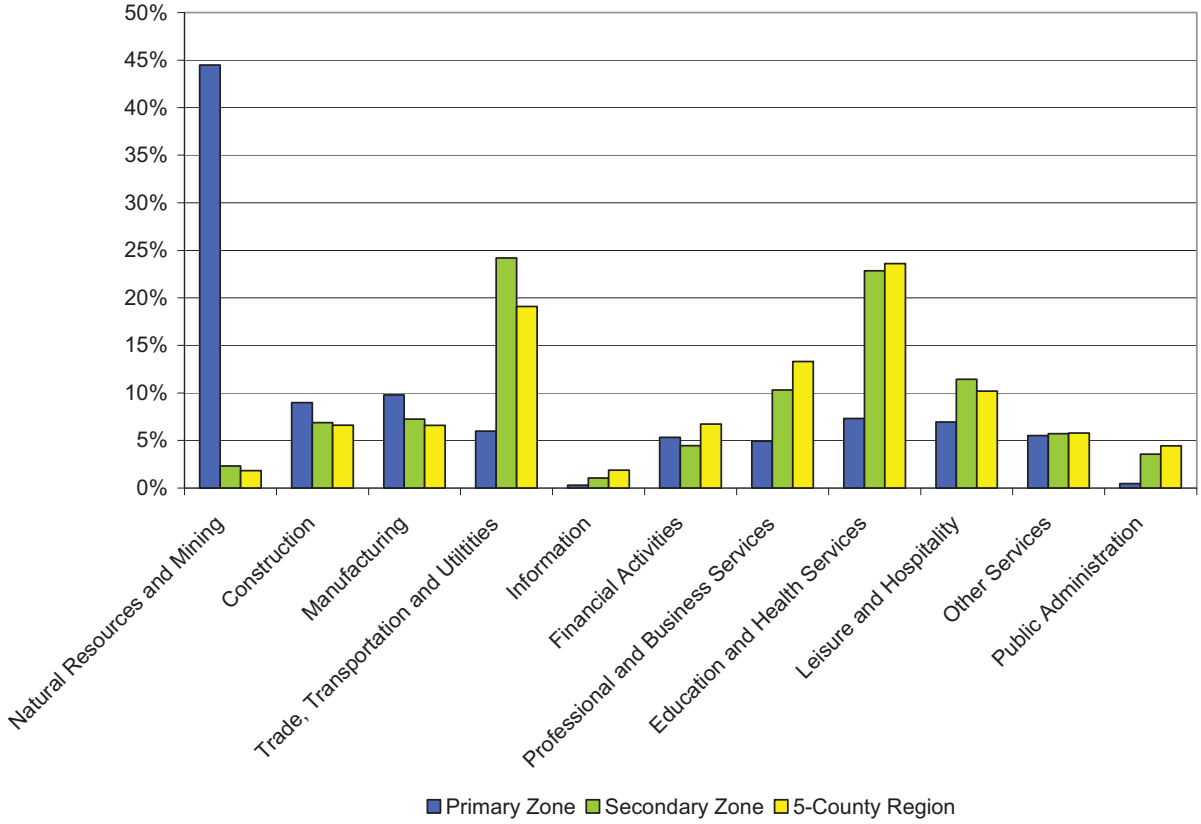
Source: Center for Economic Studies (LED-LEHD), Census Bureau

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 and social services (10 percent), and accommodation and food service (9 percent), averaged about 43 percent of total jobs between 2000 and 2009. Numerous employment sectors accounted for over half of all employment, but each with less than 9 percent of the total.

[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 manufacturing sector comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products. (BLS)

Figure 7 Distribution of Employment by Industry in the Delta



Source: Center for Economic Studies (LED-LEHD), Census Bureau

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 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 more than 60 percent of Primary Zone jobs. Recreation-related industries, which generally include the retail; arts, entertainment, and recreation; and accommodation and food services sectors, account for roughly 9 percent of jobs in the Primary Zone.

Location Quotient Analysis

Location quotient analysis is a method commonly used 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 distributions 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 Primary Zone and Legal Delta relative to employment in the five-county region.

In the Primary Zone, the location quotient analysis points to relatively high employment concentrations in the following sectors:

- Agriculture, forestry, fishing, and hunting
- Real estate and rental and leasing[8]
- Manufacturing
- Construction[9]

In the Legal Delta, the location quotient analysis points to relatively high employment concentrations in the following sectors:

- Agriculture, forestry, fishing, and hunting
- Transportation and warehousing[10]
- Wholesale trade[11]
- Accommodation and food services[12]

Given the importance of agriculture in the Primary Zone, the Economic Sustainability Plan includes a focused analysis of this sector in Chapter 6. The recreation economy is addressed by Chapter 7. The location quotient analysis also highlights real estate, manufacturing, construction and important linkages to the transportation, warehousing and wholesale trade, and accommodation and food services sectors. Other Key Sectors are discussed in Chapter 9.

3.2 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 re-circulating existing dollars.

IMPLAN data are available by U.S. Postal Service zip codes, which are not perfectly consistent with Delta boundaries, particularly in the Primary Zone. The Economic Sustainability Plan considers two geographies comprised of zip codes, including the zip codes that best represent the economy of the Legal Delta and zip codes in the Sacramento River Corridor (see Appendix A). Based on IMPLAN data for these geographies, exports represent about 33 percent of total output in the Legal Delta and 64 percent in the Sacramento River Corridor, compared to 24 percent in the state as a whole. These data suggest that economic output in the Delta is heavily biased towards producing goods and services for consumption elsewhere. Not surprisingly, agriculture is a highly export-oriented sector with exports accounting for 83 percent of total output in this sector in the Sacramento River Corridor. Utilities and manufacturing are also significant export-driven industries in the Delta.

[8] The real estate and rental and leasing sector comprises establishments primarily engaged in renting, leasing, or otherwise allowing the use of tangible or intangible assets, and establishments providing related services. (BLS)
[9] The construction sector comprises establishments primarily engaged in the construction of buildings or engineering projects (e.g., highways and utility systems). (BLS)
[10] 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)
[11] The wholesale trade sector comprises establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. (BLS)
[12] The accommodation and food services sector comprises establishments providing customers with lodging and/or preparing meals, snacks, and beverages for immediate consumption. (BLS)

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 and implemented to move water from the water-rich north to the water-poor south through the Delta and to provide irrigation water for the San Joaquin Valley. Since the late 1970s regional governance of the Delta, hub of the California water system, has been implemented at the local, regional, and State levels. The current governance proposal retains local control over most actions, retains the 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.

Water Conveyance

California's water plans have generated controversy and friction between regions of the state and among water stakeholders. A statewide water development project, proposed in 1919, envisioned moving Sacramento River water through the San Joaquin Valley and over the Tehachapis to Southern California. The plan, developed in 1931, to implement this project was approved in a $170 million bond act in 1933. The federal government took over construction of the project during the Depression. A second series of bills was passed in the late 1950s to expand the State Water Project. The bills were funded when voters approved another 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 export pumps near Tracy. The project was rejected by the voters in June 1982. The campaign on this ballot measure was described as the largest north-south split ever seen in California.

Several years of drought, followed by downturns in Delta fisheries, led Governor Pete Wilson and Secretary of the Interior Secretary Bruce Babbit to bring State and federal agencies to a joint CALFDED process to address California and Delta water issues 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 legislature established a State oversight body, the California Bay-Delta Authority. That body was later disbanded, and the CALFED program was folded into the California Natural 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 (DPC), among other actions.

Governance

In the early 1970s 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 the Delta Area Planning Council dwindled in the late 1980s and interest in State-level planning and coordination increased in the late 1980s.

In 1992, after the State conducted 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

Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992, authored by two Assemblymembers and two Senators, and signed into law by Governor Pete Wilson. The act created the DPC with membership from State agencies, local counties and cities, and Delta water agencies. Within the Legal Delta, defined in 1959 (Water Code Section 12220), the act divided the area into two zones: the Secondary Zone, which is the higher elevation and already-developed outer area of the Legal Delta, and the Primary Zone, the lower elevation and largely water-covered and agricultural lands in the "core" of the Legal Delta. The DPC was charged with preparing a land-use and resource-management plan for the Primary Zone of the Delta, addressing agriculture, recreation, and wildlife habitat on land areas. Control over the waters of the Delta remained with State and federal agencies. Action of local governments in the Primary Zone can be appealed to the DPC. Land uses in the Secondary Zone remain solely under the authority of local governments. The DPC has no authority over State or federal agencies or their programs or projects.[13]

4 County General Plans and the Delta

General plans, first authorized in California 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 guidance is outlined in specific plans and in each county or city's zoning code; zoning codes are required to be in conformance with general plans. In 1993, each of the counties with lands within the Primary Zone supported 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. These communities are 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 DPC 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 DPC's plan. All of the county and city general plans covering the Primary Zone were determined to be consistent with the DPC's plan although each county addresses these land uses and their protection in ways reflecting their community values and local history.

4.1 Contra Costa County

Contra Costa County has adopted an urban limit line; the Primary Zone within Contra Costa County 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.

4.1.1 General Plan (2005)

Contra Costa County has a program, the Contra Costa County Land Preservation Plan Ordinance, to maintain a specific ratio between developed land and open space land: 65 percent of the county will be preserved for agriculture, open space, wetlands, parks, and other nonurban uses, and 35 percent may be used for urban development. This ratio was originally adopted by the voters in November 1990 and renewed by voters in November 2006. The Primary Zone is within the area to remain in open space and low-intensity uses.

[13] Please see Chapter 1 for a map of the Primary and Secondary Zones of the Sacramento-San Joaquin Delta.

The Contra Costa General Plan uses several zoning codes to identify and protect the unique Delta land uses and characteristics of the Primary Zone lands in Contra Costa County. The general plan designates most Delta islands and nearby tracts as a special Delta Recreation and Resources. The designation recognizes the location in the 100-year flood plan, the limited services, and the value as agricultural land, as 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 area 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.

Agricultural Core: The agricultural core is comprised of prime soils which are considered the very best soils for farming a variety of crops. The agricultural core is east, south, and west of the city of Brentwood. Intensive row crops are being grown on much of this land, and a portion of the agricultural core is within the 100-year flood plain. The purpose of the agricultural core designation is to preserve and protect the most productive farmlands of the county, and the designation requires a higher minimum parcel size; “ranchette” development is discouraged. Ranchettes are rural residential lots as small as one to two acres, often five or ten acres. Uses are the same as in the Agricultural Land designation; however wineries and olive oil mills are appropriate in the agricultural core with a use permit. Residential density is one unit per 40 acres.

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.

4.1.2 East County Area Plan

An area plan for a portion of the Primary Zone in East Contra Costa County was adopted in 1985 and includes: Holland, Palm, Orwood Tracts, and Coney Island. Allowed uses 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.

4.1.3 City of Oakley

The City of Oakley was incorporated in 1999. In 2004 the DPC reviewed the city’s general plan for consistency with the DPC’s Plan. The only area of the City of Oakley in the Delta Primary Zone is a 200-foot-wide band of water-covered lands along the shoreline. The water-covered area includes Antioch/Oakley Regional Shoreline (fishing and picnic facilities at the base of the Antioch Bridge) and the new Big Break Regional Shoreline. Both facilities are owned and managed by the East Bay Regional Park District. The city’s general plan was found consistent with the DPC’s plan

4.1.4 Knightsen

Within the Primary Zone in Contra Costa County is one unincorporated community, Knightsen. Located at the intersection of Knightsen Avenue and Delta Road, east of Brentwood and south

of Oakley, Knightsen was founded in 1888 at a station on the Atchison, Topeka and Santa Fe Railway line. The community, represented by an appointed Knightsen Town Municipal Council, is home to an elementary school, a post office, and a couple of commercial enterprises. The surrounding community is agricultural. Due to its history and characteristics, Knightsen has been discussed as a potential Legacy Community (see Chapter 9 for more information)

4.2 Sacramento County

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

4.2.1 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. However, seven of the eleven “legacy communities” identified in the 2009 Sacramento-San Joaquin River Delta Reform Act (PRC Section 32301(f) are located with unincorporated Sacramento County. Land uses and future development in Freeport, Courtland, Locke , and Walnut Grove are submit to General Plan policies and typical zoning standards and to the land use and design standards in the Special Planning Area and Neighborhood Preservation Area Ordinances. The December 9, 1992 Land Use Diagram shows that the urban services boundary does not pass west of I–5. The land use diagram shows most of the Delta area designated 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, the 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 agricultural 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 of the general plan 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 establishing open space linkages (natural land corridors).

The conservation element protects key resources including water and soil. Development is to be diverted from prime soil or soils of statewide importance; conversion of more than 50 acres of prime or statewide importance soils is deemed to have a significant environmental effect under the California Environmental Quality Act (CEQA); 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, inclusion of a new economic development element, analysis of future growth within the urban policy area and the urban services boundary, and smart growth principles.

4.2.2 The Delta Community Area Plan[14]

The Delta Community Area 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, a portion of Sevenmile and Snodgrass Sloughs, and the south fork of the Mokelumne River), scenic areas (Steamboat, Sutter, and Georgiana sloughs), 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 (less than 15,000 cases produced annually) by right in the General Agricultural (AG) zones and some Agricultural-Residential zones; large wineries (51,001+ cases annually) located General Agriculture zones will be subject to the approval of a conditional use permit..

The farm stand ordinance will allow the sale of food products that are grown on-site in General Agriculture zones, and some Agricultural-Residential zones.

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 five guest rooms would be allowed per farm stay operation.

[14] Please refer to Chapter 9 for maps of the Hood, Courtland, and Walnut Grove communities.

4.3 San Joaquin County

San Joaquin County promotes future growth within the existing cities and existing unincorporated communities. There are no unincorporated communities in San Joaquin County's portion of the Primary Zone; there are some permanent residents living at the large recreational development at Tower Park Marina in Terminous where Highway 12 meets Potato Slough.

4.3.1 General Plan (1992, currently being updated)

The county's 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 Marina). 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. The general plan states that recreational values of the Delta are to be protected, and that 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 is allowed to protect the natural beauty, the fisheries, wildlife, riparian vegetation, and the navigability of the water. The plan limits development on the Delta islands to water-dependent uses, recreation, and agricultural uses.

The open space policies of the general plan state that the Resource Conservation designation shall be used to protect significant resource areas, and that 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 Primary Zone in San Joaquin County. The General Agriculture designation addresses areas where soils are capable of producing a wide variety of crops, where parcel sizes are large enough to support commercial agricultural activities, and where there is an existing commitment to commercial agriculture. In areas designated General Agriculture, development density 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 include 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. The general plan prohibits further fragmentation of land designated for agricultural use. 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 are required to incorporate adequate buffers (e.g., fences and setbacks) to prevent conflicts with adjoining agricultural operations.

4.4 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. In 2008 voters adopted Measure T, which extends the Orderly Growth Initiative through 2028. There are no unincorporated communities in the Primary Zone in Solano County.

4.4.1 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 through formation and retention of parcels of sufficient size to preserve wetlands and protection of these lands from effects 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.

4.4.2 City of Rio Vista[15]

General Plan 2001, adopted July 2002, includes policies that state “the City shall continue to support prohibitions/restriction on development within the Delta Protection Commission’s Primary and Secondary Zones.”(Policy 3.7.A (page 3-20) and that “The City shall seek to remove lands from the existing Sphere of Influence that are currently within the boundaries of the Delta and any lands that are placed in an open space land trust. “(Policy 3.7.B, page 3-20). Within the current boundary of the Primary Zone, the General Plan depicts existing land uses included: airport, sewage treatment plant, heavy commercial/light industrial uses, and landfill. A triangular area northeast of Airport Road, the boundary of the Primary Zone, and bounded by the Sacramento River, is designated SA, Study Area. Most of the land uses were in place in 1993, and only minor modifications have been approved since then. General Plan 2001 supports study of a future replacement for the current bridge across the Sacramento River and supports use of Airport Road as a future means to move additional traffic above the capacity of State Highway 12. The General Plan does not support a bypass of the City of Rio Vista to the north or the south.

4.5 Yolo County

About half of Yolo County land within the Primary Zone is in the Yolo Bypass, a flood basin which is part of the federal flood control project between Collinsville and Red Bluff. The Yolo

[15] Please refer to Chapter 9 for maps of the City of Rio Vista with respect to the Primary Zone.

Bypass is west of the Port of Sacramento Deep Water Ship Channel and bounded by a levee 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.

4.5.1 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 in the county's general plan are 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, and are directed toward lands unsuited for agricultural use. The general plan includes an Agriculture and Economic Development Element in support of agriculture, the primary economic driver of Yolo County. The element identifies wine grapes as the largest single crop in the fruit and nut category and describes the 64,640-acre Clarksburg appellation, which has 10 wineries and 11,000 acres of vineyards. The Agriculture and Economic Development Element also describes the key factors 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."

4.5.2 Clarksburg General Plan[16]

There is one unincorporated community in the Primary Zone in Yolo County. 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.

4.5.3 Clarksburg Agricultural District

In 2008, a new 40,000-acre agricultural district was adopted for Clarksburg, which supported 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 percent of the county's active farmland, it produces almost 22 percent 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 of about 100 acres in the Clarksburg area.

5 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. Sen. Patrick Johnston worked with several other legislators during a two-year

[16] Please refer to Chapter 9 for maps the Clarksburg community.

legislation drafting process that culminated in passage of the Delta Protection Act of 1992. 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 DPC, 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 DPC.

The Delta Protection Act requires the DPC to prepare, adopt, review, and maintain a comprehensive long-term resource management plan for land uses within the Primary Zone. The plan describes the needs and goals for the Delta and presents a statement of the policies, standards, and elements of the plan. Within 180 days of the adoption of the plan (or any amendments) by the commission, all local governments are required to submit proposed amendments to their general plans to the DPC. The amendments are required to ensure that local government general plans are consistent with the DPC’s 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 DPC for review of consistency with the land use plan. The DPC has no authority over State or federal agency projects or programs.

The Primary Zone 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 and are popular for recreation. 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 DPC 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 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 DPC in March 2009. After holding multiple public hearings, the DPC adopted revisions to the plan 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 DPC and added new tasks including preparation of a Delta Economic Sustainability Plan for submittal to the Delta Stewardship Council.

6 State of California Planning for the Delta

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 such as ensuring water supplies for export to the Central Valley, Southern California, and the Bay Area. Also since 1991, Cabinet secretaries were convened as the Governor's Water Council, Club Fed was created to provide coordination on Delta water issues, and CALFED was created by the Bay-Delta Accord, all resulting in the Record of Decision, 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 California state legislature to implement the Record of Decision, reorganize, and then move to existing State agencies. Governor Arnold Schwarzenegger authorized a new planning process in 2006 under the Delta Vision Blue Ribbon Task Force. In 2009 a suite of legislation, including the Sacramento–San Joaquin Delta Reform Act of 2009, was signed into law, modifying the DPC and creating the Sacramento–San Joaquin Delta Conservancy and the Delta Stewardship Council.

6.1 Delta Vision

In 2006, Governor Schwarzenegger established a two year planning process for the Delta through Executive Order S-17-06. A Blue Ribbon Task force of seven appointed citizens supervised preparation of a Delta Vision for adoption and submittal to the Delta Vision Committee. The Delta Vision Committee—five cabinet secretaries for resources, environmental protection, business, transportation and house, public utilities commission and food and agriculture—submitted a report based on the Delta Vision to the Governor at the end of 2008. Also participating in the process were a 43 member Stakeholder Coordination Group, work groups, and state agency staffs. Phil Eisenberg, Chair of the Blue Ribbon Task Force was subsequently appointed Chair of the Delta Stewardship Council.

The Delta Vision, completed in October 2008, includes 12 visions recommendations based on seven goals. Within each goal, the Delta Vision includes strategies and recommended actions to implement those strategies. Many of the actions were incorporated into the suite of legislation passed by the California legislature in 2009. The Delta Vision goals include:

- Goal 1: Legally acknowledge the coequal goals of restoring the Delta ecosystem and creating a more reliable water supply for California
- Goal 2: Recognize and enhance the unique cultural, recreational, and agricultural values of the California Delta as an evolving place, an action critical to achieving the coequal goals
- Goal 3: Restore the Delta ecosystem as the heart of a healthy estuary
- Goal 4: Promote statewide water conservation, efficiency, and sustainable use
- Goal 5: Build facilities to improve the existing water conveyance system and expand statewide storage, and operate both to achieve the coequal goals
- Goal 6: Reduce risks to people, property, and state interests in the Delta by effective emergency preparedness, appropriate land uses, and strategic levee investments
- Goal 7 Establish a new governance structure with the authority, responsibility, accountability, science support, and secure funding to achieve these goals

Within Goal 2, the Delta Vision more specifically recommended the following actions.

- Application for federal designation of the Delta as a National Heritage Area and expansion of the State Recreation Area network in the Delta
- Establishment of market incentives and infrastructure to protect, refocus, and enhance the economic and public values of the Delta agriculture

- Develop a regional economic plan to support increased investment in agriculture, recreation, tourism, and other resilient land uses
- Establishment of a Delta Investment Fund to provide funds for regional economic development and adaption
- Adoption of land use policies that enhance the Delta's unique values and that are compatible with public safety, levee, and infrastructure strategies in Goal 6

These specific strategies in Goal 2 are considered in more detail in subsequent chapters.

6.2 Sacramento-San Joaquin Delta Conservancy

The 2009 suite of legislation created the Sacramento–San Joaquin Delta 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 Delta Conservancy can also fund projects in the Suisun Marsh, west of the Legal Delta. The 12 tasks assigned to the Delta Conservancy are listed below.

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 Delta 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 10 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 Delta Conservancy adopted an interim strategic plan in January 2011 and will adopt a final strategic plan by January 2013.

6.3 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 Delta Stewardship Council is directed 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 percent 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 DPC 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.

6.4 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 Delta 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.

6.5 The 2012 Delta Plan (Delta Plan)

The 2012 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 DPC'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 include 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/

7 Bay Delta Conservation Plan

The Bay Delta Conservation Plan (BDCP) is being prepared through a collaboration of state, federal, and local water agencies, state and federal fish agencies, environmental organizations, and other interested parties with the goal of protecting and restoring the ecological health of the Delta and providing a more reliable water supply. 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. It has the dual purpose of achieving greater reliability in the water supplies through an improved Delta export water conveyance system and requiring 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. A conclusion in the draft is that addressing 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

8 Conclusions

Water is extremely valuable to all Californians. Adequate water supplies are critically important to agriculture and industry, and for urban health and resource protection. Northern California is the source of the majority of the state's water supply, and this water moves through the

Sacramento–San Joaquin Delta. Many programs and plans have been developed over the last 100 years to transport this water to agricultural and urban users in other parts of the state. All these programs and plans included elements to protect the riparian water rights of upstream rights holders and Delta water rights holders. These water rights are key to the longevity and vitality of Delta agriculture and the Delta region as a whole.

In recent decades, much effort has been made to promote the health of the Delta by a variety of agencies, commissions, and other governmental bodies. Today, local and State agencies have long-standing policies and programs to protect and enhance the natural resources, recreational values, and wildlife habitats in the Delta Primary Zone—the agricultural, riparian, and water-based area in the core of the Delta. Other State and federal programs are in place to protect Delta resources and support local government plans that have been in place since the early 1980s. Stewardship of Delta water resources continues to evolve as issues such as sustainability, water supply and quality, habitat, and access become more complex.

Chapter 4: Flood, Earthquake and Sea-Level Rise Risk Management

1 Overview and Key Findings

The present-day Delta is defined geographically and hydraulically by levees, creating a landscape that differs from that of the historic, natural Delta. In place since the early 20th century, the current-day levee system provides flood control, channels water for urban and agricultural uses, and creates an environment unique in California. It is the overall policy of the State to "protect, maintain, and, where possible, enhance and restore the overall quality of the Delta environment, including, but not limited to, agriculture, wildlife habitat, and recreational activities."[17] It is also the policy of the State to "improve flood protection by structural and nonstructural means to ensure an increased level of public health and safety."[18] Taken together, these two policies necessarily mean that the State is committed to maintaining and enhancing the Delta levees in more or less their present configuration.

For the purposes of this study, an up-to-date map of Delta levees was created. This map serves as the basis for an updated tabulation of levee lengths, which shows that in the Legal Delta, there are just under 1,000 miles of levees, of which 380 miles are project levees constructed by the U.S. Army Corps of Engineers (USACE), and an additional 63 miles are urban non-project levees, as defined by recent State legislation. Subtracting from the total the urban levees and levees in the north and south Delta that are primarily flood-control levees leaves around 650 miles of core levees, which protect lands below sea level in the Primary Zone of the Delta. Of these core levees, 193 miles are project levees that are primarily located along the Sacramento River. The remaining approximately 460 miles of core levees need to be maintained and enhanced by the State and the local reclamation districts.

Of this 460 miles of levees, only about 50 miles clearly fall below FEMA's Hazard Mitigation Plan (HMP) "standard" and 100 miles or more are already at or about the Corps of Engineers Delta-specific PL 84-99 standard. It has been the goal of the State and federal governments, working through the Department of Water Resources (DWR), the U.S. Army Corps of Engineers (USACE), and the local reclamation districts, to meet the PL 84-99 standard since 1982 when DWR and USACE produced a joint report on the Delta levees which recommended the basis for this standard. Funds currently in the pipeline should bring the Delta levees close to achieving this goal, and when these funds have been expended, more than $698 million will have been invested in improvements to the Delta levees since 1973. These improvements have created significantly improved Delta levees through modern engineering and construction, making obsolete the historic data that is still sometimes used for planning or predicting rates of levee failure.

Three approaches can help all jurisdictions and planners further reduce the risks resulting from the failure of the Delta levees. These approaches are: (1) build even more robust levees, (2) improve both regular maintenance and monitoring and flood-fighting and emergency response following earthquakes, and (3) improve preparedness for dealing with failures after they occur. With regard to the first approach, the big question with respect to the core Delta levees is not whether they should be improved to the Delta-specific PL 84-99 standard—that is already happening—but whether, in order to comply with the policies of the State quoted above, they should be improved to a higher standard in order to address hazards posed by not only floods, but also earthquakes and sea-level rise. These improvements would also allow for planting

[17] Delta Reform Act, 2009, W.C. 29702 (b)
[18] W.C. 29702 (d)

vegetation on the water side of the levees—an essential component Delta ecosystem repair. These further-improved levees would have wider crowns to provide for two-way traffic and could easily be further widened at selected locations to allow the construction of new tourist and recreational facilities out of the statutory floodplain. Improvement of core levees to this higher standard would likely cost in the order of $1–2 billion. Three broad sources of funding are identified for these improvements in Section 5 of this chapter.

2 Background

The history of the Delta levees is relatively well-known (Thompson, 1957[19]; Mount and Twiss, 2005[20]; DRMS, 2009[21]; Delta Stewardship Council Flood Risk White Paper, 2010[22]; Zuckerman, 2011[23]) 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 flood-control project levees to the local reclamation districts. A good summary of the history and current status of the Delta levees is also provided in a technical memorandum prepared for the Department of Water Resources (DWR) by outside consultants,[24] and referenced subsequently as the DWR Technical Memorandum. This document was only released for public review on July 15, 2011. Both the technical memorandum and the related "Framework for Department of Water Resources Investments in Delta Integrated Flood Management"[25] are in draft form, have only just been released for public review and comment, and are subject to change, but the basic findings of the technical memorandum are unlikely to change and several of its findings are mentioned herein.

All the Delta levees that are currently being maintained are shown in Figure 8 and are listed in Table 1. For comparison, a reconstruction of the historic Delta based on Atwater (1982)[26] is shown in Figure 9. Figure 9 shows 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, created along the edges of major waterways, 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 19th century and very early 20th centuries, some of the man-made levees were constructed over the natural levees, but many were not. Those waterways that were created by dredging 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 Inc. illustrating the history of development of both the dredger cuts and other modern levees are shown as Figures 10 and 11

[19] Thompson, J. (1957), *Settlement Geography of the Sacramento–San Joaquin Delta, California,* dissertation, Stanford University.
[20] Mount, J.F. and R. Twiss (2005), *Subsidence, sea level rise, seismicity in the Sacramento–San Joaquin Delta*, San Francisco Estuary and Watershed Science, v. 3, article 5, 2005.
[21] California Department of Water Resources (2009), Delta Risk Management Strategy Final Phase 1 Report, http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/phase1_information.cfm.
[22] Delta Stewardship Council (2010), Flood Risk White Paper, http://deltacouncil.ca.gov/delta-plan.
[23] Zuckerman, T. (2011), Comments on the Third Staff Draft of the Delta Plan, Delta Stewardship Council, http://deltacouncil.ca.gov/public-comments/read/195.
[24] California Department of Water Resources (2011), Staff DRAFT, "Background / Reference Memoranda, Delta Region Integrated Flood Management Key Considerations and Statewide Implications", July 15, 2011.
[25] California Department of Water Resources (2011), DRAFT V3 DHF and SMB, "A Framework for Department of Water Resources Investments in Delta Integrated Flood Management," February 14, 2011.
[26] Atwater, B. (1982), Geologic Maps of the Sacramento–San Joaquin Delta, California, USGS Miscellaneous Field Studies Map MF-1401.

Figure 8 Delta Levees

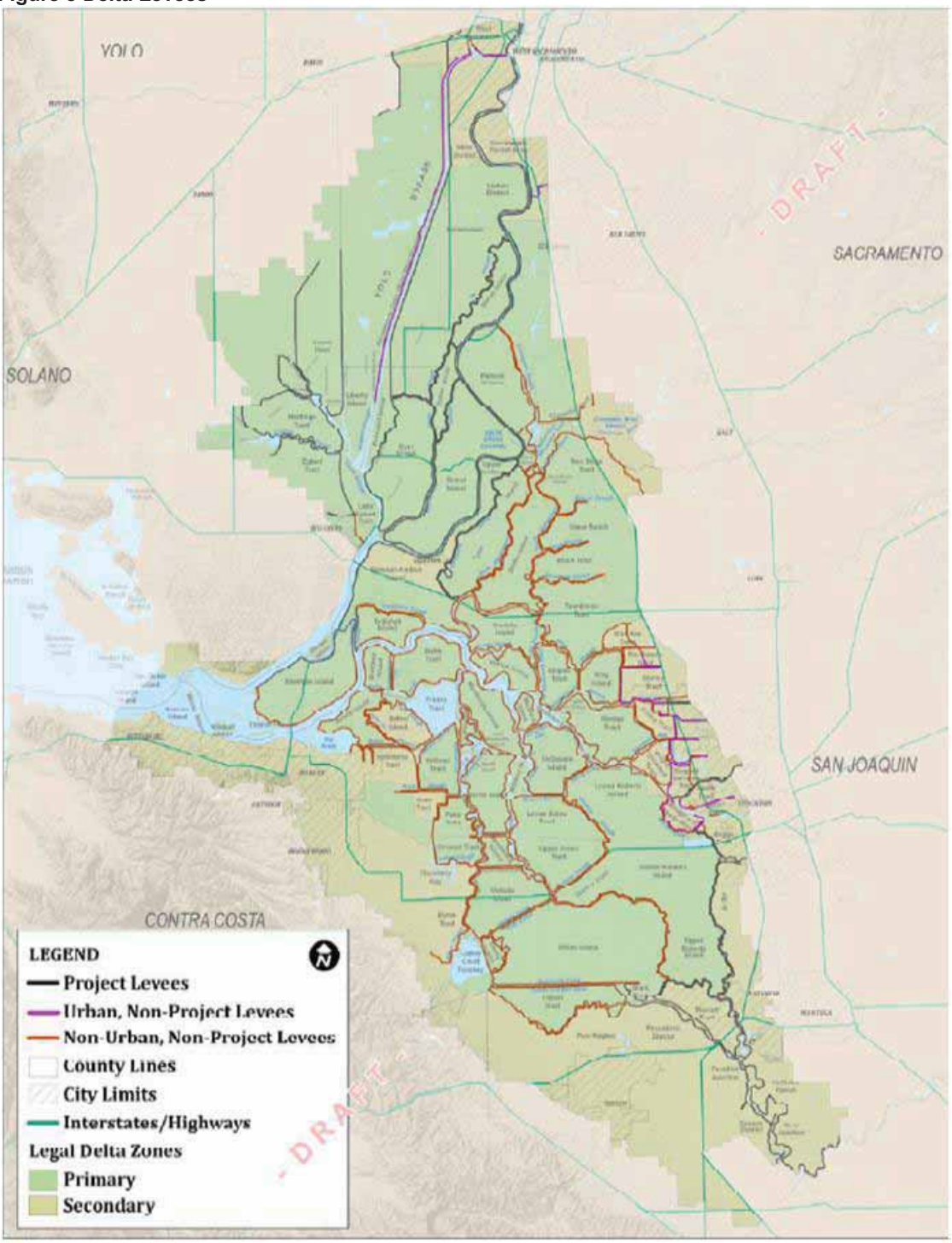


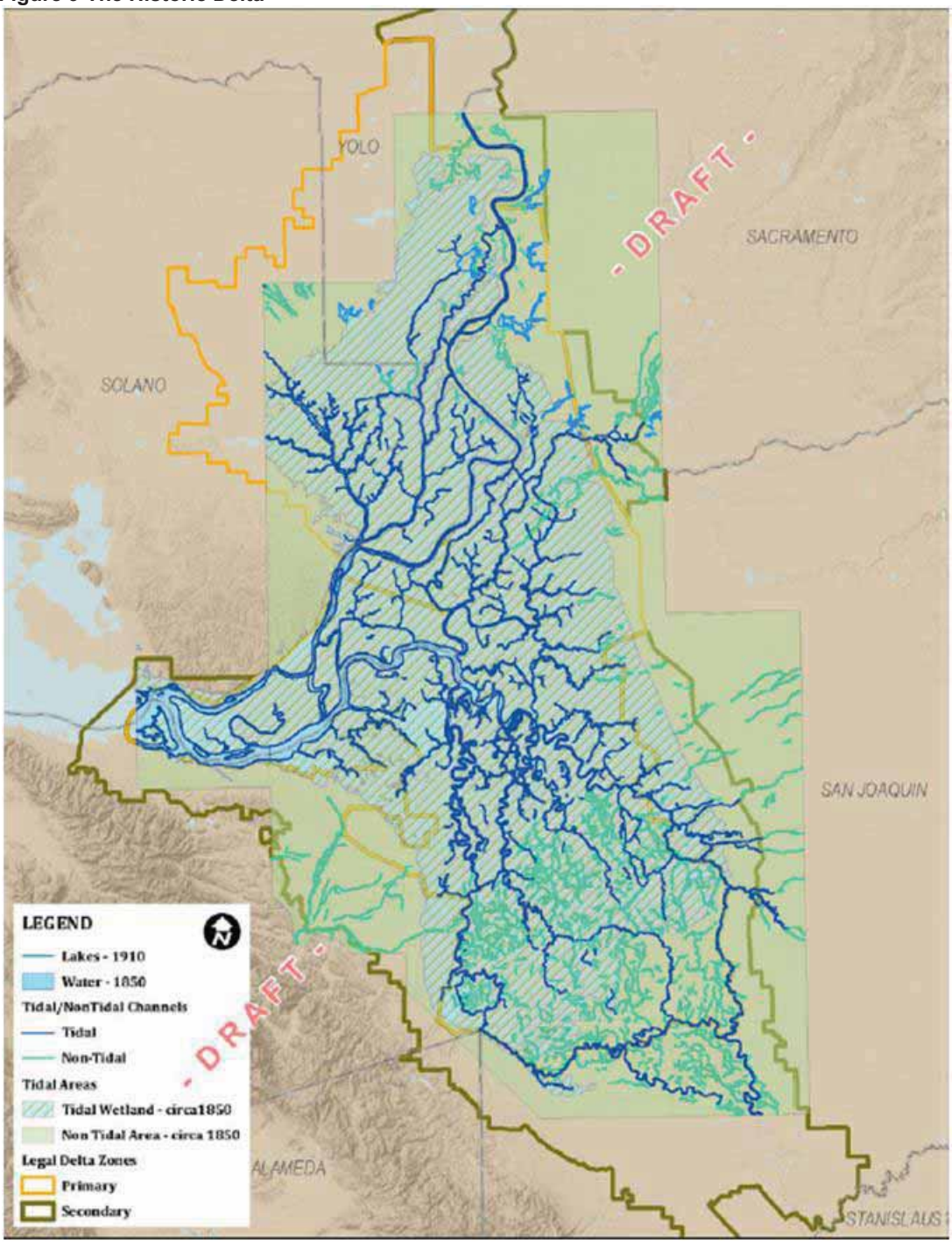
Table 1 Delta Levees (Part 1 of 2)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(I)
List	**District**	**Reclamation**		**Miles of Levee**			
Number	**Number**	**District**	**Project**	**Urban NP**	**NP-NU**	**Total**	**Core**
1	556	Andrus Island	11.2	0.0	0.0	11.2	Yes
2	2126	Atlas Tract	0.0	2.3	0	2.3	No
3	2028	Bacon Island	0.0	0.0	14.3	14.3	Yes
4		Bear Creek	3.3	0.0	0.0	3.3	No
5		Bethel Island	0.0	0.0	11.5	11.5	Yes
6	2042	Bishop Tract	0.0	6.5	1.6	8.1	No
7	404	Boggs Tract	4.0	0.6	0.6	5.2	No
8	756	Bouldin Island	0.0	0.0	18.0	18.0	Yes
9	2033	Brack Tract	0.0	0.0	10.0	10.0	Yes
10	2059	Bradford Island	0.0	0.0	7.4	7.4	Yes
11	317/407	Brannan-Andrus	17.5	0.0	10.1	27.6	Yes
12	800	Byron Tract	0.0	0.0	9.5	9.5	No
13	2098	Cache Haas	10.9	0.0	0.0	10.9	No
14	2086	Canal Ranch	0.0	0.0	7.5	7.5	Yes
15	2117	Coney Island	0.0	0.0	5.5	5.5	Yes
16	2111	Dead Horse Is.	0.0	0.0	2.6	2.6	Yes
17	2137	Dutch Slough	0.0	0.0	4.1	4.1	No
19	536	Egbert Tract	10.6	0.0	1.8	12.4	No
20	813	Ehrheart	1.8	0.0	3	4.8	No
21	2029	Empire Tract	0.0	0.0	10.5	10.5	Yes
22	773	Fabian Tract	0.0	0.0	18.8	18.8	Yes
23	2113	Fay Island	0.0	0.0	1.6	1.6	Yes
24	1002	Glanville Tract	0.0	0.0	7.1	7.1	No
25	765	Glide	1.7	0.0	0.0	1.7	No
26	3	Grand Island	28.7	0.0	0.0	28.7	Yes
27	2060	Hastings Tract	15.6	0.0	0.0	15.6	No
28	999	Holland Land	32.2	0.0	0	32.2	Yes
29	2025	Holland Tract	0.0	0.0	11.0	11.0	Yes
30	799	Hotchkiss Tract	0.0	0.0	6.7	6.7	No
31	830	Jersey Island	0.0	0.0	15.5	15.5	Yes
32	2038/2039	Jones Tract	0.0	0.0	18.4	18.4	Yes
33	2085	Kasson	6.3	0.0	0.0	6.3	No
34	2044	King Island	0.0	0.0	9.1	9.1	Yes
35	369	Libby McNeil	1.0	0.0	2.8	3.8	Yes
36	1608	Lincoln Village	0.0	3.3	0.6	3.9	No
37	307	Lisbon	6.6	0.0	0.0	6.6	No
38		Maint Area 9	12.6	1.5	0.0	14.1	No
39	2027	Mandeville Island	0.0	0.0	14.3	14.3	Yes
40	2030	McDonald Island	0.0	0.0	13.7	13.7	Yes
41	2075	McMullin	7.4	0.0	0.0	7.4	No
42	2041	Medford Island	0.0	0.0	5.9	5.9	Yes
43	150	Merritt Island	17.7	0.0	0.0	17.7	Yes
44	2107	Mossdale 2	4.3	0.0	0.0	4.3	No
45	17	Mossdale Tract	15.8	0.0	0.0	15.8	No
46	1007	Naglee Burke Tract	0.0	0.0	7.6	7.6	No
47	348	New Hope Tract	0.0	0.0	15.1	15.1	Yes
48	2064	Orwood-Palm Tract	0.0	0.0	14.4	14.4	Yes

Table 2 Delta Levees (Part 2 of 2)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(I)
List	**District**	**Reclamation**		**Miles of Levee**			
Number	**Number**	**District**	**Project**	**Urban NP**	**NP-NU**	**Total**	**Core**
49	2095	Paradise	4.9	0.0	0.0	4.9	No
51	2058	Pesadero Tract	6.6	0.0	0	6.6	No
52	2104	Peters	6.8	0.0	0.0	6.8	No
53	551	Pierson District	6.8	0.0	7.3	14.1	Yes
54	2090	Quimby Island	0.0	0.0	7.0	7.0	Yes
55	755	Randall	1.8	0.0	0.0	1.8	No
56	744	Rec District	3.9	0.0	0.0	3.9	No
57	673	Rec District	0.2	0.0	0.0	0.2	No
58	2037	Rindge Tract	0.0	0.0	15.8	15.8	Yes
59	2114	Rio Blanco Tract	0.0	1.8	4.1	5.9	No
60	2064	River Junction	9.7	0.0	0.0	9.7	No
61	524/544/	Roberts Island	16.4	0.0	34.1	50.5	Yes
62		Rough/Ready Island	0.0	5.5	0.0	5.5	No
63	501	Ryer Island	20.2	0.0	0.0	20.2	Yes
64	2074	Sargent Barnhart	2.1	2.9	2.5	7.5	No
65	341	Sherman Island	9.6	0.0	9.9	19.5	Yes
66	2115	Shima Tract	0.0	7.0	7.3	14.3	No
67		Shin Kee Tract	0.0	0.0	3.1	3.1	No
68	1614	Smith Tract	5.9	3.3	1.0	10.2	No
69	2089	Stark	2.8	0.0	0.8	3.6	Yes
70	38	Staten Island	0.0	0.0	25.4	25.4	Yes
71	2062	Stewart Tract	12.2	0.0	0.0	12.2	No
72	349	Sutter Island	12.4	0.0	0.0	12.4	Yes
73	548	Terminous Tract	0.0	0.0	20.0	20.0	Yes
74	1601	Twitchell Island	2.5	0.0	9.3	11.8	Yes
75	563	Tyler Island	12.1	0.0	10.3	22.4	Yes
76	1	Union Island	1.1	0.0	28.8	29.9	Yes
77	2065	Veale Tract	0.0	0.0	5.0	5	No
78	2023	Venice Island	0.0	0.0	12.4	12.4	Yes
79	2040	Victoria Island	0.0	0.0	15.1	15.1	Yes
80	554	Walnut Grove East	0.9	0.0	2.5	3.4	Yes
81	2094	Walthall	3.2	0.0	0.0	3.2	No
82	2026	Webb Tract	0.0	0.0	12.9	12.9	Yes
83	828	Weber	0.0	1.7	0.6	2.3	No
84	900	West Sacramento	15.0	26.6	1.6	43.2	No
85	2096	Wetherbee	0.2	0.0	0.0	0.2	No
86	2072	Woodward Island	0.0	0.0	8.9	8.9	Yes
87	2119	Wright-Elmwood Tract	0.0	0.0	7.1	7.1	No
88	2068	Yolano	8.8	0.0	0.0	8.8	No
89		Yolo Bypass Unit 4	4.2	0.0	0.0	4.2	No
	Core Total		193.1	0.0	458.5	651.6	
	Grand Total		379.5	63.0	533.4	975.9	

Figure 9 The Historic Delta



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 in more detail in Appendix D. Reasonably current land surface elevations interpreted from DWR's 2007 LiDAR surveys are shown in Figure 12.[27] The mostly deeply subsided land is about 30 feet below sea

[27] Based on DRMS GIS data set developed by URS Corporation and provided by DWR.

level, but only a fraction of the Legal Delta is more than 15 feet below sea level, as shown by the dark blue coloring in Figure 12. The subsidence has 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 affected by subsidence.

Figure 10 Construction of Delta Levees

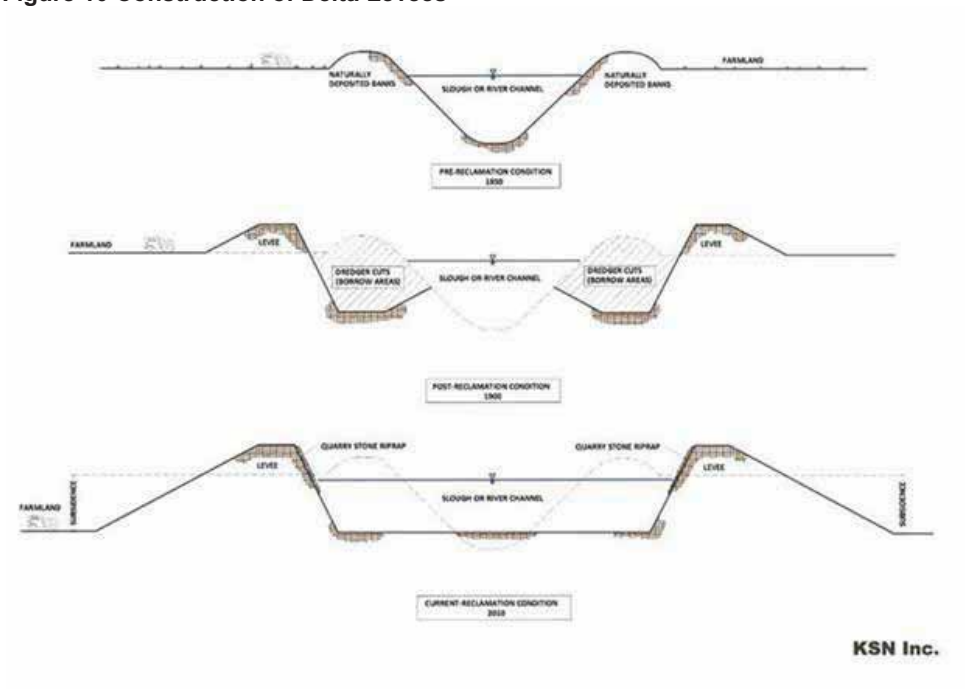


Figure 11 Construction of Dredger Cuts

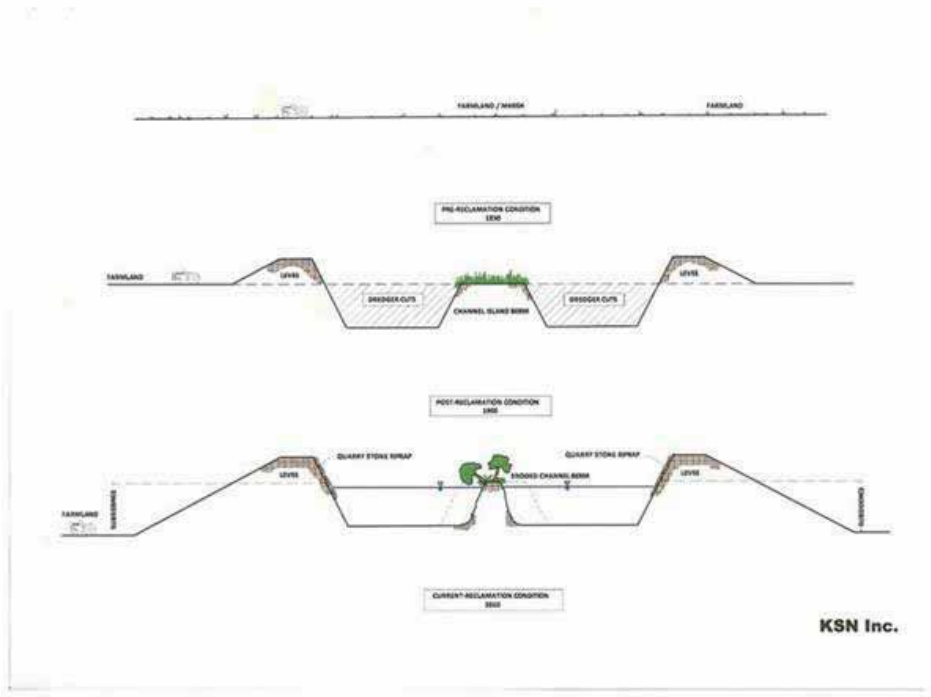
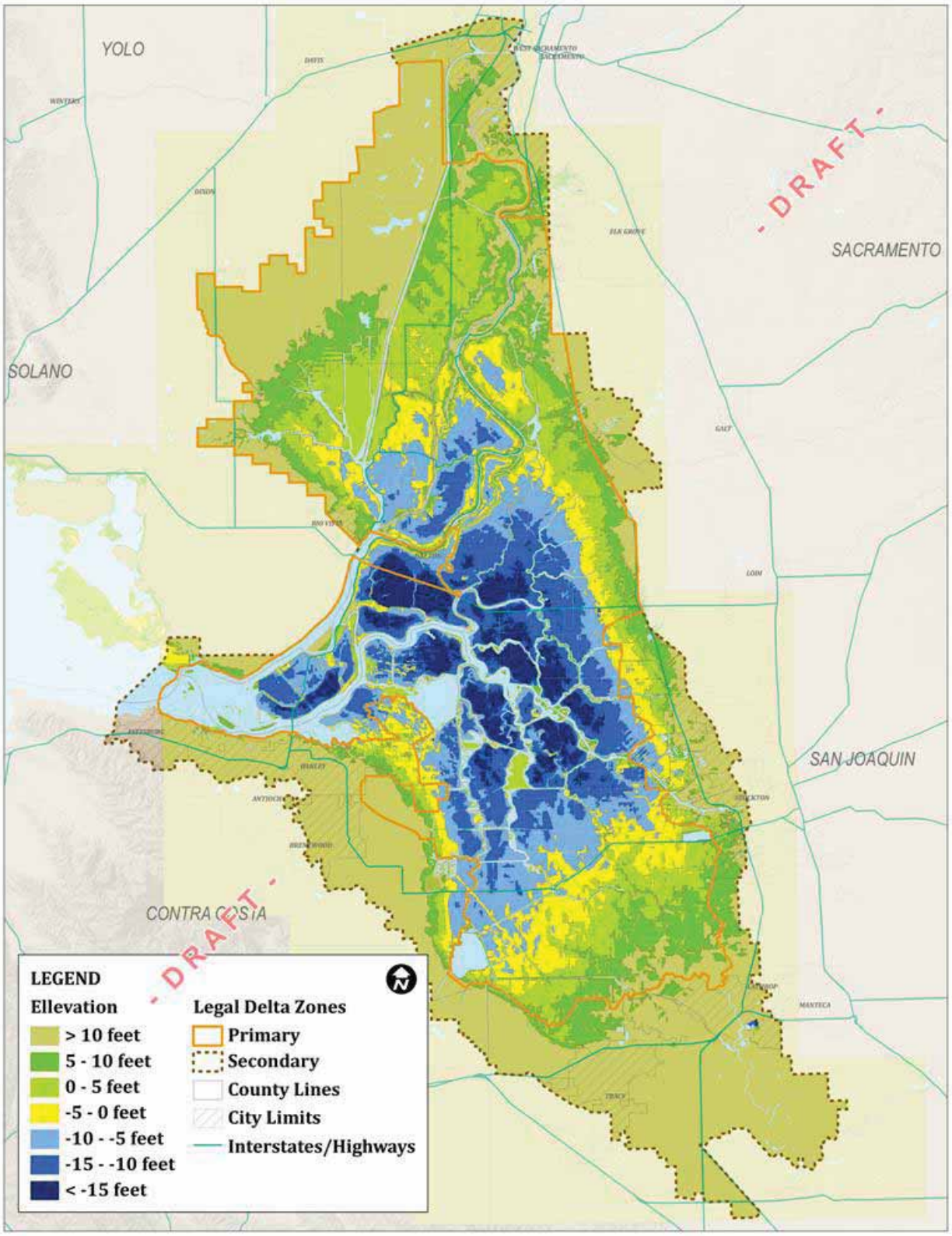


Figure 12 Current Elevations of Delta Land Surface



There is a popular impression that there are 1,100 miles of Delta levees all in poor condition. This has led to concern that there is a high probability of widespread failures in the event of flooding, earthquakes, or sea-level rise. While most Delta levees need further improvement, many miles of the Delta levees are actually in quite good condition. Even without survey measurements, touring the Delta by boat during a high-water event reveals that while the condition of the levees is variable, most levees appear to have adequate freeboard. Selected photographs taken during a period of relatively high water in March 2011 are shown in Appendix B. Casual inspection is 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 programs can be further strengthened.

