Stanislaus County
Striving to be the Best

CHIEF EXECUTIVE OFFICE

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Chief Executive Officer

Patricia Hill Thomas
Chief Operations Officer/
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March 15, 2017

Felicia Marcus, Chair
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814-0100

SUBJECT: AMENDMENT TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA ESTUARY AND SUPPORTING DRAFT REVISED SUBSTITUTE ENVIRONMENTAL DOCUMENT (SED)

Dear Ms. Marcus:

Enclosed please find comments and questions provided by Stanislaus County regarding the Revised Substitute Environmental Document (SED) prepared in support of the State Water Board's staff proposal regarding specific amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Attachment 1). Also included with our submittal package is a copy of a report prepared by Dr. Rodney T. Smith of Stratecon, Inc., titled: *"The Economic Consequences of the Proposed Flow Objective for the Lower San Joaquin River in Merced, San Joaquin and Stanislaus Counties"* (Attachment 2). Lastly, our packet includes the transcript taken from a Technical State Water Board Staff/Community Water Interests Meeting held in Modesto on November 18, 2016 (Attachment 3).

Furthermore, Stanislaus County offers the following general comments and observations:

I. <u>Imbalanced Approach</u>

A. The approach taken to impact analysis in the SED is imbalanced:

1. The effects of the unimpaired flow (UIF) proposal on fisheries have been evaluated in very specific detail, extensively described in the SED and other documents, and reviewed by several scientific panels.
2. Conversely, the effects of UIF on water supply resilience are addressed only in the SED. This analysis utilized a very generalized approach that is difficult to interpret, and has not been independently evaluated by a single scientific panel of experts.

B. Board staff have been quick to point out that the lack of detail is due to the nature of the SED being a "programmatic" document. Stanislaus County agrees that the SED does not need to be based on perfect science, but the approach is so generalized that the impacts on water supply resilience cannot be properly understood. The SED is required to support a balancing decision between two co-equal goals, but as conceived, it emphasizes the potential ecological benefits of UIF, while generalizing and de-emphasizing the potential adverse impacts on water supply resilience and the resulting impacts to our urban and rural communities, and the agricultural business sector at large.

II. <u>Analysis is Uncertain and Underestimates Impacts</u>

A. The SED did not include any analysis of the interplay between UIF and how much groundwater would be actually available under the Sustainable Groundwater Management Act (SGMA). Without understanding this fundamental limitation, the impact of UIF on agricultural and urban water supply cannot be known, and is almost certainly underestimated because less groundwater will be available in the future.

B. The SED assumes groundwater use can be increased to 2009 levels before any fallowing will occur. But as we have learned, the SED did not include any analysis whether the 2009 pumping rates are sustainable. It almost certainly will not be sustainable in all areas, and more crops will need to be fallowed than assumed.

C. The generalized analysis approach in the SED sheds no light on what areas might be hit harder than others, yet the economic impact models used (SWAP and IMPLAN) assume that impacts will be uniform and the first crops to be fallowed will be low value crops. Without knowing where the area of shortfall will be and what is being grown there, the impacts on agriculture will assuredly be underestimated.

D. Based on comments made in the recent workshops, the models assume that irrigation of permanent crops can be curtailed in some years, and then resumed in wetter years when more water becomes available and the crops will produce again. The models do not consider that permanent crops will actually be damaged or die.

E. These kinds of evaluations always have to deal with uncertainty, and normally, Stanislaus County would expect that such an important analysis would have been supported by some kind of uncertainty or sensitivity analysis. That would have helped us to at least understand what our uncertainty means to the impact and economic analyses. No such analysis was done. To provide a single estimate of the economic and agricultural impacts is misleading when there are so many moving pieces.

F. It is not clear that the economic impact analysis has considered all of the downstream impacts of land fallowing on the regional job market and economy.

In closing, agriculture is a major industry and largest water user in Stanislaus County. Therefore, the question of water supply resilience goes straight to the heart of understanding the potential agricultural impacts to our region and all of its citizens. Stanislaus County wants to be sure that the analysis in the SED is unbiased, and robust enough to support a balanced decision.

Stanislaus County believes the SED uses an approach that puts a great deal of science behind the ecosystem restoration part of the equation, but uses a generalized and uncertain approach to look at water supplies. As it stands, we do not believe the SED is very useful for informing a balanced decision. Though it has been stated that "we don't want to make this an argument about fish vs. farms," the Water Board is faced with a difficult balancing decision of the two co-equal goals of ecosystem restoration and water supply resilience.

Sincerely,

Keith D. Boggs, Assistant Executive Officer
Stanislaus County Chief Executive Office

ww:ss

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By FedEx

c: Stanislaus County Board of Supervisors (letter and Attachment 1 only):
  Vito Chiesa, Chairman
  Kristin Olsen – District 1
  Terry Withrow – District 3
  Dick Monteith – District 4
  Jim DeMartini – District 5
 Stan Risen, Stanislaus County Chief Executive Officer (letter and Attachment 1 only):
 Adam C. Gray, Assemblymember, 21st Assembly District (by e-mail letter and attachments)
 State Water Resources Control Board Members (letter and Attachment 1 only):
  Frances Spivy-Weber, Vice Chair
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Stanislaus County Written Comments & Questions

Amendment to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary and Supporting Draft Revised Substitute Environmental Document (SED)

March 15, 2017
Federal Express

Attachment 1

Stanislaus County Comments & Questions regarding the Revised Substitute Environmental Document (SED)

STANISLAUS COUNTY COMMENTS & QUESTIONS REGARDING THE SED
March 15, 2017

Comment Topic	Comments
1. The SED analysis does not support objective balancing between the coequal goals of ecosystem restoration and water supply reliability as required by the California Water Code	The water code requires that the process of amending the Bay-Delta Water Quality Control Plan be based on a balancing of the co-equal goals of water supply resilience and ecosystem restoration. Unfortunately the environmental analysis in the Substitute Environmental Document (SED) is imbalanced and as such cannot support a balanced decision-making process. As conceived, the SED emphasizes the potential ecological benefits of unimpaired flow (UIF), while generalizing and de-emphasizing the potential adverse impacts of UIF on water supply resilience. Board staff have been quick to point out that the SED is a programmatic document and the analysis of UIF impacts in the SED is not intended or required to go into very specific details. Stanislaus County agrees that the SED does not need to be based on perfect science or a complete analysis, but the approach taken is so generalized and imbalanced, that it creates an inherent policy bias and is not able to support an objective balancing decision between two co-equal goals. The SED evaluates the potential impacts of implementing unimpaired flow in the region on a programmatic level, and builds on a long and detailed study of the potential fisheries benefits of unimpaired flow in the region's rivers. Whereas the foundational premise of the concept that increased flows will directly result in increased fisheries management is of significant question, and will be addressed by other respondents to the SED, Stanislaus County does not offer any such arguments in our submittal. Unfortunately, the approach taken to groundwater impact evaluation in the SED leaves a fundamental imbalance in how in-stream benefits area evaluated compared to regional adverse impacts. For example Stanislaus County notes the following: • Work on evaluating in-stream ecosystem benefits was advised by several scientific panels; evaluation of the adverse effects on water supply resilience has not been advised even by a single panel. • In stream processes were evaluated using several models; but the approach to groundwater resources evaluation was very generalized and abstract, was based on an incomplete groundwater budget, and did not include any modeling. • The ecosystem effects analysis attempts to quantitatively evaluate the benefits of UIF on fish and habitat using very specific metrics that supposedly relate to specific benefits and balancing objectives. Unfortunately, the SED does not present any information, data or studies that specifically relate floodplain access or temperature benefits on the Tuolumne River, for example, to juvenile fish growth, survival or future adult escapement. • By contrast, the groundwater impact analysis uses a regionalized theoretical threshold of 1-inch of drawdown to predict whether significant and adverse impacts to water supplies will occur. The metric is abstract and arbitrary. There is no explanation how it was derived – why not ½ inch or 2 inches? It is impossible to tell even the approximate location and amount of drawdown, subsidence, water quality effects and supply shortfalls that will be experienced. The concepts presented are abstract and generalized, difficult to understand or even arbitrary, and are not related to specific adverse impacts or

