



GOVERNOR SCHWARZENEGGER'S CALIFORNIA PERIPHERAL CANAL



November 16, 2009
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It is easy to put a price on water, but the environment is priceless...

INTRODUCTION

Long fought water wars continue in California. The increasing population and repetitive drought conditions impose the need for revamping the outdated water system. Pressures from Los Angeles County and the agriculture industry force state officials to take action. The immediate solution is to continue to draw water from northern California to southern, via costly man-made canals and pipelines. The Sacramento-San Joaquin Delta river system has the largest, feasible supply.

The plan to route massive amounts of water from the Sacramento River, around the periphery of the Delta, will remove a primary, freshwater source from this vast estuary. Environmentalists express concern for endangered species such as the Delta Smelt. This ecosystem is already in grave decline from numerous impacts. Water exportation is now the greatest threat. Governor Schwarzenegger has made the construction of the peripheral canal a top priority. Controversy continues between environmentalists and northern California residents, versus southern California residents and farmers. Balancing the needs of water deprived stakeholders has become one of the state's greatest challenges.

A decision needs to be made to alleviate current drought stricken regions and to restore the Delta environment. The following will present the real issues of the matter and provide stakeholder views and needs. Current management and framework will be discussed. Realistic recommendations will be suggested as a means to resolve this current crisis. The best solution will harmonise desired outcomes of both the need to rehabilitate the Delta ecosystem and provide a reliable water supply to the state.

SOCIO-ECOLOGICAL DYNAMICS

The Delta

The Sacramento-San Joaquin Delta (Fig. 1), near Stockton, California, is one of the state's most ecologically significant landscapes (DBRTF, 2008). Residents and visitors attest to its tranquil mood created by its gorgeous sunsets, its 1,000 miles of flat river sloughs and the escape from urban

development. The Delta is ideal for water skiing, fishing, bird watching, kayaking and much more. Old, historical towns remain virtually unchanged. Small town residents and farmers occupy the Delta's some 60 small islands, many family generations continuing their century long businesses. Local marinas and restaurants help to preserve this closely tied community (DBRTF, 2008).

The Delta is also home to 750 species, including 55 fish species (DBRTF, 2008). 80 percent of the state's salmon fisheries occur here. Millions of migratory birds rely on this 1,300 square mile estuary for wintering grounds. Natural freshwater flows throughout the Delta system and maintains a healthy ecosystem by flushing sediments, providing nutrients, increasing dissolved oxygen and cooling temperatures (DBRTF, 2008).

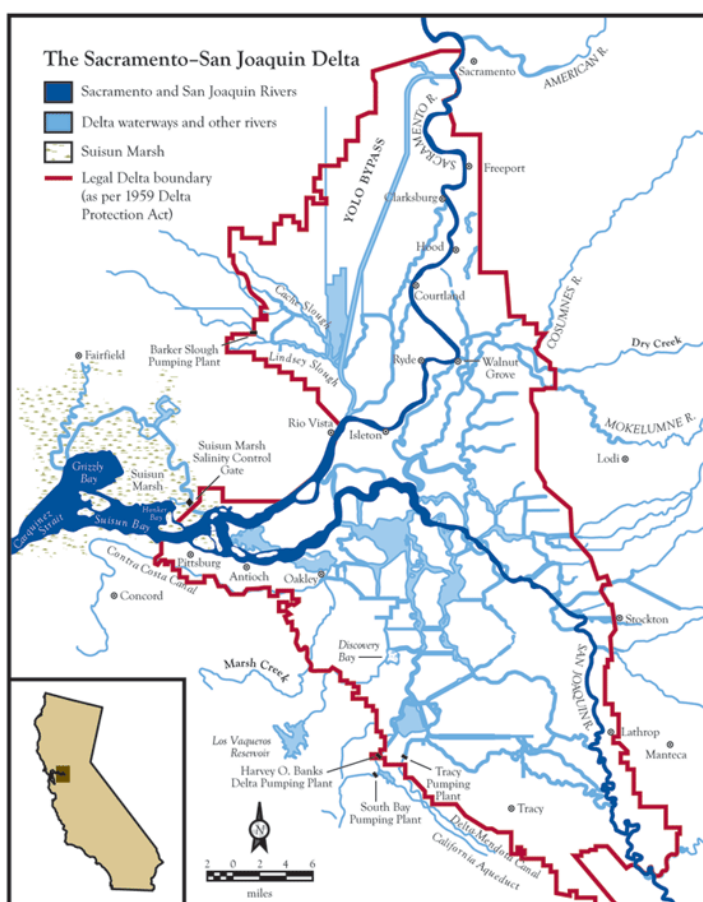


Figure 1. Map of the Delta's complex waterways in northern California. The two dark blue rivers are the Sacramento (north) and San Joaquin (south). (Latham&Watkins, 2009)

