REVISED DRAFT REPORT

THE ECONOMIC IMPACT ON STANISLAUS COUNTY OF PUBLIC LAND ACQUISITIONS AND CONSERVATION EASEMENTS ON FLOODPLAIN LANDS ALONG THE LOWER TUOLUMNE AND SAN JOAQUIN RIVERS

U.S. Fish and Wildlife Service Project Number 1933FR02

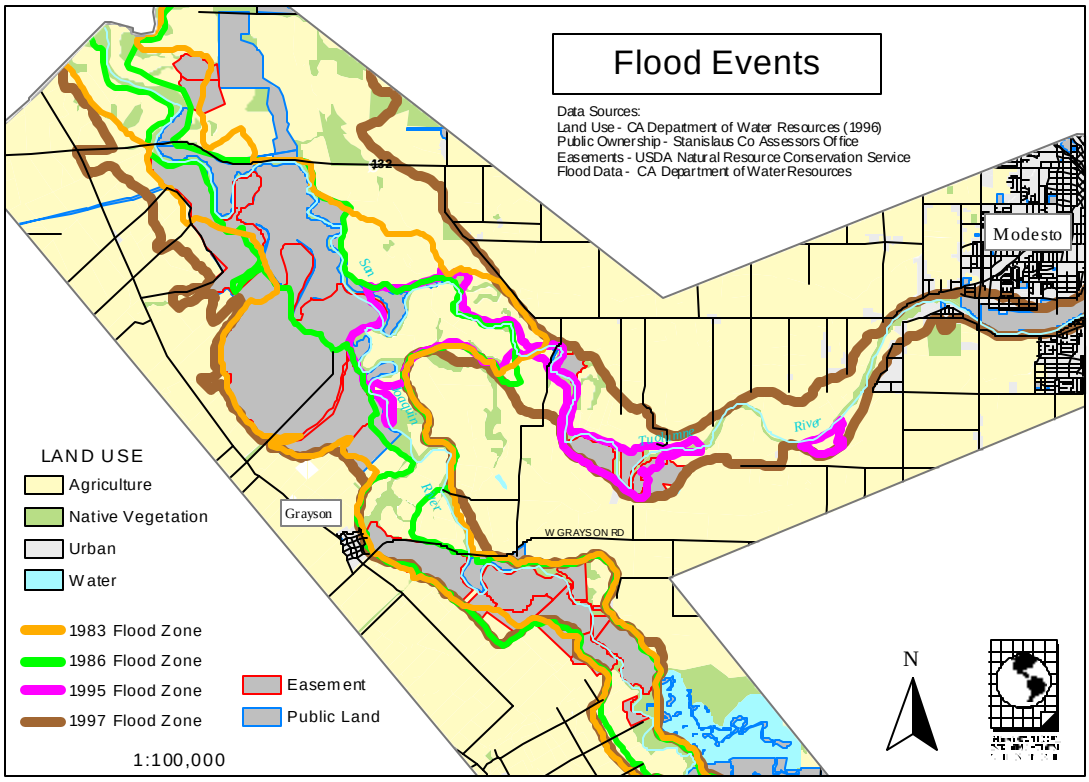
By

Dr. David E. Gallo

With Assistance from Nathan Gallo
And the Geographic Information Center

December 2002

Draft Document
Subject to Revision



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EXECUTIVE SUMMARY

Purpose and Scope of the Study

The purpose of the study is to assess the economic costs and benefits to Stanislaus County of public land acquisitions and easements along the San Joaquin and lower Tuolumne Rivers. The project includes an analysis of the economic impacts resulting from the preservation and restoration of riparian and other native habitat. The study was designed and completed with considerable input from a broad based Technical Advisory Committee (TAC). The review process was a continuous one and is described in some detail in Appendix A. The appendix also includes a list of the TAC members.

The primary negative impact on the county economy is due to the loss of agricultural output on the affected lands and is measured as the net loss of local income. Other losses examined are those that may result from limitations on resource extraction imposed as a part of channel restoration on the Tuolumne River or from the demands placed on available aggregate resources because of the restoration process.

The expansion of habitat will also provide benefits to county residents. Local benefits assessed in this report include recreational benefits and the economic activity generated by habitat and channel restoration activities. Recreational benefits include the enhanced value to anglers using the affected rivers and wildlife watching on the local refuge. Consideration is also given to non-user, or aesthetic benefits, that accrue to residents who do not directly participate in the affected recreational activities. Due to a lack of data, a number of potential benefits are not quantified including the impact on the value of hunting on lands adjacent to restored habitat, canoeing on the Tuolumne River, the value of improvements in water quality, and the value of wildlife watching activities outside of the refuge. In addition, no attempt was made to estimate the value of riverside parks and the activities that might take place within their boundaries.

Geographical Scope of the Report

The study area is limited to Stanislaus County acreage along the San Joaquin and Lower Tuolumne Rivers inundated by the 1997 flood and the 15,000 cubic feet per second (cfs) flood channel (extending 300 feet from each river bank) for the upper Tuolumne River from Geer Road to La Grange. The study area on the San Joaquin and lower Tuolumne Rivers totals 37,005 acres. The 15,000 cfs flood channel on the Tuolumne contains an additional 1918 acres for a total study area of 38,923 acres.

Extent of Public Land Ownership and Conservation Easements (Year 2000)

As of the year 2000 public land acquisitions and easements totaled 7529 acres in the San Joaquin River and lower Tuolumne River flood plain. Of that amount 4741 acres were in agricultural production in 1996 (the year the GIS data were recorded). Most of the land under public control, or 5324 acres, was due to easements ranging in duration from ten years to permanent. Agricultural lands impacted by easements totaled 3511 acres. On the lower Tuolumne River 101 acres were listed as public as of the year 2000. Public Acquisitions were almost exclusively native vegetation as 97 of the public acres are in that land use category.

Future Acquisitions and Easements

Under a willing seller program, land that floods more frequently is more likely to be removed from agricultural production through sale of the land or conservation easements. The GIS data provide land uses by crop within each of the areas flooded by the four flood events since 1980. Significant floods occurred in 1983, 1986, 1995, and 1997. The flood event boundaries are used to establish flood frequency zones. The area that flooded three or four times is roughly contained within the 1986 flood boundaries. Flood frequency zone 2 is approximately that area outside of the 1986 flood boundary but inside the 1983 flood boundary, while flood frequency zone 1 is the area inside of the 1997 flood boundary but outside of the 1983 flood boundary. A map of the study area including the derived flood frequency zones is contained in the front of this report.

The base case assumes additional acquisitions and easements in all flood frequency zones and the Tuolumne River flood channel. Currently, within the Tuolumne River flood channel a negligible amount of agricultural land is affected by public ownership and easements (less than 1 acre). For the base case it is assumed that all agricultural lands in the channel (extending 300 feet from each bank) will be removed from production through a combination of acquisitions and easements. For flood frequency zone 3&4 on the San Joaquin River and lower Tuolumne River public ownership and easements account for 18.2% of the agricultural lands. It is assumed that future acquisitions and easements will increase this percentage to 80%. For flood frequency zone 2 the current public percentage is 53.9% and it is assumed that it will reach 60%. For zone 1 the current public percentage is 14.7% and it is assumed that it will reach 20% in that flood frequency zone.

In addition, a sensitivity analysis is performed to examine the impact of acquisitions and easements in excess of those used in the base case. It assumes acquisitions and easements on an additional 10% of the current private agricultural acreage in each flood frequency zone. Summing the acquisitions and easements from the base case and the sensitivity analysis raises the public ownership shares to 88.2%, 64.6%, and 28.5% in flood frequency zones 3&4, 2, and 1, respectively.

Impacts on Stanislaus County Income due to Past Public Acquisitions and Easements

By the year 2000, 4741 acres of agricultural land within the area delineated by the 1997 flood had been acquired by public agencies or were subject to conservation easements. Land uses are defined by GIS data for the year 1996, prior to public acquisition or the sale of conservation easements. The implicit assumption is that had the land remained in private ownership and control, production of those specific crops would have continued.

Crop Yields Per Acre

Agricultural yields per acre are specified in constant 1998 dollars and are the average per acre yields times the unit price for the 1986 to 2000 period. All agricultural prices are from the Annual Crop Reports for 1986-2000 published by the Stanislaus County Department of Agriculture (Stanislaus County 2002).

Output Impacts
The direct output impacts by crop for all public lands in the three San Joaquin River flood frequency zones and the 600 foot Tuolumne River flood channel are calculated by multiplying the 1998 dollar yields per acre (from Table 2) by the total acres for each crop. These are then summed over all crops produced on the affected acreage. The total direct impact on Stanislaus County agricultural output for all lands currently public or subject to conservation easements is $4,949,470.

Converting Output to Income
The IMPLAN model uses the direct impact on output to estimate the indirect and induced effects. However, output changes are not an appropriate measure of the impact on county income. That is because the output measure double counts the value of products that are also used as inputs in another production process (for example, feed, to milk, to cheese). Income is properly measured as value added and includes wages, proprietor income, property income, and indirect business taxes. By summing the components of county income it excludes the value of inputs and thus avoids double counting. Value added is the local equivalent of Gross Domestic Product (GDP). The unadjusted impact on county value added from existing public acquisitions and easements, including direct, indirect, and induced effects on income, totals $4,666,367.

Deriving the Net Income Impact from the Gross Impact on Value Added
The impact on county value added is assuming landowners receive no compensation for lost income. The components of income that are linked to land ownership are property income and proprietor income. The approach used here is to assume that the sale of the land fully compensates landowners for lost property income, and, in the case where the seller of the land or a conservation easement is also a local resident, it also compensates for losses in proprietor income. Net income losses exclude all property income and 86 percent of proprietor income. Assuming no impact on local property taxes, and, that 100% of all other state and local indirect business taxes and 0% of federal indirect business taxes are returned as local general fund revenues, 25.1% of indirect business taxes are lost to the county when agricultural output is reduced. Where property taxes are reduced as well, 69% of indirect business taxes are lost to the county. The adjusted impact on Stanislaus County of existing public acquisitions and easements is $2,084,911.

Forward Linkages- Impact on the Local Dairy Industry
The IMPLAN model does not include the impacts on industries using agricultural inputs to produce other products. The only forward linkages are those due to local spending of income earned in connection with the value of direct and indirect output. In most cases that omission is not likely to lead to serious distortions. However, in the case of Stanislaus County a significant proportion of agricultural production is of animal feed products used by the dairy and livestock industries. It is assumed that feed production is maintained by shifting land out of vegetable production. Vegetable production is assumed to be composed of dry beans with 10% of the land double cropped. The increase in value added (the net impact on the county) is equal to the difference in the value of vegetable and feed production, or $1,790,237 for existing public lands.

The net impact on Stanislaus county income is the sum of the compensated changes in agricultural income due to past land acquisitions and easements and the effect of forward linkages to the dairy industry, measured here as the impact of changing land use from vegetable to feed production. The compensated income impact is $2,084,911. The effect of a shift in vegetable to feed production is $1,790,237 and the sum is $3,861,147.

Impacts on Stanislaus County Income from Future Public Acquisitions and Easements: Base Case

For the base case, an additional 3,911 acres of agricultural land within the area delineated by the 1997 flood will be affected by public acquisitions or conservation easements. Land uses are defined by GIS data for the year 1996. As in the calculated impacts for current public lands, the implicit assumption is that had the land remained in private ownership and control, production of those specific crops would have continued.

Net Value Added Impacts: Base Case

The IMPLAN estimate of direct, indirect, induced, and total value added for the additional base case land acquisitions and easements is $4,257,436. Adjusting the gross income impacts for compensation paid to private landowners selling the land or farming rights, the net impact is $2,007,371 for the 3911 acres of agricultural land affected, or $513 per acre. The $1,173,302 impact on the dairy industry is calculated based on the assumption that county feed production is maintained by converting 2,307 acres of vegetable production to feed. The total change in Stanislaus County income for the base case is the sum of the additional land acquisition and easement impacts and the dairy impacts, or $3,180,673.

Sensitivity Analysis

The sensitivity analysis assesses the impact of acquisitions and easements on an additional 10% of the private agricultural acreage in each of the flood frequency zones. For this case an additional 1531 acres would be removed from crop production. The direct output impact is $2,122,287 and is calculated by taking the sum of 10% of the value of agricultural production for each of the flood frequency zones. The reduction in value added is $1,974,818. The net impact of public acquisitions and easements for the sensitivity analysis is $964,222. Including forward linkages to the dairy industry of $858,527 results in a total net impact of $1,822,749. For the 1531 acres affected the county income loss per acre is $1,191.

Total Income Losses for Stanislaus County- Past and Future Acquisitions and Easements

The reduction in county income for the base case including the impact of past acquisitions and easements is $7,041,820. The income or value added loss is 0.074% of 1998 Stanislaus County income. If future acquisitions include an additional 10% of the private agricultural land in each of the flood frequency zones (sensitivity analysis) the total impact increases to $8,864,569 and 0.093% of 1998 county income.

All impact estimates are based on crop prices and yields averaged for the 1986 through 2000 period and converted to 1998 dollars. For private lands those yields exceed 1998

yields by between 18% and 28%, depending on the mix of crops in the various flood frequency zones. For acreage currently public or subject to conservation easements the 1986- 2000 per acre yields exceed those for 1998 by between 11% and 25%. IMPLAN estimates indirect and induced impacts based on 1998 prices. Therefore the estimates presented here overstate the total loss of income to the county by a similar percentage. Even assuming agricultural product prices recover to the average for the1986- 2000 period, for total county income to increase by the same percentage, it would require that wages and all input prices increase by that percentage in real terms.

The Cost to Stanislaus County of Reduced Availability of Aggregate Resources
Representatives of the mining industry and some individuals in county government expressed concerns regarding the potential impact of Tuolumne River channel restoration on the future availability of aggregate resources in Stanislaus County. There were two general types of concerns expressed. First, channel restoration will require the use of so much aggregate material that the availability for other uses will be constrained during the three-year restoration process. Second, that limits on mining within the expanded Tuolumne River floodway will reduce the amount of present and future permitted resources.

Whatever problems are presented by constraints on the future availability of construction-grade aggregate in Stanislaus County, it does not appear that channel restoration activities on the Tuolumne River will significantly affect their magnitude. More importantly, residential and commercial development in potential aggregate producing areas cause resistance to mining activities and lengthen the permitting process. This has occurred along the Stanislaus River and without the efforts of some in Stanislaus County, similar impediments could be created along the Tuolumne River (CDOC 2002). Any temporary increase in aggregate prices due to in-channel use will actually increase Stanislaus County income.

Benefits Estimates
Environmental benefits accrue to local residents through two pathways. First, an improvement in environmental quality increases the value to local residents of those activities that depend on the quality of the environment. Fishing is more highly valued when more fish are caught per unit of effort. Wildlife watching is more rewarding and thus greater value is placed on the activity in a diverse environment with more viewable wildlife. For those residents who do not engage in recreational activities on the San Joaquin and Tuolumne Rivers, there are non-user benefits deriving from the existence of enhanced biodiversity and other factors contributing to amenity value. Second, increased spending by visitors generates additional local economic activity. Resident benefits resulting from an increase in the quality of the local environment are measured as the increase in the willingness to pay for affected recreational activities. For nonresident participants the value to Stanislaus County is derived from the travel expenditures of additional visitors.

The Value of a Change in Fishery Quality

A firm value cannot be established for the improvements in fishery quality on the San Joaquin and Tuolumne Rivers. However, a reasonable estimate can be made if based on two plausible assumptions. First, populations of all fish species increase in roughly the same proportion as populations of anadromous fish. Second, that angler response to increases in the catch rate on the San Joaquin and Tuolumne Rivers is similar to what was estimated in previous studies. The increase in populations of anadromous species necessary to meet the AFRP goals are 145% and 266% on the Tuolumne River and San Joaquin River, respectively (AFRP 2002a, 2002b). For the average response rate of 41% of the change in fish populations, fishing days on the Tuolumne River would increase by 109%. On the San Joaquin River a 145% increase in fish populations would increase annual fishing days by 59%. The annual value of these changes to resident anglers is $1,721,414. The income that accrues to Stanislaus County as a result of the increase in visitor spending totals $979,865. Therefore, the annual value of the improvement in fishery quality is $2,701,210.

The Economic Value of Wildlife Watching

The value of wildlife viewing to Stanislaus County is determined as the sum of the value of projected use to county residents and the impact of added local spending by visitors from outside the area. For local residents the daily value is the sum of average daily trip costs ($44.11) and the average net value ($20.63), or $64.73. For refuge visitors from outside of Stanislaus County the impact on the county is the $39.64 increase in county net income per daily visit. Of the 17,500 visitors projected for the SJRNWR 12,662 are assumed to be 16 or older (the same percentage as for the general county population). If refuge users are evenly divided between county residents and visitors from outside of the county the total annual value of the refuge is $660,805

The Economic Value to Non-Users

Benefits from habitat restoration also accrue to residents who do not engage in recreational resource use. The environmental economics literature categorizes non-user benefits as existence, bequest, altruistic, option, and ecological services values. For Stanislaus County 75 percent of households are classified as non-users of recreational resources for hunting, fishing, or wildlife watching (USFWS 1996). Two different and very conservative approaches are used to estimate non-user benefits, both yielding similar results. The average for the two approaches is $468,555 and is used to represent annual non-user benefits**.**

Total Recreational Benefits

There are a number of additional recreational activities that may take place on or near the San Joaquin and Tuolumne Rivers not quantified in the benefits estimates generated in this report. The benefit estimates are limited to the value of a change in fishery quality, wildlife watching on local refuge lands, and non-user benefits. The total value in 1998 dollars for all estimated benefits is $3,830,639. That value includes both the impact on residents and the impact of additional visitor spending on Stanislaus County income.

The Future Value of Recreational Benefits

The real value (in 1998 dollars) of recreational benefits increase at a rate that is a function of the rate of growth in per capita real income and the rate of population growth. Resident benefits are projected using forecasted growth rates for Stanislaus County's population and income. In order to project growth in visitor expenditures, expected future increases in California's population and income are used. Accounting for county population growth, and, assuming a constant percentage of the population participates in wildlife associated recreational activities, implies a 2.41% annual rate of increase in real (1998 dollar) benefits to local residents. With a constant participation rate, visitor expenditures increase at a rate that depends on the annual percentage change in California's population and income. The resulting annual rate of increase in visitor expenditures is 2.82% in constant dollars.

Expenditures for Habitat Restoration

The effect of habitat restoration is different from the other factors included in the benefit estimates. That is because the primary impact is one-time, generated only for the three years during which each restoration project is active. For the base case there are 4,741 acres currently in agricultural production (as of 1996) that are targeted for conversion to riparian and other habitat. Future acquisitions and easements on agricultural lands are projected to total 3,911 acres. Active restoration is assumed to occur on 100% of the lands with 70% put into mixed riparian vegetation and the remaining 30% in native grasslands. From actual bids provided by those involved in local restoration activities it was determined that the cost per acre for mixed riparian vegetation is $5351 with 77.5 % of the direct output effects occurring in Stanislaus County (SRP 2002). Restoration costs include the full cost of reestablishing vegetation and replanting of native grasses. For the life of the habitat restoration projects Stanislaus County income is increased by $23,831,112 for the base case assumptions. Adding the additional acreage from the sensitivity analysis increases the impact to $28,048,106.