Comment Topic	Comments
	balancing objectives. The inherent imbalance in this approach is self evident. • Finally, the ecosystem analysis spans a range of potential conditions, as is appropriate for an analysis of this complexity and importance; whereas, the water supply impact analysis is built on a single groundwater use scenario. It was explained that this scenario was selected as the "most likely outcome," but no effort was made to evaluate whether it is actually sustainable. Furthermore, no perspective was provided on how likely it is that groundwater use might be different from the assumed scenario, and what the reasonable range of potential outcomes could be. What will happen if the assumed groundwater extraction rate cannot be supported for more than a few years, or, as is likely, cannot be supported in certain areas? Board staff argues that the water balance information to perform such an analysis is not available and that future groundwater management and demand decisions cannot be predicted; however, hydrogeologists are performing this very analysis all over the San Joaquin Valley at this time following standard hydrogeologic practice. The State also routinely incorporates more robust predictions of future groundwater demand into its water planning studies. Assessment of the future groundwater extraction rate is a basic and critical component of impact analysis. Without sensitivity or uncertainty analysis to better understand the foundational assumptions of the analysis, the reliability of the impact and economic analyses cannot be understood and stands in doubt. It is impossible to use such an analysis to support sound policy making. To sum up, the SED is required to support a balancing decision between two co-equal goals, but as conceived, it emphasizes and is very clear regarding the potential ecological benefits of UIF, while generalizing, de-emphasizing, and leaving uncertain the potential adverse impacts of UIF on water supply resilience. The impact analysis does not need to be perfect, but it needs to include a much more robust basis for balancing of objectives to occur.
2. The scientific basis for the impact analysis in the SED is inaccessible and unclear, has the appearance of being biased, and is unlikely to gain the broad public acceptance that is critical for a decision of this importance.	It is essential that a public policy decision as important, complex and controversial as the amendment process of the Bay-Delta Water Quality Control Plan be informed by science that is understandable and unbiased. Stanislaus County notes that we are not talking about perfect science, but science that is perceived as being unbiased, accessible and intelligible. There will always be those that are not persuaded, or that twist science to their own ends, but broad public acceptance of the basis of the Board's decisions is critical both to the Board and to the regulated communities. Unfortunately, the approach taken to impact analysis in the SED fails to fulfill these requirements. Conversely, the analysis of water supply reliability impacts is based on a generalized and abstract approach, is not possible to relate to actual impacts, and is superficial. The predictable public reaction to such an analysis is that the science used in the analysis is normative, that is, it favors one policy alternative over another. This perception throws the validity of the SED's intent and conclusions into doubt for a broad cross section of the people that have reviewed the document. Chair Marcus has spoken extensively on the appropriate use of science to support controversial policy decisions, and the fact that normative science tends to generate "more heat than light" in such cases.

Comment Topic	Comments
	Stanislaus County agrees with this view and finds it very troubling in that the SED is based on such an imbalanced approach that will only fuel the public mistrust of the already difficult decisions the Board is tasked with making. Public acceptance of the Board's decision, to the extent it is reasonably possible, is crucial to a successful long term policy. Stanislaus County urges the Board perform a balanced and complete analysis prior to making this important decision.
3. SGMA is a cornerstone of the State water policy, and yet the SED fails to analyze the potential effect of UIF implementation on SGMA compliance	It is essential that the effects of UIF implementation on meeting state and regional water management requirements be adequately understood. The SED is deficient in this regard in that it does not include any evaluation of the potential effect of UIF implementation on SGMA compliance, and provides no useful information for local jurisdictions to help them understand how to implement a difficult water management task that the UIF proposal will make much more difficult. The failure to provide any information or guidance in this regard is an abdication in water management leadership. Stanislaus County notes that SGMA is a new cornerstone of the California water policy and the Governor's Water Action Plan. The three-county area affected by the UIF proposal has a long history of conjunctively managing surface and groundwater. In much of the area, this has been effective, but Stanislaus County also faces some significant challenges, especially in areas where surface water is not available or reliable. Most of our cities and unincorporated communities are heavily dependent on groundwater. Water quality issues and limited surface water availability are making it a challenge for these communities to meet their forecast water demands, especially since forecast growth in this area is greater than state averages. Many domestic wells have dried up during the drought. The region is hard at work in forming Groundwater Sustainability Agencies (GSAs) and planning for SGMA compliance. As you know, this is a very challenging process, but through a lot of hard work and collaboration, we are making progress. The proposed UIF requirements will radically change the local groundwater balance and put all of these efforts into uncertainty at what is probably the most critical time ever in groundwater management planning in this region. The SED completely fails to analyze the impacts of UIF on this critical aspect of local water supply management and state policy implementation. It includes a very generalized analysis of groundwater impacts and concludes there will be significant and unavoidable adverse impacts, but it does not provide any information where those impacts will occur or how severe they will be. The SED implies, and Board staff have stated, that the burden of analyzing and addressing groundwater impacts falls to the local communities under SGMA. They state that there are areas that are already in overdraft, and this issue already has to be addressed on a local level. They argue that since the local responses cannot be predicted, that evaluation of UIF impacts on SGMA implementation would be speculative. However, there are existing tools developed by the State, like the C2VSim model, that could have been used to analyze these impacts in a useful way. The areas that currently are currently experiencing overdraft have been working hard on achieving sustainability. A key component for these areas is to find additional surface water sources to decrease

Comment Topic	Comments
	groundwater dependence or to use for recharge groundwater. Now these very plans are thrown into in a state of uncertainty because more surface water will be used to support UIF, but the effects are completely unknown. The GSAs that are trying to form in these areas are being told their job will be much more difficult, maybe impossible, and the position that Board staff has taken is that the SED is not required to analyze this direct impact on local groundwater supply resilience. Stanislaus County does not understand how the SED can possibly support a balancing decision between co-equal goals when it completely fails to analyze the impact of UIF implementation on this critical aspect of groundwater management. This approach is also inconsistent with the importance of SGMA as a cornerstone of regional and statewide water resources planning. While it is true that all local responses to the challenges of SGMA and UIF cannot be known, the SED stops short of including any analysis of the impacts or range of impacts that can be expected. The science that has been used provides no insight into the resulting impacts. Furthermore, the SED provides no information regarding potential options for mitigating what it has identified as significant and unavoidable impacts on groundwater supply reliability. This approach unfairly places the burden of all meaningful impact assessment and mitigation development on the local area and, frankly, greatly increases the chances that GSA formation and GSP implementation will not be successful. It is inconsistent and unfair that the state would require implementation of SGMA, threaten local basins with a state takeover if they do not comply, then completely change the playing field for what is needed to comply and take position that they have no responsibility to evaluate this impact.
4. The SED impact analysis is deficient in that it fails to use readily available tools and information in its groundwater resources impact analysis, including tools developed by other state and federal agencies for such studies.	Board Staff have indicated that any additional detail in the groundwater impact analysis would be speculative, and at a workshop in Modesto even said that more specific analysis is impossible because local responses cannot be predicted. How can it be then that this very analysis is currently being undertaken by hydrogeologists all over the San Joaquin Valley in order to prepare for development of Groundwater Sustainability Plans (GSPs) that comply with state regulations? Proven scientific tools and approaches are available, and sufficient data exist to evaluate groundwater resource-related impacts in specific and meaningful ways so that the nature of the impacts and their implications for groundwater management can be understood. Many of the available tools were developed by other state and federal agencies, suggesting that the failure to use them is the result of a siloed approach to the SED project by Board staff. An analysis would not need to be perfect, or as thorough as the studies that are currently being undertaken, to develop a more adequate understanding the groundwater impacts and allow objective balancing of the co-equal goals of water supply resilience and ecosystem restoration. The claim by staff that such analysis would be speculative or impossible is inconsistent with the standard of current hydrogeologic practice, and the SED is therefore substandard in its application of science. Specifically, Stanislaus County notes the following: • C2VSim was developed by DWR expressly to support these kinds of evaluations and decisions, but it was not used. Even the 2009 version of this model includes subregional water budgets that could have

