Appendix A4

Regional Economic Analysis Modeling Procedure

A4.1 Overview

A regional economic analysis was conducted to illustrate how changes in water supply and resulting changes at the local agricultural economy would affect total regional economic activity in the Sacramento/Delta watershed and the state as a whole. The regional economic analysis estimates how changes in agricultural production (crops) could affect total industry output (sales), personal income, and employment in a regional economy via changes in direct expenditures for agricultural inputs, including payments to labor and net income. Regional economic effects were estimated for the flow scenarios using economic impact models constructed using IMPLAN software designed to trace economic effects over two geographic areas of interest.

A4.1.1 Geographic Framework

The two economic impact models were developed to estimate geographical economic effects based on changes in agricultural production under different flow scenarios. The two geographies evaluated were (1) the combined Sacramento River watershed, Delta eastside tributaries, and Delta regions (Sacramento/Delta) model; and (2) a model of the State of California as a whole. The Sacramento/Delta impact model represents industries, employment, and households in the 22 contiguous counties of the Sacramento/Delta. Total economic effects resulting from changes in Sacramento/Delta agricultural production were estimated using the 22-county Sacramento/Delta model. The State of California model includes industries, employment, and households in the 58 counties in the State of California. Effects on the statewide economy resulting from changes in agricultural production based on Statewide Agricultural Production (SWAP) model results were also estimated using the State of California model. Note that results from the two models are not intended to be additive but rather are designed to identify effects at the appropriate geographical level depending on the scope of the agricultural changes.

A4.1.2 IMPLAN Modeling Platform and Model Construction

The regional economic impact models were constructed using the IMPLAN input-output (I-O) modeling system. IMPLAN is a proprietary data and modeling software system originally designed by the U.S. Forest Service and currently owned by IMPLAN Group, LLC, that enables users to construct I-O type economic impact models for virtually any defined region in the United States in addition to several foreign countries. Besides being comprehensive and widely used, IMPLAN models can be adapted by modelers to account for local conditions and characteristics.[1]

The IMPLAN I-O model is designed to track how a change in local spending affects other businesses, households, and governments within the regional economy. *Direct expenditures* ripple throughout the economy, generating secondary effects referred to as *indirect effects* and *induced effects*. Indirect effects derive from additional business spending on input supplies, services, and labor triggered by

[1] More detailed information on IMPLAN modeling software and data are available at IMPLAN.com.

the direct activity. Induced effects are additional economic ripples generated by spending of wages, salaries, and profits earned by employees and owners of the directly affected and indirectly affected businesses. These secondary effects also generate additional rounds of spending that diminish round-by-round due to the "leakage" of income and spending outside the regional economy; that is, when dollars leave the defined region, they are no longer available for re-spending within the region—the source of the ripple effect. Combined direct, indirect, and induced effects sum to the total economic effect or, as in this case, the total regional economic effects resulting under the modeled flow scenarios. The term *economic multiplier effect* is often used to describe this relationship. The economic multiplier is calculated as the total effect (i.e., the sum of the direct, indirect, and induced regional effects) divided by the direct effect (Figure A4-1).

Figure A4-1 depicts the multiplier process beginning with initial direct expenditures for material inputs, labor, and capital services necessary for a production activity such as crop agriculture. Since some inputs may not be available in the local economy, a portion of the initial expenditures leaks out to non-local suppliers, laborers, and business owners. The remaining funds circulate in the local economy, generating indirect and induced effects, as local suppliers re-stock inventories (indirect effects) and households spend their earnings (induced effects). A portion of these expenditures result in indirect leakage (i.e., re-spending that occurs outside the regional economy), but the remainder is re-spent in the local economy, generating additional indirect and induced effects that diminish with each subsequent re-spending round due to leakage. The final ratio of total (direct + indirect + induced) effects on the amount of the initial direct expenditure defines the size of the economic multiplier. The higher the leakage rate, the sooner re-spending rounds terminate and the smaller the economic multiplier (and vice versa).

The economic models were constructed from available economic data to represent the economies of the Sacramento/Delta and State of California. The data in the models were verified by comparing industry employment and/or payroll totals in the IMPLAN data with other county-level employment and payroll estimates. Revenues and expenditures under the baseline condition and modeled flow scenarios for key agricultural sectors were estimated using the SWAP model. SWAP crop production expenditures, including payments for labor and residual or net income, were mapped to the corresponding receiving IMPLAN sectors based on expenditure distributions taken from previous economic studies. SWAP identifies expenditures on material inputs using *purchaser prices*, the prices purchasers pay for goods including transportation and trade margins. The IMPLAN I-O model uses *producer prices*, the portions of the purchaser price received by the individual goods and services producing sectors, transportation providers, wholesalers. and retailers. Therefore, a conversion was done to disaggregate the components of purchaser prices from SWAP and assign them to the corresponding producing industry sector in the IMPLAN I-O model. This was done for relevant input purchases using IMPLAN margin tables. The resulting distributions of expenditures for agricultural inputs paid to producing industries, transportation sectors, wholesalers, and retailers—along with direct payments for labor and residual or net income—were applied to the appropriate IMPLAN regional model to estimate total regional economic effects of agricultural activities in the Sacramento/Delta and/or state economies under the baseline condition and modeled flow scenarios. This type of conversion to generate expenditure distributions is standard when working with SWAP and I-O models given the nature of the two models and the outputs provided from SWAP (e.g., gross revenue and expenditures for broad categories of inputs) and data inputs required by I-O models such as IMPLAN (e.g., purchases of specific commodities from producing industries).