Tuolumne River Channel Restoration

The IMPLAN model is used to estimate the income impacts of expenditures for channel restoration. The sector most representative of this type of construction activity is "new highways and streets" (sector 51). The local component of direct expenditures is assumed to be 75% of $25,304,800, or $18,978,600. Those expenditures within the county will generate $7,718,072 in direct income. In addition, indirect and induced income changes are $2,375,003 and $3,348,955, respectively. Channel restoration will generate a total income change for Stanislaus County equal to the sum of the direct, indirect, and induced income components (less 69% of the indirect business taxes). The total in 1998 dollars is $11,373,488 or $2,274,698 annually for five years.

Comparison of Benefits and Costs

Three cases are analyzed: the base case, a modified base case, and a case incorporating the additional acreage from the sensitivity analysis. For each of the cases a scenario is constructed that includes completion of land acquisition and habitat restoration within 10 years and compares projected costs and benefits over a longer 25-year period. In the base case projected agricultural losses are initially valued at 1998 prices (the basis for the IMPLAN model) but the value of agricultural production is assumed to increase at a

uniform rate, reaching the average for the 1986-2000 period after ten years. In the modified base case agricultural prices are assumed constant in real terms (at 1998 levels) over the 25 years of the cost-benefit comparison. The third case incorporates all of the assumptions of the base case projection but adds the additional agricultural losses from the sensitivity analysis.

The three different scenarios capture most of the potential variation in the benefit-cost ratio. The results within each of the cases considered are not particularly sensitive to the underlying assumptions. For example, if the pace of land acquisition and habitat restoration is limited by federal and state budget constraints, there is only a minor impact on the net impacts. That is because in the early years both the costs (in terms of lost agricultural output) and the benefits (the impacts of habitat restoration activities and recreational benefits) decrease.

Results

For the 25 years of the base case scenario there is considerable variation in the calculated net benefits to Stanislaus County residents. For the first five years the net benefits are positive, reaching a maximum of $3,176,514 in 2006. The positive value is due to the combined effects of channel restoration on the Tuolumne River and habitat restoration on existing public lands. For most of the remaining years of the scenario the net benefits are negative as the cumulative agricultural losses grow with additional public land acquisitions and easements. Losses peak at $1,298,068 in 2014 with the end of the impacts from habitat restoration. The negative net benefits in 2014 are 0.009% of forecasted income for Stanislaus County in that year. After the losses peak they gradually decline as the growing real value of recreational and non-user benefits increasingly offsets agricultural losses. The net benefits become positive in 2023 and in 25th year of the scenario the net benefits are $727,417 (0.004% of forecasted Stanislaus county income in 2025) and the present value of the net benefits for the 25-year period (at a 3% real discount rate) is a positive $4,864,467.

For the modified base case (agricultural product prices are held constant at 1998 values) net benefits are positive in each of the first five years. In 2007 net benefits are negative but again are positive for 2008. With the completion of habitat restoration net benefits become negative in 2014 but just for one year. For the remaining years of the scenario net benefits are positive and growing, reaching $1,895,667 in 2026. The present value of net benefits is a positive $18,755,080 for the 25 years of the modified base case scenario.

As in the other two cases net benefits are positive for the first five years of the sensitivity analysis case. Net benefits are negative beginning in 2007 and the losses rise through 2014 when they reach a maximum of $3,120,817. The higher value for the peak losses is due exclusively to the agricultural losses associated with the additional 1531 acres of agricultural land publicly acquired in this case. The peak losses are 0.022% of forecasted Stanislaus county income for 2014. Beginning in 2025 the losses gradually decrease reaching a minimum in the 25th year of the scenario. The loss in 2026 is $1,095,332, or 0.006% of forecasted county income in that year. The present value of the net benefits is a negative $14,928,808 for the 25 years of this scenario.

Conclusions

Public acquisitions and easements on the San Joaquin and Tuolumne Rivers impose no significant economic impacts on Stanislaus County. While there is an adverse effect on the county economy from reduced agricultural production, the sum of the positive impacts from channel and habitat restoration, recreational use by residents and visitors, and the value of non-user benefits offset the agricultural income losses. For the base case the present value of the net benefits is $4,864,467 for the 25-year period covered by the analysis.

The results for the base case probably significantly understate the net benefits to Stanislaus County residents. The recreational benefits used in the cost-benefit comparison are limited to the value of wildlife watching on the refuge and sport fishing on the lower Tuolumne River and the San Joaquin River above the delta. But the impact of fishery and water quality improvements will also affect other streams utilized by county residents including the delta. Wildlife watching will also be affected beyond the refuge by the establishment of additional riparian and other habitat. In addition, water quality improvements have value beyond their impact on fishery productivity and use. Other recreational activities not assessed in the benefits analysis may have substantial value. Hunting may improve on lands adjacent to restored habitat. Picnicking, swimming, and canoeing are among the activities that will be enhanced with the establishment of new and expanded riverside parks. Finally, the estimates of non-user value are based on a particularly conservative approach. As discussed in the benefits section of this report the actual value may be many times that used in the cost-benefit scenarios.

Other factors excluded from the analysis tend to bias the net benefits in a downward direction. Expenditures for refuge operation could add between $3 million and $4 million to the present value of the net benefits. A vegetation buffer along the San Joaquin and Tuolumne Rivers could prove to be a low cost pollution control method for agriculture in the future. If dairy expansion slows, some or all of the impacts of converting land in vegetable crops to feed production will not materialize. Then the present value of the effects on agricultural income for the base case would be reduced by as much as $50 million with an identical increase in net benefits. Therefore, for the base case the present value of net benefits could be many times higher than the $4.9 million estimate developed in this report.

INTRODUCTION

Purpose and Scope of the Study

The project includes an analysis of the economic impacts on Stanislaus County resulting from the preservation and restoration of riparian and other native habitat along the San Joaquin and Tuolumne Rivers. The study was designed and completed with considerable input from a broad based Technical Advisory Committee (TAC). The review process was a continuous one and is described in some detail in Appendix A. The appendix also includes a list of the TAC members.

The primary negative impact on the county economy is due to the loss of agricultural output on the affected lands and is measured as the loss of local net income. Other losses examined are those that may result from limitations on resource extraction imposed as a part of channel restoration on the upper Tuolumne River or from the demands placed on available aggregate resources because of the restoration process.

The expansion of riparian habitat will also provide benefits to county residents. Local benefits assessed in this report include recreational benefits and the economic activity generated by habitat and channel restoration activities. Recreational benefits include the enhanced value to participants in fishing and wildlife watching on the local refuge. Consideration is also given to non-user, or aesthetic benefits, that accrue to residents who do not directly participate in the affected recreational activities. The positive contribution to county income from channel and habitat restoration is also included in the benefits assessment portion of the report.

Report Organization

The report is organized into four sections. The first section, the introduction, includes two elements. The first is an outline of the study. The second is a general description of the Stanislaus county economy. The second section is an assessment of the economic costs to the county. The third section presents quantitative estimates of the benefits likely to accrue to county residents as a result of habitat and channel restoration. The fourth and final section compares the costs and benefits to Stanislaus County residents.

Geographical Scope of the Report

The study area is limited to Stanislaus County acreage along the San Joaquin and lower Tuolumne Rivers inundated by the 1997 flood and the 15,000 cubic feet per second (cfs) flood channel (extending 300 feet from each river bank) for the upper Tuolumne River from Geer Road to La Grange. The study area on the San Joaquin and lower Tuolumne Rivers totals 37,005 acres. The 15,000 cfs flood channel on the upper Tuolumne contains an additional 1918 acres for a total study area of 38,923 acres.

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years to permanent. Agricultural lands impacted by easements totaled 3511 acres. On the upper Tuolumne River 101 acres were listed as public as of the year 2000. Public Acquisitions were almost exclusively native vegetation as 97 of the public acres are in that land use category.

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The base case assumes additional acquisitions and easements in all flood frequency zones and the Tuolumne River flood channel. Currently, within the Tuolumne River flood channel a negligible amount of agricultural land is affected by public ownership and easements (less than 1 acre). For the base case it is assumed that all agricultural lands in the channel (extending 300 feet from each bank) will be removed from production through a combination of acquisitions and easements. For flood frequency zone 3&4 on the San Joaquin River and lower Tuolumne River public ownership and easements account for 18.2% of the agricultural lands. It is assumed that future acquisitions and easements will increase this percentage to 80%. For flood frequency zone 2 the current public percentage is 53.9% and it is assumed that it will reach 60%. For zone 1 the current public percentage is 14.7% and it is assumed that it will reach 20% in that flood frequency zone.

In addition, a sensitivity analysis is performed to examine the impact of acquisitions and easements in excess of those used in the base case. It assumes acquisitions and easements on an additional 10% of the current private agricultural acreage in each flood frequency zone. Summing the acquisitions and easements from the base case and the sensitivity analysis raises the public ownership shares to 88.2%, 64.6%, and 28.5% in flood frequency zones 3&4, 2, and 1, respectively.

Involved Agencies

There are a number of agencies and programs involved in land acquisition and purchase of conservation easements within the study area. Primarily acquisitions within the San Joaquin River flood plain have been in association with the San Joaquin River National Wildlife Refuge. Funding has come from the CALFED Bay-Delta program and the Anadromous Fish Restoration program (AFRP), a cooperative effort of the United States Fish and Wildlife Service (USFWS) and United States Bureau of Reclamation (USBR) pursuant to the Central Valley Project Improvement Act (CVPIA). Additional funding

has been provided by the Natural Resource Conservation Service (NRCS), particularly for purchase of floodplain easements on the San Joaquin and lower Tuolumne Rivers. Various agencies, organizations, and groups are involved with lower Tuolumne River restoration efforts. Restoration of natural populations of migratory chinook salmon is a central goal of channel reconstruction below La Grange Dam and is being undertaken as a part of the Habitat Restoration Plan for the Lower Tuolumne River Corridor. The plan was approved by the Tuolumne River Technical Advisory Committee (TRTAC). The TRTAC was formed out of the Federal Energy Regulatory Commission (FERC) settlement agreement and is composed of representatives from Federal and State agencies, the two local irrigation districts, the City and County of San Francisco, and private special interest groups. The Turlock Irrigation District (TID) is the lead agency for restoration projects on the lower Tuolumne River undertaken on behalf of the TRTAC.

The Stanislaus County Economy

The economic base of Stanislaus County (Year 2000) shows a relatively balanced employment pattern of agriculture and agricultural services (11.5%), manufacturing (13.4%), and government (12.1%). Services (26.0%) and wholesale and retail trade (21.8%) are the sectors that generate the most employment in the county. By the year 2025 the employment shares of agriculture and manufacturing are expected to decline to 9.8% and 10.7%, respectively, while services are projected to increase to 31.7%. Little change is forecast for the employment shares of the remaining sectors. (W&P 2000)

The IMPLAN model provides income shares for various sectors of the county economy for 1998. In that year manufacturing generated 20.9% of county income followed by services (17.9%) and wholesale and retail trade (16.9%). Agriculture, including agricultural services was responsible for 7.4% of county income. However, the small share of income is not representative of agriculture's relative contribution to the county economy. A large percentage of manufacturing (63.8%) is in various food processing industries. The majority of those industries utilize local agricultural products as inputs. The largest of those industries are responsible for a significant share of county income. The most important in terms of the percentage of county income they generate are wine and brandy (4.7%), canned fruits and vegetables (2.6%), dehydrated food products (1.3%), and poultry processing (0.9%). Overall food processing is directly responsible for 13.3% of county income (IMPLAN 2000).

Current County Income and Future Growth

The impacts of land acquisition and habitat restoration are calculated in terms of the losses in county income. Total county income provides a convenient basis for evaluating the relative significance of those impacts. For purposes of making current and future comparisons of impacts and income, 1998 income from the IMPLAN model and forecasts of future county personal income are presented. Income and personal income differ somewhat in that personal income is adjusted for various tax payments and government transfer payment receipts. In 1998, for example, Stanislaus County income was $9,515,270,000 while county personal income was $9,022,207,000 (IMPLAN 2000). It is assumed that the two income measures grow at the same percentage rate so that the

ratio of income to personal income is unchanged at 1.05465. Since the available forecasts are for personal income growth, that assumption permits their use as forecasts of income growth as well.

County personal income is forecast to grow at a 2.47% annual real rate through the year 2005 (W&P 2000). That rate of growth is expected to slow to 2.11% between 2006 and 2015 and to 1.92% for the 2016 through 2025 period (W&P 2000). The growth rates for personal income can be used project total county income. For example county income (in 1998 dollars) in 2025 is expected to reach $17,803,250,000.

Population is projected to grow at a 1.36% annual rate through 2015, slowing to 1.17% annually for the 2016 through 2025 period (W&P 2000). Population in 2025 is expected to reach 607,980. Comparing the projected growth rates for income and population shows continued growth in per capita real income. Through the year 2005 the calculated rate of growth in per capita real income is 0.98%. Due to slower forecasted growth in real income after 2005, the rate of growth in per capita real income falls to 0.79% for the 2006 through 2025 period.

Stanislaus County Agriculture

In the year 2000 total agricultural output in Stanislaus County was $1,197,302,000 and was produced on 812,482 harvested acres. Livestock and poultry products were valued at $398,998.000, followed by fruit and nut crops at $295,123,000, and livestock and poultry at $228,497,000. Field crops, primarily feed used in the livestock and dairy industries, were valued at $101,413,000, while vegetable crop production was valued at $95,680,000. (Stanislaus County Crop Report 2000)

THE COST TO STANISLAUS COUNTY OF REDUCED AGRICULTURAL OUTPUT

Methodology for Estimating the Costs of Reduced Agricultural Output

The following discussion is provided to assist the reader of this report in understanding how the estimates of agricultural losses are derived. This is a general presentation and does not include the specific assumptions used to make the actual estimates. Those are provided in the sections where the agricultural impacts are quantified.

Delineating the Flood Frequency Zones

The estimation of the impacts on the Stanislaus County economy of reduced agricultural output is based on GIS data delineating the land uses on the affected parcels. All land uses are based on 1996 data while ownership is for the year 2000. The GIS data provides land uses by crop within each of the areas flooded by the four flood events since 1980. Significant floods occurred in 1983, 1986, 1995, and 1997. The flood event boundaries are used to establish flood frequency zones. The area that flooded three or four times is roughly contained within the 1986 flood boundaries. Flood frequency zone 2 is approximately that area outside of the 1986 flood boundary but inside the 1983 flood boundary, while flood frequency zone 1 is the area inside of the 1997 flood boundary but outside of the 1983 flood boundary.

Purpose of Delineating Flood frequency Zones

Under a willing seller program land that floods more frequently is more likely to be removed from agricultural production through sale of the land or conservation easements. In order to determine the eventual economic impact on the county the amount of land converted from agriculture to habitat must be determined. A plausible scenario is one where a larger percentage of the land that flooded three or four times in the past 20 years is taken out of production than for areas that flooded only once or twice.

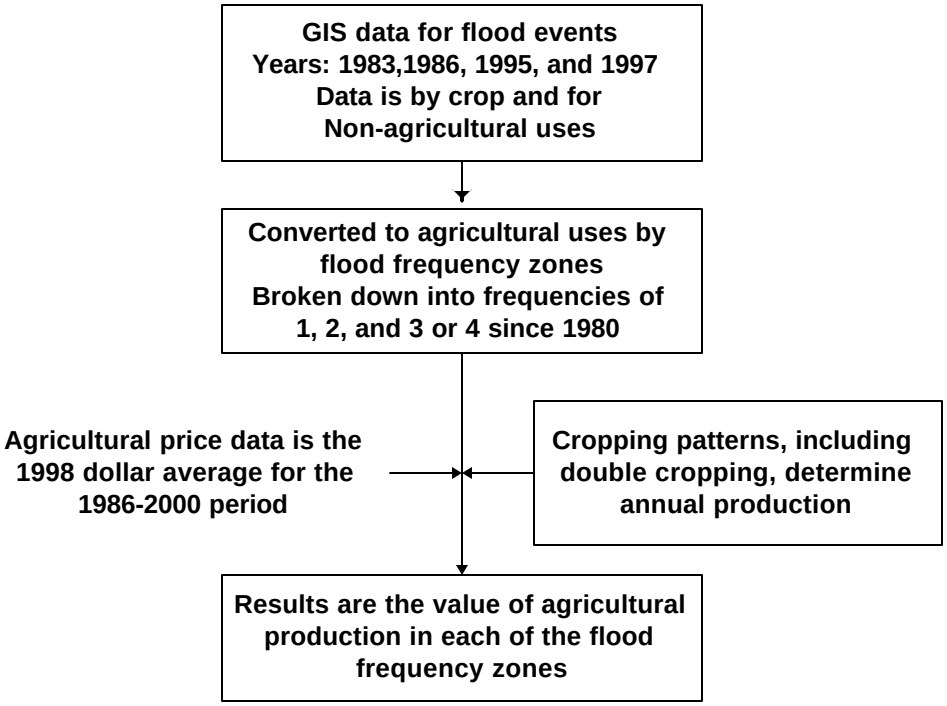
The Value of Agricultural Production

Calculating the value of affected agricultural production requires three inputs. The first input is the crops that are produced on the parcels likely to be removed from production. The GIS data provide crop information for the particular growing season when the parcel was surveyed. However, in some cases the land is double cropped. The second input is the actual cropping patterns likely to occur on the affected parcels including the frequency of double cropping. The third input needed to complete the calculations is the average value of production per acre for each of the crops produced. The data used is the average per acre value for the 1986 through 2000 period converted to 1998 dollars.

Calculating the Direct Impact on Agricultural Output

Chart I shows how the various data inputs are combined to generate the value of agricultural output for land in each of the flood frequency zones. The derived value of agricultural production is the direct output impact and does not include the impacts on input suppliers, the induced impact that occurs through spending of the income generated on the farm, or any potential effects on those industries that process the output of the agricultural sector.

Chart I
Methodology: From GIS Data to Direct Impacts
On Agricultural Output



Indirect and Induced Impacts on Output and Income

The direct output effects are entered into the IMPLAN model in order to estimate the impacts on the output of various sectors supplying production inputs (indirect output effects) and sectors affected by the spending of agricultural income (induced effects). The local income impacts are derived from the output effects within the IMPLAN model and are the components of value added. Total impacts on county income are the sum of direct, indirect, and induced value added. Output is considerably larger than income because output double counts the value of the inputs used in the production process. It is income or value added that is the local equivalent of Gross Domestic Product.

IMPLAN is an input-output model (I-O) that separates the economy into 528 industrial sectors, classifying each according to the primary product or service it provides (see http://www.mig-inc.com/about_us/clients.htm for a list of state and federal government agencies, academic institutions, and private organizations using IMPLAN for impact assessment). The mechanism through which the model estimates impacts is the transaction matrix, which contains the purchases and sales that occur among the various sectors. The column entries are the purchases made by a particular sector from all other sectors included in the model. The row elements are the industry destinations of the

sector's sales. The I-O model permits assessment of the total impact of an initial change in output for a basic industry, in this case agriculture.

Adjustments for Compensation Paid to Landowners: Sales of Land or Farming Rights

When land or conservation easements are acquired by public agencies the private landowners are compensated for lost income. Income associated with land ownership is property and proprietor income. The other components of value added are labor income and indirect business taxes. Under a willing seller program landowners must be fully compensated for the income derived from the farming operations on the land. Otherwise they would not be willing to sell. Therefore the portion of lost income for which compensation is received is not a loss to the individuals or to the economy of the county in which they reside. In addition income from the compensation in the form of investment income allows maintenance of spending. Thus the portion of induced spending sustained by the compensated changes in property and proprietor income is not lost to the county economy.