Comment Topic	Comments
	been updated to assess groundwater impacts more locally. Many improvements to C2VSim have been made in recent years and further improvements are in progress. No justification is provided why this useful tool was not used. • CVHM is a similar model developed by the USGS that could have been consulted or used. Updates for CVHM are also in progress. There is no indication that USGS was consulted regarding the potential applicability of this model to the SED analysis. • There are a number of other regional models that were constructed to evaluate these kinds of issues and that could have been used or consulted in evaluating groundwater resource-related impacts, including the USGS MERSTAN model, which includes a large portion of the area that would be affected by implementation of the proposed UIF requirements. The USGS and local governments made a substantial investment in developing this model to make it available for these kinds of studies. Again, there is no indication that USGS was consulted regarding the potential applicability of this state-of-the-art model to the SED analysis. . • The modeling effort that Board Staff have indicated would be speculative or impossible is currently being undertaken in each of the Counties affected by the UIF proposal. Available data and modeling tools are being used (or have been used) to build robust modeling tools that are adequate for impact evaluation. Building such models is considered part of the routine standard of care for practicing hydrogeologists, and are a necessary foundation to sound water management decisions. None of the Counties were consulted regarding these ongoing efforts, which are being funded by State grants. • The SED fails to utilize data tools which reflect information on small water systems. Specifically, the Water Board analysis does not appear to have referenced information collected, hosted and mandated by their very agency. The Human Right to Water (HR2W) web page, SDWIS federal database, and the Drinking Water Watch web page should have been utilized to determine real and possible effects of the SED on small water systems.
5. The groundwater impact analysis in the SED fails to follow standard hydrogeologic practice and does not meet the standard of care for a CEQA impact analysis	The SED fails to utilize basic components of sound hydrogeologic impact assessment and does not meet the standard of care for CEQA analysis. As stated above, the hydrogeologic impact analysis in the SED relies on an incomplete water budget, uses an abstract and arbitrary threshold of significance, does not use standard minimum analysis tools, and relies on a single scenario with questionable validity. The basic component of any groundwater resources impact analysis is a water budget. The SED acknowledges the importance of an adequate water budget for impact analysis, and yet the water budget information provided in the SED consists of quoted information from a variety of sources that apply to a various different areas within the study area. No attempt was made to actually develop a water balance for the study area, or to even verify or validate the information that was quoted. As such the water budget information quoted in the SED provides an inadequate understanding for impact analysis. Furthermore, the water analysis itself is not based on a water budget at all, but on a single estimate of regional groundwater demand, and the estimated increases in demand that may occur if UIF is implemented. These numbers were not evaluated in terms of their

Comment Topic	Comments
	impact to the local water budget, so impacts could not be adequately predicted, and the SED instead relied on an abstract and arbitrary threshold of 1 inch of regional drawdown to evaluate whether significant impacts were likely. The lack of an adequate water budget to support the impact analysis in the SED represents a fundamental departure from the use of hydrogeologic science in impact analysis, which is difficult to justify when the data needed to develop a water budget are available and being gathered by local hydrogeologists to prepare local jurisdictions for SGMA compliance. In addition, the DWR has been gathering data from remote sensing studies to update the water budget data in C2VSim. A hydrogeological analysis of this scope and importance is almost universally recognized as requiring construction of a calibrated numerical groundwater flow model. This has been the case for a long list of water project and policy decisions by local, state and federal agencies. A review of the CEQA and NEPA literature will show that this is usually the case for similar projects. This is largely because use of a numerical flow model is key to developing an adequate understanding of the complex inter-relationship of the various water budget components, and the resulting impacts when new stresses are added. Without the additional rigor imposed on this analysis by use of such a model, it is extremely difficult, if not impossible, to evaluate such complex questions in a meaningful way. Only a single groundwater use scenario was considered in the impact and economic analysis, with the assumption that it was the most likely outcome. However, no effort was made to evaluate whether this rate is actually sustainable. (It was not possible to make such an evaluation without an adequate water budget.) Typically, such an important assumption is supported by a sensitivity or uncertainty analysis so that the uncertainties and limitations can be understood. As it is, the SED provides no perspective on what will happen if this rate cannot be supported for more than a few years, or, as is likely, cannot be supported in certain areas. Coupling a deterministic, single outcome impact analysis of an important issue with such a generalized approach is an inadequate basis for decision making. No information is provided regarding the derivation of the “1 inch” threshold of significance adopted in the SED for groundwater resources assessment. This value appears to have no precedent and does not appear to be based on any study. Why was a value of 1 inch selected? Board staff were asked these questions in a workshop and in writing, but have provided no response. In fact, this threshold appears to be an arbitrary construct that was developed because, without an adequate groundwater budget, any such impact analysis would be impossible. The threshold itself is an arbitrary and capricious method for establishing drawdown impact significance. Using this threshold, it is not possible to determine the amount and location of the actual drawdown, water quality, groundwater storage, subsidence or other groundwater related impacts. In addition, it is possible for these impacts to occur locally as a result of the proposed UIF implementation even when the 1 inch threshold is not reached.

Comment Topic	Comments
6. The SED fails to adequately address all reasonably foreseeable impacts cumulative effects and indirect effects of UIF implementation	The SED does not evaluate the potential for significant adverse impacts related to groundwater resources sufficiently to answer questions contained in the CEQA Initial Study Questionnaire adopted by the SWRCB. Given that the SED would be expected to contain a more in depth analysis than an Initial Study, this is a significant deficiency. The questions which are not addressed include those related to subsidence, water quality effects (point and non-point, natural and anthropogenic), drawdown, water supplies and non-aquatic biological resources (e.g., Groundwater Dependent Ecosystems (GDEs)). The approach taken to impact analysis does not account for the fact that these adverse effects can only be evaluated when the water budget is known, and when the analysis can account for sub-regional or local conditions and effects. As discussed previously, this could have been readily achieved by developing a groundwater budget and analyzing impacts using a groundwater flow model. As it stands, the generalized treatment of adverse effects in the impact analysis is not sufficient to understand what impacts will actually occur. For example: • Areas at greater risk of subsidence have been identified by USGS, the BOR, DWR, and others. Evaluation of potential subsidence impacts is a standard component of CEQA-compliant groundwater resource impact analysis. Vulnerable areas, or areas with active subsidence, could have been compared with drawdown estimates to identify subsidence risk on a subregional level; however, this was never attempted. As such, the risk to public infrastructure and safety related to subsidence has not been evaluated. • Public water systems vulnerable to water quality impacts are known to exist in the study area, and evaluation of impacts to municipal and small public water systems is a standard component of any CEQA compliant impact analysis. Potential adverse impacts to these areas could have been readily identified with available tools; however, this was never attempted. No attempt was made to identify which public water supply systems have experienced water quality issues that could be exacerbated by the UIF proposal, and no assessment of the potential risks to public services or safety was completed. The ability of public water systems to respond to water quality and supply issues was not evaluated. In fact, as discussed in greater detail in our comments further below, Board staff had made no attempt to obtain any information regarding the numerous small public water systems in the area that could be adversely affected, even though these records are readily available from the Board's Drinking Water Division. These systems are the most vulnerable to potential water quality degradation, and have the least resources to respond. • Areas with domestic wells vulnerable to wells going dry or water quality impacts are known to exist in the study area, and evaluation of these impacts is a standard component of any CEQA compliant impact analysis. Potential adverse impacts to these areas could have been readily identified with available tools; however, this was never attempted. • Potential adverse effects to groundwater-dependent ecosystems from the proposed UIF implementation were not evaluated. The potential for impacts to GDEs located away from streams was not evaluated (e.g., seeps, springs, wetlands and groundwater dependent oak woodlands). As such, biological