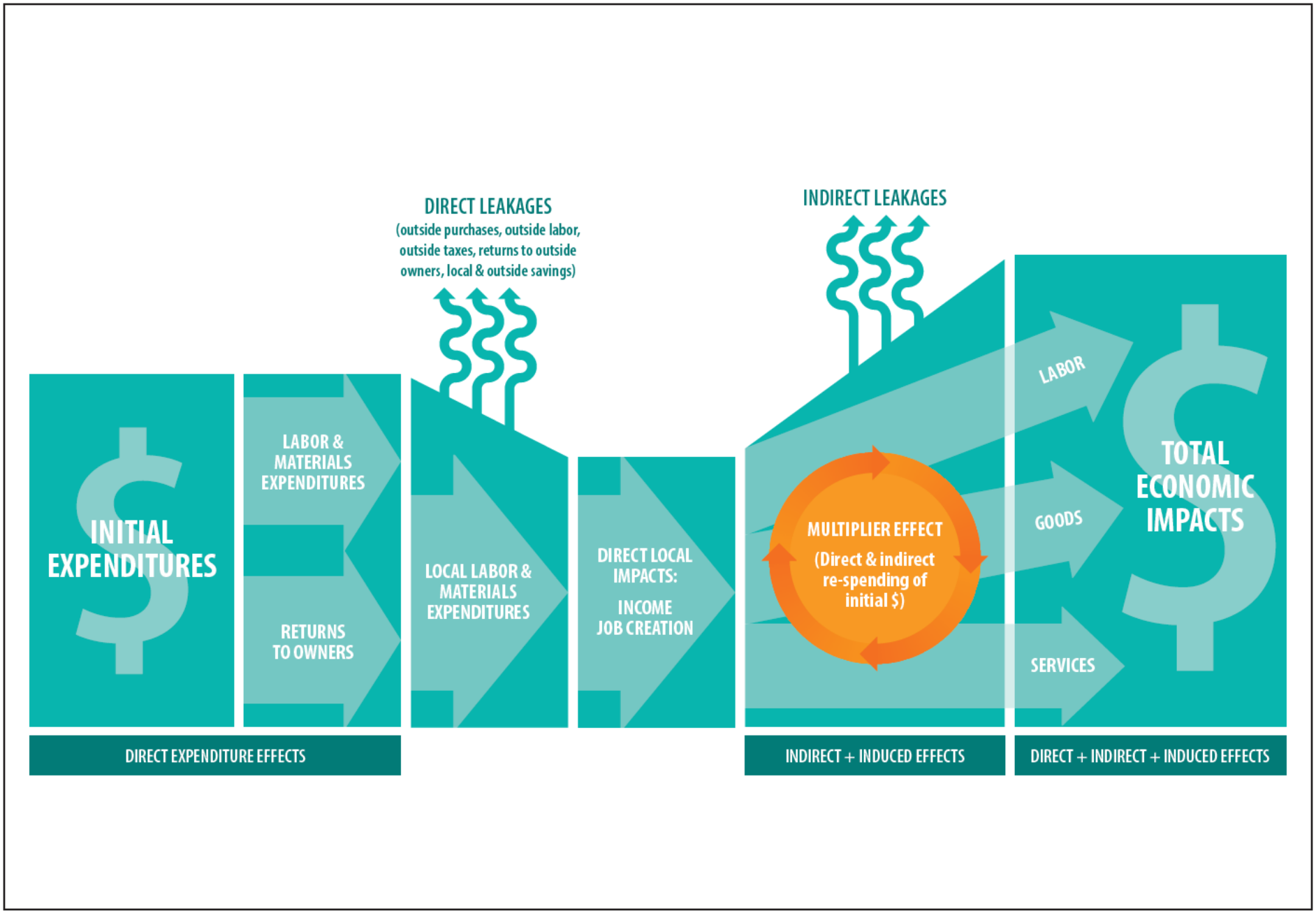

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Figure A4-1
Economic Impact-Generating Multiplier Effect

A4.1.3 Modeling Process for Flow Scenarios

Results from the SWAP model reflect estimated expenditures on agricultural inputs for growing 21 representative crops in response to production shifts under a range of modeled flow scenarios. The SWAP model expenditures were aligned (mapped) onto payments to underlying agricultural input supply businesses, labor hiring, and net income. After adjustment to producer price terms, these expenditures were treated as direct effects and run through the IMPLAN economic impact model. The IMPLAN model results provide estimates of the total (direct, indirect, and induced) output (sales), personal income, and employment (jobs) generated by the agricultural industry's expenditures on inputs under the baseline condition and flow scenarios. Relative effects for each modeled flow scenario were derived by comparing results under the modeled flow scenarios against results under the baseline condition. As noted, total effects on the Sacramento/Delta resulting from changes in Sacramento/Delta agricultural production under the modeled flow scenarios were estimated using the 22-county Sacramento/Delta model. Total effects on the statewide economy resulting from changes in agricultural production under the modeled flow scenarios in the combined Sacramento/Delta and all other agricultural regions covered by the SWAP model were estimated using the State of California model.

The total economic effects reported in this appendix represent the combined direct, indirect, and induced effects resulting from the backward linkages of the agricultural activities modeled in SWAP with the regional economy. *Backward linkages* consist of the direct expenditures for agricultural inputs, including payments to labor and owners' net income, incurred during the production process. All standard I-O type economic impact models, including IMPLAN, rely on these backward-linked expenditures (direct effects) to drive the estimated total multiplier effects in the regional economy.

Effects on industries that process agricultural products (e.g., dairies) are not automatically included in the regional effect modeling process. To capture economic effects on downstream agricultural processing sectors, it is necessary to postulate what portions of those activities are dependent on the agricultural activities modeled by SWAP and the degree to which those activities would be affected by change in the availability of locally produced crops. Without an understanding of those relationships, it is possible to envision effects ranging from a complete shutdown as raw material supplies dry up to little or no effect on local agricultural processing in cases where substitute feed or input supplies are obtained from elsewhere. The actual effect would likely fall somewhere between those two extremes. However, there is no information in IMPLAN or comparable economic impact models to shed light on the likely economic response of dairy or other agricultural processing industries to a change in local production of particular crops. Consequently, no attempt was made to use IMPLAN to estimate economic effects of the modeled change in local production of silage, pasture, and other input crops on dairy or other agricultural processing activities. Rather, those potential effects are discussed qualitatively in the *Agricultural Services, Food Processing,* and *Livestock* subsections of Section 8.4.2.4, *Effects on Farming-Dependent Industries*.

The results presented below consist of combined direct, indirect, and induced effects on business, household, and government sectors in the relevant geographic region (Sacramento/Delta or State of California) resulting from backward linkages with agricultural production activities. Metrics are expressed as changes in output (sales), personal income, and employment (jobs) relative to the levels attributable to baseline condition agricultural activity in the region.

The SWAP analysis was run for five flow scenarios under two different assumptions about groundwater conditions: (1) a more restrictive condition, wherein groundwater is not allowed to replace reductions in surface water; and (2) allowance for maximum replacement of groundwater. As discussed in Appendix A3, in the *Water Supply Inputs* subsection of Section A3.2.1.3, *SWAP Model Inputs*, SWAP results show larger effects for all modeled flow scenarios assuming no replacement groundwater pumping than under the maximum replacement groundwater pumping assumption. To convey the broadest range of estimated secondary effects, IMPLAN modeling was done only for the SWAP model results based on no replacement groundwater pumping. Therefore, the results of the IMPLAN analysis demonstrate the upper bound (i.e., worst case) of total effects. If the actual effect of the flow scenarios on agricultural production is less severe than modeled, so too would be the estimated secondary economic effects in the Sacramento/Delta and in the State of California.

A4.2 Analytical Steps

The following list of analytical steps details how the SWAP model results were incorporated with other data to inform the IMPLAN regional economic analysis and how the IMPLAN model results were summarized to display the economic effects derived from changes in agriculture under each flow scenario. See Appendix A3, *Agricultural Economic Analysis: SWAP Methodology and Modeling Results*, for additional information on the SWAP model, analysis, and results.

1. Create two regional economic impact models using 2015 IMPLAN data:
    a. Sacramento/Delta model consisting of 22 contiguous counties of the Sacramento River watershed, Delta eastside tributaries, and Delta regions.
    b. State of California model consisting of the 58 counties in the State of California.
2. Obtain SWAP model results for each of the following flow scenarios (assuming that groundwater is not allowed to replace reductions in surface water):
    a. Baseline condition
    b. 35 scenario
    c. 45 scenario
    d. 55 scenario
    e. 65 scenario
    f. 75 scenario
3. Extract the following cost components for each of the 21 crop types under each flow scenario from the SWAP modeling results:
    a. Gross revenue (GREV)
    b. Land rental cost (MARGCST)
    c. Labor cost (CINPUTS—Labor)
    d. Water cost (WATERCST)
    e. Other costs (CINPUTS—Supplies)
    f. Net revenue (Residual)

