Critique of Substitute Environmental Document

In Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality

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Executive Summary

In December 2012, the State Water Resources Control Board (Board) issued its *Public Draft Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin delta Estuary: San Joaquin River Flows and Southern Delta Water Quality (SED Report)*. The purpose of the *SED Report*, as we understand, is to evaluate alternatives to determine the preferred alternative. Michael Jackson asked us to critique the *SED Report*.

In the following sections of this report we describe our critiques in detail. A summary of our major critiques includes the following.

The *SED Report* Authors Could Have Chosen to Meet the Professional Standards, but They Didn't

The authors fail to meet the professional standards for the evaluations they conducted. For examples, they fail to meet the professional standards with the geographic scope of the analysis, with the categories of economic effects (economic values, economic impacts, and economic equity), and with risk and uncertainty. As a result, they render the results fatally flawed.

The *SED Report* Authors Selected Their Preferred Alternatives for Flows and Water Quality without Disclosing Their Reasoning

In selecting their preferred alternatives for flows and water quality, the authors again fail to meet the professional standards. They select their preferred alternatives without disclosing the progression of their reasoning from evidence to conclusion. As a result, they fail to reach a reasoned and reasonable conclusion. Among the questions begged, How exactly does 35 percent flow strike a balance among competing beneficial uses, including the public trust?

The *SED Report* Authors Overestimate the Negative Effects of the Flow Alternatives on Agricultural Producers

By assuming that agricultural producers would not compensate for the reduced surface flows with groundwater, the authors ignore the actual behavior of agricultural producers . As a result, the authors overestimate—perhaps markedly—the negative effects of the flow alternatives on agricultural producers.

The SWAP Model Overestimates the Negative Effects on Agricultural Producers

Researchers comparing the SWAP model's results with actual conditions found SWAP overstated job losses by approximately 65 percent. They question the SWAP model's validity. The *SED Report* authors failed to adjust their findings accordingly.

The *SED Report* Authors' IMPLAN Analysis Contains a Number of Shortcomings

IMPLAN can describe economic changes only over the short-run. But the flow and water-quality alternatives would affect economic activity over the long-run, decades or generations. While the *SED Report* authors acknowledge that as a result, their IMPLAN analysis overstates the negative employment impacts of the flow alternatives, they fail to adjust their findings and fail to address the long-run effects that their IMPLAN analysis doesn't address.

The authors also acknowledge that their IMPLAN analysis overstates the negative employment impacts of the flow alternatives.

The Economic Loss to Agriculture from 60% Unimpaired Flow Would Be a Negligible Share of the Three-County Economy

The employment impacts of even the 60 percent flow alternative represents a negligible portion—approximately 0.2 percent—of the total employment in the three counties (Merced, Madera, and Stanislaus).

The *SED Report* Authors' Analysis Ignores or Underestimates the Economic Benefits of Flow Alternatives and Current Salinity Standards

The authors fail to address the full range of economic effects of the flow and salinity alternatives. They address the costs of flow alternatives to agricultural producers in the upper San Joaquin, and the extent to which crops currently produced by Delta growers could tolerate higher salinity concentrations. But they ignore the economic effects on threatened or endangered species; the benefits of lower salinity concentrations on Delta growers; and the benefits of higher flows and lower-salinity concentrations on Delta habitats and species.

The *SED Report* Authors Ignore Recent Peer-Reviewed Research on Salinity

The authors ignored a comprehensive analysis of salinity impact to Delta agriculture, a part of the Delta Protection Commission's Economic Sustainability Plan. The reseachers found up to $40 million per year in lost agricultural production from moving from 0.7 dS/m to 1.0 dS/m. The

California Department of Water Resources chose the ESP model of salinity impacts on Delta agriculture for their analyses of the Bay Delta Conservation Plan.

The *SED Report* Authors Ignore Evidence of Salinity Damage

The authors ignored the evidence of salinity damage under the current standards as reported in the Draft EIR for the Bay Delta Conservation Plan, in the Economic Sustainability Plan, and by the South Delta Water Agency.

The *SED Report* Authors Rely on the Deeply Flawed Report by Dr. Hoffman

The authors' proposed increase in salinity standards rests entirely on a report by Dr. Hoffman. Dr. Hoffman admits his conclusions rest heavily on results of 30-year old studies of potted bean varieties that commercial Delta growers no longer use. But the authors ignore compelling evidence to the contrary that Dr. Hoffman's hypothesis should be rejected.

Rather Than Address Current Salinity Problems, the *SED Report* Authors Propose Increasing Allowable Salinity Concentrations

Salinity concentrations in the Delta regularly exceed current allowable amounts, and have done so for some time. Also, salinity concentrations below those the authors propose harm Delta agriculture. Instead of solving the problem by dealing with its causes, the authors propose simply increasing the amount of salinity allowed. And the authors try to counter all the evidence against this dodge with a 30-years old, severely criticized study of potted beans.

I. Introduction, Context, and Opinion

A. Introduction and Context

In 2010, the California State Water Resources Control Board (Board) issued its *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem* (*Flow Report*). In December 2012, the Board issued its *Public Draft Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality* (*SED Report*). Had the waters of the San Joaquin and Sacramento Rivers been abundant, we[1] doubt the Board would have issued either report. But abundance doesn't rule these waters; scarcity does. And there's the rub.

The *SED Report* authors, on behalf of the Board, focus on the San Joaquin River. In our comments here, Michael Jackson asked us to focus on the *SED Report* and evaluate the authors' analysis. While scarcity rules the San Joaquin River and thereby presents a challenge to the Board, it also gives the Board a powerful approach to facing the challenge.

> *Economics is the study of how societies use scarce resources to produce valuable goods and services and distribute them among different individuals.*[2]

Embedded in this definition is the origin of economics itself, namely allocating scarce resources among competing demands. Also embedded in it is the approach the Board can and should adopt to face its challenge.

The scarce resource the Board must allocate among competing demands is the San Joaquin River and, more specific, the quantity and quality of its waters. Examples of San Joaquin River goods and services are agricultural goods and ecosystem services. When the *SED Report* authors state they have "evaluated a number of different 2006 Bay-Delta-Plan amendment alternatives for State Water

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[1] Throughout this report, "we," "our," and "us" refer to ECONorthwest employees, Ed MacMullan, Philip Taylor, Dr. Bryce Ward, and Dr. Ed Whitelaw. Dr. Jeffrey Michael also assisted ECONorthwest with portions of this review.