Delta Smelt

Delta smelt, *Hypomesus transpacificus*, are a small, silvery fish which was once plentiful in the Delta's freshwater ecosystem (Bennett, 2005). They are the "most imperilled estuarine fish species in the United States". Anthropogenic impacts, such as pesticide runoff and predation by invasive species, have devastated the population; which is now a federally endangered species. Studies

designed specially for Delta smelt were limited to only two surveys by 2005. This short lived endemic species is highly susceptible to entrainment into water export facilities. The population will most likely continue to decline with our continued water uses. Our lack of knowledge on this species requires immediate research to help alleviate consequences of our actions (Bennett, 2005).

To replenish the Delta smelt, freshwater discharge must be controlled to maintain low salinity and low pesticide concentrations (Bennett, 2005). Physical restoration of shoreline habitat will ensure there are available spawning grounds for smelt and other salmonoids. Most importantly, water export must be minimised while impacts are assessed so we can gain a greater knowledge base to better predict future outcomes (Bennett, 2005).

The Dilemma

California's population bloomed with the height of the gold rush in the 1800s (DWR, 2009b). As metropolitan areas such as San Francisco and Los Angeles expanded, so did the need for a steady drinking water supply. In the 1930s, the Central Valley Project (CVP) was enacted, bringing water from the Delta and other northern California rivers, to central residents and farmers. Later, in 1960, the State Water Project (SWP) was born. Today, the SWP is the nation's largest water and power conveyance system (DWR, 2009b). These two systems pump water directly from the south Delta, drawing flow in an unnatural direction (Nobriga, 2008). The lack of scientific knowledge prevents us from predicting adverse impacts on the Delta biota. As the southern California desert population continues to flourish and demand more water, freshwater ecosystems from northern California water sources are strained.

The Delta suffers from effects of water exportation, fish population collapse, invasive species, and levee deterioration (DBRTF, 2008). Pesticide runoff from adjacent farmland into the San Joaquin River is also a concern for causing deleterious effects on aquatic species. *"Three years of below-average rainfall and lighter-than-average snowfall in the Sierra Nevada, combined with federal pumping restrictions intended to protect delta fish, have created a severe water shortage for much of the state"* (Young, 2009). Drought has been a concern in California for decades and continues to negatively affect farmers. Last year hundreds of thousands of acres of farmland were fallowed, resulting in great economic loss (DBRTF, 2008). The need for Delta restoration and an increased, reliable water supply is more than evident. Simultaneously accomplishing these goals is the challenge our governor is faced with today.

Current Solution

Governor Schwarzenegger has made overhauling the state's outdated water system a priority (Young, 2009). Democrat and Republican parties are having difficulty finding a common ground for a long-term solution. Lawmakers in the Delta area are concerned that farmers and southern California water districts will be favoured with upcoming decisions, while northern California water agencies fear the loss of existing water rights (Young, 2009). The long debated idea of a massive peripheral canal has been heavily fought in the past and is known as the "third rail", meaning it is something to be avoided due to its negative effects (Wilson, 2008). The major canal was first discussed around fifty years ago and was voted down in 1982 (Fig. 2) (DWR, 2009b). Now, the construction of the peripheral canal is being heavily pushed by the governor, in his last year of term. Rather than continuing present exports from the SWP and CVP, which are causing reverse flow, the peripheral canal will supposedly 'fix' the Delta's problems, as well as solve the water crisis (DBRTF, 2008).

