DELTA VISION STRATEGIC PLAN

Second Staff Draft

CONTENT HAS NOT BEEN APPROVED BY DELTA VISION BLUE RIBBON TASK FORCE OR DELTA VISION COMMITTEE

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This draft is primarily a correction draft of the First Staff Draft released in June 2008. More substantive revisions reflecting input received from the Delta Vision Blue Ribbon Task Force, interested stakeholders, and others, will be reflected in the Third Staff Draft in August 2008.

Comments to improve this draft are welcome at any time. Please send them to:

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Comments received before the following dates will be reviewed by staff as the draft strategic plan is revised for discussion at the subsequent Delta Vision Blue Ribbon Task Force meeting:

August 4
September 2
September 30

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Introduction

The California Delta is the heart of our state, at once a water supply, an ecosystem, and a place that is indispensable to modern California. Our vision for the future of this crucial and gravely threatened resource was published in December 2007. In that vision, we described a future in which the California Delta will continue to thrive over the coming generations, despite the major challenges – ranging from climate change to subsidence to population growth – that it will face. In this Strategic Plan, we outline the broad strategic directions that state and federal government, local government, and the people of California should pursue to make this vision a reality.

At the core of our vision is a set of 12 integrated and linked recommendations. These recommendations also form the underlying basis of this Strategic Plan, guiding the formulation and evaluation of the strategies outlined here. Of these 12 recommendations, the first two are especially central:

1. The Delta ecosystem and a reliable water supply for California are the primary, co-equal goals for sustainable management of the Delta.

2. The California Delta is a unique and valued area, warranting recognition and special legal status from the State of California.

California's water supply and the Delta ecosystem are both irreplaceable assets that are of paramount importance to the state's future. Actions taken to manage the Delta must secure the future of both, rather than encouraging one to thrive at the expense of the other. Indeed, California is increasingly realizing that neither can be fully secure if either is ailing – the ecosystem will remain under constant stress if water supplies are unreliable, and the water supply will remain vulnerable to interruptions if the ecosystem is unhealthy.

Too much is relying on a system that is far too fragile. The water system, the estuarine ecosystem, the Delta as a place, and much of the state's economy are vulnerable to intolerable levels of risk. Our process has identified six key drivers of change that are already underway in the Delta: seismicity, sea level rise, regional climate change, subsidence, population growth, and invasive species. Some of these could change the Delta suddenly and irreversibly, others will change the Delta gradually but inexorably. Reducing these risks in a systematic, socially just, and economically rational manner is one of the most important tasks facing the state of California.

California's existing water systems have provided water for half a century but at large cost to ecosystems. Now water supply systems must evolve in fundamental ways to reverse negative impacts on ecosystems while also moderating failure risks and meeting the challenge of climate change. Just as the state became a world leader in water engineering, it will now have to become a world leader in ecosystem revitalization, water conservation and regional self-sufficiency. Regenerating the Delta ecosystem will

require restoration efforts of a scale and complexity attempted few times before anywhere in the world; learning and adaptation will have to take place continually if we are to succeed. As with water management, California should secure its place as a global leader in the science and practice of wetland and floodplain restoration.

Large changes in ways in which water is provided and ecosystems are managed will not be easy. They will require a substantially increased capacity for public policy making, shaped by two fundamental conclusions:

1. California must greatly improve its capacity to make and implement important decisions regarding the Delta ecosystem and reliable provision of water.
2. A revitalized ecosystem and sustainable water supplies can be achieved, but do not guarantee water export levels of the recent past or survival of any individual species.

This Strategic Plan is organized into chapters for each of four topic areas in which successful action is required if our vision for the California Delta is to be achieved:

- Governance and Finance,
- Ecosystem,
- Water Supply Reliability,
- The Delta as a Place.

In each topic area we have identified (a) goals, (b) performance measures by which to assess progress toward the goals, and preliminary thinking on performance targets to be achieved by 2020, 2040 and 2060, and (c) actions that will achieve those goals, and that the Administration or Legislature can implement as part of the recommended strategies.

A brief summary of each of these topic areas immediately follows this introduction. The strategies and actions are then described in greater detail in the four chapters.

Governance and Finance

Goals

* Create clear lines of governmental responsibility for protecting the co-equal values and other state interests in the Delta.

* Ensure consistency of action and clarity of roles among existing agencies across all levels of government.

* Ensure adaptability of governance to changed circumstances over time.

* Create effective finance mechanisms.

Strategies

1. Create a multi-part governance structure, with a California Delta Ecosystem and Water Council, a strengthened Delta Protection Commission, a Delta Conservancy, and a Delta Science and Engineering Board. The Council develops and adopts the California Delta Ecosystem and Water Plan (CDEW Plan) and has ongoing responsibility for its implementation (see Figure 1). The CDEW Plan incorporates all plans developed under species protection laws.

2. Ensure consistency of action among existing state, federal and local entities by creating the CDEW Plan, clarifying the roles of existing agencies in the Delta, and making full use of existing laws and constitutional principles governing water.

3. Finance the activities called for in the CDEW Plan by creating effective and transparent revenue-generation mechanisms that reflect the true value of resources, and are linked to value-creation for beneficiaries and future generations of Californians.

Actions:

Action 1.1: Create a California Delta Ecosystem and Water Council to govern the co-equal values of healthy estuarine ecosystem function and a reliable water supply, and to approve policies for enhancing the Delta as a place.

Action 1.2: Refine the capacity of the Delta Protection Commission to govern land use and promote economic development in the Delta region.

Action 1.3: Create a California Delta Conservancy to undertake ecosystem enhancement projects and conduct other activities in support of the California Delta Ecosystem and Water Plan, and to coordinate effectively with non-governmental organizations, businesses, property owners, and all units of government.

Action 1.4: Create a Delta Operations Team and a California Water Utility to manage Delta water flows and the State Water Project, in concert with Central Valley Project operating guidelines and measures.

Action 1.5: Create a Delta Science Program and a Delta Science and Engineering Board to support the Council in pursuit of the co-equal goals, and to design and oversee an adaptive management plan.

Action 1.6: Develop a robust, science-based adaptive management program that enables frequent management adjustments in response to changing Delta conditions.

Action 2.1: Develop a legally binding California Delta Ecosystem and Water Plan to establish a detailed management structure for attainment of the co-equal goals as well as identified land use issues in the Delta region.

Action 2.2: Ensure that environmental justice is adequately addressed in Delta decision-making processes by requiring review of proposed actions against environmental justice criteria defined in the CDEW Plan.

Action 2.3: Improve the compliance of the diversion and use of water with all applicable laws and regulations.

Performance target schedule

	2020	**2040**	**2060**
Length of time before negative trends in ecosystem, water, and Delta as place performance measures are reversed	Years	1 year	Months
Number of federal and state court actions addressing the co-equal values	<10	0	0
Percentage of water diversions in the Delta watershed covered by SCADA monitoring or other accurate reporting system	80%	>90%	>95%
Number of preemptive or corrective actions on agency decisions taken each year by the CDEW Council to ensure consistency with CDEW Plan.			
Percentage of adaptive management actions recommended by CDEW Science Program that are implemented in a timely manner			
Percentage of recommendations by Public Advisory Group that are considered by the CDEW Council in a timely manner			
Percentage of required state and federal permits for ecosystem and water system management obtained in a timely manner			
Percentage of financial investments in Delta ecosystem enhancement that are not consistent with CDEW Plan			
Percentage of financial investments in water infrastructure and regional self-sufficiency programs that are not consistent with CDEW Plan			
Percentage of financial investments in Delta levees and highways that are not consistent with CDEW Plan			

Percentage of required Delta water user fees collected in a timely manner			
Number of times that state funding for local investments is withheld due to non-compliance with CDEW Plan			
Percentage of CDEW Council documents and meeting minutes posted online in a timely manner			
Administrative deadlines			
Passage of statute creating proposed governance system by _____			
Completion of California Delta Ecosystem and Water Plan by _____			
First official meeting of California Delta Ecosystem and Water Council by _____			
First water year fully managed by proposed new governance structure			

Ecosystem

Goals

* Support viable populations of native resident and migratory species.

* Create functional corridors for migratory species.

* Create a diverse mosaic of habitats and ecosystem processes.

* Reduce stressors to below adverse effects levels.

* Provide important human services.

Strategies

4. Restore physical habitats in multiple large, connected complexes of tidal marshes, floodplains, shallow open water, seasonal wetlands, grasslands and riparian edges that support native and desirable non-native species, and that increase the land-water interfaces characteristic of the historic Delta and other effective estuaries.

5. Restore appropriate water flows and other ecosystem processes throughout all Delta habitat types.

6. Reduce or remove stressors to the Delta ecosystem, including invasive species, contaminants, and entrainment.

Actions:

Action 4.1: Restore as much tidal marsh acreage as physically feasible, and conserve adjacent uplands in geographically linked complexes.

Action 4.2: Inundate floodplains in as many years as possible.

Action 4.3: Preserve and enhance seasonal wetland complexes and adjacent upland grasslands.

Action 4.4: Create new open water areas within the Delta and Suisun.

Action 4.5: Support and enhance established migratory corridors through temporary or permanent changes to channel geometry.

Action 5.1: Provide increased freshwater flows (and shift the timing, quantity, quality, and input locations of flows) through the Delta at critical times and locations in spring and fall that coincide with key life history stages of resident and migratory fishes.

Action 5.2: Resolve export effects on net Delta transport.

Action 5.3: Incorporate flood protection benefits into tidal marsh and floodplain restoration efforts to the maximum extent practical.

Action 5.4: Improve conjunctive use programs that shift highest exports to wettest periods and lowest exports to driest periods.

Action 6.1: Control harmful invasive species at existing locations and in restored areas.

Action 6.2: Minimize methyl mercury production.

Action 6.3: Reduce export effects on fish, including instituting pumping restrictions and diversion management and relocation.

Action 6.4: Monitor fish and wildlife health at suspected toxic sites.

Action 6.5: Construct water treatment wetlands wherever feasible at municipal, industrial, and agricultural returns.

Performance target schedule

Indicator	**2020**	**2040**	**2060**
Group 1: Habitats			
Acres of restored tidal marsh, Delta (not accounting for sea level rise)	15,000	30,000	57,000
Acres of restored tidal marsh, Suisun (not accounting for sea level rise)	12,500	25,000	> 25,000
Acres of restored shallow open water habitat, Delta (~60,000 acres potential)	TBD	TBD	TBD
Acres of active floodplain	TBD	TBD	TBD
Acres of seasonal wetlands and grasslands	TBD	TBD	TBD
Acres of fall open water habitat between 0.5-6 parts per thousand salinity	20,000	35,000	35,000
Number of functional migratory corridors per river system (Sacramento, San Joaquin, Mokelumne/ Cosumnes) (replaces "Amount of channel habitat")	2 per river	≥ 2 per river	≥ 2 per river
Group 2: Attributes of Restored Habitats			
Amount of river miles connected to habitats (replaces "Degree of connectivity")	Miles	Tens of miles	Tens of miles
Distribution of large habitat complexes along estuarine gradients and with extensive internal connectivity	Suisun, North Delta	+ East and South Delta	Throughout Delta
Percent of aquatic food web support by diatoms	TBD	TBD	TBD
Group 3: Flow			
Net downstream flow on San Joaquin River at Jersey Point Oct 1 to Jun 30	> 0 cfs	> 0 cfs	> 0 cfs
Number of 7-14 day duration fall flow pulses on San Joaquin River at 2,000-3,000 cfs at Vernalis between Sep and Nov each year	1-2	2	2

Number of months between Aug and Nov with Delta outflow of 12,000-18,000 cfs	1-2	1-2	1-2
Spring flow targets	TBD	TBD	TBD
Group 4: Species			
Delta smelt and longfin smelt abundance (% of 1967-1983 fall mid-water trawl)	>100%	>100%	>100%
Delta smelt distribution (% of pre 1983 habitat occupied)	>50%	100%	100%
Splittail abundance (% of 1987-1991 drought)	>100	>100	>100
Ducks sustained at peak wintering abundance in Delta and Suisun Marsh combined	1.4 million	1.4 million	1.4 million
Shorebirds sustained at peak wintering abundance in Delta and Suisun Marsh combined	70,000	70,000	70,000
Percent of listed species recovered and removed from ESA/CESA and state-wide lists	50%	75%	100%
Number of species newly listed on ESA/CESA and state-wide lists	0	0	0
Adult salmon, steelhead, and sturgeon migration survival through Delta	TBD	TBD	> 95%
Juvenile salmon, steelhead, and sturgeon migration survival through Delta	TBD	TBD	> 50%
Group 5: Stressors			
Fish entrained at Delta diversions, outmigrating juvenile salmonids: percent of population	TBD	TBD	<2%
Fish entrained at Delta diversions (delta smelt and longfin smelt)	TBD	TBD	TBD
Number of new, uncontrolled harmful invasive species	<5	<5	<5
Incidents of migratory passage delays, blockages, or mortalities due to physical barriers, low dissolved oxygen, high temperatures, or toxics	TBD	TBD	0 per year
Dissolved oxygen concentrations in anadromous fish migratory corridors at all times	> 5 mg/L	> 5 mg/L	> 5 mg/L
Control of invasive clams (*Corbula, Corbicula*) (% of 1995-2000 average abundance and distribution)	TBD	TBD	<100%
Control of Brazilian waterweed (*Egeria*) (% of 1990-2000 average abundance and disribution)	TBD	TBD	<50%
Administrative deadlines			
Integrate regional ecosystem restoration and management plans into Delta Vision proposals by 2010			
Complete policy relevant models, such as the Delta Regional Ecosystem Restoration Implementation Plan, in forms useful to policy makers and managers by 2009.			

Water Supply Reliability

Goals

* Improve water supply reliability, provide adequate supplies, and enhance regional self-sufficiency.

* Enhance the supply, quality, timing, and flexibility of water resources.

* Manage the co-equal values and prepare for climate change.

Strategies

7. Maximize regional water self-sufficiency throughout California by a wide range of supply augmentation and demand management techniques.

8. Integrate and strengthen management of all aspects of the water cycle, including surface flows, groundwater, flood control, infiltration, and water quality.

9. Create a wet-period diversion, conveyance and storage system to the greatest feasible extent to minimize ecosystem stress and prepare for climate change.

Actions:

Action 7.1: Improve collection of baseline water diversion and use data.

Action 7.2: Develop mechanisms to increase the implementation of urban water use efficiency measures and link state funding to achievement of efficiency goals.

Action 7.3: Require developments to include best-available water savings devices and to provide mitigation for new water use.

Action 7.4: Increase the percentage of agricultural lands irrigated with highly efficient technology and management practices.

Action 7.5**:** Increase locally generated supplies through the use of recycled water, desalination, and captured stormwater.

Action 7.6: Develop storage requirements and operational guidelines to address the use of recycled water for indirect reuse.

Action 7.7: Streamline the water transfer regulatory approval process.

Action 8.1: Increase investment in development of Delta hydrodynamic and water management modeling tools.

Action 8.2: Work with the federal government to modify flood management operations at existing major multi-purpose reservoirs to obtain additional water supply yield while maintaining flood control capacity.

Action 8.3: Coordinate with the Central Valley Flood Protection Plan to increase flood conveyance capacity along the lower San Joaquin River, including through the Delta, so that water supply yield from terminal multi-use reservoirs in the San Joaquin Valley can be increased.

Action 8.4: Ensure a clear decision process and public vetting of major modeling assumptions for the Bay Delta Conservation Plan Environmental Impact Statement/Report for a Delta Conveyance Alternative, and ensure consistency between these assumptions and those used in other major modeling efforts.

Action 8.5: Control anthropogenic (i.e. human-generated) contaminants at the source, before they enter the Delta.

Action 8.6: Improve the legal and regulatory framework associated with groundwater banking agreements and operations.

Action 8.7: Institute comprehensive basin management planning to address the availability, quality, and managed use of regional groundwater resources.

Action 8.8: Encourage infiltration or direct use of precipitation throughout the Delta watershed and export areas.

Action 9.1: In the near-term, experimentally implement a Middle River conveyance, as recommended by the Delta Vision Stakeholder Coordination Group.

Action 9.2: Over time, shift export diversion timing to wetter periods (both within and between years) while providing sufficient reliability for regions reliant on water exported from the Delta watershed.

Action 9.3: Shift major in-Delta diversions away from sensitive habitats (high priority restoration areas, low-flow channels and terminal sloughs) to channels where drinking water quality is higher.

Action 9.4: Create a dual conveyance system for the Delta designed to optimize capture of wet-period flows.

Action 9.5: Identify mechanisms to connect legal in-Delta water users to improved Delta conveyance facilities.

Action 9.6: Support expedited completion of the CALFED surface storage investigations and implement the storage options that optimize the capture of wet-period flows.

Performance target schedule

	2020	2040	2060
Water use per capita, relative to 2008 baseline, by hydrologic region	Down 20%	Down >30%	(Variable by Hydro Region)

Water use per unit economic output, relative to 2008 baseline, by hydrologic region	Down 20%	Down >30%	(Variable by Hydro Region)
Length of time, at average rates of use over a three-year period, that a given district's alternative and stored supplies will last if there is a catastrophic outage of the Delta	Up 25% (on average)	Up 50% (on average)	Up 100% (on average)
Amount of water in accessible surface and ground water storage compared to 2008 baseline	Up 20%	Up 40%	Up 60%
Concentrations of man-made contaminants in Delta water compared to 2008 baseline	Down 20%	Down 30%	Down >30%
Percentage of precipitation in the Delta watershed that is infiltrated or directly used compared to 2008 baseline	Up 5%	Up 10%	Up >10%
Amount of water exported from the Delta that is recycled or re-infiltrated (excluding water lost to direct consumption by crops and people, or evapotranspiration) compared to 2008 baseline	Up 10%	Up 25%	Up 50%
Administrative deadlines			
Complete water basin management plans by _____			
Complete CALFED surface storage investigations by ____			
Implement Delta Vision near-term actions, including improved through Delta conveyance by _____			

Delta as Place

Goals

* Increase recognition of the Delta as a place.

* Enhance tourism and recreation, sustainable and multi-functional agriculture, and the local economy.

* Decrease flood risks to people and property, and match levee types to land uses, services provided, and other management requirements.

* Improve governance of state interests and local priorities.

Strategies

10. Increase recognition of the Delta as a place, and enhance tourism and recreation, by creating a National Heritage Area and a multi-unit State Recreation Area, and by facilitating new investments in "gateway" locations near major cities and highways.

11. Enhance the Delta as a place by creating multi-purpose river corridors on each major river system entering the Delta, and by creating Special Area Management Plans for selected areas.

12. Improve the Delta's flood protection and levee system by improving upstream flood management, designing and financing levee types to protect specific land uses and services, and conducting comprehensive emergency management planning and preparation.

Actions:

Action 10.1: Fulfill the requirements necessary to achieve a National Heritage Area designation for the Delta from the federal government.

Action 10.2: Issue a model ordinance to local governments for the creation of special enterprise zones at the major "gateways" to the Delta.

Action 10.3: Create a multi-unit California Delta State Recreation Area.

Action 10.4: On the publicly-owned western Delta islands, manage a land-use transition to recreation, terrestrial habitat, subsidence reversal, carbon sequestration, dredged material handling and appropriate agriculture.

Action 10.5: Create market structures or incentives for a sustainable Delta agriculture to produce public benefits in addition to and compatible with food and fiber.

Action 11.1: Establish water quality, ecosystem management, and flood control priorities for key river corridors in the Delta.

Action 11.2: Draft Special Area Management Plans for specific areas outside of the existing primary zone where state interests in land use can be protected with either greater or lesser oversight than currently exists.

Action 11.3: Have the Delta Protection Commission lead a process to draft Specific Plans for the Delta's legacy towns.

Action 12.1: Reduce flood threats to the Delta, and increase the flexibility and reliability of water management in the Delta watershed, by improving upstream flood management.

Action 12.2: Enhance the Delta levee system by linking levee designs and financing to the land uses protected, and the services provided, by the levees.

Action 12.3: Create a Delta-specific emergency response strategy cooperatively among emergency response agencies to clearly define individual roles and responsibilities and identify gaps in existing response efforts.

Action 12.4: Reduce risks to the critical infrastructure passing through the region by conducting a comparative analysis of the long-term costs and benefits of levee reinforcement, system co-location, relocation, or tunneling.

Action 12.5: Embark upon a comprehensive series of emergency management and preparation actions, beginning immediately.