[2] Samuelson, PA and WD Nordhaus. 2010. *Microeconomics,* 19th ed. New York: McGraw-Hill Irwin, p.4. Dr. Samuelson was a Nobel laureate in economics and Institute Professor at MIT.. Dr. Nordhaus is Sterling Professor of economics at Yale University. For similar definitions of economics, see practically any other introductory economics textbook, as well as Pearce's MIT Dictionary of Economics, Pearce, DW, ed. 1992. *The MIT Dictionary of Modern Economics*, 4th ed. Cambridge: The MIT Press, p.121.

Board consideration"[3] and their "economic analysis … will help inform State Water Board's consideration of potential changes … related to LSJR flows and southern Delta water quality objectives,"[4] they appear to have adopted the approach that's embedded in the definition of economics, the approach that employs the best practices for the economic analyses the Board needs.[5] That's good, because its underlying logic rests on over a century of professional economic literature[6], in Federal and many state—including California—public documents[7], and textbooks.[8] It's also straightforward and compelling:

> *If you were asked to evaluate the desirability of some proposed action, you would probably begin by attempting to identify both the gains and the losses from that action. If the gains exceed the losses, then it seems natural to support the action.*[9]

Identifying "the gains and the losses" begins by grouping the gains and losses—the economic effects—into three categories: economic values, economic impacts, and economic equity.[10] These are not terms of art in economics. They simply provide a convenient, and technically sound, means of distinguishing among the many, disparate economic effects changes in natural resources can cause. Also, economists have published on each of the effects in the three categories.

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[3] *SED Report,* p.ES-2

[4] *SED Report,* p.18-2.

[5] Throughout the *SED Report* appear many similar descriptions of what the *SED Report* authors have included in the *SED Report* or what it will do for the Board.

[6] See, for example, Marshall, A. 1890. *Principles of Economics*. London: Macmillan and Co.; Leontief, WW. 1951. *The Structure of the American Economy, 1919-1939: An Empirical Application of Equilibrium Analysis*. Oxford: Oxford University Press.

[7] See, for example, Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. Washington, D.C.: U.S. Government Printing Office.; Department of Water Resources. 2008. *Economic Analysis Guidebook*. State of California.; National Center for Environmental Economics. 2010. *Guidelines for Preparing Economic Analyses*. U.S. Environmental Protection Agency.

[8] Tietenberg, T and L Lewis. 2012. *Environmental & Natural Resource Economics,* 9th ed. Upper Saddle River: Pearson Education. Not incidental, many universities in California have adopted this textbook in environmental and natural resource economics, including UC Berkeley, UCLA, UC San Diego, UC Santa Barbara, Stanford, and USC. So, too, have universities elsewhere, including Massachusetts Institute of Technology, Harvard University, University of Texas, Oregon State University, Wake Forest University, University of North Texas, Texas A&M University, University of Wyoming, Purdue University, and New York University.

[9] Tietenberg and Lewis, p.46.

[10] We describe these in detail in ECONorthwest (2013), *Bay-Delta Water: Economics of Choice*. We present the relevant excerpt from the report in the appendix.

As for describing and calculating the economic effects in each of the three categories, there are many professionally sound methods. And for evaluating "the desirability of some proposed action," consider these two definitions.

> *Normative economics considers 'what ought to be'—value judgments, or goals, or public policy.*[11]

> *Positive economics…is the analysis of facts and behavior in an economy, or 'the way things are'.*[12]

These two definitions apply directly to the challenge the Board faces.

> *The normative dimension helps to separate the policies that make sense from those that don't. Since resources are limited, it is not possible to undertake all ventures that might appear desirable so making choices is inevitable.*[13]

The implications for the *SED Report* are clear. For an evaluation, an assessment, or a "balancing" to meet professional standards, it must include a normative criterion—conditions as they should be—and a descriptive criterion—conditions as they are. Too often where it matters, the *SED Report* authors omit either one or both of these criteria.

B. Opinion

The *SED Report* is replete with errors of omission and commission. Some of them alone compromise the entire report. And the cumulative errors of omission and commission, taken together, simply beg too many questions across too many parts of the *SED Report* for it as a whole or part by part to meet basic professional standards.

And failing to meet the professional standards matters. For example, the authors fail to disclose evidence-based reasoning that led them from the alternatives (for flows and water quality) they identified to the alternatives they prefer. This in turn, if proffered, would fail to inform the Board adequately. Arguably, it would misinform the Board.

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[11] Samuelson, P.A. and W. Nordhaus. 2005. *Economics*, 18th ed. New York: McGraw-Hill Irwin. p. 746. Dr. Samuelson, Nobel laureate in economics and Institute Professor at MIT, died in 2009. Dr. Nordhaus is Sterling Professor of economics at Yale University.

[12] Samuelson and Nordhaus. 2005. p. 746.

[13] Tietenberg and Lewis, p.46.

II. The SED Report's Economic Analysis

A. The SED Report Authors Could Have Chosen to Meet the Professional Standards, but They Didn't.

1. Consider this extended excerpt from the *SED Report Chapter 18, "Economic Analysis"*:

   "Under CEQA, project-related social or economic effects are not, as a general rule, required to be analyzed in CEQA documents; however, a lead agency may decide to include an assessment of economic or social effects in an EIR, particularly if these effects are perceived as being important or substantial. As discussed in Section 15131 of the Guidelines for Implementation of the California Environmental Quality Act (CEQA Guidelines), economic or social information may be included in an EIR in whatever form a lead agency desires. The guidelines also indicate that social and economic issues may be discussed in an EIR when they are linked to physical change …

   Water Code Section 13241 states that "economic considerations" should be considered in establishing water quality objectives. In practice, compliance with these statutory provisions *typically* involves quantifying the costs to affected parties (e.g., farmers and water districts), and assessing potential impacts on affected local and regional economies of related changes in economic activity. Evaluation of other potential economic effects, such as water quality benefits, *typically* is conducted more qualitatively.[*emphasis added*]"

   Any project-level changes to water rights or other measures that may be needed to implement any approved changes to the 2006 Bay-Delta Plan will be considered in a subsequent proceeding and would require project-level analysis as appropriate. Therefore, the economic analysis presented in this chapter, which summarizes results from topic-specific analyses presented elsewhere in this SED and its appendices, is limited by the programmatic nature of this document. (p.18-1, 18-2)