4. Allocate SWAP cost components to crop enterprise budget categories described in UC Davis Cooperative Extension enterprise budget studies for the corresponding crop types (Attachment 1 [UC Davis 2018]).
5. Associate the crop enterprise budget categories with input commodities produced by corresponding IMPLAN industry sectors, including expenditures for farm labor and net returns. Note: Expenditures are in purchaser price terms (i.e., prices paid for bundles of goods and services purchased by regional farmers).
6. Sum the resulting expenditures for items in each IMPLAN industry sector across all 21 SWAP crop types.
7. Use an IMPLAN margin table to convert purchases in purchaser price terms to expenditures in producer price terms by unbundling margins paid to transportation, wholesale, and retail sectors from the portion paid to the input-producing industries. (*Margins* are the portions of an item's purchase price that cover the costs of transporting, distributing, and marketing that item).
8. Construct direct expenditure vectors that include all regional agricultural producers' purchases of SWAP cropping inputs by IMPLAN commodity (including goods, services, and transportation, wholesale, and retail margins) and labor income payments (employee compensation plus net income) for each flow scenario.
9. Analyze the direct expenditure vectors (i.e., full list of input supply expenditures) as combined Commodity Change and Labor Income Change scenarios for each flow scenario using the corresponding regional IMPLAN model as follows:
    a. Sacramento/Delta model: direct expenditures for affected crops grown in the Sacramento River watershed, Delta eastside tributaries, and Delta regions.
    b. State of California model: direct expenditures for affected crops grown in the area modeled with SWAP (See Appendix A3 for a description that includes the region as described for the Sacramento/Delta model above, plus the affected crops grown in the San Joaquin Valley region).
10. Access the Detail Results report within the IMPLAN model for each run scenario and save as a workbook file by selecting the Export All Detail Reports to Excel option.
11. Open the results file for each flow scenario in Excel and aggregate the total (direct, indirect, and induced) IMPLAN impact results reported for 536 detailed IMPLAN industry categories into 19 industry sectors for ease of presentation. Three metrics were used to report results: Output (total sales), Income (employee compensation plus proprietors' income), and Employment (number of jobs). While change in total output is widely reported in economic studies, this measure has little meaning in practical terms since it is actually a modeling construct that includes double-counting. Consequently, income and employment are also reported since these measures should have much more meaning to the average reader.
12. For each flow scenario, subtract the aggregated results for Output, Income, and Employment from the corresponding regional baseline condition levels calculated under the baseline condition scenarios.
13. Calculate change in total full-time equivalent (FTE) jobs by dividing the estimated change in total income by the overall average earnings per job in the corresponding region (Sacramento/Delta or State of California).

14. Display all results as raw changes and percentage changes from levels estimated under the corresponding baseline condition for each model.

A4.3 Employment, Output, and Annual Payroll by Geographic Study Area Region

Tables A4-1 through A4-6 show the 2015 IMPLAN annual employment, output (sales), and payroll data in each of 19 aggregated industry classifications for the geographic regions corresponding to the SWAP modeled areas.

Table A4-1. Employment, Output, and Payroll—Sacramento/Delta (22 counties) (2015)

Sector	Number of Jobs (thousands)	Output (sales) $ (millions)	Annual Payroll $ (millions)
Agriculture	48.6	7,842.7	1,000.5
Other Agriculture and Natural Resources	31.2	2,735.2	997.1
Construction	118.5	20,106.4	4,528.0
Utilities	9.0	8,841.6	1,385.4
Food Processing	17.4	9,849.6	974.1
Other Nondurable Manufacturing	19.1	10,788.1	1,134.2
Durable Manufacturing	46.6	17,415.7	3,547.7
Wholesale Trade	61.4	13,858.3	3,543.5
Transportation	76.1	10,754.7	3,069.1
Retail Trade	196.9	16,704.0	5,757.4
Information	22.4	10,220.9	1,541.1
Finance, Insurance, and Real Estate	190.2	37,221.8	6,020.2
Professional Services	173.1	25,562.6	10,003.5
Employment Services	114.2	7,296.9	3,186.7
Health and Educational Services	274.6	26,423.0	14,219.6
Recreational Services	36.6	2,524.9	665.3
Eating, Drinking, and Lodging	144.4	9,131.7	3,248.3
Other Services	125.2	11,176.6	3,411.7
Government and Miscellaneous	366.5	61,936.2	35,660.6
Total for Sacramento/Delta	2,071.9	310,392.0	103,894.1

Source: ^IMPLAN 2017.

Table A4-2. Employment, Output, and Payroll—San Francisco Bay Area (9 counties) (2015)

Sector	Number of Jobs (thousands)	Output (sales) $ (millions)	Annual Payroll $ (millions)
Agriculture	19.5	2,325.0	479.0
Other Agriculture and Natural Resources	19.1	2,694.4	639.7
Construction	252.2	49,328.1	14,321.0
Utilities	16.1	14,232.8	2,927.1
Food Processing	33.9	13,382.8	1,858.2

Sector	Number of Jobs (thousands)	Output (sales) $ (millions)	Annual Payroll $ (millions)
Other Nondurable Manufacturing	82.3	92,950.8	10,209.0
Durable Manufacturing	244.2	166,597.8	39,760.7
Wholesale Trade	158.2	49,164.0	18,261.6
Transportation	146.0	27,675.1	7,079.6
Retail Trade	400.8	44,780.8	16,856.1
Information	195.4	127,318.4	45,072.3
Finance, Insurance, and Real Estate	488.2	130,898.4	29,507.7
Professional Services	841.3	193,427.5	101,977.1
Employment Services	286.3	25,346.6	13,029.1
Health and Educational Services	669.8	69,536.9	39,580.8
Recreational Services	115.8	10,519.7	3,301.0
Eating, Drinking, and Lodging	390.3	27,647.7	11,745.8
Other Services	342.8	30,834.9	12,314.6
Government and Miscellaneous	466.9	105,104.3	49,154.1
Total for San Francisco Bay Area region	5,169.1	1,183,766.0	418,074.5

Source: ^IMPLAN 2017.

Table A4-3. Employment, Output, and Payroll—San Joaquin Valley (9 counties) (2015)

Sector	Number of Jobs (thousands)	Output (sales) $ (millions)	Annual Payroll $ (millions)
Agriculture	99.9	25,114.5	3,049.0
Other Agriculture and Natural Resources	143.8	12,646.0	5,912.9
Construction	73.1	12,050.0	2,767.9
Utilities	5.5	4,489.6	863.6
Food Processing	51.4	30,674.7	2,834.8
Other Nondurable Manufacturing	20.3	14,721.4	1,573.1
Durable Manufacturing	29.0	10,299.4	1,828.3
Wholesale Trade	54.8	11,915.2	2,859.0
Transportation	53.2	8,032.1	2,118.7
Retail Trade	148.5	12,219.3	4,107.1
Information	11.0	4,786.5	824.7
Finance, Insurance, and Real Estate	103.1	18,003.9	2,334.0
Professional Services	86.4	11,880.1	4,169.0
Employment Services	73.4	4,460.6	1,739.4
Health and Educational Services	190.0	17,518.5	9,060.7
Recreational Services	16.0	1,053.3	238.3
Eating, Drinking, and Lodging	102.4	6,437.7	2,081.6
Other Services	83.0	7,866.8	2,187.9
Government and Miscellaneous	245.0	37,900.5	20,229.2
Total for San Joaquin Valley region	1,589.7	252,070.1	70,779.2

Source: ^IMPLAN 2017.

Table A4-4. Employment, Output, and Payroll—Central Coast (5 counties) (2015)

Sector	Number of Jobs (thousands)	Output (sales) $ (millions)	Annual Payroll $ (millions)
Agriculture	46.4	6,712.4	1,388.6
Other Agriculture and Natural Resources	54.1	4,876.7	2,399.3
Construction	42.6	7,361.3	1,400.6
Utilities	2.6	2,825.1	487.4
Food Processing	7.9	2,574.5	304.6
Other Nondurable Manufacturing	12.0	6,126.1	677.1
Durable Manufacturing	19.9	6,871.3	1,610.6
Wholesale Trade	21.4	5,484.0	1,540.1
Transportation	14.9	2,232.7	604.4
Retail Trade	77.3	6,706.1	2,440.0
Information	10.8	4,692.1	890.7
Finance, Insurance, and Real Estate	67.6	11,905.9	1,505.2
Professional Services	74.2	10,283.1	3,681.1
Employment Services	42.5	2,685.6	1,076.3
Health and Educational Services	96.7	8,473.3	4,554.1
Recreational Services	22.7	1,668.2	407.7
Eating, Drinking, and Lodging	78.3	5,341.1	1,966.5
Other Services	57.8	4,929.0	1,529.6
Government and Miscellaneous	118.8	21,754.7	10,986.3
Total for Central Coast region	868.4	123,503.1	39,450.4

Source: ^IMPLAN 2017.