Indirect Business Taxes

Indirect business taxes are taxes paid by various business operations including property, sales, excise, severance, and other taxes and fees. They do not include Social Security, income, or profits taxes. Generally, only a certain percentage of indirect businesses taxes are returned to the county general fund. The remainder goes to various state funds. The loss to the county from this component of value added is only the part that would have been returned to the county.

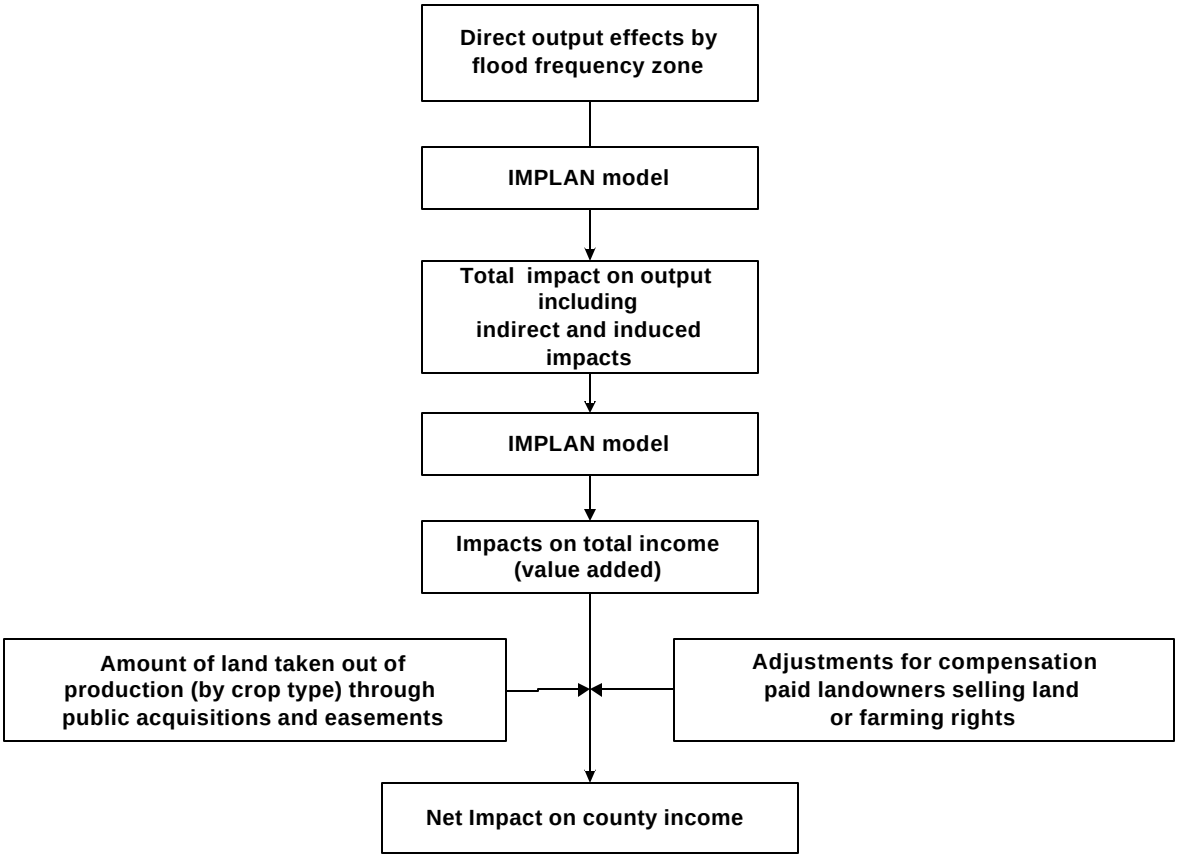
The Amount of Land Removed from Agricultural Production

The total impact on county output and income depends on the amount of land removed from agricultural production. The acreage currently in public ownership or on which conservation easements have been obtained determines the current impact. Future impacts are based on projections for the amount of land likely to be affected by future acquisitions and easements.

The Net Impact on County Income

Chart II provides an outline of the steps necessary to get from the direct output effects to the net impact on county income. The derivation of direct output effects is shown in Chart I and is the final box in that illustration. That estimate is entered as the first box in the following chart. The direct output effects are then used in the IMPLAN model to estimate the indirect and induced output effects. Output impacts are then converted to value added within the IMPLAN model. In order to estimate the net effect on county income or value added, the share of landowner income for which compensation is paid must be deducted from the total generated by the affected agricultural production. The amount of land currently held by public agencies or on which conservation easements have been purchased is used to calculate the current impact. Future impacts are based on projections of the acreage affected by additional acquisitions and easements.

Chart II
From Direct Output Effects to the
Net Impact on County Income



Impacts on Stanislaus County Income due to Past Public Acquisitions and Easements

By the year 2000, 4741 acres of agricultural land within the area delineated by the 1997 flood had been acquired by public agencies or were subject to conservation easements. Table 1 summarizes the agricultural land uses on the affected parcels. Land uses are defined by GIS data for the year 1996, prior to public acquisition or the sale of conservation easements. The implicit assumption is that had the land remained in private ownership and control, production of those specific crops would have continued.

Crop Yields Per Acre

Agricultural yields per acre are specified in constant 1998 dollars and are the average per acre yields times the unit price for the 1986 to 2000 period. Table 2 contains the per acre yields for all crops produced within the San Joaquin River flood zone and the 600 foot flood channel for the upper Tuolumne River. All agricultural prices are from the Annual Crop Reports for 1986-2000 published by the Stanislaus County Department of

Table 1
Agricultural Crops Produced on Lands Currently in Public Ownership
Or Subject to Conservation Easements:
In Acres and by Flood Frequency Zone

Acres Of Agricultural Land	By Flood Frequency Zone				
Crop	**1**	**2**	**3 or 4**	**Tuolumne**	**Total**
Alfalfa and alfalfa mixtures	382	1052	52	0	1486
Almonds	85	26	0	0	111
Apples	3	0	0	0	3
Apricots	0	0	1	0	1
Beans (dry)	36	269	189	0	494
Cauliflower	209	0	0	0	209
Corn	194	208	257	0	659
Dairies	20	0	0	0	20
Grain and Hay Crops	73	225	62	0	360
dmp	12	4	0	0	16
Misc. truck	6	0	0	0	6
Mixed pasture	556	117	43	0	716
Tomatoes	10	309	258	0	577
Vineyard	5	0	0	0	5
Walnuts	75	0	0	0	75
Total Agricultural Acres	1667	2210	863	0	4741

Agriculture (Stanislaus County 2002). Assumptions regarding double cropping were based on conversations with a number of individuals directly involved in agriculture within Stanislaus County (NRCS 2002, TID 2002, Stanislaus County 2002a). Where the crop is listed as grain hay it is assumed that 100% of the land is double cropped with corn silage. Where corn silage is the specified crop it is assumed that 56% of that land is put into grain hay during the winter months (TID 2002). Double cropping is assumed to be negligible for vegetable crops with 10% of most vegetable crops double cropped. It is assumed that all acreage planted in tomatoes is fallowed during the winter months (Stanislaus County 2002a).

Due to a lack of data, for some of the specified land uses other crops are assigned to the land use category. For onions and miscellaneous truck farming the productivity and prices from the county's miscellaneous vegetable category are used. For dairies it is assumed that the affected land is in feed production, specifically alfalfa hay. For the miscellaneous deciduous designation the value of almond production is used. In the case of other relatively minor crops for which no specific data is reported in the Annual Crop Reports the appropriate aggregated category is used to establish average yields and prices. The footnotes to Table 2 describe all crop value substitutions. No value is used for nursery production. That is because the value of production per acre is so high public

acquisition is unlikely. With the exception of flood frequency zone 1 very little nursery production occurs within the study area.

Table 2
The Value per Acre for Agricultural Production in Stanislaus County (in 1998$)

Crop	Output/Acre
Alfalfa and alfalfa mixtures	$867
Almonds	$2,087
Apples	$4,672
Apricots	$2,593
Beans (dry)	$1,196
Cauliflower	$2,429
Cherries	$6,707
Cole crops [1]	$1,651
Corn [2]	$730
Dairies [3]	$867
Grain and Hay Crops [4]	$864
Melons, Squash, and Cucucumbers	$1,992
Miscellaneous Deciduous [5]	$2,087
Miscellaneous Truck [6]	$3,086
Mixed pasture	$160
Onions and Garlic	$3,120
Peaches and Nectarines	$4,103
Safflower	$369
Sudan	$372
Tomatoes	$2,043
Vineyard	$2,487
Walnuts	$1,941

1. Uses the value of Broccoli
2. 56% of the corn crop is double cropped with grain hay
3. Uses the value of alfalfa production
4. 100% is double cropped with corn for silage
5. Equal to the value of almond production
6. Value of miscellaneous vegetables

Table 3 contains the direct output impacts by crop for all public lands in the three San Joaquin River flood frequency zones and the 600 foot Tuolumne river flood channel. The row entries are calculated by multiplying the 1998 dollar yields per acre (from Table 2) by the total acres for each crop (from Table 1). These are then summed over all crops produced on the affected acreage. The total direct impact on Stanislaus County

agricultural output for all lands currently public or subject to conservation easements is $4,949,470.

In order to calculate the indirect and induced impacts using the IMPLAN model the direct effects are aggregated by agricultural sector. Tables 4 and 5 present the impacts for the one digit SIC codes, but they were calculated using the disaggregated model.

Table 3
The Direct contribution to Stanislaus County Output of Acreage Currently under Public Ownership or subject to Conservation Easements (in 1998$)

Crop	Output
Alfalfa and alfalfa mixtures	$1,288,205
Almonds	$231,587
Apples	$12,840
Apricots	$2,134
Beans (dry)	$591,142
Cauliflower	$508,727
Corn	$481,311
Dairies	$17,724
Grain and Hay Crops	$311,327
Melons, Squash, and Cucs	$32,585
Misc. truck	$19,443
Mixed pasture	$114,342
Onions and Garlic	$125
Tomatoes	$1,179,213
Vineyard	$12,394
Walnuts	$146,372
Total	$4,949,470

The crops produced on the public acreage within the study area fit within four agricultural sectors. They are hay and pasture (sector 13), fruits (sector 16), tree nuts (sector 17), and vegetables (sector 18). Table 4 presents the output impacts in the aggregated format.

Converting Output to Income

The IMPLAN model uses the direct impact on output to estimate the indirect and induced effects. However, output changes are not an appropriate measure of the impact on county income. That is because output includes all production including the value of inputs produced.

Table 4
Direct, Indirect, and Induced Contribution to Stanislaus County
Output from Agricultural Production on Lands Currently in Public Ownership
Or Subject to Conservation Easements (in 1998$)

Industry	Direct	Indirect	Induced	Total
Agriculture	$4,949,469	$542,974	$28,693	$5,521,136
Mining	$0	$597	$485	$1,082
Construction	$0	$72,669	$29,677	$102,346
Manufacturing	$0	$155,880	$79,082	$234,962
TCPU	$0	$129,313	$77,646	$206,959
Trade	$0	$190,414	$348,419	$538,832
FIRE	$0	$248,317	$343,742	$592,059
Services	$0	$92,919	$436,586	$529,505
Government	$0	$31,236	$61,423	$92,659
Other	$0	$0	$4,554	$4,554
Instutitions	$0	$0	$0	$0
Total	$4,949,469	$1,464,319	$1,410,306	$7,824,093

FIRE = Finance, Insurance, and Real Estate

TCPU = Transportation, Communications, and Public Utilities

When the inputs used to produce another product their value is also included in the output of that industry. Thus the value of inputs is included more than once. For example, the output estimates provided by the IMPLAN model include the value of all inputs used to produce hay, the value of the hay produced, and the value of the milk or other products where hay is used as an input. In this example the value of the inputs to hay production are counted three times. First, the output value is assigned to the industry producing the inputs. Second, it is counted again as a part of the value of the hay produced. And, finally the value of inputs used to produce the hay are counted a third time by including the full value of the milk produced in the output for that sector. Also the value of hay production is counted twice, once in the hay producing sector and a second time as a part of the value of milk production.

Value added includes wages, proprietor income, property income, and indirect business taxes. By summing the components of county income it excludes the value of inputs and thus avoids double counting. Value added is the local equivalent of Gross Domestic Product (GDP). Table 5 summarizes the gross income impacts of removing from production all agricultural acreage within the San Joaquin River flood zones currently under public ownership or subject to conservation easements. The impacts are projected using IMPLAN and the results are presented for aggregated sectors. Table 5 shows that the majority of the impact on is in the agricultural sector. Of the $4,666,367 reduction in value added, $3,212,229, or 69% is in the agricultural sector. The other sectors most significantly impacted are finance, insurance, and real estate (FIRE) absorbing 9% of the reduction, retail and wholesale trade (8%), and services (7%).

Table 5
Direct, Indirect, and Induced Contribution to Stanislaus County
Income from Agricultural Production on Lands Currently in Public Ownership
Or Subject to Conservation Easements (in 1998$)

Industry	Direct	Indirect	Induced	Total
Agriculture	$2,895,327	$304,196	$12,706	$3,212,229
Mining	$0	$417	$339	$756
Construction	$0	$44,739	$16,035	$60,774
Manufacturing	$0	$49,988	$21,029	$71,018
TCPU	$0	$66,952	$47,424	$114,376
Trade	$0	$130,160	$263,466	$393,626
FIRE	$0	$177,750	$253,259	$431,009
Services	$0	$58,856	$273,648	$332,505
Government	$0	$15,314	$30,205	$45,520
Other	$0	$0	$4,554	$4,554
Total	$2,895,327	$848,372	$922,665	$4,666,367

FIRE = Finance, Insurance, and Real Estate

TCPU = Transportation, Communications, and Public Utilities

Deriving the Net Income Impact from the Gross Impact on Value Added
The impact on county value added included in Table 5 is assuming landowners receive no compensation for lost income. The components of income that are linked to land ownership are property income and proprietor income. However, it might be argued that proprietor income is not directly connected to the land but is a resource similar to labor. The approach used here is to assume that the sale of the land fully compensates landowners for lost property income, and, in the case where the seller of the land or a conservation easement is also a local resident, it also compensates for losses in proprietor income.

Property and Proprietor Income: The Natural Resource Conservation Service (NRCS) provided a list of former owners who sold the NRCS conservation easements. The list included residency, acreage, appraisal value, and sale price for all easements purchased by NRCS on 4350 acres of land in the San Joaquin River flood plain. The average sale price per acre was $1958 while 86% of the sellers were Stanislaus County residents. For all agricultural lands in the river flood plain average property and proprietor income per acre are $215 and $222, respectively. Therefore the total owner income per acre of agricultural land based on average yields and prices is $437 in 1998 dollars. However, for the publicly owned parcels in the floodplain less than 50% was in agricultural production in 1996. Most of the remaining land was water surface or native vegetation. Property income per acre of land is $101 and proprietor income per acre is $105. If the owner is assumed to take the sale proceeds and place them into a portfolio of stocks and bonds yielding a 10% annual return (consistent with the long term return expected from a

portfolio with 50% stocks and 50% corporate bonds) then the annual income from the sale of an acre of land is $196. The sum of property income and 86 % of proprietor income is $191 per acre. Therefore it appears that the compensation paid for sale of easements (not counting the residual value of the land following sale of the farming rights) is more than sufficient to cover all property income and 86% of proprietor income.

Induced Spending: The net income losses exclude all property income and 86% of proprietor income. That portion of income is not lost because the income from the invested proceeds of the land or easement sale fully compensate for that part of farm income. Since the income is not lost it is reasonable to assume that spending is not affected. There is no reason to expect spending patterns out of investment income to differ significantly from those out of property and proprietor income. Direct property income plus 86% of proprietor income is 44.4% of total income (direct, indirect, and induced). Therefore 44.4% of the induced portion of the income impact is not lost when the affected acreage is removed from agricultural production.

Indirect Business Taxes: Indirect business taxes are the sum of property taxes, sales taxes, excise taxes, severance taxes, and license fees. They do not include Social Security payroll taxes, personal income taxes, and profits taxes. When land is taken out of agricultural production the taxes on direct, indirect, and induced output are, for the most part, no longer paid. The exception is for property taxes on the direct portion of the agricultural production loss. When an easement is sold the value of the easement remains on the tax rolls leaving property tax revenues unaffected. Where the land is sold to a public agency such as the U.S. Fish and Wildlife Service partial compensation is received by the county in the form of in lieu payments. For the remaining indirect business taxes the full amount of the tax loss is not a loss to the county. That is because not all indirect business taxes are returned to the county. Sales taxes are 46% of the total and 32.2% of that amount is returned to the county and the cities within the county (Stanislaus County Department of Finance 2002). Assuming no impact on local property taxes, and, that 100% of all other state and local indirect business taxes and 0% of federal indirect business taxes are returned as local general fund revenues, 25.1% of the total is lost to the county when agricultural output is reduced. If all property taxes due the county were lost because of no payment of in lieu taxes and removal of the easement value from the tax rolls the county would lose 31% of the indirect business taxes. For purposes of calculating the net impact on county income due to conversion of agricultural lands to habitat it assumed that 25% of the indirect business tax payments represent a loss to Stanislaus County. For expansion of business activity the net revenue gain is 31% of the additional indirect business taxes generated.

Total Adjustments to Value Added: The value added impacts from Table 5 are adjusted by subtracting each of the following:

- All property income and 86% of proprietor income from the direct component of value added.
- 75% of indirect business taxes paid on direct output and 69% paid on indirect output.
- 44.4% of the value added resulting from the induced output component.

- 69% of the indirect business taxes for the 55.6% of induced spending left in the net impact calculations.

The net value added impacts are therefore 14% of direct proprietor income, all direct wage income, and 25% of indirect business taxes paid in association with direct output. All indirect value added is included with the exception of 69% of the indirect business taxes paid by the affected industries. Of the induced value added, 55.6% is included with the exception of 69% of the indirect business taxes paid. Table 6 presents the net impact on Stanislaus County income for all land within the San Joaquin River flood plain currently in public ownership or subject to conservation easements.

Table 6
The Net Impact on Stanislaus County Income from Agricultural Production on Lands Currently in Public Ownership or Subject to Conservation Easements (in 1998$)

Value added component	**1998 $**
Total value added	$4,666,366
direct property income	$1,019,477
86% of direct proprietor income	$905,602
75% direct + 69% indirect IBT	$207,118
44.4% of induced	$409,756
69% of remaining IBT	$39,503
Net Impact	**$2,084,911**
Acres -agriculture	4,741
Acres-native+water surface	5,317
Total acres	10,062
Impact /agricultural acres	$440
Impact/total acres	$207

Forward Linkages- Impact on the Local Dairy Industry

The IMPLAN model does not include the impacts on industries using agricultural inputs to produce other products. The only forward linkages are those due to local spending of income earned in connection with the value of direct and indirect output. In most cases that omission is not likely to lead to serious distortions. However, in the case of Stanislaus County a significant proportion of agricultural production is of animal feed products used by the dairy and livestock industries. Agricultural lands (including only those producing feed in 1996) within the San Joaquin river flood plain, currently in public ownership or control, constituted 2.1% of the Stanislaus County acreage devoted to feed production in 1998. If we assume that the percentage reduction in milk production is equal to the percentage reduction in feed producing acreage then an additional $6,474,000 in county value added would be lost. However, this outcome is unlikely since importing feed from outside of the county or converting land in other agricultural uses are options. The following list includes the possible approaches to valuing the lost value added in the dairy industry.