Performance target schedule

	2020	2040	2060
Number of people living in legal Delta in areas with less than 200-year flood protection			
Cumulative 200-year flood risk to property in legal Delta (i.e. probability of flood times projected dollar amounts of damage)			
Number of structures in deep floodplains (more than 10 feet below sea level or river flood stage) that are not protected by ___-year levees			
Number of people living and working in deep floodplains (more than 10 feet below sea level or river flood stage) that are not protected by ___-year levees			
Total volume of air space below sea level in legal Delta			
Mileage of designated state highways secured against catastrophic failure by adequate levee improvement, elevation, or other means			
Acres of agricultural land protected by PL84-99 levees (or better)			
Acres of land providing public benefits of habitat, flood conveyance, subsidence reversal, or carbon sequestration	Up 20%	Up 50%	Up 100%
Gross regional product from recreation and			

tourism			
Number of people who have received Delta Emergency Response Training			
Administrative deadlines			
Achievement of National Heritage Area status by ____			
Completion of Special Area Management Plans for Bethel Island and Isleton by ____			
Creation of Delta State Recreation Area by ___			
Completion of specific plans for Delta legacy towns by ____			
Completion of emergency management plan for the Delta within 18 months			
Completion of biennial joint emergency exercises			

1
2

Governance and Finance

The need for strengthened governance is at the heart of much of what ails the Delta, and the California water system generally. While California grapples with current problems and worrisome projections, it is easy to forget that our state actually enjoys great abundance, including a generous endowment of water and diverse ecosystems. But we must create more effective and enduring ways of managing this abundance so it may be passed on to future generations in a form that will serve their needs at least as well as it has served ours.

The quality and flexibility of governance is a pivotal concern that stretches across all aspects of Delta management. For California to fulfill any of the recommendations made in the Vision – and then sustain them over generations – a durable, responsible, and just governance system is indispensable. Comprehensive and effective governance need not mean centralized governance, however. Striking the right balance between governmental and private structures; between local, regional and state interests; and between regulatory and market-based incentives are all keys to a successful governance structure.

With respect to the water system, California already possesses a strong constitutional and statutory foundation for carrying out the recommendations of the Vision. Yet key agencies and institutions too often lack consistent political support for certain missions, or are simply underfunded. As a result, the existing water governance structure enforces its own laws and regulations incompletely, unevenly, and on the basis of insufficient information. Measurement, reporting, and enforcement capabilities are all inadequate. In a state where the "reasonable use" of water is mandated by the Constitution itself, this is an unacceptable state of affairs.

With respect to the ecosystem, enforcement of laws and regulations is driven more by court decisions than by any comprehensive long-range plans for ecosystem recovery. This introduces great uncertainty into water management and ecosystem management alike. It also tends to force environmental management agencies into a reactive posture focused on legal compliance rather than on proactive restoration of a badly degraded ecosystem.

Finally, with respect to the Delta as a place, the existing governance structure has been partially successful, but has also failed to protect state interests in the Delta against certain key threats, such as inappropriate urbanization. The balance between state and local interests is a key issue in the governance of the Delta as a place. The governance system should enable the state to meet its critical goals in the region, but should also empower local residents to pursue a prosperous and secure future without having to bear disproportionate burdens from statewide priorities. All financing systems should mirror this principle, with clear and consistent linkages between financing sources and the benefits received.

Strategy 1: Create a multi-part governance structure, with a California Delta Ecosystem and Water Council, a strengthened Delta Protection Commission, a Delta Conservancy, and a Delta Science and Engineering Board. The Council will develop and adopt the California Delta Ecosystem and Water Plan, and will have ongoing responsibility for its implementation.

When surveying the myriad governing agencies and institutions that currently have a stake in the Delta, one is struck by the realization that no one is in charge. Literally hundreds of governmental entities can affect the Delta, but none is ultimately responsible for it. Our Vision therefore called for the creation of a new governance structure for the Delta. This governance structure must clearly assign responsibility for the management of the co-equal values and other state interests, but it must do so in a way that retains needed management flexibility over the long term.

A multi-part management structure governed by a California Delta Ecosystem and Water (CDEW) Plan, is the best way to achieve these objectives. The proposed structure is illustrated in Figure 1. At the top of the structure should be an appointed California Delta Ecosystem and Water Council (see Action 1.1) with responsibility to create and implement the CDEW Plan. The Council would not subsume the authority of existing agencies, but would have the authority to determine whether the actions of those agencies are consistent with the CDEW Plan, which governs the co-equal values and the Delta as a place (see Strategy 2 for more description of the Plan).

The CDEW Plan should be created under the authority of the Coastal Zone Management Act (see Action 2.1), which enables state governments to create coastal plans with which federal agencies must coordinate. This provides a legal and regulatory structure for comprehensive consistency of action among federal, state and local agencies, a crucial component of any successful governance system. If these agencies should fail to act in concert with the CDEW Plan, the Council would have the authority to redress the failure.

The governance structure should also ensure that Delta water operations, and the State Water Project, are conducted in a manner consistent with the CDEW Plan (see Action 1.4). The governance structure should therefore contain a Delta Operations Team that makes operational decisions about water flows on a day-to-day basis. The ownership and operation of the State Water Project should also be transferred to a new California Water Utility. The Department of Water Resources would focus on its statewide water and flood planning functions, but with enhanced capacity and authority to support effective state policy development and regional implementation of those policies. The State Water Resources Control Board should retain its existing responsibilities and authority, but its activities should likewise be brought into consistency with the CDEW Plan.

A refashioned Delta Protection Commission (see Action 1.2), and a new Delta Conservancy (see Action 1.3), should jointly carry out efforts to manage and enhance the Delta as a place. The Delta Protection Commission should be focused on ensuring consistency of local land use and economic development decision making with the CDEW Plan. The Delta Conservancy should act in close coordination with the Council

and the DPC to carry out ecosystem restoration activities, to support regional recreation and tourism planning, and to purchase land and easements as necessary.

The governance structure must centrally include an active Delta Science Program and an independent Delta Science and Engineering Board. These should both work to ensure that scientific principles guide the CDEW Plan and help inject principles of adaptive management activities as the CDEW Plan is implemented. Finally, the governance structure should also contain a permanent Public Advisory Group to provide advice and, where requested, formal recommendations to the Council.

Action 1.1: Create a California Delta Ecosystem and Water Council to govern the co-equal values of healthy estuarine ecosystem function and a reliable water supply, and to approve policies for enhancing the Delta as a place.

The State of California should create a California Delta Ecosystem and Water Council responsible for achieving the two co-equal goals of estuarine ecosystem function and reliable water supply for California, and for policies to enhance the Delta. The Council should be a small body, numbering five to seven individuals appointed by the Governor to five-year staggered terms, subject to Senate confirmation and potential re-appointment a maximum of one time. The appointment process should be transparent to the public.

The Council should possess the following responsibilities and powers:

- To develop and adopt a California Delta Ecosystem and Water Plan with scheduled revisions every five years, or when major changes in ecosystem function or reliability of water supply require revision in the judgment of the Council, or upon direction of the Governor.

- To appoint members of the Governing Board of the Delta Conservancy.

- To maintain a direct working relationship with the Delta Science Program and the Delta Science and Engineering Board to implement science support and adaptive management.

- To receive and allocate funds raised under the California Delta Ecosystem and Water Act and from other sources (see Strategy 3).

- To receive and allocate funds raised by all bonds for improvements in the Delta ecosystem, water conveyance systems and scientific activities.

- To issue debt-financing mechanisms, including revenue bonds, tax anticipation notes and certificates of participation.

- To approve all water, road, railroad, utility and levee infrastructure projects in the legal Delta for conformity with the CDEW Plan.

- To delegate its authority to achieve the purposes of the California Delta Ecosystem and Water Act to any public or non-profit entity of its choosing, but not to delegate or abrogate its responsibility to achieve the purposes of the Act.

- To ensure that the CDEW Plan and its implementation meet environmental justice criteria (see Action 2.3).

The Council's voting membership should include legal, science and engineering, policy, and governance expertise. Ex-officio state agency membership should include representatives of the Delta Protection Commission, the Delta Conservancy, the Department of Fish and Game, the Department of Water Resources, the State Water Resources Control Board. Ex-officio federal agency membership should include the Department of the Interior, the Environmental Protection Agency, the U.S. Army Corps of Engineers, and the National Oceanographic and Atmospheric Administration.

The Council should also empanel a permanent Public Advisory Group (PAG) who will offer advice and, when requested, formal recommendations to the Council. PAG members should be appointed to staggered terms of two or three years. Among the public constituencies that must be represented are water users, environmental groups, local Delta communities, agriculture, business, and environmental justice advocates, among others.

Action 1.2: Refine the capacity of the Delta Protection Commission to govern land use and promote economic development in the Delta region.

The Delta Protection Act in its current form has thus far protected the Delta's primary zone. But the fifteen years since the Act was passed have shown that land uses outside the primary zone and the legal Delta can also impact state interests in the Delta and that not all areas of the legal Delta are equally important to state interests.

The boundaries of the legal Delta need not be changed, but the capacities of the Delta Protection Commission should be refined and enhanced. The DPC's Resource Management Plan should be made compatible with the CDEW Plan and the requirements of the Coastal Zone Management Act (CZMA). (The Resource Management Plan is already being revised; if it is completed before the CDEW Plan, a retroactive amendment may be necessary.) In addition, it should be updated to reflect the impact that the 2007 state floodplain development laws will have on communities in the legal Delta (see Action 11.3). Some functions of the DPC (such as easement acquisition) are better handled by a Conservancy (see Action 1.3).

The DPC's primary new role will be to ensure the consistency of local government plans and decisions with the state interests articulated in the CDEW Plan. To this end, the composition of the Commission should be revised to focus more exclusively on local officials and stakeholders since protection of state interests will be assured by the

consistency requirement. Since the DPC would perform the initial consistency determination, the appellate function that the DPC currently possesses should be moved to the Council.

In addition, specific areas critical to Delta management should be the subject of Special Area Management Plans (SAMPs) under CZMA so that state interests in these areas can be better protected (see Action 11.2). These should be prepared and monitored by the Delta Protection Commission. The SAMPs can be used in at least three different situations:

- For areas within the secondary zone where greater protection of state interests is required (e.g. Brannan-Andrus Island, the lower San Joaquin River floodplain).
- For peripheral areas where greater protection of state interests is required (e.g. the Yolo Bypass).
- For areas within the legal Delta where the state has few interests related to water, ecosystem and flood management, the SAMP can provide a mechanism by which the State specifies its limited interests and then decision making is left to local governments (e.g. heavily urbanized areas such as West Sacramento).

The DPC should also have a stronger economic development component, to coordinate the investment strategies that will enhance the Delta as a place (see Strategies 10 and 11). Certain of its existing functions, such as the planning and acquisition of easements, should be moved to the Delta Conservancy.

Action 1.3: Create a California Delta Conservancy to undertake ecosystem restoration and enhancement projects and conduct other activities in support of the California Delta Ecosystem and Water Plan, and to coordinate effectively with non-governmental organizations, businesses, property owners, and all units of government.

Our Vision identified the need for an entity that "helps mobilize public involvement and provides incentives and support for private interests" working in support of the Vision's goals. California has a long and successful history with conservancy structures that perform these functions at a regional level throughout the state, and there is widespread agreement that such an entity is appropriate for the Delta. The Conservancy would assume responsibility for state ecosystem-related projects now underway in the Delta, Suisun Marsh, and the Special Area Management Plan areas (see Action 1.2).

To maximize local participation and acceptance of such an entity, the state should ensure that there is adequate local representation on the Conservancy's governing body, and should ensure that the Conservancy is solely devoted to the Delta (as opposed to being an extension of another Conservancy). It is also critical that the Conservancy be given adequate funding for both acquisition and ongoing maintenance of land.

While the Conservancy is responsible to the Council, it must closely coordinate its actions with the DPC to implement the goals of the CDEW Plan and to conduct an

assessment of the conservation needs of the Delta. It should also assume some functions currently performed by the DPC, such as the acquisition of easements.

The Conservancy's powers and responsibilities should be to:

- Receive properties now in state, federal or local ownership.
- Purchase, rent or otherwise acquire decision making control over land as needed to implement the CDEW Plan.
- Work closely with the Council to identify and support needed ecosystem restoration activities.
- Acquire agricultural and conservation easements to support ecosystem and water reliability goals.
- Use easements and other incentives to promote sustainable agriculture in the Delta.
- Support regional and statewide recreation interests to bolster the local economy, in coordination with the National Heritage Area entity (see Action 10.1).
- Implement state and federal programs to create incentives for mutually beneficial mixtures of agriculture, habitat and recreation, including agri-tourism, wildlife-friendly agriculture practices, birdwatching, and hunting.

Action 1.4: Create a Delta Operations Team and a California Water Utility to manage Delta water flows and the State Water Project in concert with Central Valley Project operating guidelines and measures.

Achieving the co-equal values in the Delta will require careful management of water flows into and out of the estuary. Though the Council will be responsible for ensuring the consistency of these functions with the CDEW Plan and the co-equal values, the day-to-day management should be performed by different entities within the governance structure.

A Delta Operations Team, comprised of representatives from state and federal agencies with relevant experience and overseen by the Council, should coordinate and make operational decisions on water flows within the estuary on a day-to-day basis. As in current Delta management, these decisions must be made in accord with the State Water Resources Control Board's water quality standards. The Delta Operations Team would essentially operate as a Delta water manager, determining what inflows, outflows and exports are necessary to achieve both healthy estuarine function, and a reliable water supply, on a continuing basis. Decisions of the Delta Operations Team would be implemented by the California Water Utility. Any dispute regarding implementation of a decision of the Delta Operations Team would be appealed to the Council for final decision.

A California Water Utility should assume ownership, operation and maintenance of the State Water Project (including the power generation and flood control aspects) and should operate the project in accordance with the CDEW Plan. It should take over the

management of all existing State Water Project contracts, and should ultimately expand to include the Central Valley Project at such time as the federal and state governments can agree on appropriate terms for a transfer of project assets.

The Department of Water Resources should focus primarily on statewide water and flood control planning and management, including its established competencies in water use efficiency and conservation, regional self-sufficiency, and integrated water resources management. DWR should have the lead role in implementing and overseeing most of the measures recommended in Strategies 7 and 8.

The State Water Resources Control Board should incorporate the CDEW Plan through a water quality control plan amendment and associated water rights decision or other proceeding, as appropriate. It should regulate based on existing water rights and on the water quality and flow standards identified in the CDEW Plan.

Action 1.5: Create a Delta Science Program and a Delta Science and Engineering Board to support the Council in pursuit of the co-equal goals, and to design and oversee the adaptive management plan (see Action 1.6)

California must maintain a strong and consistent investment in science and engineering relevant to the Delta. Moreover, there needs to be a more direct link between scientific investigation and real-world management and policy needs. To achieve this, the Council must have access to both a permanent Science Program staff and to an independent Science and Engineering Board that reviews and advises upon Council actions. The leaders of these two entities shall be the Delta Science Advisors. The Council should address requests for scientific advice to these Advisors, who may also identify scientific issues of relevance and bring reports on such issues to the Council at their own initiative.

The Science Program should have responsibility for:

- Research focused on critical processes relevant to the goals of Delta Vision, including both the processes of the physical Delta and processes elsewhere in the state that may be of particular relevance to Delta management.

- Science and engineering capacity to support adaptive management policy making on a cyclical basis.

- Capacity to organize, assess and synthesize the best available science and engineering in response to requests from policy makers, to report that assessment as needed, and to make recommendations on actions supported by that assessment when possible and appropriate.

- Capacity to respond in "real time" to questions arising in the development or implementation of policies.

- Systems and capacity for oversight or participation in consistent scientific and engineering review of all major projects undertaken to advance the goals of Delta Vision.

- Capacities to organize, run, and synthesize the results from focused discussions of science and/or engineering relevant to policy making and to ongoing programs of research.

- Capacity to effectively organize, synthesize and communicate science and engineering information relevant to policy makers, public program managers and private actors.

- Direction or coordination of long-term monitoring in support of adaptive management and performance assessment

A Delta Science and Engineering Board should consist of between 12 and 20 individuals with relevant natural science, social science, engineering, and policy expertise. The members and chair of the Board should be appointed to three year terms by the Council with no limit on reappointments. The Board should itself initiate and complete, or organize others to complete, assessment of the scientific bases for the CDEW Plan. It shall also have capacity to manage independent science reviews of agency or consultant work products upon the request of the Council, the Conservancy, the Department of Water Resources, the Department of Fish and Game, and the State Water Resources Control Board.

Action 1.6: Develop a robust, science-based adaptive management program that enables frequent management adjustments in response to changing Delta conditions

Adaptive management recognizes the uncertainty that pervades ecosystem management, especially in a system as complex as the Delta. It does so by stating hypotheses about the likely effects of proposed management actions, designing action so they provide valid information as they are implemented, documenting the results, and then revising future actions as necessary to reflect the knowledge gained. Successful adaptive management requires a consistent management structure in which regulatory constraints (such as permitting), resource use, and monitoring efforts can be adjusted in the context of an adaptive management plan, rather than being resistant to change.

Adaptive management in the Delta will require federal, state and local consistency of action, as is emphasized in the proposed governance structure. The Council will approve and oversee adaptive management efforts, but they will be guided in design and implemention by the Science Program (see Action 1.5). The adaptive management program should draw heavily upon the conceptual models being created by the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP), which summarize the state of knowledge on a wide variety of Delta organisms and processes. Given previous experience in the South Bay salt ponds and elsewhere, at least 10 percent of total

expenditures for ecosystem restoration activities should be spent on the data collection and scientific analysis necessary for adaptive management.

Strategy 2: Ensure consistency of action among existing state, federal and local entities by creating a California Delta Ecosystem and Water Plan, clarifying the roles of existing agencies in the Delta, and making full use of existing laws and constitutional principles governing water.

Action 2.1: Develop a legally binding California Delta Ecosystem and Water Plan to establish a detailed management structure for attainment of the co-equal goals as well as identified land use issues in the Delta region.

Long-term governance of the Delta will be centered upon the California Delta Ecosystem and Water Plan, to be created by the Ecosystem and Water Council. Authoring a legally binding Plan and overseeing its implementation over decades will allow the Council to ensure consistency of action among existing agencies and achieve the level of flexibility appropriate to the Delta's management challenges.

The CDEW Plan must fulfill a number of functions, including:

- Clearly identify state interests in the Delta.
- Establish targets and management objectives for the Delta ecosystem incorporating any plan developed under species protection laws.
- Establish targets and management objectives for water supply reliability for all users of water diverted upstream, within, and exported from the Delta.
- Establish state land use interests in and around the Delta, especially those that impact the ecosystem, water supply reliability and flood concerns.
- Provide guidelines and procedures for adaptive management.
- Provide other mechanisms for ensuring adaptability and resiliency in governing the Delta.
- Incorporate and build upon the recommendations of this Strategic Plan.
- Identify state interests and set performance targets in the legal Delta and beyond with respect to floodplain management and water quality.
- Articulate a finance plan laying out needed expenditures and identifying sources for needed revenues.
- Contain a plan for data collection, data management, monitoring, analysis and interpretation to support policy making and management decision making.

The CDEW Plan will also provide guidance and a framework for the functions of the Council, the Delta Protection Commission, and the Delta Conservancy, as well as other state, federal and local agencies engaged in Delta management.

The CDEW Plan should be written to satisfy the requirements of the Federal Coastal Zone Management Act to allow for CZMA designation and the associated consistency between federal and state agencies. The CDEW Plan should also serve as, or provide a

direct foundation for, a programmatic Environmental Impact Statement/Report for any projects undertaken pursuant to the Plan, as the California Environmental Quality Act and the National Environmental Policy Act permit. Other Delta ecosystem or water-related plans should be compatible with the CDEW Plan to ensure consistency of action. Effective participation of the relevant state and federal agencies in development of the plan will be critical to ensure achieving the appropriate integration of their responsibilities and capacities into the DEWP.

Action 2.2: Ensure that environmental justice is adequately addressed in Delta decision-making processes by requiring review of proposed actions against environmental justice criteria defined in the CDEW Plan.

Many communities living within, and dependent upon, the Delta may be vulnerable to disproportionate negative impacts from resource management decisions in the state's interest. The Ecosystem and Water Council should consider the CDEW Plan's impacts on disadvantaged or minority communities and reduce or mitigate these as fully as possible. Specifically, the Council should adopt the following environmental justice criteria in the formulation of the CDEW Plan, and periodically review their status.

- Public health impacts resulting from mercury or other water contaminants in Delta waters.
- Impacts on drinking water quality for communities reliant on Delta supplies
- The potential for communities currently lacking potable water supplies to benefit from changes in Delta policies.
- Targeted assessments of risk to low-income and disadvantaged communities from catastrophic events and of the potential of these communities to benefit from emergency response planning.
- Effect on employment opportunities or other community resources, or the potential to improve economic conditions and job creation.
- Changes in the cost of domestic water and the impact on affordability for low-income communities or communities of color.
- Ecosystem changes that may impact access to cultural resources, especially salmon and other river-related resources critical to maintaining particular Native American resources.
- The potential existence of regressive fees and taxes.

Action 2.3: Improve the compliance of the diversion and use of water with all applicable laws and regulations.