Only the levees within the Legal Delta that are currently being maintained and are candidates for further improvement are shown in Figure 8. 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, 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 under 1,000 miles. The division of these levees into project, non-project urban, and other non-project levees and their significance is explained in the following sections. But, as noted in the DWR Technical Memorandum: “The Delta’s system of levees … and interconnected channels operate as a single, multi-function, flood management system. The failure of one levee can increase the risk of other levee failures, increasing the need for levee maintenance on adjoining islands in an effort to prevent additional levee failures. In addition, the large benefits to regions outside the Delta make it difficult to consider one island or tract separately from all others.”

The remainder of this chapter is divided into three sections. The next 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 following 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. An economic analysis of these alternatives might lead to optimizing the appropriate investments, but that beyond the scope of the present study. The final section addresses in more detail the costs of pursuing the first option, which is to further improve the levees so that they are more resistant to earthquake loadings, can more easily be raised as necessary to accommodate possible sea-level rise, and have a broader cross-section, which would allow planting of native vegetation on the water side.

3 Status of Delta Levees

3.1 Categories of Levees

3.1.1 Project Levees

Project levees were constructed by the U.S. 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[28] confirmed the State’s continued basic liability with respect to these levees. The State Plan of Flood Control Descriptive Document, dated November 2010, delineates project levees and provides the names of the local maintenance agencies. Project levees within the Delta are identified in Figure

[28] *Paterno v. State of California* (2003) 113 Cal.App.4th 998.

8. These levees were built to standards that generally exceed the PL 84-99 criteria described below.

3.1.2 Urban Levees

SB 5,[29] enacted in 2007, calls for a minimum of 200-year flood protection for urban and urbanizing areas in the Sacramento–San Joaquin Valley. SB 5 also limits the conditions for further development if this level of flood protection has not been achieved, conditions have not been imposed on the development to provide this level of flood protection, or adequate progress towards achieving this level of protection cannot be shown. DWR is developing criteria for these urban levees that will generally be more stringent than the current criteria for project levees. These criteria are discussed below.

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) to implement 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).

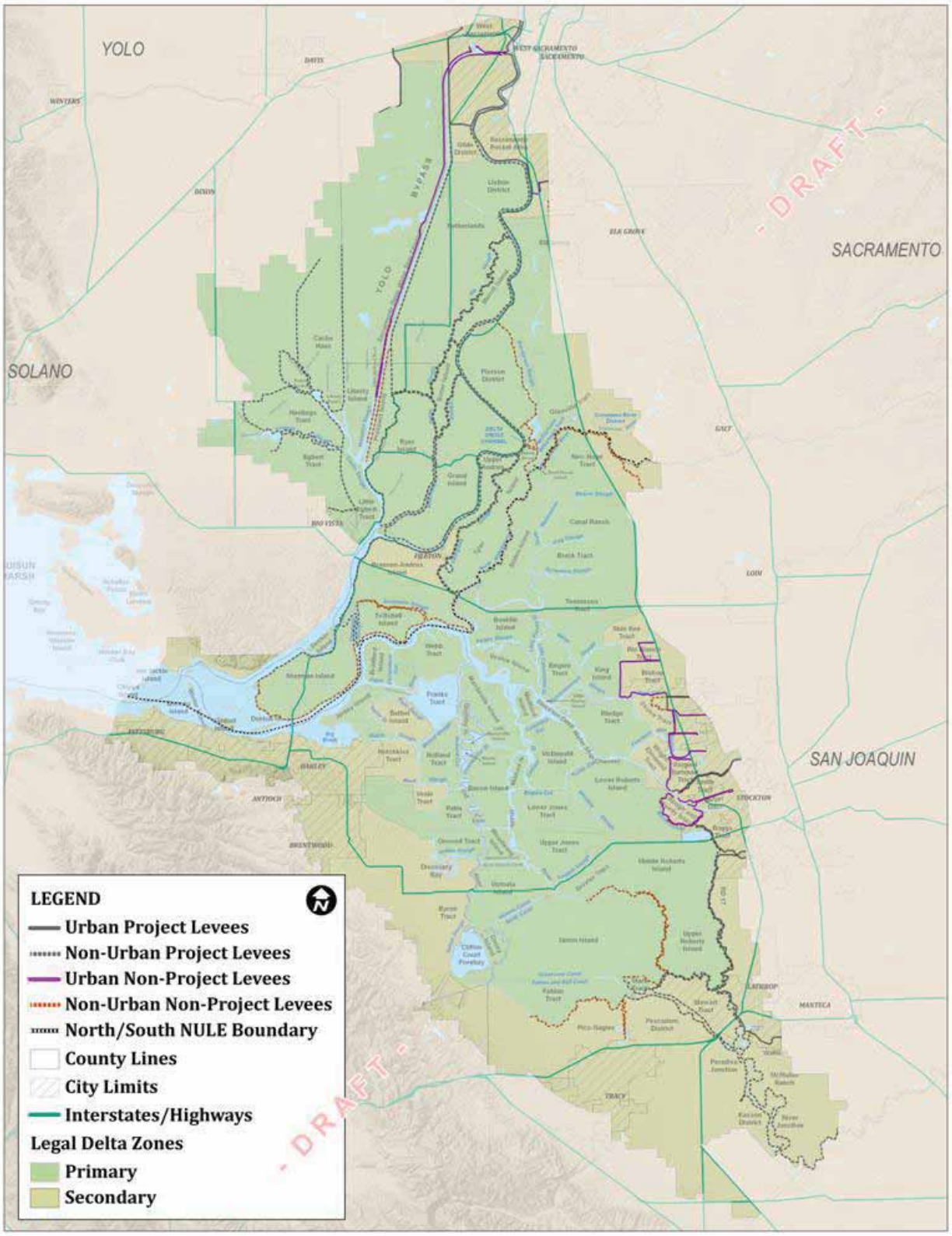
Prompted by the Paterno Decision and SB 5, DWR is undertaking a major investigation of both riverine and Delta levees that is divided into two components, the Urban Levee Evaluations (ULE), and the Non-Urban Levee Evaluations (NULE) (Inamine et al, 2010).[30] These evaluations include detailed site investigations and some analyses and are intended to inform the Central Valley Flood Protection Plan (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 13,[31] 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 8.

[29] SB 5 (Machado) was the centerpiece of a far-reaching flood control package of legislation. It requires the Department of Water Resources to prepare a Central Valley Flood Protection Plan and allows local jurisdictions to prepare their own plans only if they include specified elements that are consistent with the state plan.

[30] Inamine, M. et al. (2010), California's Levee Evaluation Program, US Society of Dams, 30th Conference, Sacramento, April.

[31] Based on GIS data set provided by DWR and URS Corporation.

Figure 13 Urban and Non-Urban Levee Evaluation Programs



3.1.3 Other Special Levees

While the Delta levees were originally constructed to protect agricultural lands and the small communities that developed primarily along the shipping routes up the Sacramento River, they now are critically important to preserving water quality, to through-Delta conveyance of water, and to the vast array of infrastructure that criss-cross the Delta. The islands that are critical to these functions are discussed and illustrated in Appendix C. It may be seen in Appendix C that few if any islands are not also critical to something else besides agriculture and the Legacy Communities.

3.1.4 Summary

As may be seen in Table 1,[32] a total of just under 1,000 miles of levees are currently being maintained within the Legal Delta. But of these, 443 miles are either project or urban levees. If these levees are subtracted from the total of 976 miles, there are only 553 miles that need to be maintained and perhaps improved by the State and the reclamation districts. The DWR Technical Memorandum makes a distinction between non-project levees that have special status in the California Water Code and are eligible for State assistance and other levees that might be owned by public agencies or private entities that are not eligible for State assistance. The Technical Memorandum indicates that those levees eligible for State assistance are shown on page 38 of the Delta Atlas.[33] The lengths of the non-project levees shown in Figure 8 and listed in Table 1 are generally consistent with those shown on page 38 of the Delta Atlas. The total of 596 miles of non-project levees listed in Table 8 is less than the 732 miles cited in the Technical Memorandum principally because this analysis omits restricted-height levees such as those surrounding the McCormack–Williamson Tract and those in the Yolo Bypass.

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 about 650 miles of core levees which protect lands below sea level in the Primary Zone. Of these core levees, 193 miles are project levees, primarily located along the Sacramento River. That leaves approximately 460 miles of core levees that need to be maintained and enhanced for the State and the local reclamation districts. Of this sub-set, over 100 miles already exceed the PL 84-99 standard that is discussed below, leaving some 350 miles in need of improvement to the PL 84-99 standard.[34] While the project and urban levees may have issues with encroachment penetrations and vegetation, there are different mechanisms for dealing with these issues; the project and urban levees are fundamentally flood-control levees rather than levees that are key to protecting water quality, the conveyance of water through the Delta, and protecting and enhancing the Delta as a place.

All of the islands shown in Appendix C, which have levees protecting infrastructure or critical facilities of one form or another, are superimposed in Figure 14. The present value or the replacement cost of this infrastructure is not known with any precision, but it is clearly measured in billions of dollars.

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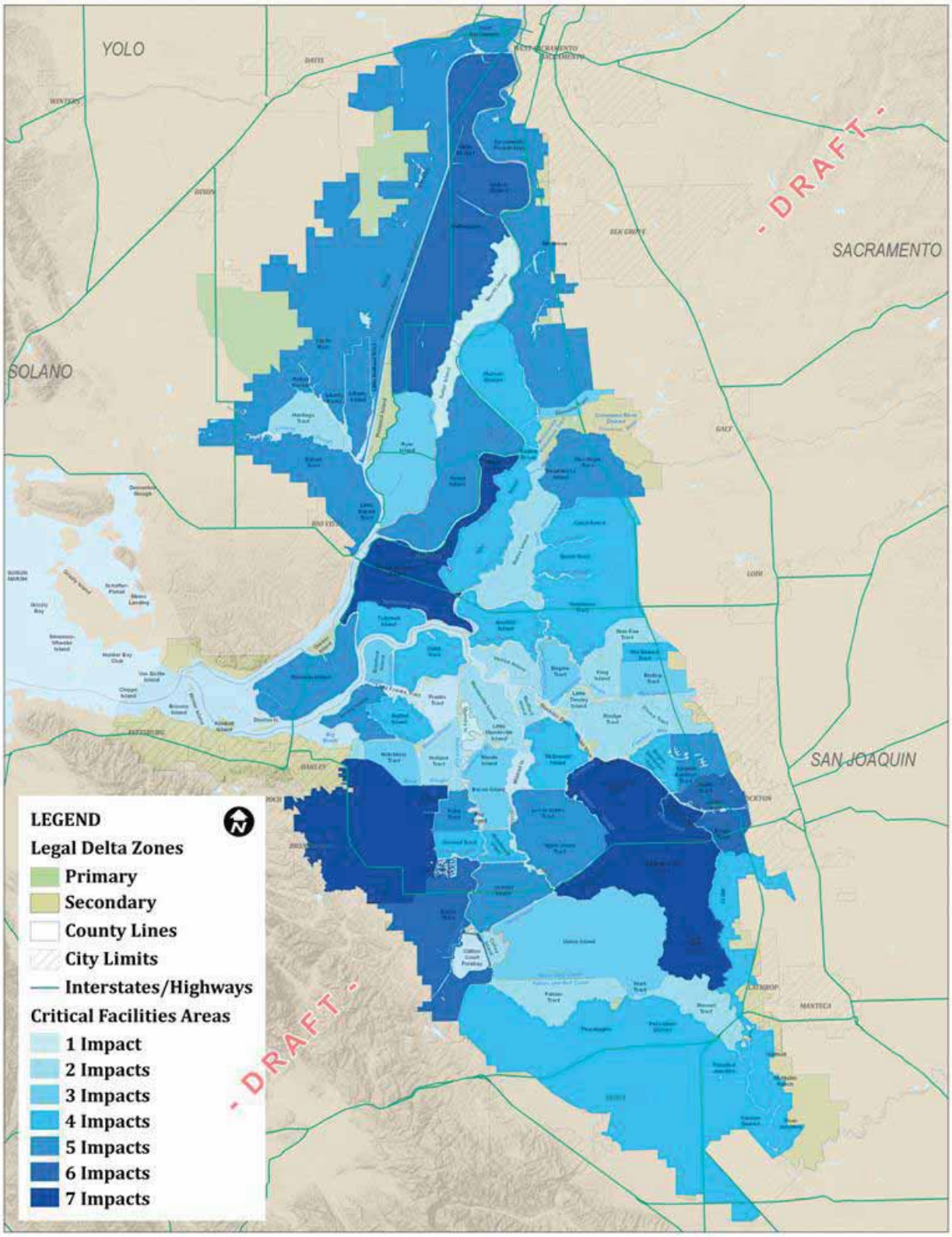
[32] The levee lengths listed in Table 1 have been generated from the GIS data used to develop Figure 1. That GIS data was based on the 2007 DWR LiDAR surveys as interpreted by URS Corporation and provided by DWR. Some, but not all, of the lengths have been cross-checked with ground survey data provided by reclamation district engineers.

[33] http://baydeltaoffice.water.ca.gov/DeltaAtlas/index.cfm

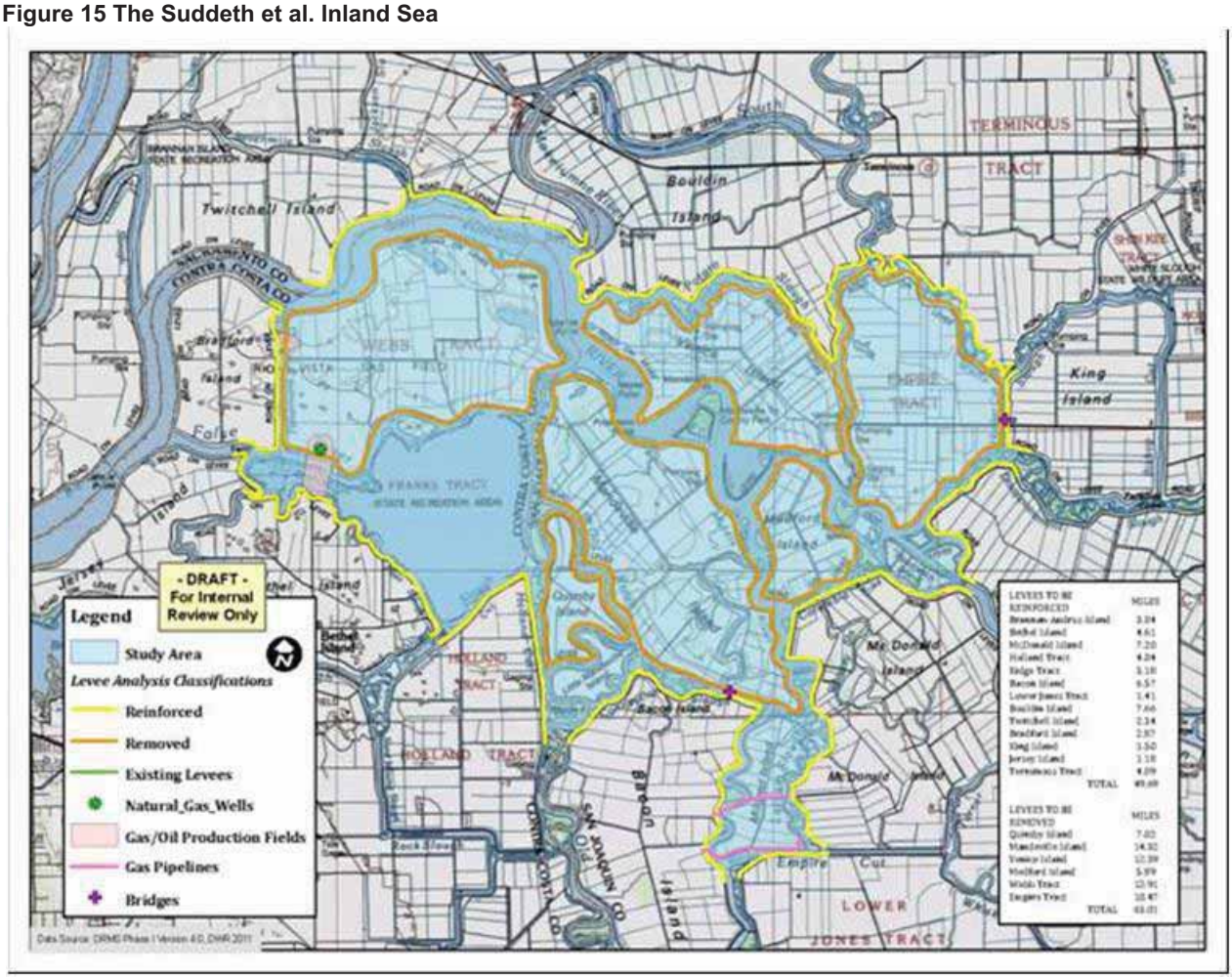
[34] Based on discussions with reclamation district engineers. These estimates will be refined and formalized in the 5-year plans that are now required as a prerequisite for State funding but the preparation of these 5-year plans has been delayed by delays in releasing the funding to develop them.

Figure 14 All Islands Containing Critical Facilities



The principal islands that are 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. Suddeth et al. (2010)[35] 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 6, but these six islands and the levees that would surround the resulting inland sea are shown in Figure 15. 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 their importance to protecting against salinity intrusion, and Empire Tract, which houses the new City of Stockton water intake, were to be omitted from the list, the length of the levees removed would drop to 43 miles. But, the length of levees that would need to be improved would only drop to approximately 45 miles.

Figure 15 The Suddeth et al. Inland Sea



[35] Suddeth. R. (2011), Policy Implications of Permanently Flooded Islands in the Sacramento-San Joaquin Delta, UC Davis Center for Watershed Sciences, http://watershed.ucdavis.edu/pdf/Suddeth_Policy_Implications_of_Flooded_Islands_080110.pdf

3.2 Levee Standards

A detailed discussion of the various standards that might apply to Delta levees was given by Betchart (2008).[36] Betchart's list can be simplified into the five standards listed below. Because the Delta is a unique place with unique soil conditions, some levee standards that are applicable elsewhere are not applicable in the Delta. These unique considerations are discussed in Appendix D.

Hazard Mitigation Plan (HMP)

The Hazard Mitigation Plan (HMP) "standard" is not an engineering standard but is a simple geometric levee description 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 a MOU signed in February 2010 between Cal EMA and FEMA, as discussed by Betchart (2011).[37] However, notwithstanding its importance to disaster-relief funding, no engineer familiar with the Delta considers the HMP geometry to be adequate for even basic flood protection, and the reclamation districts are generally working towards full compliance with the higher PL 84-99 standard. While there are some miles of levees that pending further improvement waver around the HMP geometry, there are at present only about 50 miles that fall below HMP,[38] and even those levees fall short only by about a foot of elevation. As noted in the DWR Technical Memorandum, while achieving the HMP geometry is not really a goal from an engineering perspective, consistently meeting it is not only a first step towards the real short-term goal, which is PL 84-99, but is also important from the point of view of the State in maximizing automatic federal assistance following any disaster.

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, although 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 ease of inspection.

Public Law (PL) 84-99

Among other actions, 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 a Delta-specific standard for levees, based on the Bulletin 192-82 joint DWR-USACE study that is described below. Within the legal Delta this standard plus various maintenance and inspection requirements must be met in order to qualify for rehabilitation under PL 84-99. The Corps was careful to note that "the recommended guidelines

[36] Betchart, W. (2008), Delta Levees – Types, Uses and Policy Options, Prepared for Delta Vision, August.
[37] Betchart, W. (2011), Memo to Delta Levees and Habitat Advisory Committee with attached MOU.
[38] Based on discussions with reclamation district engineers. See previous footnote regarding the development of 5-year plans.

are Delta-Specific and they are not intended to establish design standards for the 537 miles of non-federal levees in the Sacramento–San Joaquin Legal Delta, but to provide uniform procedures to be used by the Corps of Engineers in determining eligibility under PL 84-99, as amended." In the preceding Bulletin 192-82 study it had been stated that "while the Corps' design has accounted for small earthquakes, the lack of actual experience of the impacts of earthquakes on Delta soils leaves some doubt that that some, levees, even after rehabilitation, could withstand an earthquake of Richter magnitude 5 or greater if the epicenter occurred in the Delta, or of magnitude 8 on the San Andreas or Hayward faults." Thus earthquakes were considered but not fully accounted for. While sometimes referred to as the PL 84-99 Ag standard, this standard actually applies to both agricultural and urban levees within the legal Delta. The 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 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 fully 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. This Delta-specific standard leads to the result that levees in the western and central Delta which overlie peat are likely to be less susceptible to damage in earthquakes than levees in the north and south Delta, which both overlie more sandy soils and tend to be composed of sandy soils and thus are more susceptible to liquefaction. 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 SPK Practice calls for a minimum crown width of 20 feet for main-line levees and minimum water and landside 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 it describes recommended standard practice, it also makes it clear (and this aspect is often overlooked) that the responsible engineers should use appropriate judgment as a function of site-specific conditions and experience.

Urban Levee Design Criteria (ULDC)

DWR was directed by SB 5 to develop appropriate standards for urban levees, and version four 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 trees 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 Core 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 Section 3.3.1 below) did suggest that Delta levees should be designed for 300-year water surface elevations but that suggestion has not been included in subsequent standards or revisions. 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)[39] has suggested that an appropriate standard for the design of Delta levees might be to design for 500-year flood and earthquake loadings. Likely, adoption of the ULDC requirement for three feet of freeboard over the 100-year water surface elevation coupled with superior flood-fighting would effectively provide 500-year flood protection. Building to this standard would increase the cost marginally over the cost of complying with the Delta-specific PL 84-99 standard. 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)[40] is shown in Figure 16. 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 $2 million per mile in 2009. 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 $5 million per mile to the incremental cost. By comparison, Suddeth et al. (2008)[41] cited a cost of $45 million per mile

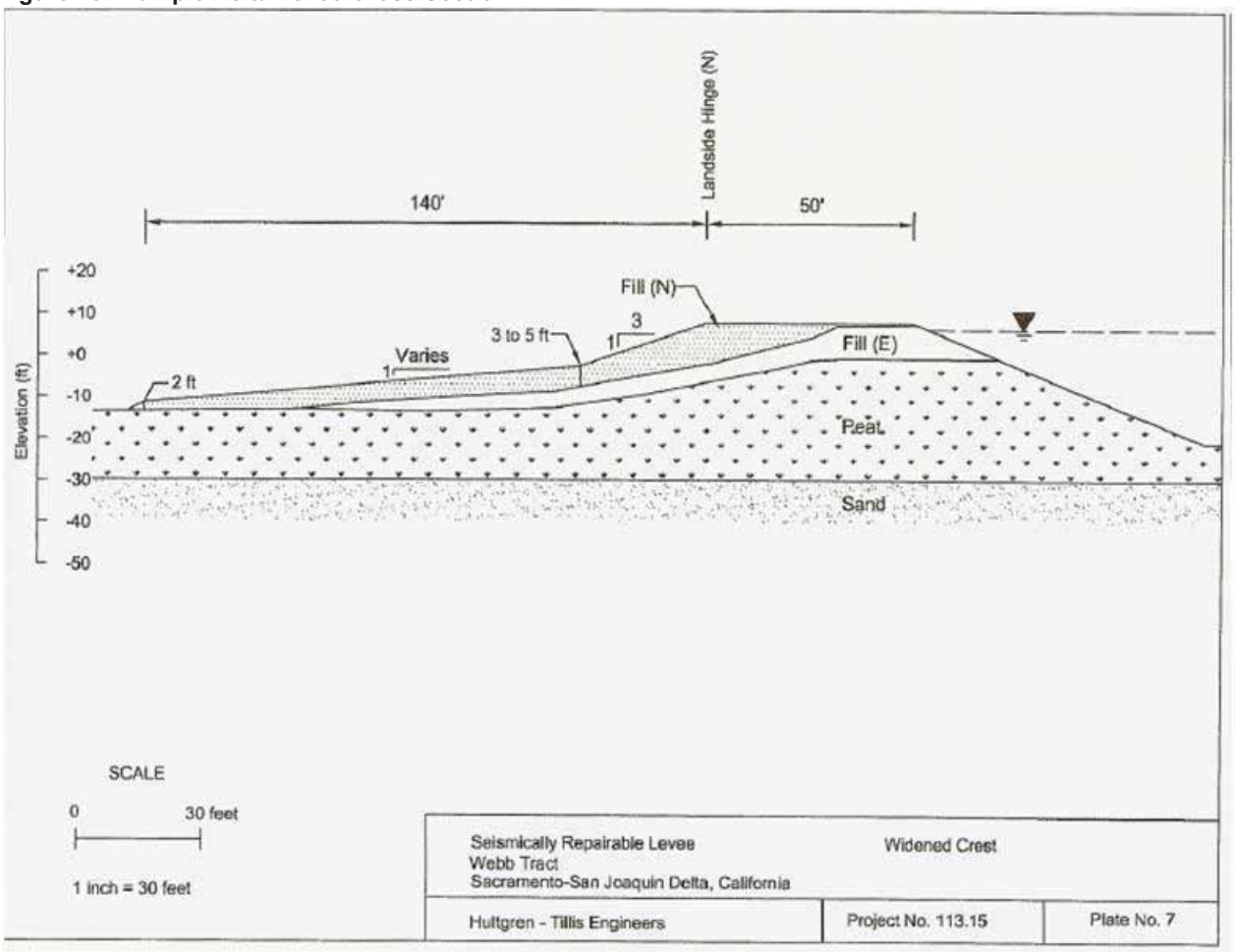
[39] Pyke, R. (2011) Comments of the First Staff Draft of the Delta Plan. Delta Stewardship Council, February, 2011. http://deltacouncil.ca.gov/public-comments/read/143?page=1.

[40] Hultgren-Tillis Engineers, Geotechnical Evaluation, Seismically Repairable Levee, Webb Tract, Report to Reclamation District 2026, December 2009.

[41] Suddeth, R., J. Mount, and J. Lund (2008), "Levee Decisions and Sustainability for the Sacramento-San Joaquin Delta," Appendix B to *Comparing Futures for the Sacramento-San Joaquin Delta*, Public Policy Institute of California, San Francisco, CA, August.

from the DRMS Preliminary Strategies Report. That figure is clearly incorrect and appears to have been intended to apply to a new embankment with a 50-foot wide crest width which would protect the BNSF railroad and the Mokelumne aqueduct. As mentioned below, the DRMS Phase 2 report also includes a figure of $38 million per mile, but that is for a setback levee in connection with widening and hardening a single conveyance path through the Delta.

Figure 16 Example Delta Levee Cross Section



A key feature of the design shown in Figure 16 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 two-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. While it is not cost-effective or rational to construct levees to those elevations today, the provision of a wider crest today has two benefits: 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. In addition, the provision of a wider crest also allows for retaining or planting vegetation on the waterside of the levee in accordance with the ULDC guidelines. Such planting should be an essential component of any comprehensive plan to repair the Delta ecosystem. Local widening

of these levees would also allow for the construction of new recreational and tourist facilities out of the flood plain.

3.3 Previous Studies of Delta Levees

3.3.1 Delta Levees Investigation, DWR Bulletin 192-82

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 and published as Bulletin 192-82,[42] which recommended a levee standard similar to the current Delta-specific PL 84-99 standard. The forward to the report, signed by Ronald Robie, then Director of DWR, states in part:

> *Now is the time for a decision. The most significant element in a decision on what action to take is how much can we afford and who will pay? These questions can only be answered by the Legislature the local landowners, and the Congress.*
>
> *There is a danger that taking a short-term view of Delta flooding problems will merely pass the tough issues on to the next generation. Short-run economic decisions may serve to subsidize private interest as the expense of the general public. The great challenge for the Delta is to find an equitable way of financing a very uncertain long-term future. The political process is the traditional arena for handling these kinds of issues and is the right forum for the next step in Delta deliberations.*
>
> *These policy issues must be addressed today. In the event the Legislature determines that a major responsibility for levee restoration should fall upon the State, a bond issue or other form of capital financing must be developed and approved by the people.*

At that time, it was estimated that improving all levees to the proposed Bulletin 192-82 standard would cost $930 million if implemented immediately. However, although funding of the subventions program continued at a relatively low level, financing was never put in place to implement this more significant levee-improvement plan.

3.3.2 CALFED Levee System Integrity Program

A similar study, called the CALFED Levee System Integrity Program, was subsequently conducted as part of the CALFED program.[43] The executive summary of the Levee System Integrity Program Plan, dated July 2000, contains the following statements:

> *Many Delta levees do not provide a level of flood protection commensurate with the high value of beneficial uses they protect. As mandated by the California State legislature and adopted by CALFED, the physical characteristics of the Delta should be preserved essentially in their present form. This is necessary to protect the beneficial uses of the Delta. The key to preserving the Delta's physical characteristics and to achieving CALFED's objectives is the levee system. Over the next 30 years CALFED will invest billions of dollars in the Delta. The levees must protect this investment.*
>
> *The existing levee program (*the subventions program*) was intended to improve Delta levees up to the California/Federal Emergency Management Agency (FEMA) Hazard*

[42] Delta Levees Investigation, Department of Water Resources, Bulletin 192-82, December 1982
[43] http://calwater.ca.gov/content/Documents/library/305-1.pdf

> *Mitigation Plan (HMP) Standard. As of January 1998, 36 of 62 (58%) Delta islands and tracts were in compliance with the HMP standard. This has resulted in a significant improvement in the ability to protect the beneficial uses of the Delta. However, as CALFED invests in the Delta, more is at risk. Therefore CALFED has chosen to improve the Delta levees to a higher level.*
>
> *The CALFED Levee program will institute a program that is cost-shared among the beneficial users to reconstruct Delta levees to the Corps' PL 84-99 Delta Specific Standard. This action will increase levee reliability and reduce emergency repair costs. In addition, levee districts meeting this standard are eligible for federal emergency assistance under PL 84-99.*

The plan to improve the levees to the PL 84-99 standard was not new. It had been recommended in Bulletin 192-82. The CALFED study estimated that the cost of improving all the Delta levees to the PL 84-99 standard ranged from $367 million to $1.051 billion, not inconsistent with the $930 million estimated in 1982. But again, no funding materialized until in 2006, in the wake of the Paterno Decision, Propositions 84 and 1E provided for up to $775 million to be spent on Delta levees. The slow pace of disbursement of these funds is discussed subsequently but, in effect, this was the funding that had been recommended first by Bulletin 182-92 and then by CALFED.

The CALFED plan also discussed the fact that funding for levee work is insufficient, inconsistent, and often delayed; that dredging is required to increase channel capacity and to provide material for levee reconstruction, habitat restoration and creation, and subsidence control, but that dredging had been curtailed due to regulatory constraints, causing dredging equipment and trained manpower to leave the Delta; that emergency response capabilities need to be continuously refined and funding increased; that levee reconstruction and maintenance sometimes conflicts with management of terrestrial and aquatic habitat resources; that obtaining permits for levee work can sometimes be difficult and time consuming; and that while subsidence may adversely affect levee integrity, this can be corrected.

With respect to seismic loadings the plan said:

> *Some CALFED stakeholders are concerned that earthquakes may pose a catastrophic threat to Delta levees, that seismic forces could cause multiple levee failures in a short time, and that such a catastrophe could overwhelm the current emergency response system.*
>
> *CALFED agrees that earthquakes pose a potential threat. In addition, Delta levees are at risk from floods, seepage, subsidence, and other threats. To address this concern, CALFED has begun a risk assessment to quantify these risks and to develop a risk management strategy.*

The plan listed 10 possible risk management options which included improving emergency response capabilities and reducing the fragility of the levees and indicated that the final Risk Management Plan might include a combination of the 10 options.

3.3.3 Delta Risk Management Strategy

AB 1200 (authored by John Laird, the current California 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 and sea-level rise, or a combination of these impacts. This legislation had the effect of changing the CALFED recommended study into what became the Delta Risk Management Strategy (DRMS) and the Risk Management Plan envisioned by CALFED has never been completed.

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 $6 million. 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 to have been a projection of future risks assuming various scenarios. The Phase One draft generated a great volume of critical comments, and the effort required to respond to them cut into the available funding for Phase 2. The Phase 1 Risk Analysis Report was released in 2009, but the report on the modified Phase 2 study has only just been released. The stated purpose of the study, the participants, and a summary of the Phase 1 results are provided in the Executive Summary prepared by DWR, available on the department's website.[44]

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 were generally critical of the study. The IRP review[45] 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 expressed concerns:

> "*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....*"

Although the DRMS developed a good framework for assessing risks to the Delta levees, the effort had data gaps that were never filled, as acknowledged in the note on page 1-1 of the report. Gaps such of these in data and knowledge tend to drive the estimates of fragilities down, and the risks up.[46] Since improvements have been made to some Delta levees under the subventions program since 2005, the DRMS results are out of date. The numerical results from the DRMS Phase 1 report, however, are widely quoted, painting a more pessimistic picture of the Delta levee system than perhaps is warranted.

The modified DRMS Phase 2 study focuses on Risk Reduction as opposed to Risk Analysis and evaluates the costs and benefits of four alternative scenarios for levee improvement and conveyance. However, in the words of its authors:

> *Similar to the Delta Risk Management Strategy (DRMS) Phase 1 Risk Analysis Report (URS/JBA 2007h), the DRMS Phase 2 Risk Reduction Report was carried out for the*

[44] http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/

[45] The independent review panel (IRP) comments on the DRMS Phase I draft report are published on the State's archived CALFED website: http://calwater.ca.gov/science/drms/drms_irp.html

[46] Use of decades-old data are evident in some of the erroneous failure probabilities, such as the over 7 percent annual failure probability attached to the Brookside subdivision in Stockton, which in reality has high quality levees that were improved as part of the subdivision development.

> *most part using existing information (data and analyses). The Phase 2 schedule did not afford the opportunity to conduct field studies, laboratory tests, or research investigations.*

Section 20 of the report then lists a number of assumptions and limitations, and concludes:

> *The complexity of the issues in the Delta and the limited time available to undertake the Phase 2 effort means that additional scenarios that could not be developed in this phase will require consideration. Further, the performance of sensitivity analyses of the scenarios themselves would be valuable to assess the importance of the major components of the scenarios on the overall risk reduction benefits. Other ongoing agency initiatives will likely require consideration of additional scenarios.*

Nonetheless, the key findings relative to the two types of levee upgrades that were considered (and are listed below) are not inconsistent with the present study.

- *Most of the Delta levees already meet the HMP standard.*
- *Some of the levees in the central Delta (project levees) already meet the PL 84-99 standards.*
- *The cost of upgrading 764 miles of selected non-project levees (levees that do not meet PL 84-99 standards) in the central Delta to PL 84-99 standards is about $1.2 billion.*
- *The cost of upgrading 187 miles of selected levees around urban centers to UPL standards is $750 million.*
- *Upgrading levees to meet the target standards will reduce the probability of failure due to flooding. However, these upgrades do not guarantee that the upgraded levees, particularly those upgraded to PL 84-99 standards, will not fail during a 100-year flood. The 1.5 feet of freeboard is insufficient for regions subject to high winds during floods.*
- *Upgrading levees to meet the PL 84-99 and UPL standards does not reduce the seismic risk of levee failure.*

Elsewhere the report says that "upgrading the levees to the Pl 84-99 and UPL standards would <u>do little</u> to reduce the risk of failure under seismic loading." However, curiously, the report says nothing about what it would take to further upgrade the critical levees so that they are more robust under seismic loadings. Rather Scenario 1, which is entitled "Improved Levees," assumes that the levees are not robust under seismic loadings and estimates the cost of hardening the state highways that cross the Delta, by putting them on piles like the elevated section of the Yolo Causeway, and the BNSF railway and the Mokelumne Aqueducts, either by building seismically-resistant embankments with a 50-foot crown width on either side of the existing railway and aqueducts, or by placing the railway and aqueducts on a single embankment with a 180-foot crown width. The cost of these hardening measures was estimated to be $6.1 billion for the highways and $3.3–3.9 billion for the infrastructure corridor. Adding these figures to the cost of the planned levee improvements resulted in a stated total capital cost for Scenario 1 of $10.4 billion, as reported in Table 1 of the executive summary. Within the estimate for the hardened infrastructure corridor are the figures of $45.2 million per miles for the 50-foot crown width embankment and $94.6 million per mile for the 150-foot crown width embankment.

Likewise Scenario 2, which is titled "Through Delta Conveyance (Armored Pathway)," ignores the possibility of a general upgrade to levees that are more robust under seismic loading and instead assumes the construction of 115 miles of new seismically-resistant setback levees, at a cost of $38 million per mile. The total capital cost given in Section Eight of the report for a

15,000 cfs through Delta facility is $5.7 billion, although in Table 1 of the executive summary this figure mysteriously jumped to $15.6 billion.

This study concludes that the core Delta levees can be made robust under seismic loadings for a total of $1–2 billion. If such a scenario had been considered in the DRMS Phase 2 study, it would likely have a lower cost-to-benefit ratio than the alternatives that were considered.

3.3.4 Delta Islands and Levees Feasibility Study

Meanwhile, the successor to the Bulletin 192-82 and CALFED studies is the USACE Delta Islands and Levees Feasibility Study, which is an on-going effort in collaboration with DWR.[47] The proposed total USACE budget for this study is $6 million and DWR is contributing the DRMS study, which also cost $6 million, as their contribution. The official description of the study is:

> *This feasibility study is USACE's mechanism to participate in a cost-shared solution to a variety of water resources needs for which we have the authority. Results of state planning efforts will be used to help define problems, opportunities, and specific planning objectives. The feasibility study will address ecosystem restoration and flood risk management, and may also investigate related issues such as water quality and water supply. USACE and DWR signed a Feasibility Cost Sharing Agreement (FCSA) in May 2006.*

Little progress has been made to date. Thus, three joint State-Federal efforts over the last 30 years have had some positive impact in that they have generated the concept of improving Delta levees to the PL 84-99 standard and have supported the continuation of the funding that is provided under the subventions program and the additional funding that was authorized under Propositions 84 and 1E, but they have not yet led to a strategy which will make the Delta sustainable longer-term facing the hazards due to floods, earthquakes, and possible sea-level rise.

4 Risk-Reduction Strategies

There are three basic approaches to addressing the risks posed to the Delta levees by floods and earthquakes. 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.

4.1 Improve 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 clear that essentially all Delta levees should be improved to the Delta-specific PL 84-99 standard. Unfortunately, Draft 3 of the "Framework for DWR Investments in Delta Integrated Flood Management," a document that was only released for public comment on July 15, 2011, but had already been forwarded to the Delta Stewardship Council, states or implies that the HMP "standard" provides an adequate basic level of protection against floods and earthquakes for Delta levees. The exact language of the draft Framework is:

[47] http://www.spk.usace.army.mil/projects/civil/Delta/News.html

> *As funding is available, DWR intends to cooperate with local public agencies to develop local plans to improve levees within the Delta levee network to at least the HMP standard. Some levees may warrant additional investment to provide a level of protection beyond the HMP standard, but these projects likely would need to be justified based on one of the other categories of benefit described in this section.*

On the basis of this language, the 4th staff draft of the Delta Plan, in Table 7-1, indicates that levees built only to the HMP "standard" are acceptable for protection of agricultural lands. However, the HMP "standard" is not an engineering standard. It is a minimum configuration agreed to by the state and federal governments for the purpose of defining a serious levee in order to protect the federal government from facing possible exposure to the cost of repairing levees that are height limited or not seriously being maintained. Since 1982 the minimum standard for engineered levees in the Delta has been the Delta-specific standard that was recommended in Bulletin 192-82 and subsequently adopted by the Corps of Engineers as the PL 84-99 standard for Delta levees. This Delta-specific PL 84-99 standard was also adopted in the CalFed Levee System Integrity Program Plan as the minimum standard for Delta levees. That plan specifically said:

> *The CALFED Levee program will institute a program that is cost-shared among the beneficial users to reconstruct Delta levees to the Corps' PL 84-99 Delta Specific Standard. This action will increase levee reliability and reduce emergency repair costs. In addition, levee districts meeting this standard are eligible for federal emergency assistance under PL 84-99*.

The draft Framework and the draft Delta Plan would roll back 30 years of joint State-Federal co-operation without sufficient justification.

While Figure 14 indicates that there are few if any islands in the Delta that are in purely agricultural use without infrastructure or other beneficial uses, flooding of even a hypothetical purely agricultural island has adverse impacts on the adjacent islands in terms of both wave action and enhanced seepage as well as on Delta-wide water quality in addition to the agricultural losses, and, as noted by both Healey and Mount (2007)[48] and Suddeth et al. (2011)[49], the ecological benefits of additional flooded islands are uncertain. The call in the draft Framework for justification of improvements beyond the HMP "standard" could easily be satisfied, but doing so would create additional delays, paperwork, and expense. Moreover, because improvement of Delta levees to the Delta-specific PL 84-99 standard has been the announced policy of the State, and because funding adequate to achieve this goal was approved by the voters in Propositions 84 and 1E, it would seem that failure of the State to conscientiously and uniformly pursue this goal exposes the State to significant Paterno, that is, inverse condemnation and liability.

If the marginal cost of making additional 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

[48] Healey, M., and J. Mount (2007), Delta Levees and Ecosystem Function, Memorandum to John Kirlin, Executive Director of Delta Vision, November 2007.
[49] Suddeth. R. (2011), Policy Implications of Permanently Flooded Islands in the Sacramento-San Joaquin Delta, UC Davis Center for Watershed Sciences, http://watershed.ucdavis.edu/pdf/Suddeth_Policy_Implications_of_Flooded_Islands_080110.pdf

"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 a greater freeboard and wider crests allowing two-way traffic, which will enhance emergency response. They would also allow emergency borrowing of materials from landside toe-berms to restore the crests of any levees that slump as a result of earthquakes. The argument for making this additional investment is pretty straight-forward: even the Delta-specific PL 84-99 standard does not necessarily provide adequate protection from more extreme floods and earthquakes and does not provide a basis for adaption should sea level rise at an enhanced rate. Assuming a cost of $2–3 million per mile for 300 to 600 miles of levees, the $1–2 billion minimum investment that would be required to improve the core levees to this higher standard is small compared to the value of the land that they protect, the recreational benefits that they provide, and the value of the infrastructure that crosses the Delta. Some idea of the value of that infrastructure can be gained from the estimate in DRMS Phase 2 that it would cost in the order of $10 billion to harden the state highways, the BNSF railway, and the Mokelumne Aqueduct to make them seismically-resistant in the absence of seismically-robust levees. Thus relative benefit to cost ratio of further improving the levees is at least five times as great as the alternative, assuming that the benefits are equal, which they are not because the seismically-robust levees would protect much more than just this selected infrastructure. Further seismically-robust levees would protect the existing through-Delta conveyance paths and, while this would not solve all the conveyance and storage issues facing the State, it is more than five times less expensive that the presently-proposed BDCP Isolated Conveyance, which does not solve all those conveyance and storage issues in any case. The real issue here is not whether to move to this higher standard for core levees, but just how high it should be, and just how much should be invested in levee improvements as opposed to better emergency preparedness, as discussed in the following section. For example, if, as opposed to spending $2 million per mile on further improvements of the kind shown in Figure 16, an internal drain was provided as suggested in one of Hultgren-Tillis Engineers' more expensive alternatives, at a cost of say $5 million per mile, would the increased cost be justified by the reduction in risk, assuming the same level of emergency preparedness? Or, could that lower level of risk be achieved more cheaply by making a greater investment in emergency preparedness? Notwithstanding all the difficulties that are noted in Appendix D of conducting complete and accurate risk analyses, which also apply to life-cycle cost benefit analyses, these are questions that may be deserving of further study.

This discussion assumes that the current levee system remains pretty much as it is, but it is not intended to suggest that small islands such as Fay, Dead Horse, and Quimby necessarily have to remain in agricultural use, that some efficiency might not be obtained by combining several islands into polders, or that intelligent combined flood risk management/ecosystem restoration projects such as the Lower San Joaquin River Flood Bypass[50] do not have merit. There may also be a valid argument for modifying the existing Delta channels to provide greater or more varied flows and retention times, but that involves various trade-offs and requires evaluation in advanced hydrodynamic and fluvial geomorphology studies of a kind that have not yet been conducted for the Delta.

[50] Lower San Joaquin River Flood Bypass Proposal, South Delta Levee Protection and Channel Maintenance Authority, Submitted to California Department of Water Resources, March, 2011

4.2 Improve flood-fighting and emergency repairs after earthquakes

As discussed above and in Appendix D, 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. Since levee failures typically come after days or weeks of initial warnings, it is clearly cost-effective to invest in emergency preparedness and modern investigative techniques to head off failures before they occur.

Below are some of the measures suggested to improve this kind of emergency response.

- 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 develop 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.

Improved federal, State, county, and community coordination 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.

4.3 Improve immediate response to breaches and repair of breaches and draining of flooded islands

In general, emergency response following a breach involves two elements. The first of these is very immediate and involves controlling the spread of flood waters, evacuating threatened people and livestock, and minimizing damage. In the riverine environment this might involve blocking freeway underpasses or otherwise reinforcing secondary levees and making relief cuts through levees to drain floodwaters back into the river system at a lower point on the river. To be effective, these actions require detailed emergency planning and preparation. However, while this kind of planning and preparation should be made for the Delta islands, there is likely little that can be done in this regard on most of the more deeply-subsided islands following a

breach. It is difficult or impossible to reduce or stop the flow of water until the island is flooded and water levels equalize. Once that has happened, the breach can be repaired and the island pumped out. However, as illustrated by the repair of the 2004 Upper Jones Tract failure, unnecessary delays and expense can occur unless the repair of the breach is planned and executed properly. In that case larger rocks were used to initially plug the breach but there were insufficient fines to limit continuing seepage to an acceptable rate. That resulted in construction of a waterside berm with provision for the planting vegetation on a bench in part as mitigation for encroachment into the channel, as may be seen in Figure B7 in Appendix B. Thus forward planning and stockpiling of suitable materials for repair of levee breaches is very desirable. In the absence of a one-stop permitting mechanism, it also seems very desirable that this forward planning includes establishment of a fast-track procedure for acquiring any necessary permits or authorizations. Speedy repair of breaches and pumping out of flooded islands not only minimizes damage and losses on the island in question but also the losses that occur as a result of enhanced seepage into adjacent islands.

4.4 Current planning efforts

4.4.1 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 $11.5 million be allocated for various planning studies and that a permanent emergency response fund of $50-150 million be established. Some of the recommended planning efforts appear to overlap with DWR-USACE activities that are already under way, but the final Task Force report has not yet been released.

4.4.2 DWR Emergency Planning

The current DWR studies were initiated by the Metropolitan Water District of Southern California (MWD) which, commencing in February 2006, undertook a study of two options for minimizing the interruption of exports resulting from a hypothetical 50 levee breaches/20 flooded islands scenario. The pre-event scenario involved advance construction of levee and river-flow barriers to block saltwater from entering the south Delta in a major emergency. It was estimated to cost $330-485 million. 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 $50 million for pre-positioning of materials, with an ultimate cost of perhaps $200 million. 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:

1. In association with USACE, development of a GIS-based flood contingency maps and associated data.

2. 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 six months, but more likely in a shorter period, even if multiple islands have been flooded.
3. 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 for the 50 breaches/20 flooded islands scenario, but the details of this are unclear. Some concern has also been expressed that the rock that has already been stockpiled is more suitable for creating river barriers than it is for repairing breaches.

4.4.3 County-Level Planning

Work is continuing on various county emergency response plans but these are more oriented to immediate response and public safety than to repair of levee breaches and de-watering of flooded islands. Nonetheless, there are many elements of these plans, such as the flood maps and guide developed by San Joaquin County[51] that could be usefully extended to cover the entire Delta. However, rather than having individual county plans, it would seem to be desirable to have a single integrated Delta-wide emergency response plan that identifies only as sub-sets the actions that need to be taken by the individual counties.

4.5 Summary

While some progress is being made on all three approaches to risk reduction, much of the DWR effort appears to be directed to the third approach, responding to failures after they have happened, instead of preventing them. While the DWR doomsday scenario is turning out to be less of a risk than initially thought and the current round of planning should be completed, much more emphasis should be given to the issues raised by Baldwin (2011),[52] most notably that a regional emergency response agency is required, and that the regional emergency response agency should place much more emphasis on preparation for flood-fighting and emergency response following earthquakes, as discussed herein in Section 4.2.

5 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 through 12995. It has been in effect since passage of the Way Bill in 1973, which has since been modified periodically by legislation. The intent of the legislation, 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.[53] The amounts for FY 2008-9 and 2009-10 are still in the

[51] http://sjmap.org/oesmg/gfcm/Flood_Map_Guide_Final_6-1-10.pdf
[52] Baldwin, R. (2011), San Joaquin County Comments on the First Staff Draft of the Delta Plan, http://deltacouncil.ca.gov/public-comments/read/143?page=1
[53] Provided by DWR – also included in the DWR Technical Memorandum

pipeline and have not actually been expended. Excluding these years, the State has provided $126 million against a local share of $110 million for a total of $236 million.

Table 3 Delta Levee Subventions Maintenance Program State & Local Cost Share 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 through 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; in 1996 it was extended to the rest of the Delta. A summary of expenditures under the special projects program is included as Table 4.[54] The funds for FY 2008-9 and 2009-10 have not yet been expended. The figure for FY 2009-10 includes $35 million specially designated by the legislature for improvements to the five islands that protect the Mokelumne Aqueduct. The expenditures for FY 2007-8, 2008-9, and 2009-10

[54] Provided by DWR and also included the DWR Technical Memorandum

are larger than in previous years because of bond funding approved by the voters in Propositions 84[55] and 1E.[56] Through FY 2007-08, a total of $115 million had been expended through the special projects program.

The funds that are in the immediate pipeline include the $21 million from the State and $9 million local share for the subventions program and special project funding of $22 million for FY 2008-9 and $100 million for FY 2009-10, for a total of $152 million plus from State and local sources, plus an additional $195 million 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.

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.

[55] The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84) authorizes $5.388 billion in general obligation bonds to fund safe drinking water, water quality and supply, flood control, waterway and natural resource protection, water pollution and contamination control, state and local park improvements, public access to natural resources, and water conservation efforts.

[56] The Disaster Preparedness and Flood Protection Bond Act of 2006 (Proposition 1E) authorizes $4.09 billion in general obligation bonds to rebuild and repair California's most vulnerable flood-control structures to protect homes and prevent loss of life from flood-related disasters, including levee failures, flash floods, and mudslides and to protect California's drinking water supply system by rebuilding Delta levees that are vulnerable to earthquakes and storms. Proposition 84 enhances these efforts with an additional $800 million for flood-control projects.

The total investment in Delta levees since these programs began will be $698 million plus once the funding in the pipeline is expended. The fact that $351 million has been spent to date is already reflected in the generally improved condition of the levees. Also, because levees tend to fail at their weakest point, such as where they were constructed over old sloughs, many levees have already failed and then been repaired and improved at their weakest point, with the result that the present levee system is more robust than it was before the breaches. Also, concurrent 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 out-of-date data compiled on the previously weaker system should not be repeated in current reports and discussions.

Table 4-1 of the DWR Technical Memorandum provides a breakdown of the funds appropriated for expenditure in the Delta from Propositions 84 and 1E. These funds total $615 million. Table 4-2 of the DWR Technical memorandum provides a breakdown of both the funds committed and the funds expended to February 2010. A total of $293 million had been committed to the subventions and special projects programs and $70 million had actually been expended at that point. The total funds committed amounted to $492 million and the total funds expended amount to $166 million, so that significant funds have been committed or expended for other purposes which include contracts, program delivery, emergency, the urban and non-urban levee evaluation programs, the Sacramento bank restoration program, and bond servicing costs. Approximately $123 million remain uncommitted.