- Milk production declines by the percentage reduction in feed producing acreage. The annual reduction in county value added is $6,474,000.
- Feed production is maintained by shifting land out of vegetable production. Vegetable production is assumed to be composed of dry beans with 10% of the land double cropped. There are actually two possibilities here. First, if the shift is anticipated prior to the sale then the higher value crop would be reflected in the sale price of the land. However, at least for existing public lands the compensation paid does not indicate that a shift was expected. The second approach assumes the shift takes place on other lands (they may or may not be in the flood zone) and therefore the entire uncompensated difference in value added is the cost to the county. Table 7 contains the direct, indirect, and induced value added figures for the case where feed production is maintained through reducing vegetable production. These are compared to the value added amounts in Table 5. The increase in value added (the net impact on the county) is the difference, or $1,790,237.
- The loss of feed production results in an equal increase in feed imports from adjacent counties. The increased dependence on feed imports increases costs because of the need to truck the feed longer distances. Feed inputs from off the dairy average only 2.62% of the value of milk sold (IMPLAN coefficients matrix). The annual impact on county value added is unknown but likely to be relatively small.
- Feed production is maintained through more intensive farming of the remaining feed producing land including double cropping on a larger percentage of the land. Some increase in feed prices would be necessary to induce the changes in cultural practices. There would be some impact on annual county value added but it is likely to be relatively small.
- Other constraints halt expansion of the dairy industry in Stanislaus County. Possible constraints aside from feed availability could be environmental restrictions, lack of demand, or changes in agricultural policies at the federal or state level. Between 1986 and 2000 milk production by Stanislaus county dairies increased at an annual average rate of 4.39%. If that rate of increase continues it will require changes in land use or additional feed imports no matter what happens to feed producing lands in the San Joaquin River flood plain. But if non-feed constraints halt growth in the near future the conversion of feed producing lands in the flood plain may have no significant impact on milk production.

For purposes of this report it is assumed that the second option is the appropriate measure of the forward linkages to the dairy industry. Therefore the net loss of value added on public lands in the San Joaquin river flood plain is calculated, based not on what was produced in 1996, but rather on the value of vegetable crops. The implication is that for each acre of feed producing land in the flood plain that is converted to habitat, one acre of vegetable producing land within the county will be converted to feed production. Table 7 presents the value added impacts when all feed producing lands are valued at the average price of dry beans with 10% of the land double cropped in winter vegetables. The additional net impact on Stanislaus County income is $1,790,237.

Table 7
Direct, Indirect, and Induced Contribution to Stanislaus County Income from Agricultural Production on Lands Currently in Public Ownership Or Subject to Conservation Easements: Value Added for Feed Producing Acreage Valued at Vegetable Prices (in 1998$)

Industry	Direct	Indirect	Induced	Total
Agriculture	3789522	577220	18523	4385266
Mining	0	462	494	956
Construction	$0	$62,579	$23,377	$85,956
Manufacturing	$0	$98,350	$30,658	$129,008
TCPU	$0	$93,525	$69,138	$162,663
Trade	$0	$182,887	$384,100	$566,987
FIRE	$0	$201,070	$369,220	$570,290
Services	$0	$85,251	$398,945	$484,196
Government	$0	$20,607	$44,036	$64,643
Other	$0	$0	$6,638	$6,638
Total	$3,789,522	$1,321,952	$1,345,129	$6,456,603

FIRE = Finance, Insurance, and Real Estate

TCPU = Transportation, Communications, and Public Utilities

Table 8
The Net Impact on Stanislaus County Income from Agricultural Production on Lands Currently in Public Ownership or Subject to Conservation Easements: Including the Effect of Shifting Production from Vegetables to Feed (in 1998$)

	Net Impact from land acquisition	Impact from shift from vegetables to feed	Total Impact
In 1998$	$2,084,911	$1,776,236	$3,861,147
Per Acre of Ag	$439	$374	$814
Per Acre Total	$207	$177	$384

The net impact on Stanislaus county income is the sum of the compensated changes in agricultural income due to past land acquisitions and easements and the effect of forward linkages to the dairy industry, measured here as the impact of changing land use from vegetable to feed production. The compensated income impact (from Table 6) is $2,084,911. The effect of a shift in vegetable to feed production (the difference between total value added from Tables 7 and 5) is $1,790,237. The sum is $3,875,148 and is included as the total in Table 8.

Impact on Stanislaus County from Future Acquisitions and Easements
The impact calculated in the previous section includes only those lands that were publicly owned or subject to conservation easements as of the year 2000. Additional acquisitions and easements within the 1997 flood zone are inevitable in connection with various state and federal programs. In this section we examine the impacts on Stanislaus County of future acquisitions and easements. The analysis is separated into base case estimates and a sensitivity analysis. The base case is designed to represent the most likely scenario, while the sensitivity analysis examines the additional impacts to be expected if agricultural acreage affected by acquisitions and easements exceeds that included in the base case assumptions.

Description of the Base Case
The base case assumes additional acquisitions and easements in all flood frequency zones and the Tuolumne River flood channel. Currently, within the Tuolumne River flood channel a negligible amount of agricultural land is affected by public ownership and easements (less than 1 acre). For the base case it is assumed that all agricultural lands in the channel (extending 300 feet from each bank) will be removed from production through a combination of acquisition and easements. For flood frequency zone 3&4 on the San Joaquin River and lower Tuolumne River public ownership and easements account for 18.2% of the agricultural lands. It is assumed that future acquisitions and easements will increase this percentage to 80%. For flood frequency zone 2 the current public percentage is 53.9% and it is assumed that it will reach 60%. For zone 1 the current public percentage is 14.7% and it is assumed that it will reach 20% in that flood frequency zone.

In the case of the Tuolumne River flood channel it is assumed that removal of all lands from production is essential for meeting the 15,000 cfs channel capacity. For the various flood zones on the San Joaquin and lower Tuolumne Rivers the assumption is that a larger percentage of the acreage that floods frequently will be offered for sale to public agencies. With the exception of flood frequency zone 2, existing patterns of acquisitions and easements support that assumption. This deviation from the prevailing pattern is largely due to the acquisition of lands for the wildlife refuge, most of which is located within flood frequency zone 2.

Sensitivity Analysis
The impact of additional acquisitions and easements assessed in the sensitivity analysis section is based on an increase of 10% of the current private agricultural acreage in each flood frequency zone. Summing the acquisitions and easements from the base case and the sensitivity analysis raises the public ownership shares to 88.2%, 64.6%, and 28.5% in flood frequency zones 3&4, 2, and 1, respectively.

Impacts on Stanislaus County Income from Future Public Acquisitions and Easements: Base Case
For the base case, an additional 3,911 acres of agricultural land within the area delineated by the 1997 flood will be affected by public acquisitions or conservation easements.

Table 9 summarizes the agricultural land uses on the affected parcels within each flood frequency zone and the Tuolumne River flood Channel. Land uses are defined by GIS data for the year 1996. As in the calculated impacts for current public lands, the implicit assumption is that had the land remained in private ownership and control, production of those specific crops would have continued.

Table 9
Private Agricultural Acreage by Flood Frequency Zone and For the Tuolumne River Flood Channel

CROP	Private Acreage by Flood Frequency Zone			
	1	2	3&4	Tuolumne
Alfalfa and alfalfa mixtures	1030.77	112.80	414.40	0.00
Almonds	334.84	8.27	6.91	33.91
Apples	0.02	0.00	0.00	0.00
Apricots	1.01	0.00	0.88	0.00
Beans (dry)	138.23	396.89	471.63	0.00
Cauliflower	54.35	0.00	1.02	0.00
Cherries	22.56	0.00	0.00	0.00
Cole crops	0.00	0.00	47.44	0.00
Corn	1653.34	798.10	1563.93	11.14
Dairies	60.49	48.42	3.39	0.00
Flowers, Nursery, and CTF's	176.78	0.14	0.00	3.53
Grain and Hay Crops	427.41	59.27	56.98	2.39
Melons, Squash, and Cucs	96.98	64.54	0.00	0.00
Misc. deciduous	45.84	0.00	0.00	0.00
Misc. truck	29.23	0.00	0.00	0.00
Mixed pasture	3572.17	0.00	182.27	20.00
Onions and Garlic	3.60	0.00	65.30	0.00
Peaches and Nectarines	293.20	0.00	0.00	0.00
Safflower	26.33	0.19	0.00	0.00
Sudan	34.45	24.13	45.27	0.00
Tomatoes	206.19	288.40	1024.30	0.00
Vineyard	251.38	1.88	0.00	1.89
Walnuts	1250.74	87.09	6.76	44.30
Total	9709.89	1890.12	3890.48	117.17

The direct output losses are calculated using the acreage from Table 9, the percentage publicly acquired through purchase or easement, and the average output per acre from Table 2. The amounts acquired by flood frequency zone are 604 acres, 250 acres, 2940 acres, and 117 acres in zones 1, 2, 3&4, and the Tuolumne River flood channel,

respectively. The additional acquisitions bring the public percentages up to those specified in the base case.

Table 10
The Direct Output Impact of Future Acquisitions and Easements on Private Lands in the San Joaquin River Flood Plain and the Tuolumne River Flood Channel (1998$): Base Case

Crop	Direct Output Value by Flood Frequency Zone			
	1	2	3&4	Tuolumne
Alfalfa and alfalfa mixtures	$893,358	$97,760	$359,161	$0
Almonds	$698,949	$17,261	$14,422	$70,792
Apples	$107	$0	$0	$0
Apricots	$2,627	$0	$2,287	$0
Beans (dry)	$165,266	$474,532	$563,883	$0
Cauliflower	$132,007	$0	$2,480	$0
Cherries	$151,303	$0	$0	$0
Cole crops	$0	$0	$78,306	$0
Corn	$1,207,208	$582,743	$1,141,919	$8,135
Dairies	$52,422	$41,964	$2,939	$0
Grain and Hay Crops	$369,251	$51,204	$49,229	$2,062
Melons, Squash, and Cucs	$193,146	$128,531	$0	$0
Misc. deciduous	$95,678	$0	$0	$0
Misc. truck	$90,198	$0	$0	$0
Mixed pasture	$570,697	$0	$29,120	$3,195
Onions and Garlic	$11,226	$0	$203,738	$0
Peaches and Nectarines	$1,203,035	$0	$0	$0
Safflower	$9,708	$70	$0	$0
Sudan	$12,833	$8,989	$16,860	$0
Tomatoes	$421,263	$589,216	$2,092,726	$0
Vineyard	$625,120	$4,683	$0	$4,706
Walnuts	$2,427,881	$169,058	$13,116	$86,001
Total (excluding nursery)	$9,333,283	$2,166,010	$4,570,186	$174,891
Base Case- %of private	6.23%	13.23%	75.56%	100.00%
Base Case- Direct Impact	$581,004	$286,542	$3,453,413	$174,891
Total Direct Output Impact	$4,495,851			

The direct output contribution for private lands is listed by flood frequency zone and crop in Table 10. The third line from the bottom is the respective percentage of private lands that must be acquired to reach the assumed public share for the base case. The next line is the 1998 dollar impact of future acquisitions by flood zone and the last line is the sum

of the four entries for the preceding line. The total is the direct output impact (in 1998 dollars) of removing the additional acreage from agricultural production, or $4,495,851.

Value Added Impacts: Base Case

Table 11 contains the IMPLAN estimates of direct, indirect, induced, and total value added for the additional land acquisitions and easements for the base case. The entries show that the majority of the impact is in the agricultural sector. Of the $4,257,436 reduction in value added, $2,911,689, or 68% is in the agricultural sector. The other sectors most significantly impacted are finance, insurance, and real estate (FIRE) absorbing 9% of the reduction, retail and wholesale trade (9%), and services (7%).

Table 11
Direct, Indirect, Induced and Total Impacts on Stanislaus County Income of Future Acquisitions and Easements on Private Agricultural Lands in the San Joaquin River Flood Plain And the Tuolumne River Flood Channel (1998$): Base Case

Industry	Direct	Indirect	Induced	Total
Agriculture	$2,597,258	$302,652	$11,780	$2,911,689
Mining	$0	$373	$314	$688
Construction	$0	$40,679	$14,866	$55,545
Manufacturing	$0	$53,590	$19,497	$73,086
TCPU	$0	$62,036	$43,967	$106,003
Trade	$0	$122,054	$244,261	$366,315
FIRE	$0	$154,574	$234,798	$389,373
Services	$0	$54,795	$253,702	$308,497
Government	$0	$14,014	$28,004	$42,018
Other	$0	$0	$4,222	$4,222
Total	$2,597,258	$804,768	$855,410	$4,257,436

FIRE = Finance, Insurance, and Real Estate

TCPU = Transportation, Communications, and Public Utilities

Net Impact of Additional Acquisitions and Easements

In order to determine the direct impact on Stanislaus County income, gross income impacts must be adjusted for compensation paid to private landowners selling the land or farming rights. The procedure is the same as for existing public lands. All of direct property income, 86% of proprietor income, a portion of indirect business taxes on direct (75%) and indirect (69%), 44.4% of induced, and 69% of the indirect business taxes on the remaining 55.6% of induced value added are deducted. Net impacts on Stanislaus County income are included in Table 13. The total net impact is $2,007,371 for the 3911 acres of agricultural land affected, or $513 per acre.

Forward Linkages- Base Case Impact on the Dairy Industry

The impact on the dairy industry is calculated based on the assumption that county feed production is maintained by converting 2,307 acres of vegetable production to feed. This is the amount of acreage currently devoted to feed production that will be publicly acquired in the base case. The procedure is the same as that used to calculate the dairy impacts for the lands currently in public ownership. Table 12 contains the IMPLAN estimates of direct, indirect, induced, and total value added when the 2,307 acres of feed producing land is assumed to be in vegetable production (dry beans with 10% of the acreage double cropped with winter vegetables). The impact is equal to the total value added from Table 12 ($5,430,738) minus the total from Table 10 ($4,257,436), or $1,173,302. The total change in Stanislaus County income is the sum of the land acquisition and easement impacts and the dairy impacts, or $3,180,673. For the 3,911 acres affected the county income loss per acre is $813.

Table 12
Direct, Indirect, Induced and Total Impacts on Stanislaus County Income of Future Acquisitions and Easements on Private Agricultural Lands in the San Joaquin River Flood Plain And the Tuolumne River Flood Channel (1998$): Base Case with Feed Producing Lands Valued at Vegetable Prices

Industry	Direct	Indirect	Induced	Total
Agriculture	$3,180,158	$487,279	$15,584	$3,683,021
Mining	$0	$392	$416	$808
Construction	$0	$53,236	$19,668	$72,904
Manufacturing	$0	$83,811	$25,794	$109,605
TCPU	$0	$79,097	$58,168	$137,265
Trade	$0	$156,201	$323,155	$479,356
FIRE	$0	$169,530	$310,636	$480,165
Services	$0	$71,903	$335,644	$407,547
Government	$0	$17,435	$37,048	$54,483
Other	$0	$0	$5,585	$5,585
Total	$3,180,158	$1,118,883	$1,131,698	$5,430,738

FIRE = Finance, Insurance, and Real Estate

TCPU = Transportation, Communications, and Public Utilities

Table 13
The Net Impact on Stanislaus County Income from Future Acquisitions and Easements (1998$): Base Case

Value added component	Income Impacts
Total value added	$4,257,436
direct property income	$902,541
86% of direct proprietor income	$757,270
75% direct + 69% indirect IBT	$173,742
44.4% of induced	$379,888
69% of remaining IBT	$36,624
Net Impact	$2,007,371
Agricultural Acres	3,794
Impact/Agricultural Acre	$529
Impact-Dairy	$1,173,302
Dairy Impact/Agricultural Acre	$309
Total Impact	$3,180,673
Total Impact/Agricultural Acre	$838

Sensitivity Analysis

If future public acquisitions of agricultural land and conservation easements are more extensive than assumed in the base case the above analysis will underestimate the ultimate impact on Stanislaus County income. The purpose of this section is to assess the impact of acquisitions and easements on an additional 10% of the private agricultural acreage in each of the flood frequency zones. Under this scenario public acquisitions would affect 28.5%, 64.6%, 88.5%, and 100% of the agricultural lands in flood frequency zones 1, 2, 3&4, and the Tuolumne River flood channel (no change from the base case), respectively. For this case an additional 1531 acres would be removed from crop production. The direct output impact is $2,122,287 and is calculated from Table 10 by taking the sum of 10% of the value of agricultural production for each of the flood frequency zones.

Value Added Impacts: Sensitivity Analysis

Table 14 contains the IMPLAN estimates of direct, indirect, induced, and total value added for the additional land acquisitions and easements for the sensitivity analysis. The entries show that the majority of the impact on is in the agricultural sector. Of the $1,974,818 reduction in value added, $1,333,635, or 68% is in the agricultural sector. The other sectors most significantly impacted are finance, insurance, and real estate (FIRE) absorbing 9% of the reduction, retail and wholesale trade (9%), and services (7%).

Table 14
Direct, Indirect, Induced and Total Impacts on Stanislaus County Income of Future Acquisitions and Easements on Private Agricultural Lands in the San Joaquin River Flood Plain And the Tuolumne River Flood Channel (1998$): Sensitivity Analysis

Industry	Direct	Indirect	Induced	Total
Agriculture	$1,191,143	$136,963	$5,529	$1,333,635
Mining	$0	$198	$147	$345
Construction	$0	$17,891	$6,978	$24,868
Manufacturing	$0	$31,159	$9,151	$40,310
TCPU	$0	$30,301	$20,636	$50,937
Trade	$0	$61,422	$114,646	$176,068
FIRE	$0	$71,179	$110,204	$181,383
Services	$0	$26,323	$119,077	$145,400
Government	$0	$6,747	$13,144	$19,891
Other	$0	$0	$1,981	$1,981
Total	$1,191,143	$382,183	$401,492	$1,974,818

FIRE = Finance, Insurance, and Real Estate

TCPU = Transportation, Communications, and Public Utilities

Net Impact of Additional Acquisitions and Easements

Net impacts are determined using the procedure for adjusting for compensation paid to landowners described in the two previous net impact sections. The net impact of public acquisitions and easements for the sensitivity analysis is $964,222 and is included in Table 16.

Forward Linkages- Sensitivity Analysis- Impact on the Dairy Industry

As with the calculations for the two previous cases, the impact on the dairy industry is determined as the effect on county value added from converting vegetable crop acreage to animal feed, leaving feed production unaffected. The additional impact of switching 1298 acres from vegetables to feed is the difference between total value added in Table 15 and the total from Table 14, or $858,527. These results are included in Table 16 under dairy impacts.

Impact on Stanislaus County Income - Sensitivity Analysis

The total change in Stanislaus County income is the sum of the land acquisition and easement impacts and the dairy impacts, or $1,822,749. For the 1531 acres affected the county income loss per acre is $1,191. The total impact and the impact per acre of affected agricultural land are included in the last two lines of Table 16.