In order to protect and enhance the co-equal values over time, the state must create an integrated policy system among state agencies with jurisdictional authority affecting the beneficial use of water from the Delta watershed. This involves establishing clear roles and responsibilities for State agencies regarding the approval, monitoring and

enforcement of water diversions, and the management of impacts of diversions to resources and values protected by the State.

This requires coordinating the authoritative oversight of the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB) to ensure compliance with the reasonable use doctrine and applicable water quality requirements by water diverters within, and exporting from, the Delta watershed. It also requires coordinating the authoritative oversight of DFG to ensure compliance with applicable environmental regulations, in balancing diversions with the resources and values protected by the State.

The SWRCB will require secure annual funding for additional positions to investigate water rights compliance, illegal diversions, waste and unreasonable use. The SWRCB's capacity should be expanded to be able to:

- Require monitoring by all water diverters, including those within the Delta who are currently not required to report diversions;
- Authorize monetary penalties for monitoring and reporting violations;
- Possess adequate penalties for unauthorized diversions and violations;
- Possess provisions for interim relief.

In addition, the SWRCB should develop an integrated Supervisory Control and Data Acquisition (SCADA) network that covers all significant permitted and licensed surface water diversions and permitted discharges to provide real-time information into a database linked to water rights licenses. The SCADA would enable the state to flag and achieve redress for any excess diversions beyond permit terms.

Strategy 3. Finance the activities called for in the CDEW Plan by creating effective and transparent revenue-generation mechanisms that reflect the true value of resources and are linked to value-creation for beneficiaries and future generations of Californians.

Successful governance of the Delta will depend on a coherent, effective and reliable financing structure. That system will include revenue generation, procedures for expenditure as approved by the California Delta Ecosystem and Water Council, and obligations placed upon recipients of benefits from those expenditures. These principles should guide design of financing systems:

1. Private beneficiaries should be assigned proportional shares of revenue obligations and of risks and liabilities, while the public of California is responsible for activities of broader benefit. A wide range of financing instruments, including appropriations, bonds, fees, contracts, and others, should be employed. This Strategic Plan expects that water required to support and revitalize the Delta will not be purchased but will be provided within the

California's systems of water rights and the constitutional principles of reasonable use and public trust.

2. Revenues should be received by and allocated by the California Delta Ecosystem and Water Council to ensure consistent action to implement its policies. Protections against diversion of these funds to other purposes will be needed, possibly including a provision stating that if any funds devoted to CDEW Plan activities are used for other purposes, no water shall be conveyed through the State Water Project.

3. Access to state funding for any purpose related to the implementation of the CDEW Plan must be contingent upon a project contractor or a water right holder demonstrating full compliance with all aspects of California resources laws and policies, including:
    a. possessing a legal right to divert, store, convey, and use water;
    b. satisfying all applicable water quality and ecosystem regulations determined to protect the resources and values of the state; and
    c. complying with provisions of the CDEW Plan and the decisions of the Council

Substantial capital investments and continuing support will be required to implement the recommendations of Delta Vision. No independent estimate of those costs has been undertaken in Delta Vision as what is included in the Strategic Plan determines the needed investments and annual expenditures. However, as many of the recommendations of this first staff draft Strategic Plan parallel those developed in other processes, some information on probable capital costs over the next 10-15 years is available.

- The range of estimated costs for alternative conveyance provided by DWR (May 2008) is $4.2 billion for an eastern alignment to $7.2 billion for a western alignment. DWR estimated through-Delta improvements to cost from $1.2 to $9.6 billion depending on the seismic robustness. The earlier Delta Risk Management Study (DRMS) analyses projected much larger costs: $26 billion for alternative conveyance and $32 billion for armored through Delta conveyance.

- A late 2007 summary of cost estimates of proposed Delta ecosystem revitalization projects undertaken totaled to $2.5 billion.

- The other large capital cost is levee improvements, where the upper estimate provided by DRMS is $20 billion. Four billion is used here as a preliminary estimate.

These estimates suggest that the range of capital expenditures required for the Delta in the next 10-15 years will range from $12 to $24 billion, with a high estimate of $80 billion. This is a large range of cost estimates which will be refined as policy choices

are made regarding conveyance and levees. Bond funds are available for some of these capital investments and water contractors are prepared to pay the capital costs of alternative conveyance.

No attempt has yet been made to estimate annual operating costs.

In 2004, a coalition of water and environmental interests proposed principles for CALFED decisions on financing which remain useful starting points for analyzing possible financing systems:

- Adhere to the "beneficiary pays" principle.
- Provide guidelines for apportioning costs of projects with both local and public benefits.
- Public benefits should be financed through federal appropriations, state bond funds, and state general fund dollars, recognizing the current budgetary restraints on the State of California Resources Agency.
- Encourage local interests to develop a finance plan to pay for the local share of a capital project.
- Require a completed finance plan as a precondition for the design and construction phases of a major capital project.
- Initiate a dialogue with stakeholders on establishing the necessary protections to prevent a surcharge from becoming a de facto water "tax."

Effective and equitable financing systems for activities as extensive and expensive as those proposed in this Strategic Plan rely on multiple revenue streams rather than a single source. "Layering" revenue generation systems better allows matching revenues collected to perceived value and actual beneficiaries.

For example, as part of the management of the co-equal values, there should be a per-acre-foot fee levied on water diversions within the Delta watershed, and a separate fee on any water conveyed through or around the Delta.

As noted above, an effective and equitable financing system also obligates beneficiaries to support desired public policies and encourages consistency of efforts among public agencies and private interests. Institutional and policy process improvements which encourage consistency in actions and oblige support of policies adopted by the Council include:

1. Require any California department to make an affirmative determination that relevant actions support the adopted CDEW Plan.
2. Ensure full transparency in all fiscal arrangements.
3. Condition access to and participation in any Delta related program on compliance with all existing policies and programs.
4. Use bond control language and contract provisions to ensure policy consistency.
5. Use life-cycle costing and benefit-cost calculations to inform decision making.

6. Require full allocation of costs and risks, in proportion to benefits received.
7. Allow no subsidized use of California resources.
8. Water pricing rate structures could be improved by greater use of variable rates, tiered rates and connection fee conservation incentives.
9. Use bidding to inform investment decisions and allocate uses.
10. Develop and implement processes to achieve timely decisions and accelerate implementation.

The Delta Ecosystem

The California Delta is one of the state's largest and most complex ecosystems, and was once one of the most productive. Originally a vast, sea-level tidal marsh fed by strong seasonal pulses of fresh river water and twice-daily infusions of nutrients from the tides, the Delta was home to phenomenal numbers of birds, fish and wildlife. Some, like the Delta smelt, lived their entire lives in the estuary. Others, like the Chinook salmon or the birds of the Pacific Flyway, passed through the Delta on their migrations between far-flung habitats. The blending of the rivers and the tides – and the particular land structures and water flow patterns that resulted – made all of it possible.

The contrast with today's conditions could not be more stark. Almost all of the key processes that created the thriving Delta ecosystem of the past have been changed dramatically, and major new stressors have been introduced. In some combination, these factors have caused both a long-term gradual decline in ecosystem health, and a sudden short-term collapse in the populations of key fish species.

Our Vision identified the ecosystem as one of the primary, co-equal values for the management of the Delta, and called for the Delta ecosystem to function as an integral part of a healthy estuary. As the Vision recognized, it is neither realistic to return the Delta to a pristine pre-levee construction condition, nor is it adequate to simply return the ecosystem to the conditions that preceded the fish crashes of recent years.

Instead, the task for California today is to restore the underlying ecosystem structures, functions and processes that will make a thriving Delta ecosystem possible in the 21st century. Such an ecosystem will possess five key characteristics:

- Viable populations of native resident and migratory species;
- Functional corridors for migratory species;
- Diverse mosaic of habitats and ecosystem processes;
- Stressors below adverse effects levels;
- Ability to provide important human services;

The task of achieving these characteristics will be difficult and complex, but can be guided by a simple and intuitive "Restoration Recipe" that organizes our actions in an understandable and easily communicable way (see Figure 2).

The three major components of this "recipe" form the key themes that guide our ecosystem strategies. The fifteen elements of a regenerated Delta ecosystem that we identified in our Vision fit neatly within this structure. So too does the set of "problem drivers" identified by the Ecosystem Work Group that we assembled to advise us in early 2008.

Strategy 4. Restore physical habitats in multiple large, connected complexes of tidal marshes, floodplains, shallow open water, seasonal wetlands, grasslands and riparian edges that support native and desirable non-native species, and that increase the land-water interfaces characteristic of the historic Delta and other effective estuaries.

The Delta was once a vast tidal marsh where the fresh water inflows of the Sacramento and San Joaquin rivers met the ocean tides in a network of branching channels and sea-level marshplains. The Delta of today bears little resemblance to this historic ecology, with subsided islands cut off from the flows of the rivers and the tides by levees. While it is neither possible nor desirable to return to the pre-levee construction Delta, any meaningful restoration of Delta ecosystems and species will require bringing back key physical habitats in critical locations and restoring the land-water interface where possible.

Tidal marsh habitats, which once dominated the Delta, are now almost non-existent. Restoring thriving areas of tidal marsh at opportune places in the Delta region is a key ecosystem management strategy. Tidal marshes are critical sites for primary biological productivity and for the rearing and feeding of many native fish. So too are seasonal floodplains, where occasional high river flows spill out over vegetated landscapes. Like tidal marshes, these can only be restored in certain locations with the correct elevation and connection to the rest of the Delta system. Finally, there is also a need to expand key terrestrial habitats in the Delta, such as grasslands, riparian forests, and seasonal wetlands, upon which a wide variety of resident and migratory species depend.

The connectivity of these habitats to each other and the rest of the Delta is also important. The primary productivity that occurs in the tidal marshes and floodplains should be carried out into adjacent channels by the river flows and the tides, to provide sustenance to the organisms living there. More generally, there is a need for a more natural land-water interface throughout the Delta. The historic Delta was dominated by this interface, with tides and floods washing over the entire landscape. Even though levees have cut it off in most of the contemporary Delta, it should be restored where possible. Even places too small to appear on the map, such as narrow river edges, in-channel islands, and the waterside toes of levees, may be valuable opportunities to re-establish some of this interface.

Because the Delta estuary is primarily an aquatic system, physical habitat restoration by itself is not enough. It is also necessary to restore appropriate water quality and flows within those physical structures. Native fish and other desirable aquatic species will not thrive unless they live in water that is within proper ranges of salinity, temperature, turbidity, and seasonal flow variation – what might collectively be called the "flow habitat." This is true both in the large open-water portions of the Delta, and in the river channels.

Finally, the shape, size and spatial organization of the river channels matter to the ecosystem as well. Maps of the historic Delta show that the Sacramento, Mokelumne and

San Joaquin rivers all had a familiar pattern of branching channels, with smaller channels feeding into larger ones and a diversity of sizes and shapes. Particularly in the South Delta, this is no longer the case, primarily because of dredging and man-made cross-cuts that join previously isolated channels (see Figure 3). The ultimate effect of these changes has been to homogenize the flow habitat, removing the diversity and the special niches that allowed different species to meet different needs in their various life stages. Returning some of this diversity in channel organization, and hence water flow, is desirable for the Delta ecosystem.

Action 4.1: Restore as much tidal marsh acreage as physically feasible, and conserve adjacent uplands in geographically linked complexes.

Tidal marshlands provide habitats for many resident and migratory aquatic and terrestrial species, they are one of the most productive ecosystems on the planet, they can help attenuate flood flows, sequester contaminants, and cool water temperatures, and they provide recreational opportunities. Opportunities today to restore tidal marsh and to provide for its long-term resiliency in the face of sea level rise are limited by the fact that most of the central Delta landscape has subsided below tidal elevation, leaving fewer places on the margin where tidal marsh restoration is physically feasible (see Figure 4).

Three other critical factors influence opportunities for tidal marsh restoration. First, proximity to export facilities greatly curtails benefits and promotes conflict with drinking water quality. The South Delta and Barker Slough diversions direct net flow towards their pumps, entraining the exported production as well as fish. Resolving the export conflict on flows (see Action 5.2) is essential before significant restoration construction is undertaken. Second, the Delta has a very limited suspended sediment supply, translating into very low rates of sedimentation to rebuild marsh elevations. Thus, using lands at existing intertidal elevations is critical to restoring tidal marsh functions. Third, some sites at appropriate elevation have large amounts of infrastructure, high-value agriculture or other issues related to land use and land ownership patterns, that make tidal marsh restoration inauspicious.

Given these considerations, the highest priority sites for tidal marsh restoration are:

- Suisun Marsh
- Cache Slough and the southern Yolo Bypass
- Prospect Island
- Sutter Island
- New Hope Tract and McCormack-Williamson Tract
- Dutch Slough

Additional medium-priority sites for tidal marsh restoration are:

- East Delta, north of the Mokelumne River, including the Stone Lakes National Wildlife Refuge area
- East Delta, south of the Mokelumne River

- In-channel islands within the San Joaquin River and Old River
- South Delta

Finally, additional lower-priority sites for tidal marsh restoration are:

- Netherlands Tract
- Southwest Delta in the vicinity of Old River

Action 4.2: Inundate floodplains in as many years as possible.

Riverine floodplains are common elements of natural landscapes, and along with estuarine wetlands and pelagic environments, support estuarine functions and the associated species and natural communities. To be effective ecologically, floodplains must allow unimpeded flow from upstream to downstream, allowing the floodplain to drain and providing connectivity that is critical for successful floodplain utilization by fish.

In the Delta, the Sacramento River watershed provides a significant majority of total Delta inflow and thus it has the greatest potential for floodplain inundation in most years. The San Joaquin River watershed provides far less Delta inflow and thus its far smaller flood flows limit floodplain inundation opportunity. The Cosumnes River is the only Delta tributary without a dam which lends it well to floodplain inundation. The high degree of urbanization and high value agriculture around the Delta margins and the extensive infrastructure greatly limits opportunities and makes those locations that still retain floodplain potential particularly important.

This strategy seeks to provide inundation of floodplains on as many years as possible on the three major river systems entering the Delta. In practical terms, this means increasing the annual frequency of Yolo Bypass inundation, establishing new floodplains on the lower Mokelumne River where it enters the Delta and further upstream along its tributary, the Cosumnes River, and establishing new floodplains on the lower San Joaquin River where it enters the Delta (see Action 12.1). Interannual inundation frequency is likely to be lowest on the San Joaquin, intermediate on the Mokelumne, and greatest on the Sacramento.

Among specific actions to assess and initiate, these appear most promising:

- Increase the number of years that the Yolo Bypass floods by minor re-engineering the Fremont Weir to allow lower Sacramento River stages to flood into the bypass and including related engineering features to transit lower-stage water to the floodplain. Reduce downstream and internal constrictions in Yolo Bypass that currently strand fish on the floodplain during drawdown.

- Add new floodplain areas on the lower Mokelumne especially as part of McCormack-Williamson and New Hope Tract to create a complex transitioning

into tidal marsh and shallow open water. Provide additional floodplain farther up the Cosumnes River consistent with ongoing planning efforts for this area.

- In the South Delta, determine what floodplain creation opportunities exist in context of existing land elevations, current frequency distribution of San Joaquin River stage, and in light of modest flow increases that may arise as part of the San Joaquin River Restoration effort (see Strategies 11.2 and 12.1)

Action 4.3: Preserve and enhance seasonal wetland complexes and adjacent upland grasslands.

Several terrestrial species and natural communities use uplands and seasonal wetland complexes located in close proximity to estuarine wetlands and floodplain systems. These contiguous ecosystems allow for movement of organisms, material, and energy between the upland and estuarine environments. In addition, gentle-sloped uplands adjacent and connected to restored estuarine wetlands will allow for the landward migration of those estuarine wetlands as sea level rises, thereby conferring a degree of resiliency.

The Delta Conservancy should preserve and enhance these upland/seasonal wetland complexes, which provide unique habitat essential for the continued existence of specially adapted local amphibian, invertebrate, and plant populations. These include some threatened and endangered terrestrial species such as Swainson's hawk and the Valley elderberry longhorn beetle. The maintenance of upland habitats adjacent to tidal marshes will also allow the system to respond to drivers of change such as sea level rise.

Where possible, acquisition and public/private restoration efforts should focus on large blocks of adjoining parcels, and on areas that can yield the greatest benefits to the land-water interface and allow for changes due to sea level rise. In addition, the Conservancy should also work with private landowners to identify privately-owned lands that are too wet or otherwise difficult to farm profitably, and that may be appropriate sites to restore seasonal wetlands complexes.

Action 4.4: Create new open water areas within the Delta and Suisun

Large, open water ares with broad tidal connectivity to Delta waterways have the potential to provide pelagic habitats important for several fish species and to provide desirable and accessible food web productivity. Such areas also have the potential to be of little value and in fact detrimental to achieving the desired ecosystem characteristics if they become colonized by submerged aquatic vegetation and introduced predatory fish species.

The Delta has examples of both outcomes. Liberty Island and Little Holland Tract, two very large shallow perimeter lands tidally restored in the late 1990s, have provided emergent tidal marsh and shallow subtidal habitats largely uncompromised by these

adverse outcomes. In contrast, Big Break, Frank's Tract, Sherman Lake, Donlon Island, and Decker Island all exhibit significant SAV establishment in their shallower areas sheltered from stronger tidal currents. All of these areas are small compared to Liberty and Little Holland.

This strategy consists of three components:

- Support ongoing research aimed at determining underlying mechanisms leading to these different outcomes and transfer those findings into the planning of new open water areas, if deemed viable.
- Implement open water creation as part of larger ecosystem restoration projects, incorporating the research results.
- Formulate a response strategy should unintentional levee failures occur in the Delta, with different strategies for deep central lands and the shallower perimeter lands.

Identifying areas to consider flooding intentionally is a complex challenge due in large part to competing resource considerations, infrastructure considerations, effects on salinity, and the relationship to conveyance and to in-Delta agriculture.

If positive outcomes are reasonably likely to be achieved, then high-priority areas would be Prospect Island, lands within the Cache Slough complex, lands in Susiun Marsh, and lands along the Mokelumne corridor. Extending the approach to some west Delta locations should also be examined, as these areas are well situated within the low salinity zone that could preferentially support target fish species. Some of these areas have relatively high infrastructure constraints that must be addressed and may preclude open water restoration.

Action 4.5: Support and enhance established migratory corridors through temporary or permanent changes to channel geometry.

Migratory fish that pass through the Delta are generally well-known and popular fishery species include the listed winter-run and spring run salmon, steelhead and green sturgeon. The listed salmon and green sturgeon spawn only in the Sacramento River watershed, while steelhead and fall-run salmon are found in both the Sacramento and San Joaquin rivers. The Mokelumne and American rivers support salmon and steelhead spawning with the most immediate connection to Delta waterways.

This strategy aims to improve multiple corridors along each river to provide redundancy by reducing stressors along the migratory paths, minimizing fish movement off the migratory paths, and improving habitat along the corridors. These migratory corridors should be established in coordination with Action 11.1.

When flooded, the Yolo Bypass is the best Sacramento River outmigration corridor, but adult upmigration is now impeded by the Fremont weir. Migration down the mainstem Sacramento as well as the secondary route along Sutter and Steamboat sloughs provides

poor survival and growth, due to potential diversion to the interior delta and limited suitable rearing habitat along much of the river channel.

On the San Joaquin the main river channel is the main migration corridor, but a number of impacts (such as low dissolved oxygen levels) arise near the city of Stockton. Old River, another migratory corridor, passes immediately in front of both the state and federal diversions. Middle River, the third corridor, is too shallow at its southern end which creates high water temperatures; once it reaches Victoria Canal it is subject to reverse flows under current conveyance. Creating a hydraulic separation between Middle and Old River to improve near-term water supply reliability (see Action 9.1) will also improve Old River's suitability as a migration corridor.

Floodplain construction along the San Joaquin could benefit both migrant fish and flood control; however, the significantly smaller water volumes reaching the lower San Joaquin compared to the Sacramento mean that in the best of conditions these floodplains would be inundated in far fewer years. Climate change could alter this setting significantly, presenting more frequent flood stage conditions as the total precipitation shifts away from snow pack toward rainfall, and the high elevation of the southern Sierra gives it proportionally greater snowpack.

Among specific actions to assess and initiate, these appear most promising:

- In coordination with Action 4.2, add gates or other structures to allow Yolo Bypass to be accessible to smolts in more years while still permitting it to dry out during summer months to prevent buildup of invasive species. Install fish passage structures to facilitate adult migration, especially during low flow conditions.

- In coordination with Strategies 4.2 and 12.1, develop floodplain habitats along the San Joaquin River to provide similar benefits to San Joaquin outmigrants. Given the lower frequency that the San Joaquin watershed produces flood flows that could inundate floodplains, these efforts would have a lower priority.