Table A4-5. Employment, Output, and Payroll—Southern California (9 counties) (2015)

Sector	Number of Jobs (thousands)	Output (sales) $ (millions)	Annual Payroll $ (millions)
Agriculture	50.9	7,229.3	1,340.0
Other Agriculture and Natural Resources	60.3	9,811.5	2,513.3
Construction	596.4	103,299.5	24,983.4
Utilities	43.1	40,830.2	6,903.2
Food Processing	77.3	33,408.2	4,169.0
Other Nondurable Manufacturing	221.2	118,592.9	15,268.3
Durable Manufacturing	488.4	181,677.4	43,148.6
Wholesale Trade	503.6	129,955.4	39,624.5
Transportation	408.0	68,366.9	19,546.0
Retail Trade	1,121.8	101,085.6	36,399.3
Information	340.6	184,719.3	35,312.1
Finance, Insurance, and Real Estate	1,294.3	303,397.4	49,995.2
Professional Services	1,381.7	251,851.2	102,700.5
Employment Services	826.9	55,962.0	25,421.4
Health and Educational Services	1,663.3	143,285.0	76,481.8

Sector	Number of Jobs (thousands)	Output (sales) $ (millions)	Annual Payroll $ (millions)
Recreational Services	386.2	35,051.6	13,278.7
Eating, Drinking, and Lodging	1,005.2	68,647.0	25,363.4
Other Services	928.7	75,837.4	25,868.1
Government and Miscellaneous	1,393.7	276,852.6	131,013.5
Total for Southern California region	12,791.4	2,189,860.4	679,330.3

Source: ^IMPLAN 2017.

Table A4-6. Employment, Output, and Payroll—State of California (58 counties) (2015)

Sector	Number of Jobs (thousands)	Output (sales) $ (millions)	Annual Payroll $ (millions)
Agriculture	269.1	49,712.3	7,308.3
Other Agriculture and Natural Resources	312.8	33,077.0	12,553.5
Construction	1,091.3	193,453.7	48,157.9
Utilities	76.7	71,560.9	12,621.6
Food Processing	188.9	90,297.7	10,176.2
Other Nondurable Manufacturing	357.0	244,258.2	28,957.0
Durable Manufacturing	831.4	383,740.1	90,073.9
Wholesale Trade	803.1	211,056.9	65,943.2
Transportation	700.5	117,402.3	32,510.3
Retail Trade	1,960.7	182,793.7	65,996.2
Information	581.2	332,109.6	83,685.5
Finance, Insurance, and Real Estate	2,152.5	502,838.5	89,530.2
Professional Services	2,565.1	493,910.1	222,732.0
Employment Services	1,348.4	96,083.3	44,555.5
Health and Educational Services	2,912.7	266,651.9	144,580.8
Recreational Services	581.0	51,026.6	17,916.1
Eating, Drinking, and Lodging	1,731.7	117,877.2	44,629.1
Other Services	1,545.3	131,226.7	45,447.3
Government and Miscellaneous	2,615.9	507,018.8	248,794.7
Total for State of California region	22,625.3	4,076,095.4	1,316,169.3

Source: ^IMPLAN 2017.

A4.4 Detailed Results: Sacramento/Delta

Table A4-7 presents existing conditions results from IMPLAN regional economic impact modeling of the agricultural sectors in the Sacramento/Delta watershed.

Table A4-8 presents results from IMPLAN regional economic impact modeling of effects derived from changes (compared with existing conditions) in the agricultural sectors' expenditures under five flow scenarios (estimated from SWAP) on the Sacramento/Delta's economy. This table is a detailed and expanded version of Table 8.4-23. These results reflect the direct economic effects of changes in purchases of agricultural inputs, payments to labor, and net income, plus secondary

indirect and induced effects on 536 IMPLAN industry sectors, 9 household income categories, and state and local governments in the region. For ease of presentation, the detailed IMPLAN model results are aggregated to 19 higher-level industry categories, highlighting key findings of the analysis.

Under the five flow scenarios, an average of approximately 62 percent of affected jobs and income in the Sacramento/Delta is estimated to be in the directly affected Agriculture and Other Natural Resources & Mining sectors.

Table A4-7. Estimated Economic Contribution of Sacramento/Delta Agriculture to Sacramento/Delta Economy under Existing Conditions

Industry/Sector	Output ($ mil.)	Income ($ mil.)	No. of Jobs
Agriculture	5,246	5,158	90,796
Other Natural Resources & Mining	1,127	670	15,923
Utilities	164	53	931
Construction	444	79	519
Food Processing	42	5	93
Other Non-Durables Manufacturing	765	55	452
Durables Manufacturing	43	9	149
Transportation & Warehousing	547	155	2,356
Wholesale Trade	280	97	1,841
Retail trade	968	414	10,594
Information & Communications Services	316	61	657
Finance, Insurance, & Real Estate Services	1,536	345	7,244
Legal, Rental, Professional, Scientific, Mgt & Tech Services	1,442	600	10,236
Employment, Administrative & Waste Services	239	123	3,678
Education, Health & Social Services	907	550	9,360
Arts, Entertainment & Recreation Services	99	32	1,385
Accommodation & Food Services	358	140	5,569
Other Services	520	234	5,378
Government & Miscellaneous	1,923	828	7,533
Totals	16,966	9,609	174,694
Total FTE Jobs (Total income/avg earnings per job)			*168,477*

Table A4-8. Estimated Economic Effects on the Sacramento/Delta from Modeled Changes in Agricultural Production under Five Flow Scenarios

	Change in:			Percent Change in:		
Industry/Sector	Output ($ mil.)	Income ($ mil.)	No. of Jobs	Output	Income	No. of Jobs
35 Scenario						
Agriculture	-39	-38	-670	-0.7%	-0.7%	-0.7%
Other Natural Resources & Mining	-10	-6	-146	-0.9%	-0.9%	-0.9%
Utilities	-1	-0	-8	-0.8%	-0.8%	-0.8%