Table 15
Direct, Indirect, Induced and Total Impacts on Stanislaus County Income of Future Acquisitions and Easements on Private Agricultural Lands in the San Joaquin River Flood Plain: Sensitivity Analysis with Feed Producing Lands Valued at Vegetable Prices

Industry	Direct	Indirect	Induced	Total
Agriculture	$1,643,673	$251,165	$8,213	$1,903,051
Mining	$0	$231	$219	$450
Construction	$0	$26,459	$10,365	$36,824
Manufacturing	$0	$50,956	$13,594	$64,550
TCPU	$0	$42,906	$30,656	$73,562
Trade	$0	$86,340	$170,312	$256,652
FIRE	$0	$87,297	$163,714	$251,011
Services	$0	$38,537	$176,894	$215,431
Government	$0	$9,344	$19,526	$28,870
Other	$0	$0	$2,944	$2,944
Total	$1,643,673	$593,235	$596,437	$2,833,345

FIRE = Finance, Insurance, and Real Estate

TCPU = Transportation, Communications, and Public Utilities

Table 16
The Net Impact on Stanislaus County Income from Future Acquisitions and Easements: Sensitivity Analysis

Value added component	Income Impacts
Total value added	$1,974,818
direct property income	$398,640
.86% of direct proprietor income	$334,065
75% direct + 69% indirect IBT	$82,399
44.4% of induced	$178,303
69% of remaining IBT	$17,189
Net Impact	$964,222
Agricultural Acres	1531
Impact/Agricultural Acre	$630
Impact-Dairy	$858,527
Dairy Impact/Agricultural Acre	$561
Total Impact	$1,822,749
Total Impact/Agricultural Acre	$1,191

Total Income Losses for Stanislaus County- Past and Future Acquisitions and Easements

Losses in county income for all cases are summarized in Table 17. The reduction in county income for the base case including the impact of past acquisitions and easements is $7,041,820. The income or value added loss is 0.074% of 1998 Stanislaus County income. If future acquisitions include an additional 10% of the private agricultural land in each of the flood frequency zones (sensitivity analysis) the total impact increases to $8,864,569 and 0.093% of 1998 county income.

Table 17
Summary of Impacts of Past and Future Acquisitions
And Easements: In 1998$ and as a Percentage of 1998 County Income

Cases	Impacts from: Acquisitions	Dairy Impacts	Total 1998$ Impacts	Percent of 1998 Stanislaus County Income
Current Public	$2,084,911	$1,776,236	$3,861,147	0.041%
Future-Base Case	$2,007,371	$1,173,302	$3,180,673	0.033%
Sensitivity Analysis	$964,222	$858,527	$1,822,749	0.019%
Totals	$5,056,504	$3,808,065	$8,864,569	0.093%
Public + Base Case	$4,092,282	$2,949,538	$7,041,820	0.074%
Public + Base Case + 10%	$5,056,504	$3,808,065	$8,864,569	0.093%
		1998 County Income		$9,515,275,000

Range of Estimated Income Impacts

The minimum impact case for future acquisitions and easements uses the base case assumptions with no impact on the dairy industry. That would be the most reasonable estimate if non-feed constraints halted dairy expansion in the near future and there was no need to shift land from vegetable to feed production. The total impact on Stanislaus County income would be $4,092,282, or 0.043% of 1998 county income. Adding the additional agricultural acreage affected in the sensitivity analysis raises the impact to $5,056,504 and 0.053% of 1998 county income. The base case income reduction including dairy impacts is $7,041,820 and 0.074% of 1998 county income. This estimate will be used as the most likely case for the cost-benefit comparisons throughout the remainder of the report. The highest estimate is for the sensitivity analysis case including dairy impacts for all acquisitions and easements and is $8,864,569 and 0.093% of 1998 county income.

All impact estimates are based on crop prices and yields averaged for the 1986 through 2000 period and converted to 1998 dollars. For private lands those yields exceed 1998 yields by between 18% and 28%, depending on the mix of crops in the various flood frequency zones. For acreage currently public or subject to conservation easements the 1986- 2000 per acre yields exceed those for 1998 by between 11% and 25%. IMPLAN

estimates indirect and induced impacts based on 1998 prices. Therefore the estimates presented here overstate the total loss of income to the county by a similar percentage. Even assuming agricultural product prices recover to the average for the1986- 2000 period, for total county income to increase by the same percentage, it would require that wages and all input prices increase by that percentage in real terms There is no reason to expect higher agricultural product prices to lead to higher real input costs, but primarily to higher property and proprietor income. Since the net impact on county income excludes all property income and 86% of proprietor income, the increase in agricultural income would not lead to greater losses to the county but higher prices for public land acquisitions and conservation easements.

If 1998 prices are used to calculate the income losses the totals are reduced by 17.2%, 23.9%, and 21.0% for the existing public, base case, and sensitivity analysis, respectively. The impact for existing public plus the additional base case acquisitions and easements decreases to $5,617,522 and 0.059% of 1998 Stanislaus county income. The impact, including the acquisitions and easements from the sensitivity analysis, is $7,0575,494 and 0.074% of 1998 county income.

THE COST TO STANISLAUS COUNTY OF REDUCED AVAILABILITY OF AGGREGATE RESOURCES

Introduction

During the public scoping process for this study a number of individuals expressed concerns regarding the potential impact of Tuolumne River channel restoration on the future availability of aggregate resources in Stanislaus County. There were two general types of concerns expressed. First, channel restoration will require the use of so much aggregate material that the availability for other uses will be constrained during the three-year restoration process. Second, that limits on mining within the expanded Tuolumne River floodway will reduce the amount of present and future permitted resources. These issues are addressed in this section of the report.

Demand-Side Considerations: Aggregate Requirements for Tuolumne River Channel Restoration

Restoration of natural populations of migratory chinook salmon is a central goal of channel reconstruction on the lower Tuolumne and is being undertaken as a part of the Habitat Restoration Plan for the Lower Tuolumne River Corridor. The plan was approved by the Tuolumne River Technical Advisory Committee (TRTAC). The TRTAC was formed out of the Federal Energy Regulatory Commission (FERC) settlement agreement and is composed of representatives from Federal and State agencies, the two local irrigation districts, the City and County of San Francisco, and private special interest groups. The Turlock Irrigation District (TID) is the lead agency for restoration projects on the lower Tuolumne River undertaken on behalf of the TRTAC. Projects funded under the AFRP include those requiring the use of significant amounts of aggregate resources. In particular, the filling of large in-channel mining pits (Special Run Pools 9 and 10) and the planned replenishment of spawning gravel will require in excess of three million cubic yards of aggregate (TRTAC 2001).

In 1995 Stanislaus County aggregate production was 2.7 million tons. Three million cubic yards is roughly equivalent to between 3.6 and 5.4 million tons or as much as two years of average Stanislaus County production. The concern raised by the mining industry is that the increased demand for aggregate during the period the channel restoration projects are ongoing will reduce the availability of aggregate with adverse economic consequences for the county's economy. However, it is unlikely that the economy will experience any adverse impact resulting from higher aggregate prices since higher production cost for those industries demanding the resources will be offset by higher income within the aggregate industry.

The Aggregate Industry in Stanislaus County

In 1995 production of aggregate in Stanislaus County was 2.7 million tons (CDOC 2002). Approximately 5% of the material produced within the county is sold outside of the county. In-county production meets roughly 75% of demand by Stanislaus County industries and institutions. Imports from outside the county came from the Corral Hollow Fan and Hospital Creek Fan in southern San Joaquin County and the Table Mountain Quarry in southwestern Tuolumne County. Eighty percent of the aggregate was used in

Portland cement and related products with the remainder going to road base and other uses requiring lower quality materials (CDOC 1993).

Future resource availability is a serious concern. In a 1993 report it was written that, "At the current rate of production, the permitted reserves of concrete-grade aggregate in Stanislaus County will be depleted by the year 2002, eight years from the time of this study (CDOC 1993)." More recently in an interview with an executive of the Construction Materials Association of California it was stated that currently permitted supplies of aggregate are sufficient to sustain production for nine years or until 2011 (CMAC 2002). It is clear that additional reserves must be permitted in the near future, however, there are sufficient resources not yet permitted to meet demand into the indefinite future.

"A total of about 32 square miles of land in the county have been classified as either MRZ-2a or MRZ-2b, which are zones that indicate significant mineral resources are known or inferred to be present." In addition, "Of the 32 square miles of land classified as either MRZ-2a or MRZ-2b, 92 percent of this area is classified for construction aggregate in the form of sand and gravel." Estimated concrete-grade aggregate resources within the county total 540 million tons with 217 million tons on the Tuolumne River (CDOC 1993).

> At present and in the near future, the most important area of Stanislaus County for mineral resources is the upstream portion of the Tuolumne River from Waterford to La Grange—an area with eleven producing aggregate mines and substantial concrete-grade aggregate resources. Other important mineral resource deposits can be found on the upper Stanislaus River, the Sierra Nevada foothills between Knights Ferry and La Grange, the foothills area of the Coast Ranges west of Newman, a small area at the very northern tip of the county, and several alluvial fans adjacent to the Coast Ranges in the vicinity of Interstate 5. CDOC 1993)

The Impact on the Stanislaus County Economy of Diverting Aggregate Resources to Channel Restoration Projects on the Tuolumne River: A Sample Calculation

The impact of a temporary increase in the price of aggregate within the county is assessed in this section. This is the demand-side issue discussed above and the analysis is limited to the impact on the Stanislaus County economy of higher prices for aggregate materials. The issue of future supplies and the effect restoration activities will have on those supplies is addressed in the following section.

Suppose the increase in demand due to channel restoration on the Tuolumne River leads to a 50% increase in the price of aggregate produced within Stanislaus County for the duration of the projects. Aggregate use is $19.8 million or 0.110% of 1998 county output of $17,970 million. A 50% increase in the price for local production would increase the cost of aggregate to $27.2 million increasing the county average cost of production by $7.4 million. Assuming that the higher production costs are passed on to consumers in the form of higher prices and that a given percentage increase in price results in an equal

percentage reduction in quantity demanded (the equivalent of assuming budgets are fixed) then county output and income decline by 0.0413% or $7.4 million and $3.9 million, respectively (IMPLAN 2000).

Aggregate industry income in 1998 was $11.4 million including wages, proprietor income, property income, and indirect business taxes. If aggregate prices were to increase by 50% industry income would rise to $18.9 million, an increase of $7.4 million. Even if production costs rose by 50% along with prices, industry income would still increase by $5.7 million, more than offsetting the income loss in other sectors of the economy (IMPLAN 2000). Unless the percentage decrease in county output is more than 1.88 times the increase in the average cost of production, county income is increased. In the case where the cost of production for aggregate increases by 50%, county output would need to decline by 1.45 times the increase in the general cost of production for all county industries and institutions.

The results of the sample calculation are somewhat counterintuitive. It seems reasonable that the income increases and decreases should exactly offset. The reason they do not is due to the structure of the aggregate industry relative to the average industry in the county. A much larger percentage of aggregate industry output (79.5%) becomes income within the county compared with the Stanislaus county average (53.0%) (IMPLAN 2000). That is because the aggregate industry is less reliant than average on inputs imported from outside the county.

Impacts on Future Supplies of Construction-Grade Aggregate in Stanislaus County

There are three possible avenues through which channel restoration work on the Tuolumne River could affect future supplies of aggregate in Stanislaus County. First, because of the volume of material needed to replenish spawning gravel and for filling holes in Special Run Pools 9 and 10, existing reserves will be exhausted at an earlier date. Given that current permitted reserves are only sufficient to last 9 years and that channel restoration will use between 1.5 and 2.0 years of those reserves, that is a legitimate concern. Second, by requiring setbacks from the river channel, existing aggregate mining could be affected. However, of the 1817 acres contained within the Tuolumne River channel, only 7.4 acres are listed under the extractive industry category (GIC 2002). Third, by removing 1817 acres of land from the potential aggregate resource category it might reduce newly permitted facilities, and thus future reserves. If all of that land contained aggregate resources it would represent 8.9% of the potential resources in the county (CDOC 1993). Current setbacks for a Stanislaus County mining use permit are 100 feet from the 11,000 cfs flow line. The project setback dikes are for a 15,000 cfs flow way, not that much wider in most cases than the current regulatory take. For most of the restoration project the area has already been mined, and the impact on resource supplies is limited (TID 2002a).

The average (1960-1991) per capita consumption of aggregate in Stanislaus County is 7.3 tons (CDOC 1993). Nine years of reserves are available at current production levels. However, in the 1993 report issued by the California Department of Conservation, Division of Mines and Geology it was estimated that the 1993 permitted reserves would

be exhausted by 2002. It is clear that it not a lack of sufficient resources but the timing of resource permitting that is responsible for the short time horizon for available reserves. The length and expense of the permitting process may make it uneconomical to permit additional reserves too far in advance of the time the production can be sold. In some cases reserves are permitted in small units with new resources becoming available as reclamation of older production areas near completion (CDOC 2002). According to the Construction Materials Association of California, the problem is that the permitting process is so lengthy and uncertain newly permitted reserves may not become available prior to exhaustion of existing permitted resources (CMAC 2002).

Conclusions

Whatever problems are presented by constraints on the future availability of construction-grade aggregate in Stanislaus County, it does not appear that channel restoration activities on the Tuolumne River will significantly affect their magnitude. More importantly, residential and commercial development in potential aggregate producing areas generate resistance to mining activities and lengthen the permitting process. This has occurred along the Stanislaus River and without the efforts of some in Stanislaus County, similar impediments could be created along the Tuolumne River (CDOC 2002). Any temporary increase in aggregate prices due to in-channel use will actually increase Stanislaus County income.

INTRODUCTION TO LOCAL BENEFITS ASSESSMENT

Habitat restoration and/or rehabilitation goals are to be achieved through the cooperation of federal, state, and local government agencies in conjunction with private individuals and organizations. Increases in populations of fish and other wildlife, as well as diverse plant communities are indicators of enhanced biodiversity and ecosystem health. The goals include a doubling of anadromous fish populations (CVPIA) and the creation of sustainable populations of threatened species. In CALFED's Strategic Plan for Ecosystem Restoration the expressed goal is, "to restore or mimic ecological processes and to increase and improve aquatic and terrestrial habitats to support stable, self-sustaining populations of diverse and valuable species" (CALFED 1999). The U.S. Fish and Wildlife Service (USFWS) also advocates an ecosystem approach as a "critically important tool in promoting the conservation of biological diversity and an environmentally sustainable level of development" (USFWS 2000). The ecosystem approach as envisioned by the USFWS "means protecting or restoring the function, structure, and species composition of an ecosystem while providing for its sustainable socioeconomic use" (USFWS 1997).

In order to achieve the CVPIA goal of a doubling of populations of anadromous fish species, the ecosystem approach implies a combination of actions. The purpose of the actions is to "improve survival rates by reducing or eliminating entrainment of juveniles at diversions", and to enhance "the opportunity for adult fish to reach their spawning habitats in a timely manner" (AFRP 2002). The Anadromous Fish Restoration Program (AFRP) involves a range of actions including alteration of seasonal water flows, restoration of riparian habitat, and improving spawning conditions in and along streams in the central valley. Projects "include removing artificial barriers to migration, installing or upgrading fish ladders, expanding or improving the quality of spawning grounds, rearing habitat and riparian habitat, and acquiring permanent easements in floodplains and riparian corridors" (AFRP 2002).

For the San Joaquin River the AFRP goals are to be achieved by continuing to,

> Engage in water management forums to help insure that the quantity, quality, and timing of water delivered benefits natural fish production in the mainstem San Joaquin below the three salmon producing tributaries. At the same time work with the San Joaquin National wildlife Refuge, in coordination with the U.S. Army Corps of Engineers and other agencies and local interests, to develop a land acquisition, restoration, and conservation strategy that will protect, restore and re-couple floodplain and riparian habitats to improve rearing and migratory habitats for anadromous fish and provide collateral flood management benefits (AFRP 2002a).

On the Tuolumne River below La Grange Dam,

> The AFRP is working with the Tuolumne River Technical Advisory Committee (TRTAC) and the FERC Settlement Agreement (SA) framework to develop restoration and monitoring strategies [that] include: 1) continue to develop and fund

the remaining two segments within the 6-mile Mining Reach, 2) complete restoration of the two large in-channel pits (Special Run Pools 9 and 10), 3) develop a sediment management plan that will protect and restore critical spawning and rearing areas in the upper river, 4) work with agriculture and municipal interests in the lower river to establish and restore a riparian corridor for river function, and 5) continue to work with local interests on the Corps of Engineer's on a flood protection strategy that will maximize benefit and potential (AFRP 2002b).

The socioeconomic costs imposed by the various projects are likely to vary considerably by county. For Stanislaus County the primary economic impact is due to the conversion of land in the river floodplains from current agricultural and mining uses to restored riparian habitat. The benefits assessed in this report can be separated into two general categories: recreational and the value of economic activity generated by channel and habitat restoration. In the following sections we consider the value of those benefits to the residents of Stanislaus County. Recreational benefits assessed include the impact of ecosystem enhancement projects on the value of fishing and wildlife watching. In addition the amenity value to local residents (non-user benefits) are considered.

Methodology for Benefits Estimation

Environmental benefits accrue to local residents through two pathways. First, an improvement in environmental quality increases the value to local residents of those activities that depend on the quality of the environment. Fishing is more highly valued when more fish are caught per unit of effort. Wildlife watching is more rewarding and thus greater value is placed on the activity in a diverse environment with more viewable wildlife. For those residents who do not engage in recreational activities on the San Joaquin and Tuolumne Rivers, there are non-user benefits deriving from the existence of enhanced biodiversity and other factors contributing to amenity value. Second, nonresident users derive value from the use of higher quality local resources. While these benefits are not received directly by residents, the increased spending by visitors generates additional local economic activity.

Resident benefits resulting from an increase in the quality of the local environment are measured as the increase in the willingness to pay for affected recreational activities. The value placed on those activities is the sum of what residents spend to participate plus what additional amount they are willing to pay. This added amount, called consumer surplus, is not actually paid, but rather is the net benefit of the activity to the participant. The value of a quality improvement is a function of the increase in willingness to pay per unit of use and the increased rate of use by participants. Specifically, the value is equal to the gross willingness to pay for use of the higher quality recreational resource times the use rate following the quality improvement, minus the pre-improvement willingness to pay times the pre-improvement use rate. For example, if an angler uses the river 14 days per year and is willing to pay $50 per day for that use, the initial value of the fishery resource is $700 per year for that angler. Assume that following an improvement in fishery quality the same angler uses the river 16 days annually and values each day of use at $70. The annual benefits to the angler of the change in resource quality are then equal to $1120 (16 days x $70/day) minus $700, or $420.

For nonresident participants the value to Stanislaus County is derived from the travel expenditures of visitors. The local value of an improvement in resource quality is due to the impact on nonresident participants' willingness to travel to the county. More frequent trips mean additional spending in the county. The value to Stanislaus County of increased nonresident use is the product of trip related expenditures per visit and the increase in the number of trips resulting from the improvement in recreational resource quality. The total value to Stanislaus County residents of an improvement in local resource quality is then the sum of resident benefits and the impact of additional local spending by visitors.

The Economic Value of Fishery Resources

The California Department of Fish and Game's (DFG) annual creel census summarizes angler effort in terms of species sought. The results for 2000 are derived from a sample obtained during the April 1 to December 31, 2000 period. The only portion of the San Joaquin River surveyed is between the delta (the confluence of the San Joaquin and Sacramento Rivers) and Mossdale Crossing in San Joaquin County. The San Joaquin River within Stanislaus County and the Tuolumne are not surveyed. The Region 4 Anadromous Fisheries Division did conduct a survey during April and May of 2000 on the San Joaquin River between the Stanislaus and Merced Rivers, the Tuolumne River from Geer Road to La Grange, and the Merced River from the Crocker-Huffman Dam to the confluence with the San Joaquin River. The results of this survey are used to estimate use on the portions of the Tuolumne and San Joaquin Rivers within the study area.