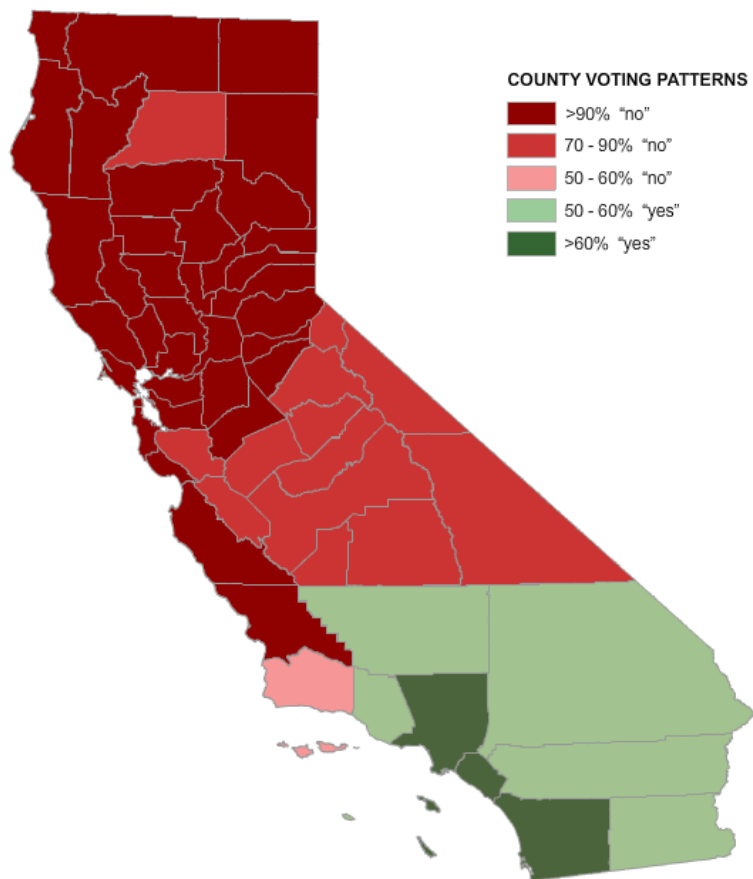


Figure 2. California votes by county on Proposition 9, against the peripheral canal in June, 1982. Northern Californians were strongly opposed while southern residents showed great support. (PPIC, 2009)

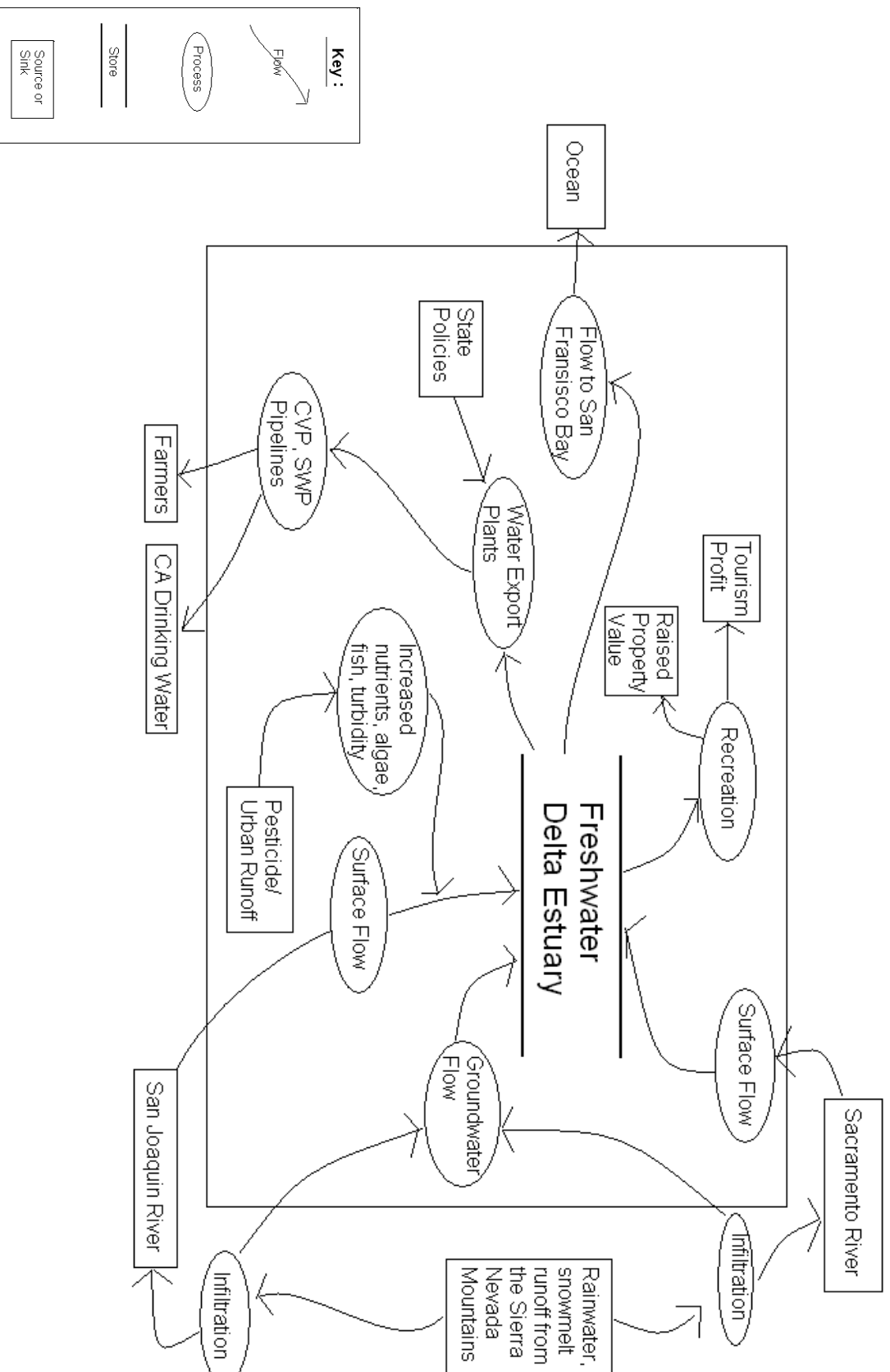
The canal will supply 25 million Californians with drinking water, delivering water to the SWP and CVP pipelines (WGI, 2006). Freshwater from the healthy Sacramento River will be pumped out at 15,000 cubic feet per second. The intended structure will be 46 miles long, 23.5 feet deep and 500 to 700 feet wide at the surface. There will be eleven inverted siphons, four flow control structures, which control the surface water elevation, a pumping plant to raise the water level up fifteen feet, and numerous road and railway crossings over the canal (WGI, 2006).