Improvement of Delta levees from at or about the HMP standard to the Delta-specific PL 84-88 standard costs in the order of $1–2 million per mile,[57] 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 plus the remaining bond funds, all the core Delta levees should be improved so that they are at or about the Delta-specific PL 84-99 standard. Indeed, if expenditure of the bond funds had not been delayed by State spending freezes and other issues, this standard could have been generally met already. Continuing funding may still be necessary to take care of unexpected settlements and to ensure that 100 percent of the core levees meet the PL 84-99 standard, but the amounts needed for this would not be large, say in the order of $20 million 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 that will 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. 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 prioritization of further improvements is relatively straightforward and does not require risk analyses or cost-benefit studies. Figure 14 provides an initial indication of which islands and tracts might be considered to have relatively high priority. These further improvements might cost in the order of an additional $2-3 million per mile. If it is assumed that this improvement is required over 300 miles of non-project and non-urban levees, the total cost might be as low as $1 billion. However, for general planning and budgeting purposes, it might be desirable to use a higher number like $2 billion. The main point is that the total cost would be $1–2 billion rather than $50 billion (obtained by multiplying 1,100 miles by $45 million per mile,

[57] Based on discussions with reclamation district engineers and DRMS Phase 2 report

the number incorrectly cited by Suddeth et al. (2008)). 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, for 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 comparable that of 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. Costs for non-urban and non-project levee improvements are much lower than costs for improvements to urban levees, which have to factor in encroachments and penetrations and where there is often 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 many landowners involved. 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 the need to move existing drainage channels, siphons, and pumps are still issues, the cost implications are much smaller for Delta levees and only a relatively small number of landowners have to be accommodated.

The need to make the core Delta levees more resistant to earthquake loadings is a logical extension of other seismic retrofit work that has been conducted in the Bay-Delta region since the 1989 Loma Prieta earthquake. These upgrades have been performed for highways and bridges, dams, water supply systems, and the BART system. The Delta levees are the last major infrastructure element in the Bay-Delta region that needs to be upgraded to modern seismic standards. In order to put the proposed spending of a further $1–2 billion on Delta levees in perspective, it is noted that the Water System Improvement Program of the San Francisco Public Utilities Commission, which is basically a seismic upgrade of the Hetch-Hetchy aqueduct system, is costing $4.6 billion.[58]

As noted in Appendix C, there are special considerations for levees that protect Legacy Communities in the Delta. Detailed estimation of the likely cost of improving those levees awaits policy decisions that have not yet been made. However, if the levees on the relevant islands are upgraded to the proposed new Delta standard, the Legacy Communities would automatically be afforded superior flood protection.

Improved inspections and planning and positioning for flood-fighting and emergency response following earthquakes, which would contribute very significantly to a reduced risk of losses, would be very well covered by an annual budget in the order of $20 million. As noted previously, it is 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

[58] http://sfwater.org/index.aspx?page=115

contributions to the upkeep of the levees that protect their facilities, but many other owners do not contribute; and (3) the agencies that convey water through the Delta. The Delta Stewardship Council has proposed the creation of a new agency, the Delta Flood Risk Management Assessment District, with fee assessment authority. 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 would also be entirely reasonable that the State and federal governments 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 region and the State, then it becomes the State's responsibility to provide funding that could, 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.

Part Two: Analysis of Key Economic Sectors in the Delta

Chapter 5: Framework for Analysis

Chapters 6–11 present analyses of key components of the Delta economy: agriculture; recreation and tourism; local government services; other economic sectors including services, transportation and development; and an integrated analysis of the Delta's Legacy Communities. This chapter discusses the framework that will be utilized for the analysis, and defines the scenarios for policy choices that will be made in the Delta in four important areas: water conveyance, habitat enhancement, levee and flood control investment, and land-use regulation.

Each of these chapters follows a common framework. First is a data-driven description of the current baseline and trends for the sector, which may include reference to other significant reports on the sector. Second is discussion of the likely outcomes for the economic sector under the baseline policy scenario, followed by recommendations that might improve economic sustainability under the baseline scenario. Third, each chapter includes an evaluation of 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. Finally, each chapter will include discussion of additional issues or proposals as appropriate, including relevant strategies outlined in the Delta Vision strategic plan. 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, sea level is expected to increase by a foot, tertiary treatment will become operational at most municipal wastewater plants discharging into the Delta and improve water quality, and significant investment in levees will occur.

As discussed in Chapter 2, the population of the region surrounding the Delta is growing. The 2010 Census found the population in the five Delta counties was 3,767,312 and grew at a 1.4 percent annual rate over the decade, slightly faster than the 1 percent annual growth rate for the state of California. Based on the 2010 Census results, the forecasting firm Global Insight projects the five-county population will reach 5.57 million in 2040, a growth rate that projects to 6.1 million in 2050. Higher projections from the California Department of Finance, most recently updated in 2007, put the 2050 population at 6.9 million. 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 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.

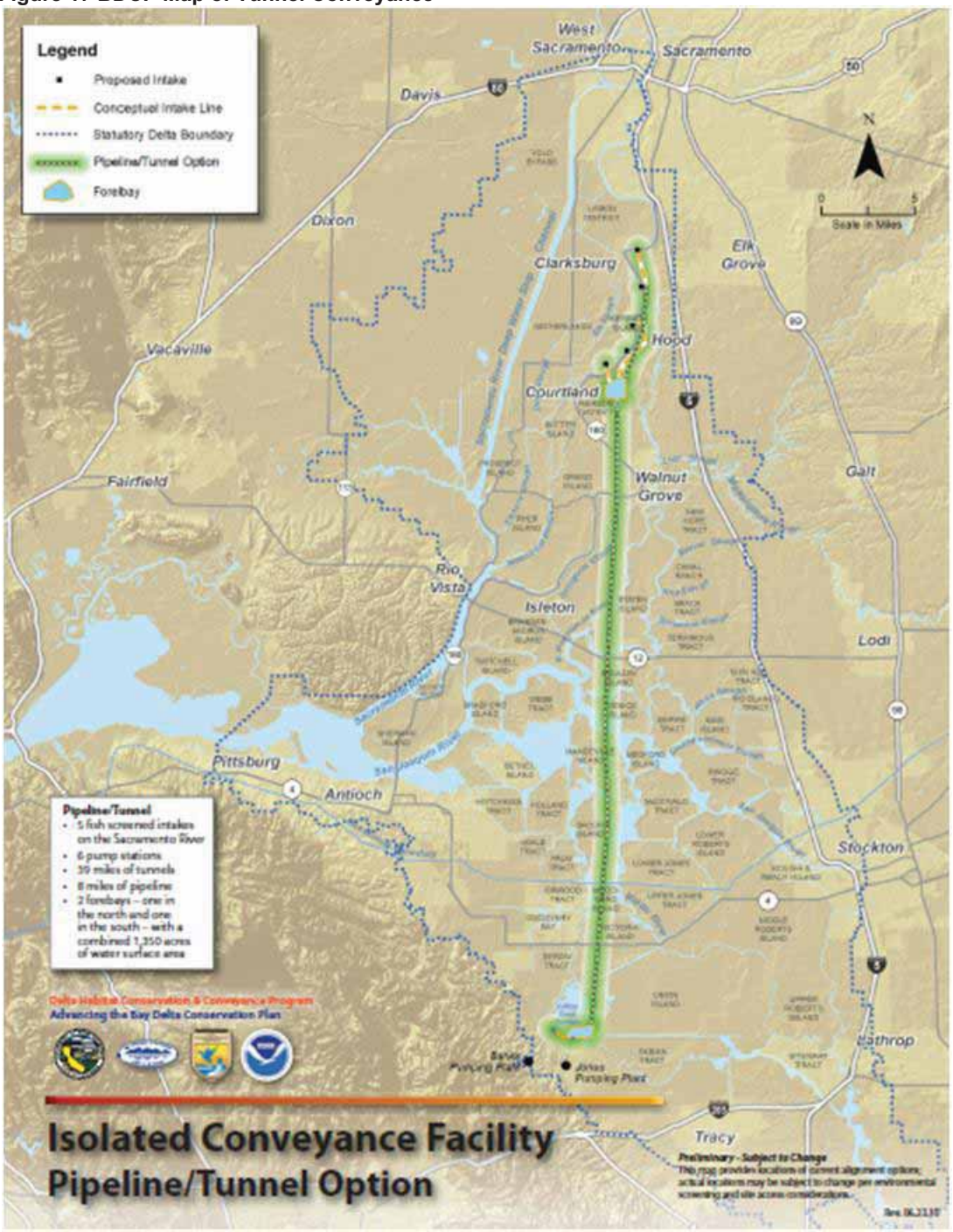
2 Isolated Conveyance Scenario

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.

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. 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.

The goals for in-Delta agricultural, municipal, and industrial water quality are among the most important provisions for the Delta economy. Both the November 2010 draft BDCP and a May 2011 revised operation documents state that existing D-1641 water quality standards will be met in the north and west Delta with the measuring point moved slightly upstream in the Sacramento River. Notably, none of the BDCP operations descriptions make any commitments to water quality in the central or southern Delta, the areas expected to see the most significant salinity impacts from isolated conveyance. The uncertainty surrounding Delta water quality impacts and the importance of the issue to the Delta economy makes it one of the most difficult issues to assess in the economic sustainability plan.

Figure 17 BDCP Map of Tunnel Conveyance



While alternative sizing and other options for water conveyance are under development and consideration, none of these options has been described in sufficient detail at this time to be included in 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

While the impacts on customers of state and federal water projects is beyond the scope of this project, the financial feasibility of water contractors' plans to pay for the proposed isolated conveyance is of critical importance to economic sustainability in the Delta. There are significant questions as to whether isolated conveyance is financially feasible, especially if operated under the proposed operating criteria.

Inadequate financing could create serious problems such as 1) pressure to increase water exports from the Delta beyond agreed upon environmental and in-Delta water quality protections to create revenue for debt service, 2) pressure to divert funds from Delta mitigation, habitat improvement, and flood control programs, 3) 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.

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 five 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. 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 the 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 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.

For the first two conservation measures on this list, it is important to note that there are locally developed alternative proposals that are likely to be preferred alternatives for Delta economic sustainability. For the San Joaquin River floodplain, an enhanced flood bypass at Paradise Cut has been negotiated between environmental groups and local landowners and reclamation districts. Yolo County is in the process of developing an alternative proposal for Yolo Bypass fishery enhancements that is less costly on the local agriculture economy than the BDCP proposal.

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 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.

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. As discussed in detail in an appendix, the Suddeth, Mount and Lund (2010) analysis 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 there is 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. The result comes from running the Suddeth, Mount, and Lund analysis with assumed property values that more closely match market values and a more accurate infrastructure costs, but still does not capture all of the economic benefits provided by the levees. Thus, this scenario can be considered a reasonable upper-bound on the extent of open water that could be economically justified in the Delta. Most notably, the figures illustrate six contiguous islands in the Central Delta as open water. These islands are the most attractive candidates for open-water habitat because they are very sparsely populated, mostly grow low-value agricultural crops, and are not crossed by completed major physical 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. 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 and McDonald, 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 50 miles of adjacent levees that would be subject to increased pressure from waves and under seepage.

Increase to Higher Standard Levees in Targeted Areas
In this scenario, areas surrounding strategically targeted areas would have levees upgraded beyond the PL 84-99 standard. As explained in Chapter 4, these could be upgrades to increase seismic resistance in the western Delta or other target areas, or they could be upgrades to support at least 100-year flood protection in and around Legacy Communities to allow development and investment consistent with the rural character of the Delta. This scenario would also further the statewide goal of increased water supply reliability, would allow the growth of natural vegetation on the water side of the levees as part of an overall ecosystem restoration plan, provide a basis for addressing possible sea-level rise, and would provide increased protection for the critical infrastructure that passes through the Delta.

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 fourth draft of the Delta Plan under development by the Delta Stewardship Council envisions expanded land-use regulations in the Legal Delta to support the coequal 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 fourth draft of the Stewardship Council's Delta Plan states (Chapter 3, page 41, **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 the Delta would likely not be a covered action because it would not appear to meet the criteria. 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 for Targeted Areas or Industries 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, an unlikely change since it 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 were 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, some of the analytical chapters consider the increased flood control and reduced land-use regulation scenarios as a package rather than individually.

Another option for reducing land-use regulation in the Delta would be to expand the list of exemptions for "covered actions" in the Delta Plan to include important investments necessary

to sustain and enhance the agriculture and recreation and tourism economy in the Delta. This would not relax regulation compared to our baseline scenario, but would create additional flexibility in the regulation of covered actions in the Stewardship Council's draft Delta Plan.

6 Delta Vision Strategies

As discussed in Chapter 3, the October 2008 Delta Vision Strategic Plan provided a list of strategies and actions to support their second goal, "Recognize and enhance the unique cultural, recreational and agricultural values of the California Delta as an evolving place, an action critical to achieving the coequal goals." The specific actions were:

- Apply for designation of the Delta as a federally recognized National Heritage Area.
- Expand the State Park and Recreation Area network in the Delta.
- Establish special Delta designations within existing federal and state agricultural support programs, primarily regional labeling and marketing programs.
- Conduct research and development for agricultural sustainability in the Delta, focusing on developing agricultural practices consistent with habitat and ecosystem restoration.
- Establish new markets for innovative agricultural practices such as carbon sequestration credits and conservation easements.
- Charge the Delta Protection Commission with creating a regional economic development plan that addresses agriculture, recreation, tourism, and innovative land use.
- Establish enterprise zones that use tax incentives to spur investment at the major "gateways" to the Delta.
- Establish a Delta Investment Fund for regional economic development and adaptation. Initiate the fund with state funding, and structure it to accept revenues from federal, state, local, and private sources.
- Adopt land-use policies that enhance the Delta's unique values and that are compatible with the public safety, levee, and infrastructure strategies.

For some of the strategies, action is in progress or complete such as the feasibility study for Natural Heritage areas,[59] a recent report from the UC Agricultural Issues Center that assessed the viability of some alternative and innovative agricultural approaches in the Delta,[60] and the preparation of this Economic Sustainability Plan.

The state budget and larger fiscal trends have presented significant challenges for some of the other strategies. While State Parks has developed a plan for the Delta, fiscal pressures have put all the state parks and recreation areas in the Delta on the closure list, the opposite of expanding the network. Enterprise zones were initially targeted for elimination in the 2011-12 state budget. Although enterprise zones survived this year's budget cuts, actions continue to reduced and reform enterprise zones, and the prospect for approving significant new enterprise zones is low.

Other strategies are discussed when appropriate in the analytical chapters, and promising strategies will be reinforced in the final recommendations including specific priorities and strategies for the Delta Investment Fund.

[59] http://www.delta.ca.gov/heritage.htm
[60] http://aic.ucdavis.edu/publications/AIC_Delta_study_final.pdf

Chapter 6: Agriculture

1 Overview and Key findings

- Close to 80% of all farmland in the Delta is classified as "Prime Farmland", the California Farmland Mapping and Monitoring Program's highest designated tier.
- Total cropped acreage in 2010 was 419,891 acres, not including approximately 38,000 acres of grazing land.
- The top five Delta crops in terms of acreage are: 1) Corn, 2) Alfalfa, 3) Processing Tomatoes, 4) Wheat, and 5) Wine Grapes.
- Total crop value in 2009 was approximately $660 million dollars. Truck and vineyard crops account for 56% of crop revenues on 17% of acreage.
- The top five Delta crops in terms of value are: 1) Processing Tomatoes, 2) Wine Grapes, 3) Corn, 4) Alfalfa, and 5) Asparagus.
- The highest per-acre values in the Delta come from truck crops mainly situated in the southern Delta and deciduous crops principally located in the northern Delta.
- The approximately $660 million in Delta crop production and $90 million in Delta animal and animal product revenue has an economic impact of 9,250 jobs, $635 million in value added and $1.3 billion in output in the five Delta counties. Across all of California, the economic impact of Delta agriculture is 12,360 jobs, $761 million in value added, and $1.5 billion in output.
- When regional canneries and wineries that are tightly linked to Delta crops are included with crop and animal production, the total economic impact of Delta agriculture is 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.
- The long-run land allocation forecast in the baseline scenario predicts a future increase in truck crops, and decreases in field and grain crops. Despite a potential 10% decline in field and grain crop acres, these crops would still dominate Delta agriculture acreage. This shift of 10% of land to higher value crops could lead to an approximately $115 million gain in crop revenues.
- The effect of isolated conveyance on salinity is highly uncertain at this time. The preliminary estimate of losses from increased salinity is between $20 million and $65 million per year. The loss of farmland to construct the conveyance facility is

estimated to generate an additional $10 to $15 million in crop losses per year. Salinity losses could be much higher if a 15,000 cfs conveyance were operated to increase water exports beyond the levels proposed in the draft BDCP.

- The agricultural impacts of most of the BDCP conservation measures are difficult to quantify due to the lack of precision in site specification and other details. Broad ranges of potential annual crop losses have been calculated from the land requirements and descriptions of easement costs in the draft BDCP.
    - Tidal habitat restoration losses range from $18 to $77 million annually with lower losses when restoration is targeted to Suisun Marsh.
    - Natural Communities Protection losses are estimated to range from $5 to $43 million annually depending on targeting of high-value, permanent crops.
    - San Joaquin River Floodplain crop losses are estimated at $15 to $20 million annually, but could be reduced up to 80% by implementing an alternative proposal to expand an existing bypass at Paradise Cut.
    - Yolo Bypass Fishery Enhancements could generate crop losses between $1 and $5 million annually.

2 Current Status and Trends

2.1 Mapping Delta Agriculture

Delta agriculture is part of a complex and constantly-changing landscape, and it 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 collectively leveraged, they create the best available picture of the Delta agriculture and its broad role in the Delta economy.

2.1.1 Land Use Data

Field Borders

California law requires 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 this analysis of Delta agriculture at an extremely granular level, that of the individual crop field. Approximately 90 percent of Delta acreage in this 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, satellite remote sensing data captured and made available by the National Agricultural Statistics Service (NASS) provides good information. 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 shows agriculture not permitted for pesticide use, and provides a means to survey Delta land not covered by field borders.

Farmland Mapping and Monitoring Program

For estimates of total farmland acreage, GIS data collected by the California Farmland Mapping and Monitoring Program (FMMP) was employed. 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. FMMP maps were leveraged 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; close examination of areas marked by FMMP as grazing land eliminated 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 a direct look at the area in question in order to ascertain into what land-use category a parcel should be attributed.

2.1.2 Revenues, Profits, and Costs Data

County Crop Reports

In order to determine aggregate revenues from Delta crop production, crop yield and price figures published in each county's annual crop report were used. 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, outside sources were consulted 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, this analysis drew from the UC Cooperative Extension studies conducted in Delta regions to calculate various costs and profits expected from different agricultural operations in the Delta region.

2.2 Crop Categories

In order to facilitate presentation and analysis of Delta agriculture, it is necessary 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, and the full crop category table is in Appendix E.

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*

2.3 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 available. The total size of available farmland in the Delta is 500,383 acres, with almost 80 percent 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

This analysis places the total number of Delta acres in agricultural production in 2010 at 457,444 acres. Acreage includes all irrigated crops and pastureland, and 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**
Grazing Land[3]	433	2,846	11,499	18,600	2,284	1,991	**37,653**
TOTAL	**214,053**	**66,428**	**54,986**	**72,499**	**44,224**	**5,354**	**457,544**

[1] Pasture acreage adjusted using NASS estimates

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

[3] Grazing land acreage estimated from 2008 FMMP data

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

Figure 18 FMMP Delta Farmland Coverage

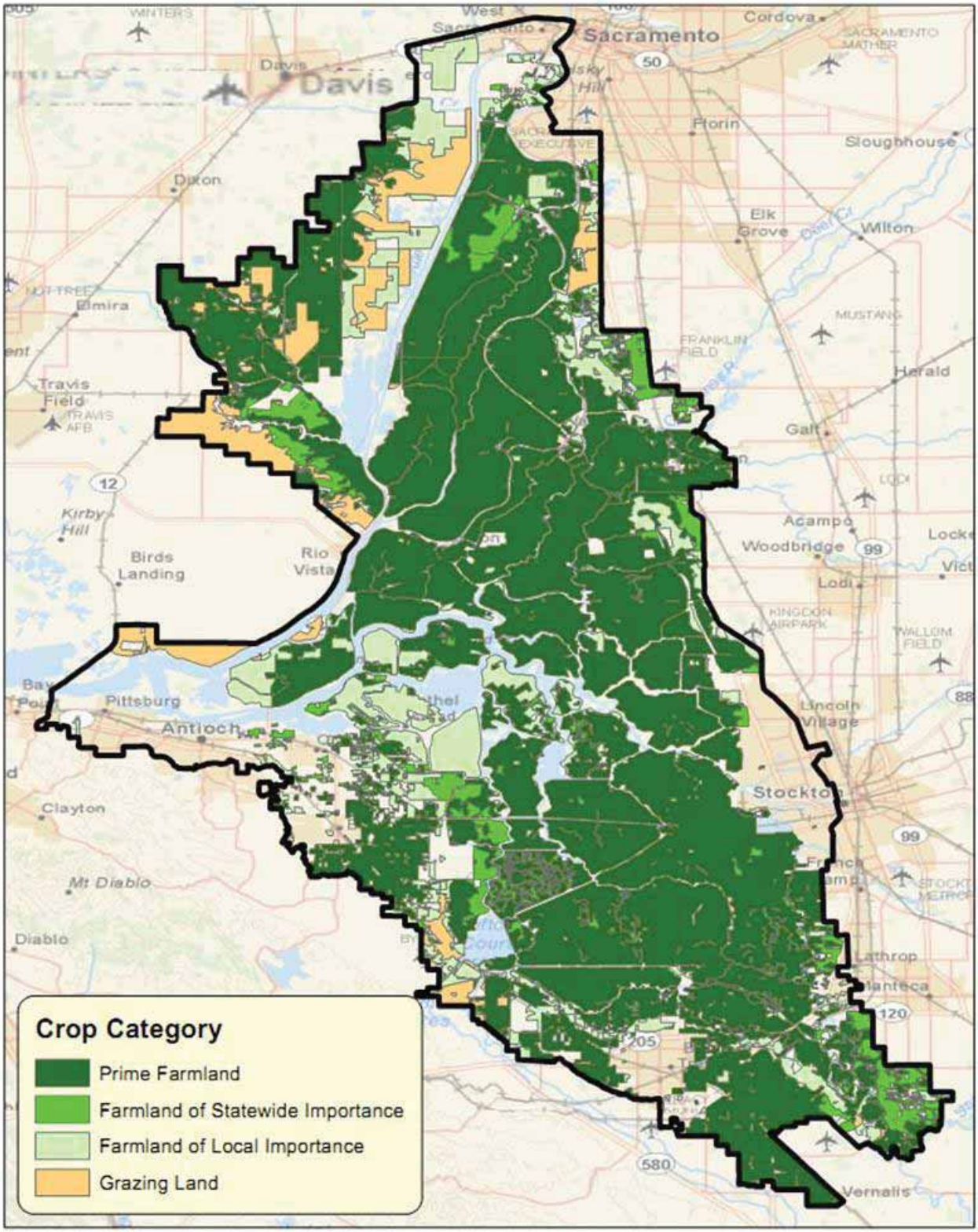
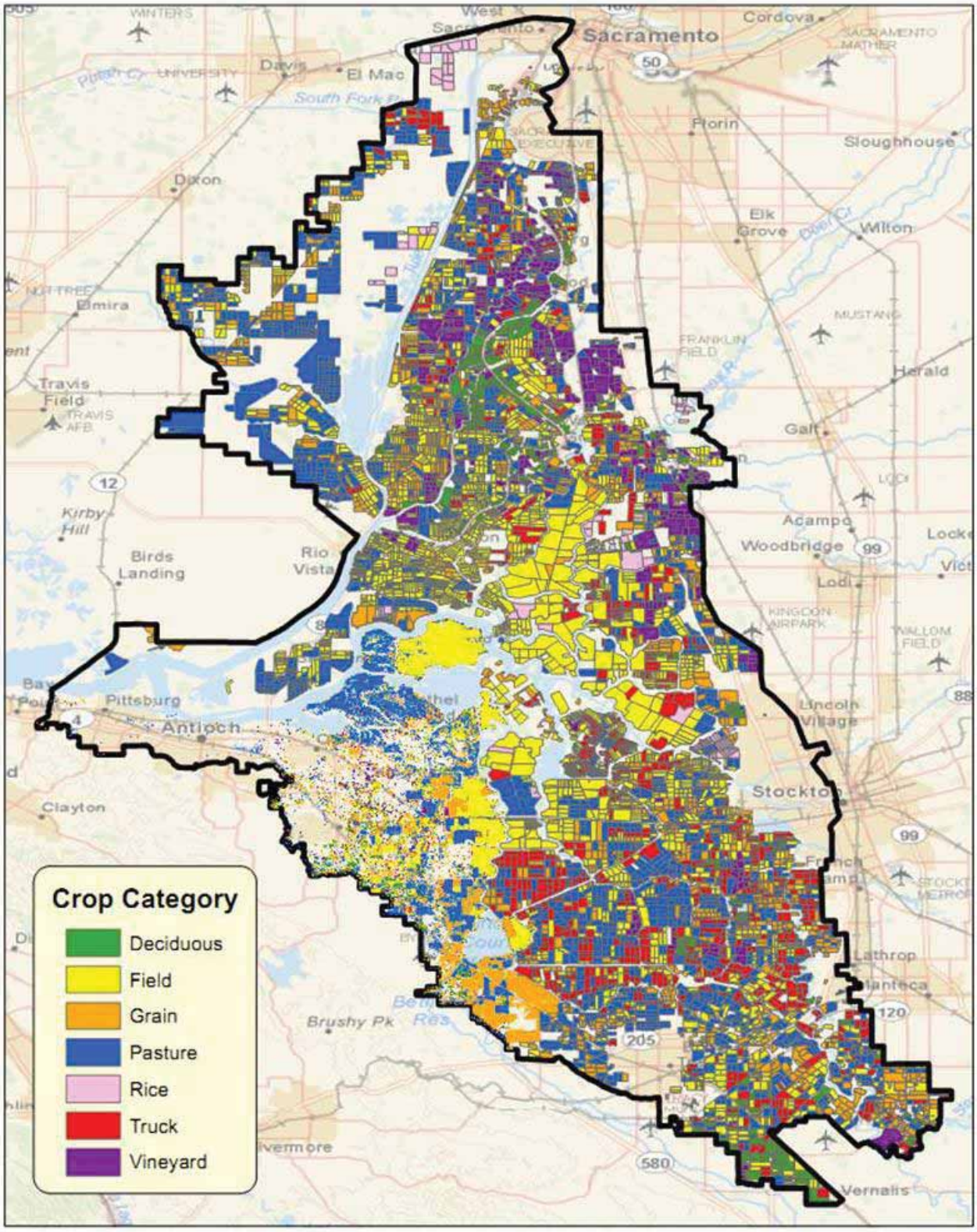


Figure 19 Agricultural Land Cover-2010. (Note: Grazing Land indicated on previous figure.)



2.4 Delta Agricultural Revenues

Total Delta agriculture revenues can be calculated using the acreage analysis described above and multiplying the acreage of each individual crop by the yield and unit price reported in county crop reports. This produces a total of $662 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 revenue-generating Delta crops.

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

Crop Class	San Joaquin	Sacramento	Yolo	Solano[1]	Contra Costa[2]	Alameda	**TOTAL**
Deciduous	25,118	41,738	3,345	1,347	8,667	498	**80,713**
Field	65,453	17,164	4,860	9,331	19,327	7	**116,142**
Grain	14,539	2,775	1,618	4,615	288	65	**23,900**
Pasture	46,801	5,902	5,753	8,113	3,084	196	**69,849**
Truck	217,491	19,148	11,570	3,389	13,871	258	**265,727**
Vineyard	32,099	28,474	32,718	5,042	6,657	6	**104,996**
Grazing Land[3]	9	57	230	372	46	40	**754**
TOTAL	**401,510**	**115,258**	**60,094**	**32,209**	**51,940**	**1,071**	**662,082**

[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

[3] Grazing land acreage estimated from 2008 FMMP data and valued at $20 acre.

Figure 20 Average Revenues per Acre

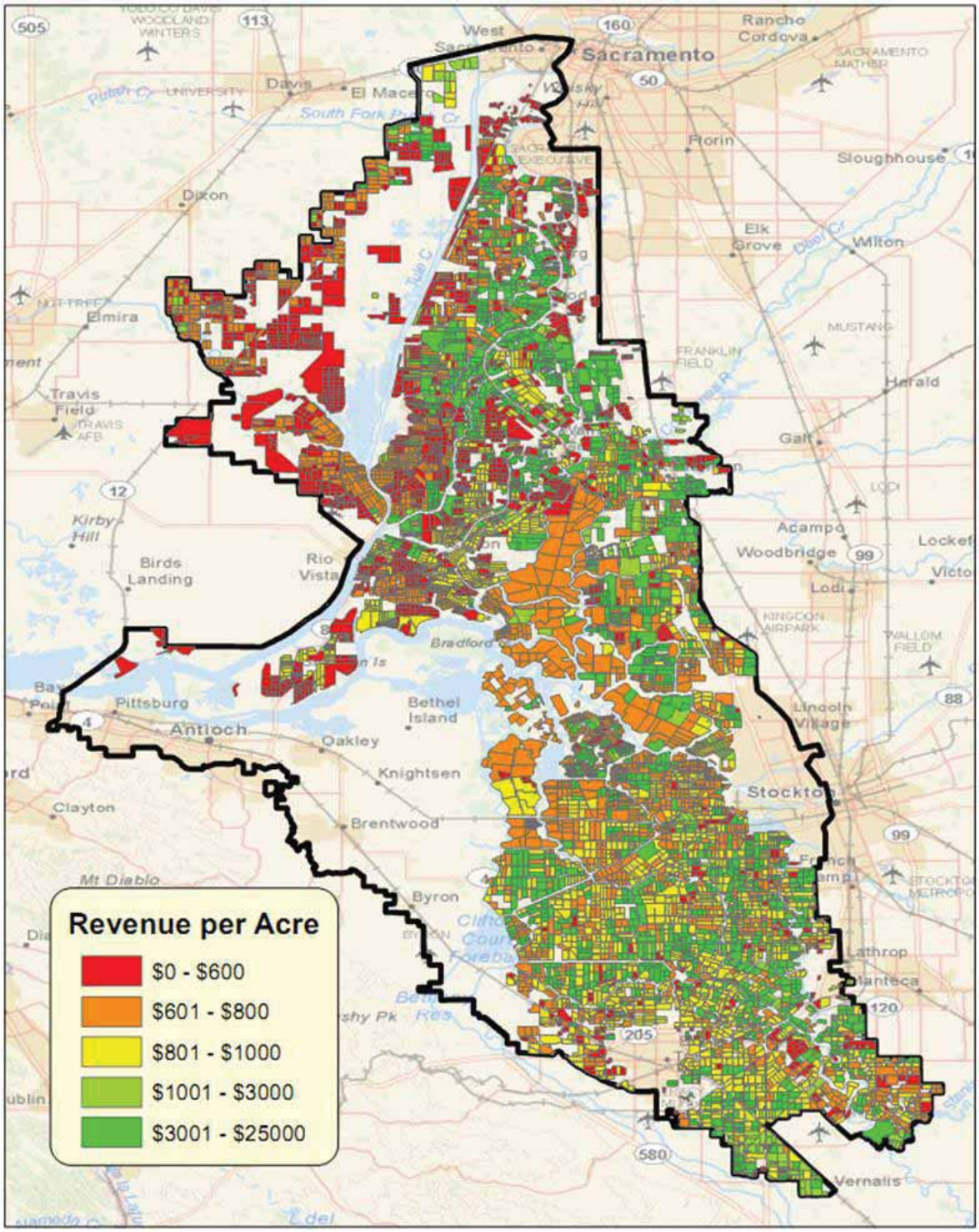


Table 10 Top 20 Delta Crops by Value, 2009

	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

3 Outcomes and Strategies Under Baseline Conditions

3.1 Long-run Forecasted Land Allocation

Important Note: The technical modeling in this section is being updated with additional data and explanation. While there is no change to the overall trend towards higher-value crops, the details of the projections could change significantly in the September draft.

A multinomial logit model produced a future allocation forecast, conditional on its current land allocation and other exogenous variables, including soil quality, salinity, temperature, slope, and field size. The model generates estimates of the probability of observing a given crop type in each specified field over a long-term time horizon. It was trained on a dataset of over 6,000 individual crop fields for which annual crop data was tabulated 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 the 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.

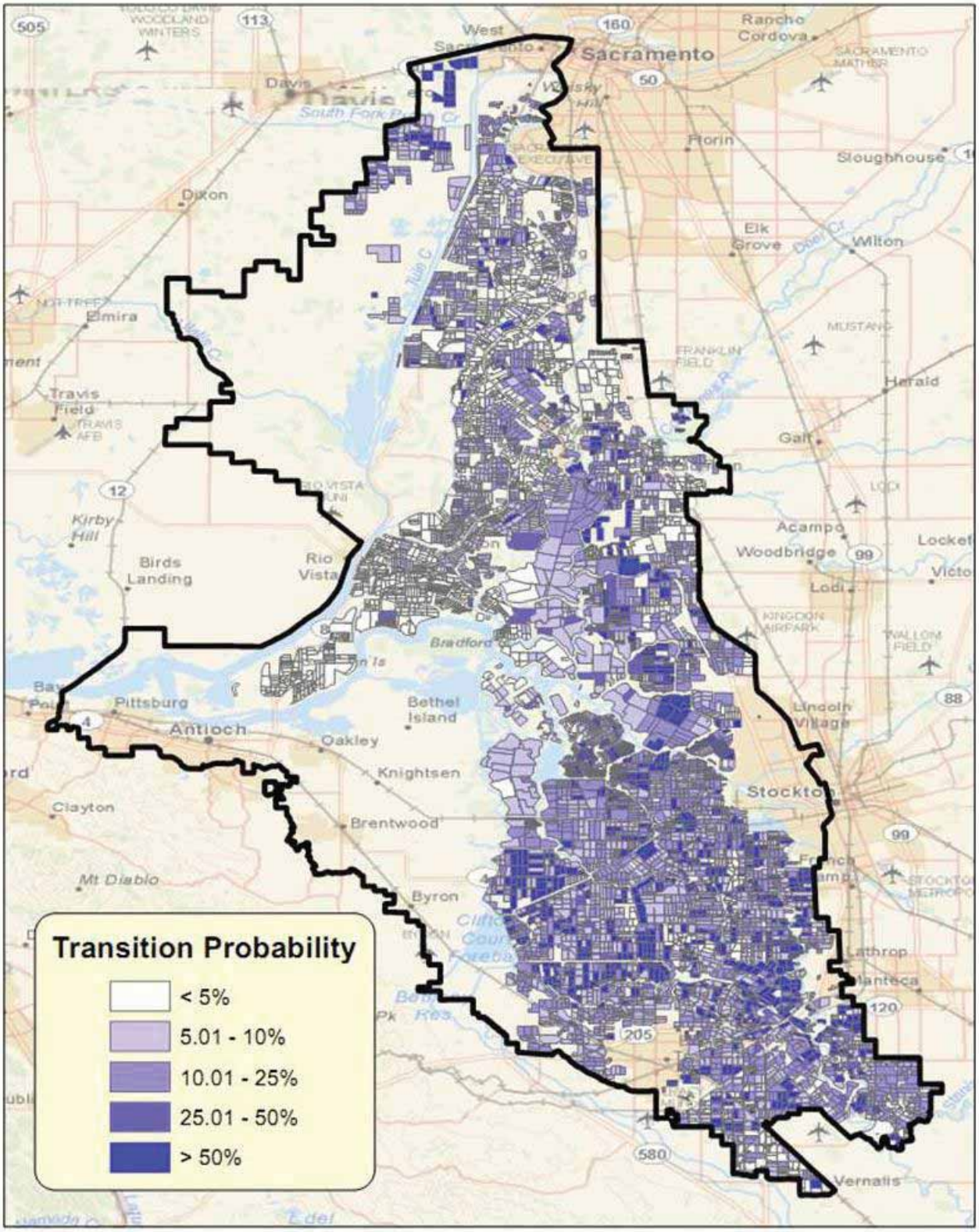
Many future crop allocations are possible, and these results merely depict the most likely allocation calculated by the model. A 10% shift towards higher-value crops over several decades is not a rapid shift and consistent with crop shifts in other areas throughout the Valley. Some stakeholders have stated an expectation that there will be somewhat more vineyard growth and less truck crop growth than the model predicts, but agree with the general prediction of modest growth in higher-value crops over time if farm land and water quality are protected.

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 21 on the following page. The map includes the individual transition probabilities of each field for which sufficient field borders data is available. Most predicted future truck crops are located in the southern end of the Delta, with 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 affect the yields of processing tomatoes and other common truck crops.

Figure 21 Probability of Long-run Transition to Truck Crops



4 Impact of Policy Scenarios

4.1 Salinity Impacts of Isolated Conveyance Facilities

Important Note: The technical modeling in this section has been updated with a longer time-series of data for key areas of San Joaquin County and some adjustments to the model in response to constructive suggestions from other economists. The revised results continue to show significant salinity impacts of a similar scale to those discussed below, although the details will change in the September draft. While the revised results will strengthen and add precision to the analysis, they are not expected to have any impact on the recommended actions in the Plan.

The introduction of isolated conveyance facilities is expected to significantly increase 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 be 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 the multinomial logit model creates an ability to capture the marginal impacts on crop choice of changes in salinity. These observations then can be used to predict how the agricultural composition of the southern Delta would change if it were subjected to various scenarios of increasing salinity. The calculations of crop production can then be used to estimate impacts on agricultural revenues.

4.1.1 Salinity Data

For the purposes of baseline salinity modeling, salinity data has been collected for over 50 sites in the Delta region. An analysis of salinity impacts required the creation of a variable representing average salinity on an annual basis. Based on information gained in a working group and further consultation with Delta farmers, a decision was made to use a value for the average salinity observed between May and August, when 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.

The modeling also required the ability to map salinity values to each individual crop field. In order to predict these values, salinity measurements were averaged across all observation sites in a three-mile radius of each crop field. The measurement value of the nearest station was used for fields without multiple monitoring stations within that radius. This generated 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.

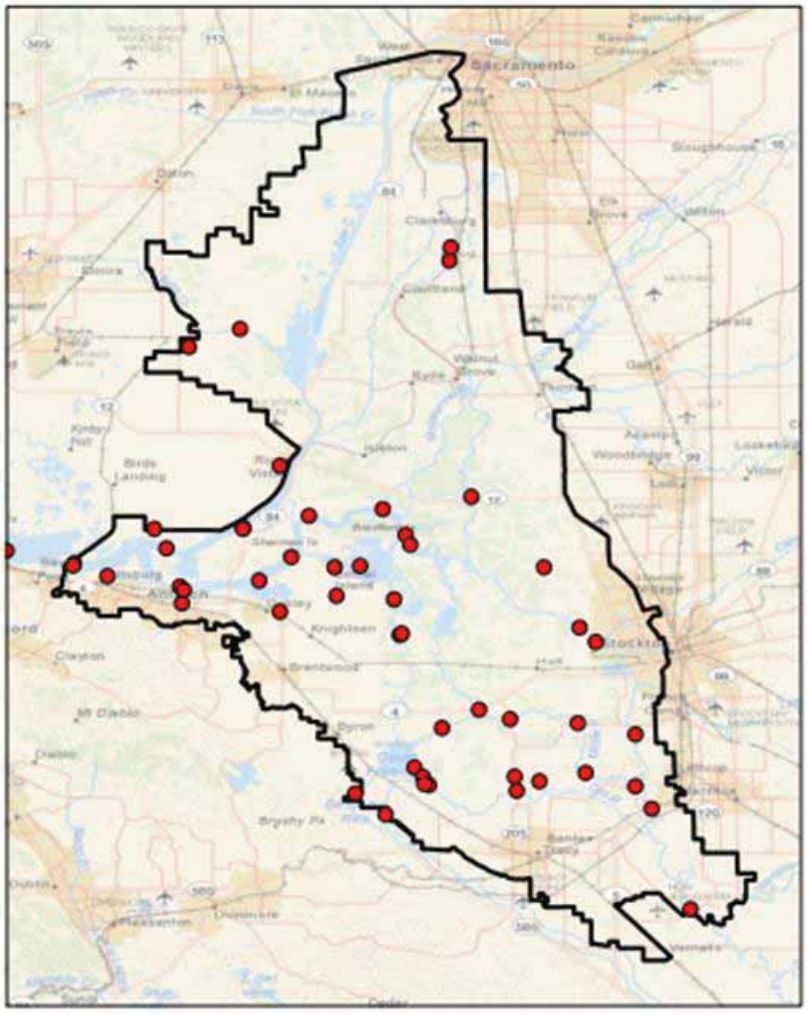
Interagency Ecological Program (IEP)

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 U.S. Bureau of Reclamation, and the U.S. Geological Survey. The sites are sampled daily, and the monthly average is taken based on reported daily values.

Figure 22 Salinity Observation Stations



4.1.2 Salinity Modeling

Tables in Appendix E give more detail about how average salinity varies across space and years in the Delta. It is important to emphasize that the data is presented here as a season long average and masks important spikes that often occur during years when the average is considerably lower. The five year sample for this preliminary modeling includes three dry years with very high salinity from 2007 to 2009, whereas salinity was significantly lower in 2006 and 2010. During 2008, average salinity levels in most of the Delta were 60% to 80% higher than in 2006. In the north Delta, average salinity is less than 200 ec in most years and there is relatively less variation between years. In contrast, the south Delta averaged 652 ec in 2008 and 361 ec in 2006, with some areas averaging 800 ec or more in 2008 and 2009. Thus, the south Delta experiences significantly higher levels of salinity and more variation than the north Delta. This reflects many factors, including the significant differences in water quality between the Sacramento and San Joaquin Rivers.

For preliminary calculations of impacts, scenarios were established for percentage increases in salinity for 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 estimates of salinity increases will 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	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
25%	4.91%	27.13%	10.85%	30.21%	20.04%	6.86%	747,063
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

The model predicts 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 potentially significant revenue impacts on Delta agriculture, and expected losses in tomatoes and wine grapes could be further amplified by downstream impacts on 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.

It is very difficult to determine the potential impacts of isolated conveyance at this time. There have been some reports that the isolated facility can and will be operated in compliance with current D-1641 standards in the south Delta of 700 ec, or proposed standards of 1000 ec. However, as noted in Chapter 5, the current BDCP does not include south and central Delta standards as it does for the north and west Delta. Thus, it is argued that the lack of standards combined with the necessity to pay for the over $12 billion facility through revenue from water sales will create pressure to operate the facility in a way that could lead to even larger increases in salinity. Nobody knows what will happen and the stakes are high for the Delta economy. Although some have commented that it is inappropriate to estimate impacts given these levels of uncertainty, these initial estimates are intended to stimulate additional research, analysis and discussion of this very critical issue.

One possible interpretation is that isolated conveyance will result in a typical year looking like 2008 when most monitoring stations in the south Delta were near the 700 ec standard. This would be a roughly 25% increase over the average levels between 2006 and 2010, and about a 50% increase over lower salinity years such as 2006 and 2010. According to the results in Table 9, the resulting loss in crop revenue would range from $28 million to $54 million. The proposed 1000 ec standard is a 42% increase over these levels, and would push the average year salinity increase to nearly 100%, a roughly $100 million loss. If water quality were to deteriorate even further, the losses would grow as illustrated by a predicted $191 million crop loss under a tripling of south Delta salinity.

The scenario in Table 9 discussed above measures the potential impacts from the predicted levels of future crop production. A more conservative scenario was also estimated that measures the potential loss from current levels of crop revenues and restricts the impacted area by eliminating conservation zone 9 and also conservation zone 6 in the most conservative scenario. Compared to a baseline of 2010 salinity, this approach estimates losses of $21 million to $34 million if all the impacted areas moved to average levels of 700 ec and losses ranging from $34 million to $63 million if all the impacted areas moved to the proposed standard of 1000 ec.

It is also important to note that the BDCP estimates that roughly 8,000 acres will still be required for a tunnel conveyance system, even though the land requirements are much lower than a surface canal. Most of the affected acres are in relatively high value agricultural lands in the North Delta that currently average about $2,000 per acre in revenue. Using detailed acreages allocated across crop classes in the draft BDCP, the land consumption of the isolated conveyance project would result in an additional $10 to $15 million annual loss to Delta agricultural revenues.

From the discussion above, it is clear that there is much uncertainty regarding the effects of isolated conveyance and that the potential losses for the south Delta are significant even under

the lowest scenarios. At this time, a conservative estimate of revenue losses in a range between $20 million and $65 million from salinity plus $10 to $15 million from land consumption is a reasonable estimate for discussion. This range is below the estimate of $70 million in Delta farm revenue losses from a peripheral canal made by Howitt in 2007.[61] However, there is a significant risk that losses could be much higher, especially given the lack of specific south Delta water quality standards in the draft BDCP and the expected political and financial pressure to weaken any future standards.

4.2 Loss of Agricultural Value from Habitat Conservation Scenarios

As outlined in Chapter 5, this report seeks to address impacts of four major conservation measures 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. Replicating the spatial extent of these zones and analyzing the agricultural landscape of each gives an estimate of the impacts on agriculture that 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 23.

Table 14 Agricultural Composition of BDCP Conservation Zones

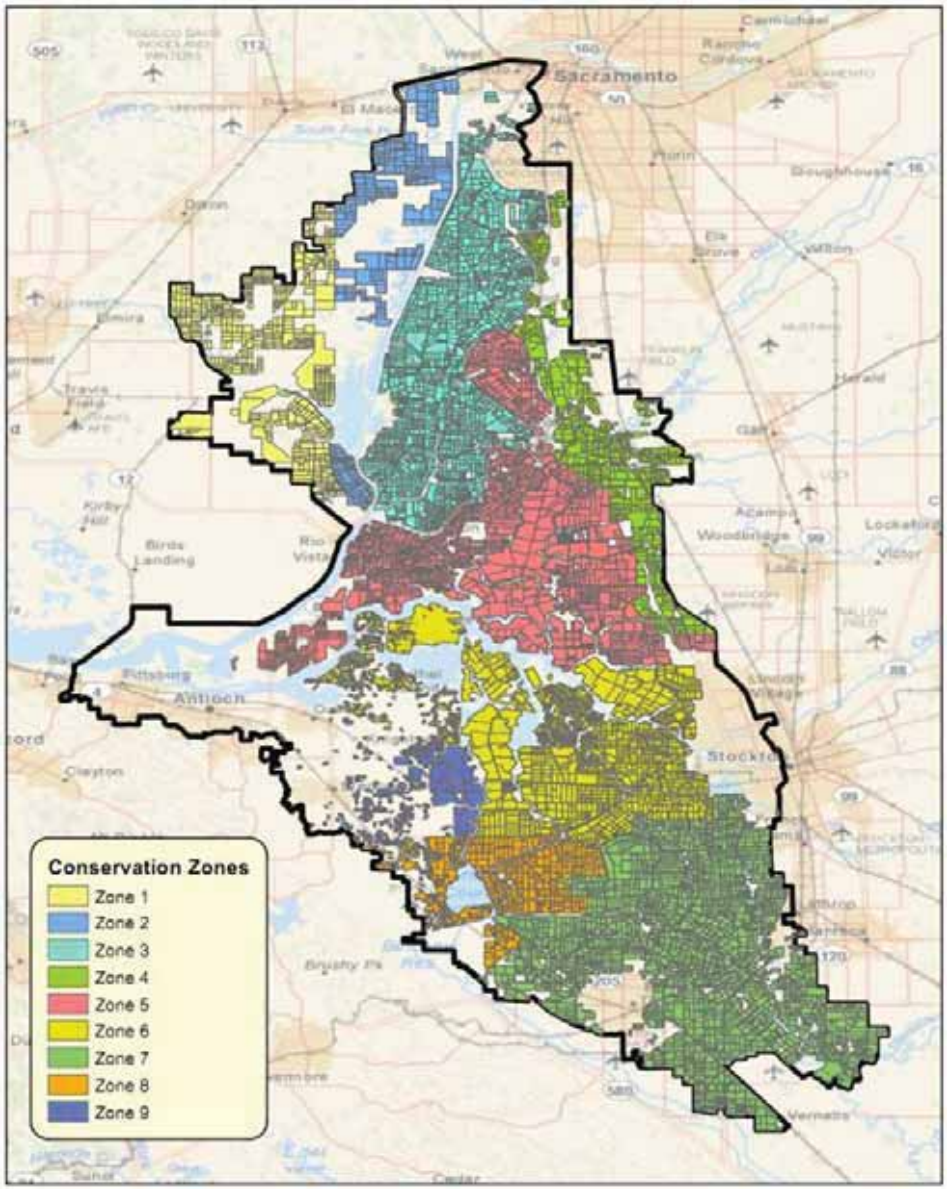
Conservation Zone	Agricultural Acreage (2010)	Revenue per Acre (2009)	Relevant Conservation Measures
1	31,030	$463	CM3, CM4
2	14,064	$802	CM2, CM3, CM4
3	59,011	$1,474	CM6
4	26,441	$2,075	CM3, CM4, CM6
5	75,239	$1,838	CM3, CM4, CM6
6	71,219	$1,885	
7	89,716	$1,823	CM3, CM4, CM6
8	27,595	NA	
9	15,809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

[61] Howitt, Richard. "Delta Dilemmas: Reconciling Water-Supply Reliability and Environmental Goals." *Agricultural and Resource Economics Update* 10(4)(2007):1-4.

4.2.1 Yolo Bypass Fisheries Enhancement

Major impacts on agriculture from Yolo Bypass Fisheries Enhancement 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, and the use of rangeland could also be impacted. Total agricultural revenue in the area is currently estimated at about $12 million, and the draft BDCP estimates flood easement costs would average about 25% of current land values. Based on this, a rough estimate of annual crop revenue impacts is $1 million to $5 million annually. Yolo County is working with BDCP to develop a proposed project that minimizes or avoids impacts to existing land uses. Like other preliminary cost estimates for habitat measures, the estimated impacts could change as plans change over time.

Figure 23 BDCP Conservation Zones



4.2.2 Natural Communities Protection

The Natural Communities Protection strategy has several elements, the most significant of which is the acquisition of 32,000 acres in "wildlife friendly" agricultural 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. In addition, the specific terms of the easements are not known, and the draft BDCP contains a very wide range of potential easement costs as a percentage of current land values.

Table 15 below provides a more detailed overview of acreage revenue for Delta cropland. The average revenue per acre of all Delta agriculture is $1,755, while the median is much lower, $818. This range reflects the range of potential impacts of agricultural conservation easements in the Delta. Easements may target relatively low value, wildlife-friendly field and grain cropland to make slight modifications in operations and protect them in these uses. In this case, the agricultural impacts are relatively small. Alternatively, the easements could attempt to convert land used for higher-valued crops such as tomatoes and wine grapes to more wildlife-friendly, lower-valued crops. This more aggressive scenario could generate significant losses of tens of millions of dollars. Considering all this information, a preliminary estimate of agricultural losses is a very wide range of $5 million to $43 million annually.

Table 15 Agricultural Revenue Distribution

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

4.2.3 Tidal Habitat Restoration

Of the major conservation measures addressed in this report, Tidal habitat restoration has the most clearly defined geographic areas and restoration targets. The agricultural fields contained in each Restoration Opportunity Area (ROA) are shown in Figure 24, 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 the Delta and Suisun Marsh. In addition, there are minimum values for acreage in each of the four ROAs which must be restored, as shown in Table 16. A minimum of 7,000 acres is targeted for Suisun Marsh which lowers the maximum target for tidal habitat in the Delta to 58,000 acres.