- In coordination with Action 4.2, develop floodplain habitats along the Mokelumne-Cosumnes river corridors to provide similar benefits to outmigrants of that system.

- Develop some marsh habitats along all migratory corridors where shallow habitats allow daytime refugia for outmigrants.

- Install and use gates or other barriers to reduce diversion of migrants from migratory corridor.

Strategy 5: Restore appropriate water flows and other ecosystem processes throughout all Delta habitat types

As the "restoration recipe" makes clear, physical habitat by itself is not enough. There are ecological processes that occur within physical habitats that are equally important to overall ecosystem health. As we have noted, the process in the Delta that matters most is the timing, direction and variability of water flows. As an estuary, the Delta is shaped by both tides and river inflows. The tides continue twice daily, but the river inflows have been profoundly altered by upstream dams, upstream diversions, flood control structures, summertime dam releases, agricultural diversions and returns within the Delta, and the powerful export pumps in the south Delta.

The general effect of these human interventions has been to make Delta river flows less variable than they once were, both between years (since we try to control floods and minimize droughts) and within years (since we send river water to the Delta to be exported for human use in the summer). While completely surrendering our control over these flows is obviously undesirable for necessary water supply and flood control efforts, the ecosystem would benefit from an increase in the variability both within and between years.

The Delta's native fish evolved in a highly variable system that had much more freshwater inflow than today's Delta, particularly in the spring and fall. Restoring a semblance of those flow patterns in a controlled and purposeful way will be an important component of ecosystem restoration. Even flood and drought times that overpower our control can be harnessed for certain ecological benefits through intelligent management.

Action 5.1: Provide increased freshwater flows (and shift the timing, quantity, quality, and input locations of flows) through the Delta at critical times and locations in spring and fall that coincide with key life history stages of resident and migratory fishes

The Delta estuary, like estuaries in general, responds strongly to variation in freshwater inflow. Many physical parameters change with flow including turbidity, toxic mobilization, toxic dilution, inundation of floodplains, connectivity amongst habitats, and many more. Many species, life stages, and ecosystem processes appear to be improved by higher Delta outflows in the winter, spring, and fall. The exact mechanisms that link changes in physical parameters with corresponding improvement in ecosystem response are generally not well understood and several have changed through time. However, for both resident and migratory species, changes in flow at many temporal and geographic scales appear to be very important.

Flows through the Delta are already regulated in the manner illustrated in Figure 5. To improve the health of the Delta estuary, however, flow changes such as those below, which have been proposed by scientists, should be further analyzed by the Science Program and the Science and Engineering Board for implementation:

1. Increase variability in fall Delta outflows to increase area of suitable smelt habitat during annual flow minimums and help disperse nutrients and toxics. These currently are stable at about 6,000 cubic feet per second (cfs) from August through November, but one or two months of outflows double or triple that rate would restore the level of variability associated with the late 1990s, when many species were doing better. One proposal to restore variability and link it to interannual variability in climate would be to ensure meeting Chipps Island flows (11,400 cfs) in Octobers that follow below normal spring flows, in October and November following above normal spring flows, and in September through November of wet years.

2. Increase San Joaquin River flows occasionally from September through November to improve upmigration of adult salmonids. Ideally, two separate pulses about 7-14 days in duration each with flows of 2,000-3,000 cfs would facilitate upstream movement of adults by providing migratory cues and help reduce dissolved oxygen barriers.

3. Remove triggering requirement for X2 (the location of water of salinity at 2 practical salinity units (psu), as measured in distance from the Golden Gate) at Roe Island so that in every month the potential exists to have flows vary from 27,000 to 71,000 cfs. Flows higher than 27,000 cfs have extremely high ecological value.

4. Coordinate fish sampling in tributaries in order to better time the release of water to coincide with the readiness of salmonid juveniles to downmigrate. Reduce stressors (entrainment and water quality) throughout the migratory pathway as these flows and fish move to the bay.

Action 5.2: Resolve export effects on net Delta transport.

Hydrodynamic effects of exports are a function of the volume of exports and the volume of water they draw from, although flow control structures can alter the effects of diversions. Effects of exports on fish movement depend on the timing and geographic distribution of both the exports and the fish, as well as the developmental stage of the fish. In all cases changes in net volume of flow are expected to be less disruptive to ecosystem processes than changes in net direction of flow. A series of decision criteria for reducing the effects of export diversions on fish are therefore proposed:

1. Continue to reduce exports when sensitive life stages are present near exports.
2. Limit exports to times when hydrodynamic impact is reduced due to higher flows.
3. Increase inflows at times when sensitive life stages are near the South Delta pumps under current conveyance and near a peripheral canal intake under possible future conveyance scenarios.
4. Move intakes away from migratory or spawning areas.

5. Move intakes to areas where the volume of water drawn from is large in relation to amounts withdrawn.
6. Move intakes to areas where flow effects of tides or rivers are greater than effects of exports.

Action 5.3: Incorporate flood protection benefits into tidal marsh and floodplain restoration efforts to the maximum extent practical.

Wetlands provide ecosystem and flood protection benefits to the surrounding landscape. Tidal marsh and seasonal floodplains act as instream "reservoirs" during periods of high flow. Wetland vegetation and the large surface area of floodplains slow the velocities of flood waters. This reduction in velocity and volume reduces levee erosion and lowers flood stage in constricted urban channels following a large upstream flood event. Urban areas are generally covered in non-permeable surfaces. Large expanses of pavement transport urban runoff quickly and in high volume to the adjacent river and can cause flash flooding. Wetlands in areas that can accept this runoff can protect urban areas from flash flooding without degrading local creeks into deep, concrete-lined canals that have essentially no fish and wildlife value. A one-acre wetland can typically store about three-acre feet of water, or one million gallons. Preserving and restoring wetlands, together with other water retention, can often provide the level of flood control otherwise provided by expensive dredge operations and levees.

Action 5.4: Improve conjunctive use programs that shift highest exports to wettest periods and lowest exports to driest periods.

Shifting exports to times of high supply has many obvious advantages but it needs to be done in a way that minimizes the impacts on ecological value of high flows. In the past export volumes have been driven by demand rather than supply and therefore export volumes have usually been greater in drier years than in wetter years. This has generally amplified the impacts of exports by increasing the extent and duration of impacts.

Proposed new storage has the potential to increase exports during high flows and reduce exports when flows (and usually water quality) is low. One downside of this possible shift in operations is reduction in the degree and duration of high flows through the Delta, which are of significant ecological value but which have been less affected by historical operations of the projects. This conflict may be mitigated as climate change is likely to produce a greater frequency of high flows in the springtime as more precipitation comes as rain than as snow.

Operational guidelines such as those suggested below would shift operations to take the greatest volume of exports during times of high flow:

1. Do not increase exports from the delta until the 15-day average of delta outflows exceed 30,000 cfs. Many fish use changes in flow (or the consequent changes in

turbidity) to initiate movements up or down steam. Such behavior makes them more sensitive to entrainment, but prolonged periods of high flow minimizes the area of effect of delta exports and entrainment has usually been low at high flows, except in the days of onset of high flows.

2. Do not divert to storage into upstream reservoirs until 15 days after inflows to on-stream reservoirs require real-time flood control operations.
3. Maximize diversion to storage during daytime hours (most fish migrate at night).
4. Limit total monthly diversions to a percentage of the inflow to on-stream reservoirs so that high flows are not limited to those required by regulation.

Strategy 6. Reduce or remove stressors to the Delta ecosystem, including invasive species, contaminants, and entrainment.

The final component of the restoration recipe is the removal of stressors. Native species in the Delta are harmed by a variety of factors that go beyond loss of appropriate habitats and processes. Harmful invasive species, entrainment in water diversion facilities, and loadings of contaminants into water and sediments all harm key Delta species, though it is difficult to determine their relative importance.

Invasive species have already dramatically altered the Delta's aquatic food webs, and more can be expected to arrive. Many scientists now conclude that the large majority of all the Delta's primary productivity – its food – is being consumed by non-native organisms. Under current conditions, these organisms are simply out-competing natives for food and habitat. Efforts must be made to limit the introduction of new invasives, limit the spread of those that are already here, and perhaps remove them from limited areas of the Delta.

Large numbers of Delta fish, some of which are listed as threatened or endangered, are entrained at water diversion facilities throughout the Delta each year. Actions to limit this entrainment should be taken, including relocating or re-opeating diversion points, improving fish screens, and timing diversions to avoid entrainment, when possible.

Finally, contaminant loadings from the Delta watershed are having a significant effect on Delta ecosystem. Pesticides applied in agricultural and residential landscapes, metals and toxins from cars and industrial facilities, mercury from historic mining activities, selenium from San Joaquin Valley agricultural drainage, ammonia and other nutrients from sewage outfalls – all have a substantial impact on the living organisms of the Delta. Controlling these contaminants at their sources must be an important component of ecosystem restoration.

Action 6.1: Control harmful invasive species at existing locations and in restored areas

The estuary has been profoundly changed by invasive species. Most invertebrate species throughout the estuary are non-native. Downstream of the delta the fish community is

still comprised mostly of native species but in both numbers and biomass non-native species dominate the Delta and Suisun. New exotic species invasions can be expected and they will likely change both ecosystem processes and our management options. Invasive species can be managed in three ways:

1. Control the ones that are here by direct control (i.e., chemical treatment, mechanical removal, etc.) or by altering the habitat in ways that disfavor unwanted species but not desired species.
2. Prepare for invasion of likely new invaders, including quagga mussel, zebra mussel and northern pike, and prolonging the time before they arrive to prepare for their impacts. This preparation would include increasing the priority of restoring habitats that they are less likely to disturb (e.g. floodplains) as well as designing fish screens that will retain their value in the presence of freshwater mussels.
3. Reduce the likelihood of new invasives by combinations of education, regulation and enforcement.

Managers should consider a carefully designed adaptive management experiment to reduce Delta outflow in summer or fall of critically dry years to see if it would reverse the spread of freshwater invasives and allow better insight into the future ecology of the Delta. Such actions would also allow greater carryover storage in upstream reservoirs to the benefit of salmon spawning but would have to rely on storage south of the Delta to minimize the impacts of curtailing delta exports. Floodplains, elevated side channels or other habitats that dry out also limit the impact of invasive species on the seasonal use of such habitats by desirable species.

Action 6.2: Minimize methylmercury production.

Methylmercury is formed from inorganic mercury (the bulk of which enters the estuary from legacy mining pollution in tributaries) by the action of anaerobic bacteria and organisms that live in aquatic systems. It is the most biologically available and toxic form of mercury, and bioaccumulates from bacteria up the food web to higher trophic level fish, with documented adverse health and reproductive impacts to fish-eating birds and humans.

Management tools to minimize methylmercury formation, such as those below, are being developed and should be assessed and implemented as demonstrated to be effective

- Continue participation in the Central Valley Regional Water Quality Control Board's Total Maximum Daily Load (TMDL) program for mercury and methylmercury in the Delta (includes monitoring and characterization studies for new proposed habitat restoration projects).

- Develop and implement TMDLs in areas upstream of the Delta, to reduce the loads of organic and inorganic mercury entering the Delta from tributary watersheds.

- Continue development of Best Management Practices (BMPs) to control the production of methyl mercury at aquatic habitat sites, and/or to control the transport of methyl mercury from those habitat areas into the system.

Action 6.3: Reduce export effects on fish, including instituting pumping restrictions and diversion management and relocation.

Exports affect fish in two ways: direct entrainment and hydrodynamic changes to the aquatic environment. Both effects are strongly affected by the size, location and timing of the diversion and by the size and hydrodynamic nature of the water body from which the diversion takes its water. Diversions from tidal areas can expose fish repeatedly to the risk of entrainment on each tidal shift, large diversions from small channels can have far-reaching geographic impacts. Diversions whose capacities are inadequate to their demands have little flexibility to shift the timing of their impacts. Finally, diversions that are either unscreened, which use screens not operated to their technical specifications or which rely on salvage operations are likely to exert greater impacts than properly operated screened diversions that leave fish in the source water body.

The state and federal diversions represent an extreme case of combinations of factors that maximize potential diversion impact. Contra Costa's diversion reduces its impact by its geographic location and its large capacity in relation to demand. This allows it to eliminate diversion during sensitive environmental times. North Bay diversions are at the end of a dead end slough, like the CVP and SWP but their volume is smaller in relation to the volume of water in the area and most species do not remain long within their region of effect. Agricultural diversions are often small in relation to the volume of their sources and much of their demand occurs at seasons of limited fishery sensitivity.

The following criteria should be considered to reduce diversion impacts:

1. Relocate diversion points to areas less likely to entrain fish and the productivity generated by habitat restoration projects (see Action 9.3)
2. Change demand relative to capacity to permit greater flexibility in operations away from times of sensitivity.
3. Carefully manage exports during times of greatest sensitivity with resident and migratory fish distribution.

Action 6.4: Monitor fish and wildlife health at suspected toxic sites

The Delta receives water from thousands of square miles of agricultural lands where more than two hundred types of chemicals are applied. Municipal discharges from

upstream combine with outfalls of two major cities and several growing communities that discharge treated effluent directly into the delta. Management of the contaminants that enter Delta waters is an on-going effort of several agencies. Most controls regarding chemical applications address only a single contaminant rather than the soup of materials that constitute the waters of the Delta.

As part of its governance authority, the Council should build on the recent work of the U.S. Environmental Protection Agency, the CALFED Science Program and the State and Regional Water Boards to develop a comprehensive monitoring program for fish and wildlife health at suspected toxic sites.

Action 6.5: Construct water treatment wetlands wherever feasible at municipal, industrial, and agricultural returns

When designed and operated properly, constructed wetlands can both treat wastewater and at the same time restore lost natural wetland habitat and its associated ecological function. Marsh vegetation, soils, and the microbes associated with them treat effluent from municipal, industrial, and agricultural sources. These wetlands provide the option for water reuse in areas where water conservation is a part of the communities' water plan (see Action 7.5). A constructed treatment wetland can be a cost effective approach to dealing with high nitrogen loads in post-secondary effluent.

Water Supply and Reliability

The capture and conveyance of water has been at the heart of California's prosperity for as long as the state has existed. Our climate blesses us with ample quantities of water, but it is very unevenly distributed across our state, and across the seasons and years. As a result, the core challenge of water supply management has always been, and will always be, to transfer the localized abundance of the wet periods to the drier times and places.

Our Vision stated unequivocally that the reliable supply of water is one of the two co-equal values that are indispensable to the future of California. It also recognized that the state appears to have crossed a historic threshold. The Delta has reached a breaking point in which the increasingly severe actions required to save a collapsing ecosystem now disrupt the very water supplies upon which much of the state depends. With millions more Californians expected in the coming decades, and with climate change altering the very engineering benchmarks around which the system was designed, the California water system as we have known it for the last half-century must evolve in fundamental ways if it is to continue serving the needs of our state.

This does not mean compromising on reliability. On the contrary, the actions recommended in our Strategic Plan are intended to increase water supply reliability so that cities and farms can plan and invest with confidence and continue generating the prosperity that benefits us all.

Strategy 7: Maximize regional water self-sufficiency throughout California by a wide range of supply augmentation and demand management techniques

The surest path to supply reliability is through regional self-sufficiency that makes use of a wide range of supply and demand management tools, including urban and agricultural water use efficiency measures, municipal water recycling, desalination, stormwater harvesting, and conservation, among others. Rather than trying to extract new water from a system that has little more to give, we must optimize the sustainability of the water supplies that we already have.

Many water districts around the state and the Department of Water Resources have already recognized these realities. In fact, it is their experience and hard-won expertise in implementing many of these measures on a local and regional scale that gives us confidence that these principles must guide development of the state's water system. The Integrated Regional Water Management Planning efforts already underway throughout the state have been key institutional mechanisms for advancing regional self-sufficiency, and should be continued and strengthened.

Regional self-sufficiency should be the linchpin of a water system that can meet our overall goals of achieving sustainability across generations. The larger the share of water needs that can be met regionally, whether through alternative supplies or through demand reduction, the more stable and reliable California's water system will be.

Action 7.1: Improve collection of baseline water diversion and use data.

A striking fact about the current water system is that information about current diversions and use is inadequate to the task of managing the co-equal values. More comprehensive data from throughout the Delta watershed would provide a better foundation for changes in water diversion timing and support efforts to become more regionally self-sufficient. Therefore, California must develop and use comprehensive information on the local, regional and statewide availability, quality, use and management of groundwater and surface water resources to help improve opportunities for regional self-sufficiency.

Among specific actions to be analyzed and implemented as judged effective are:

- Install stream gauging stations at critical outflow points associated with DWR planning area boundaries to aid in the DWR regional "water budgeting" used to help develop the California Water Plan.

- Improve local, regional and statewide collection and dissemination of agricultural land-use data to better represent crop water use and evapotranspiration changes on an annual basis for use in understanding regional trends.

- The Department of Water Resources should continue to regularly and systematically collect groundwater elevation data in all groundwater basins and sub-basins in the Delta Watershed, and make the resulting information readily and widely available.

- Require DWR to expand its current network of monitoring wells, including groundwater elevation and groundwater quality monitoring wells, and continue to coordinate data monitoring and interpretation with local entities.

- Require local and regional agencies/individuals to submit relevant and timely information on surface and groundwater attributes to state agencies, such as DWR, to include in broader data repositories.

- Coordinate state data collection of urban and agricultural water use and deliveries to facilitate measuring progress in meeting conservation targets.

Action 7.2: Develop mechanisms to increase the implementation of urban water use efficiency measures and link state funding to achievement of efficiency goals

One of the twelve integrated and linked recommendations that formed the heart of our Vision called for California's water to be managed with "significantly higher efficiency" to adequately meet our future needs. Governor Schwarzenegger has already established a

target of reducing California per capita water use by 20% by 2020, and has directed state agencies to develop a more aggressive plan of conservation to achieve this target.

As identified in several recent analyses, including the 2005 California Water Plan Update, conservation potential in the urban sector can provide a significant benefit to helping meet long-term projected demands. Further adoption of water saving devices and best management practices can have an immediate effect on today's demand, but the inclusion of this ethic into planning for future residents – whose demand has yet to occur – will be just as important. Forward thinking that better links land-use and water supply planning at the local level and recognizes the scarcity of this resource will ensure that the future residents of California use water efficiently.

As a result of the Governor's target, DWR is working in cooperation with the SWRCB, the California Energy Commission, the California Public Utilities Commission, and the Department of Public Health to define a course of action for more aggressive implementation of conservation – from retrofitting current uses to defining new expectations for California's urban water use. Opportunities to accelerate the implementation of urban water use efficiency measures include: (1) additional bond funding, (2) establishing minimum thresholds for access to funds, (3) establishing new efficiency standards, (4) developing new programs and tools, such as the new Model Water Efficient Landscape Ordinance, (5) further encouraging collaboration and reporting under the California Urban Water Conservation Council, and (6) continuing to use regulatory protection such as that offered under waste and unreasonable use constructs overseen by the SWRCB.

Among specific actions to be analyzed and implemented as judged effective are:

- Pass legislation, such as AB 2175, in a form that would require DWR to establish a statewide target to achieve a 20% reduction in urban per capita water use in California by December 31, 2020.

- Upon completion in fall 2008, expeditiously implement actions called for in the DWR-led effort to define a plan for achieving a 20 percent reduction in per-capita use by 2020.

- To further encourage water use reductions, require more aggressive tiered pricing and related mechanisms, and address challenges in Article 13D of the California Constitution (as added by Proposition 218) that potentially constrain water purveyors' budgeting methods and authorities to modify pricing during temporary drought conditions.

- Improve coordination between land planning and water planning by further broadening the scope and requirements embodied in California Water Code §10910 et. seq. (commonly referred to as SB 610 Water Supply Assessments) and related provisions under CEQA.

Action 7.3: Require developments to include best-available water savings devices and to provide mitigation for new water use.

California's population will continue to grow strongly over the coming decades, just as it has for the state's entire history. This will lead to new demand for residential water supplies within the context of an overall regional self-sufficiency program. These developments should be required to include best-available water savings devices and provide mitigation for new water use to ensure that the state can meet future water demands.

Among specific actions to be analyzed and implemented as judged effective are:

- Require all new developments in California to incorporate cost effective and feasible water efficiency measures.

- Require new water consumption in the new development to be mitigated through a combination of water efficiency measures in existing communities and by development of capacity for highly reliable local water supplies. A portion of the water mitigation programs will be directed to disadvantaged communities that otherwise would not be able to afford efficiency and adaptation.

- Urge all new residential and commercial development of a certain size in California to install dual plumbing (a.k.a. "purple pipe").

- Require all new residential and commercial development to show that its water supplies are sustainably attained and will not result in additional depletions from California rivers and streams.

- Consider also expanding this concept to require existing residential units to meet minimum health safety code standards that would be modified to include water use efficiency provisions.

Action 7.4: Increase the percentage of agricultural lands irrigated with highly efficient technology and management practices.