Comment Topic	Comments
	impacts were not adequately evaluated. • The potential for domestic and other production wells to be adversely impacted evaluated was not evaluated (e.g., wells going dry, pump lowering, increased maintenance, increased pumping cost, diminished supply for approved uses, worsening water quality, deeper wells/well deepening resulting in other adverse impacts). • The potential for more acute impacts during dry and multiple dry years was not adequately evaluated. • Groundwater impacts typically develop over many years and take many years to correct. The SED failed to identify a planning horizon for impact analysis that considers this fact. The SED also failed to adequately consider cumulative impacts. The SED did not evaluate the potential cumulative effects of UIF implementation and SGMA compliance. As discussed previously, UIF implementation could make some aspects of SGMA compliance very difficult, if not impossible, without devastating effects. The failure to consider this reasonably foreseeable cumulative effect is a significant deficiency in the SED. Other cumulative effects were only superficially evaluated. Several of the groundwater subbasins that would be adversely affected by UIF implementation are designated as being in a state of critical overdraft and have experienced active subsidence, water quality degradation and supply depletion. Other areas have seen significant drops in groundwater levels, and significant numbers of domestic wells have dried up. Although the SED acknowledges that some of the effects exist, it does not include an evaluation of the cumulative effects of UIF implementation on these existing adverse conditions. Finally, the SED failed to adequately evaluate the indirect effects of UIF implementation. As a result of the substantial reduction of surface water supply on the rivers in the region, it is expected that there would be a substantial depletion of groundwater supplies in the Modesto, Turlock, and Merced Subbasins. These reductions would potentially require service providers to construct new and expanded water supply or wastewater treatment facilities, the construction of which could result in significant environmental effects. These indirect effects were not considered in the SED.
7. The SED analysis fails to meet the requirement to consider the Human Right to Water contained in the Water Code, as it did not identify potentially disproportionate impacts to Disadvantaged Communities and small water systems	In 2013, the Human Right to Water was elucidated in the California Water Code, establishing that every human being has the right to safe, clean, affordable and accessible water. This right is required to be considered by the State Board when revising, adopting or establishing policies. The populations in the three-county area that are most vulnerable to potential adverse groundwater resources impacts resulting from the SED are disadvantaged communities (DACs). Most of these communities are entirely reliant on groundwater for their water supplies, and many have been struggling with addressing ongoing water quality issues with already strained resources. Many schools and other small water systems in disadvantaged rural areas in the region also rely on groundwater. Such communities and small water systems are the reason that the state recently incorporated the Human Right to Water in the Water Code. And yet, the analysis in the SED fails to recognize or address this issue. The generalized impact analysis in the SED is insufficient to determine which DACs and small water systems may be adversely affected, though such an analysis could have been readily completed.

Comment Topic	Comments
	Moreover, the SED does not recognize even in general terms that DACs will be disproportionally affected by water quality and supply issues resulting from UIF implementation, and offers no mitigation or guidance on actions to address these impacts. In fact, it became clear during a recent workshop in Modesto that Board staff never even reviewed its own files regarding the many small public and non-public water systems in the region that could be at risk. Such a review is foundational to meeting the Boards mandate to consider the Human Right to Water in its decision. For example: The cities of Ceres and Turlock, like most cities and communities in Stanislaus County, are entirely dependent upon groundwater for their drinking water supplies. Both Cities are experiencing significant water quality concerns which have undermined the reliability of their drinking water supplies. Drinking water contamination includes but is not limited to: nitrates, arsenic, uranium, PCP and PCE. Both agencies operate Public Water Systems that are listed as having current exceedance / compliance issues on the State Water Board's "Human Right to Water" website. Neither City currently has access to any surface water supply; however, together the agencies have formed the Stanislaus Regional Water Authority (SRWA) which has a Water Sales Agreement with Turlock Irrigation District (TID) to obtain up to 30,000 acre feet per year of Tuolumne River surface water. The SRWA's water treatment plant is in the planning stages. At present, the planned delivery schedule is that Ceres will receive 5,000 acre feet per year and over time 10,000 AFY. The City of Turlock estimates an immediate need of 10,000 AFY, increasing to 20,000 AFY over time. Not only will the SRWA's project provide an alternative source of high quality drinking water, it will also assist in our region's efforts to comply with the Sustainable Groundwater Management Act of 2014 (SGMA) by allowing for the in lieu recharge of the aquifer. The Cities of Ceres and Turlock have worked hard over the years to reduce water demand while simultaneously looking to expand the diversity of their water supply portfolio. Preliminary estimates indicate that the SRWA water treatment project will cost $200 million. For those two communities this is the single largest infrastructure investment since the communities were incorporated. The SED has undermined the viability of the project. Preliminary estimates from TID indicate that they will lack an adequate supply of Tuolumne to make the SRWA's drinking water project viable. Ceres and Turlock lack the resources to invest millions of dollars with no assurance that a surface water supply will be available. Therefore, the SED further exacerbates the Cities' drinking water supply and water quality problems.
8. The SED failed to appropriately analyze impacts to public water supply systems	The SED failed to appropriately analyze the potential impacts of UIF implementation to public water supply systems on a number of points. First, a fundamental premise that is missing from the analysis is the recognition that drinking water is a protected use for both surface and groundwater. California recognizes water for domestic purposes as the most important use of water and irrigation as the next most important use (Cal. Code Regs., tit. 23, § 106). Yet the SED concludes that groundwater "…service providers and private users relying heavily or primarily on groundwater sources for municipal and domestic use could experience significant reductions in water supply over the long term" (p. 13-64). The SED fails to identify that this impact would violate the water code and to identify adequate mitigation. Cities' General Plans and similar documents were not considered in the SED. A CEQA document would be expected to include a review of key applicable planning documents and to discuss whether the proposed action

Comment Topic	Comments
	is consistent with their requirements. This is especially important since the San Joaquin Valley is projected to experience significant population increases over the next 20+ years As a result of the substantial reduction of surface water supply on the rivers, it is expected that there would be a substantial depletion of groundwater supplies in the Modesto, Turlock, and extended Merced Subbasins. These reductions would potentially require service providers to construct new and expanded water supply or wastewater treatment facilities, the construction of which could result in significant environmental effects. These effects were not considered in the SED. In addition, no consideration was given to whether such projects are even feasible. Page 13-61 of the SED states: "The LSJR Alternative 2 program of implementation states that the State Water Board will take actions as necessary to ensure implementation of flow objectives does not impact supplies of water for minimum health and safety needs, particularly during drought periods. <u>Actions may include assistance with funding and development of water conservation efforts and regional water supply reliability projects and regulating public drinking water systems and water rights. These actions would be aimed at those service providers supplying water to municipal users and may offset water supply reduction impacts on providers</u>. However, it is expected service providers may need to construct or expand new water treatment facilities or water supply infrastructure to try to accommodate reductions in surface water supplies." This statement indicates that the burden for mitigating the impacts of UIF implementation will fall on the local agencies and the state will not provide mitigation for the actual impacts. The potential impacts of the flow proposals in the SED on our region's municipal water supplies are staggering. The document notes that groundwater supplies and groundwater impacts will be severely impacted (Chapters 13 and 16). Page 13-67: "The average annual groundwater balance is expected to be substantially reduced in the Modesto, Turlock, and Extended Merced Subbasins…which would eventually produce a measureable decrease in groundwater elevations. These substantial reductions in groundwater supplies would, in turn, impact service providers and private groundwater users. These entities would likely experience significant reductions in their groundwater supply, particularly over the long term and in dry years. Service providers at particular risk include those that have a higher potential for a well to run dry in the future. For example, Hickman, Hilmar CWD, Hughson, and Keys CSD in the Turlock Subbasin; Le Grand CSD and the City of Merced in the Extended Merced Subbasin; and the City of Modesto in the Modesto Subbasin (Table 13-3b). This is because these service providers have relatively few active wells relative to the size of the population served and/or the range of difference between well depths and depths to groundwater is less than 100 feet" Unfortunately the State Water Board is deliberately and consciously undermining the drinking water supply and security in our entire region.