Figure 24 BDCP Restoration Opportunity Areas

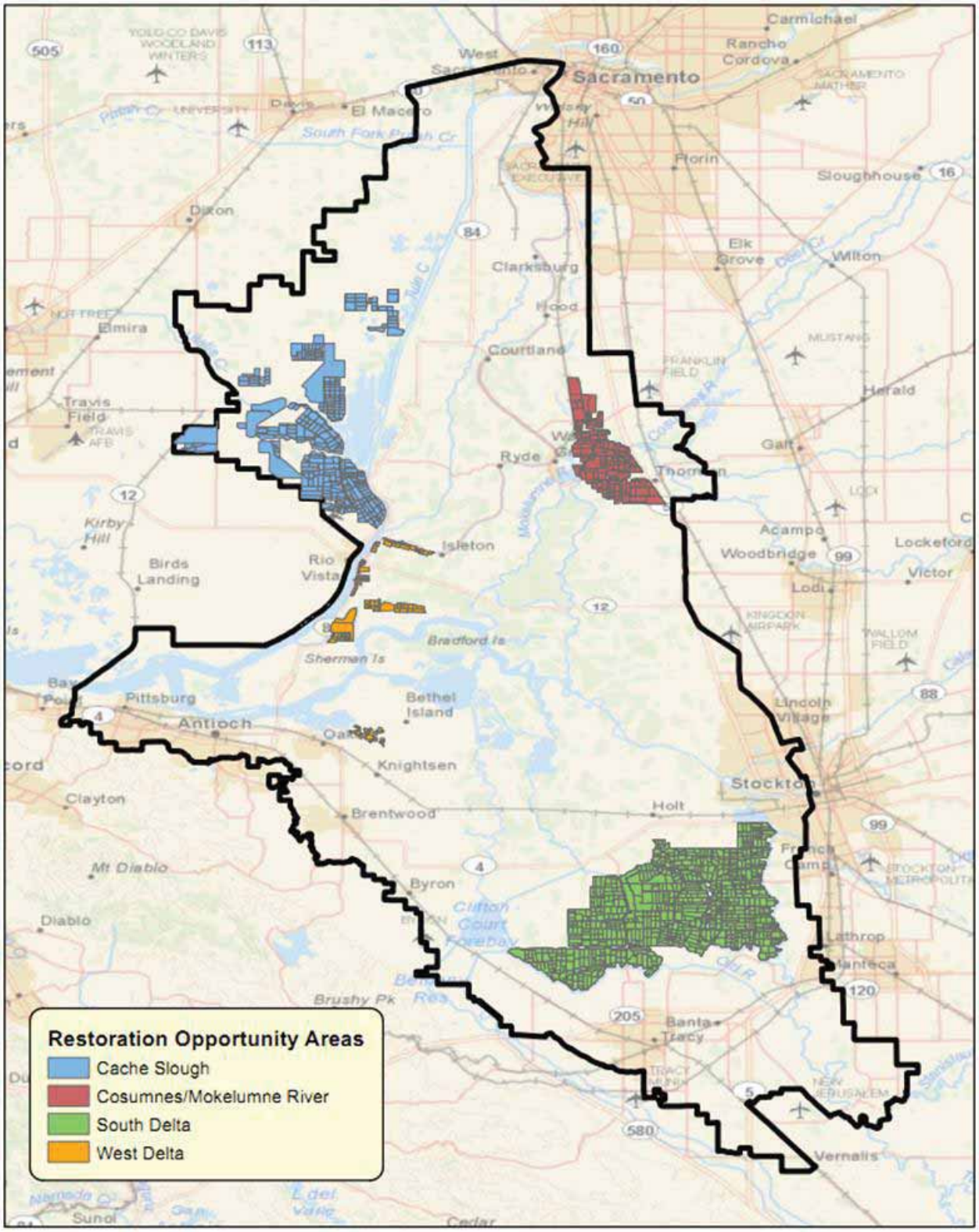


Table 16 Agricultural Composition of BDCP Restoration Opportunity Area

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. Even if over 50,000 acres were restored in Suisun Marsh so that only the minimum restoration targets were reached in the four Delta ROAs, total agricultural revenue loss would be about $18 million per year with nearly $11 million of the total loss occurring in the South Delta. If only the minimum were restored in Suisun Marsh and the remaining 58,000 acres distributed across the Delta, the estimated revenue loss would reach $77 million per year with about a $46 million loss in the South Delta.

The wide range of potential agriculture losses ranging from $18 million to $77 million annually illustrate the risk and uncertainty this conservation strategy poses for Delta agriculture, particularly in the South Delta. Compared to the other conservation measures, the tidal marsh restoration strategy entails by far the largest necessary direct impacts on Delta agricultural production, and also has some of the highest direct implementation costs for BDCP. 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. Targeting criteria that avoids high-value agriculture lands and reduced target acreages, particularly in the South Delta, should be considered.

4.2.4 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. Based on current

production, the San Joaquin River Floodplain Restoration could reduce annual agricultural revenue by $15 million to $20 million per year.

An alternative proposal focused on enhancing the flood bypass at Paradise Cut has been developed cooperatively between environmental groups and local Delta landowners. This proposal would generate significant flood control and ecosystem benefits while limiting agricultural impacts to 2,000 acres, thereby reducing agricultural impacts by up to 80%. The alternative proposal is recommended in the fourth draft of the Delta Stewardship Council's Delta Plan.

4.3 Loss of Agricultural Value from Open Water Scenario

The central Delta open water scenario discussed in chapter 5 would result in a loss of agricultural production on the flooded islands. The impacts can be quantified simply by looking at the agricultural farmland currently in production on each island. If the five islands were flooded, assuming Empire Tract is not included, 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**

5 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, two additional areas needed to be considered: 1) the value of animal agriculture in the Delta, and 2) the output of local food and beverage manufacturing firms that are located in the region because of Delta crop output.

5.1 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.

Estimates produced for this study are very similar. Enterprise data from Dun and Bradstreet and NETS were used to identify dairy, cattle, and other animal production enterprises located within the legal Delta, and this figure was compared to the total number in the counties. The percentage of animal enterprises in each county located in the Delta was applied to the total animal production in the crop reports for each of the five Delta counties, resulting in an estimate of $93 million in animal output, 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**

5.2 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 or for other reasons. To be conservative, only food and beverage manufacturing (where a clear and strong link to local production could be established) were used. Other factors considered included 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. It was 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, to be conservative, dairy production outside the Legal Delta was not attributed 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 percent 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 compared to local

output than winery capacity, 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, it is estimated that $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, it is estimate that $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 (mostly Napa) is sourced from the Delta.

5.3 Economic Impact Estimates

The IMPLAN 3 model calibrated to 2008 regional and statewide economic data was used to estimate the overall economic impact of Delta agriculture. See Appendix E for a description of the IMPLAN model and formal definitions of terms such as direct, indirect, and induced effects. As has been 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, the default IMPLAN production functions were adjusted to account for the unusually high use of contract labor in California agriculture. The production functions were adjusted to ensure that virtually all (97 percent) of the output of the agricultural service sector was utilized by the regional agriculture industry, a methodology that recently yielded accurate predictions of the employment effects of the 2009 drought in the San Joaquin Valley.

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. In the initial model, only the impacts of the $753 million in direct agricultural production were modeled. As shown in Table 20, the approximately $660 million in Delta crop production and $90 million in Delta animal and animal product revenue has an economic impact of 9,250 jobs, $635 million in value added and $1.3 billion in output in the five Delta counties. Table 21 shows that across all of California, the economic impact of Delta agriculture is 12,360 jobs, $761 million in value added, and $1.5 billion in output without including upward linkages to canneries and wineries.

To get a more complete picture of the full economic impact, the impact of locally linked food manufacturing in fruit and vegetable canning and wineries were included. These upward linkages must be estimated separately, because the indirect effects of the IMPLAN model only includes backwards linkages from purchased inputs. To avoid double counting impacts from the initial stage, the indirect effects attributed to the purchase of crops as inputs to canneries and wineries were netted out of the results. The total five county economic impacts are displayed in Table 22. Delta agriculture supported 13,700 jobs, $1.11 billion in value-added, and $2.77 billion in output. For the California economic impact model, the additional $541 million of Delta dependent winery production from adjacent counties was add to the totals. The economic impact rises from this extra production, and also because the indirect and induced effects grow when considered on a statewide rather than five-county basis. Table 23 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 $)
1 Oilseed farming	3.3
2 Grain farming	136.7
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
Locally Linked Processing in expanded analysis	
54 Fruit and vegetable canning, pickling, and drying	722
72 Wineries	180.5 in Delta 722 statewide

Table 20 Economic Impact of Delta Agriculture on 5 Delta Counties (not including processing)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	4,005	$136,405,744	$338,921,900	$753,700,032
Indirect Effect	3,826	$143,749,040	$176,479,000	$348,913,376
Induced Effect	1,419	$64,282,712	$119,500,200	$203,569,088
Total Effect	**9,250**	**$344,437,504**	**$634,901,100**	**$1,306,182,528**

Table 21 Economic Impact of Delta Agriculture on California (not including processing)

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	4,955	$147,794,976	$338,921,800	$753,700,032
Indirect Effect	5,199	$191,501,232	$222,314,000	$411,410,112
Induced Effect	2,206	$110,576,296	$199,624,100	$351,857,728
Total Effect	**12,360**	**$449,872,512**	**$760,860,000**	**$1,516,967,936**

Table 22 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 23 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**

6 Other Agriculture Issues

There has been significant interest in alternative forms of agriculture in the Delta, as well as new approaches to increase agricultural revenue. Many of the ideas have been proposed in Delta Vision and other Delta related plans and reports. Ideas include increased agri-tourism, regional branding and marketing of Delta crops, growing crops for biofuels, subsidence-reversal agriculture, and growing crops for carbon sequestration purposes and the marketing of carbon credits. Some of the ideas are promoted for the dual benefits of ecosystem restoration and reducing flood risks, whereas others are primarily seen as a way to enhance local agricultural income.

Most of these options were evaluated in a recent report by the UC Davis Agricultural Issues Center (AIC) developed for the California Department of Food and Agriculture and presented to the Delta Stewardship Council. In virtually all cases, the AIC report determined that the ideas have very limited potential to develop a significant market in the Delta. For example, most Delta crops are commodities such as corn and processing tomatoes are commodities for which branding is not effective.

Agritourism, defined as recreational, educational and other visits to working farms, is a small but fast growing source of income for farms in the region. As discussed in the Appendix of the recreation and tourism chapter, agritourism was estimated by USDA to generate $4 million in income for farms in the five Delta counties in 2007. Assuming agritourism in the Delta is proportional to overall agriculture in the county, a roughly 25% share, agritourism generated roughly $1 million in revenue in 2007. An inventory of agritourism enterprises in California maintained by UC cooperative extension (http://www.calagtour.org/) identifies 91 agritourism operations in the five Delta counties, and 12 (13%) of these are located in the Delta. Over half of the Delta agritourism enterprises were in Contra Costa County where there is a cluster of U-pick orchards and other farms open to tourists around Brentwood. Only one of the twenty agritourism locations in San Joaquin County was in the Delta, but it was a very large attraction at Dell'Osso Family Farm adjacent to Interstate 5 near Lathrop that is estimated to draw over 100,000 visitors each fall to its corn maze and other attractions. Currently, it appears that agritourism is only significant in the suburban edges of the Delta secondary zone

A January 2011 report prepared for the Nature Conservancy examines the potential of carbon capture wetland farms and low carbon agriculture in the Delta.[62] Although carbon capture wetland farms could generate environmental benefits and potentially reverse subsidence on Delta islands, the report casts doubt on whether carbon capture farming is economically viable, although the authors encourage large scale demonstration projects to further research the potential. Specifically, the authors state:

> "Our analysis illustrates that Carbon Capture Wetland Farms are unlikely to provide a clear incentive to both landowners and investors without either fairly high carbon prices or some type of grant or payment scheme to subsidize some of the costs of conversion and annual management." (p. 106)

The report also details other problems including increased methylmercury, organic carbon, and mosquitos that could have negative impacts on various aspects of the Delta economy. The report discusses other low carbon changes to agriculture including conversion to rice growing and reduced tillage practices that may be more economically feasible. The authors encourage large-scale demonstration projects to more fully research the potential of carbon capture wetland farms.

All of these ideas for alternative agricultural revenues have some potential for the Delta. However, it is important to maintain realistic expectations and not use the ideas to deflect discussion of larger actions within BDCP or the Delta Plan that could have negative effects on Delta agriculture.

[62] A. Merrill, S. Siegel, B. Morris, A. Ferguson, G. Young, C. Ingram, P. Bachand, Holly Shepley, Maia Singer, Noah Hume. 2010. Greenhouse Gas Reduction and Environmental Benefits in the Sacramento-San Joaquin Delta: Advancing Carbon Capture Wetland Farms and Exploring Potential for Low Carbon Agriculture. Prepared for The Nature Conservancy, Sacramento, California. Available at: *(http://www.stillwatersci.com/).*

Chapter 7: Recreation and Tourism

1 Overview and Key Findings

- Recreation is an integral part of the Delta, complementing its multiple resources and contributing to the economic vitality of the region. Nearby residents visit virtually every day, 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.
- 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 a percentage of visitors to the Delta come from elsewhere, the majority of visitors are from Northern California. These visitors represent the focal market for Delta recreation growth opportunities in the future, and their places of origin define the market area for this study. The total Market Area had a population estimate of approximately 11.9 million in 2010, with projections of 17.6 million by 2050.
- Based on demand models, recreation visitation for 2010 is estimated to be approximately 8 million *resource-related* (e.g., boating and fishing) visitor days of use per year, 2 million *urban parks-related* (e.g., golf, picnic, and turf sports), and 2 million *right-of-way-related* (e.g., bicycling and 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 is estimated at roughly $251 million inside the Delta (in 2011 dollars). 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.
- When attracting visitors and expanding recreation access to waterways and landside recreation improvements, potential negative impacts on agriculture from increased tourism and recreation can be minimized by focusing recreation uses and activities through expansion of existing recreation sites, development in Legacy Communities, and creating buffer areas adjacent to agriculture.
- The future growth of recreation in the Delta consists of five location-based strategies which would emphasize:
  - 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. An existing organization should be designated as a Delta recreation and tourism marketing and economic development facilitator.
- If resource quality and recreational facilities are maintained such that the Delta retains its current level of competitiveness as a recreation destination, baseline forecasts for visitation show increases of 3.4 million visitor days, or about 35 percent, over 40 years.
- Assuming that current visitor spending patterns remain unchanged and Delta business growth accommodates recreation-related spending increases, baseline visitation growth is estimated to increase spending in the Delta roughly $78 million (2011$) to about $329 million (2011$) by 2050.
- Possible policy scenarios are qualitatively evaluated as to their primary elements and their potential positive and negative impacts on recreation.
  - Scenarios evaluated may affect recreation visitation by a range of a decrease of approximately 23 percent to an increase of approximately 13 percent over the baseline scenario, with the largest potential for negative impacts from increased regulatory changes and the largest potential for positive impacts from the habitat conservation scenario.
  - Visitation changes would affect recreation-related spending in the Delta, with spending impacts ranging from increases of roughly 14 percent, a positive impact of $47 million, to decreases of 23 percent, a negative impact of $77 million, in 2050, as compared with the baseline forecast.
  - The largest potential negative impacts would result from regulation changes, six-island flooding, salinity increases in the central and south Delta, large tidal marsh creation in the south Delta, and intake and pumping stations near Clarksburg and Courtland.
  - Positive impacts could result overall through project enhancements to fishing, wildlife viewing and nature study, and Delta-as-a-Place.

2 Introduction

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 a vast area, covering over half a million acres, with about 60 islands and over 650 linear miles of waterways and channels.

The Delta links California's Central Valley with the San Francisco Bay. It is surrounded by cities (some of which have historic roots) and urbanizing areas at the edge of the Delta, and its two primary rivers, the Sacramento and the San Joaquin.

Approximately 12 million people live within close proximity of the Delta, yet most do not see it as a vital water source for the state, 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 recreation opportunities found there.

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

Recreation is an integral part of the Delta, complementing its multiple resources and contributing to the economic vitality of the region. Nearby residents visit virtually every day, 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.

3 Current Status and Trends

3.1 Understanding 'Delta as Place' Today

The Delta is difficult to characterize as both a region and, likewise, a recreation destination. Unlike well-known water recreation destinations such as Lake Tahoe or Shasta Lake, the Delta is not a single entity and cannot easily be conceived in its entirety. It has highly varied physical attributes and covers a vast and varied landscape that can be viewed and accessed from activity points that are so disparate, it is possible to repeatedly visit the Delta and still have little understanding of exactly what the Delta is or how large it is.

Extending more than 50 miles from north to south, the Delta is sometimes centered on a wide river, though more often it is a network of narrow channels, sloughs, and islands. It presents itself from two distinct vantage points, each of which represents a completely different character. One view is from the water, where the landscape typically lies, unseen, behind tall levees and riparian vegetation, with only distant mountains visible. From the perspective of thicket-edged sloughs, narrow rock-faced channels, or spreading, open waterways, there is little landside context. The other view of the Delta, the landside perspective, largely precludes the water environment, which can be glimpsed primarily from levee-top roads and bridges. The predominant visual character landside is the agricultural landscape, which is as varied as the waterscape hidden on the other side of the levees.

This setting creates a place of 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 and less notion of where it begins and where it ends.

Defining the Delta for visitors and recreation users is a necessary and yet difficult task. Because of the scope of the disparate environment, recreation destinations appear as 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. Sailors coming up from San Francisco Bay would use the same area, but define the Delta as offering protected deeper channels and coves. 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, house-boaters, birders, hunters, and others, each seeking an aspect of the Delta specific to their interests and water-based pursuits, will define the Delta in their own specific terms.

Recreationists from the landside may see a completely different Delta. 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, wineries and produce outlets, and sometimes, perhaps a Legacy Community's historical or cultural landmarks.

3.2 Existing Physical Conditions

3.2.1 Resource and Facility Analysis

3.2.1.1 Existing Facilities

In the Delta, people seeking recreation experiences primarily 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, which generally are related to habitat areas.

3.2.1.2 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,*[63] 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, 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 25 provides a map of recreation zones and Figure 26 shows recreation facilities. Table 24 summarizes all facilities, as of 2002, by recreation zone with additional information about these zones.

The Delta's other major private recreation facilities are the numerous private hunting clubs, which typically are associated with agricultural lands. Very little information exists on the number of these facilities or the number of hunters who utilize them. In a 1997 survey, the Delta Protection Commission identified 23 private hunting facilities, most in Yolo County. Conversations with hunters indicate that many additional formal and informal hunting clubs are 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 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. The preserve has a visitor center with picnic areas, interpretive displays, restrooms, and three designated hiking trails and allows bird watching, photography, hiking, and paddling.

[63] DBW 2002

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 27).

Table 24 Summary of Facilities and Resources by Recreation Zone

	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[64]	3	0	7	28	12	6	56
Source: DBW 2002, Table 2-1, Page 2-5							

[64] A phone and internet survey was completed as part of this project to update the total number of fuel stations. Upon phoning or viewing websites of the marinas previously identified as having fuel stations, it was found that currently (July, 2011) 43 of the prior-identified 56 marinas still have fuel docks, 7 indicated they no longer provide this service, and six had phone lines that had been disconnected. However, the numbers in Table 24 are left as is, as those were taken directly from the DBW 2002 survey and other numbers have not been updated.

Figure 25 Delta Recreation Zones

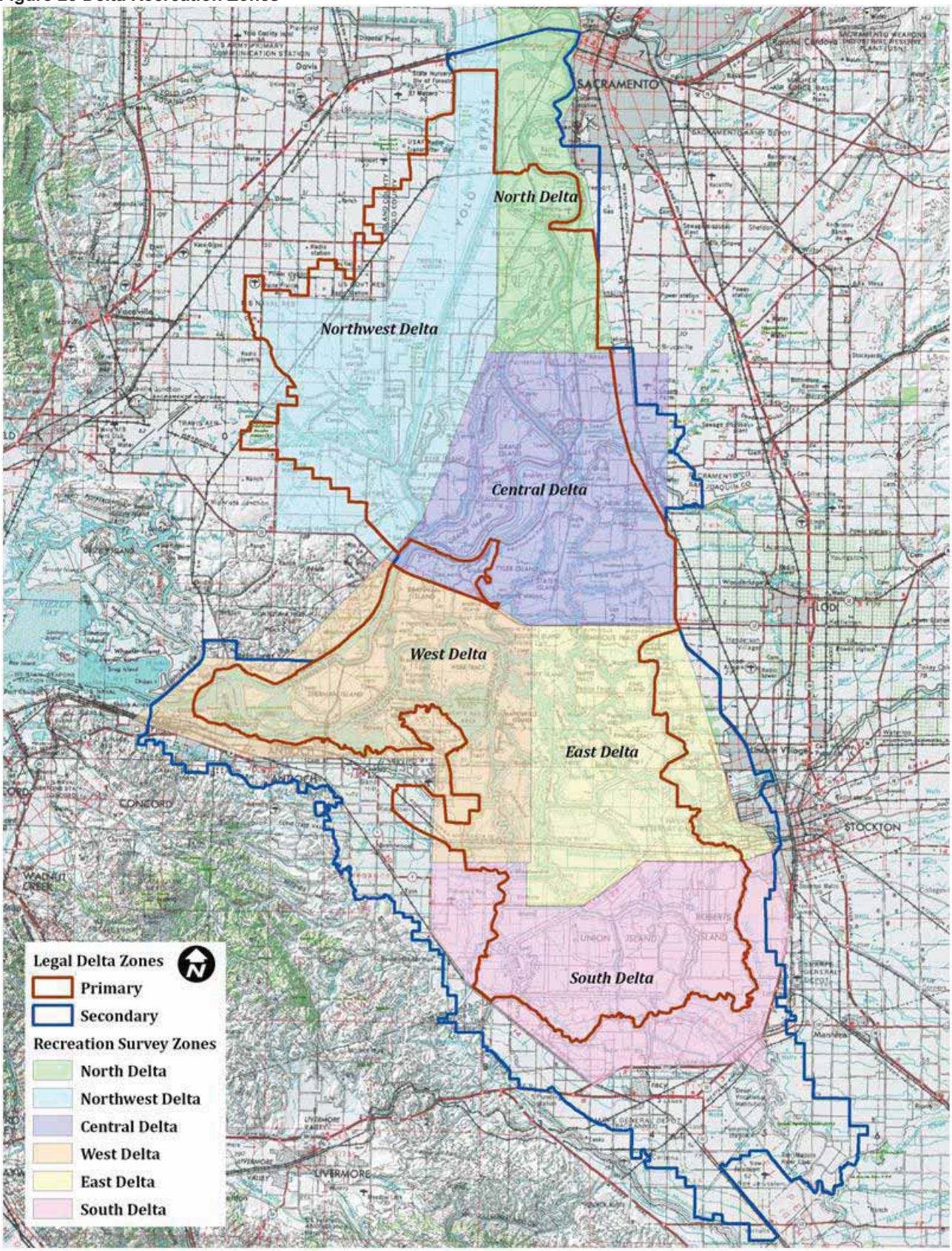


Figure 26 Delta Recreation Facilities

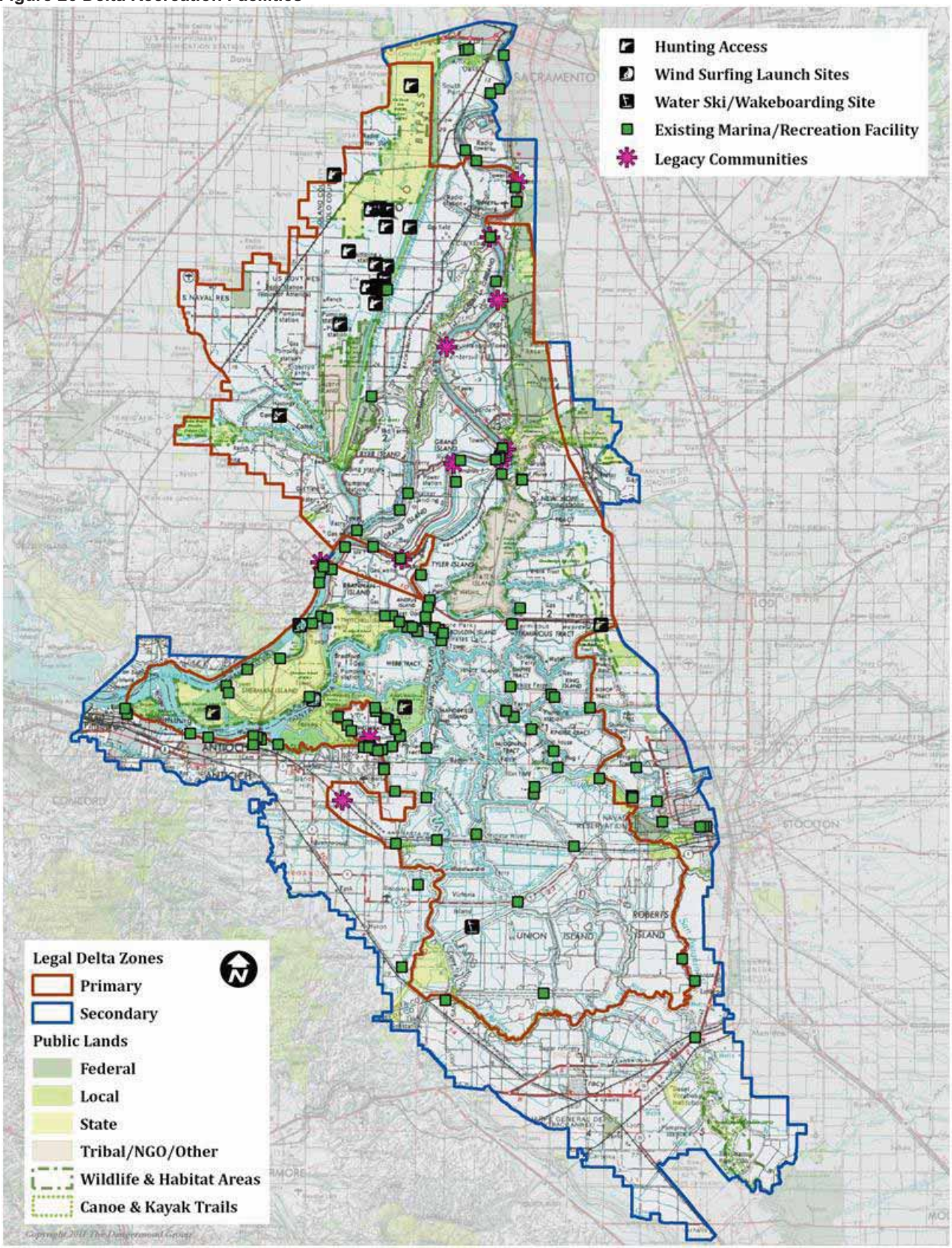
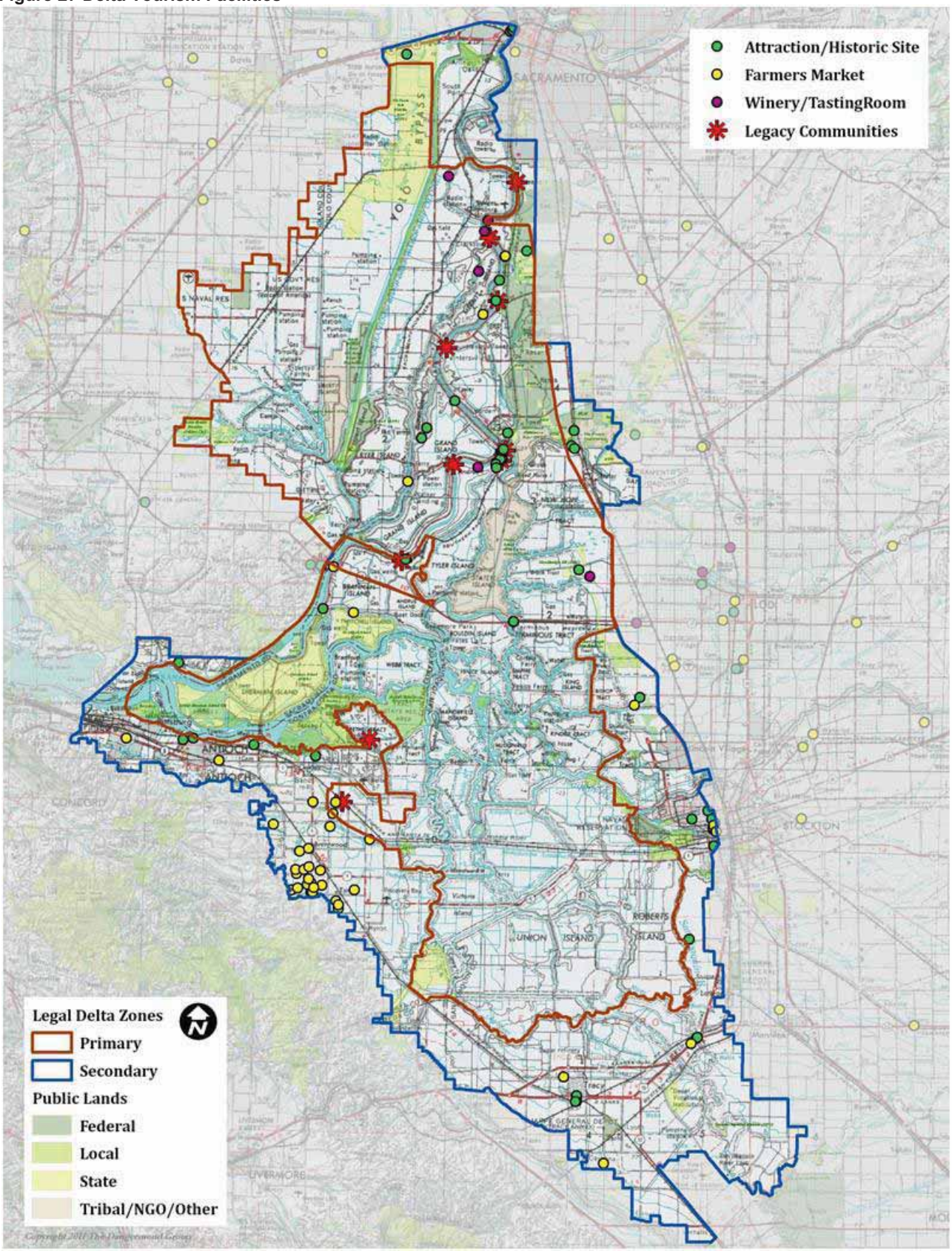


Figure 27 Delta Tourism Facilities



3.2.1.3 Public Facilities

There are a number of publicly-owned lands in the Delta, covering almost 40,000 acres. A percentage of these lands is 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.[65,66] 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 27 above lists some of these public facilities.

3.2.1.4 Recreation Enterprises in the Delta

A variety of data on business enterprises in the Delta describe economic activity attributable to recreation and tourism. As seen in Table 25 below, nearly 100 business enterprises within the Primary Zone are recreation-related. In the Secondary Zone, there are nearly 1,500 recreation-related enterprises, though many businesses likely provide for broad urban and non-local recreation opportunities in addition to serving Delta recreation.

Within the recreation-related businesses, the detail for “Accommodations” was further expanded and is presented in Table 26. There are very few choices for recreation travelers for overnight accommodation within the Primary Zone. The only establishment that provides rooms within the Primary Zone is the Ryde Hotel. There are a number of additional hotels, motels, and bed and breakfasts within the Secondary Zone; however, they seem to primarily cater to travelers through the area, rather than Delta recreationists. Also, as listed above in Table 24, there are approximately 2,100 campsites within the Delta.

[65] State Parks 2010, p. 20-21.
[66] This site is on the State Parks closure list and may be closed to public access as of July 1, 2012.

Table 25 Data for Recreation-Related Enterprises within the Legal Delta in 2008[67]

	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 (including marinas)	34	255
Accommodation	22	148
Food Services and Drinking Places	26	778
Total	96	1,460
Source: NETS; UOP		

Table 26 Accommodations within the Delta

	Hotels, Motels, and B&Bs	
	Number of Establishments	**Number of Rooms**
Primary Zone	1	32
Isleton and Rio Vista	4	56
Secondary Zone	70	4,451
Delta Total	75	4,539
Note: There are also 84 small cabins available for rent in campgrounds, and 31 additional rooms available for special events, primarily weddings at Grand Island Mansion.		
Source: NETS, UOP		

3.2.1.5 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.*[68] The following constraints have an impact on current facilities and recreation access and are described in more detail below.

- 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
- Lack of fishing access from the shore and boat launches

[67] Boat repair services were also examined. In total there are 37 establishments offering boat repair services - 5 in the primary zone and 32 in the secondary zone. These establishments are included in Table 25 under Marinas, Boat Dealers and Boat Builders.
[68] DPC 2006, pp. 56-69

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 marina owners and boating facility operators. 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.

The U.S. Army Corps of Engineers is spearheading a multiple-agency process called the Delta Dredged Sediment Long-Term Management Strategy (LTMS)[69] that aims to, among other goals, clarify the permitting process relative to Delta dredging and reuse projects. They are working to create an effective multi-agency task force called the Delta Dredging and Reuse Management Team (DDRMT), similar to the inter-agency Dredge Material Management Office (DMMO) which exists in San Francisco Bay. They are also working on drafting a Joint Permit Application.[70]

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 boating 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.

Other gates, screens, and barriers that exist throughout the Delta include Montezuma Slough Salinity Gates, South Delta Temporary Barriers (operated by DWR), and a wide variety of bridges and drawbridges. The proposed Two-Gates project has been developed by the U.S. Bureau of Reclamation and the Department of Water Resources. This project would install gates on Old River and Connection Slough in order to manipulate the flow of turbid water to keep Delta smelt away from export facilities.[71] This proposed project, currently on hold, would install temporary barriers along two waterways used by 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 1980s 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), be dangerous for swimmers, and create operational problems for both boaters and water infrastructure. DBW has primary responsbility for removing water hyacinth and *Egeria densa*, though the program is

[69] For more information, see http://www.deltaltms.com/index.htm
[70] http://www.deltaltms.com/DredDispReusePer.htm
[71] http://www.usbr.gov/mp/2gates/docs/2-Gates_Factsheet_latest.pdf and http://www.water.ca.gov/deltainit/docs/TwoGatesProject.pdf

underfunded compared to the magnitude of the problem. More recently, South American Spongeplant (*Limnobium laevigatum*), a floating plan similar to water hyacinth, has been found in California waterways and is being watch by local and state agencies for potential infestations[72].

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

Snags, debris, floating logs, and abandoned vessels in the river and sloughs are very dangerous to boaters throughout the Delta. Until about 20 years ago, U.S. 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 S*acramento–San Joaquin Delta Boating Needs Assessement,*[73] 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.[74] 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.
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 development of such new areas is contemplated, they should be placed adjacent to public lands or in areas that avoid the risk of trespass, vandalism, and other conflicts.

Highly Sensitive Habitat Areas
There are several existing proposals (e.g., Delta Plan, Ecosystem Restoration Program) 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.

[72] Akers, Patrick. Aquatic Weed Integrated Vegetation Management Plan – Contra Costa Delta. Updated 10/9/2010. Found at http://www.delta.ca.gov/res/docs/Spongeplant%207%2028%2011.pdf
[73] DBW 2002, p. 4-23
[74] DBW 2002, p. 3-12 – 3-14

3.3 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.*[75] 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 Delta, due to the overlapping jurisdictions of several counties and cities.

The diversity of boating activities in the Delta, from high-speed wakeboarding and personal watercraft (PWC) usage to fishing 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 created 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 a marina. Those can include up to three federal agencies, seven state agencies, and three local agencies; the process can take upwards of two years.[76]

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.

[75] DPC 2006, pp. 56-69
[76] DPC 2006, p. 59

3.4 Visitation and Demand

3.4.1 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 and planners need to understand what percentage of users come from Delta counties, surrounding counties, Southern California, the western region of the United States, and beyond national borders.

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.[77] A survey of statewide registered boat owners found that 77 percent 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 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 percent 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 percent of all Delta boating visitors (Figure 28).

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 27. 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 17.6 million by 2050.

Table 27 Population Projections for the Primary and Secondary Market Areas

	2010	2020	2030	2040	2050
Market Area Population (millions)	11.9	13.4	14.9	16.3	17.6
Growth Rate		12.7%	10.8%	9.3%	7.9%
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 San Francisco Bay. Anglers can fish in the numerous reservoirs, but also in 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 the Sierra foothills. Other recreation and tourist destinations in Northern California include the Monterey Bay area, San Francisco Bay area, the Sierras, and north coast redwoods.

[77] DBW 2002, p. 6-4 - 6-6

Figure 28 Delta Market Area and Competing Regions

3.4.2 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 is reviewed, ranging from U.S. Fish and Wildlife Service to Delta Protection Commission publications. Unfortunately, no one study or survey presents a complete picture of current recreation and tourism visitation and economic impact in the Delta. Summary information from relevant studies is presented below.

3.4.2.1 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."[78] 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 28. 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 tend to 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 28 Summary of 2008 Survey of Public Opinions 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

3.4.2.2 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) *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 percent of the total population in California participated in either hunting or fishing activities, while 21 percent of the population participated in wildlife watching. The results of the survey are summarized in Table 29. Both participation rates and average annual days of

[78] State Parks 2009

participation per year are lower than in the State Parks survey, which may be due to differing methodologies. USFWS also collects information on average trip expenditures.

Table 29 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

3.4.2.3 State Registration and License Numbers

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

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.[79]

Resident Sport Fishing

In 2009, 1,179,312 resident sport fishing licenses statewide were issued by the Department of Fish and Game (DFG).[80] 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 to 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, results in approximately 3.3 million fishing activity days in the Delta in 2010. Note, however, that this number does not differentiate between shore anglers or those who fish from a boat.

Hunting

In 2009, the State issued 1,056,556 game bird hunting licenses and 1,683,445 general hunting licenses, which is approximately 6 percent 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.

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

3.4.3 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.

3.4.3.1 Sacramento-San Joaquin Delta Boating Needs Assessment

As part of *The 2002 Sacramento-San Joaquin Delta Boating Needs Assessment,*[81] 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 feet in length) and small boats (less than 26 feet in length). In this statewide survey, 52 percent of all owners of large boats had boated in the Delta, with 68 percent of those having been in the previous two years. Conversely, only 40 percent of all small-boat owners had been boating in the Delta, with 61 percent 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 to 6.6 million in 2000 with a projected growth to 8 million by 2020.[82] 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.

3.4.3.2 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 percent 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 percent 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.

3.4.4 Delta Recreation and Tourism Visitation Estimates

There are few 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 30.

[81] DBW 2002
[82] DBW 2002, Table 6-11

Table 30 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
Cosumnes River Preserve (approx.)	70,000
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	**796,480**
Sources: State Parks 2010, personal communications	

3.4.5 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 3.4.2.1 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 have 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 certain categories, listing 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 percent 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 percent 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 percent 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 of participation.

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 resource-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.[83] As part of the study, projections were made that this use would grow by 1 percent a year, but with the recent recession's impact, on motor boating in particular, as well as the overall lack of investment in facilities and upgrades over the past 20 years, the 2000 count likely reflects today's usage level. None of the remaining activities has 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, Sacramento's Garcia Bend Park, on the Sacramento River, combines boat launching, bank fishing, and levee-top trails with 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.[84] Estimated conservatively, 2 million visitor days of urban parks-related use occurs 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 waterways and agricultural areas, 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 deepen the Delta experience. To many, the resources are part of the charm—the

[83] DBW 2002
[84] Dangermond 1993, Table 15.2, p. 219

historical town of Locke, the wildlife preserves, or even the beautiful oak trees hanging over the roadway.

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 160 million annual participation days[85] (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 Nevada. Assuming the Delta is able to capture 1–2 percent of that overall market, driving for pleasure and associated activities (e.g., visiting historic sites and farm stands, etc.) in the Delta generates significant visitation. Using these estimates, Right-of-way-related recreation is 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 1990s the State Department of Parks and Recreation estimated an annual use of 12 million days in the Delta. Since that time, population in the Market Area has increased; however, there have been limited investments in new facilities or upgrades to existing facilities. The constraints outlined in Sections 3.2 and 3.3 above have not been resolved, and in some cases have been only exacerbated over time (e.g., lack of dredging, water quality). Additionally, the recession of 2007-2009 has negatively affected recreation and tourism, as well as boat registrations. Absent new research, this 12 million visits per year estimate seems to be a reasonable working number until additional primary data collection is performed.

3.4.6 Market Demand-Based Delta Visitation Estimates

Visitor estimations can be tested based on estimates of demand, generated from population numbers using participation rates and frequencies. 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 market demand 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 1.7-2.5 million activity days per year. These ranges are similar in magnitude to those discussed above and are summarized in Table 31.

[85] 12 million population x 60 percent participation x 22 average days (taken from Table 25)

Table 31 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*	N/A	2.0	N/A
Totals	8.2	11.7	15.2

Sources: U.S. Census, State Parks 2009, The Dangermond Group, EPS

* Demand for urban parks is not estimated by the visitor market analysis.

3.5 Economic Impact/Benefits

3.5.1 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 3.4, 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 dollars) 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, direct spending in the Delta economy attributable to resource-related and right-of-way/tourism recreation is estimated at approximately $251 million (2011$).

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., team sports). 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 32.

Table 32 Estimated Resource-Related and Right-of-Way/Tourism Visitation to the Delta by Activity

Activity	Visitor Days	Percent of Total
Boating, Fishing, and Camping	6.4 Million	66%
Hunting	500,000	5%
Other Resource-Related and ROW Activities	900,000	9%
Driving for Pleasure and 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[86] and the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.[87] 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).

[86] State Parks 1997
[87] USFWS 1996 and USFWS 2006

Table 33 Estimated Per-Day Per 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 and 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 and 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 campsites.

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 dollars), as shown in Table 34.

Table 34 Estimated Direct Delta Recreation Trip Spending Impacts by Activity (2011$)

	Expenditure Inside Delta
Boating, Fishing and Camping	
Accommodation	$33,572,000
Food	$53,354,000
Supplies	$72,571,000
Other	$34,929,000
Total	$194,426,000
Hunting	
Accommodation	$4,822, 000
Food	$2,087, 000
Supplies	$7,579, 000
Other	$3,690, 000
Total	$18,177, 000
Other Resource-Related and ROW Activities	
Accommodation	$3,110, 000
Food	$4,312, 000
Supplies	$2,843, 000
Other	$1,183, 000
Total	$11,449, 000
Driving for Pleasure and Tourism	
Accommodation	$2,456, 000
Food	$13,621, 000
Supplies	$8,980, 000
Other	$1,868, 000
Total	$26,925, 000
Resource-Related and ROW/Tourism Total	
Accommodation	$43,960, 000
Food	$73,374, 000
Supplies	$91,973, 000
Other	$41,670, 000
Total	$250,978, 000

While visitor spending occurs in a wide variety of categories, the bulk of visitor spending is likely to occur at recreation facilities, overnight accommodations, restaurants and bars, food and beverage stores, gas stations, and convenience stores. Comparing the estimated expenditure levels with total Delta revenue estimates for these industries shows that Delta recreation and tourism generates a large share of sales for these industries. For example, our estimates show that Delta recreation accounts for 90 percent of recreation sector spending, 58 percent of accommodation spending, 16 percent of sporting goods retail spending (including book and hobby stores), 12 percent of gas station sales, and 7 percent of restaurant and bar spending in the legal Delta.[88]

Table 35 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 percent of other accommodation spending in the legal Delta region, 47 percent of hotel and motel spending, and 7 percent of restaurant and bar spending. As an additional reasonableness check, a comparison was made of these expenditure levels

[88] Industry and retail data from IMPLAN and ESRI, respectively.

against the establishment data for the legal Delta from the NETS database. The level of spending was 42 percent of other amusement and recreation industry revenues in the legal Delta, a category that includes marinas and golf courses, 71 percent of total accommodation industry revenues, and 19 percent of food service and drinking places.

Table 35 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 36 summarizes the economic impact of recreation on the five-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 36 Economic Impact of Delta Recreation and Tourism on Five 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 37 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 37 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

3.5.2 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, The Economic Impact of Recreational Boating and Fishing in the Delta.[89] Using data from the 1997 survey on numbers of anglers and registered boat owners and their reported expenditures, Goldman et al,

[89] Goldman et al., 1998

estimated the expenditures of registered boaters at $247 million in the Delta, generating $445 million in total output, $183 million in income, $279 million in value added, and 8,058 jobs in the overall Delta region. For licensed anglers, expenditures totaled $186 million in the Delta, generating $336 million in total output, $138 million in income, $209 million in value added, and 6,152 jobs in the overall Delta region. 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 and canoes), non-licensed anglers, hunters who do not boat, etc., and so is not a complete picture of the economic impacts of Delta recreation.

While the estimates of total recreation spending in the Delta are similar between the ESP and the Goldman study, at about $250 million (Goldman's boating estimate), there are two primary reasons why the Goldman study estimates significantly higher total regional employment and output attributable to recreation in the Delta. These factors are (1) the change over time in output per worker and (2) the method of accounting for direct output. Goldman's economic data is from 1994 when each nominal dollar of spending supported more employment than it does today. Specifically, the Goldman study indicates that total output of roughly $55,000 from Delta boating activities supports one job in the regional economy, while in today's economy the ESP finds that it takes approximately $105,000 in boating-related output to support one job. Furthermore, the Goldman study appears to count the full value of boater spending as production output value, whereas the ESP measures output in retail industries using the retail margin (i.e., the addition to the price of a product when the product is sold through a retailer). In the ESP, the $251 million estimate of in-Delta spending translates to approximately $167 million in direct output, whereas the Goldman study seems to treat the full value of sales revenue (e.g., $247 million of in-Delta boater spending) as direct output. Accounting for this difference, the Goldman study and the ESP reveal a very similar economic output multiplier within the regional economy.

3.6 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. These trends must be taken into account when projecting the Delta's recreation potential over the next 50 years, as must the Delta's recreation history.

One way of trying to estimate recreation use over the next 50 years is to look back in time. Fifty years ago (1960s), people engaged in virtually all the recreation activities they now enjoy. 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: Resource-related, urban parks-related, and right-of-way/tourism-related., i.e., 20 percent (16-23 percent) of activities take place in urban developed parks and golf courses; 50 percent (48-58 percent) are right-of-way related, including jogging, walking, bicycling, and driving for pleasure; and the remaining 30 percent (25-30 percent) 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 percent 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 percent of the use will be developed urban park-related, 50 percent right-of-way-related, and 30 percent resource-related.

The Delta may likely become even more important for these types of uses because the populations that encircle it are expanding. 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.

In the Delta, the present uses are highly related to the availability and condition 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.

Developed local and state resource-related recreation areas in the Delta are quite limited, when compared to 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.[90] The following activities were found by State Parks to be the top five activities that adults would like to participate in more often.

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 represent an opportunity for growing visitation, if facilities were available and attractive.

USFWS reported on trends since 1996 in fishing, hunting, and wildlife viewing. Overall in California, fishing has declined 36 percent since 1996, while hunting has declined 45 percent (though it has been flat since 2001).[91] Conversely, away-from-home wildlife watching is up 23 percent since 1996. These data seem to represent a trend away from consumptive recreation (i.e., hunting and fishing) and towards non-consumptive wildlife recreation (i.e., bird watching

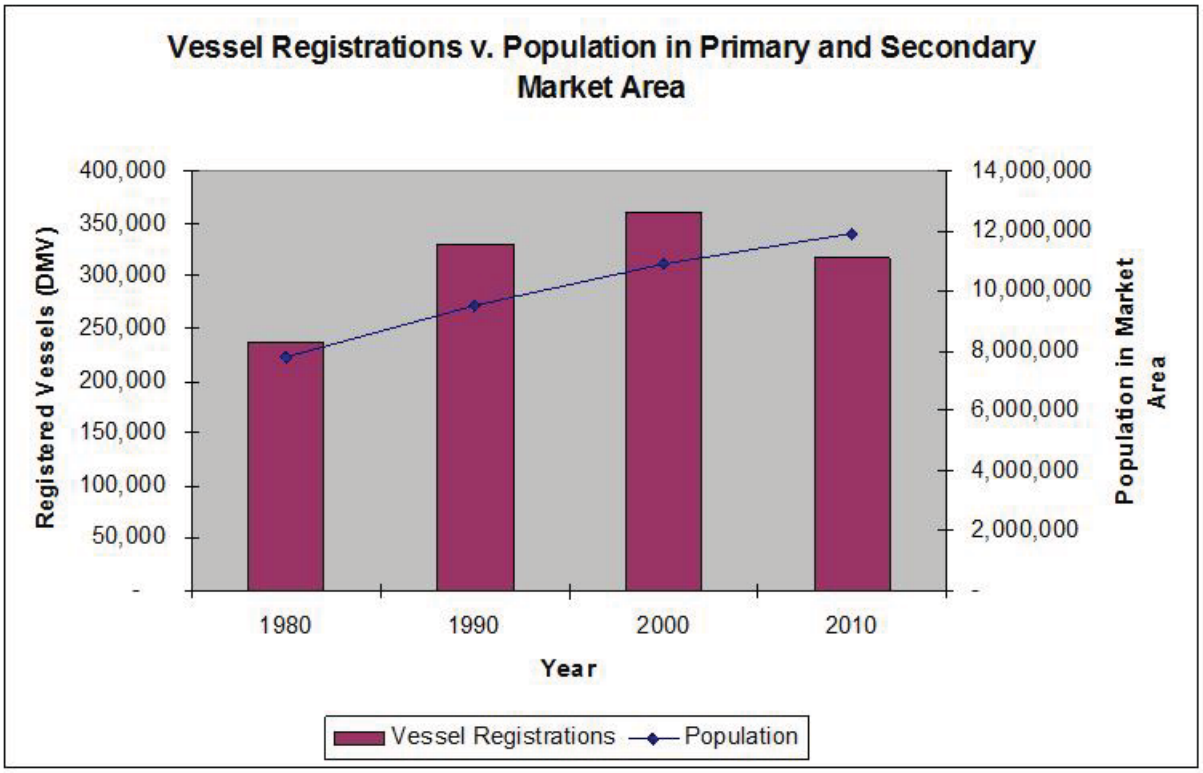
[90] State Parks 2009, p. 36
[91] USFWS 2006

and nature photography). State Parks figures also support these trends. Recreational programming and facilities in the Delta should respond to this trend.

Section 3.2.4.1 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 percent statewide and 13 percent in the Market Area. The 2010 number, however, is likely affected by the ongoing "great recession" and it cannot yet be determined if it represents a new trend. Figure 29 below shows boat registrations versus population over the past 40 years in the Market Area.

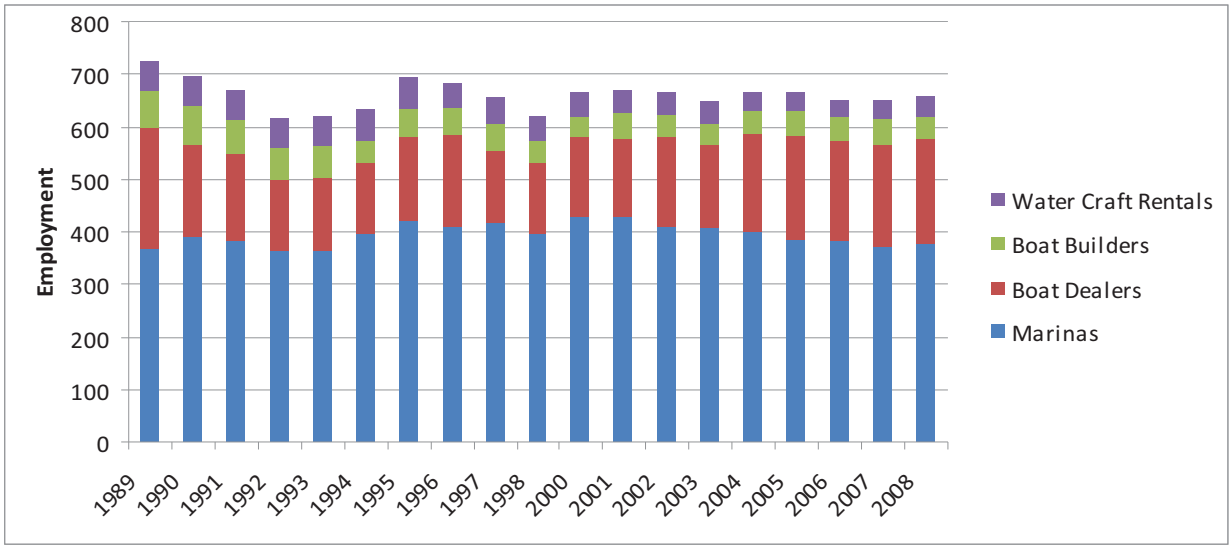
While boat registrations were increasing at a faster pace than population growth through the 1980s, they have increased at a slower pace than population growth since then, and as mentioned above, have decreased overall since 2000. As boating is the dominant recreational activity in the Delta, these trends indicate that motorized and sail boating may not keep pace with population growth over the next 50 years.