2. Consider our comments:

   a. Consider these terms: "an assessment of economic or social effects"; important or substantial [effects]"; "economic or social information may be included in an EIR in whatever form a lead agency desires"; "social and economic issues … linked to physical

change"; "'economic considerations' should be considered"; "compliance *typically* involves" [*emphasis added*]; "assessing potential impacts on affected local and regional economies of related changes in economic activity"; "Evaluation … water quality benefits, *typically* is conducted more qualitatively" [*emphasis added*]; "economic analysis … limited by the programmatic nature of this document."

b. None of the terms in #2a, as used in the extended selection from Chapter 18, is a term of art in economics (except possibly "local and regional economies"). In its entirety, the selection leaves the *SED Report* authors great leeway in what they could have done to prepare Chapter 18. But without rigorous definitions of these terms, we're left with ambiguities throughout. What they chose not to do is heed the relevant, readily and widely accessible professional standards, e.g., 1983 P&G[14], 2008 CA DWR[15], 2010 EPA[16]. The question begged, of course is, Why? We don't try to answer.

B. The Failure to Meet the Professional Standards Matters

1. Failing to get the correct geographic scope of the economic analysis could render the results fatally flawed. Consider the questions one should ask to define the relevant geography for "consideration," "assessment," or "evaluation," all terms contained in the excerpt above. What biophysical resources would the Board's decision affect? How does the combined affect of the drainage from Mud Slough and Salt Slough into the San Joaquin and the SED salinity and flow alternatives affect the biophysical resources in the portion of the San Joaquin in the Planning Area and further downstream? How would the salinity and flow alternatives affect biophysical resources in the Delta, including species at risk of extinction?

2. Failing to address all the potential economic effects could render the results fatally flawed. The relevant categories of economic effects are: economic values; economic impacts; and economic equity.[17] For

[14] Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. Washington, D.C.: U.S. Government Printing Office.

[15] Department of Water Resources. 2008. *Economic Analysis Guidebook*. State of California.

[16] National Center for Environmental Economics. 2010. *Guidelines for Preparing Economic Analyses*. U.S. Environmental Protection Agency.

[17] See appendix. ECONorthwest. 2013. *Bay-Delta Water: Economics of Choice*.

example, what are the questions one should ask to identify the relevant populations and thereby describe the economic equity or environmental justice. Who are the stakeholders affected over the relevant geography and how would they be affected? What would be the distributional effects—who enjoys the benefits and who bears the costs—of the economic outcomes of the alternatives?

3. Failing to address risk and uncertainty adequately could render the results fatally flawed.

    a. Consider all the *SED Report*'s Chapter 18 (Economic Analysis) says about risk and uncertainty.

    "Risk: The lower flows may substantially decrease the quantity and quality of spawning, rearing, and migration habitat; increase exposure of fish to pollutants; increase predation risks; and substantially change fish transport flows. Changes in flow, water temperature, and water quality also may increase fish disease risk." (p.18-17)

    "Uncertainty: The extent that economic values associated with recreation on the Merced and Tuolumne Rivers would be affected is uncertain, primarily because reliable data on use by activity and the relationship between changes in flows and use are not known. However, for purposes of developing a worse-case, planning-level scenario affecting potential displacement of recreational activities, the recreational use information in Table 18-10 is used to assess order-of-magnitude effects on recreation benefits and spending." (18-17)

    b. Consider our comments:

        i. Contrast the treatment that the *SED Report* authors give risk and uncertainty with the treatment (CA DWR 2008) and (EPA 2010) gives these two factors. The contrast is stark.

        ii. The fact that risk-aversion applies to actions that threaten natural assets and ecosystem services[18] compounds the *SED*

[18] Field, B.C. 1994. *Environmental Economics*. p.129; Goodstein, 1999. E.S. *Economics and the Environment*. p.150; Lesser, J.A., D.E. Dodds, and R.O. Zerbe, Jr.. 1997. *Environmental Economics and Policy*. p.406

Report authors' error of omission. But the authors fail even to mention it.

C. The SED Report Authors Selected Their Preferred Alternatives for Flows and Water Quality without Disclosing Their Reasoning

1. Consider these excerpts from the *SED Report*:

"The State Water Board's 2010 report, *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem*, determined that approximately 60 percent of unimpaired flow at Vernalis February-June would be fully protective of fish and wildlife beneficial uses in the three eastside tributaries and LSJR when considering flow alone." (p.3-4)

"The Goal of the Preferred LSJR Alternative is to protect fish and wildlife by supporting and maintaining the natural production of viable native SJR watershed fish populations migrating through the Delta. The Preferred LSJR Alternative established February-June flow requirements of 35 percent of unimpaired flow, ….. The 35 percent unimpaired flow requirement would strike a balance between providing water for the protection of fish and other competing uses of water, including agriculture and hydropower generation." (p.ES-2, 3)

"The LSJR alternatives and SDWQ alternatives analyzed in the preceding chapters and in the appendices were selected in order to evaluate and compare the different environmental, economic, and hydropower effects of a broad range of conceivable LSJR flow and southern Delta water quality requirements. The preferred alternatives were identified after reviewing and considering this information and information included in the administrative record for this substitute environmental document (SED)." (p.20-1)

"The Preferred LSJR Alternative (35 percent unimpaired flow) is not explicitly analyzed in the preceding chapters of this SED. Instead, the Preferred LSJR Alternative falls within the range of alternatives analyzed in those chapters (20-60 percent of unimpaired flows) and is, accordingly, encompassed by those analyses." (p.20-1)

"Since the preferred LSJR Alternative (35 percent unimpaired flow) falls between LSJR alternative 2 (20 percent unimpaired flow) and LSFR Alternative 3 (40 percent unimpaired flow), in order to determine the level of impact under the Preferred LSJR Alternative, impacts determinations under LSJR Alternatives 2 and 3 were evaluated." (p.20-1)

2. Consider our comments:

    a. Among the most important professional standards in economics and courtrooms is demonstrating explicitly the progression in reasoning from evidence to conclusion. Attempting it implicitly simply doesn't cut it. To the best of our knowledge, the excerpts above constitute the *SED Report* authors' progression from what they represent as evidence to their preferred alternatives for flows and water quality. If this is true, then by the professional standards, the authors have failed to balance the relevant competing uses, including, for example, public trust uses. As a result, they have not reached a reasoned and reasonable conclusion.

    b. Among the questions begged by this series of excerpts is, How exactly does 35 percent flow strike a balance?

    c. For guidance, the authors can look to the Board's own decision in the Mono Lake case for guidance on balancing.[19]

[19] Broussard, J. 1983. *National Audubon Society et al., Petitioners, v. The Superior Court of Alpine County, Respondent; Department of Water and Power of the City of Los Angeles et al., Real Parties in Interest*. 33 Cal.3d 419. S.F. No. 24368. Supreme Court of California. February 17.; ECONorthwest. 2013. *Bay-Delta Water: Economics of Choice*. p.6-8.