Comment Topic	Comments
	The document acknowledges that the proposed regulatory action will have a significant impact on municipal groundwater supplies, and yet places the burden for developing alternate water supply sources on the local agencies. For instance, page 13-67: "The average annual groundwater balance is expected to be substantially reduced in the Modesto, Turlock, and Extended Merced Subbasins under LSJR Alternative 3, which would eventually produce a measureable decrease in groundwater elevations (Chapter 9, Groundwater Resources). The SWRCB lists a suite of alternative water supplies that local agencies could develop to mitigate the impacts of the SED but does not consider where the water will come from or whether it is actually available. Chapter 16 details a number of alternative water supplies that <u>local</u> agencies could develop to offset the impacts of the SWRB's regulatory program. The actions include the following capital intensive projects, the costs and feasibility of which were not considered: • Transfer/Sale of Surface Water • Substitution of Surface Water with Groundwater • Aquifer Storage and Recovery • Recycled Water Sources for Water Supply • In-Delta Diversions • Water Supply Desalinization • New Surface Water Supplies Additional surface storage projects on the Tuolumne, Merced and Stanislaus should be considered to provide additional municipal and agricultural supplies. There should be an analysis of developing additional storage in existing reservoirs on the Merced, Tuolumne and Stanislaus Rivers. This is not found in the document, not even in the "New Surface Water Supplies" section which is limited to a discussion of new locations for dams and reservoirs. The document should investigate enhancing storage by increasing the heights of New Exchequer Dam, New Don Pedro Dam, and New Melones Dam. Increasing storage may be an appropriate means of meeting fishery flows and retaining enough water to offset impact to irrigation and municipal users. The document defers groundwater impacts and mitigation to GSAs under SGMA. In effect, similar to the above, the state is indicating that mitigation will be provided by the local communities. The document notes that the unimpaired flow proposal will have an adverse impact on groundwater sustainability and result in the degradation of groundwater quality but defers mitigation to others, stating that "…local agencies can and should nevertheless exercise their authorities under SGMA to prevent and/or mitigate any degradation of groundwater quality from the migration of contaminants." (p. 13-80).

Comment Topic	Comments
9. The SED did not adequately consider the impacts to small water systems and local schools that are reliant on groundwater	There are a significant number of small water providers, including schools and disadvantaged communities that will be adversely impacted by implementation of UIF. Small districts and many rural School District systems that rely on groundwater for drinking and irrigation from wells will likely experience the need for well deepening, additional wells (deeper levels) and/or water treatment. Many of these small systems have shallow wells that are particularly vulnerable to groundwater quality and supply impacts. Surface water has been unavailable or prohibitively expensive for these districts, and funding for water treatment, well replacement or well deepening has been problematic. The expenses associated with these impacts have not been planned for or budgeted, and these districts do not have the rate structure, size and funding available to implement such changes. Small water providers have developed operational, capital programs and rate structures based on the regulatory environment established by the State. Efforts to adjust to the impact of UIF would have comparatively huge time and money impacts for these districts. Small agencies do not have the staffing and expertise to handle such a significant change. The disproportionate impacts to these small districts would wipe out decades of capital, operations and financial planning. Without significant financial support and technical assistance many of these small agencies would be doomed to bankruptcy or extinction. This is not evaluated or recognized in the SED. No potential avenue for these districts to address these issues is proposed or discussed in the SED. Some are questioning if the treatment of these districts in the SED is part of a tactical endeavor to force small district to consolidate and in effect loose independent and local control. The SED fails to reflect the Water Boards own policies and procedures (SB88, SB1263 and Technical Managerial Financial Reports) that acknowledge small water systems struggle with sustainability by not including an acceptable analysis of real and possible effects on small water systems.
10. Agricultural impacts	Although it has been stated that implementation of UIF should not be an argument about fish vs. farms, the Board is faced with a difficult balancing decision of the two co-equal goals of ecosystem restoration and water supply resilience. Agriculture is the biggest industry and biggest water user in the region that will be most affected by UIF, so the question of water supply resilience goes straight to looking at agricultural impacts, which must be addressed in a way that is unbiased, and that is robust enough to support the balancing decision. As stated previously, the SED uses an approach that puts an extensive evaluation behind the ecosystem restoration part of the equation, but uses a generalized and uncertain approach to look at water supplies, and therefore at the impacts on agriculture. As it stands, the SED is not useful for informing a balanced decision. Stanislaus County agrees that the SED does not need to be based on perfect science, but the approach to evaluating the impacts on water supply resilience is so generalized that, unlike the SED evaluation of benefits and impacts to fisheries, the adverse impacts to water supply resilience and therefore to agriculture cannot be properly understood. This undermines the balancing of the two co-equal goals. The SED did not include any analysis of how SGMA may limit the availability of groundwater if UIF is

Comment Topic	Comments
	implemented. Without understanding this fundamental limitation, the impact of UIF on agriculture cannot be known, and is almost certainly underestimated because the general consensus is that less groundwater is likely to be available in the future. The SED assumes groundwater use can be increased to 2009 levels before any fallowing will occur. As stated previously, this single demand number is used with the assumption that it represents the most likely outcome, but the likelihood of being able to sustain 2009 extraction levels is not known. The SED did not include any evaluation that 2009 extraction levels would be sustainable. Indeed, such evaluations are impossible without first understanding the groundwater budget, which the Board staff did not attempt to do. The assumed extraction levels almost certainly will not be sustainable in all areas, and more crops will need to be fallowed than assumed These kinds of evaluations always have to deal with uncertainty, and normally, Stanislaus County would expect that such an important analysis would have been supported by considering additional possible outcomes, such as less, or no groundwater being available to replace surface water used to support UIF requirements. An uncertainty or sensitivity analysis of the reasonable range of possible outcomes is also usually completed. As it is, the SED provides no insight into the certainty that the 2009 groundwater pumping rate can be implemented or sustained, and therefore no perspective on the reliability of the impact and economic analyses. In addition, averages are provided throughout the document to show the impacts. As we all know an average can represent vastly different ranges of values, and for impact evaluation more specific understanding of the range of inputs and outputs is needed. To provide a single estimate of the economic and agricultural impacts is misleading when so much is uncertain in the SED. The following additional deficiencies in the SED place additional uncertainty on estimated environmental and economic impacts: • The generalized analysis approach in the SED sheds no light on what areas, or what crops, might be hit harder than others. The analysis was based on water use information in the Modesto ID, TID, Merced ID, OID or SSJID and the results extrapolated across the region using the SWAP and IMPLAN models. In addition, some areas that receive surface water will almost certainly have less groundwater available than assumed. Nevertheless, the SWAP and IMPLAN models assume that impacts will be uniform and the first crops to be fallowed will be low value crops. Without first knowing where the area of shortfall will be and what is being grown there, the impacts on agriculture cannot be known, and almost certainly be underestimated. • The SED uses 2010 data in regard to groundwater. These values have changed significantly, and in some cases resulting in negative and irreversible changes in groundwater use and availability as a result of the extended drought. These changes would influence the conclusions and the degree of impact as determined in the SED, but were not considered. For example, pumping capacities have dropped around 40% for the Merced ID wells.