Figure 29 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. In 1990, the database counts 95 marina-related establishments, 90 in 2000, and 93 in 2008. Likewise, employment by water-based recreation-related establishments has remained relatively constant over the past 20 years, as demonstrated by Figure 30.

Figure 30 Employment in Legal Delta for Water-Based Recreation Sectors, 1989-2008



Source: NETS

There are several other external or societal trends that could affect the present recreation use and demand over the next 50 years.

- 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
- Continued decline and stagnation of existing facilities without new capital investments

3.7 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 a percentage of visitors to the Delta come from elsewhere, the majority of visitors are from Northern California. These visitors represent the focal market for Delta recreation growth opportunities in the future, and their places of origin define the market area for this study. The total Market Area had a population estimate of approximately 11.9 million in 2010, with projections of 17.6 million by 2050.
- Based on demand models, recreation visitation for 2010 is estimated to be approximately 8 million *resource-related* (e.g., boating and, fishing) visitor days of use per year, 2 million *urban parks-related* (e.g., golf, picnic, and turf sports), and 2 million *right-of-way-related*

(e.g., bicycling and 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 principal 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 is estimated at roughly $251 million inside the Delta (in 2011 dollars). 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.

4 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, under baseline conditions.

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 in Chapter 6.

4.1 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 3.2 and 3.3 of this chapter. Those that would have the most significant impacts on future planning scenarios are expanded below.

4.1.1 Constraints

4.1.1.1 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. Transient tie-ups or places to temporarily tie up a boat are also limited. 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 landside 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.

4.1.1.2 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 “Monterey,” “Delta” lacks brand recognition and any significant sense of critical mass in the minds of visitors. In addition, it lacks a strong identifying focal point area, like Fisherman’s Wharf and the Monterey Bay Aquarium. 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.

4.1.1.3 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 landside 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.

4.1.1.4 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 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.

4.1.1.5 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 some 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.

4.1.1.6 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 boat motors.

4.1.1.7 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 or services. 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.

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 many future opportunities.

4.1.1.8 Increasing Demand

By 2050, population growth in the counties surrounding the Delta is projected to grow by 50–60 percent. As population and gasoline prices increase, there will be a growing focus on recreation opportunities close to population centers. Increasingly, past experience would indicate, the Delta, where will become a primary source of open space and recreation activity for the greater Northern California region.

If so, boating access and landside recreation opportunities today will be inadequate to accommodate this growing demand. Similarly, increased agri-tourism will create demand for expanded overnight visits to Legacy Communities and the growing wine region. Recreation and agri-tourism will likely 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 landside recreation improvements, potential negative economic impacts on agriculture from increased tourism and recreation can be minimized by increasing and focusing recreation uses and activities.

4.1.1.9 Physical Capacity of Delta Waterways

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

4.1.1.10 Public Lands

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, such as State Parks’ *Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh*, could provide a significant expansion of access and facilities that could boost recreation use.

4.1.1.11 Delta-as-a-Place

The Delta must be a better-defined destination for visitors. Increased programming, special events, festivals, and marketing have the potential 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. 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.

The Delta-as-a-Place identity would also be enhanced by efforts to identify and establish gateways and edges to the Delta that reinforce its unique landscape character, particularly along the primary east-west highway corridors.

4.1.1.12 Market Area Development

Projected population growth within communities on the edge of the Delta may likely create additional demand for recreation offerings. Urban water front recreation improvements such as those built by the City of Stockton over the last few years will provide capacity for new visitors to participate in leisure activities. This trend could continue if communities, such as Tracy and Lathrop, orient planned development towards the Delta, interconnecting recreation corridors on the periphery of the Delta, and contributing to buffer zones between urbanized areas and the Delta to 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.

4.1.1.13 Future Prominence

As growth in the region and the state continues 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 landside recreation activities can 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.

4.2 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 the following guidelines at the forefront.

- Avoid developing recreation facilities within high flood risk areas or areas inaccessible during emergency flood 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 Delta, in combination with Legacy Communities, and by 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, and standard community park developments—within or on the edge of Legacy Communities and existing recreation areas.
- Develop appropriate visitor-serving access facilities at wildlife areas providing nature study, bird-watching, and environmental education. Include 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 identifying or providing loan funds, coordinating marina dredging and permitting, and helping them 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 the report, 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.[92]
- Promote the creation of recreation destinations as focal points of the Delta. Such multi-interest complexes should each highlight Delta values by incorporating 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, community docks, etc.
- 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 regional coordination, advertising and signage, marketing, and promotional-scale events.
- Identify and develop appropriate opportunities for small boat-in day-use areas, as well as larger destinations akin to Delta Meadows for boaters. Such areas should provide basic facilities for boaters, such as docks, tie-ups, restrooms, as well as opportunities to participate in many different forms of recreation.
- 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, including completing planning and implementation of the Great Delta Trail,[93] and trails recommendations from State Parks.[94]
- Ensure appropriate and coordinated response to operational issues including exotic aquatic vegetation control, boater safety enforcement, waterway maintenance, abandoned and derelict boat removal, boating hazard control, etc.
- Provide additional on-shore access facilities for shore fishing and boat launching.

4.3 Recreation Enhancement Strategy

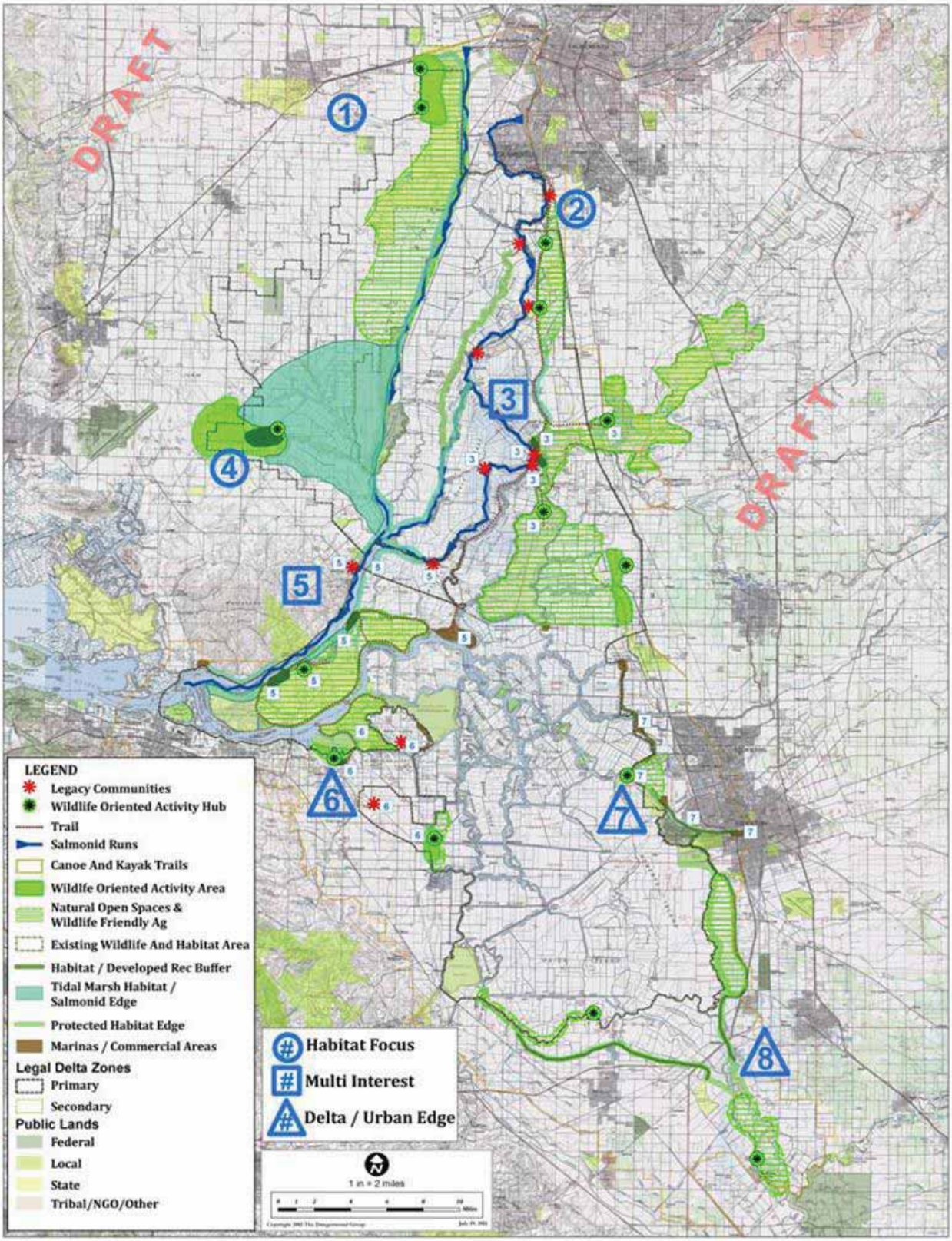
The future growth of recreation in the Delta is proposed to be based upon the principles and goals previously discussed, and a recommended recreation enhancement strategy consists of the following five location-based concepts (See Figure 31).

1. Delta waterways
2. Dispersed, small points of interest and activity areas
3. Focal point destinations (activity bases)
4. Natural habitat areas
5. Delta-urban edges (the edges of existing and emerging urban areas that surround the Delta)

Each concept is described in greater detail below.

[92] State Parks 2011.
[93] DPC 2010
[94] State Parks 2011

Figure 31 Recreation Enhancement Strategy Plan



4.3.1 Delta Waterways

The primary location for recreation in the Delta is, of course, the waterways. These waterways are 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.

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 were provided. The third recommendation was that smaller boat-in day-use areas with adequate facilities and transient tie-ups be established in appropriate locations throughout the Delta. Suggested elements and features 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, waterways have sufficient capacity to accommodate greatly increased use. The recommendations, therefore, anticipate future boating demands and changing use patterns.

4.3.2 Dispersed Points of Interest and Activity Areas

The Delta's diverse points of interest and activity areas are dispersed throughout its vast landscape. These features grant the Delta a distinctive character, especially in contrast with the surrounding urban and even rural agriculture landscapes. Overall, this aspect has come to be referred to as Delta-as-a-Place. These diverse points of interest—the small Legacy Communities, the loose network of 95 marinas scattered throughout the area, the farm stands and wineries, winding waterways, and intriguing riparian landscape—underscore the need to protect, enhance, and expand the elements that give the Delta its charm and sense of place. The sheer number and diversity of things to see and do is a valuable feature.

The expansion, over time, of additional areas will be accomplished primarily through private enterprise responding to opportunities such as farm markets, wineries, art galleries, restaurants, etc. On the public side, the Department of Water Resources[95] identified, in a past study, approximately 40 small day-use, launching, and fishing access locations that were economically viable, but which were never developed. State Parks has identified park and facilities expansions. Federal, State, and non-profit wildlife entities have planned facilities for increasing and managing public access and use.

Policies should be developed to encourage private development of additional appropriate facilities in non-conflicting locations and funding needs to be identified to accomplish public agency-planned improvements.

[95] DWR 1981

4.3.3 Focal Point Destinations

An important way to expand recreational capacity and draw new visitors to the Delta is to create destination complexes. By concentrating multiple recreation opportunities in one location, these complexes would provide focal points to visitors, particularly new visitors, and also present opportunities for businesses to develop economically viable operations.

Three locations have been identified that already have complexes of natural areas, parks, Legacy Communities, marinas, historic features, and trail potentials. They are: (1) Walnut Grove/Locke/Cosumnes River Preserve, (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 developed into a focal point destination.

The first focal point destination is proposed to include the Legacy Communities of Locke, Walnut Grove, Ryde, Cortland, and Hood, as well as Delta Meadows, the Cosumnes River 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 wildlife viewing/nature study opportunities. A network of water and land trails would knit together the complex and give it a sense of cohesion. The proposed historic railway connection between Old Sacramento and Hood could foster the growth of critical mass at this complex, making it more attractive for investment. Chapter 13 discusses some strategies for the Legacy Communities, but additional features and activities could be evaluated to assist in creating viable settings for private enterprise operations.

The Brannan Island/Rio Vista focal point destination complex is proposed to 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 also be evaluated for this proposed destination complex.

The Bethel Island focal point would include its marina and existing businesses, Big Break Regional Park, and the natural-lands conversion of Jersey Island. As with the other proposed complexes, these areas could be tied together and enhanced with trails.

The proposed focal point along Stockton's edge has a different character and does not include a Legacy Community or a major natural landscape feature. The planning and emerging development for the area, however, create a Delta-related focal point area because 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.

4.3.4 Natural Habitat Areas

The fourth location-based recreation enhancement strategy is the association of appropriate visitor access to natural habitat areas with and on the edges of the Delta. Three existing natural habitat areas have the potential of providing expanded environmental education and nature-appreciation opportunities: 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 National Wildlife Refuge. These three natural habitat areas, in combination with the previously identified focal point areas, are important assets of the greater Delta. They all have the need for improved visitor access and interpretive facilities.

4.3.5 Delta-Urban Edges

The final location-based recreation enhancement strategy 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—from Stockton around to Antioch and Bethel Island, the north edge of Tracy and Lathrop, and in selected locations such as Rio Vista. It is recommended that criteria be developed to assist in locating this interface zone (open space corridor) generally in conjunction with existing urban limit lines, in an area that would optimize its value for habitat enhancement with park nodes and interconnecting trails.

4.4 Potential Operational Solutions

Among the opportunities and constraints discussed previously is the lack of a Delta brand or overall marketing strategy. The average potential visitor has to overcome a number of barriers in order to recreate in the Delta—it's hard to see, there's no main entrance or focal point for information and activities, and facilities are sparse, spread out, and hard to access. As an example, the California Trade and Tourism Commission (CTTC) groups the Delta in with the Central Valley, as one of 12 travel regions CTTC promotes throughout the state, rather than promoting the Delta as its own unique travel region.[96]

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 regulations which control operations and development in the Delta. Currently, there are numerous organizations trying to overcome these barriers, including Discover the Delta Foundation and the Delta Chamber of Commerce. These organizations are small, underfunded, and limited in scope.

The Delta needs a well-funded "facilitator" organization that can assist visitors in accessing the Delta's many offerings, help brand and label the Delta, and support the economic development of businesses that serve visitors. Given the already myriad of public agencies and private organizations which operate in the Delta, it would be recommended that an existing organization take on this overarching economic development/marketing role. This expanded existing organization could promote the Delta in a number of ways, including those listed below.

- Help form and organize wine tours, farm tours, and boat tours.
- Develop and install Delta signage and visitor amenities.
- Operate visitor centers or kiosks at entry points to the Delta.
- Operate a website and social media linking potential visitors to activities, festivals, and facilities.
- Offer training and professional development support for local businesses.
- Serve as a clearinghouse for funding opportunities for local businesses, including marinas, farms, bed and breakfasts, restaurants, and retail shops.
- 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.

[96] The twelve regions are North Coast, Shasta Cascade, Gold Country, San Francisco Bay Area, Central Valley, High Sierra, Central Coast, Los Angeles, Orange County, San Diego, Inland Empire, and Deserts. http://www.visitcalifornia.com/Explore/

There are many types of organizations which could fill this void: nonprofit organizations, public agencies, public/private partnerships, and others. 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 state 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 Delta Protection Commission, as mandated by SBX-1,[97] is currently completing a feasibility study for a National Heritage Area (NHA) and determining what that designation might mean for the Delta. A National Heritage Area is designated by Congress as "a place where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape."[98] National stature would be achieved through NHA designation, enabling the Delta to gain visibility as a destination for persons as close as the Bay Area and Sacramento region, as well as on a national and international level. NHA designation can also be used as a marketing tool, to help brand the unique aspects of the Delta, such as its waterways and levees, long history of agricultural production, numerous recreational opportunities and diverse rural communities and cultural groups. Federal seed money is granted with NHA designation, which can be utilized to leverage other funds from public and private sources. NHA designation also has the capabilities to offer the following additional benefits.

- Provide sustainable economic development.
- Promote heritage tourism and recreation in the Delta that is aligned with existing land uses.
- Offer environmental and cultural interpretation and educational opportunities.
- Facilitate partnerships to undertake projects such as historic preservation with the consent and involvement of willing landowners.
- Develop necessary visitor amenities in the Delta such as waste receptacles, public restrooms and directional signage.
- Improve local quality of life and retain local control.

Senator Dianne Feinstein introduced S.29: Sacramento-San Joaquin Delta National Heritage Area Establishment Act on January 25, 2011,[99] while Rep. John Garamendi introduced H.R. 486 on January 26, 2011.[100] Both bills would establish the Sacramento-San Joaquin Delta National Heritage Area and designate the Delta Protection Commission as the management entity.

The matrix below presents a listing of existing organizations that could potentially adopt a facilitator role and the criteria that could be used to evaluate which organization could best move forward in this role. Existing organizations that are operating currently in the Delta and may have existing alignment with this role include Discover the Delta Foundation, State Parks, the Delta Protection Commission, the Delta Conservancy, and cities and counties. 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 10 years. Theoretically, any of the organizations could be assisted through funding from future Delta capital projects.

[97] Senate Bill X7 1, Sacramento-San Joaquin Delta Reform Act of 2009 (Simitian and Steinberg). Additionally, Delta Vision Strategic Plan, Strategy 2.1, October 2008 (www.deltavision.ca.gov)
[98] http://www.delta.ca.gov/res/docs/InfoSheet_NHA.pdf
[99] http://thomas.loc.gov/cgi-bin/bdquery/z?d112:SN00029:
[100] http://thomas.loc.gov/cgi-bin/bdquery/z?d112:h486:

Table 38 Delta Recreation Facilitator Opportunities and Constraints Matrix

	Potential Facilitator						
	Existing Local Control/ No Central Authority	Existing Nonprofit Organi-zation (i.e. Discover the Delta Foundation)	State Parks	Delta Con-servancy	National Heritage Area with DPC as manage-ment entity	Public/ Private Partnership (funded by local assessment e.g. Downtown Partnership)	Delta Economic Development Joint Powers Authority (cities, counties, state 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 Mission	Yes	No	Partial	Partial	Partial	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	With partners	With partners	With partners	Yes	Yes
Can identify and establish gateways	Yes	Yes	Maybe	Yes	Yes	Yes	Yes
Act as clearinghouse for information for private entrepreneurs	No	Yes	No	Yes	Yes	Yes	Yes

A key issue with all of the alternatives is their ability to generate adequate ongoing funding that can develop, market, and, potentially, operate improved facilities and activities described in this report.

4.5 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 visitation in the future, making adjustments to participation rates and market demand capture rates based on the principles and assumptions discussed

above, as well as on general recreation trends that may influence recreation participation rates in the future, also discussed above. General assumptions for this baseline scenario forecast follow.

- Market Area population will increase by approximately 50 percent between 2010 and 2050.
- Approximately 20 percent of the future recreation use will trend towards developed urban park-related, 30 percent right-of-way-related, and 50 percent resource-related.
- There is a trend away from consumptive recreation (i.e., hunting and fishing) and towards non-consumptive wildlife recreation (i.e., bird watching and nature photography).
- Increasing participation in agri-tourism is likely.
- Gas prices will continue to increase, with a responding trend towards recreating closer to home.
- Boating trends will shift towards non-motorized boats (i.e., more canoe/kayaks) in protected waterways.
- The proposed Great Delta Trail will be completed.

Based on these trends, quantitative visitor-day projections have been developed for the baseline scenario and are presented in Table 39. Note that this scenario does not represent status quo (i.e., disinvestment and stagnating visitation), but represents a conservatively optimistic perspective which includes the assumptions that follow.

- Visitation is based on overall trends described above.
- There will be increased investment to address deferred maintenance of existing facilities.
- There is enough capacity within existing waterways to capture growth.
- In most instances, growth in recreation activities will keep pace with population increases, with additional growth in wildlife related, non consumptive activities, and slowing growth in motor boating, fishing, and hunting.
- If disinvestment in facilities and stagnation continue, visitation may not keep pace with population growth, as seen has been seen over the past 20 years.

Table 39 Summary of Predicted Visitor Days under Baseline Scenario (in millions)

Activity Type	2010	2020	2030	2040	2050
Resource Related	7.6	8.3	8.9	9.5	10.0
Right-of-Way/Tourism Related	2.1	2.4	2.6	2.9	3.1

4.6 Economic Potential

4.6.1 Recreation Spending

Based on a quantitative framework, estimates have been made of potential future recreation levels and associated spending in the Delta. As discussed above, recreation participation trends and Delta competitiveness over the next 40 years were considered. This baseline scenario forecast will be against which potential impacts to the Delta recreation economy are measured. Again, the baseline forecast assumes that resource quality and recreational facilities are maintained such that the Delta retains its current level of competitiveness as a recreation destination.

Under the baseline scenario, recreation visitation in the Delta (including resource-related recreation, ROW recreation, and tourism) increases by roughly 3.4 million visitor days, or about

35 percent, over 40 years. Assuming that current visitor spending patterns remain unchanged and Delta business growth accommodates recreation-related spending increases, baseline visitation growth is estimated to increase spending in the Delta roughly $78 million (2011$) to about $329 million (2011$) by 2050.

4.7 Key Findings

- When attracting visitors and expanding recreation access to waterways and landside recreation improvements, potential negative impacts on agriculture from increased tourism and recreation can be minimized by focusing recreation uses and activities through expansion of existing recreation sites, development in Legacy Communities, and creating buffer areas adjacent to agriculture..
- The future growth of recreation in the Delta consists of five location-based strategies which would emphasize:
  - 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. An existing organization should be designated as a Delta recreation and tourism marketing and economic development facilitator..
- If resource quality and recreational facilities are maintained such that the Delta retains its current level of competitiveness as a recreation destination, baseline forecasts for visitation show increases of 3.4 million visitor days, or about 35 percent, over 40 years.
- Assuming that current visitor spending patterns remain unchanged and Delta business growth accommodates recreation-related spending increases, baseline visitation growth is estimated to increase spending in the Delta roughly $78 million (2011$) to about $329 million (2011$) by 2050.

5 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.

5.1 Policy Scenarios Impacts on Recreation Potential

5.1.1 Assumptions Under All Scenarios

In Chapter 5, different policy scenarios were presented on which to base analysis for future economic impacts. Although not explicitly discussed, it is assumed 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 coequal goals of water conveyance and habitat protection. Thus, under all scenarios, it is assumed explicitly as follows.

- 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.
- Water exports from the Delta will continue.

5.1.2 Isolated Conveyance Scenario

In Chapter 5, 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 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 uses 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 impacts.

- 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 relative stagnant waterways. This change in water salinity and quality will likely impact fishing, boating, and hunting in the lower Delta.
- 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 have an impact on 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.
- 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. This move could improve fishing in parts of the Delta.
- It is unknown how the loss of agricultural lands would affect hunting opportunities, based upon long-term land use of the lands needed for construction.

5.1.3 Habitat Conservation Scenario

The habitat conservation scenario was described in Chapter 5 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 with the intention to improve fisheries
- Creating approximately 10,000 acres of new floodplain along the San Joaquin River using setback levees
- Restoring tidal marsh 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
- Restoring 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 any of the following.

- 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 create 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.
- Specifics regarding channel margin improvements are not described. Most of these impacts can be avoided or mitigated through appropriate design. Potential conflicts could arise from reducing or eliminating windsurfer access, creating use restrictions on other forms of boating, eliminating State and county park facilities with access to the river, and restricting shore fishing.
- The conversion of agricultural lands to habitat could decrease hunting opportunities if farmland conversions are of lands also used for hunting.
- Impacts on general tourism are uncertain, as the effect on Legacy Communities is unclear.
- 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. If limited in carrying capacity, it could be restrictive regarding these recreation elements as is the Yolo bypass between Davis and West Sacramento.
- Increased wildlife viewing/photography and paddle sports and other nature-associated recreation, if restored habitat areas also include public access facilities.
- Yolo Bypass fisheries amendments may negatively impact existing hunting clubs in the area.
- Increased fishing will likely occur due to better fisheries.
- Boating overall could increase with increased habitat and water quality.
- Camping would increase to support increasing nature-related recreation, if new sites and successful synergies can be established.

5.1.4 Flood Control Scenario

The flood control scenario was described in Chapter 5, with two general possibilities:

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

The number of potential impacts on future recreation from the flooded-island scenario may include the considerations listed below.

- 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 affect the existing boating use, and have very little offsetting use. The existing uses in this area are fishing, water skiing, personal watercraft use, speed boating, house-boating, cruising, and, to a limited degree, windsurfing.
- While a large open body of water would have severe negative effects on all these users, the open water area could arguably be more conducive to sailing. There are a number of factors, however, that will minimize sailing as a potential substitute use.
    - 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 with many adequate local marinas which, at present, are not fully occupied.

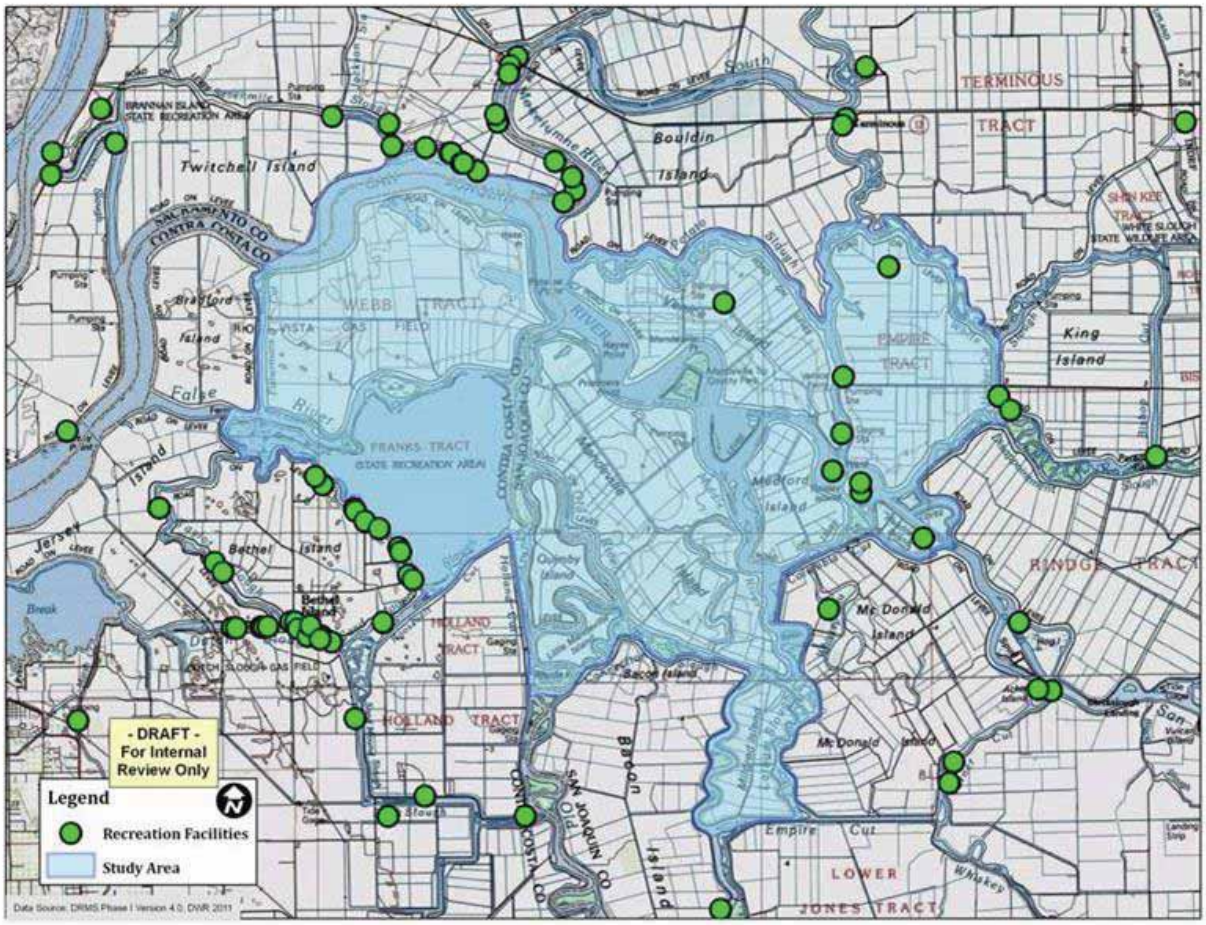
- Those boaters in the Sacramento metropolitan area who enjoy sailing are primarily berthed at Folsom Lake, which has more favorable winds and higher water quality than found in the six-island area.
- Sail boat densities on the water are lower.

- Approximately 40 percent of all the marinas in the Delta are clustered around or near this potential area and another 5 percent are along the San Joaquin River from Pittsburg to Antioch. These marinas are also, on average, larger than those in other parts of the Delta. The resulting negative impact to the largest single recreation activity in the Delta could be very severe. See Figure 28 which overlays existing marinas and recreation facilities over the six-island flood scenario.
- This open water will have unknown changes to fisheries, which will affect anglers.
- The elimination of hunt clubs on those islands will reduce hunting.

The increased levee upgrade scenario may have a number of potential impacts on future recreation, including the following impacts.

- Better protection of marinas allowing investment in facilities
- Increased protection of Legacy Communities, resulting in more right-of-way/tourism activity
- Unknown changes to fisheries

Figure 32 Existing Recreation Facilities in the Vicinity of Six-Island Flood Scenario



5.1.5 Regulatory Changes Scenario

Proposed regulatory changes are not known at this time. The following potentials could have a negative effect on recreation.

Increased Regulation

- Regulations against water, sewer, and building developments would make it difficult for both existing and new enterprises to locate within the Delta or to respond to changing market demands. These restrictions could adversely affect park expansions, marinas and related resorts, 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.
- Continuing and/or increasing restrictions and regulations on dredging and vegetation controls in and around marinas could have significant impacts on such recreation providers.

Decreased Regulation

- 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.

5.1.6 Policy Scenarios Impacts Summary

Table 40 presents a summary of predicted potential impacts to recreation and tourism by the policy scenarios described above, with range estimates of potential impacts to visitation in 2050, as compared to the baseline scenario presented in Section 4. Note that these impacts are presented in relationship to population growth, so a “Flat” trend would keep pace with population growth, while “Increase” would grow faster than population. “Decrease” would grow slower than population and may or may not represent an actual decrease in raw numbers of visitor days.

Table 40 Predicted Trends in Major Recreation Categories under Policy Scenarios Conditions

	Policy Scenarios				
Activity Type	**Isolated Conveyance**	**Habitat Conservation**	**Flood Control – Six Islands**	**Flood Control – Increased Levees**	**Regulatory Changes**
Resource Related					
Boating	Decrease	Increase	Decrease	Flat	Decrease
Fishing	Flat	Increase	Decrease	Flat	Decrease
Hunting	Decrease	Flat/Decrease	Decrease	Flat	Flat
Wildlife Viewing/Outdoor Photography	Flat	Increase	Flat	Flat	Flat
Camping	Decrease	Increase	Decrease	Flat	Flat
Right-of-Way/Tourism Related	Decrease	Flat	Flat	Increase	Decrease
Urban Parks Related	Flat	Flat	Flat	Flat	Decrease
Overall	Decrease	Increase	Decrease	Flat	Decrease
Potential Visitation in 2050 (millions)	11.6 – 12.1	13.7 – 14.8	10.6 – 12.0	13.2 – 13.4	10.1 – 11.6
Potential Change in Visitation as Compared to Baseline	-11% - -7%	5% - 13%	-19% - -9%	1% - 2%	-23% - -11%

The probable future condition of the Delta will not, however, occur as a result of a single policy scenario, but of necessity, will be a combination solution. Among these various scenarios, there is an opportunity to avoid the largest potential negative impacts and to emphasize positive solutions.

5.1.7 Economic Benefits/Projections

An evaluation was made as to the probable scale of negative and positive economic impacts from various actions described in the scenarios. The scenario analysis relies on professional judgments concerning the positive and negative effects of the analytical scenarios described in Chapter 6 and should be considered order-of-magnitude, illustrative estimates. The scenario impacts range from increases in recreation spending in the Delta of roughly 14 percent, a positive impact of $50 million, to decreases in recreation spending in the Delta of 23 percent, a negative impact of $77 million, in 2050.

- The isolated conveyance scenario could lower recreation spending in the Delta by 9 to 12 percent, a negative impact of $29 million to $40 million in 2050.
- The habitat conservation scenario could increase recreation spending in the Delta by 5 to 14 percent, a positive impact of $17 million to $47 million in 2050.
- The six-island open water scenario could lower recreation spending in the Delta by 11 to 23 percent, a negative impact of $35 million to $77 million in 2050.
- The increased levee scenario could increase recreation spending in the Delta by about 1 percent, a positive impact of $2 million to $4 million in 2050.
- The increased land use restrictions scenario could lower recreation spending in the Delta by 11 to 21 percent, a negative impact of $35 million to $71 million in 2050.

5.2 Impact Analysis and Mitigation Potential

5.2.1 Negative Impacts

Of all the potential negative impacts, our analysis indicates that the following five items are the most significant. They are listed in order of their impact magnitude. These major items are most likely significant enough that major changes to the project would be required, rather than simple mitigation measures.

1. *Regulation Changes.* If increased and burdensome land-use regulations prohibited most or all permits for remodeling or constructing commercial and recreation facilities, they would have the largest negative impact on recreation use in the Delta. At best, it would bring growth in recreation to a standstill in all but hunting and wildlife viewing/outdoor photography. It is quite likely that an actual decline in recreation levels would occur as facilities aged and became out of date.

2. *Six-Island Flooding.* As previously described, the purposeful flooding of the six islands, basically north and east of the existing open water area of Frank's Tract, could have a major impact on boating in the Delta. Over 50 percent of the Delta's marinas are located within or in close proximity to this area, and would suffer both direct and indirect negative impacts. Boating, fishing, hunting, camping, and tourism-related activities are all anticipated to be impacted.

3. *Salinity Increases in the Central and South Delta.* This possible impact is based upon the concern that an isolated conveyance which removes all export water at the north end of the Delta will create increased water stagnation and salinity in the central and south Delta. If that occurs, it would affect boating, fishing, and camping.

4. *Large Tidal Marsh in South Delta.* A large-scale tidal marsh area in the south Delta would likely increase salinity and strong currents in the waterways leading to the south Delta. It would affect boating and fishing, and may impact hunting due to the loss of agriculture properties jointly used for hunting.
5. *Intake and Pumping Stations—Clarksburg to Courtland.* These pumping stations, if placed along the river at this location, could seriously impact the Delta-as-a-Place recreation and tourism. This is one of the primary entry and destination areas in the Delta; the industrial scale, noise, and night lighting could transform its character.

In addition, there are other lesser impacts as previously described. These can most likely be mitigated through careful planning.

5.2.2 Positive Impacts

There could be positive impacts to recreation within future scenario predictions. Specifically, three elements of certain scenarios would likely have the most positive influence on recreation use.

1. *Fishing Enhancements.* The various fishery enhancements proposed in the habitat conversion and isolated conveyance scenarios are expected to help restore fisheries, and thereby elevate fishing use.
2. *Wildlife Viewing/Nature Study.* The proposed expansion of natural preserves and wildlife-friendly agriculture would increase the opportunities for wildlife viewing and nature study.
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.

5.2.3 Potential Mitigation Measures

This report has analyzed existing recreation uses and projected a baseline forward to 2050. It also has analyzed the negative and positive impacts to the baseline from various elements of proposed scenarios. Analysis has also been made of actions that could be taken to increase recreation visitation over the baseline, or to mitigate for some unavoidable impacts. The Recreation Enhancement Plan outlined in this report describes such actions. The four most important enhancement measures are thought to be the following.

1. There is a long standing need for a Delta-focused public recreation, planning, development, and management facilitator organization. As early as 30 years ago, 41 economically feasible recreation improvements, studied by the Department of Water Resources, were not developed because of the lack of an entity that could be responsible for their care. As a part of this report, major recreation improvements have been identified that could stimulate visitation and economic benefits. A responsive, Delta-wide organization is vital to accomplishment of such a program. To be effective, this organization needs an assured funding source that can be relied upon for both development and operation. The organization also needs to have the authority to assist in marketing the Delta, to facilitate actions by private enterprise, and to assist with, or take over, the operation of state and local recreation facilities.
2. Plan and assist with the development and marketing of the two focal point complex areas identified in this report. Priority and emphasis should be given to catalyst features that help create settings for private enterprise developments, as well as develop synergistic recreation improvements.

3. In coordination with bordering communities, plan urban limit lines along the Delta edge, with guidelines for future urban development in coordination with Delta buffering park/open space/trail areas.
4. Plan and assist with the development and marketing of smaller dispersed recreation facilities, including creating settings for Delta-related private enterprise recreation development.

It is anticipated that the formation of the facilitator organization and accomplishment of the general programs outlined over the next 10 years would result in the stimulus of recreation visitation and resultant economic activity, in an amount over the baseline scenario.

5.3 Key Findings

- Possible policy scenarios are qualitatively evaluated as to their primary elements and their potential positive and negative impacts on recreation.
- Scenarios evaluated may affect recreation visitation by a range of a decrease of approximately 23 percent to an increase of approximately 13 percent over the baseline scenario, with the largest potential for negative impacts from increased regulatory changes and the largest potential for positive impacts from the habitat conservation scenario.
- These visitation changes may result in a range from increases in recreation spending in the Delta of roughly 14 percent, a positive impact of $47 million, to decreases in recreation spending in the Delta of 23 percent, a negative impact of $77 million, in 2050, as compared with the baseline forecast.
- The largest potential negative impacts would results from regulation changes, six-island flooding, salinity increases in the central and south Delta, creation of a large tidal marsh in the south Delta, and intake and pumping stations near Clarksburg and Courtland.
- Positive impacts could result overall through project enhancements to fishing, wildlife viewing, and nature study, and Delta-as-a-Place.

Chapter 8: Infrastructure

1 Overview and Key Findings

The Delta is a critical infrastructure hub for the regional and state economy. While the Delta's importance to the state water system is well-known, its importance to energy, transportation, and in-Delta municipal and industrial water supplies is less appreciated. There are basically two kinds of infrastructure in the Delta: the kind that adds to the economic sustainability of the Delta and the kind that is just passing through. Some idea of the variety and extent of the infrastructure in the Delta is provided by Figure 33.[101]

Three broad categories of infrastructure that serve the Delta economy are reviewed and analyzed within the framework detailed in Chapter Five: (1) Transportation; (2) Energy; and (3) Water Resources and Flood Control.

This chapter focuses on water supply and other infrastructure that directly serves communities within the Legal Delta and the adjacent region but also includes mention of infrastructure that basically serves other regions.

The key findings are:

(1) Transportation and energy are important components of the economy of the Delta region. Maintenance of the levee system in order to protect transportation and energy infrastructure is crucial.

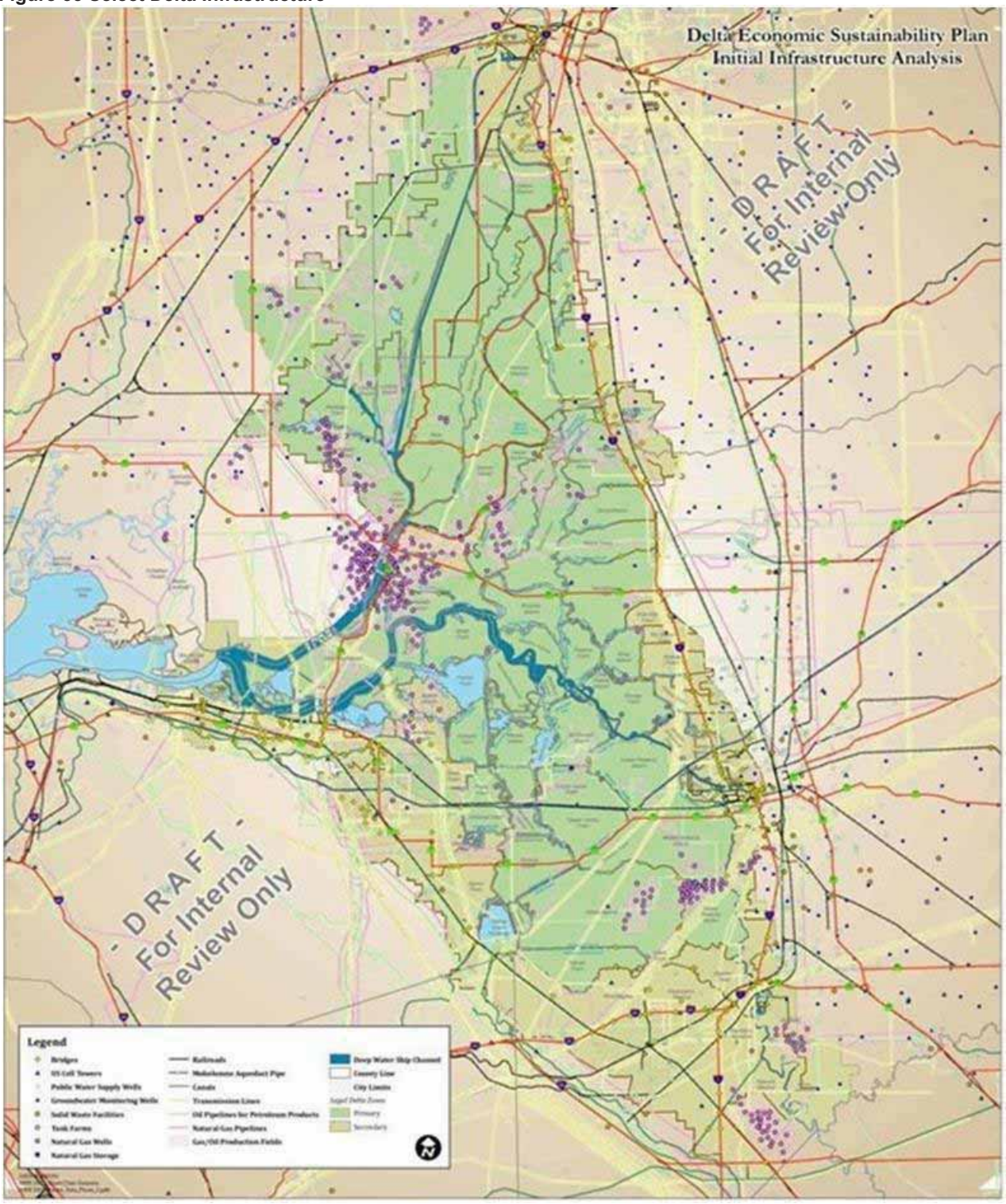
(2) Extraction of water from the Delta is critical to the economy of the Delta region. Any decline in water quality—whether it is an increase in salts or organic carbon—has very negative effects on both agriculture and urban water supplies. Delta water quality is potentially threatened by both the kind of isolated conveyance being studied as part of the BDCP and by some of the conservation measures that are being proposed as part of BDCP. Delta water quality would also be threatened by the six-islands open-water scenario, but it can be protected, even in the face of sea-level rise, by improving Delta levees to a higher standard and restoring or developing tidal marshes in the far western Delta, downstream of Sherman Island and in the Suisun Marsh. A key to not only maintaining the present levels of Delta water quality but improving it, with benefits both for human use and the ecosystem, is cleaning up the San Joaquin River, whether by order of the State Water Resources Control Board or some other means.

(3) An example of a win-win solution is provided by the proposed Lower San Joaquin River Bypass, which, while it would both reduce peak water surface elevations in the San Joaquin River adjacent to Lathrop and Stockton and provide ecosystem benefits by activating floodplains, would only contribute increased organic carbon for a relatively short period of time and at periods of high flows, so that the impacts on water quality would be minimized.

(4) Infrastructure that passes through the Delta should financially contribute to the maintenance and improvement of the levee system on which it relies. This includes but is not limited to through-Delta conveyance of water.

[101] Based on DRMS GIS data set developed by URS Corporation and provided by DWR.

Figure 33 Select Delta Infrastructure



2 Transportation

The Framework study identified the important role that Delta's transportation infrastructure has in linking the large regional population and diverse concentration of agricultural producers,

retailers, manufacturers and distributors.[102] All primary modes of transportation are located in the Delta.

2.1.1 Trucking and Automotive Transportation

There are three state highways in the Delta's Primary Zone (SR 4, SR 12, and SR 160). These highways are principal road transit routes through that region. In addition, the Delta's Secondary Zone hosts three Interstate freeways (I-5, I-80, and I-205) and is bordered by two others (I-580 and I-680). The 2007 Status and Trends of Delta-Suisun Services report identified evidence of Delta traffic growth disproportionate to population growth.[103] That trend continues to be evident in recent years. Table 41 reports an index of daily total vehicle trips (DTVT) on these transportation corridors between 1992 and 2009 as well as actual 2009 DTVTs. Accordingly, excluding some sections of SR 160, traffic volumes on highways and freeways increased between 23 percent and 65 percent during this period. In comparison, population in the five-county region increased by 20 percent, ranging between 12 percent (Solano County) and 26 percent (Yolo County and San Joaquin County) during the same period.[104]

Table 41 Daily Total Vehicle Trips (DTVT) on Key Transportation Routes 1992-2009

Route	Intersection	1992	1995	2000	2005	2006	2007	2008	2009	2009 DTVTs
CA-12	CA-84 (Rio Vista)	100	93	111	147	150	150	134	129	***39,000***
CA-12	I-5 (Lodi)	100	99	97	151	153	153	134	134	***31,000***
CA-160	CA-220 (Walnut Grove)	100	64	73	80	81	81	70	70	***4,700***
CA-160	Wilbur Ave (Antioch)	100	94	113	125	140	136	124	123	***25,000***
CA-160	Isleton Bridge (Isleton)	100	71	73	80	81	81	73	73	***6,150***
CA-4	Byron Highway (Byron)	100	108	125	131	123	125	112	117	***38,600***
CA-4	Roberts Road (Stockton)	100	115	N/A	N/A	165	153	139	135	***19,400***
CA-4	Port Chicago Freeway (Concord)	100	105	140	184	177	179	171	165	***277,000***
I-205	Old Route 50 (Tracy)	100	115	139	169	170	170	180	160	***195,000***
I-5	I Street (Sacramento)	100	116	133	161	166	167	155	159	***364,000***
I-5	CA-12 (Lodi)	100	103	113	166	169	169	156	156	***130,000***
I-5	French Camp Overcross (French Camp)	100	105	108	174	176	176	159	159	***196,000***
I-80	I-5 (Sacramento)	100	82	114	124	127	134	128	126	***231,000***
I-80	CA 113 (Davis)	100	107	123	137	135	130	126	135	***246,000***

Source: Caltrans traffic volume data. Traffic Data Branch. Accessed 2011/6/30: http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm

The decline in vehicle traffic along SR 160 is notable. SR 160 has Scenic Roadway designation and as such it is an important driving-for-pleasure resource within the Delta. When examined, the largest decline in vehicle traffic occurred between 1992 and 1995, with some recovery followed by a period of flat to slightly declining traffic volumes along SR 160 in the northern Delta between 1995 and 2009, and with some growth in the southern portion of the route.[105]

The trends in truck traffic are more diverse as indicated in Table 42. Truck traffic has decreased markedly in some areas, such as the 45 percent decline in truck traffic on I-80 near Davis. However, truck traffic has increased in other areas, particularly along the I-5 corridor where

[102] DPC 2010 *Final Draft Delta Protection Commission Economic Sustainability Plan Framework Study Volume II.* Delta Protection Commission. December 6, 2010.
[103] DWR 2007 *Status and Trends of Delta-Suisun Services*. Public Review Draft. Department of Water Resources. March 2007.
[104] Population calculations based on U.S. Department of Commerce, Bureau of Economic Analysis data downloaded from the *California Regional Economic Analysis Project on 6/30/2011.*
[105] See Chapter 7 Recreation and Tourism for a discussion of trends in driving for pleasure in the Delta.

traffic increased by 112 percent near Lodi, 66 percent near Sacramento, and 59 percent near French Camp.

Table 42 Daily Total Truck Trips (DTTT) on Key Transportation Routes 1992-2009

Route	Intersection	1992	1995	2000	2005	2006	2007	2008	2009	2009 DTVTs
CA-12	CA-84 (Rio Vista)	100	90	87	136	137	137	120	120	3,871
CA-12	I-5 (Lodi)	100	78	76	90	92	92	83	83	4,519
CA-4	Byron Highw ay (Byron)	100	80	124	130	123	124	111	116	5,775
CA-4	Roberts Road (Stockton)	100	103	137	76	164	152	138	134	2,471
CA-4	Port Chicago Freew ay (Concord)	100	97	109	139	134	135	129	124	14,779
I-205	Old Route 50 (Tracy)	100	114	138	103	104	104	110	94	12,240
I-5	I Street (Sacramento)	100	120	136	166	171	173	162	166	17,856
I-5	CA-12 (Lodi)	100	142	144	231	233	233	212	212	23,459
I-5	French Camp Overcross (French Camp)	100	124	138	151	153	174	159	159	49,480
I-80	I-5 (Sac)	100	111	156	131	134	140	135	132	16,428
I-80	CA 113 (Davis)	100	59	69	55	53	54	52	55	8,107

Source: Caltrans traffic volume data. Traffic Data Branch. Accessed 2011/6/30: http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm

These highways and freeways are represented in Table C2 in Appendix C. Based on the DRMS database approximately 337 miles of this highway and freeway infrastructure are located within the Delta's 100-year flood plain.[106] In addition to the highways and interstate freeways, the Delta 100-year flood plain alone is estimated to contain 1,456 miles of minor road infrastructure.[107]

Interconnecting this terrestrial transportation infrastructure are 31 bridges in the 100-year flood zone. Many of these bridges need capacity upgrades to meet current capacity standards.[108] There are also five operational ferries in the Delta; two of the five ferries are operated by Caltrans and the other three ferries are privately operated.[109]

2.1.2 Rail Infrastructure

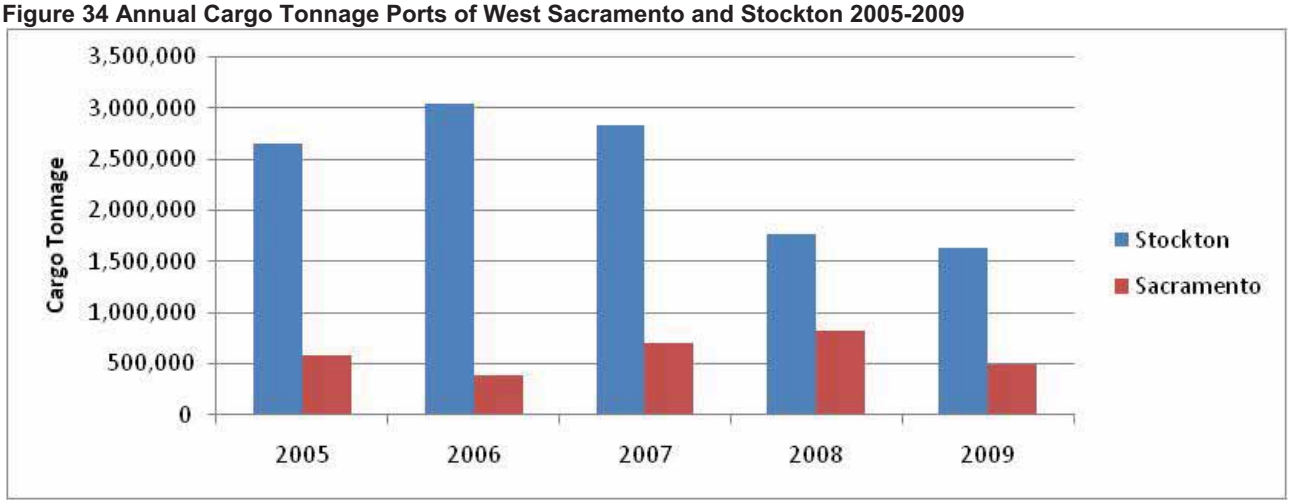
The Delta's short-line railroad was historically an important transportation resource for the region's agricultural industry.[110] Two transcontinental railways pass through the Legal Delta: the Burlington Northern Santa Fe (BNSF) railway and the Union Pacific railroad. These lines primarily carry freight and form a critical component of the regional transport infrastructure with multimodal linkages to the area's trucking and maritime infrastructure. In addition to freight transportation, the Amtrak San Joaquin route from Bakersfield to Sacramento/Oakland is a significant passenger rail line; it passes through the Legal Delta and carried just over 960,000 riders in 2010.[111]

[106] DRMS 1
[107] DRMS 1
[108] NARPRAIL 2011 *Amtrak Fact Sheet: San Joaquin Service*. Status *and Trends of Delta-Suisun Services*. Public Review Draft.
[109] Caltrans 2011 *SR-12 Comprehensive Corridor Evaluation and Corridor Management Plan from SR-29 to I-5.*
[110] DPC 1994 Utilities and Infrastructure. Background Report.
[111] DWR 2007 *Status and Trends of Delta-Suisun Services*. Public Review Draft. Department of Water Resources. March 2007.