III. Other Critiques

Critique #1: Ignoring groundwater as a substitute for reduced surface flows exaggerates the negative effects

The *SED Report* authors' analysis includes what they describe as a "conservative" assumption that agricultural producers would not replace reduced surface flows by increasing groundwater applications. This assumption, however, ignores how agricultural producers operate. As a result, the authors overestimate—perhaps markedly—the negative effects of the flow alternatives on agricultural producers.

We find the authors' use of this assumption curious given the following well-known, and documented facts:

1. Agricultural producers use groundwater. Agricultural producers in the authors' analysis use groundwater and substitute groundwater for surface water.[20]

2. The SWAP model includes groundwater. The SWAP model includes the capabilities of modeling increased use of groundwater as a substitute for reduced surface flows.[21] Other studies conducted with the SWAP model have routinely included groundwater substitution for surface water supplies.[22] This begs the question: Why were these capabilities not applied in the *SED Report* authors' analysis?

3. The authors calculated the increased groundwater use. Indeed, as described in SED Chapter 9 Groundwater Resources, the authors even calculated the quantities of groundwater that would be needed to offset reduced surface flows (see Table 9-10, page 9-23).
"*Irrigation district and water district service areas may experience reduced surface water supplies as a result of the LSJR alternatives, which could result in increased groundwater pumping. … [T]he magnitude of potential groundwater*

[20] Howitt, R., D. MacEwan, and J. Medellin-Azuara. 2011. "Drought, Jobs, and Controversy: Revisiting 2009," Agricultural and Resource Economics Update. V.14 no.6. Giannini Foundation of Agricultural Economics, University of California. July/August; SED 2012, Chapter 9, page 9-11.

[21] Michael, J. R. Howitt, J. Medellin-Azuara, and D. MacEwan. 2010. A Retrospective Estimate of the Economic Impacts of Reduced Water Supplies to the San Joaquin Valley in 2009. September 28.

[22] Howitt et al. 2011; Michael et al. 2010.

impacts was quantified by assessing the expected increased pumping to replace the reduced surface water supplies."[23]

4. Reviewers pointed out that not including groundwater in the SED analysis would overstate the negative effects on agricultural producers. In his comments on the Draft analysis of agricultural-economic effects of the flow alternatives, Dr. Rich Adams states,
"*… Years of empirical research have documented that irrigators will seek other water sources when confronted with water supply disruptions. By not allowing such an adjustment in modeling of the stream flow effects, the assessment here likely overstates the economic costs of the flow alternatives*."[24]

   Dr. Rex Chaffey states in his review,
"*I understand the rational for this assumption* [of no groundwater substitution] *given the potential complexity involved in characterizing the variable quantities (and the range of agricultural impacts) that might result from development of alternative irrigation sources in response to the proposed LSJR flow alternatives. Nevertheless, I find the description of this assumption (as used here) to be a bit misleading—though not necessarily intentionally so. I would suggest that this assumption is more "convenient" than "conservative" because its use (as the Staff points out) ultimately results in higher economic impacts. By incorporating some element of incremental substitution, the economic impacts of the LSJR alternatives could be partially offset. Thus, use of this assumption potentially exaggerates the upper bounds of economic impact produced via the IMPLAN model.*
… I cannot say how realistic it would be to assume (and account for) any incremental substitution effects, but describing this assumption as 'conservative' seems odd at best and strategic at worse—especially given its acknowledged inflationary effect…."[25]

The facts do not support the *SED Report* authors' assumptions or analysis that generated a "worst case" outcome for agricultural producers. The facts do support a "reasonably foreseeable" or "likely" outcome for agricultural producers of little effects for any of the flow alternatives—including the 60-percent flow alternative. We expect that an analysis that generated "reasonably

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[23] SED 2012. Chapter 9, page 9-1.

[24] Adams, R. 2011. Review of "DRAFT Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives." June 11. Submitted to, and at the request of, the State Water Resources Control Board.

[25] Chaffey, R.. 2012. Review of "Draft report: Agricultural Economic Modeling for Phase 1 Update to the 2006 Bay-Delta Plan." June 23. Submitted to, and at the request of, the State Water Resources Control Board.

foreseeable" rather than "worst case" outcomes for agricultural producers would also produce a preferred alternative much closer to, if not, at the 60-percent flow amount.

Critique #2: The SWAP model overestimates the negative effects

The authors' analysis of the agricultural-economic effects of the flow alternatives relies on the predictive capabilities of the SWAP model. This model, however, has questionable capabilities as a predictive tool. For example, a retrospective analysis that compared SWAP results with real-world conditions found that the model's output—and the follow-on economic analysis—overstated job losses from the 2009 drought by approximately 65 percent. Researchers have raised serious questions about the SWAP model's validity.

A recent report by David Sunding and Max Auffhammer[26] describes some of their concerns and recommendations regarding the SWAP model.

> *"…[W]e are concerned that SWAP is built on a very large number of relatively untested assumptions. We also have concerns about the underlying data, and about the calibration procedures used to fit the model to the data."*[27]
>
> *"The state should conduct a systematic peer review of SWAP, focusing on the large number of assumptions underlying the model …*
>
> *We recommend that the predictions of the SWAP model be tested against real-world changes in land allocation….*
>
> *DWR should work to integrate SWAP with a groundwater model…*
>
> *The UC Davis researchers should consider reconfiguring the SWAP regions to better correspond to actual water rights, project service areas, and groundwater conditions.*
>
> *DWR should develop an econometric model for the agricultural sector in the San Joaquin Valley…. A key advantage of an econometric model is that it would produce standard errors around forecasts, a key omission of the SWAP model."*[28]

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[26] Sunding, D. and M. Auffhammer. 2012. An Assessment of Models for Measuring the Economic Impact of Changes in Delta Water Supplies. Public Comment, Bay Delta Plan Workshop 3. October 24.