This supposed long-term remedy will not solve the water crisis or rehabilitate the Delta, according to Barbara Barrigan-Parilla, director of the NGO "Restore the Delta" (KQED, 2009). On November 4th, just two weeks ago, California lawmakers approved the last of six bills which will help pass the construction of the new canal infrastructure (Therault, 2009). More than \$11 billion of state funding will go towards new dams and other water projects. Groundwater will be monitored throughout the state. Residential water restrictions will cut back 20 percent of use by the year 2020 (Therault, 2009). Though this sounds appealing, residential conservation efforts minimally preserve a mere four percent of the supply when compared to the 80 percent fed to agriculture (KQED, 2009). Water restrictions should also apply to Los Angeles, which has a population of almost ten million people (USDOC, 2009).

Cost analysis of the total project was estimated in 2006 by Washington Group International to be around \$3.5 billion (WGI, 2006). Other estimates are as high as \$20 billion (KQED, 2009). After the project is underway, it is uncertain who will fund future environmental mitigation efforts which could cost \$50 billion. If the bond is not passed by voters, the peripheral canal can still go forward. Aaron McLear, press secretary for Governor Schwarzenegger stated that it is known Delta residents and farmers will not be happy with the decision, but this is the chosen solution for a stable water supply (KQED, 2009). Perhaps gaining community feedback and suggested solutions will provide insight to gaining more viable alternatives, rather than assuming stakeholders cannot all be compromised.

The following page provides a diagram (Fig. 3), outlining inputs and outputs for the Delta system and related processes. This simplified flow chart visually displays significant interactions and possible conflicts.

Figure 3. Systems Analysis flow chart of the Sacramento-San Joaquin River Delta estuary.



THE STAKEHOLDERS

Large decisions, such as the peripheral canal can impact multiple groups or organisations. The table below (Table 1) identifies each stakeholder and briefly outlines what they have to gain or lose. Some alternates are more suitable than others, as this management decision affects stakeholders differently.