2.1.3 Ports and Maritime Infrastructure

The Stockton Deep Water Ship Channel was constructed in 1927 and the Sacramento Deep Water Ship Channel in 1963.[112] The Port of West Sacramento is located 79 nautical miles from the Golden Gate Bridge and consists of 150 acres of operating terminals that currently handle a variety of bulk, break-bulk (general cargo), and project cargos. The Port of Stockton is located 75 nautical miles from the Golden Gate Bridge it operates a diversified transportation center that encompasses 2,000 acres of operating area.[113] These ports are currently developing a marine highway for short sea shipping collaboratively with the Port of Oakland. This marine highway will reduce truck transportation of containers on the San Francisco Bay Area's congested road infrastructure through regularly schedule barge service.[114] When the marine highway is fully operational, these two Delta ports will further deepen the regions' freight transportation infrastructure and significantly deepen multi-modal linkages.

Figure 34 Annual Cargo Tonnage Ports of West Sacramento and Stockton 2005-2009



Source: U.S. Army Corps of Engineers Waterborne Commerce Statistics Center. http://www.ndc.iwr.usace.army.mil//wcsc/webpub09/webpubpart-4.htm Accessed: 2011-06-30.

2.1.4 Air Transportation Infrastructure

There are 11 general aviation airports located within the Legal Delta. Besides these facilities, there are also small landing strips for property owners' use and small agricultural air strips used by commercial crop-dusting services.[115] Sacramento International Airport and Stockton Metropolitan Airport both are located near the Legal Delta.

[112] DWR 2007 *Status and Trends of Delta-Suisun Services*. Public Review Draft. Department of Water Resources. March 2007.
[113] http://www.portofstockton.com/ Accessed/2011-06-30
[114] Port of Stockton 2011 *Marine Highway Project Brochure*. http://www.portofstockton.com/Downloads/SSS%20Brochure.pdf
[115] DPC 1994 *Utilities and Infrastructure*. Background Report.

Table 43 Aviation Facilities in the Legal Delta

Name	County	City	Category
Byron Airport	Contra Costa	Byron	General Aviation
Las Serpientas Airport	Contra Costa	Brentwood	General Aviation
Funny Farm Airport	Contra Costa	Brentwood	General Aviation
Spezia Airport	Sacramento	Isleton	General Aviation
Tracy Municipal Airport	San Joaquin	Tracy	General Aviation
Kingdon Airport	San Joaquin	Lodi	General Aviation
Lost Isle Seaplane Base	San Joaquin	Stockton	General Aviation
New Jerusalem Airport	San Joaquin	Tracy	General Aviation
33 Strip Airport	San Joaquin	Tracy	General Aviation
Rio Vista Municipal Airport	Solano	Rio Vista	General Aviation
Borges-Clarksburg Airport	Yolo	Clarksburg	General Aviation

Source: http://www.airport-data.com Accessed 2011-06-30

3 Energy

The largely rural and unpopulated nature of the Delta's Primary Zone makes it a valuable location for energy infrastructure; significant regional natural gas pipelines, underground natural gas storage, and electricity transmission lines are present in the region. This infrastructure provides critical linkages to nearby electrical generation facilities that are significant features of the State's power generation capacity.

3.1.1 Natural Gas

The Delta hosts major natural gas pipelines, production, and storage facilities. There are approximately 250 miles of natural gas pipeline that serve regional users and the local gas fields in the Delta. There are two major natural fields in the Delta: the Rio Vista Gas Field and the French Camp Gas Field. The Rio Vista Field, the larger of the two, is California's largest natural gas field. Combined, these two fields produced 43 percent of California's non-associated, independent-from-oil production, natural gas and 13 percent of the State's total natural gas production in 2009.[116] Pacific Gas and Electric's (PG&E) underground storage facility at McDonald Island is the largest natural gas storage facility in the state with approximately 82 Bcf of gas storage capacity, which provides up to one-third of PG&E's peak natural gas supply.[117] This natural gas infrastructure also has important linkages with the proximate electricity generation facilities.

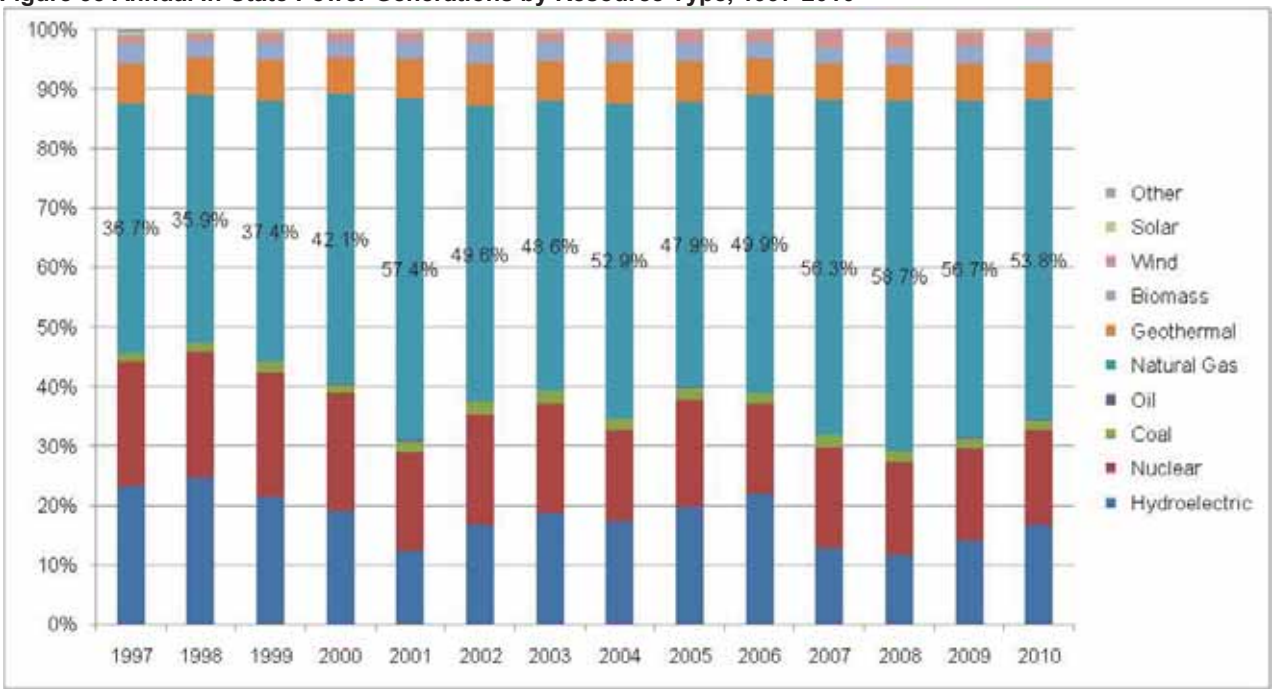
3.1.2 Electricity Generation Systems

The Legal Delta and nearby power facilities are significant sources of energy for California's electrical grid. Natural gas has become an increasingly significant resource in California's electricity generation, rising in its contribution from 37 percent of the State's total electricity generation in 1997 to 54 percent in 2010.[118] This rise in natural gas use in electricity generation is highly relevant given the Delta's natural gas infrastructure. The Legal Delta hosts 23 power plants with generation from natural gas, petroleum coke, wind, biomass, and landfill gas.[119] The most significant was natural gas-based generation; in 2010, plants within the Legal Delta generated nearly 10 percent of the State's total natural gas-based electricity, and plants within

[116] DOGGR 2010 *Report of the state oil & gas supervisor: 2009*. Department of Oil, Gas, and Geothermal Resources. California Department of Conservation.
[117] PUC 2010 California Natural Gas Infrastructure January 2010. California Public Utilities Commission.
[118] California Energy Commission. 2011 *The California Energy Almanac*. Accessed 2011-06-30.
[119] For a list of the Plants, their Mw capacity, Primary Fuel, and Owner, see Appendix G.

the five-county Delta region generated nearly 20 percent of the State's total natural gas-based electricity.[120]

Figure 35 Annual In-State Power Generations by Resource Type, 1997-2010



Source: California Energy Almanac: http://energyalmanac.ca.gov/ Accessed 2011-06-30.

3.1.3 Electricity Distribution Systems

According to the 2007 Department of Water Resources *Status and Trends of Delta-Suisun Services Report,* PG&E, the Sacramento Municipal Utility District, and Western Area Power Administration oversee most of the transmission lines and provide local electricity services within the Delta.[121] There are more than 500 miles of transmission lines and 60 substations within the Delta.

3.1.4 Other Energy Infrastructure

There are also approximately 70 miles of pipeline that carry gasoline and aviation fuel across the Delta from Bay Area refineries to depots in Sacramento and Stockton for distribution to Northern California and Nevada. These pipelines provide roughly half of all transportation fuel used in this region.[122]

Lastly, it is significant that the geologic structure of the Delta's associated sedimentary basin also appears to offer promising opportunities for potential CO_2 sequestration (capture and

[120] Power generation facilities in the Legal Delta generated nearly a third of the State's coal and coal-derived generation, but this only totaled 1,072 Gwh in 2010 and is a product of petroleum coke inputs supplied to these facilities from nearby oil refineries.
[121] DWR 2007 *Status and Trends of Delta-Suisun Services*. Public Review Draft. Department of Water Resources. March 2007.
[122] DWR 2007 *Status and Trends of Delta-Suisun Services*. Public Review Draft. Department of Water Resources. March 2007.

storage of carbon dioxide). This important potential development to reduce atmospheric man-made CO_2 emissions has identified the Delta's Sacramento Basin as one of California's five most promising basins for CO_2 sequestration from an analysis of over 100 basins in California.[123]

4 Water Issues for Delta Communities

4.1.1 Water Supplies for Delta Communities and the Delta Region

Communities in and surrounding the Legal Delta rely on a variety of water supplies including groundwater, direct diversions from natural flows in the Delta, and diversion of surface water supplies that originate upstream from the Delta. For simplicity, this section focuses on municipal water supplies for Delta communities that divert water directly from the Delta. The largest municipal sources in this category are the Contra Costa Water District, which has several intakes in the western and south Delta, and the new City of Stockton water supply project that is currently under construction. The City of Antioch also has an important water supply intake at the western edge of the Delta, and purchases water from the Contra Costa Water District when the water quality at their intake deteriorates to poor levels. The Solano County Water Agency has a major water intake in the northwest Delta that serves significant areas in a Delta county and nearby Napa, but does not directly serve customers in the Legal Delta. The City of Tracy receives a portion of its supply from the federal Central Valley Project that serves areas to the south, but has added other supplemental supplies in recent years to reduce its dependence on this source.

As it is for agriculture, water quality is a critical consideration for these users, although its impacts can be controlled to a greater extent than for agriculture by using modern water treatment procedures—which may be very expensive. Water quality impacts on agriculture are discussed elsewhere.

There are four potential sources of significant changes in Delta water quality:

(1) Further degradation, or conversely, improvement of the water quality in the San Joaquin River. This is a long-standing problem with no easy solution. Actions directed towards improvement may be forced by an upcoming ruling of the State Water Resources Control Board, but if this does not happen, other mechanisms might be required to move forward.

(2) Proposed actions under the BDCP, both with respect to conveyance and ecosystem restoration. The BDCP proposes to construct new intakes for exporting water from the Sacramento River to areas south of the Delta. Assuming that there is no separate action taken on San Joaquin River water quality, this would tend to reduce water quality in the South Delta, which at present is sustained by cross flow of relatively fresh Sacramento River water through the Delta as it is drawn to the present export pumps. While it is reported that the current preferred conveyance alternative would include some through-Delta flow, the operating rules have not yet been fixed and there is no consensus on the BDCP effects analyses, so that the impact on South Delta water quality is uncertain, but it cannot be positive. Of the various conservation measures that have been suggested as part of BDCP, there are two in particular would have an effect on water quality in the Delta. One proposed measure is the conversion to tidal wetlands of lands around the periphery of the Delta, principally in the Cache Slough area and in the South Delta. Although very beneficial for a range of fish species because of the

[123] Downey and Clinkenbeard, 2005. *An Overview of Geologic Carbon Sequestration Potential in California*. California Geological Survey.

steady introduction of organic carbon into the rivers and sloughs of the Delta, this same increase in organic carbon can have an almost catastrophic effect on municipal water supplies because it can only be treated with very expensive membrane technology. Expected costs of this are noted below. A strategy for creating additional tidal marshes that would have fewer impacts to Delta water quality would be to restore the sunken islands in the far western Delta (and also perhaps Frank's Tract) as tidal marshes and to convert what are presently managed wetlands in the Suisun Marsh to tidal wetlands. This would not only have less impact on the introduction of organic carbon into municipal water supplies, but as discussed below, would also help control the tendency for salinity intrusion into the Delta as sea level rises. The second kind of conservation measure that is included in BDCP, which has potentially negative effects on water quality but positive effects on both ecosystem restoration and flood control, is the proposed use of historic floodplains to temporary store flood waters. This generally requires the removal of levees or the construction of new set-back levees. Re-activation of historic floodplains contributes to flood control by reducing the peak water-surface elevation as a flood crests and stretching out the flood hydrograph. It also directly restores one important element of the natural ecosystem, the burst of organic carbon introduced to the aquatic environment during flood crest. However, because this is only a temporary burst, rather than a sustained introduction of organic carbon, and it only occurs during periods of high flows, the consequences for municipal water treatment are not as severe. An excellent example of this approach to floodplain restoration is provided by the proposed Lower San Joaquin Bypass project which would widen Paradise Cut and reduce peak-water surface elevations in the San Joaquin River as it passes Lathrop and Stockton.[124]

(3) The third possible source of significant changes in Delta water quality is the possible increase in the rate of sea-level rise from the 6 inches or so per century that has been observed for the last three centuries. It is the policy of the State to plan for 55 inches of sea-level rise by 2100, although this has a relatively low probability of occurrence. Regardless, and regardless of the catastrophic effect that this would have on other man-made and natural communities, rises in sea level approaching this number would have a significant effect on tidal action and salinity in the Delta. However, these effects can be mitigated by adaptive management and engineering, primarily by restricting the tidal flows into the Delta by narrowing the channels in the Western Delta, in part by restoring the flooded islands to the west of Sherman Island, and by creating tidal marshes, which absorb tidal energy, in the far western Delta and the Suisun Marsh. Maintenance and improvement of the levees on the eight western islands will become even more critical as sea level continues to rise.

(4) A fourth possible source of water quality degradation is the failure of levees and the failure to restore flooded islands. As noted elsewhere, the ecological benefits of leaving islands flooded, or even deliberately breaching islands where the land surface is presently below sea level, are uncertain. What is clear, however, is that increasing open water in the Delta, is not natural, has an adverse effect on adjacent islands as a result of increasing wave action and seepage forces, and would contribute to the conversion of the Delta from an estuarine ecosystem to that of a weedy lake. Water quality would tend to be degraded both as a result of increased salinity intrusion and as a result of more organic carbon and introduced organisms.

[124] Lower San Joaquin River Flood Bypass Proposal, South Delta Levee Protection and Channel Maintenance Authority, Submitted to California Department of Water Resources, March, 2011.

In order to provide some idea of the expected costs of advanced water treatment, we included the following estimates that were provided by the Contra Costa Water District.

From FY2011 CIP: Implementation of advanced treatment technology such as membrane filtration and multiple barriers for District facilities

- Total capital cost: $ 80 M (based on 115MGD capacity, advanced treatment add-on would cost ~ $0.7/gallon)

From Annual District O&M cost: $6.6 M

- Estimate costs for based on treatment capacity

By city/agency

- CCWD (125 MGD): $87 M capital + $7.2 M/year O&M
- Brentwood (16.5 MGD): $11 M capital + $0.9 M/year O&M
- Antioch (38 MGD): $26 M capital + $2.2 M/year O&M
- Pittsburg (32 MGD): $22 M capital + $1.8 M/year O&M
- Martinez (14.7 MGD): $10 M capital + $0.8 M/year O&M

TOTAL (226 MGD): $157 M capital + $13 M/year O&M

- Accuracy Range: -30% to +50% (e.g. $110M - $ 236M for total capital)

Note: O&M should probably be scaled by average treatment, not capacity.

4.1.2 Wastewater Treatment for Delta Communities

Most Delta communities discharge treated wastewater directly into the rivers and sloughs of the Delta, contributing to environmental problems and reducing Delta water quality for human use. In recent years, the Central Valley Regional Water Quality Board has ordered virtually all Delta wastewater dischargers to significantly upgrade their plants to tertiary treatment. Some wastewater utilities are in the building process whereas others, including Sacramento the largest discharger, are in the planning stages after recent regulatory decisions by the Board. Although the costs vary between utilities, the upgrades will cost the typical household in the Delta counties $200 or more per year when fully operational compared to secondary treatment. While the improvements are costly, they are expected to make significant improvements to Delta water quality which furthers the coequal goals of the Delta Plan, and benefits the resource-related agriculture and recreation industries within the primary zone. They represent a significant investment from Delta communities, and are an action item already in progress to support the coequal goals and enhance Delta recreation and agriculture.

Chapter 9: Legacy Communities

Communities in the Sacramento–San Joaquin 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 communities considerably—some to the extent that visible signs of underutilization and physical deterioration are prevalent. Despite the trends that suggest otherwise, there is great potential for revitalization of the Delta's Legacy Communities.

Important Note: This chapter is being significantly restructured and updated with additional data, graphics, and case studies in the September draft.

1 Overview and Key Findings

This chapter discusses the "Legacy Communities" of the Sacramento–San Joaquin Delta, including Clarksburg, Courtland, Isleton, Locke, Ryde, and Walnut Grove, providing a general overview of each.[125] In addition, Clarksburg, Walnut Grove, and Locke have been selected for more detailed study and focused economic sustainability planning. As part of that deeper dive, this chapter discusses a potential "vision" of a sustainable future for each of these focal communities, the goal being to preserve their rich cultural histories while simultaneously providing for economic prosperity. The chapter also provides high-level implementation strategies with recommended action items. The overarching goal is to promote economic sustainability in Clarksburg, Walnut Grove, and Locke, prioritizing actions based on the vision for these communities. It is anticipated that facets of the strategies for Clarksburg, Walnut Grove, and Locke may be applicable to other Legacy Communities.

A primary aspect of sustainability planning for the Delta's Legacy Communities is the notion of enhancing legacy themes and creating better awareness of each of these distinctive communities. It is contemplated that promoting the uniqueness of these communities, in combination with strategic investments, will attract new residents, businesses, and visitors, thereby stimulating overall economic health and sustainability. To fully realize the economic potential of the Legacy Communities will require a comprehensive plan. Accordingly, the Economic Sustainability Plan provides a multi-faceted strategy for Clarksburg, Walnut Grove, and Locke that touches on historic preservation, economic development, urban design, recreation, marketing, and other factors. In addition, the Economic Sustainability Plan considers the need for a facilitator (an existing agency) to guide and support reinvestment in the Legacy Communities.

The vision and implementation strategy for each community relies on extensive research of historical context, analysis of socioeconomic conditions, and public input. This chapter includes historical narratives, presents local demographic and economic data, and incorporates findings from community outreach. The chapter also reflects findings from field work, including assessments of community character and site-specific development opportunities. The following presents key opportunities and constraints for the Legacy Communities; the high-level vision for Clarksburg, Walnut Grove, and Locke; and an overview of the implementation strategy.

[125] While the Delta Reform Act of 2009 (SBX7-1) identifies additional "Legacy Communities," the ESP focuses on the communities of the Sacramento River Corridor. Findings and recommendations from the ESP may serve as a useful template for analysis of other Legacy Communities.

1.1 Opportunities and Strengths

Outdoor and cultural recreation remains critical to long-term sustainability. Already a well-known and heavily visited recreation area, daytrip and overnight visitors are an important source of revenue for Delta businesses. It is crucial to maintain and enhance recreation offerings in the Delta, ensuring that the Delta remains a top visitor destination for outdoor and cultural recreation in Northern California.

Improved lodging, entertainment, and retail options capture additional tourism dollars. Despite the significant number of recreation visitors to the Delta, there are relatively few hotel rooms, stores, and attractions. Overnight accommodations and entertainment options, in combination with supporting retail, could increase visitation, length of stay, and spending in the Delta.

Transportation-related improvements enhance the visual landscape, attract visitors, and improve public safety. Roadway landscaping, signage, bike lanes, sidewalks, parking, transportation services, and other transportation-related improvements are needed in the Delta. Investments in transportation will improve quality of life for residents and increase tourism potential.

Restored historic buildings and contextual infill development improve community aesthetics and support economic growth. The Legacy Communities offer a unique sense of place and history that must be preserved. Historic preservation should be pursued in concert with new projects. Reinvestment and new investment in real estate is critical to economic sustainability. Development projects that are consistent with the existing community fabric will be an important factor in retention and recruitment of businesses.

Agricultural tourism has growth potential. Agritourism and rural recreation is currently found throughout the Delta and is growing. Farms and other agricultural businesses (including wineries) are increasingly leisure destinations, with businesses seeking direct sales and brand awareness and visitors seeking fresh food and a physical connection to their food source.

Festivals and community celebrations raise awareness and generate economic activity. There are numerous festivals and community events each year that boost tourism and business activity in Delta. Additional visitor programming, coordinated scheduling, marketing, and branding could increase the economic benefits of existing and future events in the Delta.

1.2 Constraints and Challenges

A strict and multi-layered regulatory framework limits economic development. With numerous government agencies overseeing land use in the Legacy Communities, permitting new projects is frequently a costly and lengthy process. Furthermore, some projects are disallowed entirely.

Risks associated with insufficient flood protection limit new investment. Adequate flood protection is essential to economic development in the Delta. Costly new and improved levees are necessary to encourage reinvestment and new investment in the Legacy Communities.

Housing options for Delta workers are limited. Only about one in ten employees working in the Primary Zone also lives there. Without sufficient workforce housing, Delta employers must

recruit non-local employees who must drive long distances to work, thereby compromising 'sustainability' from an environmental standpoint.

1.3 The Vision for Clarksburg, Walnut Grove, and Locke

Clarksburg – A Vibrant Agricultural Community. Clarksburg's primary competitive advantage is its agricultural abundance. This region produces exceptional agricultural goods, most notably wine grapes, and attracts visitors who tour farm country and local wineries. The Economic Sustainability Plan proposes that the vision for Clarksburg build on momentum in the areas of agricultural tourism and value-added agricultural processing. Clarksburg should retain its historic character, grow as a food and wine destination, and attract new agriculture-related craft production businesses.

Walnut Grove – The Heart of the Delta's Sacramento River Corridor. Walnut Grove is centrally located, with a cluster of businesses providing residents, workers, and visitors a variety of goods and services not found elsewhere in the Primary Zone. The Economic Sustainability Plan proposes that the vision for Walnut Grove build on its status as a hub of local businesses and services. Walnut Grove should preserve its community character; grow and diversify business activity; and continue to strengthen its physical connection to the Sacramento River.

Locke – A Historic Delta Community. Locke is known for its cultural heritage, historical significance, unique building stock, and points of interest. With great sensitivity to cultural, historical, and environmental values, the Economic Sustainability Plan proposes that Locke would leverage its notable assets to increase tourism and spending in the community. Locke should preserve its historic character, offer improved hospitality and visitor services, and revitalize its "main street" business environment.

1.4 Implementation

An existing agency should be designated to manage and implement economic sustainability efforts in the Delta. A designated entity responsible for economic development and community reinvestment should plan, coordinate, and participate in the implementation of the Economic Sustainability Plan. Future planning efforts would build on recommendations and findings from this Plan, refining the goals for the Legacy Communities and prioritizing potential strategic actions. The agency would ensure that strategic actions, such as marketing efforts and economic development, are implemented in a systematic, efficient, and consistent fashion throughout the Legacy Communities. Additionally, the agency might contribute to implementation directly, either carrying out implementation actions independently or by coordinating partnerships between public and private sector actors.

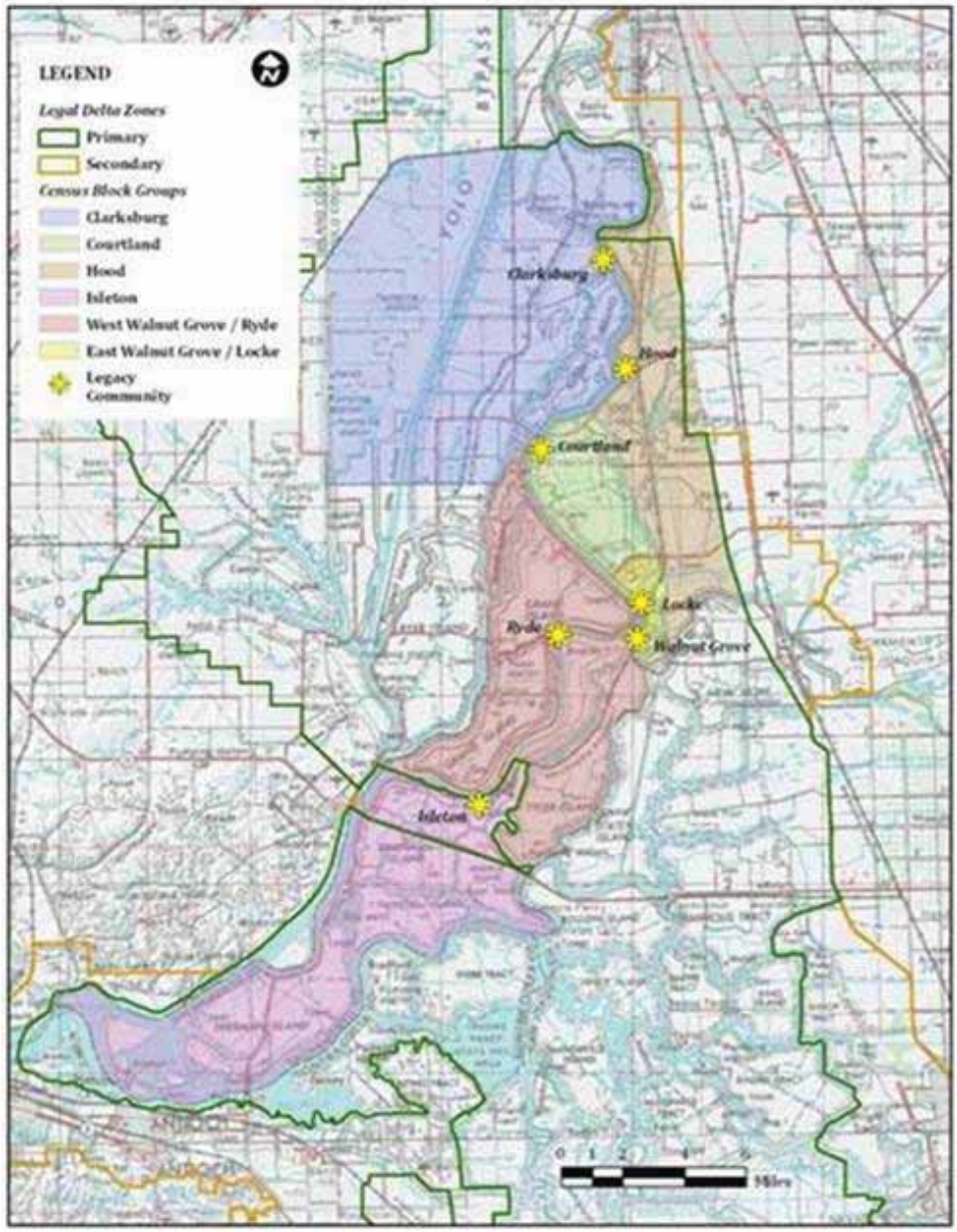
Potential strategic implementation actions must be analyzed, refined, and prioritized. The Economic Sustainability Plan considers a number of strategic actions for the communities of Clarksburg, Walnut Grove, and Locke. In addition, specific sites are evaluated for higher and better land use potential. The proposed strategic actions and the review of opportunity sites presented in this chapter are intentionally high-level. As community- specific economic sustainability goals are refined over time, associated strategic actions will need to be updated and further detailed.

2 Current Status and Trends

This section describes the historical context, current socio-economics, and business environment of each Legacy Community. From this contextual platform, a vision and strategic

action plan has been developed which seeks to leverage the strengths of each community and address many of the weaknesses and constraints that hinder economic prosperity. Figure 36 below shows the Legacy Communities and their corresponding U.S. Census Block Group boundaries.

Figure 36 Legacy Communities and Census Block Group Boundaries



2.1 Clarksburg

Clarksburg is the only Yolo County community located within the Delta Primary Zone. 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 addresses it as a distinct place that, if developed, would be done so in a manner consistent with other communities in Yolo County.

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.*

The housing element of Yolo County's 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:

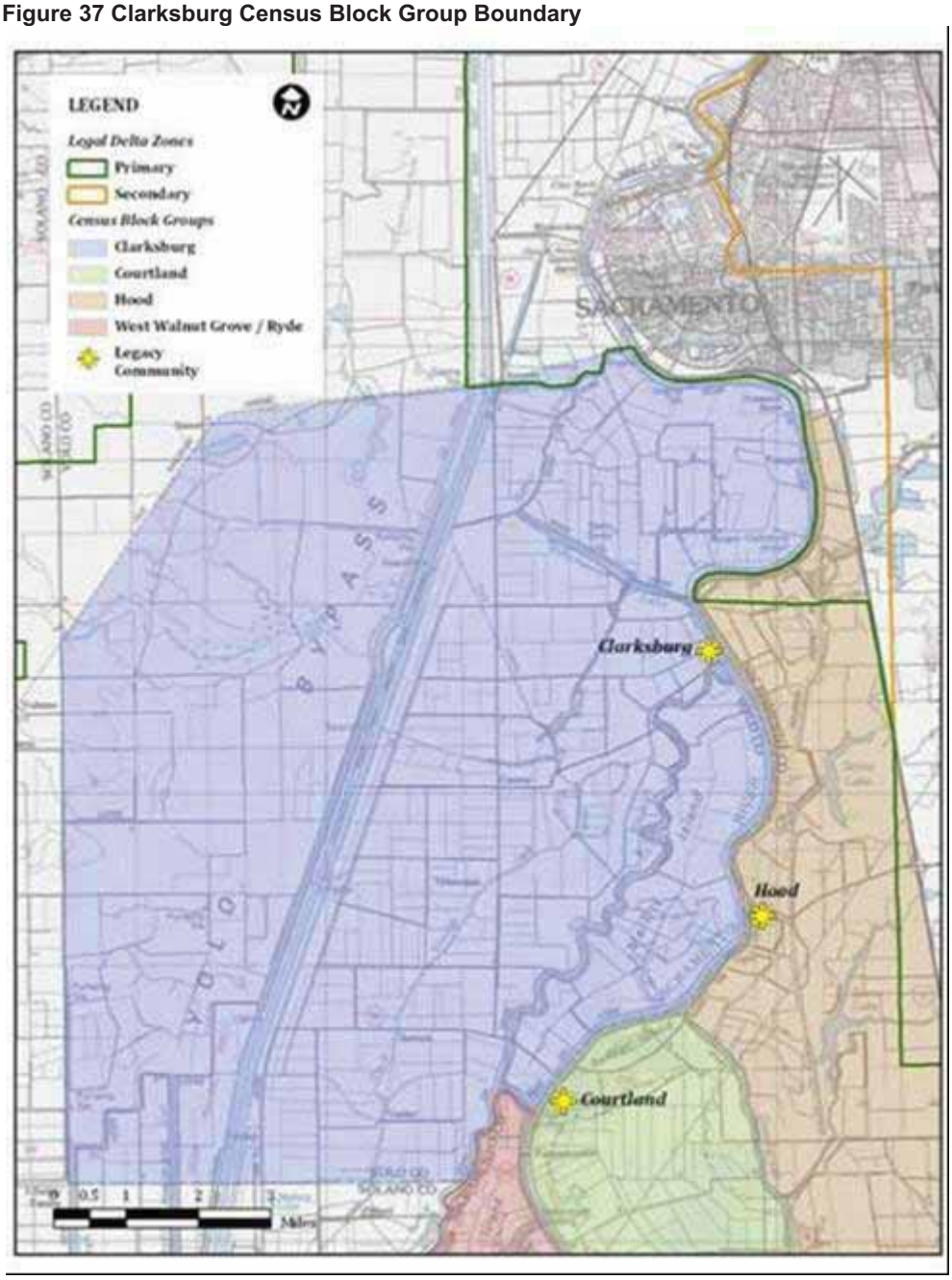
- Provide affordable housing and farm worker housing in the Clarksburg Region, consistent with the Land Use and Resource Management Plan.
- Advocate for amendment of the Delta Protection Act or Delta Protection Commission Land Use and Resource Management Plan as necessary and appropriate to encourage 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.

2.1.1 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 37 below. Although this boundary may differ from some other political or locally accepted definitions of Clarksburg, the census data from the block groups is the best socio-economic information available for the purposes of this analysis. It is important to note that the socio-economic context that is presented in this section is based upon the data collected for this geographic area.

Figure 37 Clarksburg Census Block Group Boundary



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 resembles or differs 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 Appendix H.

Population and Households 2010

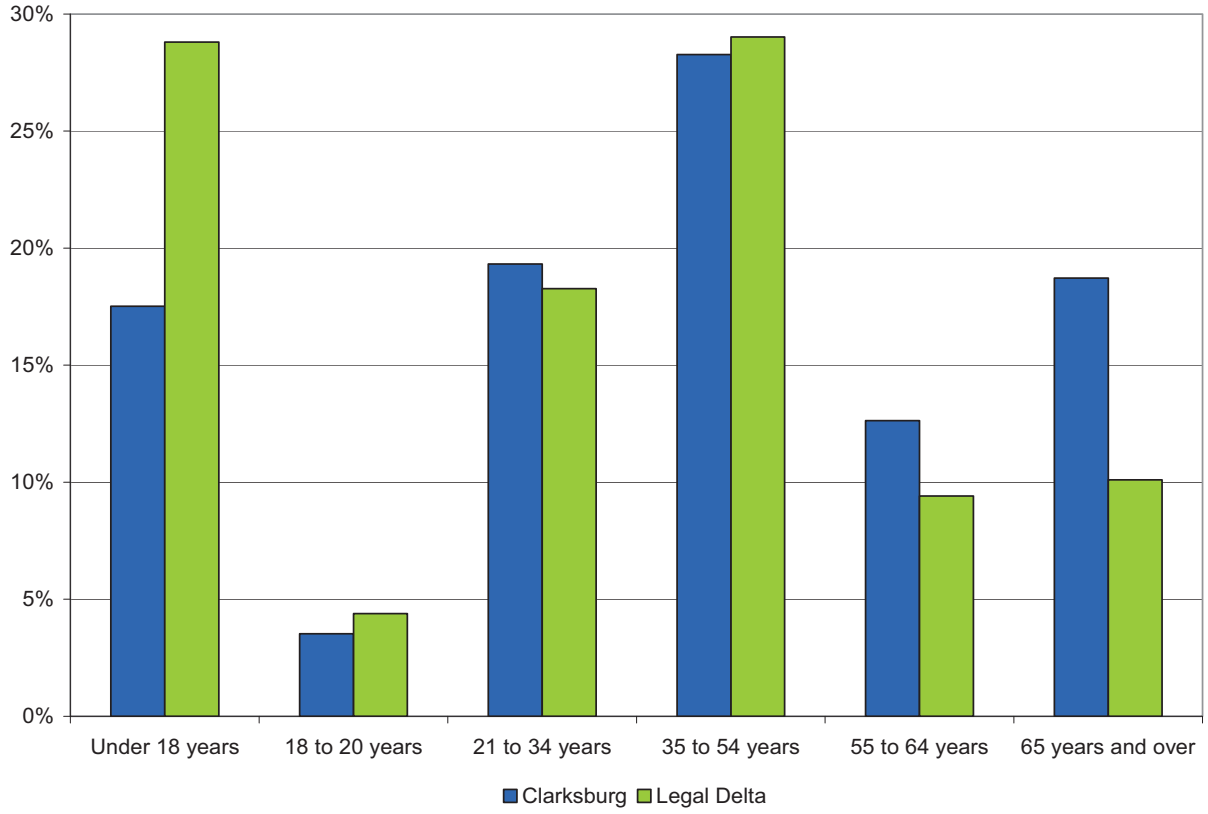
According to the latest U.S. Census Bureau American Community Survey estimates, there are approximately 1,330 residents and 489 households residing in Clarksburg block groups, which

is not dissimilar to the population base a decade ago. The lack of growth in Clarksburg reflects Yolo County's general plan designations, which allocate minimal growth to the area. New planning initiatives may be brought forth for approval; however, the denial of the residential component of the Old Sugar Mill development proposal in 2007 sent a negative signal to potential residential developers. It is safe to assume that Clarksburg's population and household size will remain at or near its current size for the foreseeable future, unless major changes in land use policy, flood protection, and market conditions occur.

Age

The age distribution of residents in Clarksburg indicates a population that is generally similar to the Legal Delta overall but with fewer young children and a much higher proportion of older residents. As shown in Figure 38, 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 and older is 19 percent (compared to 10 percent in the Legal Delta).

Figure 38 Clarksburg Population Age Distribution



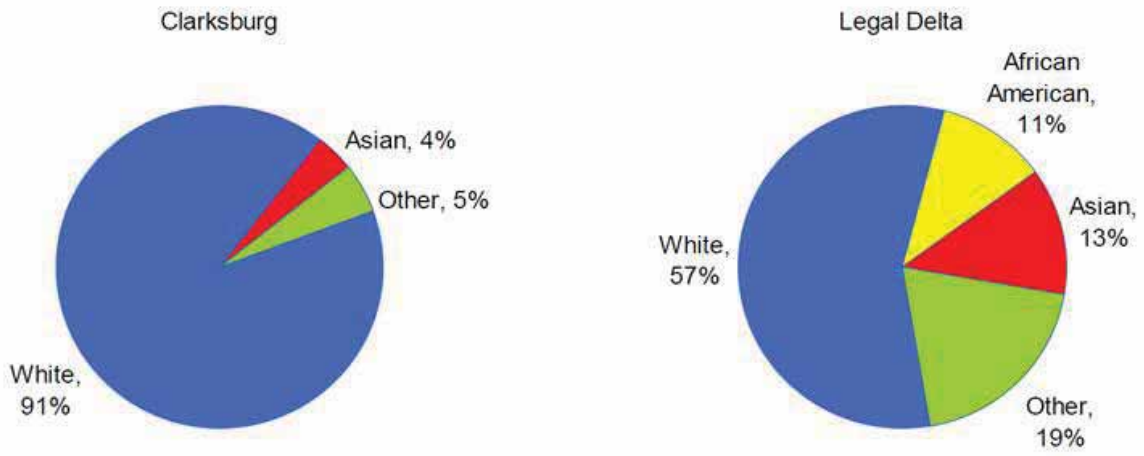
Source: 2005-9 American Community Survey, Census Bureau

Race and Ethnicity

The residents of Clarksburg are generally Caucasian, with residents identifying themselves as "White alone" making up approximately 91 percent of the population (which is significantly higher than the 57 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 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 in the 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 H for more information.

Figure 39 Population Racial Distribution in Clarksburg

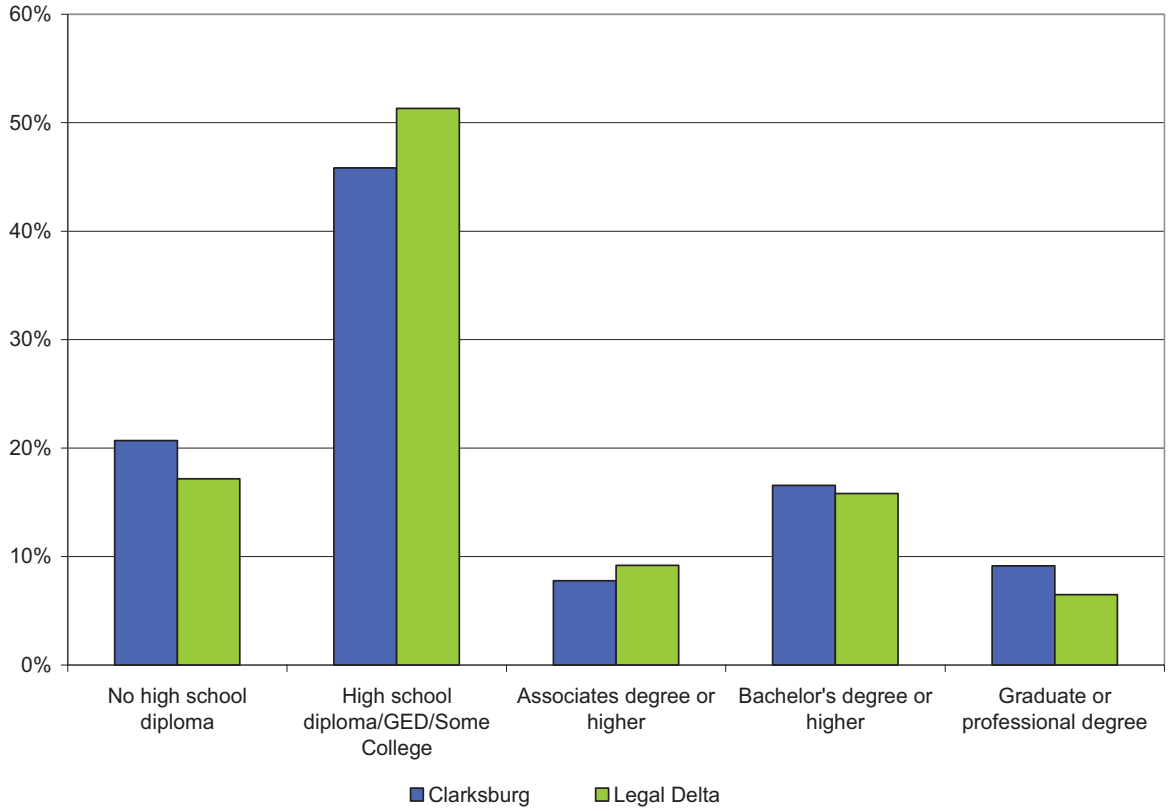


Source: 2005-9 American Community Survey, Census Bureau

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 Figure 40. Clarksburg does, however, show a slightly lower percentage of residents having completed high school (or GED) than in the Legal Delta overall. However, Clarksburg residents are more likely to have completed post-secondary education as compared to the rest of the Legal Delta.

Figure 40 Clarksburg Educational Attainment (Population 25 years and older), 2005/2009

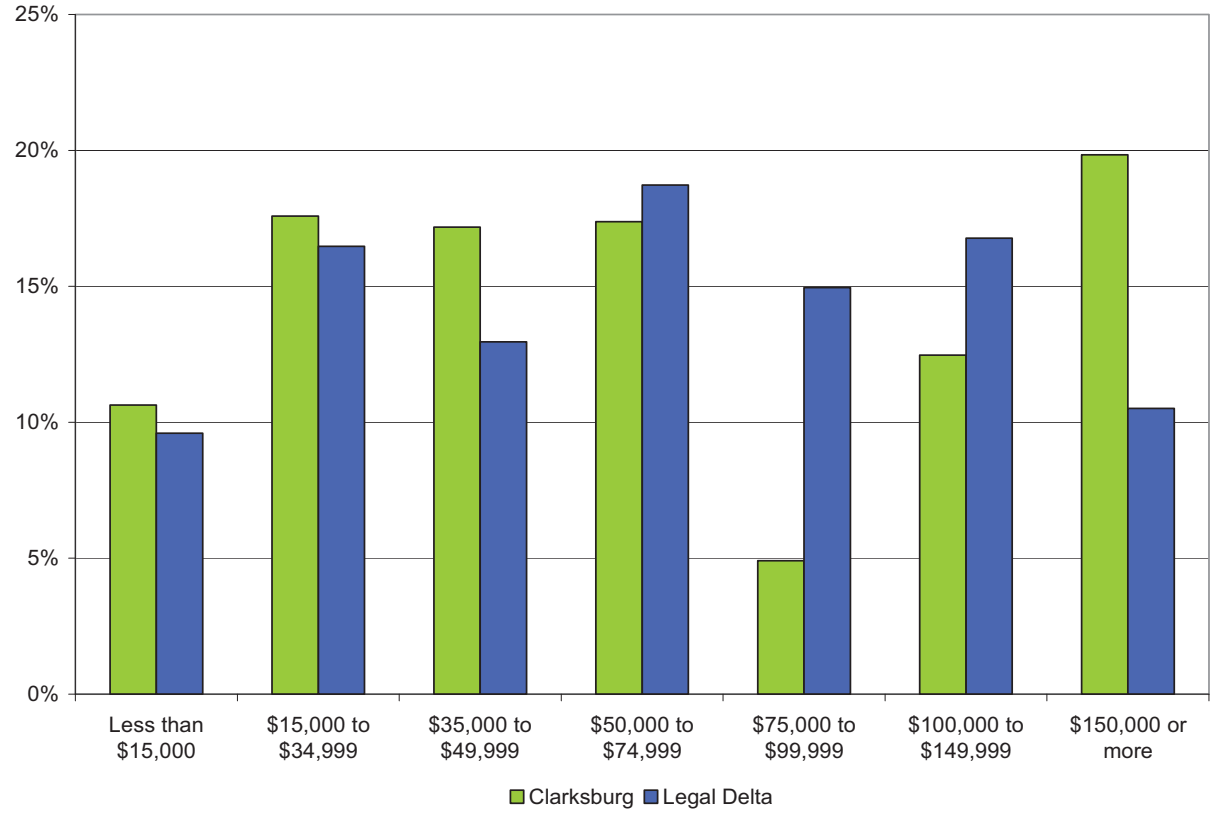


Source: 2005-9 American Community Survey, Census Bureau

Household Income

The household income distribution in Clarksburg is generally similar to that in the Legal Delta, as shown in Figure 41. A slightly larger proportion of Clarksburg households have a total household income of 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 64 percent in the Legal Delta). A significantly greater share of Clarksburg residents earn more than $150,000 (20 percent, as opposed to 11 percent in the Legal Delta), indicating that while blue collar in nature, Clarksburg does indeed contain some wealth and high-net-worth residents.

Figure 41 Clarksburg Household Income Distribution, 2005/2009



Source: 2005-9 American Community Survey, Census Bureau

Housing

Approximately 63 percent of the housing units in Clarksburg are occupied by their owners. This is slightly lower than in the Legal Delta (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 rental 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 the total.[126]

Resident Labor Force Employment by Sector

The labor force residing in the Clarksburg area is largely employed in the agriculture industry, at nearly 25 percent of employment. The next largest industries are manufacturing, finance and insurance, and construction. 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.

[126] U.S. Census Bureau, OnTheMap and LEHD Origin-Destination Employment Statistics, 2009. Note that this figure is for place-of-work employment (as opposed to place-of-residence, which is also shown elsewhere in this report).

Employment Trends

Clarksburg employment is dominated by the agriculture industry. Figure 42 shows the distribution of jobs that are physically located in Clarksburg. As shown, the agriculture industry accounts for over 50 percent of local jobs. The manufacturing industry is also an important employer in Clarksburg.

Figure 42 Distribution of Clarksburg Employment (2007-9)

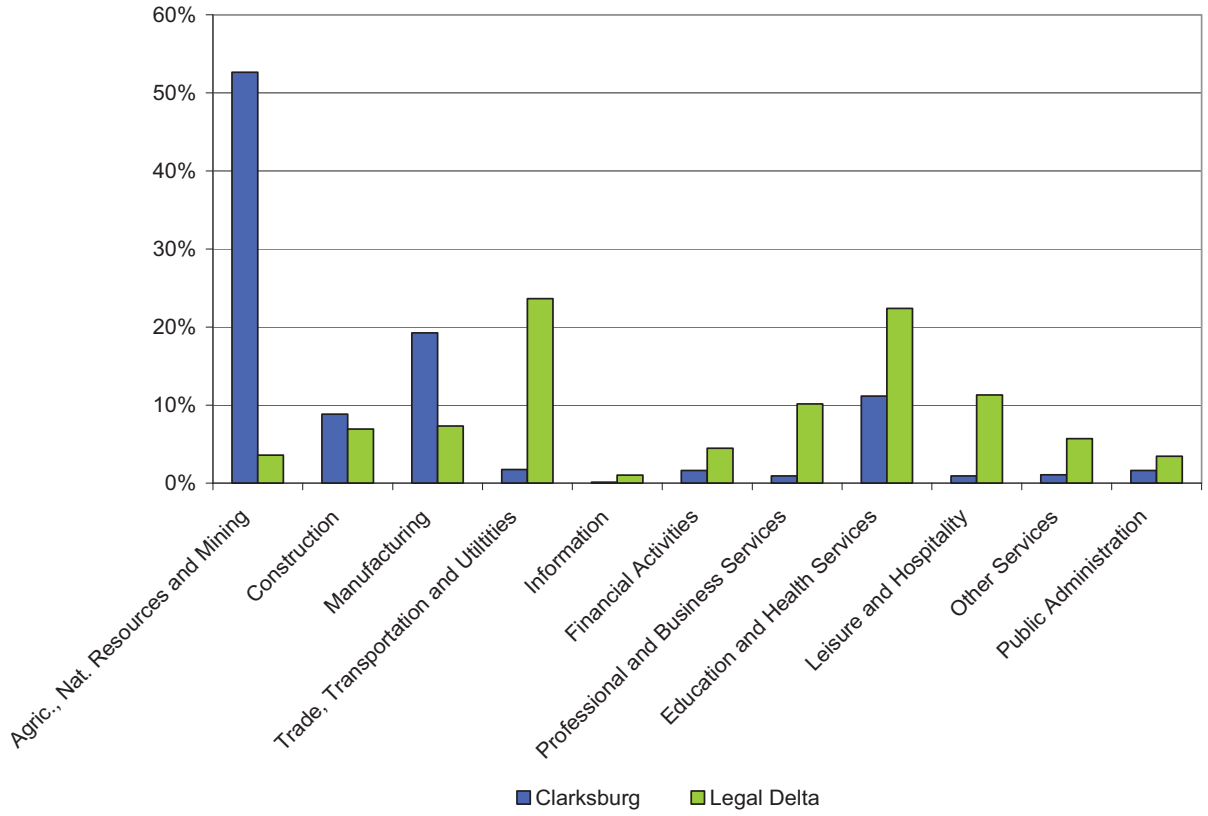


Figure 43 shows the annual change in jobs located in Clarksburg from 2002 to 2009.[127] Although total employment increased in Clarksburg during this period, this growth was characterized by large fluctuations in a few key industries, such as the agriculture, forestry, fishing, and hunting industries, which reportedly shed nearly 150 jobs during this time period.[128] 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 the area, or by a construction business' headquarters location being relocated.[129] 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

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

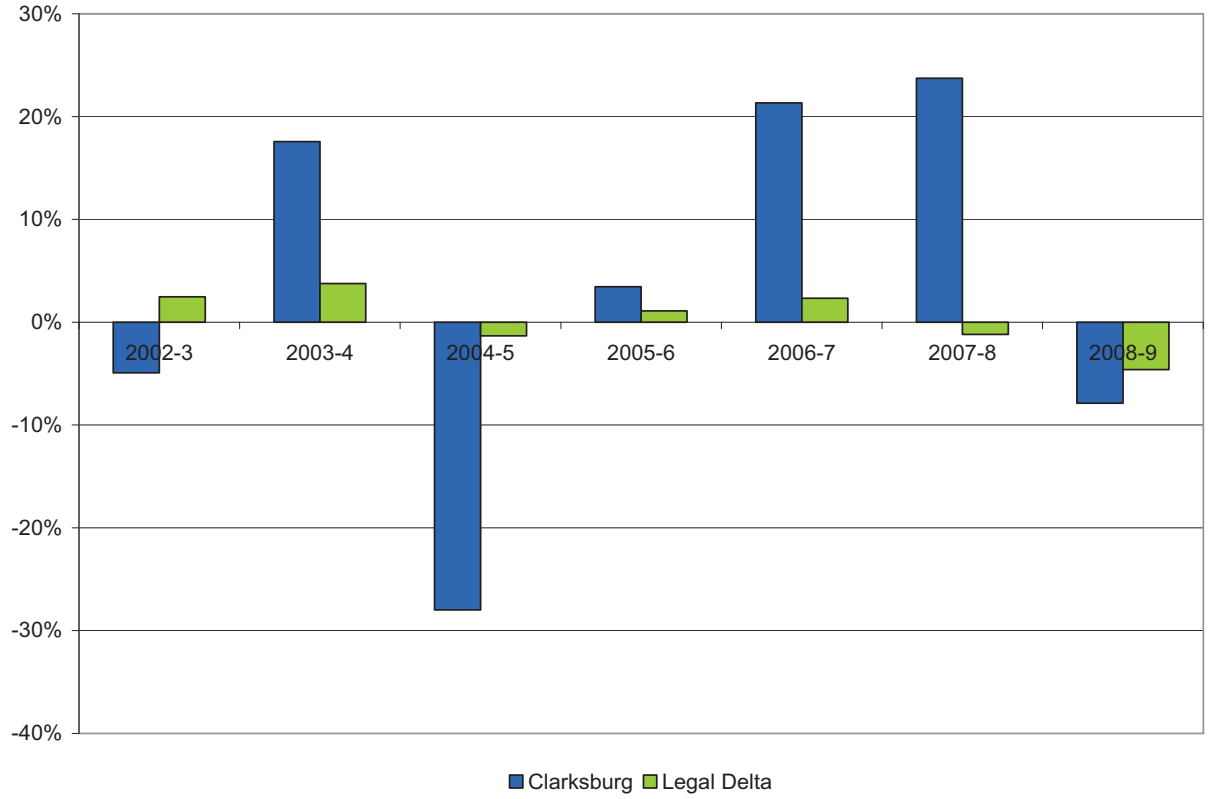
[128] Local employment swings in this industry are common because employment is often tied to designated accounting/payroll offices rather than agricultural fields. In addition, major changes in the construction industry have occurred throughout the Sacramento region in recent years, and a substantial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

[129] Hoover's Dunn & Bradstreet (2010) reported that six small construction companies opened in Clarksburg during this time period.