[27] Sunding and Auffhammer, 2012, page 27.

[28] Sunding and Auffhammer, 2012, page 27-28.

Regarding the recommendation to submit the model to peer review, the *SED Report* authors did solicit comments on the model as part of the review of the authors' draft analysis of the LSJR flow alternatives. One reviewer, Dr. Rich Adams, noted, however, that the authors' requested review fell short of an academic-quality peer review. "*I note that the requested review is somewhat circumscribed compared with a peer review for publication in a scientific journal*."[29]

Regarding the recommendation to test the model against real world changes, the evidence of one such comparison found the model substantially overestimated negative effects on agricultural producers. Researchers estimated the economic effects on agricultural producers of the reductions in surface flows attributed to the 2009 drought. The SWAP model, and the resulting economic analysis, overestimated revenue losses by approximately 50 percent, and overestimated job losses by approximately 65 percent, relative to actual outcomes.[30] Unlike the *SED Report*, the SWAP analysis of the 2009 drought accounted for groundwater substitution for surface water and still overestimated losses by a considerable margin. In the case of the 2009 drought, the authors said that the SWAP model overestimated the negative effects on agricultural producers because there were more water transfers than the model predicted.[31]

For illustrative purposes, adjusting the 4.5 percent reduction in crop revenues estimated for LSJR Alternative 4 (60-percent flows) by a 50-percent overestimation factor, yields a reduction in crop revenues of 2.25 percent. Taking this measure of negative agricultural effects into account—which represent a large share of the total negative effects in the *SED Report* authors' analysis—would likely result in a preferred alternative with a flow rate much closer to, if not, at the 60-percent flow.

Critique #3: IMPLAN yields only short-run effects and overestimates the impacts of the alternatives

The authors' IMPLAN analysis contains a number of shortcomings. We focus on two. First, IMPLAN can describe economic changes only over the short-run—of only a few quarters or of a year or two. Second, IMPLAN overestimates the true employment and income impacts of alternatives.

In general, the IMPLAN analysts estimate economic impacts by holding static all economic sectors and relationships among sectors in the economy. It gives a

[29] Adams, 2011, page 1.

[30] Howitt et al., 2010.

[31] Michael, et al., 2010; Howitt, et. al., 2011.

snapshot, not a video. Thus, IMPLAN produces economic impacts over the short run. Economies, however, are not static. They develop, change, and react to economic forces and trends. For example, agricultural producers will likely continue substituting capital (equipment) for labor over time. If that's the case, how does this affect our interpretation of IMPLAN results, which rely on the assumption of no such substitution?

Missing from the *SED Report* authors' static, short-run IMPLAN analysis is information on:

- The relevant economic forces and trends that will likely affect the stakeholders and economies affected by the authors' decision.
- Revising the static IMPLAN results given these likely economic forces and trends.
- Identifying likely mitigation possibilities that could lessen negative effects that happen over time.

The Board's decision would affect dynamic, changing economies, and these effects would happen not just in the short-run, but for the foreseeable future—decades or generations. As such, IMPLAN, cannot describe these dynamic changes over the time that stakeholders would experience the economic impacts of the Board's decision.

In the context of the *SED Report*, the results from IMPLAN's snapshot overestimate the negative economic impacts of the flow alternatives:

> "*Input-output analysis approach employed by IMPLAN usually overestimates indirect job and income losses. One of the fundamental assumptions in input-output analysis is that trading patterns between industries are fixed. This assumption implies that suppliers always cut production and lay off workers in proportion to the amount of product supplied to farms or other industries reducing production. In reality, businesses are always adapting to changing conditions. When a farm cuts back production, some suppliers would be able to make up part of their losses in business by finding mew markets in other areas. Growth in other parts of the local economy is expected to provide opportunities for these firms. For these and other reasons, job and income losses estimated using input-output analysis should often be treated as upper limits on the actual losses expected* (SWRCB 1999)."[32]

Even though the *SED Report* authors acknowledge that their IMPLAN analysis overstates the true employment and income impacts of the flow alternatives,

[32] SED 2012, page G-29.

they apparently ignored this fact when selecting their preferred alternative of 35 percent unimpaired flows. The authors compounded or magnified the "worst case" results from their SWAP analysis by using the SWAP results as input into their IMPLAN analysis, which also produced its own "worst case" output.

Critique #4: A 60% unimpaired flow would have a negligible effect on the three counties' economic activity

The *SED Report* authors estimated agricultural-employment impacts of the flow alternatives for the counties of Merced, Madera, and Stanislaus. According to the IMPLAN data upon which the *SED Report* authors' analysis rests, the economic activity of these three counties had total employment of 356,125.[33] Assuming for the sake of argument that the authors' IMPLAN results reflect the economic impacts of the flow alternatives—which we do not assume for the reasons we describe elsewhere in this critique—the employment impacts of even the 60 percent flow alternative represents a negligible portion of total employment in the affected counties. The negative employment impacts of the 60 percent flow alternative of 1,432 represent just 0.4 percent of the total. The authors admit these losses are exaggerated. A more reasonable estimate of economic losses is likely to be less than half the amount estimated in the *SED*, which would represent approximately 0.2 percent of the three counties' economic activity.

If we were to include San Joaquin County,[34] the negative employment impacts of the 60 percent flow alternative represent just 0.23 percent of the four counties' total employment of 625,178. Halved to be more reasonable, this represents approximately 0.1 percent of the counties' economic activity.

These results offer no support of the *SED Report* authors' preferred flow alternative, 35-percent unimpaired flow. The available evidence supports a preferred alternative closer to, if not, at the 60-percent flow alternative.

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[33] Bureau of Economic Analysis, Local Area Personal Income and Employment Data. BEA employment data is the source data for IMPLAN, and its definition of employment is consistent with IMPLAN. The most recent data is for 2011. http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=5#reqid=70&step=1&isuri=1.

[34] This is a reasonable addition, because economic impacts of a flow alternative would be felt in San Joaquin County, where South San Joaquin Irrigation District and Stockton East Water District are located. In addition to the farms themselves, most of the labor force and input suppliers for farms in these districts will be located in San Joaquin County, primarily Stockton, which also is the primary location of workforce and suppliers for farms within the South Delta Water Agency territory.