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	• Based on comments in the recent Modesto workshop, the SWAP and IMPLAN models assume that irrigation of permanent crops can be curtailed in some years, and then resumed in wetter years when more water becomes available, with an immediate resumption in productivity. The models do not consider that permanent crops will actually be damaged or die, resulting in decreased production and considerable cost to the affected farmers. • Water quality changes issues, and their potential impacts were not adequately considered in the SED. The variability of groundwater quality throughout the region, and its potential effect on crop productivity, does not appear to have been considered. The loss of surface water is also likely to lead to additional water quality challenges with respect to nitrate, total dissolved solids (TDS) and other constituents, which are of concern under the Irrigated Lands Program as well was as for local municipal water providers. In addition, water quality degradation and the use of poor quality groundwater leads to inevitable reductions in crop productivity. None of these factors were considered, and all of them result in underestimation of the impacts and costs of UIF implementation. • The cost of shifting to a more groundwater based agricultural water supply was not considered in the SED. Increased reliance on groundwater will mean installation of new wells, and increased pumping costs, well deepening and well rehabilitation as groundwater levels fall. This will be the case even if groundwater is withdrawn sustainably as required under SGMA. • It is not clear that the economic impact analysis has considered all of the downstream impacts of land fallowing on the regional job market and economy. This is further addressed in the comments prepared on the economic analysis by Stratecon, Inc. • No analysis was performed to evaluate whether the water that may be needed to convert lands to agricultural uses with a lower water demand will actually be available.

Attachment 2

"The Economic Consequences of the Proposed Flow Objective for the Lower San Joaquin River in Merced, San Joaquin and Stanislaus Counties"

Report prepared by
Rodney T. Smith, Ph.D.
Stratecon, Inc.
January 6, 2017

The Economic Consequences of the Proposed Flow Objective for the Lower San Joaquin River in Merced, San Joaquin and Stanislaus Counties

By

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Prepared for the Counties of Merced, San Joaquin and Stanislaus

January 6, 2017

EXECUTIVE SUMMARY

The Substitute Environmental Document ("SED"), recently issued by the California State Water Resources Control Board ("SWRCB"), proposes substantial increases in the unimpaired flows of the Merced, Stanislaus and Tuolumne Rivers that will fundamentally alter the water supply portfolios of Merced, San Joaquin and Stanislaus counties (collectively the "Study Area"). The SWRCB's assessment, however, of the potential economic impacts of the SED is narrow in scope and completely fails to account for the water supply reliability, sustainability and volatility challenges that will confront the counties.

Stratecon estimates that the proposed flow objectives would reduce the counties' reliable surface water supplies on average by 60% or about 600,000 acre-feet per year, from 1.0 million acre-feet to just short of 400,000 acre-feet. Stratecon estimates that this loss of reliable water supply is partially offset by an increase in the expected annual yield of unreliable surface water supplies from 290,000 acre-feet per year to 656,000 acre-feet per year. The partial offset is no bargain. The SED would reduce the economic value of surface water rights by 50% and drastically reduce the reliability of the region's water supplies, which will have far reaching adverse impacts on the region's long-term economic stability and growth.

The SWRCB severely understates the potential regional economic impacts of the proposed SED flow objectives. It presumes that the surface water supply reductions would be largely offset by unsustainable increases in regional groundwater pumping. Before implementation of the Sustainable Groundwater Management Act ("SGMA"), when groundwater pumping may increase to partly offset reductions in surface water supplies, Stratecon estimates that land fallowing in response to the SED proposal for a 40% increase in the unimpaired flows of the Merced, Stanislaus and Tuolumne Rivers ("SED 40") would reduce crop revenues in the Study Area an average of $58 million per year (2015$), which is about 45% higher than estimated by the SWRCB after accounting for inflation. Furthermore, SWRCB's focus on average annual impacts masks the expected volatility in Study Area annual crop revenues under the SED. Annual revenues losses frequently exceed $100 million and, at their peak, reach as high as $260 million (2015$).

SGMA implementation will effectively preclude additional groundwater pumping to offset SED surface water supply reductions. Stratecon estimates that resulting land fallowing would reduce regional crop revenues by an average of $100 million per year (2015$), or more than 2.5 times the amount estimated by SWRCB after accounting for inflation. In addition, Stratecon estimates that single year crop revenue losses in the Study Area may frequently exceed $200 million and, at their peak, could reach as high as almost $450 million.

The economic impacts within the Study Area of the proposed SED flow objectives is substantial and derives from a combination of: A) reduced crop production; B) reduced output by enterprises relying on that crop production as key inputs, most notably dairies and livestock producers, as well as enterprises further downstream such cheese production using milk produced locally and beef slaughter and packing using locally produced cattle, as key examples; C) increased costs of pumping incurred by irrigators and communities due to potentially substantial increases in regional ground water depths as a result of increased pumping to offset surface water supply reductions (only before SGMA); D) reduced lake recreation visitor spending; and E) reduced hydropower generation values.

Tables EX-1 and EX-2 summarize the estimated economic output and employment impacts within the Study Area.[1] Table EX-1 summarizes the average annual estimated impacts were implementation of the SED 40 proposal overlaid on the historical hydrology of the San Joaquin River system from 1922 through 2003 ("Study Period"). Table EX-2 summarizes the estimated peak annual economic output and employment impacts after SED 40 implementation. The tables present what are termed "upper bound" estimates of both the economic output and employment effects of:

A) Reductions in the regional production of intermediate and end-market dairy and livestock commodities such as raw milk, fluid milk, cheese, cattle and processed meat, among others, due to anticipated SED-related reductions in regional feed grain (particularly corn silage), hay and pasture crops, primary inputs to the region's dairy and livestock sectors; and
B) Estimated increases in the costs incurred by the Study Area's farmers and communities to pump groundwater due to potential SED 40-related increases in Study Area groundwater depths, accounting for both current pumping and additional potential pumping in response to SED-related reductions in regional surface water supplies.

There is no debate with the SWRCB that the SED's implementation will have economic impacts within the Study Area. However, there is also no crystal ball as to the eventual full nature and extent of those impacts. SWRCB chose to focus its quantification of economic impacts primarily on agricultural production adopting sophisticated models for that purpose while providing cursory or no consideration of numerous other potential impacts including, among others, the impacts of reduced regional agricultural production on regional dairy-related activities. Dairy product production and manufacturing are very large and important components of the Study Area's economy. SWRCB's underlying argument for failing to address many of the SED's potential impacts, including the impacts on the region's dairy sectors, is that there is a lack of information necessary for pinpoint quantification.