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 eight years, with the exception of educational services, which accounts for 40 jobs (2009), but has shed 31 jobs since 2002. This likely is due to a combination of 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.

Figure 43 Employment Growth Trends, 2002-2009



Source: Center for Economic Studies (LED-LEHD), Census Bureau

Some of the largest employers in Clarksburg include Bogle Vineyards (which employs approximately 60 workers in Clarksburg[130]) and the River Delta Unified School District (which has approximately 30 employees in Clarksburg[131]). 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 facilities. The company has stated that it intends to hire approximately 20 more employees in the next two to three years as this facility is constructed.

[130] Bogle company representative.

[131] Hoover's Dunn & Bradstreet enterprise data, 2010.

Overall, it is interesting to note that although significant changes in key industry sectors have occurred over the past eight 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 agriculture to other industries, including construction and manufacturing.[132]

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 proportion as compared to other Legacy Communities.

2.1.2 Economic Sustainability Vision for Clarksburg: A Vibrant Agricultural Community

Clarksburg's primary competitive advantage as a community is its agricultural abundance. This region is known to produce exceptional agricultural products, most notably wine grapes, and other wine products, and the culture of the town is very supportive of this agricultural heritage. An economically sustainable vision for Clarksburg should build upon the momentum already gained in this key sector, while continuing to selectively round out and add to the package of local- and visitor-serving uses in the community. Key tenets of a vision for Clarksburg include the following:

Preserved Historic Character: Clarksburg's established, attractive, and high-quality building stock should be maintained and/or enhanced, and properly-planned and scaled adaptive reuse opportunities should be assessed for their potential to improve the community.

Establishment as a Regional Food and Wine Destination: 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. Clarksburg has potential to become a regional destination by enhancing the current offerings and adding high-quality visitor attractions that pertain to wine, vineyards, slow food, and the "loco-vore" movement.

Enhanced Resident and Visitor Amenities: Opportunities to add a variety of visitor-serving and/or local-serving uses to the existing roster should be carefully evaluated. Such uses could potentially include retail stores, restaurants, wine tasting rooms, small-scale lodging, and others as appropriate.

Increased Value-Added Agriculture Processing: In order to provide jobs and increase wealth created and retained within the community, select value-added processing facilities should be encouraged.

2.1.3 Strategic Action Plan for Clarksburg

The following items should form the basis of a Strategic Action Plan for Clarksburg:

[132] 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.

- To remain consistent with Clarksburg's general plan, direct growth toward infill and replacement development in the existing Clarksburg town area. There is an approximate total of 76,000 square feet of land and with approximately 18,500 of either vacant or underperforming buildings. These vacancies provide opportunity sites for catalyst redevelopment that can serve existing and emerging markets related to tourism, outdoor recreation, food, wine and agriculture.
- Promote wine grape growing and establish the wine and viticulture industry as the primary economic development theme of the community.
- Promote the enhancement and development of businesses like the Old Sugar Mill, installing wayfinding signage and improving accessibility to the site (e.g., complete streets). Enhancements should be consistent with the character of the Clarksburg town area.
- Establish or expand local crushing, fermentation, bottling, and storage facilities.
- Promote tourism, including farm stays.
- Promote farm stands and the sale of locally-produced agricultural products.
- Review land-use policies to assure allowance 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.

2.1.4 Opportunity Sites

Although the capacity for development within the "town" of Clarksburg are extremely limited, there are a small number of "opportunity sites" that occupy key geographic locations, have important adjacencies/connections, or for 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. However, in order to accommodate future development, these sites would require sufficient infrastructure to serve them, including adequate flood protection, sewer, water, and roadway access, as well as good visibility, ideally both from the land and 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 Old Sugar Mill is home to state-of-the-art wine production facilities and six micro-wineries, and the facility hosts many events throughout the year, including weddings, concerts, fundraisers, etc.

The Old Sugar Mill project is important to Clarksburg in a variety of ways. 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, this potential is hindered by a variety of political, regulatory, environmental, and infrastructure issues.

Nonetheless, the Old Sugar Mill is operating successfully today and the vacant land and building space at and adjacent to the site 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 regulatory agencies and local community members.

2. Yolo County has identified approximately 100 acres of newly zoned 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. Specific uses have not been determined for the remaining ag-industrial lands identified by the plan.

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 and it is 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. Other parcels located along Riverview Drive near Netherlands Avenue may have merit for future development as well.

CASE STUDY FRAMEWORK EXAMPLE SUTTER CREEK AND WINTERS

Other communities in the region have newly created, or in some cases longstanding, programs and policies that lend themselves to establishing a "brand" or strategic direction that contributes to economic sustainability, community vitality, and civic engagement on the part of residents and visitors alike. Like each community, the results are varied and unique, but the outcomes are similar: thriving, small-scale, functional towns that create hubs in and of themselves. The communities cited below are visionary influences and can serve as models for economic and cultural enhancement, redevelopment and renewal, and adaptation to new market forces.

We have selected two distinctly different communities in different physical settings to serve as stimuli and idea generators as to how the Legacy Communities could possibly evolve and adapt as market forces and demographics combine to change how they function, market themselves, and remain viable into the future.

Sutter Creek in Amador County, California (population 2,500) has established a co-brand with other nearby towns in the Gold Country as well as California's "Golden Chain Highway 49"

- Characterized by well-preserved architecture as well as new development that complements existing buildings in the historic core
- Tidy and very clean public and private realms
- Reinvestment is evident in the historic core
- New development has occurred away from the historic core that is suburban in nature and not terribly inspiring or exemplifies typical contemporary development standards. Landscape is limited and site planning could be characterized as 'strip'
- Functioning town amenities—post office, shops, restaurants, walkable streets
- Emphasis on tourism, wine, and antiques
- Destination restaurants and lodging are comparable to Delta establishments in terms of recognition and longevity
- Regularly occurring, year-round community festivals generally geared towards commerce of all types
- Has a Facebook page
- Has a business association and City-sponsored website
- Council/Manager form of government with very limited City staff
- No economic development efforts other than a business association

Main Street, Sutter Creek, CA

Winters, in western Yolo County, California (population 6,600) has what could be described as an emerging brand centered on wine, slow food and agriculture.

- Has a City sponsored website
- Has a Facebook page and a Twitter account
- Recent redevelopment efforts including streetscape, park, pedestrian bridge
- Vibrant street scene evolved only over the last 5 years
- Emerging reinvestment; quality historic preservation
- Emphasis on community and uniqueness while recognizing agricultural heritage and ongoing prowess, not unlike Delta communities
- Not so much a tourist destination, but heavy cyclist/motorcycle destination
- Community emphasis on slow food branding
- Wineries in town (3)
- Council/Manager form of government with a volunteer Economic Advisory Committee that looks at a broad range of topics: land use, all manner of design, fiscal sustainability, and economic development
- The City website advertises properties for sale or lease

2.1.5 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 report.

- **Water and sewer:** Each developed parcel in Clarksburg is served by its own well and septic system. This condition is not sustainable in the long term, primarily as it pertains to public health and water quality. There are currently no plans to provide municipal services to the community. If any meaningful development is to be implemented in the future, the issue of sewer and water provision must be solved, which is a significant barrier—although not insurmountable.

- **Flood protection**. As discussed elsewhere in this chapter and throughout this report, establishing adequate flood protection is a crucial issue which severely constrains development. Several possible solutions have been brought forth and will continue to be evaluated. In the meantime, new development is severely hampered.

- **Telecommunications:** Current internet access in most Delta communities is very limited, and Clarksburg is no exception. This issue limits the degree to which "white collar" businesses can locate in the Delta. Economic development plans should include digital connectivity as a first step in enhancing the livability and competitiveness of the town.

- **Roadways:** Most community roadways are incomplete, missing sidewalk, curb, gutter, and accessibility features. Existing roadways are adequate for current vehicle traffic; however, if streets are to be considered "complete", significant infrastructure investments are needed.

- **Waterway access**: Clarksburg has a small dock, but it does not accommodate transient vessels, which can attract visitors. These facilities should be planned for and constructed in order to enhance the recreational appeal of Clarksburg and the surrounding area.

2.2 Walnut Grove/Locke

Although Walnut Grove and Locke are nearly adjacent to each other and have similar populations, services, employment linkages, etc., they are distinctively unique communities. This section describes the history and socio-economic context of these communities.

2.2.1 Walnut Grove/Locke Socio-Economic Context

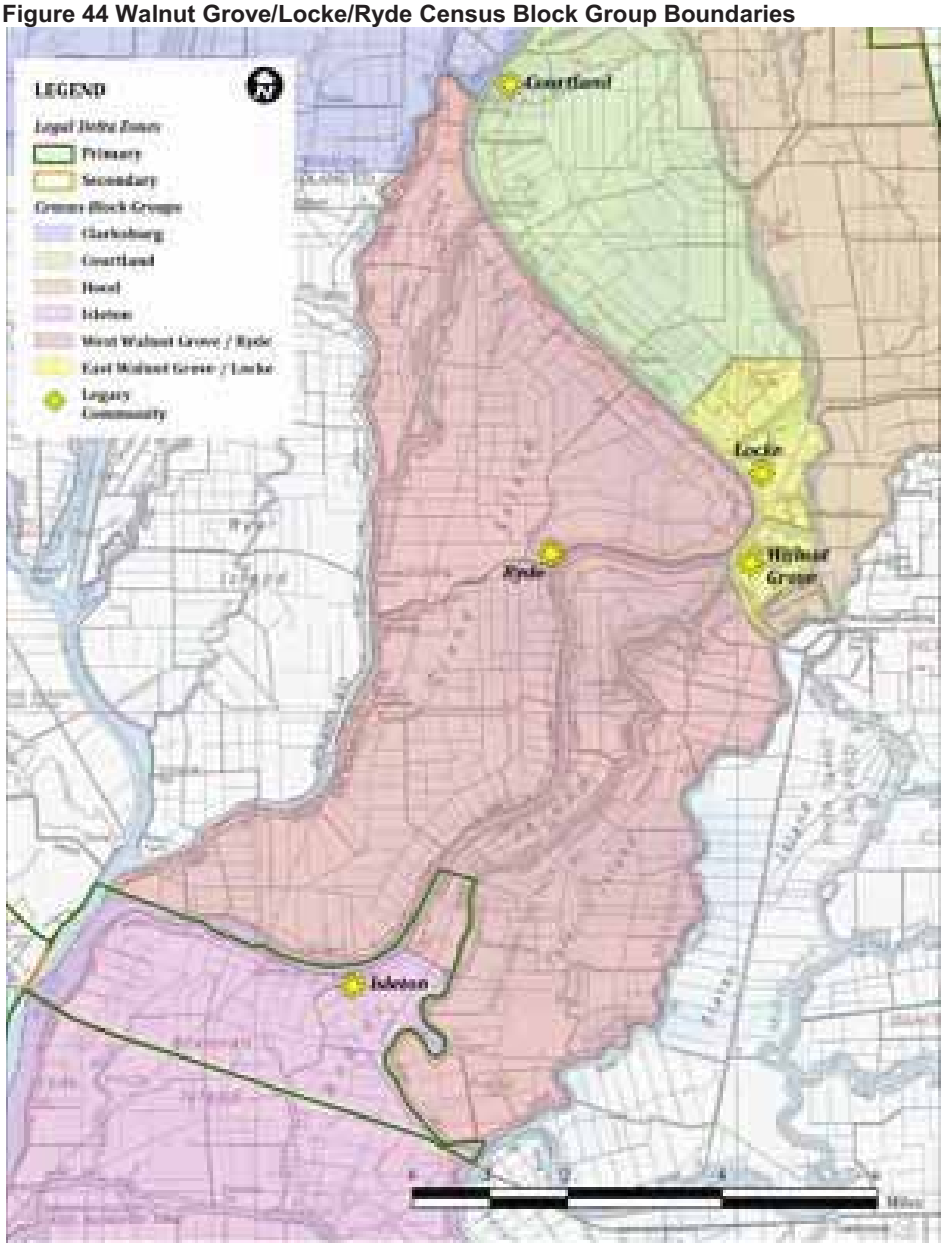
The ESP Team has evaluated the socio-economics of Walnut Grove and Locke based on various data sources that originate from the U.S. Census Bureau. Census Bureau data concerning detailed socio-economic factors for Walnut Grove/Locke are available at the Census Block Group level, and comprise the area shown in Figure 48 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 data groups the western portion of Walnut Grove (i.e., Clampett and Great Isle Estates) with Ryde to the south, as shown in Figure 44 below. Although this geography is not ideal, the ESP provides the best data available for the purposes of characterizing these communities. The ESP 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, field observations, 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 resembles or differs 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 H.

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 in additional land acquisitions to unite land and buildings. Once the land was purchased from the original families and Southern Pacific Railroad, subdivided and transferred to individual building owners, SHRA, in concert with the homeowners and merchants association, 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, as well as 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 suspended its involvement in the area.

Source: The Walnut Grove Area Website, 2011, Walnut Grove Chamber of Commerce (now defunct), www.walnutgrove.com, accessed 7/1/11.

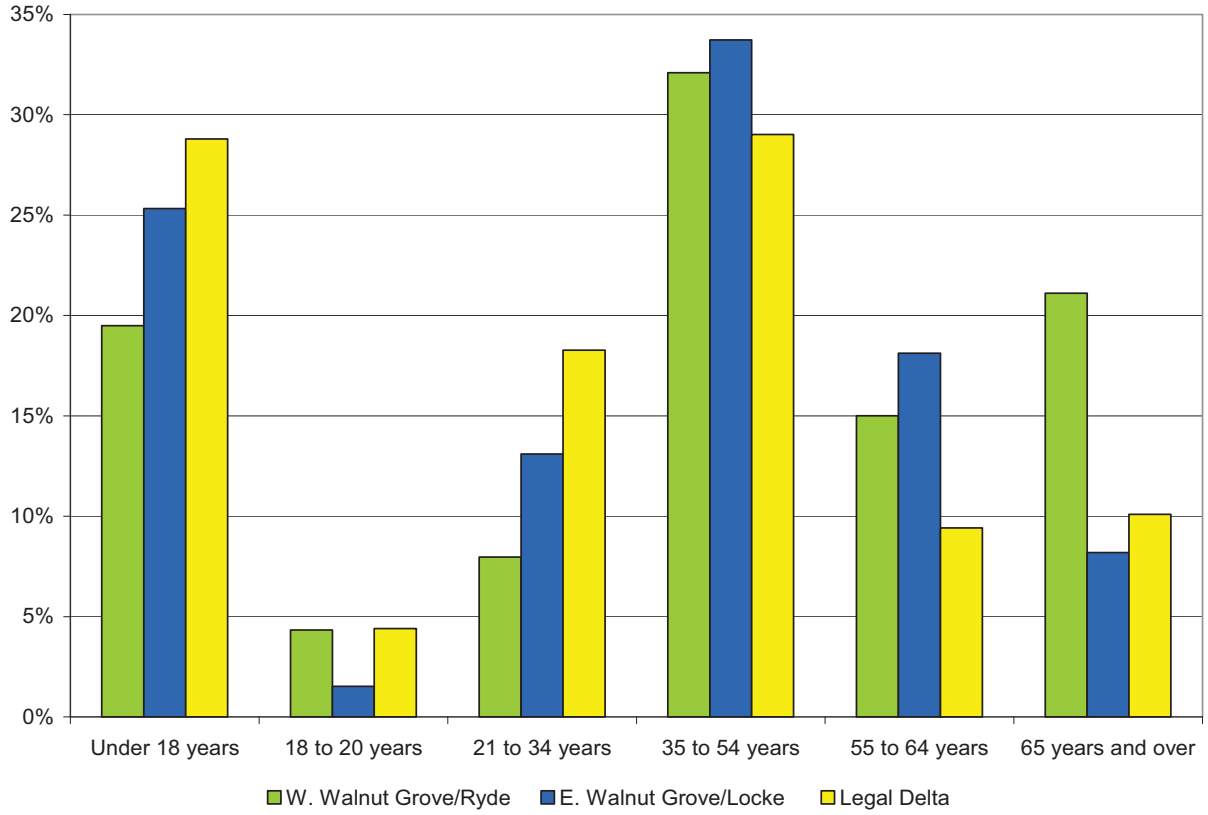
Figure 44 Walnut Grove/Locke/Ryde Census Block Group Boundaries



Population and Households

The Census Bureau's American Community Survey data indicates that there are 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, although it is characterized by a slightly older population on average, with a significantly higher proportion of residents in the 55 to 64 age category. Population in the under-18 age group is only 26 percent of population in East Walnut Grove/Locke and 20 percent in West Walnut Grove/Ryde (compared to 30 percent in the Legal Delta), and population 55 years and older is 26 percent in Walnut Grove/Locke and 36 percent in West Walnut Grove/Ryde (compared to 20 percent in the Legal Delta). Compared to the state overall, an older population is a common trait of Delta Legacy Communities.

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



Source: 2005-9 American Community Survey, Census Bureau

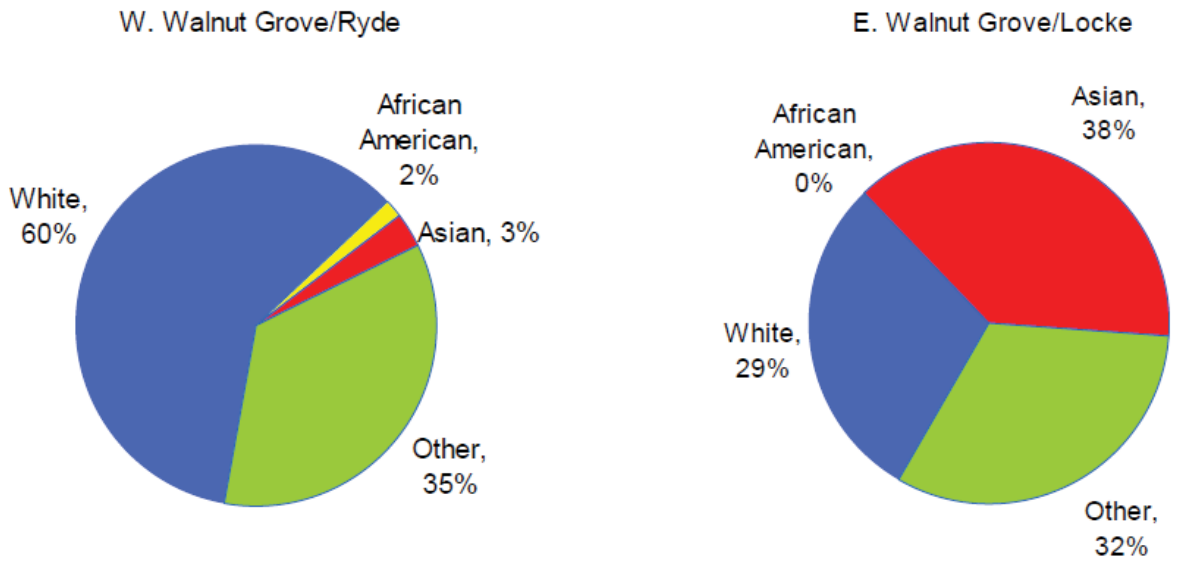
Race and Ethnicity

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 percent of the population, which is significantly higher than the reported 13 percent in the Legal Delta (as shown in Figure 46). The data indicate that 21 percent of the East Walnut Grove/Locke population reports being "White alone," which is the next highest racial category (as compared to nearly 42 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 Legal Delta and is 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 racial and ethnic composition is quite different. Only approximately 3 percent of residents in West Walnut Grove/Ryde identify as "Asian alone," and 56 percent identify as "White alone."

Figure 46 Population Racial Distribution in Walnut Grove/Locke/Ryde



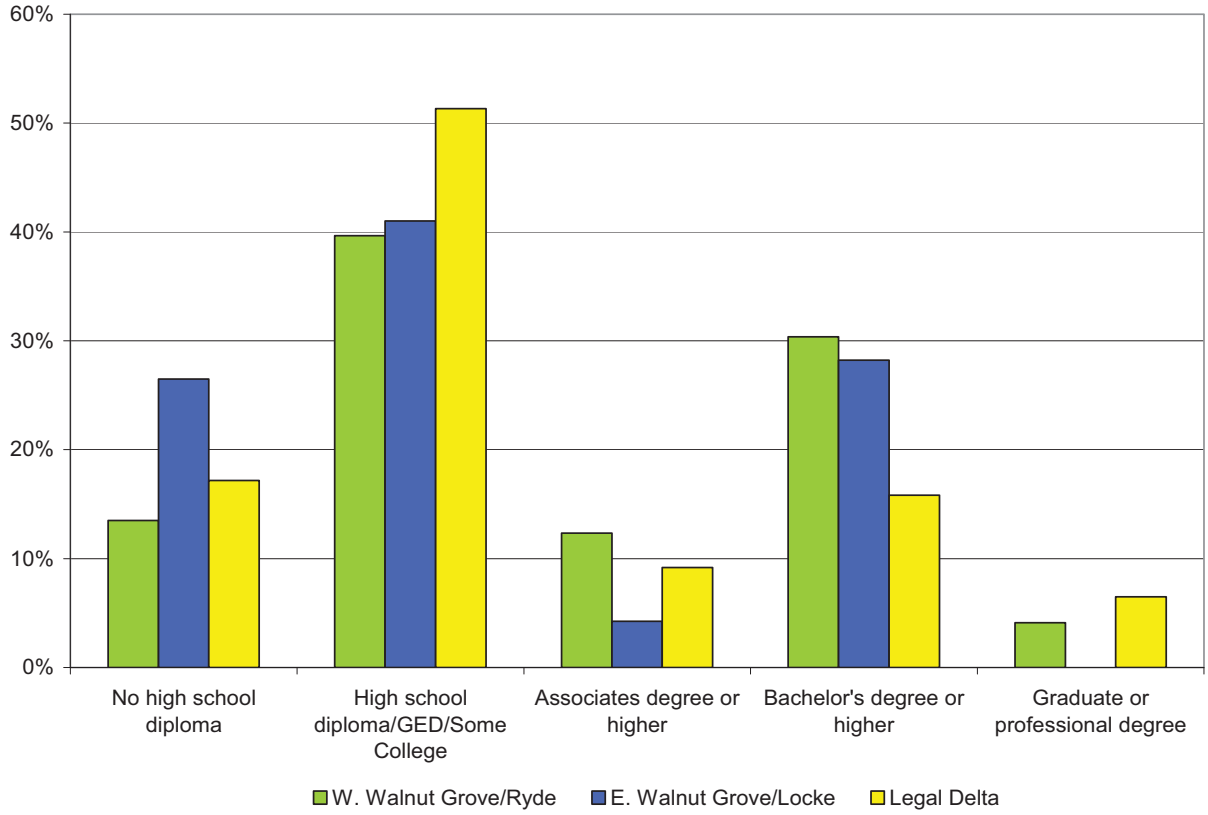
Source: 2005-9 American Community Survey, Census Bureau

Educational Attainment

The educational attainment of the residents of East Walnut Grove/Locke is lower than that of the rest of the Legal Delta (as shown in Figure 51). Of this population, approximately 27 percent does not possess a high school diploma, as compared to 17 percent in the Legal Delta. There are no residents of East Walnut Grove/Locke who reported having a graduate degree, compared to 7 percent who do 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 percent, compared to 16 percent for the Legal Delta.

The educational attainment of residents of West Walnut Grove/Ryde is also quite different from that of residents in East Walnut Grove/Locke. Only 14 percent of these residents do not possess a high school diploma, while 30 percent have earned a bachelor's degree or higher.

Figure 47 Walnut Grove/Locke/Ryde Educ. Attainment (Pop. 25 yrs & older), 2005/2009



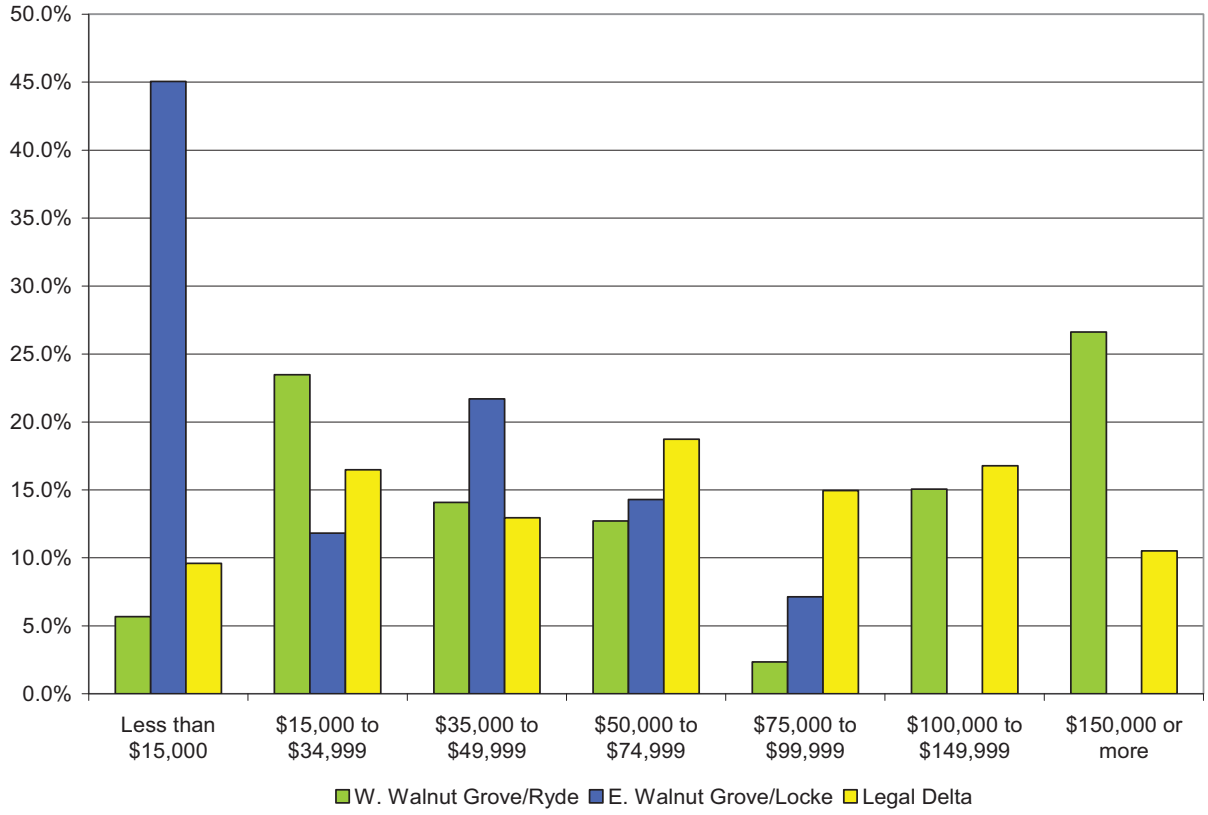
Source: 2005-9 American Community Survey, Census Bureau

Household Income

At $29,000 on average, the household incomes in East Walnut Grove/Locke are much lower than those in the Legal Delta and the lowest of all Legacy Communities. More than 45 percent of households in East Walnut Grove/Locke report an income less than $15,000, compared to just 10 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 percent versus 34 percent in the Legal Delta).

The residents of West Walnut Grove/Ryde are considerably more affluent than East Walnut Grove/Locke residents. For example, the average household income in West Walnut Grove/Ryde is $92,000 on average, as compared to under $80,000 in the Legal Delta. More than 27 percent of West Walnut Grove/Ryde households earn more than $150,000 per year, compared to just over 11 percent in the Legal Delta.

Figure 48 Walnut Grove/Locke/Ryde Household Income Distribution



Source: 2005-9 American Community Survey, Census Bureau

Housing

East Walnut Grove/Locke are among the few areas in Legacy Communities that have a fair stock of multifamily housing and affordable/workforce housing. Approximately 57 percent of the housing units in East Walnut Grove/Locke are occupied by their owners, a lower rate than found in the Legal Delta (which reports 66 percent), but consistent with statewide averages. On the other side of the river in West Walnut Grove/Ryde, over 71 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 places of employment are Stockton (6 percent) and West Sacramento and San Jose (3 percent each). Other cities where area residents work include San Francisco, Pleasanton, Fresno, and Arden-Arcade (in Sacramento), demonstrating that many Walnut Grove/Locke residents travel significant distances to work.

Commute patterns are similar in West Walnut Grove/Ryde, with 15 percent of residents working locally (in the Ryde/Walnut Grove area), and 8 percent commuting to Sacramento. Other notable place-of-work destinations for these residents include Stockton and Rio Vista.

Resident Labor Force Employment by Sector

As in other Legacy Communities, employment of residents of East Walnut Grove/Locke is heavily influenced by the agriculture industry. Agriculture, forestry, fishing, and hunting comprise more than 32 percent of employment (as compared to less than 2 percent for the Legal Delta). Other important sectors include administration and support of waste management services; educational services; professional, scientific, and technical services; information; and manufacturing. Of employed East Walnut Grove/Locke residents, approximately 76 percent are employed by for-profit enterprises (which are 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).

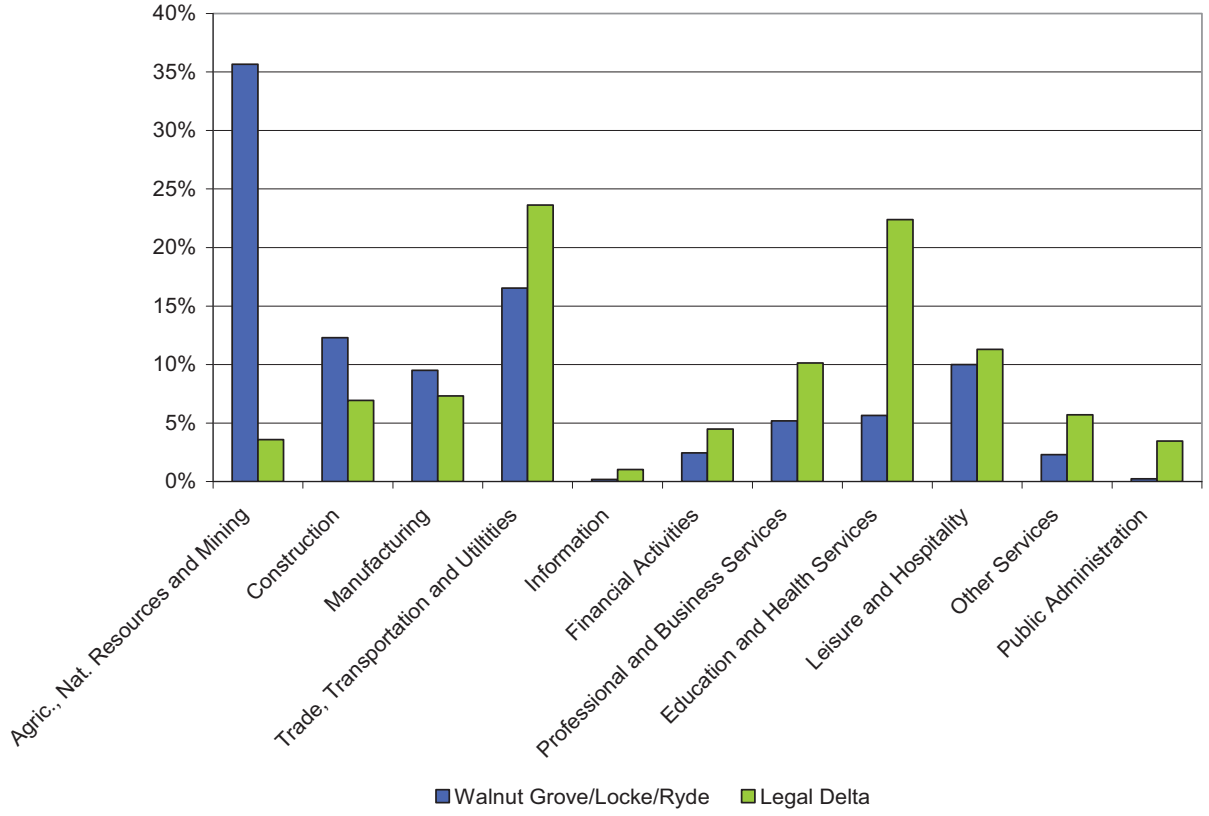
The West Walnut Grove/Ryde labor force is comparable to that in other Legacy Communities. Most residents work in the agriculture sector, which accounts for more than 21 percent of employment. Other significant industries are education (12.5 percent), real estate (12.1 percent), public administration (11.4 percent), and health care (10.1 percent).

Employment Trends

As described above, Walnut Grove, Locke, and Ryde are heavily influenced by the agriculture industry. According to estimates from the U.S. Census Bureau LED/LEHD, the agriculture industry (which also includes forestry, fishing, and hunting) comprises approximately 36 percent of total jobs in East Walnut Grove/Locke and West Walnut Grove/Ryde (2009). As recently as 2002, this sector accounted for 58 percent.[133] As stated in a previous section of this chapter, and 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.

[133] Please note that these figures are by place-of-work (as opposed to place-of-residence, which is also shown elsewhere in this chapter).

Figure 49 Walnut Grove/Locke/Ryde Employment 2002-2009[134]



Source: Center for Economic Studies (LED-LEHD), Census Bureau

Figure 49 shows annual job growth for East Walnut Grove/Locke and West Walnut Grove/Ryde (combined) from 2002 to 2009. As shown, large annual fluctuations have occurred during this time period; however the total employment in these towns has remained relatively steady (especially in the last three years).

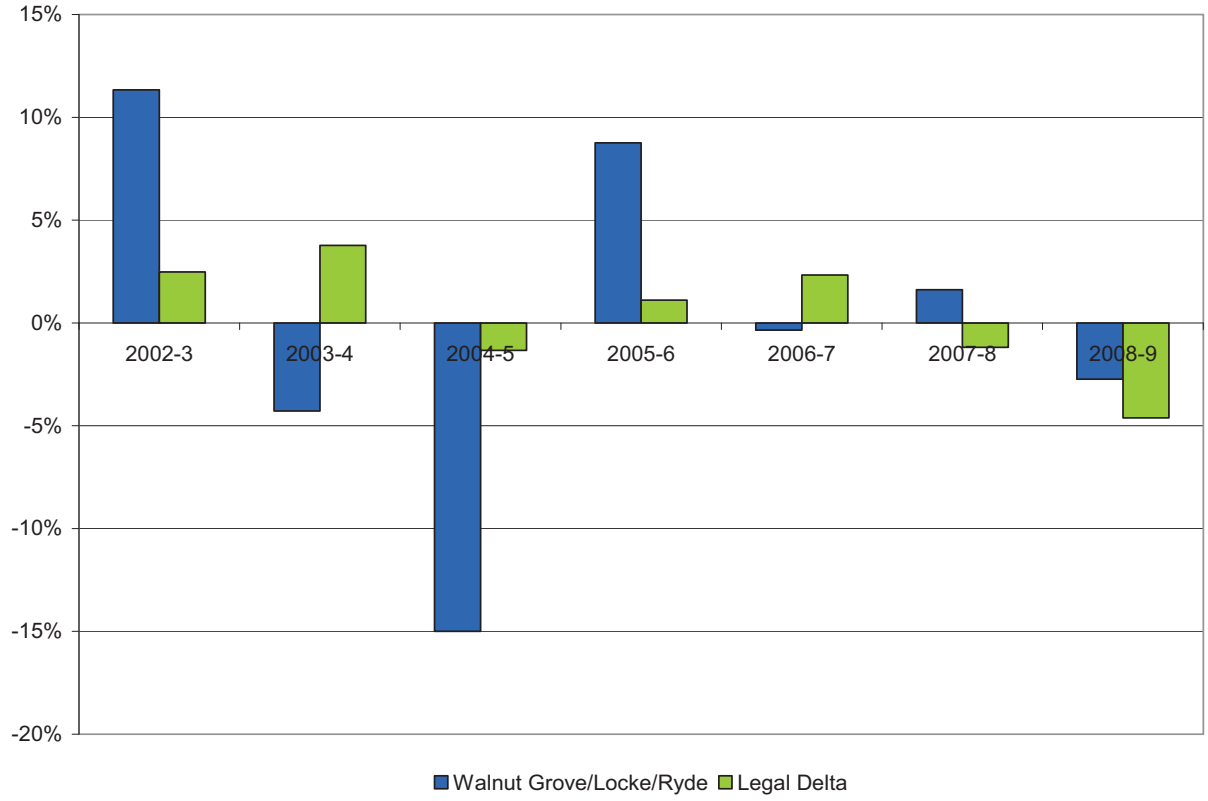
As in Clarksburg, the construction and manufacturing industries have demonstrated significant fluctuations in employment but have been growing overall since 2002. Transportation/ warehousing, administration/support for waste management and remediation, and retail trade have shown significant gains in 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

[134] This figure represents the *aggregate* employment of the E. Walnut Grove/Ryde and W. Walnut Grove/Locke block groups.

Grove/Ryde are Wilcox Brothers farming equipment, the Ryde Hotel, MacCormack Farms, and Salman Ranch.[135]

Figure 50 Walnut Grove/Locke/Ryde Employment Growth Trends, 2002-2009



Source: Center for Economic Studies (LED-LEHD), Census Bureau

Employee Commute Patterns

People who work in East Walnut Grove/Locke 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 higher proportions (13 percent) of these workers live locally.

2.2.2 Economic Sustainability Vision for Locke – A Historic Delta Community

Locke is known for its cultural heritage, historical significance, unique building stock, and visitor attractions. These assets should be bolstered in a culturally, ecologically, and economically sustainable manner. Key tenets of a vision for Locke include the following:

Preserved Historic Character: Locke's unique and long-established building stock should be maintained and/or enhanced to meet certain building code and safety standards, as appropriate.

Improved Hospitality and Visitor Services: Opportunities to add a variety of visitor-serving and/or local-serving uses to the existing roster should be carefully evaluated. Such uses could potentially include retail stores, restaurants, wine tasting rooms, and others as appropriate.

[135] Hoover's Dunn & Bradstreet enterprise data, 2010.

Revitalized Main Street Business Environment: The scale of Main Street Locke is conducive to an interesting, walkable retail district. Efforts to maintain and enhance this resource should be undertaken with the objective of creating an active and economically-viable destination for tourism and visitation.

2.2.3 Economic Sustainability Vision for Walnut Grove – The Heart of the Delta's Sacramento River Corridor

Walnut Grove is considered to be a focal point of the Legacy Communities, and contains many key services and amenities that are not available elsewhere outside of nearby major urban areas. Walnut Grove has the potential to build upon this stature and continue to foster an accepting environment of uses that are desired by residents, visitors, and business representatives of the nearby communities. Key tenets of a vision for Walnut Grove include the following:

Preserved Community Character: Walnut Grove's established, attractive, and high-quality building stock should be maintained and/or enhanced, and properly-planned and scaled adaptive reuse opportunities should be assessed for their potential to improve the community.

Increased Resident, Visitor, and Business Services: Opportunities to add a variety of uses to the existing roster should be carefully evaluated. Such uses could potentially include additional retail stores, business service providers, restaurants, and others as appropriate.

Improved Connection to the Sacramento River: The recent construction of water-side docking facilities in Walnut Grove have enhanced the ability for users to access the river and created momentum which should be built upon. Similar efforts to enhance connections to the river in order to increase opportunities for locals and visitors to interact with this important asset should be encouraged.

2.2.4 Strategic Action Plan for Walnut Grove & Locke

The following items should form the basis of a Strategic Action Plan for Walnut Grove and Locke:

- To remain consistent with the Walnut Grove/Locke Special Planning Area document, direct growth toward infill and replacement development in the existing Walnut Grove and Locke town areas. There is an approximate total of 81,000 square feet of land and with approximately 29,000 square feet of either vacant or underperforming buildings in these areas. These vacancies provide opportunity sites for catalyst redevelopment that can serve existing and emerging markets related to tourism, outdoor recreation, food, wine, and agriculture.
- Promote only high-quality building rehabilitation.
- Preserve the integrity of Locke and create opportunities for interpretation or cultural and historic sites.
- Promote recreation and agricultural support as the community's primary economic development theme.
- 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, taxi/shuttle services, community-themed convenience markets akin to the one that exists, and landside parks or other places to eat and rest while ashore.
- Work with nonprofits and the Delta Citizens Municipal Advisory Council to implement economic strategies and community initiatives.
- Ensure that modifications to the Walnut Grove and Locke communities maintain and enhance agricultural and recreational resources that are already in place.

2.2.5 Opportunity Sites

There are 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 the following.

- Market, A, B, and C Streets in Walnut Grove is composed of generally small, compact, one- and two-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 slowly moving in as older, failing businesses are moving out, and this area presents a key opportunity for future visitor- and local-serving commercial uses, 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.
- Main Street in Locke is similar in scale, but considerably different in character than Walnut Grove. Exceptionally compact, almost exclusively built of wood, and definitely Asian, its covered walks, raised wood sidewalks and quirky character contribute significantly to its uniqueness and desirability as a tourist destination.
- The Locke boathouse is the largest single building in Walnut Grove/Locke and dominates the view-shed from State Route 160. Because it is bulky, it creates a barrier between Locke and the water. The boathouse could be modified to allow for more visitor-serving uses or temporary boat parking. This would allow for more visitors coming from the water and more space for motorists to park when launching their boats from this point.
- Locke Community Garden lies east, behind the developed part of Locke. This former community garden site could be rehabilitated to provide 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 Locke Management Association.
- Historic preservation, regulatory, permitting, and flood control issues must be resolved 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 River Preserve) comprise one of these complexes.

The focal point complex centered on Locke/Walnut Grove is proposed to include Ryde, Courtland, and Hood, as well as the Stone Lakes Preserve, Delta Meadows, the Cosumnes River 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.

2.2.6 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.** Current internet access to most Delta communities is very limited, which hinders the degree to which many "white collar" would be likely to locate in the Delta. Improved digital connectivity would be significant step in enhancing the livability and economic competitiveness of these towns.
- **Roadways.** Most community roadways are incomplete, missing sidewalk, curb, gutter, and accessibility features. Existing roadways are adequate for current vehicle traffic; however, if streets are to be considered "complete", significant infrastructure investments are needed.
- **Flood protection.** As discussed elsewhere in this chapter and throughout this report, establishing adequate flood protection is a crucial issue which severely constrains development. Several possible solutions have been brought forth and will continue to be evaluated. In the meantime, new development is severely hampered.

2.3 Other Legacy Communities

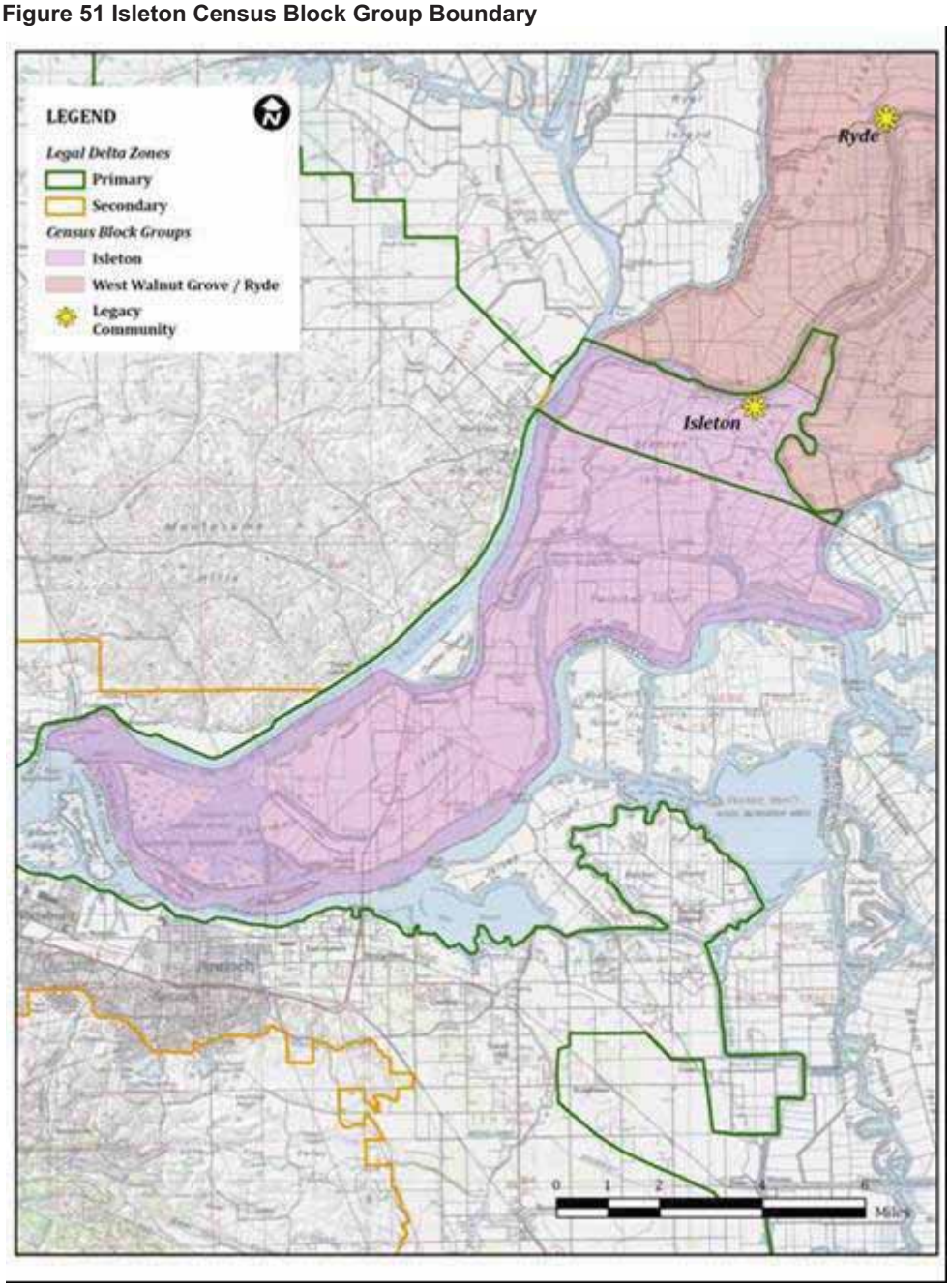
The communities of Hood, Ryde, Courtland, and Isleton are important members of the Legacy Community framework. While many of these communities share common attributes (such as a connection to the waters of the Delta and a strong influence from the agricultural industry), each is unique in its composition, 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 the Appendix H.

2.3.1 Isleton

The Isleton Block Group is home to approximately 2,183 residents, making it the largest of the Legacy Communities.136 Please note that the socio-economic data for Isleton is generated from the American Community Survey based up the Block Group boundary shown below.

[136] The population and demographic estimates in this section are from the U.S. Census for Block Group number 060670098001.

Figure 51 Isleton Census Block Group Boundary



Isleton is characterized by a population that is older than the rest of the Legal Delta and older than the general state population, 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 86 percent of residents identifying themselves as “White alone,” which is significantly higher than the 57 percent who identify this classification in the Legal Delta.

The educational attainment of Isleton residents is similar to that found in the Legal Delta, although—as seen in other Legacy Communities—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 percent in the Legal Delta), 54 percent are high school graduates with some

college (as compared to 51 percent in the Legal Delta), and 26 percent have an associate degree or higher (as compared to 32 for the Legal Delta).

The average household income of the Isleton population is generally lower than it is in 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. The average household income in Isleton is approximately $57,000, as compared to nearly $80,000 in the Legal Delta.