Table 1. Stakeholder Views

STAKEHOLDER	INTERESTS	BATNA – Best Alternative to Negotiated Agreement	ALTERNATIVE SOLUTIONS
CA Government	Providing a long-term sustainable water supply for CA farmers and residents	Finding an alternative water source acceptable by the public	Research new means of acquiring substantial water sources
Developers	Gaining profit from construction of a massive project	Building similar project with comparable outcomes	Finding alternative project
Farmers/ Agriculture	Acquiring affordable water in larger amounts	At least having minimum water allotment to continue current farming practices	Without enough water, CA agriculture industry would have to change land practice
Central and Southern California Residents	Gaining larger, reliable drinking water source	Water can have alternative source, as long as there is enough	Water restrictions on residents, less water for golf courses, educate public
Delta Residents	Maintaining the community, preventing massive amounts of Delta water from being removed, protect levees	Find way to remove some Delta water while mitigating any environmental damage	Locating alternative water source or means of harvesting freshwater
Marinas/ Delta Businesses	Maintaining or increasing business from residents, visitor's, recreation users	Keeping current number of clients and profit	Somehow making profit from new alterations of waterways
Recreation Users	Continue fishing, water skiing, etc. in aesthetically pleasing surroundings without alterations	Have access to Delta sloughs throughout the appropriate season	Provide alternative locations on Delta which allow applicable activities
Delta Ecosystem	Maintain water quality, amount, stable habitat, minimal levee damage, estuary components	Remediation of affected areas to ensure minimal disruption to Delta inhabitants	Monitor, restore affected components, replace losses

Regardless of the assumed adverse effects on the Delta ecosystem and local residents; farmers, southern California residents, and the governor hold more power in deciding what actions will be taken. Financial interests typically take precedence over impacts to the environment. Unfortunately, this can lead to an economic loss later on, as the environment provides resources which we rely on.

Decision makers must take a holistic approach when resolving this water crisis. *“Other lawmakers, especially those from delta-area districts, railed that they felt excluded from the negotiations that shaped the water bills”* (Young, 2009). It is important to understand all stakeholders’ interests and concerns, and to allow them to feel apart of the process. To maintain a stable water source for California’s growing population, the health of the Delta must be monitored and properly managed. By ensuring biotic components are not severely altered and the minimum amount of water is removed from the system, all stakeholders may be satisfied.

WATER MANAGEMENT

Current water supply is strained from an increasing demand by California residents and especially agriculture. Governor Schwarzenegger’s immediate relief entails tapping into the Delta from the Sacramento River, while continuing to draw from the CVP and SWP. To alleviate impacts on the recently publicised endangered Delta smelt, a \$30 million project will be erected this year (DWR, 2009a).