California's agricultural industries are collectively the largest users of water in the state, and therefore any program for regional self-sufficiency will have to include improvements in efficiency of agricultural water use. The state should incentivize the adoption of highly efficient irrigation management and technology to improve on-farm application efficiencies and reduce surface water degradation from runoff. Drip irrigation systems are currently the state-of-the-art technology for achieving this goal. Drip systems also represent a significant investment by a grower which will likely not be made unless there is acceptable water supply reliability.

Among specific actions to be analyzed and implemented as judged effective are:

- Increase the funding available and streamline the procedural requirements for very-low interest loans and/or grants for the installation of state-of-the-art drip or micro irrigation systems, or other equipment and methods that eliminate any return flows to surface water systems.

- Consider exemption for individual irrigators from regulations under the various RWQCB irrigated lands runoff programs upon installation and maintenance of state-of-the-art drip or micro irrigation systems, or other equipment and methods that eliminate any return flows to surface water systems. Rationale for exemptions would adapt over time as understanding of relationships between irrigation methods and degradation of surface and groundwater resources is improved.

Action 7.5: Increase locally generated supplies through the use of recycled water, desalination, and captured stormwater.

Increasing locally generated water supplies along with improved water use efficiency can help increase regional water supply self-sufficiency. The California Water Plan Update 2005 stressed the importance of regions throughout California becoming more self-sufficient for their water supplies. The need to reduce dependence on long-term imports of water from other hydrologic regions has become even more apparent since that time as the Delta (and the Colorado River) have become less reliable sources of supply. Droughts, catastrophic events, ecological constraints, legal requirements, or changes in water availability from climate change could further limit availability of imports in the coming decades.

Three methods to help generate more local water supply include the following:

- Water recycling is reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, and recharging groundwater basins. DWR has estimated that recycling municipal wastewater could provide about 900 thousand acre-feet (TAF) to 1,400 TAF annually by 2030.

- Desalination is treatment to remove salts from brackish groundwater basins or seawater to make new freshwater supply available. DWR has estimated that desalination could provide about 300 TAF to 500 TAF annually by 2030.

- Water agencies are increasingly recognizing the value of capturing, treating (when necessary), and storing urban stormwater for later use. Since storm runoff generally occurs for short duration, capturing stormwater to enhance water supply requires storing the water in surface or groundwater reservoirs for later use. The

potential quantity of water available is site specific and will vary widely among communities.

Integrated Regional Water Management (IRWM) planning should identify the best water portfolio for each region of the state, which will vary according to local conditions. There is a wide variety of actions that will expand the development of these alternative supplies.

Among specific actions to be analyzed and implemented as judged effective are:

- Rvise relevant water management legislation, such as the Urban Water Management Planning Act and SB 610, to require coordination between water purveyors and wastewater agencies and to require identification of all local opportunities for use of recycled wastewater and harvested stormwater.

- The State should continue to provide technical assistance for regional recycled water and stormwater use, including public education campaigns, promotion of best management practices, promulgation of planning guidelines, and partial funding of demonstration projects as needed.

- The State should continue funding and administration of the IRWM competitive grant process for the foreseeable future.

- The State should provide technical and financial assistance for research and development to advance desalination technology, efficiency, cost effectiveness, and environmental sensitivity in coastal ecosystems.

- Require dual plumbing with "offset" credits to developments in SB 610 assessments (where recycled water delivery is practical and/or planned)

- Require the Department of Health Services and the Regional Water Quality Control Boards to review and harmonize their permitting requirements for recycled water and stormwater

- Require salinity management plans to be prepared for groundwater basins using or planning to use significant recycled water resources.

Action 7.6: Develop storage requirements and operational guidelines to address the use of recycled water for indirect reuse

Recycled water is most commonly used for industrial processes, agriculture, and irrigation of landscaping, parks, and golf courses. These direct uses of recycled water generally require storage only on a seasonal basis to help adjust the supply pattern to better match the demand pattern. Although direct use of recycled water for drinking purposes has been safely used in other countries, it is not a commonly accepted practice

in the United States. However, for indirect potable reuse, recycled water is typically discharged into a water body before it is extracted for reuse.

For many years, recycled water has been successfully used to recharge groundwater basins before extracting water for potable use. Although discharging recycled water into surface water bodies for reuse is less common, many cities take their water from large rivers that carry substantial wastewater discharges from upstream communities, which is a form of indirect potable reuse.

Several federal and State guidelines and regulations have been written for use of recycled water. Improved guidelines on sizing storage, water quality requirements and operational guidelines could help communities expand indirect potable use of recycled water.

Among specific actions to be analyzed and implemented as judged effective are:

- The State should review existing federal and State regulations and guidelines, including those used by other states and local entities, and then develop storage requirements and operational guidelines for both surface and groundwater storage to support indirect potable use of recycled water.

- The State should encourage communities to develop pilot projects for indirect reuse opportunities, including addressing the need and operational requirements of related storage infrastructure.

Action 7.7: Streamline the water transfer regulatory approval process.

Water transfers will be an increasingly important component of water supply reliability as the 21st century progresses and urban populations throughout the state continue to grow. However, current procedural requirements for even simple water transfers can be unduly complicated and in some cases can delay the transfer to such an extent that the transfer can no longer meet the goals for which it was intended. The state must have a more robust and effective short-term water transfer market to help manage water supply uncertainties, and to ensure that the state continues to benefit from a thriving agricultural economy on its most productive lands.

Control agencies, such as DWR, should provide clear information to transfer proponents well in advance of typical transfer seasons, specifying the information about the transfer that will be needed, when the information will be needed, points of contact within the agencies, etc. As soon as possible during the water year, DWR and Reclamation should provide estimates of their ability to conduct cross-Delta transfers including timing and amounts.

All water transfers involving the temporary or long-term reduction in agricultural consumptive use should only be contemplated after consideration of:

a. The existence of groundwater basin assurances to protect the long-term recharge benefits to groundwater basins that occur from historic irrigation activities.
b. The ability for other agricultural purveyors within the immediate watershed of the proposed transfer to have a first-right-of-refusal for purchase of the water supplies.
c. Adequate monitoring and reporting of both short and long-term water transfer activities, as well as related groundwater conditions, to keep local water users informed and educated.

Among specific actions to be analyzed and implemented as judged effective are:

- Standardize legal and regulatory requirements for short-term water transfers including consistent rules defining the determination of transferrable water, streamlined CEQA and NEPA compliance, and pre-defined mitigation options.

- Create permanent interagency team that incorporates direct and substantial participation from potential buyers and sellers to provide one-stop shopping for transfers. The team would develop rules and procedures well in advance, and get that material out to all potential sellers and buyers.

- Establish an entity or entities (likely not a State agency) to oversee a pool of water supply options by working through regulatory and procedural steps that would allow willing sellers to obtain pre-approval for defined water transfers.

- Modify water transfer procedures established in the California Water Code and as administered by the SWRCB and DWR to facilitate pre-approval considerations.

Strategy 8. Integrate and strengthen management of all aspects of the water cycle, including surface flows, groundwater, flood control, infiltration, and water quality

Regional self-sufficiency is tightly linked with the need for greater integration across various water management arenas, primarily water quality management, groundwater management, and flood control. Our political debates on water supply too often forget some simple truths: that reliable supplies mean nothing if the quality of the water is unacceptably poor; that ground water and surface water are part of the same hydrological system; and that flood control planning is simply the flipside of water supply planning. Each of these ideas has important implications for strategic planning of California's water system.

Managing water quality in the Delta is a significant challenge. Indeed, balancing the water quality needs of the co-equal values may challenge future Delta managers as much or more than balancing flow requirements, particularly with respect to organic carbon and salinity. But there are also water quality impairments that threaten drinking water supplies and ecosystems alike, such as contaminant loading from the Delta watershed. Control of these contaminants will require a higher degree of management integration

throughout the Delta watershed, as the State Water Resources Control Board has recently recognized with the announcement of new Total Maximum Daily Load regulatory efforts for the Delta.

The Delta watershed and export service areas contain abundant groundwater storage potential. As regional self-sufficiency efforts expand, it will be critical to incentivize local water districts to bring these storage resources to market, and to engage in conjunctive management of surface and groundwater resources. With auspicious new surface storage sites becoming fewer and farther between, groundwater storage will play an increasingly important role, especially south of the Delta. Simply put, the more water can be stored economically throughout the state, the more flexibility and predictability water managers have, at both regional and statewide scales.

Finally, flood control planning should be integrated with water supply planning to a much greater degree. Many of the reservoirs upstream of the Delta provide both flood control and water supply services. Given new technologies and forecasting capabilities, these reservoirs can be re-operated so that water supply yields can be increased without compromising flood protection. In order to maximize yield gains from this re-operation, however, the flood conveyance capacity of the downstream river systems must be expanded (including through the Delta), an action that can and should have important benefits for the ecosystem and the Delta as a place (see Action 11.1).

Even beyond flood control planning and conjunctive use, California must take a much broader perspective on management of precipitation. Encouraging infiltration into the soils at or near points of precipitation reduces flood flows, slows down the release of water into streams, and can improve water quality. Management and infiltration of stormwater must become a high priority throughout the Delta watershed in order to manage flood risks, recharge aquifers, and help prepare for climate change.

Action 8.1: Increase investment in development of Delta hydrodynamic and water management modeling tools

Numerical models play an important part in understanding flow related conditions in the Delta and in evaluating how potential physical and operational changes could alter those conditions. The models are also essential in managing Delta water operations on a day-to-day basis. Basin-scale water resources simulation models are accounting models that track water storage, releases from storage, diversions, and accretions to river flows. Estuary hydrodynamic models simulate water flows and water levels within the maze of Delta channels. The hydrodynamic models also include components for simulating water quality (salinity, temperature, or other variables), and tracking of sediment and small fish.

Although modelers have made major advances in improving models over the past decade, uncertainties still exist. The models can provide reliable information on water flows and water levels in Delta channels, but making accurate determinations of salinity is more challenging, especially when considering the effects of sea level change. Also, there is

little information on how changes in hydrodynamic conditions will affect the estuarine ecosystem or even certain fish species. The accuracy of basic input data also affect the accuracy of the models.

The models are tools that require interpretation by their users. Since no combination of models provide complete simulation of the Delta system, a multidisciplinary team of experts is required to run the numerical models, supplement interpretation with conceptual models, and apply expert judgment in drawing conclusions on the most likely outcomes.

Among specific actions to be analyzed and implemented as judged effective are:

- Under the auspices of the California Delta Ecosystem and Water Science Program, convene and maintain a multidisciplinary group of modelers and scientists to make recommendations for new models or enhancements to the existing models as scientific understanding of the system improves.

- Fund research and development of next-generation hydrodynamic model(s) that can better model the mechanics of salt movement resulting from sea level rise, and the hydrodynamic consequences of various conveyance alternatives under different sea level rise scenarios and levee configurations.

- Improve data collection on the physical configuration of the Delta, water quality parameters of major inflows, and other parameters used as inputs to the numerical models.

- Fund research and development of ecological and economic models linked to outputs of hydrodynamic models

Action 8.2: Work with the federal government to modify flood management operations at existing major multi-purpose reservoirs to obtain additional water supply yield while maintaining flood control capacity.

Major multi-purpose reservoirs exist on many of the tributaries to the Delta to store surface water supplies, control floods, generate hydroelectricity and provide recreation. Within a given reservoir, water supply storage and flood control are competing priorities at certain times of year – more of one means less of the other. Therefore, it is very important that flood management operations be tailored as closely as possible to actual flood probabilities, without compromising safety, so that as much reservoir space as possible can be devoted to water supply storage.

In many cases, flood control management criteria have not been updated in several decades and do not reflect contemporary capabilities for forecasting and dynamic management. Present management practice focuses on maintaining a given capacity in the reservoir and not on the actual threat of flooding. Improved forecasting capabilities

now allow reservoir managers to modernize flood control operations diagrams so that more water supply yield can be obtained without compromising flood safety.

Among specific actions to be analyzed and implemented as judged effective are:

- Modernize flood control operation diagrams for all major California reservoirs for which the Army Corps of Engineers has prescribed flood control regulations. The modernization should account for existing technology advances, the hydrologic changes that have occurred since the operations diagrams were created, and the hydrologic changes that are likely to occur because of climate change. As a minimum, the operations criteria should be based on forecasts and not be based on existing reservoir storage.

- Cooperate with the Corps on both the update of the operations criteria and manuals and the environmental documentation (EIS) that may be required to accomplish the changes in operation.

Action 8.3: Coordinate with the Central Valley Flood Protection Plan to increase flood conveyance capacity along the lower San Joaquin River, including through the Delta, so that water supply yield from terminal multi-use reservoirs in the San Joaquin Valley can be increased.

Another key component of reservoir re-operation is expanding the flood conveyance capacity downstream of the reservoirs. This increases management flexibility by allowing more flood water to be released safely from the reservoir if necessary, thereby reducing the amount of space within the reservoir that must be reserved for flood storage. That in turn allows more space to be devoted to water supply storage. Expansion of the conveyance capacity downstream of the reservoirs must be continuous along the entire river, and the capacity of the most downstream area sets the upper limit for the entire system.

Among specific actions to be analyzed and implemented as judged effective are:

- In coordination with the Central Valley Flood Protection Plan, identify areas of the lower San Joaquin River, including through the Delta, where flood conveyance capacity can be expanded in a continuous reach (also see Action 11.1).

- Conduct a feasibility study of possible reservoir re-operation options under the various flood conveyance capacity expansion scenarios identified in Action 8.3.1.

- Work with the federal government to carry out the reservoir re-operation options determined to be feasible under Action 8.3.2.

Action 8.4: Ensure a clear decision process and public vetting of major modeling assumptions for the Bay Delta Conservation Plan Environmental Impact Statement/Report for a Delta Conveyance Alternative, and ensure consistency between these assumptions and those used in other major modeling efforts.

Success of the Bay Delta Conservation Plan (BDCP) process will play an important role in achieving important components of Delta Vision's plan for a resilient and regenerated California Delta ecosystem and increased reliability of water supply. A critical part of this process is the completion of necessary environmental compliance documentation and analysis to satisfy the California Environmental Quality Act and the National Environmental Policy Act. The BDCP process is at the threshold of a 30-month effort to prepare and certify an Environmental Impact Report/Statement (EIR/EIS) that will analyze the impacts of alternative conservation actions including improved water conveyance infrastructure in the Delta. The EIR/EIS will also analyze the impacts of alternative water operations and management actions to achieve conservation and water supply reliability goals.

Several elements must be included in the BDCP EIR/EIS to ensure that success in BDCP also contributes to our vision of co-equal priorities of reliable water supplies for Californians and protecting and improving the Delta ecosystem.

Key among these is the clear understanding of major assumptions used to evaluate impacts and effectiveness of proposed alternatives. Major assumptions could include: (1) expected Delta fish protection actions, (2) expected operations of the CVP and SWP, (3) achievements in regional self-sufficiency, including projected reductions in per-capita water use, (4) implementation of major agreements and settlements (e.g. San Joaquin River settlement), (5) changes to demand and supply from expected climate change, and (6) changes to operations from expected sea level rise.

In addition to establishing a clear understanding of major assumptions, the BDCP EIR/EIS effort should also ensure consistency with (or provide a documented basis for variance from) other major modeling efforts, including the on-going CALFED surface storage investigations, the recently completed revised Operational Criteria and Plan (OCAP), and others.

Among specific actions to be analyzed and implemented as judged effective are:

- Well in advance of a public draft of the BDCP EIR/EIS, produce and request comments from non-Agency decision makers, potential partners and primary stakeholders on an administrative report documenting the representation of projects, regulations, procedures and policies for projected future no-action conditions. This report should, among other items, provide the basis for the major assumptions listed above or deviations from other major water supply and operations investigations recently completed or underway by the State or federal agencies.

- Require communications and coordination among BDCP EIR/EIS teams, Agency management, and other State and Federal related programs and projects to enable development of common policies and procedures while reducing misunderstandings, misuse of data, or other factors that could impede the completion of the EIR/EIS.

Action 8.5: Control anthropogenic (i.e. human-generated) contaminants at the source, before they enter the Delta.

Given current trends of population growth and climate change, Delta water quality will be degraded and the Delta will no longer consistently provide a reliable supply unless steps are taken to further protect water quality. The Central Valley Regional Water Quality Control Board (Regional Water Board) is charged with protecting the beneficial uses in the Delta watershed. However, water quality objectives have not been established for several key drinking water quality contaminants (organic carbon, nutrients, and pathogens). Existing source control methods will not be adequate to protect water quality as the population increases. Preventing contaminants from entering waterways will be the most efficient and sustainable strategy to protect Delta water quality for drinking water uses.

Among specific actions to be analyzed and implemented as judged effective are:

- Improved Enforcement – Provide adequate staff to the Regional Water Quality Control Board to improve inspections and enforcement of water quality regulations.

- Water Quality Objectives – Provide adequate staff to support the Regional Water Board's work to develop water quality objectives for organic carbon, nutrients, and pathogens and to conduct the program of implementation to achieve the objectives.

- Wastewater Treatment – Implement source control necessary to achieve water quality objectives. Advanced treatment will likely be required at all wastewater treatment plants discharging to Delta source waters. Many of the larger wastewater treatment plants including Stockton, Modesto, and Lodi have already installed or are planning to install advanced wastewater treatment.

- Urban Runoff – Implement best management practices (BMPs) and source control necessary to meet water quality objectives. This may include treatment of dry weather and first flush storm flows.

- Agricultural Discharges - Implement management plans to reduce loads of contaminants identified through monitoring required under the Regional Water Board's Irrigated Lands Regulatory Program.

- Confined Animal Feeding Operations - Implement BMPs for animal agricultural operations including Confined Animal Feeding Operations.

Action 8.6: Improve the legal and regulatory framework associated with groundwater banking agreements and operations.

Groundwater storage is essential to the management of the co-equal values, but the extraction and delivery of banked groundwater can be extremely complicated because of regulatory and contractual limitations. Removing limitations on the extraction and delivery of banked groundwater would enhance water supply reliability and expand state-wide storage capacities. The state must therefore clarify and otherwise make consistent (as practical) the legal and regulatory framework that governs the intentional placement, storage and extraction of surface water into groundwater aquifers.

Use of advanced technologies, such as aquifer storage and recovery (ASR) projects, would increase the ability to store surface water. Alternative methods would enhance the ability to store water during winter months when more surface water and conveyance capacity are available but groundwater storage through conventional spreading operations is limited because of soil conditions, and in urban areas where land for recharge is often in short supply. A program whereby the State, working with local agencies, purchases high-valued lands for banking operations with the expectation that the purchase price would be repaid from revenues once local agencies develop the banking project would expand water banking.

Among specific actions to be analyzed and implemented as judged effective are:

- Facilitate banking, extraction, and delivery of State and local water supplies through revisions of place-of-use restrictions

- Exempt extractions and deliveries of banked groundwater from county ordinances that require permits for out-of-county exports of groundwater

- Work with the U.S. Bureau of Reclamation to facilitate flexible groundwater banking, extraction, and delivery operations

- Encourage technological advances in groundwater banking methods

- Require SWRCB to adopt statewide guidelines regarding the permitting of Aquifer Storage and Recovery operations

- Expedite grants and loans for the purchase of high-valued lands for groundwater banking to prevent urbanization of said lands

- Continue to support and incentivize regional groundwater basin management activities

Action 8.7: Institute comprehensive basin management planning to address the availability, quality, and managed use of regional groundwater resources.

Groundwater is already a vital resource throughout California, but more can be done to manage and conjunctively use this resource and the aquifers that contain it. But to help ensure we do not jeopardized this resource, we need improve our understanding and develop local, regional and statewide policies to protect its long-term functionality and availability.

Coupled with surface storage, our Vision anticipates greater use of groundwater storage throughout the State – either by directly infiltrating surface water into aquifers or by using surface water in-lieu of groundwater – to help water users manage increasing hydrologic variability and to allow for greater flexibility in the timing and quantity of waters exported from the Delta as needed for Delta ecosystem health.

To optimize these opportunities and efficiently manage groundwater resources, we need comprehensive local, regional and statewide planning. We need to protect areas of natural recharge as well as locations ideal for managed recharge. This latter aspect includes protection of farmland and open space that helps contribute to groundwater recharge and, in some locations, provides cost-effective opportunities for infiltration basins. Furthermore, we need to incentivize continued improvements to store, monitor and recover groundwater, such as Aquifer Storage and Recovery (ASR) wells, local storm water capture techniques, and satellite-based gravitational groundwater level monitoring.

Among specific actions to be analyzed and implemented as judged effective are:

- Require Integrated Regional Water Management Plans, Urban Water Management Plans and Agricultural Water Use Efficiency Plans to identify groundwater currently being used for beneficial uses in the basin as well as groundwater and groundwater storage opportunities that could contribute to beneficial use in the basin. Constrain public funding sources for plans that do not adequately address groundwater resources.