Stratecon has taken a different tact. There will be a wide a range of potential regional economic impact outcomes based on: A) alternative considerations for how regional businesses and communities may mitigate the potential impacts of reduced regional agricultural production and increased depths to groundwater; B) how groundwater depths in different areas may be effected by projected increases in groundwater pumping; and C) the incremental costs of pumping water from greater depths. As such, the probability of specific outcomes within that range are extremely difficult to pinpoint. Accordingly, Stratecon doesn't attempt to produce an exact answer as to the potential output and employment impacts of SED effects on the dairy and livestock

[1] It should be noted that the estimated "upper bound" impacts presented in the tables do not account for additional capital investment in groundwater pumping and treatment infrastructure by irrigators, irrigation districts and municipal water users due to SED-related declines in groundwater elevations and associated expected declines in groundwater quality. They, therefore, may be considered conservative.

production or farmer and community water costs. Instead, Stratecon focuses on developing economic impact estimates assuming that limited opportunities are available to regional dairy and livestock businesses for mitigating reduced local crop production and the high end of estimated potential increases in regional aquifer groundwater depths and observed cost of pumping groundwater, to provide an "upper bound" assessment of the SED 40's potential regional economic impacts. Stratecon finds these impacts highly instructive for the SED evaluation process as to the potential magnitude and severity of the impacts that could occur.

Table EX-1 shows, for example, that the estimated upper bound average annual total lost economic output and employment within the Study Area that may result from the SED 40 before SGMA is approximately $607 million (2015$) and 2,976 jobs, respectively. Table EX-2 shows that in the expected peak year of SED 40 impacts before SGMA, the region's total economic output and employment may fall as much as an estimated approximately $2.75 billion (2015$) and 12,739 jobs, respectively. The tables do not account for recreation or hydropower-related impacts. Stratecon was unable to obtain the data necessary to effectively quantify potential impacts on Study Area recreation spending and associated economic impacts because of SED-related reductions in regional reservoir elevations. However, those impacts are material, particularly during drier hydrologic years. Stratecon did not evaluate the potential economic impacts related to anticipated SED effects on Study Area hydropower generation as Stratecon believes those impacts are relatively small in comparison.

Table EX-1
Average Annual Estimated Economic Impacts

Average During Study Period	Before SGMA			With SGMA		
Impact Category	Lost Revenues/ Increased Cost (2015$)	Total Lost Output (2015$)	Total Lost Jobs	Lost Revenues/ Increased Cost (2015$)	Total Lost Output (2015$)	Total Lost Jobs
Reduced Crop Production Irrigation Districts	$ 57,589,316	$ 101,026,280	638	$ 100,024,842	$ 175,842,740	1,101
Reduced Dairy & Livestock Sectors Production (Upper Bound)	$ 213,996,694	$ 374,831,334	1,270	$ 292,327,424	$ 512,033,510	1,735
Increased Irrigation District Costs (Upper Bound)	$ 25,310,496	$ 27,378,418	223	N/A	N/A	N/A
Increased Other Irrigation Costs (Upper Bound)	$ 73,065,124	$ 79,034,700	643	N/A	N/A	N/A
Increased Urban Water Costs (Upper Bound)	$ 23,025,416	$ 24,906,642	203	N/A	N/A	N/A
Total	**$ 392,987,047**	**$ 607,177,374**	**2,976**	**$ 392,352,266**	**$ 687,876,250**	**2,835**

Table Ex-2
Peak Year Estimated Economic Impacts

Peak Year of Impacts During Study Period	Before SGMA			With SGMA		
Impact Category	Lost Revenues/ Increased Cost (2015$)	Total Lost Output (2015$)	Total Lost Jobs	Lost Revenues/ Increased Cost (2015$)	Total Lost Output (2015$)	Total Lost Jobs
Reduced Crop Production Irrigation Districts	$ 259,856,755	$ 457,288,570	3,050	$ 449,311,194	$ 787,683,503	4,996
Reduced Dairy & Livestock Sectors Production (Upper Bound)	$ 1,042,793,423	$ 1,826,531,252	6,188	$ 1,387,009,263	$ 2,429,451,230	8,230
Increased Irrigation District Costs (Upper Bound)	$ 101,513,377	$ 109,807,236	893	N/A	N/A	N/A
Increased Other Irrigation Costs (Upper Bound)	$ 270,177,684	$ 292,251,778	2,376	N/A	N/A	N/A
Increased Urban Water Costs (Upper Bound)	$ 89,462,327	$ 96,771,590	787	N/A	N/A	N/A
Total[1]	**$ 1,735,395,477**	**$ 2,751,921,335**	**12,739**	**$ 1,822,286,141**	**$ 3,194,565,527**	**13,206**

1. Represents peak year for all categories combined so may differ from sum of peak year figures for each category.

The expected present value of total lost output in the Study Area equals $14.5 billion over a 40-year horizon (2017-2056). The time profile of lost output reflects the pre-SGMA scenario for 2018 and 2019, a mix of the pre-SGMA and post-SGMA scenarios during the statutory SGMA implementation period (2020-2039) and solely the post-SGMA scenario thereafter.

SED implementation will fundamentally transform the investment landscape for agriculture and related industries within the Study Area. Lost water supplies reduce locally produced inputs for livestock and dairy operations. The volatility in locally produced inputs will more than triple the risk of shortfalls in available local inputs (from 18% to 61%). For operations relying on hay and pasture, expected unused capacity increases from 4% with baseline conditions to 23% under SED implementation before SGMA and 29% after SGMA implementation. For operations relying on grains, expected unused capacity increases from 1% with baseline conditions to 7% under SED implementation before SGMA and 11% after SGMA implementation. This increased risk in unused capacity reduces the economic incentive for investment. The consequences from reduced investment are not quantified in this study.

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1. INTRODUCTION

Reliable and affordable water service is a critical foundation for a community's economic sustainability and growth. Accordingly, the water policy and financial communities widely recognize water supply reliability as fundamental to water system success. Correspondingly, abrupt and unmitigated cutbacks in water service due to drought, regulatory restrictions on water sources or from inadequate infrastructure undermine the vitality of communities.

Lower San Joaquin River water users have surface water rights that are the backbone of the local economies in Merced, San Joaquin and Stanislaus counties ("Study Area"). Under the "baseline condition" as defined by the State Water Resources Control Board ("SWRCB"), Lower San Joaquin River water rights currently have a reliable annual yield of one million acre-feet ("AF") and an expected annual unreliable yield of 290,000 AF.[2] The annual variability in surface water available to the irrigation and urban water districts reliant on those surface water supplies is largely managed by the conjunctive use of groundwater. Under the baseline, groundwater pumping by these surface water-users hovers around 200,000 AF per year in all hydrologic conditions other than critical water years, when groundwater pumping increases to almost 500,000 AF per year.[3]

San Joaquin River water rights are a key driver of the Study Area's economies. Direct farm employment is seven times more important in Merced County than in California generally and about three times more important in San Joaquin and Stanislaus counties than in California generally.[4] The counties additionally rely heavily on employment generated by businesses operating downstream of the farm sector including dairies, dairy product manufacturers, livestock producers, food processing and agricultural commodity transportation, among others. In addition, population in the Study Area has historically grown 45 percent faster than statewide population. The Department of Finance projects that the rate of population growth in the Study Area will be double the rate of growth in statewide population through 2060.

Two of the many challenges facing the Study Area economies include poverty and groundwater overdraft.

The proportion of the region's population residing in economically disadvantaged or severely disadvantaged communities ("DACs"), as defined by the state, is 81.9 percent in Merced County, 54.2 percent in San Joaquin County and 57.0 percent in Stanislaus County. These high rates compare unfavorably to the statewide rate of 41.5 percent.

Study Area groundwater resources are stressed due to overdraft. In 2014, the Department of Water Resources ("DWR") ranked all four sub-basins in the Study Area as "high priority" for action under the Sustainable Groundwater Management Act ("SGMA"). Accordingly, the existing and growing challenge of overdraft needs to be a front-and-center consideration in the evaluation

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[2] See Section 3.

[3] See Section 4.

[4] See Section 2.

of the proposed SED flow objectives as the costs associated with increasing depths to groundwater and declining groundwater quality have already imposed significant financial burdens on regional communities. The potentially large cost impacts of any definitive cutbacks in regional surface water supply availability on the region's households, commercial enterprises and school districts, who have already been hit hard by high drought-related increases in their water costs, will prove untenable in the long run.