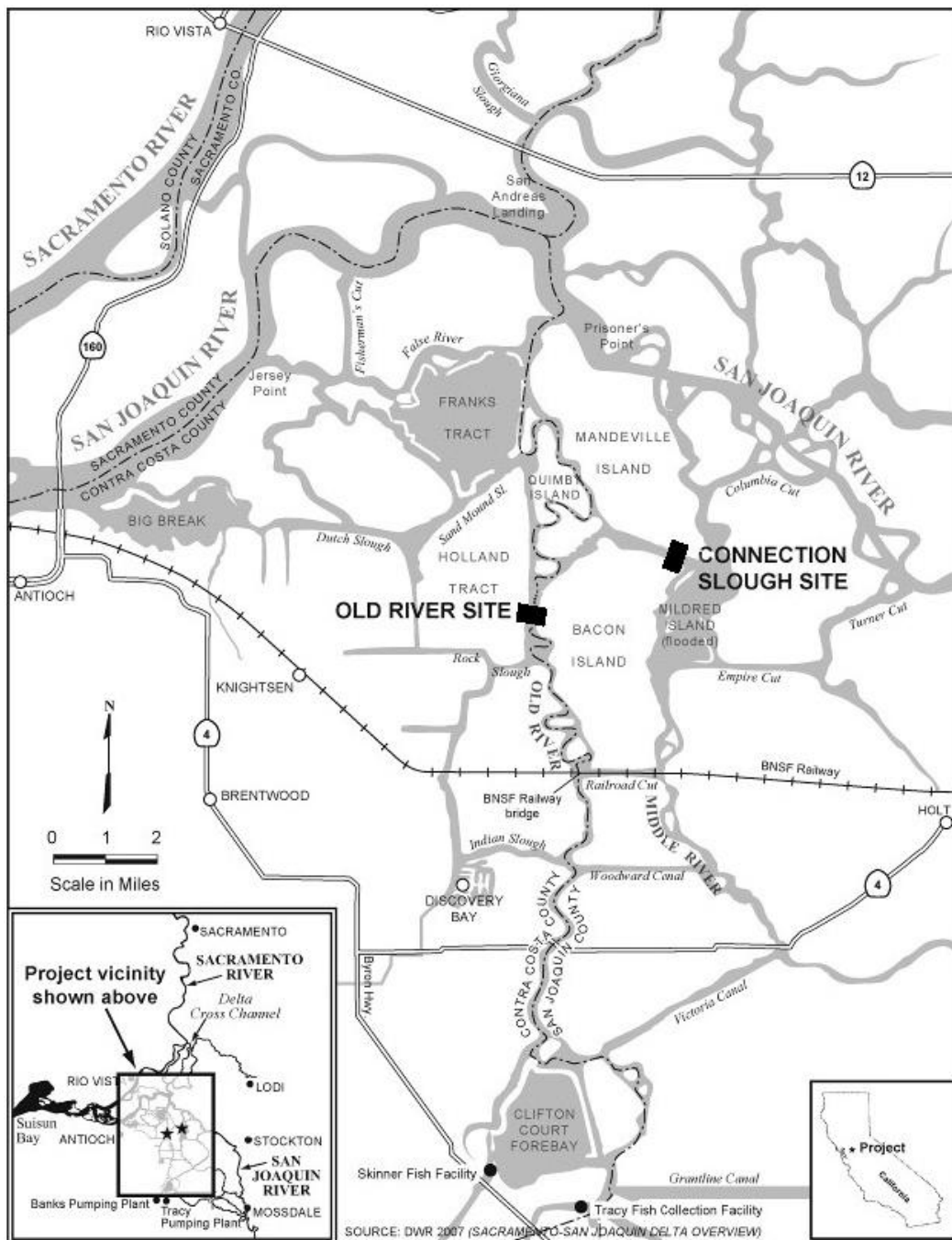
A recent government study on delta smelt indicates smelt abundance increases in some areas with water clarity and low salinity levels (Nobriga, 2008). However it is also theorised high flow causes low salinity → increased food-plankton → raised turbidity → inability for prey to visually see smelt. The Delta is the clearest during summer months, March to November. This is when adult smelt inhabit the San Joaquin River and also conflicts with the water export schedule. The protection by the endangered species act requires the state to take action to minimise mortality rates (Nobriga, 2008).

2-Gates Project

The purpose of the 2-Gates Project is to protect Delta smelt from entrainment at export sites, over a five year trial period (CALFED, 2009). In two locations in the central Delta (Fig. 4), temporary 75-foot steel butterfly gate structures will be placed. Sampling stations will collect temperature, salinity,

turbidity, and chlorophyll data. Monitoring of smelt abundance and responses to the project will provide information on project effects and effectiveness. The project is in collaboration with regulatory agencies such as National Marine Fisheries Service and the US Fish and Wildlife Service. Gate operation will alter the flow of waterways, delaying turbidity temporarily. It is hypothesised this may prevent the smelt from moving upstream towards the export pumps. The gates will be partly or completely closed from December through June, during the “off-season” for boaters (CALFED, 2009).

Figure 4. 2-Gates Project locations on the central Delta. (DWR, 2009a)



Growing up on the Delta, boating season actually starts in May. This will cause tension and safety concerns for water skiers, swimmers and other recreation seekers. If the gates are in the closed position, sheriff patrol vessels, which usually travel between Bethel Island and the populous Discovery Bay, will have to travel a longer route around the obstructions. Other likely negative outcomes are degradation of levees and financial loss by marinas who rely on business from Discovery Bay boaters. These gates will virtually divide the delta community. If the gates block the smelt from export pumps, they may also prevent them from travelling to their spawning grounds towards the western Delta (Bennett, 2005). This would have a trophic cascade effect on ducks, geese, blue herons and other Delta reliant species. The lack of knowledge of the Delta smelt and the uncertainties of this experimental project should raise much concern for project managers, as this small fish population is especially vulnerable to disturbance. Sceptics are concerned the 2-Gates Projects' actual purpose is to prevent salt intrusion towards current export pumps, rather than to simply protect Delta smelt (KQED, 2009). The 2-Gates Project does not provide a balanced solution for the Delta ecosystem, nor is it likely to be a long-term solution.