Industry/Sector	Change in: Output ($ mil.)	Income ($ mil.)	No. of Jobs	Percent Change in: Output	Income	No. of Jobs
Construction	-4	-1	-5	-1.0%	-1.0%	-1.0%
Food Processing	-0	-0	-1	-0.8%	-0.8%	-0.8%
Other Non-Durables Manufacturing	-7	-0	-4	-0.9%	-0.9%	-0.9%
Durables Manufacturing	-0	-0	-1	-0.8%	-0.8%	-0.8%
Transportation & Warehousing	-4	-1	-19	-0.8%	-0.8%	-0.8%
Wholesale Trade	-2	-1	-14	-0.8%	-0.8%	-0.8%
Retail Trade	-8	-3	-84	-0.8%	-0.8%	-0.8%
Information & Communications Services	-2	-0	-5	-0.8%	-0.8%	-0.8%
Finance, Insurance, & Real Estate Services	-12	-3	-55	-0.8%	-0.8%	-0.8%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-9	-4	-68	-0.7%	-0.7%	-0.7%
Employment, Administrative, & Waste Services	-2	-1	-28	-0.8%	-0.8%	-0.8%
Education, Health & Social Services	-7	-4	-70	-0.8%	-0.8%	-0.8%
Arts, Entertainment & Recreation Services	-1	-0	-10	-0.8%	-0.8%	-0.8%
Accommodation & Food Service	-3	-1	-42	-0.8%	-0.8%	-0.8%
Other Services	-4	-2	-42	-0.8%	-0.8%	-0.8%
Government & Miscellaneous	-14	-5	-51	-0.7%	-0.7%	-0.7%
Totals	-131	-72	-1,324	-0.8%	-0.8%	-0.8%
Total FTE Jobs [a]	-	-	*-1,267*	-	-	*-0.8%*
45 Scenario						
Agriculture	-66	-65	-1,140	-1.3%	-1.3%	-1.3%
Other Natural Resources & Mining	-16	-10	-230	-1.4%	-1.4%	-1.4%
Utilities	-2	-1	-13	-1.3%	-1.3%	-1.3%
Construction	-7	-1	-8	-1.6%	-1.6%	-1.6%
Food Processing	-1	-0	-1	-1.3%	-1.3%	-1.3%
Other Non-Durables Manufacturing	-11	-1	-6	-1.4%	-1.4%	-1.4%
Durables Manufacturing	-1	-0	-2	-1.3%	-1.3%	-1.3%
Transportation & Warehousing	-7	-2	-31	-1.3%	-1.3%	-1.3%
Wholesale Trade	-4	-1	-24	-1.3%	-1.3%	-1.3%
Retail Trade	-13	-5	-138	-1.3%	-1.3%	-1.3%
Information & Communications Services	-4	-1	-8	-1.3%	-1.3%	-1.3%
Finance, Insurance, & Real Estate Services	-19	-4	-91	-1.3%	-1.3%	-1.3%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-16	-7	-113	-1.1%	-1.1%	-1.1%
Employment, Administrative, & Waste Services	-3	-2	-46	-1.3%	-1.3%	-1.3%
Education, Health & Social Services	-11	-7	-118	-1.3%	-1.3%	-1.3%

Industry/Sector	Change in: Output ($ mil.)	Income ($ mil.)	No. of Jobs	Percent Change in: Output	Income	No. of Jobs
Arts, Entertainment & Recreation Services	-1	-0	-17	-1.3%	-1.3%	-1.3%
Accommodation & Food Service	-4	-2	-70	-1.3%	-1.3%	-1.3%
Other Services	-7	-3	-70	-1.3%	-1.3%	-1.3%
Government & Miscellaneous	-23	-9	-87	-1.2%	-1.1%	-1.2%
Totals	-217	-121	-2,214	-1.3%	-1.3%	-1.3%
Total FTE Jobs [a]	-	-	*-2,121*	-	-	*-1.3%*
55 Scenario						
Agriculture	-130	-127	-2,240	-2.5%	-2.5%	-2.5%
Other Natural Resources & Mining	-30	-18	-423	-2.7%	-2.7%	-2.7%
Utilities	-4	-1	-24	-2.6%	-2.6%	-2.6%
Construction	-13	-2	-15	-2.9%	-2.9%	-2.9%
Food Processing	-1	-0	-2	-2.4%	-2.4%	-2.4%
Other Non-Durables Manufacturing	-21	-1	-12	-2.7%	-2.6%	-2.6%
Durables Manufacturing	-1	-0	-4	-2.4%	-2.4%	-2.4%
Transportation & Warehousing	-14	-4	-60	-2.5%	-2.5%	-2.5%
Wholesale Trade	-7	-2	-46	-2.5%	-2.6%	-2.5%
Retail Trade	-25	-11	-269	-2.5%	-2.6%	-2.5%
Information & Communications Services	-8	-1	-16	-2.4%	-2.4%	-2.4%
Finance, Insurance, & Real Estate Services	-37	-8	-175	-2.4%	-2.4%	-2.4%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-30	-13	-216	-2.1%	-2.1%	-2.1%
Employment, Administrative, & Waste Services	-6	-3	-89	-2.4%	-2.4%	-2.4%
Education, Health & Social Services	-22	-13	-228	-2.4%	-2.4%	-2.4%
Arts, Entertainment & Recreation Services	-2	-1	-34	-2.4%	-2.4%	-2.4%
Accommodation & Food Service	-9	-3	-135	-2.4%	-2.4%	-2.4%
Other Services	-13	-6	-133	-2.5%	-2.5%	-2.5%
Government & Miscellaneous	-44	-17	-163	-2.3%	-2.1%	-2.2%
Totals	-416	-234	-4,283	-2.5%	-2.4%	-2.5%
Total FTE Jobs [a]	-	-	*-4,099*	-	-	*-2.4%*
65 Scenario						
Agriculture	-245	-241	-4,242	-4.7%	-4.7%	-4.7%
Other Natural Resources & Mining	-57	-34	-809	-5.1%	-5.1%	-5.1%
Utilities	-8	-3	-45	-4.9%	-4.9%	-4.9%
Construction	-24	-4	-28	-5.4%	-5.4%	-5.5%
Food Processing	-2	-0	-4	-4.7%	-4.6%	-4.6%
Other Non-Durables Manufacturing	-39	-3	-22	-5.1%	-5.0%	-4.9%
Durables Manufacturing	-2	-0	-7	-4.6%	-4.6%	-4.6%
Transportation & Warehousing	-26	-7	-113	-4.8%	-4.8%	-4.8%

	Change in:			Percent Change in:		
Industry/Sector	**Output ($ mil.)**	**Income ($ mil.)**	**No. of Jobs**	**Output**	**Income**	**No. of Jobs**
Wholesale Trade	-14	-5	-88	-4.8%	-4.9%	-4.8%
Retail Trade	-47	-20	-512	-4.9%	-4.9%	-4.8%
Information & Communications Services	-15	-3	-30	-4.6%	-4.6%	-4.6%
Finance, Insurance, & Real Estate Services	-71	-16	-334	-4.6%	-4.6%	-4.6%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-57	-25	-416	-4.0%	-4.1%	-4.1%
Employment, Administrative, & Waste Services	-11	-6	-170	-4.6%	-4.6%	-4.6%
Education, Health & Social Services	-42	-25	-434	-4.6%	-4.6%	-4.6%
Arts, Entertainment & Recreation Services	-5	-1	-64	-4.6%	-4.6%	-4.6%
Accommodation & Food Service	-17	-6	-257	-4.6%	-4.6%	-4.6%
Other Services	-25	-11	-254	-4.8%	-4.8%	-4.7%
Government & Miscellaneous	-86	-34	-318	-4.5%	-4.1%	-4.2%
Totals	-793	-445	-8,149	-4.7%	-4.6%	-4.7%
Total FTE Jobs [a]	-	-	*-7,805*	-	-	*-4.6%*
75 Scenario						
Agriculture	-430	-421	-7,428	-8.2%	-8.2%	-8.2%
Other Natural Resources & Mining	-99	-58	-1,391	-8.8%	-8.7%	-8.7%
Utilities	-14	-4	-78	-8.4%	-8.4%	-8.4%
Construction	-38	-7	-45	-8.7%	-8.7%	-8.7%
Food Processing	-3	-0	-8	-8.2%	-8.1%	-8.1%
Other Non-Durables Manufacturing	-74	-5	-41	-9.7%	-9.2%	-9.0%
Durables Manufacturing	-4	-1	-12	-8.2%	-8.1%	-8.1%
Transportation & Warehousing	-48	-13	-206	-8.7%	-8.7%	-8.7%
Wholesale Trade	-24	-8	-157	-8.7%	-8.7%	-8.5%
Retail Trade	-85	-37	-922	-8.8%	-8.9%	-8.7%
Information & Communications Services	-26	-5	-54	-8.1%	-8.2%	-8.2%
Finance, Insurance, & Real Estate Services	-125	-28	-590	-8.2%	-8.1%	-8.1%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-102	-44	-740	-7.0%	-7.3%	-7.2%
Employment, Administrative, & Waste Services	-19	-10	-299	-8.1%	-8.1%	-8.1%
Education, Health & Social Services	-73	-44	-759	-8.1%	-8.1%	-8.1%
Arts, Entertainment & Recreation Services	-8	-3	-113	-8.1%	-8.1%	-8.1%
Accommodation & Food Service	-29	-11	-450	-8.1%	-8.1%	-8.1%
Other Services	-45	-20	-450	-8.6%	-8.5%	-8.4%
Government & Miscellaneous	-146	-57	-538	-7.6%	-6.9%	-7.1%
Totals	-1,392	-779	-14,280	-8.2%	-8.1%	-8.2%