The largest category of employment for Isleton residents is construction (18 percent), followed by accommodations and food service (15 percent). Other prominent sectors include educational services (11 percent), transportation/warehousing (10 percent), and manufacturing (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.137

2.3.2 Ryde

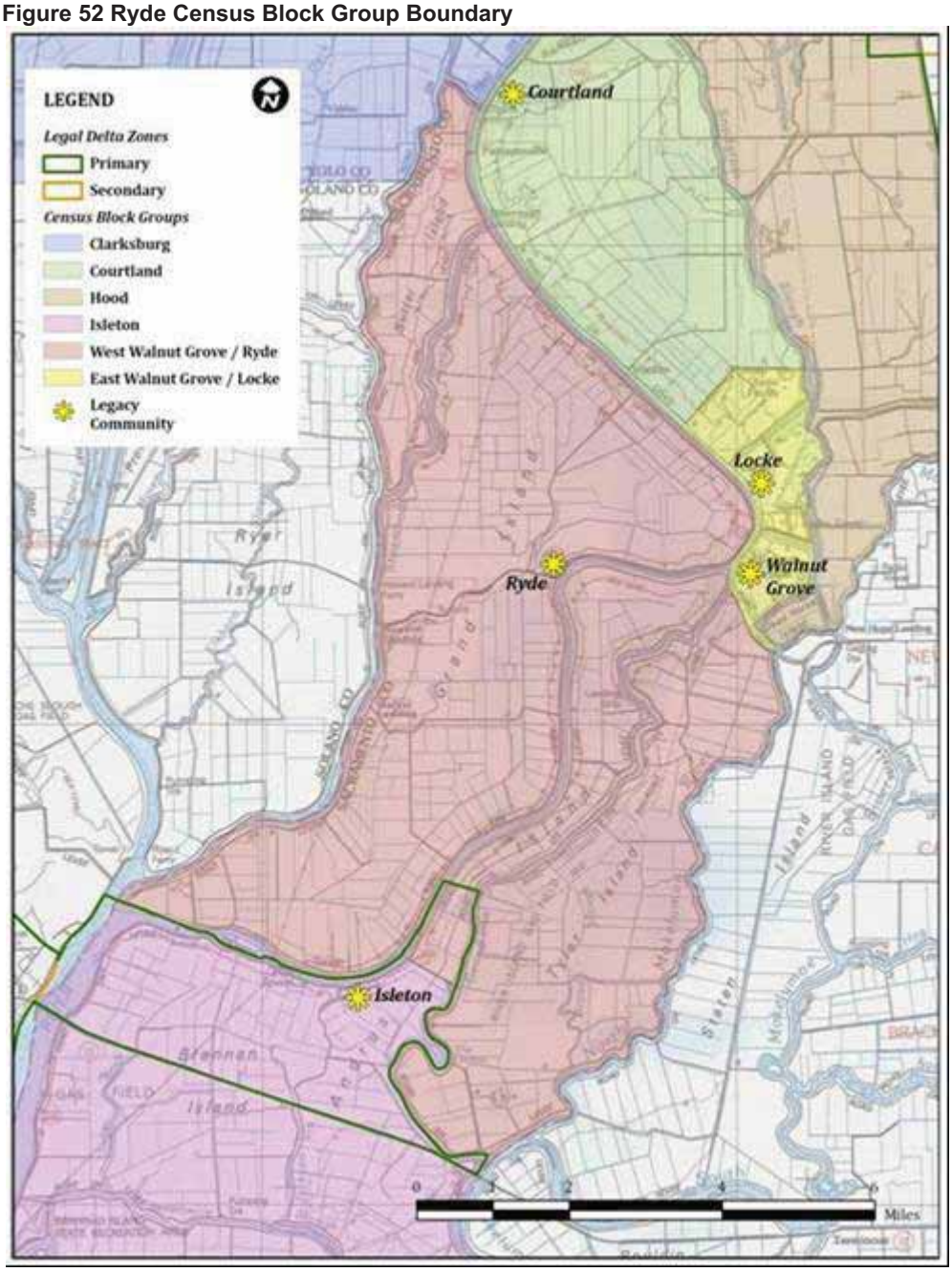
The Ryde Hotel is the focus and essentially the entire commercial portion of the town. Built in 1927 at the peak of prohibition, the hotel was an opulent establishment, complete with beauty salon and barbershop, which served as a riverboat way station. It was also rumored to be a bordello. The lower 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 notoriety and 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.138 Please note that the socio-economic data for Ryde is generated from the American Community Survey based up the Block Group boundary shown below. As described elsewhere in this chapter, this data includes the population for west Walnut Grove, as shown in the map below.

[137] Hoover's Dunn & Bradstreet enterprise data, 2010.

[138] 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.

Figure 52 Ryde Census Block Group Boundary



As in most of the Legacy Communities, Ryde is characterized by a population older than found in the Legal Delta and the state. 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 the 21-34 age category, as compared to more than 18 percent for the Legal Delta.

The population of Ryde consists mostly of Caucasian residents, with 59 percent of residents identifying themselves as “White alone” (which is a similar distribution as is observed throughout the Legal Delta). The population of Ryde is significantly more educated than most of the Legacy

Communities and the Legal Delta. Of this population, more than 34 percent of residents have a bachelor's degree or higher, as compared to under 22 percent in the Legal Delta.

The household income of the Ryde population is significantly higher than the surrounding area. The average income is $92,000; it is 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, compared to approximately 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. Ryde residents also travel to Stockton, Rio Vista, Elk Grove, and Roseville for employment.

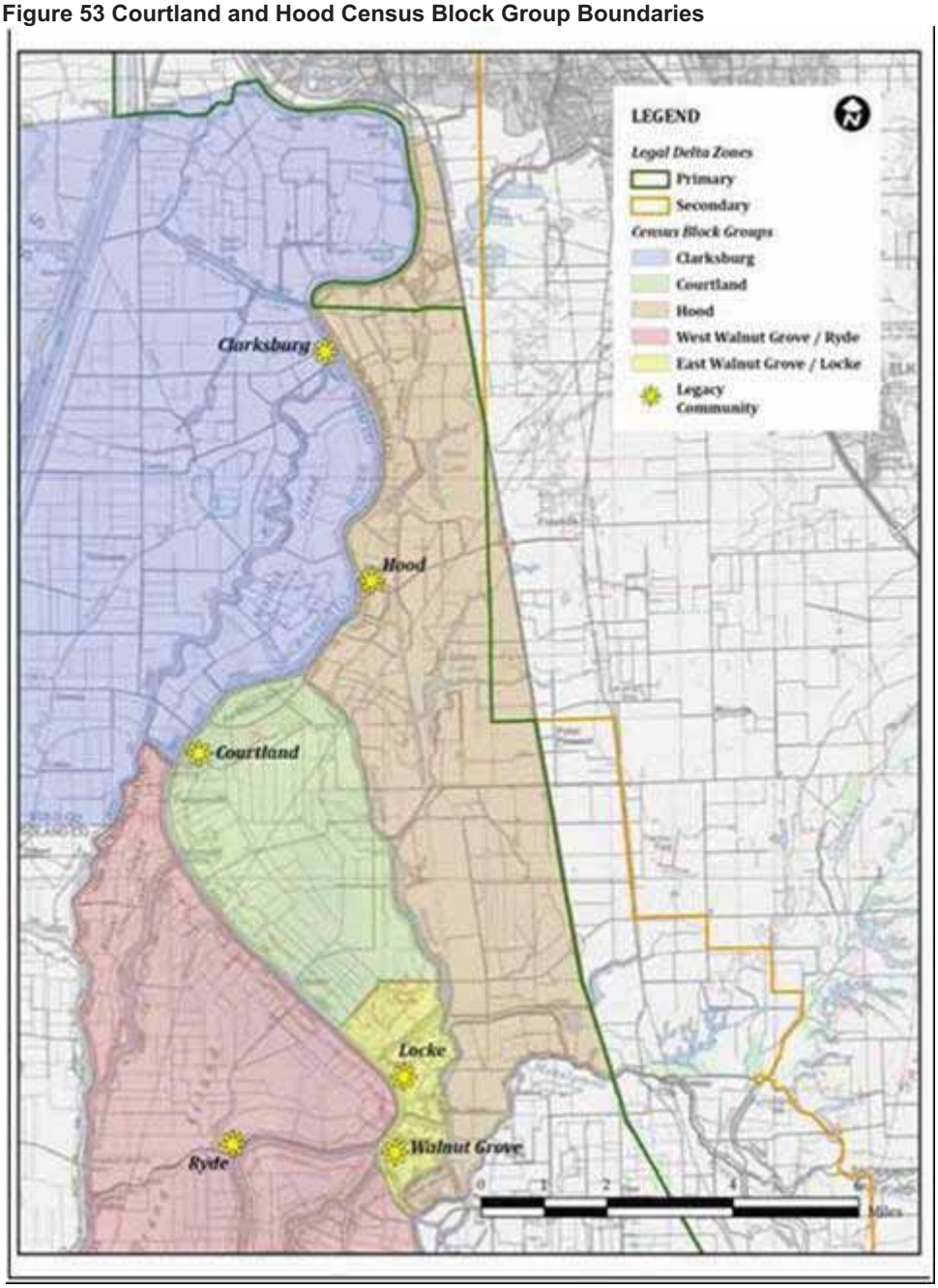
Ryde is similar to other Legacy Communities in that most residents work in the agricultural field, which accounts for more than 20 percent of employment. Other significant industries are education, real estate, public administration, and health care.
Time-series analysis based on the U.S. Census LED-LEHD employment data by industry for Ryde shows that total employment has grown modestly in recent years, and that Ryde 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 it has added nearly 100 jobs in Ryde over the past seven years. The largest employers in Ryde are Wilcox Brothers farming equipment, the Ryde Hotel, MacCormack Farms, and Salman Ranch.[139]

[139] Hoover's Dunn & Bradstreet enterprise data, 2010.

2.3.3 Courtland

The Courtland community (as defined by the US Census Block Group boundaries shown in the map below) houses a population of just fewer than 500 residents.

Figure 53 Courtland and Hood Census Block Group Boundaries



The age of the Courtland population is similar to that in other Legacy Communities; more than 44 percent of Courtland residents are over the age of 55 (as compared to less than 20 percent for the Legal Delta).

Courtland is racially and ethnically distinct from the rest of the Legal Delta. More than 65 percent of Courtland's population has identified itself as Hispanic, as compared to just 30 percent in the Legal Delta.

Courtland reports lower levels of educational attainment than other Legacy Communities and the Legal Delta. Nearly 34 percent of Courtland's population does not possess a high school diploma, compared to 17 percent for the Legal Delta. Only approximately 23 percent of Courtland's population has an associate's degree or higher, whereas more than 32 percent of the Legal Delta's population has reached this educational milestone.
At approximately $73,000, the average annual household income of Courtland falls just below the average for the Legal Delta. This is lower than the household income in Ryde, but is significantly higher than in both Hood and Isleton.

As in other Legacy Communities, most Courtland residents work outside the community in which they live, although 5 percent does 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 agriculture is not among the top categories of employment for local residents; instead, education is the largest employment category. Other significant industries are wholesale trade, and transportation and warehousing, and agriculture.

U.S. Census LED-LEHD employment data by industry for Courtland indicates that total employment has declined modestly in recent years, and that Courtland has shed 35 jobs from 2002 to 2009. Agriculture is the largest industry, although it has lost a significant number 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.[140]

2.3.4 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 the Hood Census Block Group contains a population of just 276 residents (please refer to the Courtland map above). Although most Legacy Communities have a significant share of retirees and older residents, Hood is characterized by a much older population base than even these communities. More than 62 percent of Hood's population is over the age of 55, compared to just 20 percent in the Legal Delta.

Hood's racial and ethnic composition is primarily Caucasian, with nearly 100 percent of its population identifying as "White alone." Hood's educational attainment statistics are more or less in line with the Legal Delta, although Hood has slightly fewer residents who are college educated and slightly more who do not have a high school diploma. The average income in Hood is slightly more than $54,000, compared to $79,000 for the Legal Delta.

Only 3 percent of Hood residents actually work in Hood. Most employed residents in Hood work in Sacramento (21 percent) or Stockton (9 percent). Other cities in which Hood residents work include Roseville, Lodi, Elk Grove, Rancho Cordova, Woodland, and San Francisco.

[140] Hoover's Dunn & Bradstreet enterprise data, 2010.

Hood is similar to Courtland in that most residents do not work in agriculture; instead, health care and social assistance is the largest employment category. Other significant industries are wholesale trade, manufacturing, and educational services.

Time-series analysis of the U.S. Census LED-LEHD employment data by industry for Hood shows that total employment in Hood has recently increased fairly substantially, with 88 jobs added 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.[141]

[141] Hoover's Dunn & Bradstreet enterprise data, 2010.

Part Three: Integration and Recommendations

Chapter 10: Key Findings and Recommendations

Overview

The Sacramento–San Joaquin Delta is at a crossroads. There has been significant environmental deterioration in the Delta, and many people 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 the Economic Sustainability Plan for the Sacramento–San Joaquin Delta. The Economic Sustainability Plan consists of three primary components:

- ***Part I presents critical background and an overview of existing conditions.*** This component includes an evaluation of demographic and economic data; a review of planning and land-use regulation in the Delta; and an assessment of levee conditions.

- ***Part II analyzes specific important industry sectors and communities in the Delta.*** This component focuses in on the strongest forces in the Delta economy: agriculture, recreation-related industries, and infrastructure services. This component also explores the future of Legacy Communities in the Delta. Throughout Part II, the Economic Sustainability Plan considers the potential economic effects that could stem from various policy proposals for the Delta.

- ***Part III ties together study findings and recommends economic sustainability strategies for the Delta.*** This component integrates findings from Part I and Part II, highlighting the opportunities, constraints, and threats affecting the Delta's economy and communities. This component recommends specific action items and policy alternatives. Part III constitutes the Economic Sustainability Plan.

This Chapter provides an overview of the key findings for each component of the Economic Sustainability Plan.

Part I: Existing Conditions

Overview of the People and Economy of the Delta

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 profile that differs in many ways from both the region and the 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.

- ***Population growth in the Primary Zone has stagnated while the surrounding region has experienced a population boom.*** 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 statewide, the Primary Zone population has remained essentially unchanged.

- ***With little new growth in the Primary Zone, the population is aging.*** Since 2000, the age distribution of the population in the Legal Delta has not changed dramatically, likely because of an influx of younger people 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 24 percent in 2000 to 38 percent today.

- ***There is less population diversity in the Primary Zone compared with the surrounding region.*** 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 as non-White and approximately 81 percent are younger than 55 years of age, similar to the 39 percent and 79 percent statewide, respectively. In contrast, only about 25 percent of Primary Zone residents describe themselves as non-White and about 62 percent younger than 55 years of age.

- ***Employment growth in the Primary Zone has not kept pace with the surrounding region.*** While the Legal Delta has enjoyed employment gains in recent years, corresponding with increased urbanization, 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.

- ***Agriculture is the most important industry in the Primary Zone economy.*** While the Legal Delta possesses a relatively diversified and stable economy, the Primary Zone is a highly resource-driven economy with a heavy reliance on agriculture and to a lesser degree recreation. 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, agriculture alone makes up about 45 percent of total employment in the Primary Zone.

- ***The Delta economy is highly export oriented, bringing new money into the region instead of recirculating existing income.*** In the Legal Delta, exports are roughly 33 percent of economic output, compared to the 24 percent for California overall. Agriculture-intensive areas, such as the Sacramento River Corridor—where exports make up approximately 64 percent of output, are even more distinctly export-oriented.

Review of Key Policies and Planning Processes

Since the late 1970s regional governance of the Delta has been implemented at the local, regional, and state level. In recent decades, a variety of agencies, commissions, and other governmental bodies have undertaken efforts to promote the health of the Delta. Today, local and State agencies have long-standing policies and programs to protect and enhance the natural resources, recreational values, and wildlife habitats in the Delta's Primary Zone. However, the stewardship of the Delta's natural resources continues to evolve as issues such as sustainability, water supply and quality, habitat, and access become more complex. The State's current Delta governance proposal retains local control over most actions, maintains the 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.

- ***California's water conveyance plans have generated controversy and friction between regions of the state and among water stakeholders for decades.*** In the early 1980s, there was significant controversy over legislation to upgrade the statewide water system with a peripheral canal that would convey water around the Delta to pumps near Tracy. The project was narrowly rejected by California voters in June 1982.

- ***Severe drought, degraded environmental conditions, and degraded fisheries led to a joint State and federal process to address water issues in California and the Delta***. From 1994 through 2000, the CALFED Bay-Delta Program developed a science-based planning process to make and implement actions and programs related to water and ecosystem management in the Delta and its watershed.

- ***State oversight of water issues in California and the Delta has evolved in recent years***. The State legislature established the California Bay-Delta Authority in 2002, but that body was later disbanded, and the CALFED program was folded into the California Natural Resources Agency. In 2006, the Governor and legislature appointed a cabinet committee and a Delta Vision Blue-Ribbon Task Force to prepare the Delta Vision, a strategic plan completed in 2008. In late 2009, the Governor and legislature enacted a package of laws to implement the recommendations of the Delta Vision, creating the new Delta Stewardship Council, establishing the Delta Conservancy, and modifying the role of the Delta Protection Commission.

- ***Development pressure has influenced regional planning in the rural Delta.*** In the early 1970s, as agricultural lands in the Delta counties came under pressure for development, the five Delta counties came together to develop a regional strategy for future development of the Delta. The Delta Area Planning Council (DAPC) adopted a plan for the region which supported agricultural and recreational land uses. Funding for the Delta Area Planning Council dwindled in the late 1980s and interest in State-level planning and coordination increased in the late 1980s.

- ***Creation of the Delta Protection Commission solidified the State's role in Delta planning and governance.*** In 1992, after the State conducted 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 Johnston-Baker-Andal-Boatwright Delta Protection Act which established the Delta Protection Commission, a body with membership from State agencies, local counties and cities, and Delta water agencies. The Delta Protection Commission is a State entity created to plan and guide the conservation and enhancement of the natural resources of the Delta while sustaining agriculture and meeting increased recreational demand.

- ***The Delta Protection Act established a framework for State influence over Delta land-use planning and decision making.*** The act divided the Delta into the Primary Zone and the Secondary Zone. The Primary Zone consists of the agricultural lands in the "core" of the Legal Delta. The State charged the Delta Protection Commission with preparation of a land-use and resource-management plan for the Primary Zone of the Delta, to address agriculture, recreation, and terrestrial wildlife habitat. The Delta Protection Commission possesses land-use jurisdiction in the Primary Zone and the actions of local governments may be appealed to the Commission. Land uses in the Secondary Zone remain solely under

the authority of local governments and the Delta Protection Commission has no authority over State or federal agencies.

- ***County-level planning is consistent with the Delta Protection Commission Resource Management Plan.*** 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 were determined to be consistent with the Delta Protection Commission plan, though each county addresses land-use planning in ways reflecting their community values and local history.

- ***The unincorporated communities in the Primary Zone all have their own community plans/special area plans.*** The communities of Clarksburg in Yolo County; Courtland, Locke, and Walnut Grove in Sacramento County; and the City of Isleton, the only incorporated city in the Primary Zone, have their own, unique land-use plans.

Flood, Earthquake, and Sea-Level Rise Risk Management

The present-day Delta is defined geographically and hydraulically by levees, creating a landscape that differs from that of the historic, natural Delta. In place since the early 20th century, the current-day levee system provides flood control, channels water for urban and agricultural uses, and creates an environment unique in California. While Delta levees require investment, maintenance and enhancement is manageable if addressed strategically. Further, enhancement of Delta levee could have significant benefits for economic sustainability.

- ***The State of California is committed to maintaining and enhancing the Delta levees.*** It is the overall policy of the State to "protect, maintain, and, where possible, enhance and restore the overall quality of the Delta environment, including, but not limited to, agriculture, wildlife habitat, and recreational activities."[142] It is also the policy of the State to "improve flood protection by structural and nonstructural means to ensure an increased level of public health and safety."[143]

- ***Only about 460 miles of Primary Zone levees need to be maintained and enhanced by the State and the local reclamation districts.*** There are approximately 1,000 miles of levees in the Legal Delta. Excluding the 380 miles of project levees constructed by the U.S. Army Corps of Engineers and an additional 63 miles of urban, non-project levees, there are about 650 miles of levees, which protect lands below sea level in the Primary Zone of the Delta. Further excluding the 193 miles of project levees located primarily along the Sacramento River leaves roughly 460 miles levees that need to be maintained by State and local entities.

- ***Non-project levees in the Primary Zone are in better condition than they are often portrayed.*** Of the 460 miles of levees identified above, only about 50 miles clearly fall short of FEMA's Hazard Mitigation Plan standard. Further, 100 miles or more are already at or about the Corps of Engineer's Delta-specific PL 84-99 standard.

- ***Funds currently in the pipeline should bring Delta levees close to achieving goals for maintenance and enhancement.*** State and federal governments, working through the

[142] Delta Reform Act, 2009, W.C. 29702 (b)
[143] W.C. 29702 (d)

Department of Water Resources, the U.S. Army Corps of Engineers, and the local reclamation districts, are working to meet the Delta-specific PL 84-99 standard. This goal has been in place since 1982, when the Department of Water Resources and U.S. Army Corps of Engineers produced a joint report on the Delta levees which recommended this standard.

- ***Through modern engineering and construction, Delta levees have been improved significantly, making some historic data misleading.*** Once pipeline funds have been expended, nearly $700 million will have been invested in improvements to the Delta levees since 1973. The improvements have enhanced critical levees throughout the Delta, but outdated data derived from the older levees is still sometimes used for planning or predicting rates of levee failure. These data have, at times, skewed the understanding of true Delta levee conditions.

- ***Three approaches can help all jurisdictions and planners further reduce the risks resulting from the failure of the Delta levees.*** These approaches are: (1) build even more robust levees, (2) improve both regular maintenance and monitoring and flood-fighting and emergency response following earthquakes, and (3) improve preparedness for dealing with failures after they occur.

- ***Levees should be improved to a higher standard that addresses earthquakes and sea-level rise risks.*** The question is not whether levees should be improved to the PL 84-99 standard—that is already happening. The higher standard would comply with the policies of the State, allow for planting vegetation on the water side of the levees, provide for two-way traffic, and could be widened at selected locations to accommodate development.

Part II: Key Economic Sectors, Legacy Communities, and Public Services

Framework for Analysis

The Economic Sustainability Plan provides targeted analysis of key economic sectors, public services, and Legacy Communities in the Delta. For each detailed assessment, the Economic Sustainability Plan relies on a common framework for evaluation.

- ***Current Status and Trends***: Includes a data-driven description of the current baseline and trends for the sector.

- ***Outcomes and Strategies under Baseline Conditions***: Discusses the likely outcomes for the economic sector under the baseline policy scenario, followed by recommendations that might improve economic sustainability under the baseline scenario.

- ***Economic Impact of Policy Scenarios***: Provides an evaluation of the positive and negative impacts of alternative policy choices on economic sustainability in each area. The policy scenarios are focused in four important areas: water conveyance, habitat enhancement, levee and flood control investment, and land-use regulation.

Despite the common analytical framework, the methodology differs by topic. For some topics, such as agricultural production, impacts are analyzed in detail using a quantitative approach. Other topics, such Delta tourism and recreation, rely on more qualitative analysis and expert opinion.

Agriculture

The analysis of agriculture in the Delta clearly establishes this sector as the most significant component of the Delta economy and a driver of economic activity in the region. The analysis relies on a variety of detailed and current land use and agricultural data to value current and future agricultural activities in the Delta. In addition, the study considers the potential impact of policy changes affecting Delta agriculture.

- ***The majority of the Delta's agricultural lands have California's highest quality-rating designation.*** Close to 80 percent of all farmland in the Delta is classified as "Prime Farmland" by the California Farmland Mapping and Monitoring Program. This designation reflects soil quality and irrigation found on Delta farms.

- ***Over 60 percent of the Legal Delta's land area is actively being farmed with crops.*** Total cropped acreage in 2010 was about 420,000 acres, not including approximately 38,000 acres of grazing land. The top five Delta crops in terms of acreage are corn, alfalfa, tomatoes, wheat, and grapes. Many other field crops, fruit and nut crops, and vegetable crops are also found in the Delta.

- ***Agricultural production in the Delta is valued at approximately 25 percent of total agricultural production value in the five Delta counties.*** Total agricultural revenues in the Delta were $753 million in 2009, including approximately $660 million dollars in crops, and $93 million from animals and animal products.

- ***Vegetables and fruits grown in large quantities for city markets and vineyard crops for winemaking contribute the most to the agricultural production value of the Delta.*** These truck crops and vineyard crops account for 56 percent of total crop revenues, using just 17 percent of farmed acreage in the Delta. The top five Delta crops in terms of production value are tomatoes, grapes, corn, alfalfa, and asparagus. The highest per-acre values in the Delta come from truck crops, mainly situated in the southern Delta, and deciduous tree crops, principally located in the northern Delta.

- ***Delta agriculture is significant to the economy of the region and the state.*** Delta crop and animal production supports roughly 9,000 jobs, $635 million in value added, and $1.3 billion in output in the five Delta counties. Across all of California, the economic impact of Delta agriculture is approximately 12,000 jobs, $761 million in value added, and $1.5 billion in output.

- ***Agriculture is directly linked to downstream industries which magnify the economic importance of Delta farming.*** When regional canneries and wineries are included with crop and animal production, the total economic impact of Delta agriculture is roughly 14,000 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 California.

- ***The long-run baseline Delta agriculture forecast predicts an increase in truck crops and decreases in field and grain crops by 2050.*** Despite a potential 10 percent decline in field and grain crop acres, these crops would still dominate Delta agriculture acreage. The shift to higher-value crops could lead to an estimated $115 million gain in crop revenues (current dollars).

- ***The effect of isolated conveyance on salinity and agricultural production value is uncertain at this time.*** Preliminary estimates of the Delta's lost agricultural production value from increased salinity attributable to isolated conveyance range from $30 million to $70 million per year. Losses could be higher if a 15,000-cfs conveyance project were operated to increase water exports beyond the levels currently proposed.

- ***The agricultural impacts of most of the BDCP conservation measures are difficult to quantify due to the lack of precision in site specification and other details.*** Tidal habitat restoration is anticipated to have the largest direct impact on agricultural revenues per year due to large acreage targets in high-value crop areas.

Recreation and Tourism

The analysis of recreation and tourism takes a broad view of leisure activities in the Delta, including resource-related activities, right-of-way- and tourism-related activities, and urban parks-related activities. The analysis relies on a variety of data to establish current use patterns, future visitation potential, and possible impacts from policy changes in the Delta.

- ***Recreation is an integral part of the Delta, complementing its multiple resources and contributing to the economic vitality of the region.*** Nearby residents visit virtually every day, generating a total of roughly 12 million visitor days of use annually and spending of roughly $250 million dollars in the Delta each year.

- ***The Sacramento–San Joaquin Delta supports a diversity of recreation experiences.*** From the thrill of a speeding personal watercraft to the relaxation of canoeing or cruising, 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, the Delta offers a wide variety of activities.

- ***The majority of visitors to the Delta are from Northern California, an area with great population growth potential.*** The residents of a dozen counties around the Delta represent the principal market for growth in Delta visitation in the future. This market area has a population of approximately 11.9 million people and projections indicate this figure could grow by roughly 48 percent or 5.7 million people by 2050.

- ***Recreation visitation to the Delta is primarily attributable to resource-related activities.*** Of the roughly 12 million visitor days spent in the Delta each year, approximately 8 million days are for resource-related activities (e.g., boating and fishing), 2 million days are for right-of-way-related and tourism activities (e.g., bicycling and driving for pleasure), and 2 million days are for urban parks-related activities (e.g., picnicking and organized sports).

- ***Recreation-related economic activity in the Primary Zone has been relatively flat over the past 20 years.*** Data concerning employment at marinas in other boating-related industries reveal that the number of jobs in these sectors remains largely unchanged. This

trend is corroborated by data that indicate that the number of marinas in the Primary Zone is about the same as a decade ago.

- ***Delta recreation is significant to the economy of the region and the state.*** Excluding visitors to urban recreation areas (e.g., City of Stockton waterfront), spending by visitors to the Delta supports roughly 2,700 jobs, $152 million in value added, and $284 million in economic output in the five Delta counties. Across all of California, the economic impact of Delta recreation is approximately 5,000 jobs, $324 million in value added, and $600 million in output.

- ***Trends affecting Delta recreation suggest that there is potential for increased recreation visitation in the future.*** Over the next 50+ years, positive physical changes to the Delta, population growth in Northern California, increasing agricultural and environmental tourism, and stronger preferences for recreation close to home could boost visitor days in the Delta.

- ***The potential negative impacts of increased recreation on natural resources and agricultural activities can be minimized through careful planning.*** By focusing recreation uses and clustering visitor activities, undesirable effects commonly associated with increased recreation access and development can be diminished.

- ***A potential plan for the enhancement of recreation in the Delta centers on five location-based strategies.*** Under this approach, recreation growth would emphasize specific waterways, points of interest, focal point complexes (e.g., Bethel Island/Jersey Island/Big Break); natural habitat areas; and urban edge areas that surround the Delta (e.g., Stockton).

- ***Recreation development in the Delta should be coordinated, consistent, branded, and marketed.*** A “facilitator organization” could be created to develop the Delta brand, prepare and implement a marketing strategy, and facilitate establishment of a significant-scale focal point area, among other functions.

- ***The long-run baseline recreation visitation forecast predicts a 35 percent increase in visitation by 2050.*** Detailed market study and professional judgment suggest that if resource quality and recreational facilities are maintained such that the Delta retains its current level of competitiveness as a recreation destination, visitation could increase by 3.4 million visitor days over 40 years. Assuming that current visitor spending patterns remain unchanged and Delta business growth accommodates recreation-related spending increases, visitor spending in the Delta would increase by roughly $78 million (current dollars).

- ***The effects of potential policy scenarios on Delta recreation are difficult to assess, but could be significant.*** Rough judgment-based estimates indicate that the impact of the policy scenarios on visitation could range from a decrease of approximately 23 percent to an increase of approximately 13 percent over the baseline scenario. The largest potential for negative impacts is from additional regulatory constraints while the greatest potential for positive impacts would come from the significant habitat conservation. Associated economic impacts could range from a negative impact of nearly $80 million to a positive impact of almost $50 million in visitor spending.

Infrastructure

There are two primary categories of infrastructure in the Delta, including (1) infrastructure that serves the Delta and (2) infrastructure that passes through the Delta. This infrastructure analysis focuses on infrastructure that serves the Delta, including transportation, energy, and water resources and flood control.

- ***Transportation and energy infrastructure are important components of the regional economy.*** Transportation and energy infrastructure support the trade flows and the production of goods and services in the regional economy. These infrastructure types are vulnerable to floods, earthquakes, and sea-level rise, making maintenance and enhancement of protective levees crucial.

- ***Water resources originating in the Delta are critical to the regional economy.*** Declines in water quality—whether an increase in salts or organic carbon—can have very negative effects on both agriculture and urban water supplies. Delta water quality is potentially threatened by isolated conveyance and some proposed conservation measures that are being proposed as part of BDCP. Delta water quality would also be threatened by the six-island open-water scenario.

- ***Even with sea-level rise, Delta water quality can be protected and improved.*** Enhancing Delta levees to a higher standard and restoring or developing tidal marshes in the far western Delta, downstream of Sherman Island, and in the Suisun Marsh, will help maintain current water quality. In addition, cleaning up the San Joaquin River would improve Delta water quality beyond current conditions, generating benefits for both human use and the Delta ecosystem.

- ***In some cases, increased water conveyance and flood control can be achieved while creating environmental benefits.*** An example of a win-win solution is provided by the proposed Lower San Joaquin River Bypass. This project would both reduce peak water surface elevations in the San Joaquin River adjacent to Lathrop and Stockton and provide ecosystem benefits by activating floodplains. Increased organic carbon would only occur for a relatively short period of time and at periods of high flows, so that the impacts on water quality would be minimized.

- ***The beneficiaries of levee infrastructure should contribute to maintenance and enhancement funding.*** Other infrastructure that passes through the Delta without providing services or contributing to the economy of the Delta should be levied in some fashion in order to help fund the maintenance and improvement of the levee system on which it relies. This particularly includes through-Delta conveyance of water.

Legacy Communities

This chapter discusses the Legacy Communities of the Sacramento–San Joaquin Delta, including detailed study and focused economic sustainability planning for Clarksburg, Walnut Grove, and Locke. This chapter discusses a potential “vision” of a sustainable future for each of these focal communities and discusses high-level implementation strategies with potential action items.

- ***Outdoor and cultural recreation remains critical to long-term sustainability.*** Already a well-known and heavily visited recreation area, daytrip and overnight visitors are an important source of revenue for Delta businesses. It is crucial to maintain and enhance outdoor and cultural recreation offerings in the Delta, ensuring that the Delta remains a top visitor destination for outdoor and cultural recreation in Northern California.

- ***Improved lodging, entertainment, and retail options could capture additional tourism dollars.*** Despite the significant number of recreation visitors to the Delta, there are relatively few hotel rooms, stores, and attractions. Overnight accommodations and entertainment options, in combination with supporting retail, could increase visitation, length of stay, and spending in the Delta.

- ***Transportation-related improvements would enhance the visual landscape, attract visitors, and improve public safety.*** Roadway landscaping, signage, bike lanes, sidewalks, parking, transportation services, and other transportation-related improvements are needed in the Delta. Investments in transportation will improve quality of life for residents and increase tourism potential.

- ***Restored historic buildings and contextual infill development would improve community aesthetics and support economic growth.*** The Legacy Communities offer a unique sense of place and history that must be preserved. Historic preservation should be pursued in concert with new projects. Reinvestment and new investment in real estate is critical to economic sustainability. Development projects that are consistent with the existing community fabric will be an important factor in retention and recruitment of businesses.

- ***Festivals and community celebrations would raise awareness and generate economic activity.*** There are numerous festivals and community events each year that boost tourism and business activity in Delta. Additional visitor programming, coordinated scheduling, marketing, and branding could increase the economic benefits of existing and future events in the Delta.

- ***A strict and multi-layered regulatory framework limits economic development.*** With numerous government agencies overseeing land use in the Legacy Communities, permitting new projects is frequently a costly and lengthy process. Furthermore, some projects are disallowed entirely.

- ***Risks associated with insufficient flood protection restrict new investment.*** Adequate flood protection is essential to economic development in the Delta. Costly new and improved levees are necessary to encourage reinvestment and new investment in the Legacy Communities.

- ***Housing options for Delta workers are limited.*** Only about one in ten employees working in the Primary Zone also lives there. Without sufficient workforce housing, Delta employers must recruit non-local employees who must drive long distances to work, thereby compromising “sustainability” from an environmental standpoint.

- ***The Vision for Clarksburg – A Vibrant Agricultural Community.*** Clarksburg’s primary competitive advantage is its agricultural abundance. This region produces exceptional agricultural goods, most notably wine grapes, and attracts visitors who tour farms and wineries. The Economic Sustainability Plan proposes that the vision for Clarksburg build on momentum in the areas of agricultural tourism and value added agricultural processing.

Clarksburg should retain its historic character, grow as a food and wine destination, and attract new agriculture-related "craft production" businesses.

- ***The Vision for Walnut Grove – The Heart of the Delta's Sacramento River Corridor.*** Walnut Grove is centrally located, with a cluster of businesses providing residents, workers, and visitors a variety of goods and services not found elsewhere in the Primary Zone. The Economic Sustainability Plan proposes that the vision for Walnut Grove build on its status as local a business hub. Walnut Grove should preserve its community character; grow and diversify business activity; and continue to strengthen its physical connection to the Sacramento River.

- ***The Vision Locke – A Historic Delta Community.*** Locke is known for its cultural heritage, historical significance, unique building stock, and points of interest. With great sensitivity to cultural, historical, and environmental values, the Economic Sustainability Plan proposes that Locke would leverage its notable assets to increase tourism and spending in the community. Locke should preserve its historic character, offer improved hospitality and visitor services, and revitalize its "main street" business environment.

- ***An existing agency should be designated to manage and implement economic sustainability efforts in the Delta.*** A designated entity responsible for economic development and community reinvestment should plan, coordinate, and participate in the implementation of the Economic Sustainability Plan. Future planning efforts would build on recommendations and findings from this Plan, refining the goals for the Legacy Communities and prioritizing potential strategic actions. The agency would ensure that strategic actions, such as marketing efforts and economic development, are implemented in a systematic, efficient, and consistent fashion throughout the Legacy Communities. Additionally, the agency might contribute to implementation directly, either carrying out implementation actions independently or by coordinating partnerships between public and private sector actors.

- ***Agricultural tourism has growth potential.*** Some farm-related recreation is currently found throughout the Delta and interest is growing. Farms and other agricultural businesses are increasingly leisure destinations, with businesses seeking direct sales and brand awareness and visitors seeking fresh food and a physical connection to their food source.

- ***Potential strategic implementation actions must be analyzed, refined, and prioritized.*** The Economic Sustainability Plan considers a number of strategic actions for the communities of Clarksburg, Walnut Grove, and Locke. In addition, specific sites are evaluated for higher and better land use potential. The proposed strategic actions and the review of opportunity sites presented in this chapter are intentionally high-level. As community- specific economic sustainability goals are refined over time, associated strategic actions will need to be updated and further detailed.

Chapter 11: Recommended Strategies and Policies for Economic Sustainability

The research and analysis for the Economic Sustainability Plan resulted in a number of findings and identified many important issues. The key findings are summarized in the previous chapter, and this chapter discusses four cross-cutting issues that are important to all three of the main economic sectors dependent on Delta resources: agriculture, recreation and tourism, and infrastructure services. The first critical issue deals with the future of the Delta levee system, the critical infrastructure that supports the Delta economy and numerous state interests in the Delta. The second issue is the importance of water quality and quantity to the Delta economy. The third issue concerns the current status and future of agriculture, recreation, and tourism as important economic drivers in the Delta, and their role in defining and enhancing the Delta as a unique place. The fourth issue is the opportunities and challenges facing the Delta's historic Legacy Communities, and how they illustrate the strategies and recommendations.

Although the focus of this plan is the Delta, it is also a part of on-going statewide planning initiatives related to the broader state's interests in the Delta's water resources and ecosystem. The plan recommends many specific actions where the state's coequal goals of water supply reliability and ecosystem restoration are consistent with the requirement to restore and enhance the Delta. However, a small number of the water supply and ecosystem proposals create large conflicts with economic sustainability and are not recommended in the plan.

Four Key Issues

1. The Delta Levee System

Since the early 20th century, the current-day Delta levee system provides flood control that allows productive agricultural and urban uses of land, channels water for urban and agricultural uses, protects critical infrastructure, and creates a desirable setting for boating and water-based recreation in an environment unique in California. The levee system is the foundation on which the entire Delta economy is built. Therefore, a sustainable Delta economy requires a sustainable levee system.

To support the Economic Sustainability Plan, an up-to-date map of Delta levees was created. This map serves as the basis for an updated tabulation of levee lengths, which shows that in the Legal Delta, there are just under 1,000 miles of levees, of which 380 miles are project levees constructed by the U.S. Army Corps of Engineers (USACE), and an additional 63 miles are urban non-project levees, as defined by recent State legislation. Subtracting from the total the urban levees and levees in the north and south Delta that are primarily flood-control levees leaves around 650 miles of core levees, which protect lands below sea level in the Primary Zone of the Delta. Of these core levees, 193 miles are project levees that are primarily located along the Sacramento River. The remaining approximately 460 miles of core levees need to be maintained and enhanced by the State and the local reclamation districts.

Of this 460 miles of levees, only about 50 miles clearly fall below FEMA's Hazard Mitigation Plan (HMP) "standard" and 100 miles or more are already at or about the Corps of Engineers Delta-specific PL 84-99 standard. It has been the goal of the State and federal governments, working through the Department of Water Resources (DWR), the U.S. Army Corps of Engineers (USACE), and the local reclamation districts, to meet the PL 84-99 standard since 1982 when DWR and USACE produced a joint report on the Delta levees which recommended the basis for this standard. If effectively used, funds currently in the pipeline should bring the Delta levees

close to achieving this goal. When these funds have been expended, more than $698 million will have been invested in improvements to the Delta levees since 1973. These improvements have created significantly improved Delta levees through modern engineering and construction, making obsolete the historic data that is still sometimes used for planning or predicting rates of levee failure.

Three approaches can help all jurisdictions and planners further reduce the risks resulting from the failure of the Delta levees. These approaches are: (1) build even more robust levees, (2) improve both regular maintenance and monitoring and flood-fighting and emergency response following earthquakes, and (3) improve preparedness for dealing with failures after they occur. With regard to the first approach, the big question with respect to the core Delta levees is not whether they should be improved to the Delta-specific PL 84-99 standard. Instead, the key question is whether in order to support and enhance various in-Delta, regional, State and federal interests they should be improved to a higher standard in order to address hazards posed by not only floods, but also earthquakes and sea-level rise. Our conclusion is that these improvements would be advantageous not only for flood control and protection against earthquakes and sea-level rise, but because they also would allow for planting vegetation on the water side of the levees—an essential component of Delta ecosystem repair. These further-improved levees would have wider crowns to provide for two-way traffic and could easily be further widened at selected locations to allow the construction of new tourist and recreational facilities out of the statutory floodplain. Improvement of core levees to this higher standard would cost in the order of $1 to 2 billion, a significant sum but much less costly than other estimates. Chapter 4 contains further detail regarding funding sources, the assessment of Delta levees, and evaluation of strategies.

2. Delta Water Quality and Supply

Water quality and quantity is essential to the three key components of the Delta economy: agriculture, recreation, and infrastructure services. As discussed in Chapter 6, the impact of increased salinity on Delta agriculture is already apparent in many areas, and further deterioration would have very large costs. Surveys of Delta boaters have identified water quality as being the most important area of improvement to increase the quality of Delta recreation. Similarly, lower water quality increases costs for municipal and industrial water supplies in the Delta, and creates a financial burden for Delta households and businesses. Much like levees, adequate water quality and quantity is a necessary foundation for a sustainable Delta economy.

Water quality and quantity is the largest impact of many of the proposed changes to the Delta. Proposed changes in conveyance that might lower water quality, particularly in the South Delta, could have adverse impacts on all parts of the Delta economy. Conversely, there would be positive effects if state agencies were to require greater “environmental flows” in the San Joaquin River, Sacramento River, and through the Delta as a whole. Likewise, tighter controls on both urban and agricultural waste water will have positive effects.

In addition to water quality, the Delta economy depends on the availability and right to use sufficient quantities of water. In-Delta use of water is small compared to upstream diversions and water exports from the state and federal projects in the south Delta, and unlike these other diversions, in-Delta water use has not increased in recent decades. Thus, protection of adequate fresh water flows and in-Delta water rights is critically important to economic sustainability.

3. The Present and Future Contribution of Agriculture, Recreation, and Tourism

Agriculture is the main economic driver in the Delta, generating five to six times the regional economic impact of recreation and tourism. However, recreation and tourism has the most growth potential. Research for this plan found that a dollar of crop production in the Delta has nearly double the regional employment and income impacts of a dollar of recreation and tourism spending in the Delta. This result is important for economic sustainability since many proposals to change the Delta would reduce agricultural production while potentially increasing recreation and tourism. Even using the weakest definitions of economic sustainability that would allow growth in one sector to offset decline another, the projected growth in Delta recreation spending over the next 40 years would only be equivalent of 5 percent of the current economic impact of Delta agriculture on the five Delta counties. Thus, economic sustainability requires the value of Delta agriculture to be sustained and enhanced in the future.

The lower economic impact of recreation and tourism spending is because fuel and retail purchases dominate expenditures for the types of recreation and tourism that are currently available in the Delta. Although these are local expenditures, the goods are typically produced elsewhere have relatively low multiplier effects on the regional economy. While recreation trips to the Delta are a significant contributor to the Delta economy and are expected to increase, increasing the economic impact of tourism spending requires increasing spending per trip to the Delta and the local economic impact of spending that does occur. This requires diversification through new investment in high value-added, land-based tourist services that generate more local income and jobs than retail and fuel expenditures. A successful strategy would require significant new investment in hospitality enterprises within the Delta, and also stimulate investments needed to sustain and enhance the large existing economy associated with Delta boating. This is a difficult challenge given the market and regulatory constraints of operating in the Delta.

This plan offers some tactics to support this strategy, but it is important to have realistic expectations of the growth potential. In the baseline scenario, recreation and tourism spending is projected to grow about $80 million, 30 percent over the next 40 years. Successful efforts to expand and enhance tourism and recreation experiences could consequently increase this by another $30 million. However, increasing day trips for wildlife viewing and other ecologically-based activities is unlikely to generate significant increases to in-Delta economic activity, especially without new investment in services that encourage longer visits and overnight stays.

On the agricultural side, supporting the high-value processing tomato and wine grape crops is critically important to the regional economy because of the local value-added manufacturing industries associated with these crops, and the potential for significant growth in local winery capacity and direct sale of product. The baseline projection developed for this plan predicts that an additional 10 percent of Delta agricultural land will shift towards these higher-value crops over the next few decades, creating a significant boost to the regional economy. However, these crops are generally considered to be less wildlife friendly, and significant expansion could conflict with ecological restoration goals in the Delta.

4. Sustainable Legacy Communities: Where the Challenges and Strategies Come Together

Economic opportunities and constraints facing the Delta's Legacy Communities mirror those in the broader Primary Zone. The current economies of the Legacy Communities are agriculturally based providing support services and limited workforce housing for the Primary Zone's largest

industry as well as some housing for retirees and service and professional workers who commute into nearby urban areas such as Sacramento. Despite the current base in agriculture and rural bedroom and retirement communities, much of the revitalization strategies for Legacy Communities are based on growing their appeal as destinations for recreation and tourism. This includes promoting the emerging agritourism sector—including wine and local foods—as an economic development theme.

However, a strict and multi-layered regulatory framework places limits on economic development opportunities within the Delta's Legacy Communities. The aging and occasionally sub-standard building stock needs improvement, potentially utilizing redevelopment of existing buildings and/or a limited amount of new development in order to accommodate visitor- and local-serving enterprises. New investment is especially important because the existing base of hospitality- and tourism-related enterprises is very limited and insufficient to attract and capture significant tourist activity. The most developed recreation and tourism enterprises in the Delta are campgrounds and marinas that serve water-based recreation; these are mostly located outside the Legacy Communities and often outside the Primary Zone.

An already burdensome regulatory environment has been made significantly worse by the recent remapping of FEMA flood zones. All of the Legacy Communities along the Sacramento River have either been or are in the final process of being remapped into the 100-year floodplain. This designation requires elevation of new and substantially remodeled existing structures 10 feet or more above ground level, making most new construction, additions and major renovations financially infeasible. Many stakeholders are concerned that the flood zone designation will cause the Legacy Communities to slowly wither away. It is clear that the economic sustainability of the Legacy Communities is dependent on levee and flood-control investments as well as other strategies to address the constraints of flood zone designation.

Despite these challenges, the Legacy Communities have significant historical, cultural, and economic values and the potential to become attractive destinations for visitors and more prosperous, higher quality of life for residents. Chapter 11 includes more detailed visions and strategies for Legacy Communities, including case studies of Walnut Grove, Locke, and Clarksburg.

Recommended Actions for Economic Sustainability

The following actions are recommended. All of these actions and strategies are consistent with economic sustainability in the Delta and the coequal goals of increased water supply reliability and ecological restoration.

- **Improve core, non-project Delta levees to the PL 84-99 standard by 2015 using the existing Delta levee subventions and special project programs.** This engineering standard has been developed and supported by numerous studies, is attainable with current bond funds, and consistent with the intended use of the bonds California voters passed in 2006. Achieving this goal will increase water supply reliability, and will leverage the substantial benefit of federal support from the Army Corps of Engineers in the event of future levee failures. (Chapter 4)
- **Improve many Delta Levees beyond the PL 84-99 that addresses earthquake and sea-level rise risks, improve flood fighting and emergency response, and allow for vegetation on the water side of levees to improve habitat.** Upgrades beyond PL 84-99 are the appropriate place to consider implementing island-by-island life-cycle cost-

benefit analyses. Improvement of most core Delta levees to this higher standard would cost $1 to $2 billion. While this is a longer-term program, planning should be initiated immediately. (Chapter 4)

- **Transfer responsibility for coordination of regional emergency management and response and recovery to a regional agency.** The regional agency should place much more emphasis on preventative maintenance and inspections, flood-fighting, and emergency response. The Delta Protection Commission should consider taking on this role.
- **Maintain or enhance the value of Delta agriculture.** The contribution of agriculture to the economy of the Primary Zone is irreplaceable, and it is also very important to the Secondary Zone and regional economy. While some modest loss in agricultural acreage may be unavoidable, it is possible to maintain and enhance the value of Delta agriculture if current trends towards higher value crops continue. The requirement to protect the value of Delta agriculture must be part of any habitat, water supply or development plans. The fifth draft of the Delta Plan under development by the Delta Stewardship Council includes maintaining and enhancing Delta agricultural revenues as a performance measure.
- **Initiate a process to streamline local, State, and federal regulations and permitting.** Overlapping layers of regulatory oversight in the Delta create uncertainty and costs that discourage private investment needed for economic sustainability.
- **The Delta Stewardship Council should not increase regulation of "covered actions" for industries it is trying to enhance in the Delta.** Exemptions should be made for needed investments in agriculture, recreation, and tourism.
- **An existing agency should be designated to manage and implement economic sustainability efforts in the Delta.** The agency would ensure that strategic actions, such as marketing efforts and recreation enhancements, are implemented in a systematic, efficient, and consistent fashion throughout the Delta. The Delta Protection Commission should consider taking on this role.
- **Create a Delta and/or Legacy Communities "brand" to enhance awareness.** The agricultural products, attractions, and communities of the Delta should be marketed strategically in order to raise the stature of the region and encourage added visitation.
- **Designate the Delta as a National Heritage Area (NHA).** This recommendation is contingent on the outcome of the Delta Protection Commission feasibility study. The NHA could be an effective tool for marketing and branding the Delta and implementing the recreation and tourism enhancement strategy.
- **The Delta Investment Fund should be established and used strategically to implement the recreation and tourism enhancement strategies.** Funding for planning and development of focal point complex areas and catalyst features, especially those close to Legacy Communities, should be a high priority.
- **Develop measurable targets for recreation and tourism and agricultural sustainability, and track performance over time.** A key first step is to improve data on recreation and tourism use with an updated visitor survey and additional primary data collection that is repeated at five-year intervals. This data is crucial for future recreation planning and marketing. Agricultural data is more available but needs to be consistently collected and compiled over time.
- **Create flood bypass and habitat improvements in the Yolo bypass, McCormack-Williamson Tract, and the lower San Joaquin River near Paradise Cut.** In all cases, the BDCP and State interests should work collaboratively with local stakeholders to minimize negative economic impacts and develop effective mitigation. In the lower San Joaquin River, an alternative proposal developed collaboratively with local stakeholders

is recommended as an alternative to the more expansive and costly plan outlined in the draft Bay Delta Conservation Plan (BDCP). These ecological and flood-control investments should be designed with appropriate facilities to enhance recreational opportunities.

- **Improve water quality and freshwater outflow in the Delta.** In addition to ecosystem benefits, this goal improves agriculture, recreational boating and fishing, and in-Delta municipal and industrial water supplies.

The following proposed actions to further the coequal goals are not recommended because they conflict significantly with economic sustainability. These proposed actions all had significant negative impacts on all three key components the Delta economy evaluated in the plan: agriculture, recreation and tourism, and infrastructure services.

- **A 15,000 cubic feet per second isolated water conveyance facility is inconsistent with economic sustainability**. This project would have significant negative effects on all aspects of the Delta economy. There are unacceptably high risks surrounding the financial feasibility, environmental impacts, and operations of the project. There are many alternative options for increasing water supply reliability, and the large cost of isolated conveyance could drain resources that could support the state policy of reducing reliance on water exports from the Delta.
- **Tidal marsh in the south Delta is inconsistent with economic sustainability.** Tidal marsh in the south Delta eliminates a large amount of high-value agricultural land and would affect water quality in ways that are negative for recreational, municipal, industrial, and agricultural uses.
- **A large area of open water in the Central Delta caused by the permanent flooding of several contiguous islands is inconsistent with economic sustainability.** Although the agricultural value of these deeply subsided islands does not justify levee investments, this strategy would cause significant harm to recreation, and negatively affect water quality for in-Delta municipal and industrial uses through increased levels of organic carbon, and increase flood risks on adjacent islands.

Finally, the plan discusses a number of additional potential actions that require further study and development. These are mostly medium-term strategies that could be consistent with Delta economic sustainability and the coequal goals. However, there are significant concerns or uncertainties regarding their impact on the Delta economy that must be further researched and addressed before they can be recommended in the plan. These potential actions include proposals for smaller capacity water conveyance such as a 3,000 cfs tunnel, moving water supply intakes for conveyance downstream into the west Delta, proposals for enhanced through-Delta conveyance such as Delta corridors, extensive use of wildlife-friendly agricultural easements as described in the BDCP, tidal marsh in the west Delta and Cache Slough, and subsidence-reversal and carbon-sequestration agriculture on private lands.

In conclusion, the recommended strategies in the Economic Sustainability Plan show that it is possible to sustain and enhance the Delta economy while making significant progress towards the coequal goals of increased water supply reliability and ecosystem restoration. Compared to plans centered on large, isolated conveyance like the draft BDCP, implementing the strategies in the Economic Sustainability Plan is less costly for the state and the customers of water agencies, and delivers more immediate progress towards the coequal goals.