- Require water resource plans, as well as land use plans (e.g. General Plans, Specific Plans, etc.), to identify how land use plans will protect areas needed for groundwater recharge.

- Provide public cost-share funding for pilot projects to improve techniques for local storm water capture.

- Require DWR to make all collected groundwater data readily available to the public (integrated with additional data collection and reporting discussed in *Action 2.1*).

Action 8.8: Encourage infiltration or direct use of precipitation throughout the Delta watershed and export areas.

The entire Central Valley is either upstream of the Delta, reliant on diverted Delta water for its supplies, or both. In a very real sense, the challenges of flood control and water supply reliability in the Delta are a product of land use and infrastructure patterns throughout the Valley. Infiltration of precipitation that falls on the Delta watershed has the triple benefit of reducing flood peaks, storing water for later use in groundwater aquifers, and potentially reducing the amount of water that has to be exported from the Delta at critical times. It can also improve the quality of water through the natural filtering capabilities of soils.

Communities throughout the Central Valley should therefore aggressively pursue stormwater harvesting or infiltration wherever possible, both to reduce flood threats to the Delta and to reduce the need for diversions from the Delta system. This includes urban areas, where stormwater harvesting can help supply landscape irrigation and other uses, and where infiltration zones can provide valuable open space amenities. Much of the upper watershed of the Delta is forested. Forests are rarely managed now for the water holding capacity of their soils, but this should become standard practice in the future, particularly as climate change produces more rain and less snow in California. Increasing infiltration above the reservoirs can slow down rates of runoff, in effect partially replacing snowpack storage with soil storage.

Among specific actions to be analyzed and implemented as judged effective are:

- Issue a model stormwater management ordinance for urban areas throughout the Delta watershed

- Require rainwater harvesting in new developments and incentivize rainwater harvesting retrofits in existing developments

- Over time, work with the USDA Forest Service to revise the Forest Plans for the National Forests in the Sierra Nevada to encourage greater infiltration

- In coordination with Action 12.1, study, and if feasible implement, a plan to convey water from storage reservoirs to groundwater infiltration sites to expand storage resources and to improve flood control capacities of the reservoirs.

Strategy 9: Create a wet-period diversion, conveyance and storage system to the greatest feasible extent to minimize ecosystem stress and prepare for climate change.

Even with aggressive efforts toward regional self-sufficiency and management integration, diversions from the Delta watershed will continue to be a very important piece of the water supply puzzle. As we suggested in our Vision, these diversions should occur during the wet periods (both seasons and years) to the greatest feasible extent in order to balance the co-equal values. Linked investments in new facilities for conveyance and storage, which we also called for in our Vision, should be made with this objective in mind.

Patterns of diversions and the methods of conveyance must be responsive to ecosystem needs, even if they are not the sole (or perhaps even the primary) cause of the ecosystem's distress. Wet-period management flexibility in diversions, conveyance and storage must also be institutionalized in a fashion that allows water districts and users to achieve reliability. In concert with regional self-sufficiency and management integration measures, new facilities for conveyance and storage can achieve this flexibility and allow for the protection of the Delta estuary.

Changes in diversions and conveyance should be done in a fashion that improves water quality for both irrigation and drinking water. Changing the locations of major diversions to points along flowing channels, rather than terminal sloughs, will be a key tool in improving water quality for end users. Wet-period diversions also tend to improve the quality of diverted water since there is greater dilution of harmful pollutants at these times.

The desirability of a wet-period diversion system will only increase as climate change unfolds. Projections indicate that California will experience more intense storms, but will also lose a large fraction of the Sierra snowpack. This means that more of our potential water supplies will be arriving in quick bursts of winter rain, rather than the slower springtime melt of snow. Under these conditions, it will be all the more imperative that we have the capacity to divert and store large amounts of water when it comes, and then convey it to points of use. It will also be critically important to slow precipitation runoff and encourage infiltration of water into soils for later release into streams.

The Strategic Plan actions introduced below carry important implications for the governance of the Delta and the state's water system. California already possesses the constitutional and statutory principles necessary to manage the water system in the ways envisioned here. The Vision declared that the constitutional principles of reasonable use and public trust should be the foundation for policymaking about the state's water resources, as in many ways they already are.

The challenge at hand for our state is to improve the application and effectiveness of the legal and institutional structures that already exist. The water rights system, and the information base that underlies it, should be strengthened and clarified so that water

managers around the state can make sound long-range decisions that optimize supply reliability and regional self-sufficiency. This is described in greater detail in the governance and finance section of this plan, particularly Action 2.5.

Action 9.1: In the near-term, experimentally implement a Middle River conveyance, as recommended by the Delta Vision Stakeholder Coordination Group.

Given the current undesirable state of Delta-related water supply reliability and the Delta ecosystem, near-term improvements in the through-Delta water conveyance system are necessary even as the process of identifying and implementing a permanent conveyance solution proceeds.

The Vision identifies a reliable water supply for California as one of the co-equal values, and identifies dual conveyance as a "preferred direction" for analysis of a permanent conveyance solution. In addition, the Vision also calls for "Improvements in the current water conveyance" as one of the seven near-term actions (p. 48 of the Vision), and states that such improvements should be improved as rapidly as possible. It is likely that a permanent solution will take at least several years to design, study, and build. In the meantime, improved through-Delta conveyance may be able to support the co-equal values by improving water supply reliability and protection of fish species.

A "Middle River conveyance" system would convey water intended for export from the Sacramento River to the Clifton Court Forebay by routing it through the Delta Cross-Channel, the Mokelumne River, the Middle River fork of the San Joaquin, and Victoria Canal. The sloughs connecting Old River and Middle River would be fitted with operable barriers and Victoria Canal may need to be siphoned under Old River. This hydraulic separation of Middle and Old Rivers is anticipated to allow Old River to be managed for aquatic habitat without suffering from pumping impacts or compromising the quality of export water in Middle River. Necessary fish screens would be installed to keep fish in desirable habitat.

Among specific actions to be analyzed and implemented as judged effective are:

- If no fatal flaws are identified in preliminary evaluation, obtain permits and ground-test the components of a Middle River Conveyance option, initially as a reversible experiment. In an open, transparent manner, analyze and refine the Middle River Conveyance option, including evaluation and appropriately staged implementation of fish screens, gates and other "testable" components.

- Develop performance standards that will be applicable to any conveyance option, including ecosystem, water supply, environmental justice, water quality, and fish populations.

- The analyses should include a siphon and gates to separate Old and Middle Rivers, under varying water operations and flows. Conduct real-time monitoring and establish protocols to either stop or alter any experimentation.

Action 9.2: Over time, shift export diversion timing to wetter periods (both within and between years) while providing sufficient reliability for regions reliant on water exported from the Delta watershed

Our Vision establishes a reliable water supply for California as a co-equal objective to a healthy Delta ecosystem. One component of water supply reliability is the ability for exporting water purveyors to have a level of certainty regarding expected diversion, especially on a long-term average basis. Establishing a level of reliability for Delta exports that is consistent with average quantities diverted in the 1990's can improve opportunities for export communities to implement other actions analogous to regional self-sufficiency. Our Vision also recommends developing a healthier Delta ecosystem focused on multi-species objectives and identifies the need to reduce ecosystem stressors including but not limited to the affects of export diversions.

To help meet these co-equal objectives, Delta export diversions should be reduced from long-term average goals during drier periods – from annual as well as seasonal perspectives – and allowed to increase when conditions are above normal. Doing this will require potentially significant increases in Delta and export area conveyance capacity as well as upstream and export area ground and surface storage.

Establishing flexible diversion standards that encourage more diversions during wetter periods and less during drier periods is consistent with this objective.

Among specific actions to be analyzed and implemented as judged effective are:

- Using the ecosystem strategies recommended in this Strategic Plan, establish seasonal and annual interim (next 10 years) variable ecosystem flow objectives for differing hydrologic conditions. Use these to determine opportunities for shifting diversion rates and timing, while maintaining long-term average total diversions equivalent to quantities seen during the 1990's. Identify needed conveyance and storage to achieve desired shifting in export diversion rates and timing. Require DWR to provide a report to the legislature on recommended actions by January 2010.

- Upon acceptance of recommendations, initiate environmental analysis and design to obtain permits, enter into agreements, and expeditiously approve and construct storage and conveyance facilities to achieve goals.

Action 9.3: Shift major in-Delta diversions away from sensitive habitats (high priority restoration areas, low-flow channels and terminal sloughs) to channels where drinking water quality is higher.

Relocating intake facilities or modifying the flow of water within the Delta to effectively draw water from flowing Delta channels improves the quality of drinking water and agricultural export supplies while reducing ecosystem impacts. Naturally occurring constituents in the Delta (salinity, including bromide, and organic carbon) are needed within the Delta for a healthy and resilient ecosystem, but are detrimental to drinking water and agricultural water supplies. This strategy includes immediate steps to relocate smaller in-Delta drinking water diversions by constructing pipelines and new diversion structures on channels with higher water quality and more removed from critical aquatic habitat. The larger multi-purpose diversions in the south Delta will be addressed in stages. All of these new conveyance facilities can be operated together for more effective and flexible water supply and ecosystem management.

Using the ecosystem strategies recommended in this Strategic Plan, establish seasonal and annual interim (next 10 years) variable ecosystem flow objectives for differing hydrologic conditions. Use these to determine opportunities for shifting diversion rates and timing, while maintaining long-term average total diversions equivalent to quantities seen during the 1990's. Identify needed conveyance and storage to achieve desired shifting in export diversion rates and timing. Require DWR to provide a report to the legislature on recommended actions by January 2010.

Among specific actions to be analyzed and implemented as judged effective are:

- Relocate North Bay Aqueduct intake.
- Relocate Contra Costa Water District Old River intake.
- Implement interim conveyance measures, such as constructing barriers in the western Delta near Franks Tract, to control seawater intrusion and protect pelagic fish during critical times.
- Implement modifications to through-Delta conveyance as described in Action 9.1.
- Relocate intake facilities for State and Federal pumps to a single intake on the Sacramento River.

Action 9.4: Create a dual conveyance system for the Delta designed to optimize capture of wet-period flows

Our Vision identified the current Delta water conveyance systems as inadequate and needing improvement – both to help improve reliability for water users dependent on the Delta for water supply conveyance and to help the Delta's failing ecosystem regain health

and stability. Eliminating or significantly reducing south Delta water diversions at the SWP and CVP export facilities during the sensitive life stages will likely improve the conditions for sustaining the Delta smelt population.

But doing this action alone violates the Vision's co-equal objectives. By creating an alternative intake and conveyance path for SWP and CVP diversions during these, or other, periods identified as critical to Delta ecosystem health, ecosystem objectives can be achieved while sustaining reliable water exports.

The dual-Delta water conveyance system would include a combination of modified Delta channels and a new isolated canal or pipeline. The isolated conveyance portion of the system would connect the Sacramento River in the north Delta to the SWP and CVP export facilities in the south Delta (see Figure 6 for possible alignments and costs). This duality provides a wide array of opportunities to adaptively manage for Delta ecosystem health while flexibly shifting the location and timing of export water diversions to when and where least harmful to the environment.

Though many questions still linger regarding the degree of benefit, a dual-Delta water conveyance system will provide significant flexibility for operations – providing the best opportunity to achieve our co-equal objectives. The degree of flexibility depends on the volume and timing of water moved through the individual conveyance components, their location and design, and the regulatory framework in which they operate.

As stated in the Bay Delta Conservation Plan (BDCP) November 2007 Principles of Agreement, the operation of any new dual-Delta water conveyance system is critical and will take some time to develop. The critical process of evaluating a large array of possible operational scenarios is underway in the BDCP process and will take several months. Until that process is complete, the detailed benefits and impacts of a dual-Delta water conveyance system cannot be fully assessed. However, even with questions still unanswered, this alternative stands superior in its ability to help meet the Vision's co-equal goals when compared against only a fully isolated facility or only modifications to existing Delta channels.

Among specific actions to be analyzed and implemented as judged effective are:

- Ensure the appropriate State and federal funding and authorities exist for the expeditious completion of engineering design studies, feasibility studies, hydrodynamic modeling, cost-benefit analyses, and other relevant investigations of a dual-Delta water conveyance system. In addition to addressing the benefits for export water reliability and ecosystem health, these efforts must also answer important questions addressing: (1) impacts on in-Delta water supply and quality; (2) impact on flood threats; (3) security of an isolated facilities to earthquake, flooding; (4) stability in the face of sea level rise; (5) cost and fiscal impact on Delta levee maintenance and rehabilitation, and flood response; and (6) security of Delta infrastructure and agricultural production.

- Require necessary decisions, permits and funding mechanisms for the dual-Delta water conveyance system to be expeditiously obtained after the selection of a recommended alternative as determined through the BDCP EIR/EIS and related efforts.

- As stated in another strategy, expeditiously complete all agreements with other legal in-Delta water diverters that are to be connected to the dual-Delta water conveyance system.

Action 9.5: Identify mechanisms to connect legal in-Delta water users to improved Delta conveyance facilities.

Our Vision specifically stated that Delta water conveyance systems are inadequate and must be improved. As discussed in Action 9.4, we recommend creation of a dual conveyance system designed to optimize capture of wet-period flows and reduce the impact of diversion on the Delta ecosystem.

Implementation of this conveyance system should also consider opportunities to help improve reliability and water quality for other legal water users with intakes located within the Delta, possibly including Delta agricultural users, Contra Costa Water District and the City of Stockton, among others to be identified. Investing in additional alternative intakes for these users can provide further flexibility in helping change the pattern of diversions when and where least harmful to the environment.

Among specific actions to be analyzed and implemented as judged effective are:

- Undertake necessary studies in coordination with the Bay Delta Conservation Plan (BPCP) effort to identify and evaluate alternative intake locations and configurations for other in-Delta diverts with legal diversion authority.

- Upon identification and recommendations by State agencies of additional connections and configurations, secure appropriate agreements with individual water diverters to allow for implementation of recommended connections.

- Work with individual water diverters to permit and construct new connections.

Action 9.6: Support expedited completion of the CALFED surface storage investigations and implement the storage options that optimize the capture of wet-period flows.

Our Vision, as part of the near-term actions, specifically stated that improvements in the current water conveyance and groundwater and surface water storage systems should be pursued as rapidly as possible by the responsible agencies and departments. Specifically, publicly-available draft studies and environmental impact analyses for the CALFED storage projects including Temperance Flat, Sites Reservoir, and the Los Vaqueros

expansion must be completed by spring 2009. Though fraught with delays from state funding constraints, these investigations have finally reached a critical milestone. With input from stakeholders and assistance from local agencies, preliminary environmental impact studies and conceptual modeling scenarios are nearing completion.

The result of these current investigations is vital to inform decisions about investments in our water systems. Further delay in the availability of this information impedes the ability to make decisions or even undertake supplemental analysis that takes a more integrated approach. Currently, the CALFED surface storage investigations are assessing feasibility and performing environmental impact assessments in isolation from each other. Reconfigured alternatives that evaluate integrated opportunities may provide additional benefits to the Vision's co-equal objectives.

Each of these projects, depending on how they are built and operated, could contribute to the achievement of the co-equal objectives of our Vision. Unlike in the past, when local entities built storage facilities for their own benefit and with little state investment, the current deteriorating condition of the Delta may justify public investment in exchange for public benefits the entire state can realize.

Among specific actions to be analyzed and implemented as judged effective are:

- The legislature and the administration must ensure stable State and federal funding through FY 2010 for the storage investigations to facilitate public reporting by spring of 2009, and completion of final documents by 2010.

- Immediately following or concurrent with on-going efforts, additional overview investigations should be undertaken to address (1) opportunities to integrate surface storage alternatives and (2) the response of identified alternatives to Delta ecological restoration objectives and the water supply conveyance alternatives represented elsewhere in this Strategic Plan.

- If found to be feasible by U.S. Bureau of Reclamation and not in conflict with P.R.C 5093.542, the legislature should provide for the State's participation in a recommended project to enlarge Shasta Lake.

The Delta as a Place

The Delta is one of the state's most distinct regions, combining a unique physical geography of islands and river channels with a cultural heritage as enduring as any in California. The Delta possesses natural, historical and recreational resources of statewide and even national significance. But despite this fact, it is little known or recognized by most Californians, including many of the millions living in the cities just outside the Delta's boundaries.

Our Vision strongly declared the Delta to be a unique and valued area, warranting recognition and special legal status. The Delta's value comes not just from the economic or infrastructure services that it provides to the state, but also from its intrinsic worth as a community with a distinct natural and cultural heritage. The Delta should continue to thrive not only as a key component of the state water system and the estuary, but for its own sake.

This Strategic Plan identifies specific actions that will achieve the key goals of the Vision for the Delta as a place. Those goals are:

- to increase recognition and protection of the Delta, enhance agriculture, and expand the tourism and recreation economies,
- to discourage inappropriate urbanization and to foster a land use pattern that recognizes the region's unique constraints and values,
- to reduce flood risks and to strengthen selected portions of the levee system.
- to reduce risks to the critical infrastructure passing through the region.

Strategy 10: Increase recognition of the Delta as a place, and enhance tourism and recreation, by creating a National Heritage Area and a multi-unit State Recreation Area, and by facilitating new investments in "gateway" locations near major cities and highways.

Given the risks and challenges that the Delta region faces, a positive future depends upon the Delta achieving much greater recognition from the rest of the state, and even from the rest of the nation. There are two reasons for this. First, the Delta merits such recognition. Second, putting large numbers of new permanent residents and buildings into the Delta is not a responsible course of action given the flood risks. Therefore, bringing many more visitors to the Delta – in large numbers, but also in a fashion that is manageable for local communities – is one of the clearest paths to sustainable economic growth for the region.

Appropriate recognition also should serve to bring external funding and investment to the Delta. This may take the form of state or federal grants for preservation and enhancement of natural and cultural resources. But it is perhaps even more important that there also be robust private investment in the Delta's recreation and tourism economy. New private investment in appropriate projects, at appropriate locations,

would be a welcome sign that the Delta region had achieved both the recognition and the security that it will need over the long term.

Because the lowlands are an inappropriate place for significant new construction, investments in welcome centers, hotels, and recreational service industries should be concentrated in "gateway" locations on the edge of the Delta. These should be places that are highly visible and easily accessible from highways, that have pre-existing infrastructure adequate to handle visitors, and from which key sites in the primary Delta can easily be reached by land or water. The sites should also be above projected sea level and should have acceptable flood protection, in order to increase investor confidence. Concentrating visitation infrastructure in these gateways also reduces stress on the roads and infrastructure of the Delta primary zone, which are ill-equipped to handle it.

These goals should be accomplished in a manner that maintains and enhances the vitality of the Delta's economy and communities, rather than either changing them irrevocably or "freezing" them in place as museum pieces.

Action 10.1: Fulfill the requirements necessary to achieve a National Heritage Area designation for the Delta from the federal government.

National Heritage Areas (NHAs) are places designated by the United States Congress "where natural, cultural and recreational resources combine to form a cohesive, nationally-distinctive landscape arising from patterns of human activity shaped by geography." This description is ideally suited for the Delta, which is a very large and complex mixture of working landscapes, habitats, and recreation sites. Many NHAs have been formed across such working landscapes, in areas with distinctive natural features, and in recreational areas.

Despite being a federal designation, NHAs do not entail any federal ownership or regulation of land. The National Park Service and the Department of the Interior review proposed NHA management plans to see that intended actions tend to advance the mission of the Park Service and the NHA program, but otherwise the federal role is limited to partnering in marketing efforts. The planning can and should be done by local organizations, and should create a regional management structure that empowers local citizens and generates new economic opportunities in the recreation and tourism industries.

The identity, "imageability," and marketing potential of the region are all enhanced by the designation and the participation of the National Park Service. The characteristics that make the Delta special – its unique environment, its distinctive cultural heritage, and its importance as a habitat – should be recognized, enhanced, and shared without turning the region into a "museum piece."

Among specific actions to be analyzed and implemented as judged effective are:

- To achieve the designation from Congress, the State of California and local entities should secure public support within the Delta for the designation, jointly conduct the required feasibility study, and identify a local agency or a private non-profit that can serve as the ongoing management entity.

- Upon conducting the feasibility study, the State of California and the local management entity should apply to the United States Congress for the designation.

- Upon receiving the designation, the management entity and its partners must develop a management plan within three years that describes how the NHA will combine preservation, recreation, economic development, heritage tourism, and heritage education to interpret and promote the region's distinctive landscape.
- The preceding actions should be mutually supportive with the planning for the Great California Delta Trail already mandated under SB 1556.

Action 10.2: Issue a model ordinance to local governments for the creation of special enterprise zones at the major "gateways" to the Delta.