Industry/Sector	Change in: Output ($ mil.)	Change in: Income ($ mil.)	Change in: No. of Jobs	Percent Change in: Output	Percent Change in: Income	Percent Change in: No. of Jobs
Total FTE Jobs [a]	-	-	*-13,652*	-	-	*-8.1%*

Combined direct, indirect, and induced effects on business, household, and government sectors in the Sacramento/Delta regional economy attributable to backward linkage effects of modeled agricultural production activities, expressed as change relative to estimated effects of baseline (existing) condition agricultural activity.

[a] FTE = full time equivalent. Total FTE jobs calculated by dividing the estimated change in total income by the overall average earnings per job in the region.

A4.5 Detailed Results: State of California

Table A4-9 presents existing conditions results from IMPLAN regional economic impact modeling of the agricultural sectors in California.

Table A4-9. Estimated Economic Contribution of Sacramento/Delta and San Joaquin Valley Agriculture to California Statewide Economy under Existing Conditions

Industry/Sector	Output	Income	Employment
Agriculture	18,932	18,590	280,160
Other Natural Resources & Mining	4,488	2,647	64,904
Utilities	498	170	2,690
Construction	1,904	374	2,192
Food Processing	599	71	1,223
Other Non-Durables Manufacturing	3,872	332	3,020
Durables Manufacturing	612	144	1,718
Transportation & Warehousing	2,277	777	8,420
Wholesale Trade	1,277	447	7,110
Retail trade	3,350	1,472	34,160
Information & Communications Services	1,760	466	2,776
Finance, Insurance, & Real Estate Services	5,741	1,542	22,953
Legal, Rental, Professional, Scientific, Mgt & Tech Services	6,019	2,869	33,879
Employment, Administrative & Waste Services	896	469	12,184
Education, Health & Social Services	3,302	2,021	33,353
Arts, Entertainment & Recreation Services	474	189	4,972
Accommodation & Food Services	1,329	552	19,530
Other Services	1,816	862	18,377
Government & Miscellaneous	5,083	1,627	13,439
Totals	64,227	35,619	567,059
Total FTE Jobs (Total income/avg earnings per job)			*536,647*

Table A4-10 presents results from IMPLAN regional economic impact modeling of effects derived from changes (compared with existing conditions) in the agricultural sectors' revenues and expenditures (estimated from SWAP) on the California economy under five flow scenarios. This

table is a detailed and expanded version of Table 8.4-24. These results reflect the direct economic effects of changes in purchases of agricultural inputs, payments to labor, and net income, plus secondary indirect and induced effects on 536 IMPLAN industry sectors, 9 household income categories, and state and local governments in the State of California. For ease of presentation, the detailed IMPLAN model results are aggregated to 19 higher-level industry categories, highlighting key findings of the analysis.

Note that, generally speaking, the economic linkages in the State of California economy are proportionately larger than those in the Sacramento/Delta regional economy because of the relatively greater economic diversity and deeper economic relationships that are characteristic of larger regional economies. For example, affected agricultural businesses likely purchase only a portion of their inputs from suppliers within the Sacramento/Delta. Inputs purchased from suppliers outside the Sacramento/Delta's economy represent a direct leakage or loss of funds from the Sacramento/Delta model, which thereby limits re-spending in that region's economy. In the State of California model, inputs purchased from suppliers located anywhere in the state are included and available to generate re-spending within the modeled region. However, since agriculture represents a smaller portion of the State of California's economy than of the Sacramento/Delta's economy, effects under the flow scenarios represent a smaller percentage of baseline conditions in the State of California model than in the Sacramento/Delta model.

Under the five flow scenarios, an average of approximately 60 percent of affected jobs and 59 percent of affected income in the California State economy are estimated to be in the directly affected Agriculture and Other Natural Resources & Mining sectors.

Table A4-10. Estimated Economic Effects on the California Statewide Economy from Modeled Changes in Agricultural Production under Five Flow Scenarios

	Change in:			Percent Change in:		
Industry/Sector	**Output ($ mil.)**	**Income ($ mil.)**	**No. of Jobs**	**Output**	**Income**	**No. of Jobs**
35 Scenario						
Agriculture	-58	-57	-861	-0.3%	-0.3%	-0.3%
Other Natural Resources & Mining	-15	-9	-220	-0.3%	-0.3%	-0.3%
Utilities	-2	-1	-10	-0.4%	-0.4%	-0.4%
Construction	-10	-2	-11	-0.5%	-0.5%	-0.5%
Food Processing	-2	-0	-4	-0.3%	-0.3%	-0.3%
Other Non-Durables Manufacturing	-14	-1	-10	-0.4%	-0.4%	-0.3%
Durables Manufacturing	-2	-0	-6	-0.3%	-0.3%	-0.3%
Transportation & Warehousing	-8	-3	-29	-0.3%	-0.3%	-0.3%
Wholesale Trade	-4	-2	-24	-0.3%	-0.3%	-0.3%
Retail Trade	-11	-5	-115	-0.3%	-0.3%	-0.3%
Information & Communications Services	-6	-2	-9	-0.3%	-0.3%	-0.3%
Finance, Insurance, & Real Estate Services	-18	-5	-73	-0.3%	-0.3%	-0.3%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-18	-9	-101	-0.3%	-0.3%	-0.3%

Industry/Sector	Change in: Output ($ mil.)	Change in: Income ($ mil.)	Change in: No. of Jobs	Percent Change in: Output	Percent Change in: Income	Percent Change in: No. of Jobs
Employment, Administrative, & Waste Services	-3	-2	-40	-0.3%	-0.3%	-0.3%
Education, Health & Social Services	-10	-6	-105	-0.3%	-0.3%	-0.3%
Arts, Entertainment & Recreation Services	-1	-1	-16	-0.3%	-0.3%	-0.3%
Accommodation & Food Service	-4	-2	-61	-0.3%	-0.3%	-0.3%
Other Services	-6	-3	-61	-0.3%	-0.3%	-0.3%
Government & Miscellaneous	-16	-4	-36	-0.3%	-0.3%	-0.3%
Totals	-209	-112	-1,790	-0.3%	-0.3%	-0.3%
Total FTE Jobs [a]	-	-	*-1,688*	-	-	*-0.3%*
45 Scenario						
Agriculture	-139	-136	-2,046	-0.7%	-0.7%	-0.7%
Other Natural Resources & Mining	-32	-19	-459	-0.7%	-0.7%	-0.7%
Utilities	-5	-2	-25	-0.9%	-0.9%	-0.9%
Construction	-25	-5	-29	-1.3%	-1.3%	-1.3%
Food Processing	-4	-1	-9	-0.7%	-0.7%	-0.7%
Other Non-Durables Manufacturing	-32	-3	-24	-0.8%	-0.8%	-0.8%
Durables Manufacturing	-5	-1	-13	-0.8%	-0.8%	-0.8%
Transportation & Warehousing	-18	-6	-67	-0.8%	-0.8%	-0.8%
Wholesale Trade	-10	-4	-57	-0.8%	-0.8%	-0.8%
Retail Trade	-27	-12	-276	-0.8%	-0.8%	-0.8%
Information & Communications Services	-13	-4	-21	-0.8%	-0.8%	-0.8%
Finance, Insurance, & Real Estate Services	-43	-12	-172	-0.7%	-0.7%	-0.7%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-43	-21	-249	-0.7%	-0.7%	-0.7%
Employment, Administrative, & Waste Services	-7	-4	-95	-0.8%	-0.8%	-0.8%
Education, Health & Social Services	-25	-15	-249	-0.7%	-0.7%	-0.7%
Arts, Entertainment & Recreation Services	-4	-1	-37	-0.8%	-0.8%	-0.8%
Accommodation & Food Service	-10	-4	-146	-0.7%	-0.7%	-0.7%
Other Services	-15	-7	-145	-0.8%	-0.8%	-0.8%
Government & Miscellaneous	-40	-11	-96	-0.8%	-0.7%	-0.7%
Totals	-497	-266	-4,216	-0.8%	-0.7%	-0.7%
Total FTE Jobs [a]	-	-	*-4,008*	-	-	*-0.7%*
55 Scenario						
Agriculture	-282	-276	-4,161	-1.5%	-1.5%	-1.5%
Other Natural Resources & Mining	-63	-37	-900	-1.4%	-1.4%	-1.4%
Utilities	-9	-3	-50	-1.9%	-1.9%	-1.9%
Construction	-49	-10	-56	-2.6%	-2.6%	-2.6%