Critique #5: The SED Report authors ignore or underestimate the economic benefits of flow alternatives and of current salinity standards

The authors' analysis does not adequately address the full range of economic effects of the flow and salinity alternatives. They emphasize costs of flow alternatives to agricultural producers in the upper San Joaquin, and the extent to which crops currently produced by Delta growers could tolerate higher salinity concentrations. Economic effects missing from the authors' analysis include:

1. Effects of flow alternatives on threatened or endangered species: Comments on the *SED Report* by Thomas Cannon[35] and reports by EPA[36] document the precarious state of existing salmon and steelhead populations in the Delta, and the important role of water flow and quality on these species. But the *SED Report* authors fail to describe how the alternatives would affect these species, and the values that Californian's place on these species. Why couldn't the authors have used an EPA-approved benefits transfer to monetize the values?

   Specifically, the *SED Report* authors should more completely address the following questions: To what extent do flows below 60 percent, and increased salinity concentrations, increase the threat to the salmon and steelhead populations—and to the other aquatic life populations (e.g., striped bass, splittail, zooplankton, phytoplankton, etc.)? What is it worth to California residents and other stakeholders of avoiding extinction of these species?

   The EPA describes the important interactions between restoration efforts in the upper San Joaquin and the quality of aquatic habitats in the lower migratory corridors. "*The measured survival and decreasing populations of salmon in the San Joaquin watershed suggest that fall-run salmon restoration in the San Joaquin River tributaries cannot succeed until the lower migratory corridor is more supportive of salmon migration*."[37] Given this relationship between the San Joaquin and lower migratory corridors, the *SED Report* authors' analysis failed to address the extent to which the flow and salinity alternatives jeopardize the effectiveness and benefits from

[35] Cannon, T. 2013. Flow Requirements and other Recommendations to Protect San Joaquin River Fisheries. Prepared for the California Sportfishing Protection Alliance. March.

[36] EPA. 2011. Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: Unabridged Advanced Notice of Proposed Rulemaking. February;

[37] EPA 2011, page 61.

upstream restoration efforts—and the approximately $890 million[38] expenditures on these restoration efforts—conduced under the San Joaquin River Restoration Settlement Act of 2009.

2. The market benefits of enhanced commercial and recreational fishing: Low salmon populations resulted in the closure of salmon fishing in 2008 and 2009. The California Department of Fish and Game estimated that the salmon fishery closure in 2009 resulted in a loss of $279 million in output and 2,690 jobs. A report by the University of the Pacific estimated the economic impact of the closure at 1,823 jobs when compared to 2004-05 levels, and a report commissioned by the fishing industry estimated the loss at over 23,000 jobs.[39]

3. The benefits of lower salinity concentrations on Delta growers: The *SED Report* authors note that under baseline conditions, current salinity standards in the 2006 Bay-Delta Plan, "*are not always fully met.*"[40] The authors' analysis of salinity issues focused on the extent to which crops currently grown by Delta producers could tolerate higher salinity concentrations in Delta waters. The analysis ignored the economic benefits to Delta growers of fully enforcing current salinity concentrations. For example, increasing allowable salinity concentrations may limit the types of crops that Delta growers could produce in the future.

4. The benefits of higher flows and lower salinity concentrations on Delta habitats and species: The *SED Report* authors make no mention of the relationships between flows and salinity, and the Delta habitats and species, including salmon and steelhead. To the extent that higher flows and lower salinity concentrations affects natural resources and related ecosystem services that benefit society, it will also affect the values of these services.

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[38] Kantor, S. 2012. The Economic Benefits of the San Joaquin River Restoration. Fresno Regional Foundation. September.

[39] Business Forecasting Center. 2010. Employment Impacts of California Salmon Fisher Closures in 2008 and 2009. University of the Pacific. April. http://forecast.pacific.edu/BFC%20salmon%20jobs.pdf

[40] SED 2012, page ES-15.

Critique #6: The SED Report authors ignored recent peer-reviewed research on the effects of salinity on Delta agriculture

In 2011, the most comprehensive study of salinity impacts to Delta agriculture was conducted for the Delta Protection Commission's Economic Sustainability Plan (ESP).[41] The ESP econometric model controlled for a variety of physical (e.g., elevation, soil type, temperature, field size, irrigation water salinity) and market variables (e.g., prices) that impact crop choices. The results showed that the salinity of irrigation water had a large and significant effect on planting decisions in the Delta. The ESP model predicts that the degradation in water quality from moving the standard from 0.7 dS/m to 1.0 dS/m could result in agricultural revenue losses of up to $40 million per year in the South Delta. Not incidental, the loss in revenue from this model stems solely from a shift towards lower-value, more salt-tolerant crops and does not include any loss from lower yields.

An independent panel of experts for the Delta Science Program reviewed the ESP and praised the agricultural economics work in the ESP as, "well drafted and used appropriate techniques." Regarding the model for measuring salinity impacts, the reviews commented, "We commend the authors for using this approach," and that it was "state of the art."[42] Finally, the California Department of Water Resources (DWR) chose the ESP model of salinity impacts on Delta agriculture for their analyses of the Bay Delta Conservation Plan.[43] The DWR's adoption of the ESP model shows that DWR recognizes that the ESP model represents the best available science on salinity impacts on Delta agriculture. The *SED Report* authors failed to mention this work.

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[41] Economic Sustainability Plan for the Sacramento-San Joaquin Delta, chapter 7, Agriculture. Retrieved from http://forecast.pacific.edu/DESP/report/Chapter_7.pdf; Caswell, M.F. and D. Zilberman. 1985. The choice of irrigation technologies in California. *American Journal of Agricultural Economics* 67: 224-34; Wu, J. and B. A. Babcock. 1998. The choice of tillage, rotation, and soil testing practices: Economic and environmental implications. *American Journal of Agricultural Economics* 80: 494-511; Wu, J., R.M. Adams, C.L. Kling, and K. Tanaka. 2004. From micro-level decisions to landscape changes: An assessment of agricultural conservation policies. *American Journal of Agricultural Economics* 86: 26-41.