The creel survey results for the delta to Mossdale Crossing portion of the San Joaquin River indicate that 17.57% of the angler use (49,580 hours) is during the months of April and May. Estimated angler hours for those months on the Stanislaus River to Merced River segment of the San Joaquin River is 30,071 hours or 60.65% of the use on the lower San Joaquin. Using the estimated fishing days from the lower San Joaquin River and taking 60.65% of the total yields an estimated 26,662 fishing days for the Stanislaus River to Merced River portion of the San Joaquin River. Using a similar approach for the Geer Road to La Grange portion of the Tuolumne River yields an estimated 8,541 annual fishing days (DFG 2000, 2001, 2001a).

The fishery benefits estimates are calculated for the portion of the San Joaquin River passing through Stanislaus County and the Tuolumne River below La Grange Dam. In addition, Stanislaus County resident use of the San Joaquin River between Mossdale Crossing and the delta are included in the benefits calculations. The value of resident use of the Sacramento-San Joaquin Delta is excluded from the total. The reason for including the value of downstream fishing for residents is that changes leading to improved fishery quality within the county also affect the quality of fishing further down river. However, since delta water quality is primarily influenced by Sacramento River water quality, the value of resident use of that resource is not included. Due to a lack of data, the value of Stanislaus County resident use of the Merced and Stanislaus Rivers is also excluded from the benefit calculations.

Resident use of the lower San Joaquin River is taken directly from the raw data for the 1999 creel survey. The observations are listed by ZIP code allowing identification of Stanislaus County residents. The Region 4 survey is used to estimate use on the San Joaquin River between Mossdale Crossing and the Stanislaus County line. The number of river miles between the southern county line and the Merced River is roughly equal to the distance between Mossdale Crossing and the confluence of the San Joaquin and Stanislaus Rivers. Geer Road is at river mile 26 on the Tuolumne and thus the Region 4 survey does not provide estimated use for the portion of that river from Geer Road to the confluence with the San Joaquin River. Because of the similarities in access, bank material, and river miles, estimated angler use for the San Joaquin is also employed for projecting use on the lower Tuolumne River.

The ratio of local use to total use is established using the raw data for the lower San Joaquin River. The delta to Mossdale Crossing portion of the river is located primarily within San Joaquin County. Local county residents are responsible for 51.1% of the use and it is assumed that the same ratio of local to total use applies for the Tuolumne River and the portion of the San Joaquin River located within Stanislaus County. Local resident and visitor use is used to calculate the value of the fishery resource. For local residents the value is the value of a fishing day for each species sought. For visitors it is the impact on Stanislaus County income of the visitor spending.

There are a number of studies that attempt to measure the value of fishery resources. Using LOGIT functions, travel cost analysis, contingent valuation or other methodologies they estimate the value of a fishing day or some other unit of fishery resources. Summaries of the results of several studies are included in Table 18.

There are a number of problems associated with applying the results of these studies to the estimation of local benefits from improvement in San Joaquin and Tuolumne River fishery resources. The main difficulty is that the studies are site-specific. Estimates can vary considerably depending on proximity to population centers, species of fish sought, availability of substitute sites, and other factors. The use of the results of a study based on one set of site-specific parameter values to estimate the economic value of fishery resources in an area where parameter values differ substantially can result in significant errors in the estimates.

Another issue is whether the gross or net willingness to pay should be used to value a fishing day. The difference is the cost of accessing the particular site. However, where local residents are using the resource, travel costs are relatively low and the gross willingness to pay is the more appropriate value measure. In the case of Stanislaus County resident use of the lower San Joaquin River net values are used since some travel costs are incurred.

Table 18
Value Of Fishery Resources (in 1998$)

Study	Date/ Location	Species/ Type	Unit	Net*	Gross**
Charboneau and Hay 1978	1975/U.S.	Trout and Salmon Catfish Bass	Per Day	$102.21 $40.35 $51.10	
Creel and Loomis 1992	1989/San Joaquin Valley, California	Fishing	Per Participant Annually		$165.69 – $180.16
Daubert and Young 1975	1978/Colorado	Trout	Per Day		$29.18 – $75.88
Duffield and Allen 1988	1986/Montana	Trout	Per Trip		$141.88
Gorden, Chapman and Bjornn 1972	1970/Idaho	Salmon	Per Day	$96.60 – $142.80	
Gum and Martin 1975	1973/Arizona 1973/Arizona	Cold Water Warm Water	Per Trip Per Trip		$184.03 $168.57
Huppert 1989	1985 -` 86/ California	Salmon and Striped Bass/Saltwater	Per Day	$89.23 – $440.21	
Loomis, Sorg, and Donnelly 1986	1982/Idaho	Brown Trout	Per Trip		$83.45
Olsen, Richards, and Scott 1991	1991/U.S.	Trout and Steelhead Salmon	Per Trip		$89.55 $107.66
Russell and Vaughn 1982	1975/U.S. 1975/U.S. 1975/U.S,	Trout Bass Catfish	Per Day Per Day Per Day	$33.63 $29.39 $21.21	$73.02 $64.84 $48.48

* Net Value is the total willingness to pay for the fishery resource minus the cost of the use.

**Gross Value is the total willingness to pay for the fishery resource.

The entries in Table 18 indicate that the value of a fishing day varies considerably depending on the species sought. For purposes of the calculations the 1998 dollar values from the 1982 Russell and Vaughn study are used for trout, bass, and catfish. The value for catfish is also used for other warm water species such as sunfish and carp. Where "any" is listed as the target species the value used for a fishing day is the weighted average by type of fish sought for those anglers indicating a species preference.

Table 19 summarizes the value of a fishing day by species sought. All local fishing is valued at gross willingness to pay while Stanislaus County resident use of the delta to Mossdale Crossing portion of the San Joaquin River is valued at net willingness to pay. Table 20 presents the estimated fishing days by county residents for each river segment. Table 21 includes the estimated annual value of each river segment to Stanislaus County residents. The table entries are the product of the corresponding entries from Table 19 and Table 20 and the total estimated annual value to county residents is the sum, or $2,089,903.

Table 19
Daily Fishing Values Used to Calculate Resident Fishing Benefits
By River Segment (in 1998$)

River Segment	Any	Catfish	Bass	Sturgeon	Trout
San Joaquin- Delta to Mossdale Crossing	$27.40	$21.21	$29.39	$29.39	n.a.
San Joaquin- Mossdale Crossing to Southern County Line	$49.77	$48.48	$64.84	n.a.	n.a.
Tuolumne- San Joaquin River to Geer Road	$49.77	$48.48	$64.84	n.a.	n.a.
Tuolumne- Geer Road to La Grange Dam	$68.43	$48.48	$64.84	n.a.	$73.02

Table 20
Estimated Annual Fishing Days by Stanislaus County Residents
By River Segment

River Segment	Any	Catfish	Bass	Sturgeon	Trout
San Joaquin- Delta to Mossdale Crossing	1649	3463	10249	518	0
San Joaquin- Mossdale Crossing to Southern County	12412	1117	95	0	0
Tuolumne- San Joaquin River to Geer Road	12412	1117	95	0	0
Tuolumne- Geer Road to La Grange Dam	2623	183	428	0	1130

Table 21
Annual Value of Fishing to Stanislaus County Residents
By River Segment (in 1998$)

River Segment	Any	Catfish	Bass	Sturgeon	Trout	Total
San Joaquin- Delta to Mossdale Crossing	$45,183	$73,450	$301,218	$15,224	$0	$435,075
San Joaquin- Mossdale Crossing to Southern County Line	$617,739	$54,162	$6,184	$0	$0	$678,085
Tuolumne- San Joaquin River to Geer Road	$617,739	$54,162	$6,184	$0	$0	$678,085
Tuolumne- Geer Road to La Grange Dam	$179,496	$8,887	$27,733	$0	$82,542	$298,658
				Total Value		$2,089,903

The value of nonresident use of local fishery resources is calculated from the estimated fishing days by non-residents and the local income impact of daily visitor expenditures. Daily expenditures are from the *National Survey of Fishing, Hunting,, and Wildlife-Associated Recreation* (USFWS 1996). Daily expenditures total $39.40 (1998 dollars) and are separated into various categories: food, lodging, transportation, boat related, and other. Income impacts are estimated using the IMPLAN model and total $37.04 (after deducting 69% of indirect business taxes). The annual contribution to Stanislaus County income from an estimated 30,252 annual visits by non-resident anglers is the product of the daily impact and the number of visits, or $1,120,467. The total annual value to Stanislaus County residents of fishing activity on the Tuolumne River below La Grange Dam and the San Joaquin River from the delta to the southern border of the county is the sum of the benefits to residents and the income impacts of visiting anglers. The total is $3,210,292.

The Value of a Change in Fishery Quality

The goal of the Central Valley Improvement Act (CVPIA) is to "at least double natural production of anadromous fish in California's Central Valley streams". This is to be achieved through enhanced water flows, reduced entrainment of juvenile fish at diversions, improved access to spawning habitats, and restoration of riparian habitat. Specifically, Section 3406(b)(1) of the CVPIA states that the goal of the Anadromous Fish Restoration Program (AFRP) is to,

> Develop within three years of enactment and implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991 (USFWS 1997).

Targeted species include chinook salmon, steelhead, striped bass, American shad, and white and green sturgeon.

For the 1992-1998 period average salmon runs on the San Joaquin River were 15,584 fish annually. The 1967-1991 average was 38,234 fish annually. Achieving the CVPIA target implies a 145% increase in salmon abundance on the San Joaquin River. Salmon runs on the Tuolumne River averaged 5,161 for the 1992-1998 period while the 1967-1991 baseline runs were 18,872 fish annually. Achieving the CVPIA target implies a 266% increase in salmon abundance on the Tuolumne River (AFRP 2002a, 2002b).

Anadromous species are not the target of fishing activity in any of the river segments included in this study. The sole exception is for sturgeon fishing in the portion of the San Joaquin River between the delta and Mossdale Crossing. However, changes in the Tuolumne River channel, water quality on the Tuolumne and San Joaquin Rivers, and amount of riparian habitat are likely to significantly impact the populations of all fish species.

We could find only a single published study linking fish abundance with the catch rate. In the majority of studies attempting to measure the value of changes in the quality of sport fishing resources, the unit of quality is the per day or per trip catch rate. The one study addressing the link between abundance and catch rate was for salmon fishing at various ports along the California coast. The authors found that for a ten percent increase in fish populations, catch per trip increased by more than ten percent. In addition, they found that a ten percent increase in abundance increased angler use by between 1.3 and 6.9 percent (Andrews and Wilen 1988). In a recent unpublished study of fishing on the Sacramento River basin it was found that a 35% increase in the weighted catch rate for salmon and striped bass increased the value of a fishing day by 46% and increased annual use by 62% (Gallo 2001). In a study done for the Columbia River basin a doubling of the catch was valued at $27.28 and $53.94 (1998 dollars) for trout and salmon, respectively (Olsen 1991).

Andrews and Wilen point out that abundance in the ocean salmon fishery is well publicized. For ports where the majority of anglers are local and thus are able to respond to known changes in fishing conditions, angler use and catch rate are particularly responsive to variations in salmon populations. As populations of anadromous and other species in the San Joaquin and Tuolumne Rivers increase and that fact becomes well known to anglers, it is likely that a strong relationship between fish abundance and angler participation will emerge.

The value of the changes in fishery quality resulting from the channel and habitat restoration efforts on the Tuolumne and San Joaquin Rivers depends on a number of factors. If recovery of anadromous species progresses to the point where limited fishing is permitted, the value of the fishery would increase significantly. Limiting fishing opportunities to species currently the target of angler effort in the area would have a smaller impact on fishery value even with a substantial increase in the average catch rate. The degree to which land acquisitions and easements provide improved access also affects the value of the fishery. Limited access to many areas of the river prevents full utilization of its recreational potential. Restoration of riparian habitat serves a dual purpose in enhancement of the value of the fishery. By providing shade, and contributing woody debris and nutrients to waterways it reduces water temperatures and increases cover and food for juvenile fish, thus increasing fish populations. It also raises the value of fishing activities by enhancing the aesthetic value of the associated environment. The impact on the value of the fishery depends on the combined effect of these ecosystem impacts.

A firm value cannot be established for the improvements in fishery quality on the San Joaquin and Tuolumne Rivers. However, a reasonable estimate can be made if based on two plausible assumptions. First, populations of all fish species increase in roughly the same proportion as populations of anadromous fish. Second, that the Andrews and Wilen estimates of angler response to increases in the catch rate are indicative of what will occur on the San Joaquin and Tuolumne Rivers. The increase in populations of anadromous species necessary to meet the AFRP goals are 145% and 266% on the Tuolumne River and San Joaquin River, respectively (AFRP 2002a, 2002b). For each 10% increase in the catch rate (assumed proportional to fish populations) angler effort in terms of fishing days increases by between 1.3% and 6.9%, or an average of 4.1% (also equal to 41% of the change in catch rate and fish populations). Assuming no change in the value of a fishing day the annual value of a quality change is equal to the increase in the number of fishing days per year. For the average response rate of 41% of the change in fish populations, fishing days on the Tuolumne River would increase by 109%. On the San Joaquin River a 145% increase in fish populations would increase annual fishing days by 59%. The annual value of these changes to resident anglers is $1,721,414. The income that accrues to Stanislaus County as a result of the increase in visitor spending totals $979,865. Therefore, the annual value of the improvement in fishery quality is $2,701,210.

The reliability of the estimated impact of quality changes on fishery value depends on the reasonableness of the assumptions on which the estimates are based. However, it is the

author's opinion that the error is likely to underestimate the value. There are several reasons for this. First, the value of a fishing day was assumed constant. A number of studies indicate that an improvement in fishery quality increases the value of a fishing day as well as the angler participation rate (Gallo 2001). Second, it is assumed that no fishing for salmon and striped bass will be permitted even if the AFRP fish population goals are met. The lack of baseline catch data for these species makes estimation of future angler effort impossible. However, even a limited catch and release program for steelhead, salmon, or both species would increase the fishery value substantially (Loomis 1986). Third, it is assumed that improvements in water quality increase angler use of the fishery only through the hypothesized impact on fish populations. A number of studies have estimated the value to anglers of improvements in the fishing environment including water quality and the aesthetic quality of the riparian environment (USFWS 1999, Meyer Resources 1985).

The Economic Value of Wildlife Watching - Stanislaus County Residents

In the *National Survey of Fishing, Hunting and Wildlife-Associated Recreation* (USFWS 1996) nonresidential wildlife watching is defined as those activities involving "trips or outings at least one mile from home for the primary purpose of observing, photographing, or feeding wildlife" (USFWS 1996). According to the survey, 10% of California's population aged 16 and over engages in nonresidential wildlife watching for an average of 8.2 days per year in their state of residence. Daily expenditures including trip and equipment costs average $101.27 in 1998 dollars. Assuming Stanislaus County resident interest in wildlife watching is represented by the state average, 10% of the 339,034 adult county residents (as of July 1, 2001) engage in that activity for a total of 278,007 days annually, spending $28,153,819 each year. While these figures are useful for describing the importance of this recreational activity to county residents, they cannot be used to value a particular wildlife watching opportunity or site.

Wildlife Watching in Stanislaus County

Wildlife watching opportunities created in association with acquisitions, easements, and habitat restoration in the Tuolumne River and San Joaquin River flood plains can be categorized according to whether they are created inside or outside of a refuge area. The purpose of the San Joaquin River National Wildlife Refuge (SJRNWR) project is:

> To acquire lands and to restore riparian and other wetland habitats along the San Joaquin River for the benefit of numerous species including Aleutian Canada geese, greater sandhill cranes, western yellow-billed cuckoos, raptors such as the Swainson's hawk and bald eagle, riparian brush rabbit, riparian wood rat, valley elderberry longhorn beetle, splittail, and San Joaquin tributaries full-run chinook salmon. In addition, shorebirds, waterfowl, herons, and neotropical migratory songbirds will benefit from restoration and protection actions. (UC Davis 2001)

Creation of additional riparian and other natural habitat will also increase wildlife viewing opportunities outside of the refuge. Those opportunities will not be limited to the acreage directly affected by acquisition and restoration activities. Increased biodiversity will increase the quality of wildlife viewing throughout the area. However,

due to a lack of baseline data it is impossible to present even tentative estimates of the value of the enhanced off-refuge wildlife viewing opportunities.

Currently entry to the SJRNWR is limited to guided tours with annual on-refuge use at 1500. It is estimated that an additional 2500 individuals view wildlife from the perimeter of the refuge. With the construction of a viewing platform and other facilities use is projected to increase by 15,000 visitor days annually. This is considerably less than current use at the Merced and San Luis refuges with in excess of 40,000 visitor days annually for each (USFWS 2002).

Use data for the Merced and San Luis units is not compiled by area of residence of the visitor. The only refuge in the system that has visitor data by ZIP code is the Sacramento National Wildlife Refuge (SNWR) at Willows, California. But, that data cannot be used to establish the mix of resident and nonresident visitors since the refuge is located in Glenn County with a total population of just over 27,000. Only 99 visits by adult county residents were recorded out of a total of over 4,000 visits in 1999 (Adams and Gallo). Adding in the residents of nearby Butte County brings the total of "resident" users to just over 25%. The combined population of Butte and Glenn County is roughly one-half that of Stanislaus County, and like the Willows refuge, the SJRNWR is near Interstate 5 and accessible to out of county visitors. Therefore, for purposes of estimating the value of wildlife watching on the SJRNWR it is assumed that visitors are evenly divided between county residents and those residing outside of the county.

Valuation of Wildlife Watching in the San Joaquin River National Wildlife Refuge

Non-consumptive wildlife recreation has received little attention in the literature despite the fact that participation exceeds that of hunting and it is nearly as popular as freshwater fishing. However, two studies were published based on data collected during 1988-89 for visitors to San Joaquin Valley sites. One estimate of the net benefits associated with wildlife viewing was based on a 1988 survey of refuge visitors engaged in bird watching in the San Joaquin Valley (Cooper and Loomis 1991). They estimated that for then current conditions visitors were willing to pay $154.32 annually (in excess of trip costs) for three trips per year. Dividing by 8.2 days per participant annually results in an estimate of $18.82 (1998 dollars) for daily net benefits. Creel and Loomis provided another estimate for the value of wildlife watching. They estimated a net annual value per participant of $184.03 (1998 dollars), or for 8.2 visits per year, a value of $22.44 per day (in excess of trip costs) (Creel and Loomis 1992). The average value from the two studies is $20.63 per day.

The *National Survey of Fishing, Hunting, and Wildlife Associated Recreation* presents total daily expenditures per wildlife watching participant aged 16 and over. In 1998 dollars the average is $101.27 per day. For visitors daily expenditures for travel averages $44.11. Using IMPLAN to project the effect of visitor expenditures on Stanislaus County income yields a total income impact of $39.64 (after deducting 69% of indirect business taxes) for each visitor day.

The value of wildlife viewing to Stanislaus County is determined as the sum of the value of projected use to county residents and the impact of added local spending by visitors from outside the area. For local residents the daily value is the sum of average daily trip costs ($44.11) and the average net value ($20.63), or $64.73. For refuge visitors from outside of Stanislaus County the impact on the county is the $39.64 increase in county net income per daily visit. Of the 17,500 visitors projected for the SJRNWR 12,662 are assumed to be 16 or older (the same percentage as for the general county population). If refuge users are evenly divided between county residents and visitors from outside of the county the total value of the refuge is $660,805.