Industry/Sector	Change in: Output ($ mil.)	Income ($ mil.)	No. of Jobs	Percent Change in: Output	Income	No. of Jobs
Food Processing	-9	-1	-18	-1.5%	-1.5%	-1.5%
Other Non-Durables Manufacturing	-64	-5	-47	-1.7%	-1.6%	-1.6%
Durables Manufacturing	-9	-2	-27	-1.6%	-1.6%	-1.6%
Transportation & Warehousing	-36	-12	-135	-1.6%	-1.6%	-1.6%
Wholesale Trade	-21	-7	-115	-1.6%	-1.7%	-1.6%
Retail Trade	-55	-25	-566	-1.6%	-1.7%	-1.7%
Information & Communications Services	-27	-7	-43	-1.5%	-1.5%	-1.5%
Finance, Insurance, & Real Estate Services	-86	-23	-344	-1.5%	-1.5%	-1.5%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-85	-42	-496	-1.4%	-1.5%	-1.5%
Employment, Administrative, & Waste Services	-14	-7	-190	-1.6%	-1.6%	-1.6%
Education, Health & Social Services	-49	-30	-501	-1.5%	-1.5%	-1.5%
Arts, Entertainment & Recreation Services	-7	-3	-75	-1.5%	-1.5%	-1.5%
Accommodation & Food Service	-20	-8	-294	-1.5%	-1.5%	-1.5%
Other Services	-30	-14	-291	-1.6%	-1.6%	-1.6%
Government & Miscellaneous	-79	-22	-182	-1.6%	-1.3%	-1.4%
Totals	-996	-535	-8,490	-1.6%	-1.5%	-1.5%
Total FTE Jobs [a]	-	-	*-8,059*	-	-	*-1.5%*
65 Scenario						
Agriculture	-644	-630	-9,504	-3.4%	-3.4%	-3.4%
Other Natural Resources & Mining	-129	-76	-1,836	-2.9%	-2.9%	-2.8%
Utilities	-20	-7	-107	-4.0%	-4.0%	-4.0%
Construction	-98	-19	-113	-5.2%	-5.2%	-5.2%
Food Processing	-20	-2	-41	-3.3%	-3.3%	-3.3%
Other Non-Durables Manufacturing	-145	-12	-107	-3.8%	-3.6%	-3.5%
Durables Manufacturing	-21	-5	-60	-3.5%	-3.5%	-3.5%
Transportation & Warehousing	-82	-28	-303	-3.6%	-3.6%	-3.6%
Wholesale Trade	-46	-16	-257	-3.6%	-3.7%	-3.6%
Retail Trade	-124	-55	-1,272	-3.7%	-3.8%	-3.7%
Information & Communications Services	-60	-16	-95	-3.4%	-3.4%	-3.4%
Finance, Insurance, & Real Estate Services	-191	-51	-765	-3.3%	-3.3%	-3.3%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-192	-94	-1,103	-3.2%	-3.3%	-3.3%
Employment, Administrative, & Waste Services	-31	-16	-423	-3.5%	-3.5%	-3.5%
Education, Health & Social Services	-111	-68	-1,125	-3.4%	-3.4%	-3.4%

Industry/Sector	Change in: Output ($ mil.)	Income ($ mil.)	No. of Jobs	Percent Change in: Output	Income	No. of Jobs
Arts, Entertainment & Recreation Services	-16	-6	-169	-3.4%	-3.4%	-3.4%
Accommodation & Food Service	-45	-19	-660	-3.4%	-3.4%	-3.4%
Other Services	-69	-32	-662	-3.8%	-3.8%	-3.6%
Government & Miscellaneous	-174	-49	-411	-3.4%	-3.0%	-3.1%
Totals	-2,220	-1,202	-19,012	-3.5%	-3.4%	-3.4%
Total FTE Jobs [a]	-	-	*-18,107*	-	-	*-3.4%*
75 Scenario						
Agriculture	-1,055	-1,030	-15,554	-5.6%	-5.5%	-5.6%
Other Natural Resources & Mining	-220	-129	-3,121	-4.9%	-4.9%	-4.8%
Utilities	-32	-11	-173	-6.4%	-6.4%	-6.4%
Construction	-152	-30	-176	-8.0%	-8.0%	-8.0%
Food Processing	-33	-4	-67	-5.5%	-5.5%	-5.5%
Other Non-Durables Manufacturing	-241	-20	-176	-6.2%	-5.9%	-5.8%
Durables Manufacturing	-35	-8	-98	-5.7%	-5.7%	-5.7%
Transportation & Warehousing	-136	-46	-503	-6.0%	-6.0%	-6.0%
Wholesale Trade	-77	-27	-425	-6.0%	-6.1%	-6.0%
Retail Trade	-206	-92	-2,110	-6.1%	-6.3%	-6.2%
Information & Communications Services	-99	-26	-157	-5.6%	-5.7%	-5.7%
Finance, Insurance, & Real Estate Services	-318	-85	-1,269	-5.5%	-5.5%	-5.5%
Legal, Rental, Professional, Scientific, Mgt & Tech Services	-320	-157	-1,853	-5.3%	-5.5%	-5.5%
Employment, Administrative, & Waste Services	-52	-27	-698	-5.7%	-5.7%	-5.7%
Education, Health & Social Services	-183	-112	-1,849	-5.5%	-5.5%	-5.5%
Arts, Entertainment & Recreation Services	-26	-11	-277	-5.6%	-5.6%	-5.6%
Accommodation & Food Service	-74	-31	-1,085	-5.6%	-5.6%	-5.6%
Other Services	-112	-53	-1,084	-6.2%	-6.1%	-5.9%
Government & Miscellaneous	-280	-77	-647	-5.5%	-4.7%	-4.8%
Totals	-3,650	-1,975	-31,322	-5.7%	-5.5%	-5.5%
Total FTE Jobs [a]	-	-	*-29,757*	-	-	*-5.5%*

Combined direct, indirect, and induced effects on business, household, and government sectors in the State of California economy attributable to backward linkage effects of modeled agricultural production activities, expressed as change relative to estimated effects of baseline (existing) condition agricultural activity.

[a] FTE = full time equivalent. Total FTE jobs calculated by dividing the estimated change in total income by the overall average earnings per job in the region.