A Case Example

The "Bay-Delta Water Crisis of November to December, 1999" was a single-focused management decision (ACWA, 2001). Delta Cross Channel Gates were closed when the Sacramento River flow exceeded 20,000 cubic feet per second (CVO, 2009), to prevent salmon from entering export pipes. Preventing the flow of the Sacramento River into the central Delta resulted in rapid deterioration of water quality below drinking standards for 23 days (ACWA, 2001). This could have been avoided if the gates were re-opened within the month, to decrease salinity and thereby increase fish distribution. Information must be transmitted in a more timely matter. This case illustrates the need for decision makers to continually reflect on changing circumstances (ACWA, 2001).

The Plan

The management plan to construct the peripheral canal from the Sacramento River should be carefully analysed from a scientific, political and managerial outlook, including feedback from stakeholders. By combining interests and goals, a more intuitive approach can help reduce negative results and gain approval by those who are affected by the project. In Washington state, a major delta system has undergone similar changes and has resulted in devastating habitat loss (Jay, 1996). Freshwater diversion not only affects aquatic species, severe changes to sediment transport and bank alterations may also occur (Jay, 1996). It is more important to take time to develop an integrated approach, than risk irreversible damage to a fragile estuarine ecosystem. Table 2 below

contains expected outcomes from implementing the peripheral canal as a means of solving California’s water concerns.

Table 2. Assumed Pros and Cons of the Peripheral Canal Project

BENEFITS OF THE PERIPHERAL CANAL	NEGATIVE OUTCOMES
Possible stable water supply for 25 million people Sufficient supply to CA agriculture industry Possible economic gain from selling water Ease government responsibility to solve water crisis	Loss of Delta habitat for natural communities Water quality degradation 2-Gates impacts on recreationists, businesses Aesthetically unpleasing canal from Delta to southern CA Safety concerns on delta with navigating around new canal developments Risk to endangered species Degradation to our primary water source risks the loss of an irreplaceable resource

Previous situations, current scientific knowledge, and stakeholder concerns, should empower decision makers with intuitive skills, which allow them to determine whether the project is feasible and if it balances the needs of others. If the canal were a means to restore the Delta and solve the water crisis, the majority of northern Californian residents would most likely be comfortable with the decision, rather than writing the government thousands of letters in protest every day (Theriault, 2009). If concerns become reality, the situation will only become worse. Perhaps other solutions are readily available which should be further explored, before taking drastic measures with uncertain outcomes.

RECOMMENDATIONS

Freshwater supports all human life on Earth. This limited resource must be carefully managed to maintain its longevity (Baron, 2002). Since freshwater systems are highly dynamic, water management must: incorporate policies which recognise ecosystem needs and variables, include entire catchment area, increase communication and education among all parties, increase restoration, and protect areas of high diversity (Baron, 2002). A way to alleviate the amount of water needed from the Delta is to acquire water from multiple sources, reduce our use, and to increase water reuse.

The concept of using “involution”, or adaptive resource management may be applied for California’s dilemma (Palmer, 1978). This is an integrated approach, which can be used to resolve the problems

with limited resources. By creating greater use efficiencies and installing green-powered desalinization plants, we can maximise our diminishing water supply (Palmer, 1978). Other tactics include the installation of rainwater collection in residential areas. More options are readily available, as companies such as Sydney-based “Ecological Design” (E.D., 2008), offers affordable means of saving significant amounts of water. Large cities should focus on becoming more ecologically sound, by installing efficient street and building designs, which reduce stormwater runoff. Rather than running water fountains, watering lawns and golf courses during the day, strict regulations should be in place. Agriculture should evolve their crops to those which require less irrigation, with scheduled evening watering times (El Asswad, 1995). Farmers, residents, politicians, and school children, should all be educated about the importance of conserving water. Perhaps the most effective, beneficial solution to the world’s water crisis is to control human population growth. This can only benefit our surrounding environment with which we rely on every day.

CONCLUSION

California’s history of continued water issues has only escalated with exponential population growth and farming practices. The time has come when the state government is forced to update its exhausted water system. The simplest solution is not always the most feasible. Governor Schwarzenegger’s decision to create a 700 foot wide peripheral canal to drain 15,000 cubic feet per second will only temporarily solve one major aspect of the problem. Concerned citizens and environmental groups have made it obvious this is not the best solution. Other measures must be taken, to ensure the preservation of the Delta ecosystem, satisfaction of involved stakeholders, and creation of stable water supplies for the future of the state. Continuing long-term monitoring and implementing adaptive, integrated management can achieve the best outcome.

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