[42] Adams, R., J. Chermak, R. Gilbert, T. Harris, and W. Marcuson III. Independent Panel Review of the Economic Sustainability Plan for the Sacramento-San Joaquin Delta. December 2, 2011. Retrieved from http://forecast.pacific.edu/DESP/other/Review%20of%20Sustainabilty%20Plan_Final.pdf

[43] See page 3 of the scope of work posted at http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/ICF-11_Amend1_finalCombined.sflb.ashx

Critique #7: The SED Report authors ignored evidence of salt damage to crops in the south Delta

Direct observation of salt damage to crops has been reported throughout the south Delta. For example, the draft EIR for the Bay Delta Conservation Plan states,

> "*Areas of the south Delta that grow processing tomatoes, which are particularly salt-sensitive in seedling and blooming growth stages, have been documented to exhibit seedling mortality and bloom loss resulting from salt burning during irrigation that have resulted in reduced yields and crop quality during certain years.*"[44]

The Economic Sustainability Plan also reports focus groups in which Delta farmers described salt damage to crops when salinity levels in the Delta were below 1.0 dS/m, and that Delta farmers reported regularly monitoring salinity levels when planning and managing their farms. We understand that the South Delta Water Agency will provide declarations and further evidence to support crop damage that has occurred under existing conditions.

Critique #8: The SED Report authors relied on the deeply flawed report on salinity by Dr. Hoffman.

The *SED Report* authors state that increases to Delta salinity standard of 1.0 dS/m would have no impact on Delta agriculture. They conclude this based entirely on a report by Dr. Hoffman (2010).[45] Dr. Hoffman used overestimated leaching fractions to estimate the potential loss to Delta farmers from changes to salinity. However, the Hoffman report does not have the data necessary to support the leaching fractions it assumes. In fact, Hoffman states,

> "*The leaching fraction in the South Delta is difficult to estimate because measurements of soil salinity or salt concentration of drainage water are not measured routinely.*"[46]

Dr. Hoffman generally assumes leaching fractions of 0.15 or above, which as we understand, came from soils that differ in soil type and elevation from most of

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[44] Administrative Draft of the EIR for the Bay Delta Conservation Plan. Chapter 14, Agricultural Resources. http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/EIR-EIS_Chapter_14_-_Agricultural_Resources_2-29-12.sflb.ashx

[45] Hoffman, G. 2010. Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta, Final Report. Prepared for the California EPA and the State Water Resources Control Board.

[46] Hoffman 2010, page 51.

the area at issue. In contrast, an analysis by Dr. Orlob of leaching fractions in the relevant area found that 40 percent of the soils in the south Delta have leaching fractions as low as .05, and in another 34 percent are approximately .09.[47] Dr. Orlob calculated yield loss for soils with a leaching fraction of .05 and applied water salinity of 1.0 dS/m as beans, -68 percent; corn, -34 percent; alfalfa, -19 percent; tomatoes, -21 percent;, fruit and nuts, -61 percent; and grapes, -29 percent.[48]

Dr. Hoffman's conclusions resemble untested hypotheses about soil conditions in the south Delta. He states his hypotheses unencumbered by current, site-specific evidence. For example, he collects no field data on Delta agriculture to test the prediction of his hypothesis. He admits that his conclusions rest heavily on results of 30-year old studies of potted bean varieties that commercial growers no longer use. It is unbelievable that the *SED Report* author supports a degradation of water quality standards based on an untested hypothesis while ignoring compelling evidence, presented in this critique and elsewhere, that Dr. Hoffman's hypothesis should be rejected.

Dr. Hoffman identified the deficiencies of his analysis regarding the lack of field data.

> "*It is unfortunate that the published results on the salt tolerance of bean are taken from five laboratory experiments conducted more than 30 years ago. In addition, there are not data to indicate how the salt tolerance of bean changes with growth stage. With such an important decision as the water quality standard to protect all crops in the South Delta, it is unfortunate that a definitive answer can not be based on a field trial with modern bean varieties.*"[49]

Dr. Mark Grismer, one of those asked by the Board to review Dr. Hoffman's report, agreed with Dr. Hoffman on this deficiency of his analysis.

> "*I also agree with Hoffman's observations on (p. 21) the limited data available for determination of bean salt tolerance. This data is relatively old, based on greenhouse pot studies and bean varieties unlikely used today commercially. Field studies in typical Delta clay soils (dominant soil type) considering salt tolerance of commercially grown beans in the Delta are needed. …*"[50]

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[47] Orlob, G. 1987. Impact of San Joaquin River Quality on Crop Yields in the South Delta. Page 2-3.

[48] Orlob 1987, page 6.

[49] Hoffman 2010, page 98.

[50] Grismer. M. 2011. Peer Review of Technical Reports on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives. Prepared for the Bay-Delta Unit, State Water Resources Control Board. November 10. Page 4-5.

Of the five scientists asked to review Dr. Hoffman's work, only Dr. Grismer provided comments.

Dr. Hoffman's analysis focuses on the salt tolerance of crops, mostly beans. Missing from his or other analyses is the effects of increases salinity concentrations on species and habitats in the Delta. To the extent that increased salinity negatively affects natural resources and related ecosystem services that benefit society, the higher salinity concentrations will negatively affect the values of these services. One of the scientists asked by the Board to review the scientific basis for the flow and salinity alternatives noted this lack of information on the relationship between proposed increased salinity concentrations and effects on salmon. Dr. Thomas Quinn, from the School of Aquatic and Fishery Sciences at the University of Washington, Seattle commented:

> "*The report has so much effort devoted to salmon and steelhead that the absence of reference to these fishes in the section on salinity is stark. Are there no issues related to estuarine dynamics or salinity related to salmon?*"[51]

Critique #9: Rather than address current salinity problems, the SED Report authors dodge them by increasing allowable salinity concentrations

The record on salinity concentrations in the Delta clearly shows that concentrations regularly exceed current allowable amounts, and have done so for some time.[52] Indeed, the authors acknowledge as much in the *SED Report*, "*Under baseline, these salinity levels* [allowable concentrations] *are not always fully met*."[53]

The record is also clear that salinity concentrations below those proposed by the *SED Report* authors harm Delta agriculture. As we mention elsewhere in our critique, the analyses conducted for the Draft EIR for the Bay Delta Conservation

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[51] Quinn, T. No date. Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives.

[52] California Department of Water Resources. 2011. *Low Head Pump Salinity Control Study - Prepared to meet requirements of the State of California State Water Resources Control Board Water Rights Order WR 2010-0002, Condition A.7*. April.; State of California State Water Resources Control Board. 2006. *In the Matter of Draft Cease and Desist Order Nos. 262.31-16 and 262.31-17 Against the Department of Water Resources and the United States Bureau of Reclamation Under their Water Right Permits and License and In the Matter of Petitions for Reconsideration of the Approval of a Water Quality Response Plan Submitted by the Department of Water Resources and the United States Bureau of Reclamation for their Use of Joint Points of Diversion in the Sacramento-San Joaquin Delta*. Order WR 2006-0006.