Our Vision urged that new investments to enhance tourism and recreation in the Delta be made in a fashion consistent with the need to preserve public safety, the Delta's unique character and the co-equal values. Though recreation and tourism should be enhanced throughout the Delta, the buildings and services required to expand the industry should be concentrated in highly visible locations near highways and population centers, and in areas with relatively low disaster risks (i.e. above sea level or well protected by high-quality levees). Concentrating such investments in specific gateway areas also will confine traffic impacts and other undesirable side effects of increased visitation to the areas best able to handle them. In particular, many levee roads in the primary zone are narrow and winding, heavily used by agricultural vehicles, and cannot safely accommodate dramatically increased traffic loads.

The state should issue a model ordinance to local governments for the creation of special enterprise zones at the major "gateways" to the Delta. These zones should provide economic incentives, possibly including tax breaks and low-interest loans, to appropriate investments in welcome centers, interpretive centers, recreational support services, and transportation (both land and water) from these locations to points of interest throughout the region.

Potential sites for such gateways include Rio Vista on the west; Freeport, West Sacramento, or the Yolo Bypass on the north; Thornton or Stockton on the east; and Antioch, Discovery Bay or Lathrop on the south. There should be at least one gateway on each of the four sides of the Delta to ensure visibility and access.

Among specific actions to be analyzed and implemented as judged effective are:

- Require the State Office of Planning and Research to prepare and issue a model ordinance for gateway enterprise zones.

- Pass legislation establishing tax breaks and/or a low-interest loan fund for which investments in the gateway areas will be eligible.

Action 10.3: Create a multi-unit California Delta State Recreation Area.

In addition to seeking the National Heritage Area designation, the state should act more directly to enhance recreational and tourism opportunities in the Delta by creating a new state recreation area. The northern unit should include Liberty and Prospect Islands and Little Holland Tract. The southern unit should be located on Sherman Island, in an area that is visible from the Antioch Bridge and is easily accessible from Highway 160. The Legislature and the California State Parks Department should also consider consolidating Brannan Island State Recreation Area and Delta Meadows River Park into the new multi-unit structure.

The Sherman Island unit should be created as part of a planned land use transition in the publicly-owned western Delta islands (see Action 3.6). It should also be sited in a location that allows it, Highway 160, and major electricity and natural gas infrastructure to be cost-effectively protected by seismically robust interior cross-levees.

Among specific actions to be analyzed and implemented as judged effective are:

- Create a state recreation area on Liberty and Prospect Islands, and Little Holland Tract.

- Charge the California State Parks Department with completing a siting study for the Sherman Island unit, and to study the advantages and disadvantages of consolidating Brannan-Andrus State Recreation Area and Delta Meadows River Park into the multi-unit structure.

- Pass legislation implementing the course of action recommended by the State Parks Department as a result of the studies undertaken in Action 3.4.2.

Action 10.4: On the publicly-owned western Delta islands, manage a land-use transition to recreation, terrestrial habitat, subsidence reversal, carbon sequestration, dredged material handling and appropriate agriculture.

Rising sea levels and the declining availability of freshwater to repel salinity in the driest summers will make irrigated agriculture increasingly difficult in the west Delta in the coming decades. The three west Delta islands that are predominantly publicly owned – Sherman, Twitchell and Jersey – offer an important opportunity to innovate new land use patterns that will respond to these evolving conditions.

The California Department of Water Resources (which owns most of Sherman and Twitchell Islands) should form a consortium with the Ironhouse Sanitary District (which owns Jersey Island) to plan and manage this land use transition. This should be done in coordination with Action 3.4.

Among specific actions to be analyzed and implemented as judged effective are:

- Empower the California Department of Water Resources to form a consortium with the Ironhouse Sanitary District to plan and manage this land use transition.

Action 10.5: Create market structures or incentives for a sustainable Delta agriculture to produce public benefits in addition to and compatible with food and fiber. Such public benefits include:

- Wildlife habitat
- Subsidence reversal
- Carbon sequestration
- Flood management
- Recreational and tourism opportunities

The Delta should become a leading center of agricultural innovation in which the unique physical circumstances of the region create new market opportunities. For example, the State should take advantage of the carbon sequestration potential of Delta soils by ensuring that carbon farming is officially recognized as an emissions reduction mechanism under AB32 (a.k.a. The Global Warming Solutions Act). If further research proves this to be effective, this could allow greenhouse gas emitters to meet their carbon reduction requirements by paying Delta farmers to grow carbon-consuming crops.

The California Department of Food and Agriculture, commodity boards, and local governments should work together to allocate available Farm Bill funding to begin a regional labeling program and assist in direct marketing of Delta produce in nearby cities. The California Department of Food and Agriculture should also earmark directed specialty crop funding in support of Delta agriculture, including labeling, direct marketing and the development of new crops and crop varieties. In addition, the State should use its working lands conservation programs in a coherent manner to leverage the conservation funding available through the USDA Farm Bill, such as that available through the Cooperative Conservation Partnership Initiative. Federal, state and local mitigation requirements and agricultural easement programs should also be crafted to support the transition of Delta growers to multifunctional forms of agriculture, particularly wildlife habitat and flood management.

Among specific actions to be analyzed and implemented as judged effective are:

- Ensure that carbon sequestration farming is recognized as an emissions reduction mechanism under AB32

- The California Department of Food and Agriculture and local governments begin a regional labeling program and a program to assist in direct marketing of Delta produce in nearby cities.

- Provide permit assistance and coordination (among agencies and the five counties) for growers who are willing to take actions consistent with sustainability, that add value to the Delta as a place, and that are otherwise furthering the ecosystem and water goals of the strategic plan

- With the assistance of the Delta Protection Commission, local governments should create sufficient zoning and permit assistance for agricultural support industries in and around the Delta

Strategy 11: Enhance the Delta as a place by creating multi-purpose river corridors on each major river system entering the Delta, and by creating Special Area Management Plans for selected areas.

"Corridors" are continuous stretches of river in which specific ecosystem water quality, riparian habitat, recreational, and flood conveyance objectives are met. There should be at least one such corridor on each of the major river systems entering the Delta. They serve a variety of important purposes for the Delta as a place, and for California as a whole, by:

- Creating a continuous estuarine habitat, stretching from freshwater-dominated river habitat to saltwater-dominated Suisun Bay, on each river system;
- Allowing the locations of salt-fresh mixing zones to move with the tides, inflow conditions, and climate conditions, as they would in a natural estuary;
- Creating riparian vegetation and possibly strips of tidal marsh along re-designed levees, to enhance habitat conditions, levee strength and scenic values;
- Providing refuges for native fish and other desirable aquatic species, where efforts to reduce population stressors can be concentrated to maximum effect;
- Increasing flood conveyance capacity of selected Delta channels, protecting Delta islands and improving flood management flexibility upstream;
- Providing highly scenic places for low-impact boating and eco-tourism opportunities.

These multi-purpose corridors may also be matched by corridors serving different purposes, such as water conveyance, infrastructure protection (if found to be cost-effective), and overland recreational trails. In addition to its functional benefits, the "gateways and corridors" pattern helps create a clear and marketable image for the Delta that would help visitors to recognize and navigate the region.

Action 11.1: Establish water quality, ecosystem management, and flood control priorities for key river corridors in the Delta.

For each of the major river systems entering the Delta (the Sacramento, the Cosumnes-Mokelumne, and the San Joaquin), the state should ensure that at least one continuous corridor of high-quality aquatic habitat and riparian vegetation is sustained. These selected river corridors (especially those that are downstream of flood bypasses) should also be enlarged where possible to convey more floodwater safely through the Delta. Investments in levees, water conveyance, and other infrastructure should be compatible with this objective.

Because high-quality aquatic habitat may require water quality conditions that are incompatible with drinking water and/or irrigation diversions, and water flow conditions that are incompatible with certain export pumping patterns, this strategy will require hydrologic separation of these selected habitat channels from channels used in water conveyance. Such separation may be achieved through operable barriers that allow long-term management flexibility and boat passage, and should be conducted on an experimental basis first.

Potential key habitat corridors may include Old or Middle River, the Steamboat-Sutter-Elk Slough corridor, Georgiana Slough, and the Mokelumne/Cosumnes system. Environmentally friendly recreational investments should also be concentrated along the selected corridors, given their high scenic quality.

Among specific actions to be analyzed and implemented as judged effective are:

- Mandate that the Delta Policy and Management Plan, in consultation with the Central Valley Flood Protection Plan, identify the corridors that should be managed for ecosystem water quality, riparian vegetation, and flood conveyance, and establish numerical standards for these functions.

Action 11.2: Draft Special Area Management Plans for specific areas outside of the existing primary zone where state interests in land use can be protected with either greater or lesser oversight than currently exists.

There are specific areas outside of the current primary zone where state interests, such as flood protection and potential liability for levee failure, are affected by land use changes. These areas are within the current legal Delta, at or below the 16-foot contour, and within the 200-year floodplain. The current regulatory structure permits the Delta Protection Commission to comment upon, but not exercise decision authority over, potential changes in these areas.

To ensure that these state interests are protected, the Delta Protection Commission should draft Special Area Management Plans for each area. These SAMPs must be consistent

with the California Delta Ecosystem and Water Plan (see Strategy 2) and the DPC's Resource Management Plan, and that consistency determination must be made by the California Delta Ecosystem and Water Council (see Strategy 1). The following areas would be subject to SAMPs:

1. The San Joaquin River/South Delta Floodplain to the southern boundary of the legal Delta, including all of Pescadero Tract and Paradise Cut, and Reclamation Districts R-2075, R-2084, R-2085, R-2094, R-2095, the portion of R-1077 generally north of Bethany Road, and the portion of R-2058 north of I-205. This SAMP would address:

- Flood safety
- A natural floodway for the San Joaquin River sufficient to account for restored river flows, climate change, and sea-level rise
- Non-structural floodplain management
- Protection and enhancement of river and slough corridors and riparian vegetation
- Fish passage and fish habitat restoration
- Flood tolerant land uses
- Reconciliation of existing flood-intolerant land uses
- Water diversion management
- Water quality
- Recreation, boating, and waterway access.

2. The Cosumnes River/Dry Creek/Mokelumne River confluence, generally east of I-5 running from the southern border of New Hope Tract to the northern border of Glanville Tract to the eastern boundary of the legal Delta. This SAMP would address:

- Protection and enhancement of river corridors and riparian vegetation
- Flood-tolerant land uses
- Non-structural floodplain management
- Ecosystem restoration
- Water quality

3. Isleton/Brannan-Andrus Island, defined as all of Brannan-Andrus Island not currently in the primary zone. This SAMP would address:

- Protection of life and property under current conditions, and under sea level rise
- Emergency services and access, under current conditions and multi-island failure conditions
- Levee failure response
- Seismic safety
- Benefit/cost analysis of levee upgrade options
- Implications of Brannan-Andrus levee failure for other islands, Delta hydrodynamics, and salinity intrusion

4. Bethel Island. This SAMP would address:

- Protection of life and property under current conditions, and under sea level rise
- Emergency services and access, under current conditions and multi-island failure
- Seismic safety
- Levee failure response
- Benefit/cost analysis of levee upgrade options
- Implications of Bethel Island levee failure for other islands, Delta hydrodynamics, and salinity intrusion

In addition, there are areas within the current legal Delta where state oversight of land use may be unnecessarily extensive for the purposes of protecting state interests, such as heavily urbanized areas of West Sacramento and elsewhere that are currently categorized within the secondary zone. These areas should also be the subject of SAMPs, in order to focus state oversight on protecting state interests related to the co-equal values and public safety.

Among specific actions to be analyzed and implemented as judged effective are:

- The Governor should immediately issue an Executive Order that provides guidance consistent with our Vision and Strategic Plan on inappropriate land uses in the four areas named above.

- The Legislature should ensure that pending the adoption of SAMPs, land development actions shall comply with DPC policies.

- Once the California Delta Ecosystem and Water Plan is finished, charge the DPC with creating the Special Area Management Plans named above so that they are consistent with the California Delta Ecosystem and Water Plan and the Delta Protection Commission's Resource Management Plan.

Action 11.3: Have the Delta Protection Commission lead a process to draft Specific Plans for the Delta's legacy towns.

These plans will assist the legacy towns' protection and continued vitality by:

- Planning the construction of ring levees at a level of flood protection consistent with appropriate development patterns for the legacy towns.
- Siting the ring levees to allow long-term growth consistent with the towns' historic internal needs, the towns' historic growth rates, the Delta Protection Commission's Management Plan for the primary zone, and the architectural and cultural character of the existing communities.
- Encouraging new investment in legacy towns associated with recreation, tourism, ecosystem revitalization, and multi-functional agriculture.
- Protecting productive agricultural lands, especially those that can provide public benefits in addition to food and fiber.

Specific plans for the legacy towns should strategize the financing of new flood protection consistent with appropriate, small-scale development and the criteria listed above. These specific plans should also include consideration of the full range of topics dealt with in local plans in California, including economic development, public services and infrastructure.

Among specific actions to be analyzed and implemented as judged effective are:

- Mandate the Delta Protection Commission to lead a process to draft Specific Plans for Delta legacy towns, in coordination with the Central Valley Flood Protection Plan process.

Strategy 12. Improve the Delta's flood protection and levee system by improving upstream flood management, designing and financing levee types to protect specific land uses and services, and conducting comprehensive emergency management planning and preparation.

The Delta is, first and foremost, a floodplain where several major river systems meet. Residents of the Delta have lived with periodic floods for generations, and nothing can make that threat entirely disappear. Designing an appropriate flood protection system will therefore mean striking the right balance between strategic levee investment and a wide variety of other measures, including comprehensive flood protection planning in the Central Valley and emergency preparedness planning in the Delta region.

The State of California is beginning a new Central Valley Flood Protection Plan that will ultimately achieve 200-year flood protection for the entire Central Valley (i.e. the entire Delta watershed). This will be a major improvement over existing protection levels, and will provide needed requirements for land use decision making in floodplains throughout the Valley, including in the Delta. The CVFPP should emphasize upstream infiltration and floodplain storage wherever possible so that protection of the Sacramento and San Joaquin Valleys does not come at the expense of the Delta.

Action 12.1: Reduce flood threats to the Delta, and increase the flexibility and reliability of water management in the Delta watershed, by improving upstream flood management.

This involves the following measures:

- Acquiring lands or flood easements to create a flood bypass on the lower San Joaquin River that reduces flood threats to the urbanized areas of northern San Joaquin County.

- Acquiring lands or flood easements to expand the floodplain of the Cosumnes-Mokelumne River in the vicinity of Stone Lakes.
- Increasing the flood conveyance capacity of the San Joaquin River by expanding and restoring floodplains beginning at the Delta's edge and working upstream.
- Infiltrating and storing more floodwater upstream of the Delta using both groundwater and floodplain storage in the Sacramento Valley, San Joaquin Valley, and the Tulare Basin, as well as opportune sites in the upper watersheds.
- Re-operating reservoirs to increase water supply yield without compromising flood management, at least partially by conveying some stored water to groundwater basins.

Improving flood protection for the Delta is essential to its future, and is an important component of our Strategic Plan. Flood management must take a watershed-wide approach, rather than focusing exclusively on Delta levees. In coordination with Action 11.1, these actions would allow more floodwater to be passed safely through the upstream reservoirs, the river channels, and the Delta. This not only reduces flood risk, but also could allow upstream reservoirs to devote more of their space to water supply storage (rather than leaving it empty for flood storage), increasing total yield for water users.

At the same time, the more water (either runoff or reservoir water) that can be infiltrated into groundwater upstream, the more total water yield there is in the system, again to the benefit of water users. These actions as a whole could have major benefits for the co-equal values and for the Delta as a Place.

Among specific actions to be analyzed and implemented as judged effective are:

- Use existing bond funds to begin acquiring title or easement to floodplain lands immediately, especially in areas where urbanization threats are high

- Instruct the Department of Water Resources to strongly consider the other actions listed above as part of the Central Valley Flood Protection Plan.

Action 12.2: Enhance the Delta levee system by linking levee designs and financing to the land uses protected, and the services provided, by the levees.

Delta levees provide a wide range of important services, ranging from flood protection for farmland, urban areas and infrastructure to controlling salinity intrusion and providing habitat. Each of these services has different beneficiaries and may require different levee designs, depending on the physical characteristics of a given location. Our Vision therefore argued that not all levees should provide equal levels of protection. Figure 7 describes what land uses may be appropriate for specific cross-sections, and Figure 8 illustrates some designs currently in use in the Delta.

Assessment districts should be created for levees that provide urban protection, infrastructure protection, salinity control, or water conveyance services, wherein all of the beneficiaries directly contribute to the costs of improvements for the levees from which they benefit. These funds can be shared with local reclamation district funds to upgrade selected levees to levels of protection appropriate to the service provided. Those determinations should be aided by an economic risk analysis for the current water conveyance and with dual conveyance that includes hydrodynamic modeling for salinity intrusion under plausible levee failure scenarios with varying levee designs.

Over time, the State Levee Maintenance (Subventions) Program should be directed solely toward those levees that do not provide these additional services (e.g. non-urban and agricultural levees), with the ultimate goal of raising these to PL84-99 standards. Existing cost-share arrangements between the state and local reclamation areas should be continued for these areas.

In addition, a permanent entity devoted to the study of existing levee conditions and performance, and research and development of new levee designs, should be created. Research and development should focus on:

- Reducing the cost of seismically resistant and seismically recoverable levees
- Appropriate designs and potential costs for setback levees
- Appropriate designs and potential costs where critical or historic structures are on or immediately adjacent to the levee.
- The physical feasibility and cost of multi-island ring levees (a.k.a. "polders"), especially in the west Delta
- The physical feasibility and cost of interior cross-levees to partition islands into more easily protected pieces
- "Green engineering" principles that propose to use planned vegetation to improve levee strength, reduce the risk of flooding, lower costs of reclaiming flooded islands, reduce subsidence, and improve habitat. These principles may have particular relevance to the river corridors designated under Action 11.1.

Among specific actions to be analyzed and implemented as judged effective are:

- Create four special assessment districts covering beneficiaries in urban areas, beneficiaries of infrastructure systems, beneficiaries of salinity control, and beneficiaries of water conveyance services.

- Conduct economic risk analysis to set the fees that beneficiaries will pay

- Establish a research entity within the Science Program (see Action 1.4) to conduct research and development on new levee designs as described above.

Action 12.3: Create a Delta-specific emergency response strategy cooperatively among emergency response agencies to clearly define individual roles and responsibilities and identify gaps in existing response efforts.

Within two years, the State should complete a collaboratively prepared Delta-wide emergency response strategy that includes life safety personnel, evacuation, animal control, and public safety, as well as flood fighting needs in an emergency. The plan must be comprehensive and incorporate existing organizations, recognizing their respective authorities for conducting their portion of emergency response needs in the Delta. The strategy must identify problems, such as gaps, overlaps or conflicts among these organizations responsible for emergency response and work within existing authorities to address these problems.

This collaboration must include the Delta Protection Commission, the Department of Water Resources, the Governor's Office of Emergency Services, the Delta counties Flood Response Group, the U.S. Army Corps of Engineers, the Department of Defense, the Department of Transportation (U.S. Coast Guard), the regulated utilities, the railroads, reclamation districts, and water purveyors both public and private. The entities involved in a comprehensive emergency response strategy must conduct exercises together to determine in emergency planning or response still exist. The Delta Protection Commission should be a partner, with the emergency response agencies, to provide Delta-specific information and insights concerning the social aspects of emergency response efforts, including identified gaps within existing plans and response processes.

Among specific actions to be analyzed and implemented as judged effective are:

- Complete the emergency response plan that the Governor ordered the Department of Water Resources and the Governor's Office of Emergency Services to create in coordination with other relevant state agencies.

- Provide grants, matching resources and contracts to the Office of Emergency Services and the Delta Protection Commission to support these efforts.

Action 12.4: Reduce risks to the critical infrastructure passing through the region by conducting a comparative analysis of the long-term costs and benefits of levee reinforcement, armoring of individual facilities, and system co-location, relocation, or tunneling.

With respect to highways, the State of California should conduct a comparative analysis of the costs and benefits of:

- Reinforcement of levees protecting highways against seismic and other levee failure threats;
- Armoring or raising individual highways or segments;

- Co-location of highways with adjacent infrastructure systems into fortified corridors;
- Relocation of highways to areas with lower flood risks both now and under expected sea level rise conditions.

In addition, the state should organize a consortium of public utilities and other infrastructure service providers to conduct a comparative analysis of the collective long-term costs and benefits of:

- Reinforcement of levees protecting infrastructure systems against seismic and other levee failure threats;
- Co-location of adjacent infrastructure systems into fortified corridors;
- Relocation of infrastructure systems to areas with lower flood risks both now and under expected sea level rise conditions.
- Tunneling infrastructure systems below the Delta.

Executive Order S-17-06 that created Delta Vision specifically identified transportation and utility infrastructure as a critical aspect of the Delta Vision. The service providers themselves are in the best position to conduct assessment of the long-term risk exposure facing these systems. Highways should be considered separately, since they are directly managed by the state and are essential to emergency response efforts in the Delta.