As in the case of fishery benefits, the estimated value of wildlife viewing probably understates the true value to county residents. First, the value is limited to wildlife viewing on the refuge. Yet habitat preservation and restoration is likely to create additional wildlife viewing opportunities on and near the affected parcels. Second, no value is included for wildlife viewing by those residents under the age of 16. Younger residents derive educational benefits from the existence of an accessible local refuge. Third, the SJRNWR provides a unique opportunity to view the Aleutian Canada goose. It is possible that the value of that viewing opportunity might exceed the average value of wildlife watching used to determine the benefit value. Due to a lack of data there was no available basis for assessing the impact of these additional factors on estimated wildlife watching benefits.

Other Recreational Benefits

There are a number of additional recreational activities that may take place on or near the San Joaquin and Tuolumne Rivers not quantified in the benefits estimates generated in this report. The value of hunting on lands adjacent to restored habitat may be enhanced. Acquired land along the rivers may be used for a variety of activities including picnicking, hiking, or allowing additional access for canoeing, swimming and other water-based recreational uses. The interest in establishing parks along these waterways is indicative of the potential value the additional facilities will have for residents. The cities of Modesto, Ceres, and Waterford have plans for park expansion and development in the study area. While it can be assumed that this interest is in response to the needs of area residents, it is difficult to provide dollar estimates of the value of additional recreation use.

Habitat restoration and improvements in water quality will enhance the value of any recreation activities undertaken in the vicinity of the river floodplains. In this study valuation of the impact of changes in natural vegetation and water quality is limited to their effect on the quantity of fishing and wildlife watching. That is not to argue there are no additional beneficial effects, rather that a lack of available data makes deriving reliable estimates impossible. Therefore, any additional impacts on the quality of life are classified as non-user benefits.

The Economic Value to Non-Users

Benefits from habitat restoration also accrue to residents who do not engage in recreational resource use. The environmental economics literature categorizes non-user

benefits as existence, bequest, altruistic, option, and ecological services values. It is impossible to separate non-user value into its various components; however, there have been attempts to estimate overall non-user valuation of resource quality changes. The results of various studies provide a basis for estimating the amenity value of wetlands preservation. Two studies useful for this purpose are considered in this section. A study assessing the amenity value of wetlands estimated 1998 dollar values ranging from $287 to $520 per acre (Whitehead 1994). Using an interest rate of seven percent gives a perpetual annual value per acre of $20.09 to $36.40.

In a 1999 study by Taylor and Douglas the value of water flow increases in the Trinity River were estimated for various categories of recreational users, as well as for households classified as non-users. The value per household for a 40 percent increase in stream flow was estimated at $48.97 annually for non-users. For non-users willingness to pay increased by 200 percent for the 40 percent increase in stream flow. The projected benefit increases for non-users were 26.8 percent of the benefits received by all categories of recreational resource users (Taylor and Douglas 1999).

For Stanislaus County 75 percent of households are classified as non-users of recreational resources for hunting, fishing, or wildlife watching (USFWS 1996). The only category of significant benefits common to this study and that done by Taylor and Douglas are those for the value of the fishery. Assuming non-user benefits of 26.8% of the value to resident anglers the Taylor and Douglas' estimates imply non-user benefits of $461,339 annually. Alternatively, using the average annual amenity value for an acre of wetlands of $28.25 and assuming 16,841 acres of restored or preserved habitat in the San Joaquin and Tuolumne River flood plain (base case) yields an estimate for non-user benefits of $475,771 per year. The average for the two approaches is $468,555 and is used to represent non-user benefits.

The value of non-user benefits calculated above appears implausibly low. For the 153,518 households in Stanislaus County as of 1998 the non-user benefits per household are only $3.05. That amount represents the sum of all categories of non-user benefits including the value residents place on species preservation, improvements in the visual landscape (water quality and vegetation), and the ecological services value of enhanced biodiversity.

The environmental economics literature contains a number of studies (based on surveys of residents' attitudes toward preservation) attempting to place values on the various categories of non-user benefits. Several studies estimate households' willingness to pay to preserve threatened and endangered species. For example, the annual willingness to pay per household for a 100% increase in the population of various species was estimated at $15.40, for bald eagles in the state of Washington; $32.94, for bald eagles in New England; $31.29, for Pacific Northwest salmon; and $58.00 for a group of 26 species in the state of Colorado (Loomis and White 1996). Using these figures and the 153,518 households in Stanislaus County implies annual non-user benefits of $2,364,177, $5,066,883, $4,803,578, and $8,904,044, respectively.

Summary of Recreational and Non-User Benefits

Table 22 contains the estimated values for all recreational and non-user benefits to the Stanislaus County economy and residents. Fishing, wildlife watching, and non-user benefits are included for residents, while income effects are provided for visitor expenditures. Visitors are categorized as anglers or wildlife watchers according to the primary purpose of the visit.

Table 22
Summary of Annual Recreational and Non-User Benefits for Stanislaus County Residents and the Economy

Category	Annual Benefits to Stanislaus County
Resident Benefits	
Fishing	$1,721,414
Wildlife Watching	$409,876
Non-Users	$468,555
Sub-Total	$2,599,845
Impact of Visitor Spending	
Fishing	$979,865
Wildlife Watching	$250,929
Sub-Total	$1,230,794
Total Benefits to Stanislaus County	$3,830,639

The Future Value of Recreational and Other Environmental Benefits

- **Population Growth and the Future Value of Recreational Activities**

For purposes of projecting future benefits it is assumed that a constant percentage of the population participates in fishing and wildlife watching activities. Between 1980 and 1990 the percentage of the pacific region population (over the age of six) engaged in fishing activity increased slightly from 25.2% to 25.3%. Between 1991 and 1996 there was a 1% decrease in the participation rate for adult anglers. For non-consumptive wildlife activities away from home the participation rate of the pacific region population aged six and over increased from 13.7% to 17.7% between 1980 and 1990. But between 1991 and 1996 the percentage of the Pacific region adult population engaged in nonresidential wildlife watching declined from 17% to 11% (USFWS 1996). There is no clear trend in participation rates for either recreational activity. In addition, assuming any constant rate of increase (decrease) in participation rates will eventually lead to the unreasonable result that 100% (0%) of the population participates in wildlife associated recreational activities.

- **Income Growth and the Future Value of Recreational Activities**

Between 1965 and 1985, real expenditures per freshwater fishing participant increased by 71.2% (USFWS 1996). During that period per capita Real GDP increased by 50.1%. The implication is that the real income elasticity of demand for freshwater fishing is equal to 1.42 (71.2/50.1) and each 1% increase in real income will induce a 1.42% increase in real spending on that activity. Lacking expenditure data specific to wildlife watching the same 1.42 elasticity of demand estimate is used for that activity.

The Future Value of Recreational Benefits

The real value (in 1998 dollars) of recreational benefits increase at a rate that is a function of the rate of growth in per capita real income and the rate of population growth. Resident benefits are projected using forecasted growth rates for Stanislaus County's population and income. In order to project growth in visitor expenditures, expected future increases in California's population and income are used. There are a number of forecasts of state population growth. For example, the California Department of Finance projects that between 2000 and 2040 the annual rate of population growth for the state at 1.33% (DOF 1998). Woods and Poole (W&P) project annual rates of population growth through 2025 for the state and county of 0.93% and 1.30%, respectively (W&P 2000).

Estimates of the annual growth rate in real per capita personal income also vary widely. The Bureau of Economic Analysis (BEA) estimates that California per capita income will grow at a 0.73% annual rate through 2045 while W&P forecast 1.32% annual growth in per capita income through 2025 (USBEA 2000, W&P 2000). The W&P estimate of annual growth in Stanislaus County per capita income is 0.77% (W&P 2000). All benefit projections presented below are based on the 25-year projections from Woods and Poole.

Per capita real benefits for Stanislaus County residents are projected to rise at an annual rate equal to 1.42 times the rate of increase in county real per capita income, or 1.10% per year. Real expenditures per visitor are projected to increase at a rate equal to 1.42 times the growth rate of California real per capita income, or 1.87 % per year. Accounting for county population growth, and, assuming a constant percentage of the population participates in wildlife associated recreational activities, implies a 2.41% annual rate of increase in real (1998 dollar) benefits to local residents. With a constant participation rate, visitor expenditures increase at a rate that depends on the annual percentage change in California's population. The resulting annual rate of increase in visitor expenditures is 2.82% in constant dollars.

Table 23
Components of the Rate of Increase in Resident Benefits And Visitor Expenditures (Constant Dollars)

(1) Geographic Unit	(2) Annual Growth in per Capita Income	(3) = 1.42 times (2)	(4) Annual Rate of Population Growth	(5)* Annual Rate of Growth in Benefits or Visitor Expenditures
Stanislaus County	0.77%	1.10%	1.30%	2.41%
California	1.32%	1.87%	0.93%	2.82%

* Column 5 is approximately equal to the sum of columns (3) and (4), but column (5)=[1+column (3)][1+column (4)]-1

Expenditures for Habitat Restoration

The effect of habitat restoration is different from the other factors included in the benefit estimates. That is because the primary impact is one-time, generated only for the three years during which each restoration project is active. This is in contrast to the estimated recreational and non-user benefits. These benefits are ongoing and accrue to county residents every year following habitat and fishery restoration. The annual impact on Stanislaus County income due to habitat restoration thus depends on the amount of spending and the time period over which the spending occurs.

For the base case there are 4,741 acres currently in agricultural production (as of 1996) that are targeted for conversion to riparian and other habitat. Future acquisitions and easements on agricultural lands are projected to total 3,911 acres. Active restoration is assumed to occur on 100% of the lands with 70% put into mixed riparian vegetation and the remaining 30% in native grasslands. From actual bids provided by those involved in local restoration activities it was determined that the cost per acre for mixed riparian vegetation is $5351 with 77.5% of the direct output effects occurring in Stanislaus County (SRP 2002). Restoration costs include the full cost of reestablishing vegetation and replanting of native grasses.

The IMPLAN model is used to project the impact on Stanislaus County income. The components of restoration expenditures are allocated to the appropriate IMPLAN sector including greenhouse and nursery products (14.26%), agricultural services (21.19%), and landscape and horticultural services (64.55%). The total impact including the direct, indirect, and induced effects is $4,147 per acre for a 2002 project start date. Assuming a three-year project schedule with uniform annual spending the 1998 dollar income impact per acre totals $3,634 and the average county income change is $1211 annually for three years. For native grasses alone the 1998-dollar impact on the county economy is $702 with 100% of the activity occurring in IMPLAN sector 26.

For the life of the habitat restoration projects Stanislaus County income is increased by $23,831,112 for the base case assumptions. Adding the additional acreage from the sensitivity analysis increases the impact to $28,048,106. For all land currently in riparian or other native vegetation, it is assumed that no additional expenditures are

undertaken in association with preservation or enhancement of existing habitat. Since the income effects are one-time, the annual impact on the Stanislaus County economy depends on the rate at which habitat restoration activity takes place. In the final section costs and benefits are compared assuming habitat restoration occurs over a ten-year period.

Tuolumne River Channel Restoration

Expenditures for channel restoration for projects sponsored by TRTAC are projected to total $28,500,000 over the next five years. In addition the DFG expects to spend $631,000 for the Basso Bridge restoration project. The agency is also planning to introduce additional spawning gravel at a projected cost of $2,500,000. The impact of these projects on Stanislaus County income depends on how much of the spending occurs within the county. For the TRTAC projects some of the contracts have been awarded to firms outside of the county. Vegetation restoration ($700,000), engineering and permitting ($4,000,000), and monitoring ($1,000,000) will be done firms located in other counties (TID 2002). While these activities may still generate local income, for these expenditure categories it is assumed that no income accrues to Stanislaus County residents. For the remaining construction work the firms that have submitted bids are from San Joaquin, Tuolumne, and Stanislaus County (two different firms). Even if contracts for some of the work are awarded to firms outside of the county much of the work is likely to be done with local labor and materials. In the following impact analysis it is assumed that 75% of the income (after deducting the $5.7 million already awarded to outside businesses) is earned by Stanislaus County residents.

The IMPLAN model is used to estimate the income impacts of expenditures for channel restoration. The sector most representative of this type of construction activity is "new highways and streets" (sector 51). The local component of direct expenditures is assumed to be 75% of $25,304,800, or $18,978,600. Those expenditures within the county will generate $7,718,072 in direct income. In addition, indirect and induced income changes are $2,375,003 and $3,348,955, respectively. Channel restoration will generate a total income change for Stanislaus County equal to the sum of the direct, indirect, and induced income components less 69% of the indirect business taxes (the average percentage that does not come back to the county), or $12,975,007 in current dollars. In order to maintain consistency with other cost and benefit estimates contained in this report the income impacts must be converted to 1998 dollars. Using the actual increase in the CPI through 2001, an assumed inflation rate of 2.5% annually thereafter, and a uniform rate of expenditure over the five-year construction period yields a 1998 dollar impact on Stanislaus County income of $11,373,488 or $2,274,698 annually.

COMPARISON OF COSTS AND BENEFITS

Cases Analyzed

In this section three cases are analyzed: the base case, a modified base case, and a case incorporating the additional acreage from the sensitivity analysis. For each of the cases a scenario is constructed that includes completion of land acquisition and habitat restoration within 10 years and compares projected costs and benefits over a longer 25-year period. Although some of the reductions in agricultural production and habitat restoration projects were initiated between 1998 and 2002, the starting point for the 25-year period is 2002. The base case and the modified base case use the agricultural production losses from the second section summarized in Table 17 and the benefit estimates from the third section summarized in Table 22. In the base case projected agricultural losses are initially valued at 1998 prices (the basis for the IMPLAN model) but the value of agricultural production is assumed to increase at a uniform rate, reaching the average for the 1986-2000 period after ten years.

In the modified base case agricultural prices are assumed constant in real terms (at 1998 levels) over the 25 years of the cost-benefit comparison. As in the base case benefits assessed are limited to those associated with increased recreational and aesthetic values, and, the increased economic activity that results from habitat and channel restoration expenditures. Recreational and non-user benefits are assumed to increase with population and income growth. The real rates of growth in recreational benefits and visitor expenditures are included in Table 23.

The third case incorporates all of the assumptions of the base case projection but adds the additional agricultural losses from the sensitivity analysis. Because the percentage of the land acquired in the San Joaquin river floodplain is so large in this case, this represents an upper limit on the potential impacts. The projections are based on the assumption that agricultural product prices recover to their 1986-2000 average, yet it seems unlikely that such a large percentage of the floodplain lands would be sold under a willing seller program with the agricultural economy recovering from the low prices of the late 1990's.

For the cases analyzed it is assumed that no benefits accrue in the first five years of the scenario. While the CVPIA goals regarding populations of anadromous fish species are to be met by 2002, it is assumed that the full impact of the goals on angler effort occurs in 2005. The wildlife watching and nonuser benefits are also deferred until the 3rd year of the scenario. That allows sufficient time to construct a management plan and begin establishing the facilities necessary to attract and service participants in recreational activities. It is assumed that the recreational and non-user benefits are phased in over a five-year period. In 2005 20% of the benefits are included, with an additional 20% added each year until the full value of the benefits accrue in 2009. In the interim the value of those benefits are assumed to grow at the rates specified in Table 23.

For all cases habitat restoration is assumed completed within five years for all lands currently public or subject to public easements. The same schedule is applied to restoration activities in the Tuolumne River channel with the expenditures allocated

equally for the five years of the projects. Additional land acquisitions are assumed to commence in 2003 and be completed in 10 years, or in 2012. Habitat restoration is projected to begin in the year following acquisition with all projects completed in the year they begin. Although the actual completion schedule is three years, assigning all restoration costs to a single year simplifies the analysis. All habitat restoration is assumed completed by 2013.

Base Case

Table 24 contains the annual impacts for the base case over a 25-year period. For the 25 years of the base case scenario there is considerable variation in the calculated net benefits to Stanislaus County residents. For the first five years the net benefits are positive, reaching a maximum of $3,176,514 in 2006. The positive value is due to the combined effects of channel restoration on the Tuolumne River and habitat restoration on existing public lands. For most of the remaining years of the scenario the net benefits are negative as the cumulative agricultural losses grow with additional public land acquisitions and easements. Losses peak at $1,298,068 in 2014 with the end of the impacts from habitat restoration. The negative net benefits in 2014 are 0.009% of forecasted income for Stanislaus County in that year. After the losses peak they gradually decline as the growing real value of recreational and non-user benefits increasingly offsets agricultural losses. The net benefits become positive in 2023 and in 25th year of the scenario the net benefits are $727,417 (0.004% of forecasted Stanislaus county income in 2025) and the present value of the net benefits for the 25-year period (at a 3% real discount rate) is a positive $4,864,467.

Modified Base Case

Table 25 contains the results of the projections for the modified base case. For this case (agricultural product prices are held constant at 1998 values) net benefits are positive in each of the first five years. In 2007 net benefits are negative but again are positive for 2008. With the completion of habitat restoration net benefits become negative in 2014 but just for one year. For the remaining years of the scenario net benefits are positive and growing reaching $1,895,667 in 2026. The present value of net benefits is a positive $18,755,080 for the 25 years of the modified base case scenario.

Sensitivity Analysis Case

The results of the sensitivity analysis case are contained in Table 26. As in the other two cases net benefits are positive for the first five years of the scenario. Net benefits are negative beginning in 2007 and the losses rise through 2014 when they reach a maximum of $3,120,817. The higher value for the peak losses is due exclusively to the agricultural losses associated with the additional 1531 acres of agricultural land publicly acquired in this case. The peak losses are 0.022% of forecasted Stanislaus county income for 2014. Beginning in 2025 the losses gradually decrease reaching a minimum in the 25th year of the scenario. The loss in 2026 is $1,095,332, or 0.006% of forecasted county income in that year. The present value of the net benefits is a negative $14,928,808 for the 25 years of this scenario.