[53] SED 2012, p.ES-15.

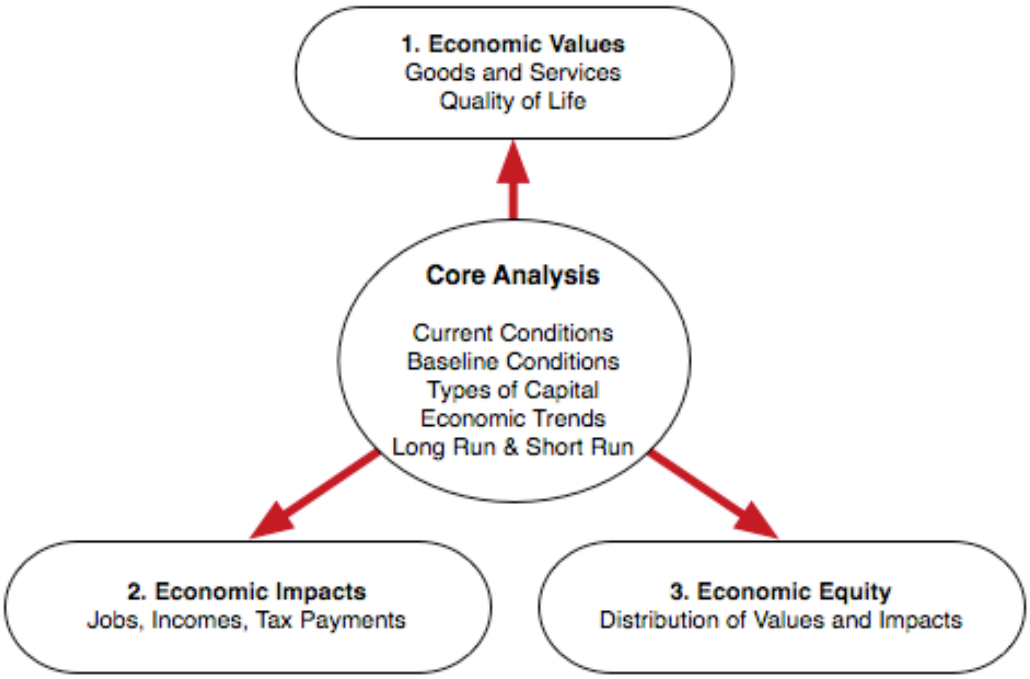
Plan, and the Delta Protection Commission's Economic Sustainability Plan (ESP) documented this harm, as does the Orlob report.[54] Peer reviewers validated this work and the California Department of Water Resources gave the ESP study its seal of approval by adopting the ESP model of salinity impacts on Delta agriculture.

Instead of solving the problem by dealing with its causes, the *SED Report* authors simply hide it by increasing the amount of salinity allowed, which strongly resembles polluters turning off the monitors. And the authors try to counter all the evidence against this dodge with a 30 year old, severely criticized study of potted beans. We don't see how this can possibly be taken seriously.

[54] Orlob 1987.

Appendix: Figure 1. Categories of Economic Effects

Figure 1. Categories of Economic Effects[55]



Source: ECONorthwest. 2013. *Bay-Delta Water: Economics of Choice*.

Figure 1 shows the three categories of economic effects each alternative would cause. The first category, Economic Values, represents *changes in the values of goods and services* available to Californians that result from the market and non-market activities associated with each alternative. Such effects include changes in economic benefits, costs or both, as well as changes in the quality of life. The second category, Economic Impacts, represents changes in jobs and incomes for workers, costs or revenues for private firms, and expenditures or tax revenues for governments. These impacts occur directly, as workers are employed on construction, deconstruction, and restoration, for example, and indirectly, as

[55] For a description and explanation of the economic consequences of a shift from abundance to scarcity in an ecological system, e.g., a watershed, see Courant, P., E. Niemi, and E. Whitelaw. 1997. *The Ecosystem-Economy Relationship: Insights from Six Forested LTER Sites*. Grant No. DEB-9416809. National Science Foundation. November.; Hulse, D., G. Gordon, and E. Niemi. 2001. *Establishing Correlations Between Upland Forest Management Practices and the Economic Consequences of Stream Turbidity in Municipal Supply Watersheds*. EPA Grant No. R825822. Environmental Protection Agency. September.

dollars are spent locally on goods and services, dollars which multiply through the local economy, supporting additional jobs and incomes. The third category, Economic Equity, represents the distribution of the other two categories of effects, Economic Values and Economic Impacts, across income brackets of households, across ethnicities, and across geographic areas. These changes are particularly challenging to describe and evaluate when, say, groups of households who enjoy the benefits, jobs, and incomes, differ from those who bear the costs.

The center of Figure 1—the Core Analysis—shows the analyses common to characterizing or calculating all three categories of economic effects.

1. By describing the Current Conditions and Baseline Conditions for each alternative, the analyst can describe the gap between the two. The larger the gap, the larger the problem.

2. By describing the four basic forms of capital (physical capital, human capital, social capital and natural capital)[56] under both Current and Baseline Conditions for each alternative, the analyst can, for example, measure the effects of the alternative on the stocks of economic assets and thereby on the flows of services from those assets.[57]

3. By taking economic trends into account, the analyst can apply a with-versus-without approach, which isolates the economic effects (values, impacts, equity) caused by the alternatives from changes that will likely occur unrelated to the alternatives.

4. By addressing both the short- and long-term effects, the analyst can avoid errors of omission and commission through confusing today and tomorrow. The literal differences in effects between today and tomorrow would be trivial. But since the relevant period of time may stretch to a century, the figurative differences would likely be huge.

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[56] These four types of capital affect local economic productivity, which in turn is the source of economic growth in, say, California. Examples of physical capital are private and public machines, buildings, roads, and water and sewage systems. Examples of natural capital are rivers and streams, mountains and valleys, and grasslands and forests. Examples of human capital are workers of all types and their knowledge and skills. Examples of social capital are social networks and the norms, laws, and judicial and political systems.

[57] O'Sullivan, A. 2008. *Urban Economics*, 7th Edition. p.90-91.