A4.6 References Cited

A4.6.1 Common References

^IMPLAN Group, LLC (IMPLAN). 2017. IMPLAN System data for year 2015. Published and purchased 2017. www.IMPLAN.com.

A4.6.2 Section References

University of California, Davis (UC Davis). 2018. 2009–2017. *Agricultural and Resource Economics. Cost and Return Studies.* Available: https://coststudies.ucdavis.edu/en/. Accessed: May 5, 2017 to May 24, 2017.

Attachment A4a

List of Crop Budget References

Attachment A4a
List of Crop Budget References

The California agricultural costs and returns studies used are listed in alphabetical order based on associated Statewide Agricultural Production Model (SWAP) crop categories. All studies listed below were accessed from the University of California, Davis, Agricultural and Resource Economics website: https://coststudies.ucdavis.edu/en/ from May 5, 2017, through May 24, 2017 (weblinks were updated on November 14, 2018).

Alfalfa

UC Davis. 2015*. Sample Costs to Establish and Produce Alfalfa Hay in The Sacramento Valley and Northern San Joaquin Valley Flood Irrigation*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/39/f2/39f29aa5-b991-4a13-816e-c695ed243249/alfalfa-flood-sv-2015.pdf. Accessed: May 2017.

Almonds

UC Davis. 2016. *Sample Costs to Establish an Orchard and Produce Almonds, Sacramento Valley, Micro-Sprinkler Irrigation*. UC Cooperative Extension and Agricultural Issues Center. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/57/1c/571c5eea-78fe-4dd2-a950-cd886bc7b5cb/16almondsacvalfinaldraft81216.pdf. Accessed: May 2017.

Corn

UC Davis. 2015. *Sample Costs to Produce Field Corn in the Sacramento and Northern San Joaquin Valleys.* UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/03/dc/03dc4496-32af-47c6-b479-38e1d27c134e/15cornsacramentovalleyfinaldraftjuly20.pdf. Accessed: May 2017.

Cotton

UC Davis. 2012. *Sample Costs to Produce Cotton - Pima Variety, San Joaquin Valley*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/a3/60/a360464e-9d4c-4948-ac28-82978d9e4be7/cotton2012pima.pdf. Accessed: May 2017.

Cucurbits

UC Davis. 2009. "Melons" from: *Sample Costs to Produce Mixed Vegetables, Tomatoes, Winter Squash, Melons, Small Farm, Sierra Nevada Foothills*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/aa/27/aa2706a3-382b-471e-b649-e09bd3dbe228/mixedvegir09.pdf. Accessed: May 2017.

Dry Beans

UC Davis. 2014. *Sample Costs to Produce Beans, Dry Bush and Vine Varieties – Single-Cropped in the Sacramento Valley*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/de/d6/ded6333c-02e2-4a1c-9efb-b0b96a1fc713/beans_singlecropped_sv_2014.pdf. Accessed: May 2017.

Grain

UC Davis. 2016. *Sample Costs to Produce Wheat, Sacramento Valley-Irrigated.* UC Cooperative Extension, Agricultural Issues Center, and UC Davis Department of Agricultural and Resource Economics. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/dc/15/dc158210-055c-494c-9c2f-54083fbf0323/2016wheatsacvalleyfinaldraft122116.pdf. Accessed: May 2017.

Onions

UC Davis. 2016. *Sample Costs to Produce Onions for Dehydrating, Intermountain Region Tule Lake & Klamath Basin.* UC Cooperative Extension and Agricultural Issues Center. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/a7/1e/a71ed327-7d6c-4ae5-92a2-52854cb4195c/16_onionshydrostulelakefinaldraftmar22.pdf. Accessed: May 2017.

Other Deciduous Crops

UC Davis. 2012. *Sample Costs to Establish a Walnut Orchard and Produce Walnuts, English Walnuts, Sacramento Valley, Micro-Sprinkler Irrigated.* UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/de/5b/de5b047e-efb5-4145-b618-1c643240abe9/walnutsv2012.pdf. Accessed: May 2017.

Other Field Crops

UC Davis. 2009. *Sample Costs to Produce Sudan Hay, San Joaquin Valley South.* UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/61/f3/61f30970-b762-4de5-b84c-41fd03b761cd/sudanhayvs09.pdf. Accessed: May 2017.

Other Truck Crops

UC Davis. 2012. *Sample Costs to Produce Fresh Market Broccoli, Central Coast Region – San Luis Obispo County*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/84/2e/842e78c3-3f2c-4595-ab4b-230b89b24150/broccoli_cc2012.pdf. Accessed: May 2017.

Pasture

UC Davis. 2015. *Sample Costs to Produce Pasture, Sacramento Valley, Flood Irrigation*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/0e/23/0e230982-8610-42a4-8a26-32a0b10a4c5c/pasture_sv_2015.pdf. Accessed: May 2017.

Potatoes

UC Davis. 2015. *Sample Costs to Produce Potatoes, Fresh Market, Klamath Basin in the Intermountain Region*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/4e/f5/4ef54da3-114e-4952-a66a-049765b9a747/15potatofreshmktklamathfinaldraftdec10.pdf. Accessed: May 2017.

Rice

UC Davis. 2015 (Amended June 2016). *Sample Costs to Produce Rice, Sacramento Valley, Rice Only Rotation, Medium Grain*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/e8/9c/e89c1d86-f3fd-47bf-8e9a-02714e1e046e/2015_rice_2016_amendedfinaldraft7516-1.pdf. Accessed: May 2017.

Safflower

UC Davis. 2011. *Sample Costs to Produce Safflower, Sacramento Valley, Irrigated-Bed Planted and Dryland-Flat Planted*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/63/a9/63a948b0-8cef-4843-b66c-ac27006f726f/safflowersv2011.pdf. Accessed: May 2017.

Silage Corn

UC Davis. 2015. *Sample Costs to Produce Silage Corn, Conservation Tillage in the Northern San Joaquin Valley.* UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/a9/c5/a9c55e16-83cf-46f3-86b8-436ae2deb41f/15ctsilagecornsanjoaquinvalleyfinaldraftjuly20.pdf. Accessed: May 2017.

Subtropical Crops

UC Davis. 2015. *Sample Costs to Establish an Orange Orchard and Produce Oranges, Navels and Valencias, Low Volume Irrigation*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/19/d4/19d4f1bb-408a-443e-a759-36fd53a2948f/oranges_vs_2015.pdf. Accessed: May 2017.

Sugarbeets

UC Davis. 1994. *Sample Costs to Produce Sugarbeets, Spring Planted and Fall Harvest in Yolo County*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/9f/96/9f96b16e-60aa-4f14-bcab-effe68b82dc9/94sugarbeets.pdf. Accessed: May 2017.

Tomatoes

UC Davis. 2017. *Sample Costs to Produce Processing Tomatoes, Sub-surface Drip (SDI) in the Sacramento Valley and Northern Delta*. UC Cooperative Extension, Agricultural Issues Center, and UC Davis Department of Agricultural and Resource Economics. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/d7/b2/d7b2ee5f-8961-417d-b9d1-216d41fb47d8/2017processtomssacvalfinaldraft32817.pdf. Accessed: May 2017.

Vine Crops

UC Davis. 2013. *Sample Costs to Establish a Vineyard and Produce Wine Grapes Chardonnay Variety, Sacramento Valley, Sacramento River Delta, Sacramento and Yolo Counties – Crush District 17*. UC Cooperative Extension. Available: https://coststudyfiles.ucdavis.edu/uploads/cs_public/42/a7/42a7ee28-6775-426d-9e93-e621128aeb5d/grapewinesv2013.pdf. Accessed: May 2017.