These analyses must consider the full range of economic and life safety consequences of service outages, the likelihood of such outages, and the proportionate share of the collective costs and benefits achievable under alternative (b) above. The analyses must consider these costs and benefits over a time period commensurate with the expected lifespan of the infrastructure system in question, not any shorter planning horizon dictated by financial or regulatory processes.

Among specific actions to be analyzed and implemented as judged effective are:

- Mandate that the California Department of Transportation conduct the highway assessment outlined above.

- Mandate that the California Public Utilities Commission and the California Energy Commission form the consortium to conduct the infrastructure analysis outlined above.

- Assist infrastructure service providers in coordinating and executing any mutually beneficial actions that the analyses find to be necessary.

Action 12.5: Embark upon a comprehensive series of emergency management and preparation actions, beginning immediately.

Our Vision contained a series of near-term actions that we urge the State of California to commence immediately, including a broad suite of emergency management and preparation actions. The urgency to complete the following actions has not diminished:

- Clarify chains of command for responses to emergencies;
- Establish clear benchmarks for recommending and demanding evacuations;
- Develop good regional evacuation plans, including evacuation routes and shelter locations;
- Begin emergency response exercises and drills with citizens as well as emergency response personnel;
- Stockpile and pre-position supplies, including caches for citizen emergency response;
- Earmark money and give spending authority for rapid response;
- Sign contracts for barges along the West Coast to move people and supplies. In a major event, California will likely need help from other states and any existing mutual aid agreements should be assessed and improved as needed;
- Ensure that adequate human labor resources to repair breaches will be available, and sufficiently mobile in the Delta, after any potential disaster.
- Set up a Boat Search and Rescue Marshal Program for rapid evacuation of neighborhoods;
- Change building codes to require exits to a building's roof from the inside;
- Paint lampposts on every block behind levees to show the 100-year flood or sea level, to address human tendencies to underestimate risks and avoid disaster preparation; and
- Begin required school programs about emergency training.

State government should also immediately conduct an emergency disaster planning exercise in the Delta, involving all appropriate federal, state and local agencies.

Among specific actions to be analyzed and implemented as judged effective are:

- Instruct the responsible emergency response agencies (see Action 12.3) to carry out the actions named above, commencing immediately

Figure 1

First Staff Draft Governance Structure

The authorities of state and federal agencies described in this figure are limited to Delta Vision-related activities.

This diagram is a draft work product of Delta Vision staff and has not been seen or reviewed or endorsed by the Delta Vision Blue Ribbon Task Force.

Key:

- authority
- consistency
- coordination

CALIFORNIA DELTA ECOSYSTEM & WATER COUNCIL

- adopts the Plan that implements the two co-equal goals: ***revitalization of the Delta ecosystem*** and ***reliable water supply for California***
- is a quasi-legislative body
- has bond authority
- delineates state interests and risks
- receives and allocates money

DELTA SCIENCE and ENGINEERING BOARD

- independently advises the Council on scientific and engineering issues
- supports adaptive management policy-making

SCIENCE PROGRAM

- coordinates research on critical processes
- coordinates independent reviews of projects & proposals

CALIFORNIA DELTA ECOSYSTEM and WATER PLAN

used to achieve consistency with all state and federal action via CZMA, legislative authority, and other consistency requirements

DELTA OPERATIONS TEAM

- coordinates and makes operational decisions on a day-to-day basis
- makes decisions in accord with SWRCB Delta water quality standards
- includes state & federal agencies

PUBLIC ADVISORY GROUP

additional STATE and FEDERAL AGENCIES

DELTA PROTECTION COMMISSION

- ensures local land use planning consistency with the Plan
- promotes economic development within the Delta

CALIFORNIA WATER UTILITY

- owns, operates, and maintains the SWP, including power and flood aspects, in accord with the Plan's Delta water quality standards
- manages SWP contracts
- ultimately expands to CVP

STATE WATER RESOURCES CONTROL BOARD

- incorporates and approves the Plan through a water quality control plan amendment and associated water rights decision or other proceeding, as appropriate
- regulates based on Delta water rights and water quality standards identified in the Plan

DEPARTMENT of WATER RESOURCES

- statewide water and flood planning & management (the California Water Plan), including
  - water use efficiency and conservation
  - regional self-sufficiency
  - integrated water resources management
- integrated management of hydrology
  - state framework
  - regional application
- monitors water quality and flow
- gathers objective information

integrated land-water ecosystem planning & information

DEPARTMENT of FISH and GAME

- implements the state Endangered Species Act
- enforces species and habitat protection laws

CALIFORNIA DELTA CONSERVANCY

- restores the estuary through land and water acquisition and management
- has a scientific research capacity

Figure 2. The "Restoration Recipe"

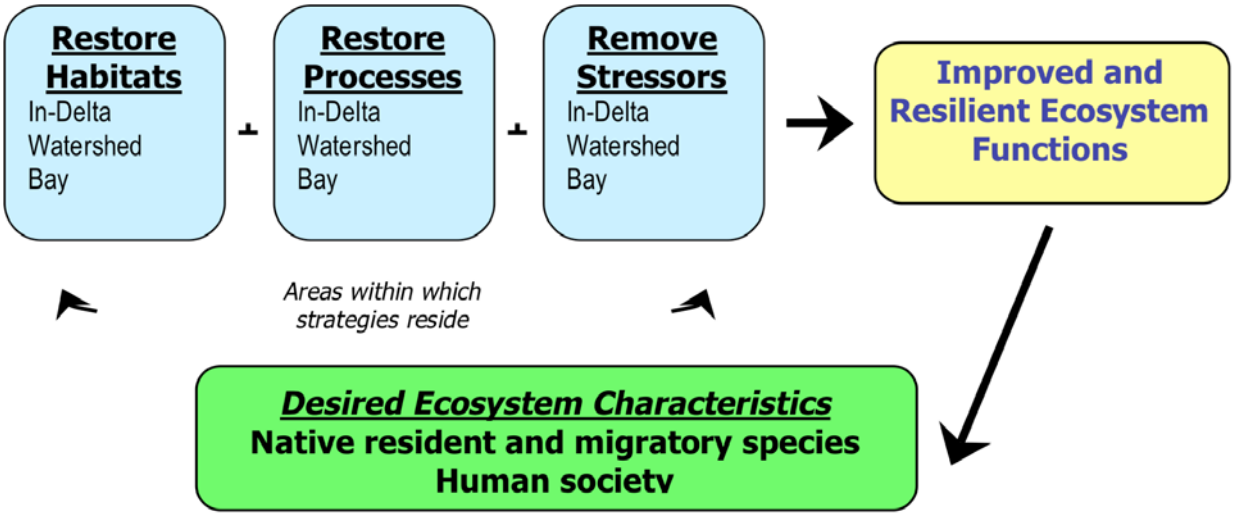
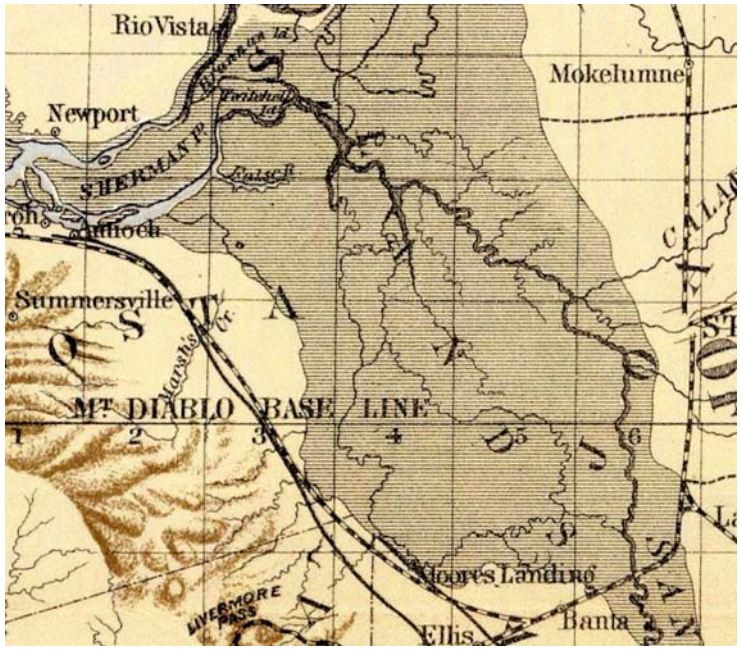
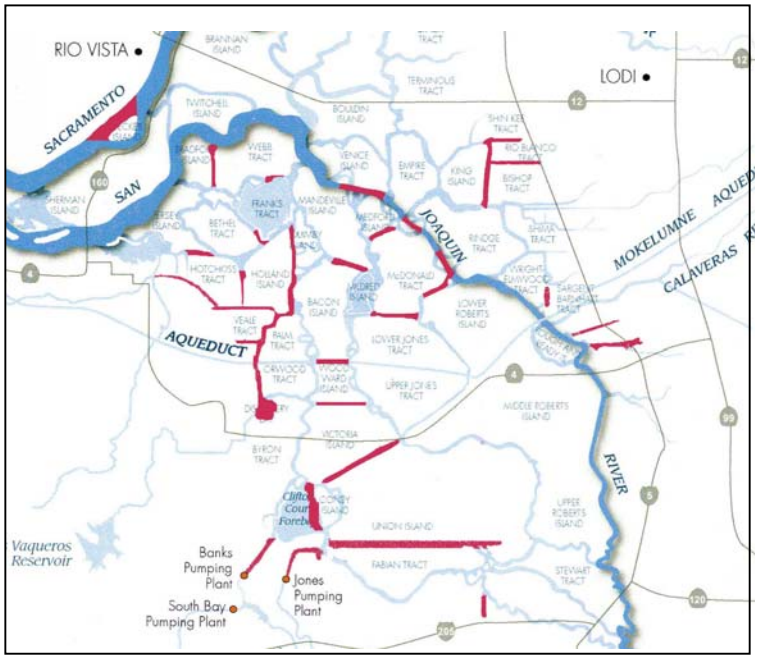


Figure 3. Natural branching versus man-made "cross-cuts" in south Delta channels.



Natural branching channels in the Delta in 1873



Channels in red are the man-made "cross-cuts" in the Delta of today (data from Department of Water Resources Delta Atlas)

Figure 4. Sectional view of typical tidal marsh in the Delta/Suisun region
(courtesy of Stuart Siegel, Wetlands and Water Resources, Inc., from Moffat and Nichol)

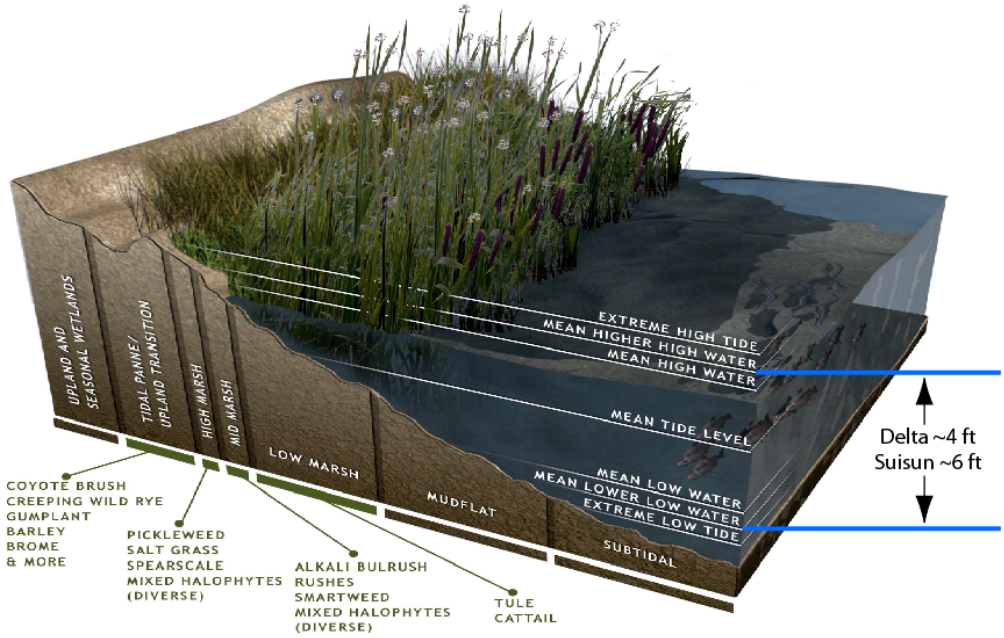


Figure 5. Current points of Delta flow and water quality control
(courtesy of State Water Resources Control Board)

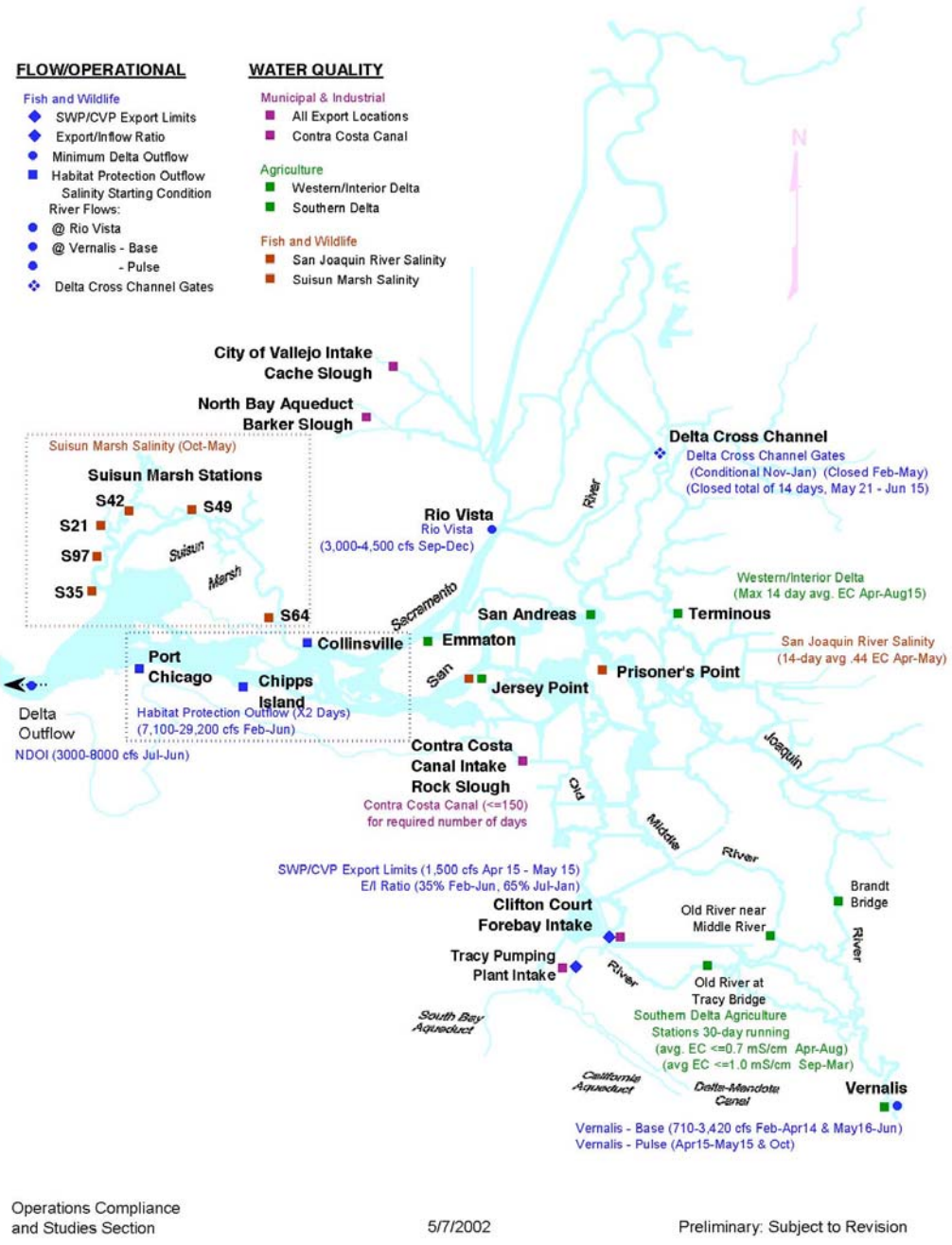


Figure 6. Possible dual conveyance alignments and cost estimates
(Image and data from California Department of Water Resources)

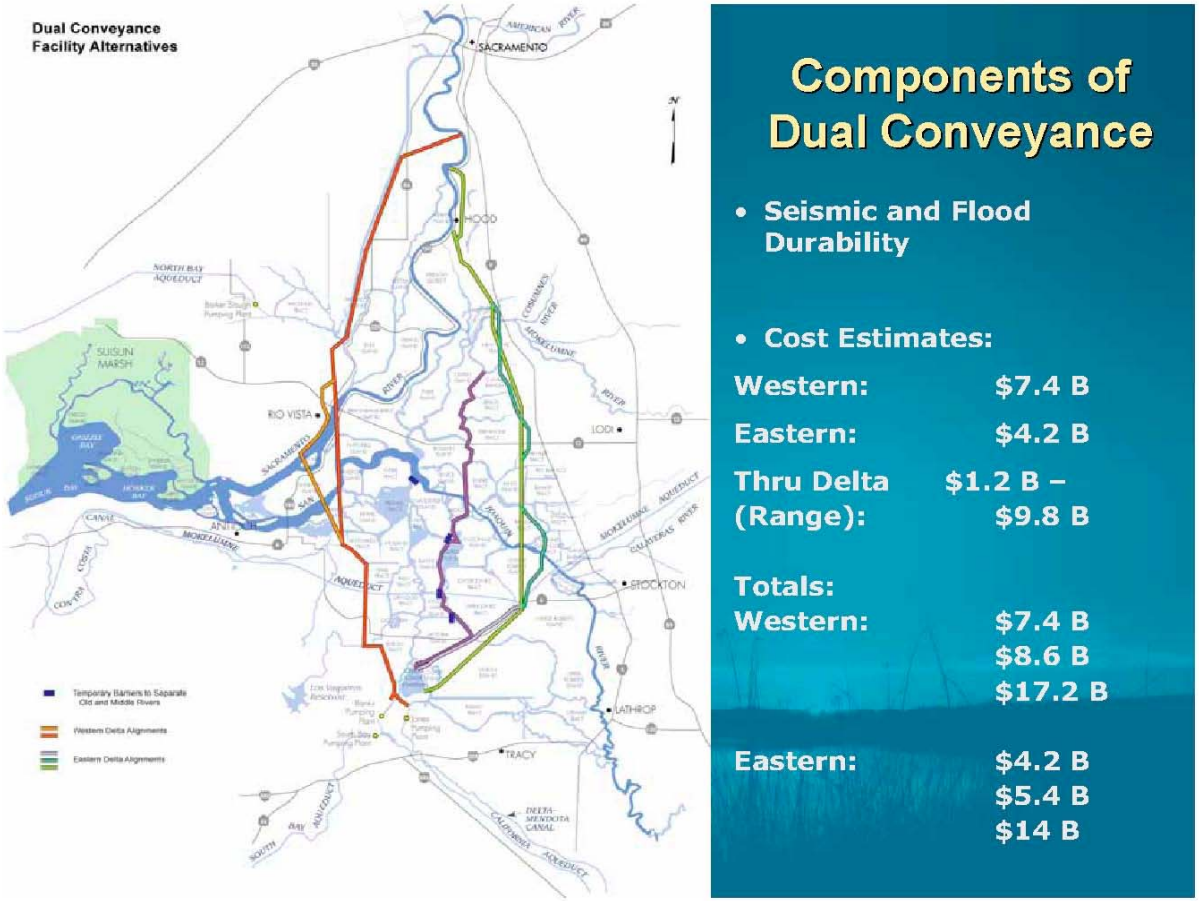


Figure 7. Levee types and potential associated land uses

	Levee Types					
	Enhanced Suisun Class	**HMP**	**PL 84-99**	**FEMA / Urban**	**Seismicly Repairable**	**Seismically Resistant**
	For shallow inundation	Deeper inundation		with sea level upgrade		
Purposes	Hunting, recreation	Hunting, recreation	Agriculture	Housing	Agriculural infrastructure	State highways
	Carbon sequestration	Carbon sequestration	Critical eco-restoration	Commerce	Oil & gas pipelines	Bridges
	Eco-restoration	Critical eco-restoration	Hydro / salinity control		Hydro / salinity control	Emergency Services
	Flood-tolerant agriculture	Flood-tolerant agriculture	Commercial recreation		Aqueducts	Oil & gas pipelines
		Hydro / salinity control	Marinas			Hydro / salinity control
						Aqueducts

Figure 8. Cross-sections of typical levee designs in common use in the Delta.
Not exhaustive of existing or potential levee designs.