Table 24
Net Benefits to Stanislaus County from Land Acquisitions and Easements in the Tuolumne and San Joaquin River Floodplains: Base Case (in 1998$)

	Ag Income Losses			Benefits					
Year	Existing Public	Base Case Acquisitions	Total Costs	Channel . Restoration	Habitat Restoration	Recreational Benefits Residents	Visitor Impacts	Total Benefits	Net Benefits Base Case
2002	$3,306,440	$0	$3,306,440	$2,274,698	$2,611,727	$0	$0	$4,886,424	$1,579,984
2003	$3,359,336	$262,274	$3,621,610	$2,274,698	$2,611,727	$0	$0	$4,886,424	$1,264,815
2004	$3,413,078	$547,519	$3,960,597	$2,274,698	$3,688,975	$0	$0	$5,963,672	$2,003,075
2005	$3,467,680	$839,069	$4,306,748	$2,274,698	$3,688,975	$617,128	$299,060	$6,879,861	$2,573,112
2006	$3,523,155	$1,142,992	$4,666,147	$2,274,698	$3,688,975	$1,264,002	$614,987	$7,842,661	$3,176,514
2007	$3,579,517	$1,459,690	$5,039,207	$0	$1,077,248	$1,941,696	$948,495	$3,967,439	-$1,071,768
2008	$3,636,782	$1,789,571	$5,426,353	$0	$1,077,248	$2,651,321	$1,300,323	$5,028,893	-$397,460
2009	$3,694,962	$2,133,059	$5,828,021	$0	$1,077,248	$3,394,023	$1,671,241	$6,142,511	$314,490
2010	$3,754,074	$2,490,588	$6,244,661	$0	$1,077,248	$3,475,819	$1,718,370	$6,271,436	$26,775
2011	$3,814,130	$2,862,606	$6,676,736	$0	$1,077,248	$3,559,586	$1,766,828	$6,403,661	-$273,075
2012	$3,861,147	$3,113,592	$6,974,739	$0	$1,077,248	$3,645,372	$1,816,652	$6,539,272	-$435,467
2013	$3,861,147	$3,180,673	$7,041,820	$0	$1,077,248	$3,733,225	$1,867,882	$6,678,355	-$363,465
2014	$3,861,147	$3,180,673	$7,041,820	$0	$0	$3,823,196	$1,920,556	$5,743,752	-$1,298,068
2015	$3,861,147	$3,180,673	$7,041,820	$0	$0	$3,915,335	$1,974,716	$5,890,051	-$1,151,769
2016	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,009,695	$2,030,403	$6,040,097	-$1,001,723
2017	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,106,328	$2,087,660	$6,193,988	-$847,832
2018	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,205,291	$2,146,532	$6,351,823	-$689,997
2019	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,306,639	$2,207,064	$6,513,703	-$528,117
2020	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,410,428	$2,269,303	$6,679,732	-$362,088
2021	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,516,720	$2,333,298	$6,850,018	-$191,802
2022	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,625,573	$2,399,097	$7,024,670	-$17,150
2023	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,737,049	$2,466,751	$7,203,800	$161,980
2024	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,851,212	$2,536,314	$7,387,526	$345,706
2025	$3,861,147	$3,180,673	$7,041,820	$0	$0	$4,968,126	$2,607,838	$7,575,964	$534,144
2026	$3,861,147	$3,180,673	$7,041,820	$0	$0	$5,087,858	$2,681,379	$7,769,237	$727,417
25-Year Net Present Value			$103,590,748					$108,455,215	$4,864,467

Table 25
Net Benefits to Stanislaus County from Land Acquisitions and Easements in the Tuolumne and San Joaquin River Floodplains: Modified Base Case (in 1998$)

	Ag Income Losses			Benefits		Recreational Benefits			Net Benefits
Year	Existing Public	Base Case Acquisitions	Total Costs	Channel Restoration	Habitat Restoration	Residents	Visitor Impacts	Total Benefits	Modified Base Case
2002	$3,306,440	$0	$3,306,440	$2,274,698	$2,611,727	$0	$0	$4,886,424	$1,579,984
2003	$3,306,440	$256,713	$3,563,153	$2,274,698	$2,611,727	$0	$0	$4,886,424	$1,323,271
2004	$3,306,440	$513,426	$3,819,866	$2,274,698	$3,688,975	$0	$0	$5,963,672	$2,143,806
2005	$3,306,440	$770,139	$4,076,579	$2,274,698	$3,688,975	$617,128	$299,060	$6,879,861	$2,803,281
2006	$3,306,440	$1,026,852	$4,333,292	$2,274,698	$3,688,975	$1,264,002	$614,987	$7,842,661	$3,509,369
2007	$3,306,440	$1,283,565	$4,590,005	$0	$1,077,248	$1,941,696	$948,495	$3,967,439	-$622,566
2008	$3,306,440	$1,540,277	$4,846,718	$0	$1,077,248	$2,651,321	$1,300,323	$5,028,893	$182,175
2009	$3,306,440	$1,796,990	$5,103,431	$0	$1,077,248	$3,394,023	$1,671,241	$6,142,511	$1,039,080
2010	$3,306,440	$2,053,703	$5,360,144	$0	$1,077,248	$3,475,819	$1,718,370	$6,271,436	$911,293
2011	$3,306,440	$2,310,416	$5,616,856	$0	$1,077,248	$3,559,586	$1,766,828	$6,403,661	$786,805
2012	$3,306,440	$2,567,129	$5,873,569	$0	$1,077,248	$3,645,372	$1,816,652	$6,539,272	$665,703
2013	$3,306,440	$2,567,129	$5,873,569	$0	$1,077,248	$3,733,225	$1,867,882	$6,678,355	$804,786
2014	$3,306,440	$2,567,129	$5,873,569	$0	$0	$3,823,196	$1,920,556	$5,743,752	-$129,817
2015	$3,306,440	$2,567,129	$5,873,569	$0	$0	$3,915,335	$1,974,716	$5,890,051	$16,481
2016	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,009,695	$2,030,403	$6,040,097	$166,528
2017	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,106,328	$2,087,660	$6,193,988	$320,419
2018	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,205,291	$2,146,532	$6,351,823	$478,254
2019	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,306,639	$2,207,064	$6,513,703	$640,133
2020	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,410,428	$2,269,303	$6,679,732	$806,162
2021	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,516,720	$2,333,298	$6,850,018	$976,448
2022	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,625,573	$2,399,097	$7,024,670	$1,151,100
2023	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,737,049	$2,466,751	$7,203,800	$1,330,231
2024	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,851,212	$2,536,314	$7,387,526	$1,513,956
2025	$3,306,440	$2,567,129	$5,873,569	$0	$0	$4,968,126	$2,607,838	$7,575,964	$1,702,394
2026	$3,306,440	$2,567,129	$5,873,569	$0	$0	$5,087,858	$2,681,379	$7,769,237	$1,895,667
25-Year Net Present Value			$89,700,135					$108,455,215	$18,755,080

Agricultural Prices remain at 1998 levels

Table 26
Net Benefits to Stanislaus County from Land Acquisitions and Easements in the Tuolumne and San Joaquin River Floodplains: Sensitivity Analysis (in 1998$)

	Ag Income Losses				Benefits	Recreational Benefits				Net Benefits
Year	Existing Public Base Case	Sen. Ana	Total Costs	Channel Res.	Habitat Res	Residents	Visitor Impacts	Total Benefits	sens analysis
2002	$3,306,440	$0	$0	$3,306,440	$2,274,698	$2,611,727	$0	$0	$4,886,424	$1,579,984
2003	$3,359,336	$318,067	$153,539	$3,830,943	$2,274,698	$2,611,727	$0	$0	$4,886,424	$1,055,482
2004	$3,413,078	$636,135	$319,012	$4,368,225	$2,274,698	$4,110,674	$0	$0	$6,385,372	$2,017,147
2005	$3,467,680	$954,202	$487,727	$4,909,609	$2,274,698	$4,110,674	$617,128	$299,060	$7,301,560	$2,391,951
2006	$3,523,155	$1,272,269	$662,818	$5,458,242	$2,274,698	$4,110,674	$1,264,002	$614,987	$8,264,361	$2,806,119
2007	$3,579,517	$1,590,337	$844,467	$6,014,321	$0	$1,498,947	$1,941,696	$948,495	$4,389,138	-$1,625,183
2008	$3,636,782	$1,908,404	$1,032,862	$6,578,048	$0	$1,498,947	$2,651,321	$1,300,323	$5,450,592	-$1,127,456
2009	$3,694,962	$2,226,471	$1,228,196	$7,149,630	$0	$1,498,947	$3,394,023	$1,671,241	$6,564,211	-$585,419
2010	$3,754,074	$2,544,538	$1,430,666	$7,729,278	$0	$1,498,947	$3,475,819	$1,718,370	$6,693,136	-$1,036,143
2011	$3,814,130	$2,862,606	$1,640,474	$8,317,210	$0	$1,498,947	$3,559,586	$1,766,828	$6,825,361	-$1,491,849
2012	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$1,498,947	$3,645,372	$1,816,652	$6,960,971	-$1,903,598
2013	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$1,498,947	$3,733,225	$1,867,882	$7,100,054	-$1,764,515
2014	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$3,823,196	$1,920,556	$5,743,752	-$3,120,817
2015	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$3,915,335	$1,974,716	$5,890,051	-$2,974,518
2016	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,009,695	$2,030,403	$6,040,097	-$2,824,472
2017	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,106,328	$2,087,660	$6,193,988	-$2,670,581
2018	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,205,291	$2,146,532	$6,351,823	-$2,512,746
2019	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,306,639	$2,207,064	$6,513,703	-$2,350,866
2020	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,410,428	$2,269,303	$6,679,732	-$2,184,837
2021	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,516,720	$2,333,298	$6,850,018	-$2,014,551
2022	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,625,573	$2,399,097	$7,024,670	-$1,839,899
2023	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,737,049	$2,466,751	$7,203,800	-$1,660,769
2024	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,851,212	$2,536,314	$7,387,526	-$1,477,043
2025	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$4,968,126	$2,607,838	$7,575,964	-$1,288,605
2026	$3,861,147	$3,180,673	$1,822,749	$8,864,569	$0	$0	$5,087,858	$2,681,379	$7,769,237	-$1,095,332
25 Year Net Present Value				$126,774,712					$111,845,904	($14,928,808)

All acreage assumed in the sensitivity analysis is publicly acquired

Comparison of the Three Cases

The specific scenarios presented in Tables 24-26 are constructed based on several assumptions regarding the timing of land acquisition, habitat restoration, and the availability of enhanced recreational and non-user values. The results are not particularly sensitive to the specific assumptions. For example, if land acquisition and habitat restoration are delayed due to government funding constraints, the agricultural income losses are reduced in the early years. But, postponing acquisition also reduces the positive contribution to county income from habitat restoration activities and further defers the recreational benefits that accrue from expansion of restored habitat. The resulting changes in costs are roughly offset by the changes in benefits. The factors having the greatest impact on the magnitude of calculated net benefits are the amount of land ultimately removed from production and agricultural product prices. That is why those are the factors varied across the three scenarios presented.

The three cases presented in this section represent the widest range of possible outcomes. Assigning the title of "base case" does not imply that the projected impacts are the most likely. What the base case does represent is the impact assuming a particular amount of land is removed from agricultural production through public acquisitions and easements and that agricultural product prices recover from their current low levels. However, if agricultural prices do rise, reaching their 1986-2000 average, public agencies might find acquiring the amount of acreage assumed in the base case difficult, if not impossible. Existing conservation easements have been negotiated in an environment of depressed prices for most agricultural products. For this reason the modified base case might describe the most likely outcome and clearly the sensitivity analysis case is the least plausible of the three scenarios.

The recreational and non-user benefits used in each of the scenarios were the best estimates possible given the limited data available. In all likelihood they understate actual benefits, particularly in regards to non-user benefits. Also the exclusion of a number of categories of potential benefits including off-refuge wildlife watching, hunting, canoeing, picnicking, swimming, hiking, etc. imparts a downward bias to estimated benefits. But, the actual value of recreational use of the riverside resources depends, in part, on the management plan established for the use of the restored habitat and the willingness of various government entities to provide the access and facilities necessary to achieve the full recreational potential of the acquired public lands.

Significant differences can be expected in the county-level and regional impacts of habitat preservation and restoration. Estimates of both costs and benefits will be larger for the broader region. The impacts of reduced agricultural production will be larger because the indirect and induced effects across county boundaries will be included. Generally impact multipliers are larger for more broadly defined regions. Benefit estimates will also be larger for habitat restoration activities and increased recreational opportunities. It is likely that close to 100 percent of the direct impact of restoration investment will be felt in the regional economy, while a much smaller percentage will occur in the particular county where the restoration occurs. Estimated recreational benefits are higher when they accrue to local residents. The local benefits of visitor use

of recreational resources include only trip related expenses, which are somewhat less than the total willingness to pay of residents. By defining the local region more broadly, a larger percentage of the use value of the enhanced environment accrues to local residents, thus generating greater measured benefits to the local economy.

Other Considerations: Comments on the Draft Report

Where critical comments were received on the draft report, the writers generally expressed concern regarding the underestimation of benefits, particularly when specific categories of benefits were excluded from the analysis. Two of the comments having the greatest potential to change the results are considered here.

One comment received from the California Department of Water Resources (DWR) expressed concern that no estimate was included for the value of water quality improvements. The only positive impacts of water quality improvements included in the benefits section are through the indirect impact on the quality of the fishery and the aesthetic effects measured as non-user benefits. While water quality improvements may have additional benefits in the form of positive impacts on health and reduced water treatment costs, the value of those benefits to Stanislaus County residents is difficult to quantify. The DWR comment specifically pointed out an important benefit to agriculture, although estimating the impact would require additional data. Riparian vegetation provides a buffer that can reduce agricultural runoff into adjacent rivers and streams. Other measures to control water pollution from agricultural operations may involve the addition of soil binding agents or changes in the timing and methods of applying pesticides and fertilizers. Part of the value of riparian habitat is the cost savings or productivity gains that result from not having to implement these alternative pollution control methods.

Another comment received from the U.S. Fish and Wildlife Service mentioned that the estimated value of the refuge included the use value but not the local economic impact of the spending for refuge operation and maintenance (USFWS 2002a). The reason it was not included in the draft report is that no information was available delineating the local component of that spending. The necessary data has since been made available and a estimates for this impact can be provided.

Refuge operation in Stanislaus County involves one full-time employee earning $70,000 annually and operation and maintenance spending within the county of $100,000 to $200,000 per year. It is expected that another full-time employee will be in residence within a few years (USFWS 2002a). The midpoint of the local spending estimate, or $150,000 annually, and a single resident employee generates an additional $176,410 in county income each year. Removing 69% of the indirect business taxes results in a net annual impact on county income of $168,069. That adds $2,926,603 to the present value of the net benefits to the county for each of the three scenarios. If an additional employee is included in the calculations, the net present value increase is in excess of $3.5 million. The local effects of facilities construction on the refuge bring the net present value of the impact on Stanislaus county income to roughly $4 million for the 25-year period encompassed by the scenarios.

Conclusions

Public acquisitions and easements on the San Joaquin and Tuolumne Rivers impose no significant impacts on the Stanislaus County economy. While there is an adverse effect on county income from reduced agricultural production, the sum of the positive impacts from channel and habitat restoration, recreational use by residents and visitors, and the value of non-user benefits offset the agricultural income losses. For the base case and the modified base case the present value of the net benefits is positive. Only in the sensitivity analysis case is the present value of net benefits negative.

The results for the base case probably significantly understate the net benefits to Stanislaus County residents. The recreational benefits used in the cost-benefit comparison are limited to the value of wildlife watching on the refuge and sport fishing on the lower Tuolumne River and the San Joaquin River above the delta. But the impact of fishery and water quality improvements will also affect other streams utilized by county residents including the delta. Wildlife watching will also be affected beyond the refuge by the establishment of additional riparian and other habitat. In addition, water quality improvements have value beyond their impact on fishery productivity and use. Other recreational activities not assessed in the benefits analysis may have substantial value. Hunting may improve on lands adjacent to restored habitat. Picnicking, swimming, and canoeing are among the activities that will be enhanced with the establishment of new and expanded riverside parks. Finally, the estimates of non-user value are based on a particularly conservative approach. As discussed in the benefits section of this report the actual value may be many times that used in the cost-benefit scenarios.

Also implicit in the results is the assumption that dairy expansion will continue and any loss of feed producing land will need to be offset with an equal reduction in vegetable production elsewhere in the county. For the base case nearly $3 million of the calculated annual losses are due to this factor alone. Other constraints on dairy expansion such as new air and water quality regulations on agriculture may slow dairy expansion in the county and make the assumed shift in cropping patterns unnecessary. If this were the case the present value of the net benefits would increase by over $51 million for the base case and $66 million for the sensitivity analysis case. Under this alternative assumption the present value of net benefits is large and positive for all of the scenarios included in this report.

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APPENDIX A

Public Participation: Study Design

The study was initially conceived while work on a similar study for Glenn County was nearing completion. Discussions with USFWS began in early summer of 2001 and the initial work was completed as part of a sabbatical project during a Fall 2001 leave from California State University, Chico. A number of interviews were conducted with involved individuals in late October and early November of that year. A presentation of the initial study design was made at the Biodiversity Council meeting held in Modesto on November 14-15, 2001. During the ensuing weeks an advisory committee was formed. Its purpose was to provide input on what issues were of primary concern and to review parts of the study in draft form.

Advisory Committee for the Lower Tuolumne/San Joaquin River Study

Representative	Agency/Group
Cesar Blanco	U.S. Fish and Wildlife Service
Allison and Dave Boucher	Friends of the Tuolumne
Ann Chisney	California Riparian Habitat Joint Venture
Steve Cowdin	DWR/ACE Comprehensive Study
Norm Crow	East Stanislaus Resource Conservation District
Chuck Deschenes	City Administrator for the City of Waterford
Jan Ennenja	Stanislaus County Farm Bureau
Paula Landis	DWR
Michael McElhiney	USDA- NRCS
Kim Forrest	Los Banos Refuge
Ron Frietas	Stanislaus County Planning Department
Rebecca Fris	CALFED
Wilton Fryer	Tuolumne Irrigation District
Tim Heyne	California Department of Fish and Game- La Grange Office
John Hurtle	East Stanislaus Resource Conservation District
Campbell Ingram	CALFED
Patrick Koepele	Tuolumne River Preservation Trust
Jim Niskanen	City of Modesto
Rhonda Reed	California Department of Fish and Game
Bonnie Ross	California Department of Water Resources
Jeff Stuart	National Marine Fisheries Service
Diana Westmoreland-Pedrozo	American Farmland Trust
Tom Schroyer	California Department of Fish and Game

Public Participation: Communications and Review of Drafts

On February 11, 2002 an email was sent to the TAC requesting the members' input on assumptions critical to the analysis. In particular, input was sought on the percentage of land that was likely to be publicly acquired or subject to future public easements, the amount of land in the area that was double-cropped, and the amount of the area acreage that was owned by residents. In that email the committee members were provided Excel

files containing GIS data on the flood frequency zones and average agricultural product prices paid for Stanislaus County crops. A February 15 email provided the TAC with additional data, refining the flood frequency zones and delineating the percentage of agricultural land currently public within each of the zones. In many cases the TAC members passed on my data and requests for input to others they felt would be more knowledgeable. The feedback provided sufficient data on double-cropping and resident ownership of county farmland to eliminate the need for simplifying assumptions. Other input by TAC members (on the percentage of agricultural lands in the flood zones likely to be publicly acquired in the future) was the foundation for the base case.

On March 11, 2002 a general description of the study methodology and the preliminary estimates of economic impacts on Stanislaus County was presented to San Joaquin River Watershed Action Committee in Modesto, CA. A March 20, 2002 email to the TAC requested feedback on the assumptions concerning the amount of land that would ultimately be acquired by public agencies in the various flood frequency zones. In April and May portions of the draft report were sent to the committee members. A draft of the introduction was sent to the TAC at the end of March 2002 and a revised version was sent on April 2, 2002. Two drafts of the agricultural impacts section were made available to the TAC. The first was made available in April 2002. The revised version, sent in early May, incorporated the comments received following the April draft. A draft of the benefits estimates section was emailed to the committee members in late May followed at the beginning of June by a second version incorporating the suggested additions. The last portion of the draft report sent for review was the section on estimated impacts on the aggregate mining industry and the resulting effect on the county economy. That section was made available in early June 2002.

On August 21, 2002 the results of the preliminary report were presented to the TAC in Modesto, California. That was followed by a public review period, initially limited to 45 days, but eventually extended through November 1, 2002. Printed copies of the report were made available at the meeting and electronic copies were sent to all committee members and other interested parties. The comments received were incorporated into the revised draft completed in December 2002. A final draft is expected to be available and will be presented at a public meeting in late January 2003.