The SWRCB's Substitute Environmental Document ("SED") proposes a starting point of leaving 40 percent of the unimpaired flows in the Stanislaus, Tuolumne and Merced Rivers in the rivers during February through June ("SED 40"). The purpose of this study is to evaluate the economic consequences of these proposed flow regulations on the Study Area's local economy.

SWRCB Method v. Stratecon Method

There are four differences in approaches relating to: (i) how water users respond to the loss of surface water, (ii) consideration of the volatility of impacts within the context of water supply reliability and sustainability, (iii) consideration of how the loss of surface water supply would reduce regional well elevations, and (iv) consideration of how impacts in the farm sector impact related downstream industries (such as the dairy and livestock sectors).

Groundwater Pumping and Lost Surface Water Supplies. A critical component of any study of the impact of the proposed flow objective involves specifying how water users may respond to the loss of surface water supplies. The SWRCB analysis is based on a critical assumption:

> Users of Lower San Joaquin River surface water will *fully* offset their loss of surface water by increasing groundwater pumping until groundwater pumping capacity is exhausted.

That is, only that portion of lost surface water supplies that exceeds currently unused groundwater pumping capacity will represent lost local water supplies. The fallowing of crop land only occurs after groundwater pumping capacity is exhausted.

Stratecon turns to evidence of how a reduction in the availability of surface water supplies generates land fallowing and increased groundwater pumping. The almost quarter century of experience of the Westlands Water District provides evidence on how a reduction in an irrigation district's surface water supplies may impact land fallowing, cropping patterns, groundwater pumping and groundwater elevations (see Attachment 1). The Westland's record indicates that increased groundwater pumping offsets half the loss of surface water for a wide range of reductions in available surface water. Therefore, Stratecon's analysis is driven by a different assumption than the SWRCB's:

> Users of Lower San Joaquin River surface water will offset *half* of their loss of surface water by increasing groundwater pumping until groundwater pumping capacity is exhausted.

Accordingly, in many instances land fallowing within the Study Period will occur even before groundwater pumping capacity is exhausted.

SGMA implementation will further limit the ability of increased groundwater pumping to offset any loss of surface water supplies. The Study Area is already in a condition of groundwater overdraft. With the need to reduce groundwater pumping under SGMA, the prospect of increasing groundwater pumping in response to SED will prove illusionary.

Volatility of Impacts. Like any area, the Study Area faces variable hydrologic conditions. Using the history of hydrologic conditions within the Study Area for the period 1922 through 2003, SWRCB staff estimated the availability of surface water for the Study Area irrigation districts reliant on surface water by "water year" type. Generally, the SWRCB projects that the proposed flow objective will only reduce surface water available to the irrigation districts in "critical", "dry" or "below normal" water years. SWRCB staff looked at each water year separately and then took averages over all the years.

In contrast, Stratecon argues that the volatility of impacts has consequences and must be explicitly considered. There are two ways a hiker can perish in the desert: die from thirst or drown in a flash flood. Volatility in available surface water relates directly to supply reliability. Thus, Stratecon considers the implications of reduced supply reliability. The SWRCB staff did not. Increased levels and variability in groundwater pumping raise issues about the sustainability of that pumping. Stratecon considers the impact of the proposed flow objective before and after SGMA implementation. The SWRCB staff did not.

Impacts on Well Elevations. The SWRCB acknowledges that the proposed flow objective will have significant and unavoidable impacts on groundwater resources. It does not quantify those impacts. Therefore, the SWRCB staff implicitly assumes that regional well depths will remain unchanged despite forecasted substantial expansion in groundwater pumping to offset reduced surface water supplies. Stratecon uses evidence from the observed impact of the large variability in the annual delivery of surface water to the Central San Joaquin Water Conservation District on well elevations within the District to assess the potential effect of the proposed flow objective on Study Area well elevations and pumping costs.

Downstream Linkages from Farm Sector. The Study Area's economies have significant dairy and livestock operations. Stratecon examines how the SED impact on crop production impacts downstream dairy and livestock operations. The SWRCB did not.

Stratecon Findings

Surface Water Supply Reliability. The proposed flow objective reduces the reliable surface water supply of the Study Area by 60%, from 1 million AF per year to 399 thousand AF ("TAF") per year. The expected annual yield of the Study Area's unreliable surface water increases from 290 TAF to 656 TAF. Partially offsetting the loss of reliable surface water supplies with an increase in unreliable surface water supplies is not an attractive bargain. The proposed flow objective undercuts severely the reliable water supply that is foundational to the region's long-term capital investment and economic development landscape. The SED would reduce the economic value of surface water rights by 50%.

Groundwater Sustainability. The proposed flow objectives would significantly reduce groundwater recharge from distribution losses and deep percolation in the Study Area. The average annual loss of groundwater recharge is 77,000 AF with greater impacts the drier the hydrologic condition. When SGMA is implemented, the proposed flow objective would reduce allowed groundwater pumping. The expansion of groundwater pumping allowed before SGMA implementation would no longer be viable.

Well Elevations. The proposed flow objective would reduce regional well elevations significantly and especially in dry and critical years before SGMA implementation. Well depths can easily double. This will significantly increase pumping costs for agricultural and municipal water users.

Agriculture. Before SGMA implementation, when groundwater pumping can increase to partly offset lost surface water supplies, land fallowing will reduce crop revenues by an average estimated annual amount of $52 million in 2008 dollars, $58 million in 2015 dollars, or about 45 percent higher than estimated by SWRCB staff. (Consistent with the SWRCB's economic impact evaluation of the SED, all economic impact estimates in this section are presented in 2008 dollar terms ("2008$") in addition to 2015 dollar terms ("2015$") to facilitate comparison to the SWRCB's estimates, which are in 2008$. All inflation adjustments are made based on the Consumer Price Index for the western United States published by the U.S. Bureau of Labor Statistics.) Average annual impacts mask the volatility of lost annual crop revenues, where estimated annual revenue losses often exceed $100 million and may peak as high as $235 million in 2008$, $260 million in 2015$. After SGMA implementation, land fallowing will reduce crop revenues by an estimated average annual amount of approximately $91 million in 2008$, $101 million in 2015$, or 2.5 times the amount estimated by SWRCB staff. Annual revenue losses will then often exceed $200 million and peak at as high as $413 million in 2008$, $457 million in 20015$.

In addition to lost crop revenues, SED 40-related increases in regional groundwater depths in the absence of SGMA implementation will potentially cause a significant increase in farmer irrigation costs and associated decreases in incomes due to increased pumping costs. These costs are estimated at their "upper-bound" to average as much as $31 to $89 million in 2008$, $34 to $98 million in 2015$, with an upper-bound peak of as much as $117 to $336 million in 2008$, $129 to $372 million in 2015$, reflecting a range of observed electrical costs regionally to pump one acre-foot of water one foot in elevation.

The estimates on irrigator cost impacts are deemed "upper bound" as they reflect the assumption that the region's irrigators will face the high end of potential regional groundwater basin depth increases due to the SED in conjunction with the high end of observed regional incremental costs per foot of lift for pumping groundwater. The presentation in this report focuses on the upper-bound of potential impacts also for the Study Area's dairy and livestock sectors as well as the region's communities with respect to the increased costs of groundwater pumping.

SWRCB chose not to quantify the impacts on economic sectors other than farming and simply ignored the potential farmer and community cost impacts of increased groundwater depths due to SED implementation. SWRCB's underlying argument is that there is a lack of information available to provide pinpoint quantifications of the effects of reduced crop production on other sectors of the regional economy like dairy as well as the potential groundwater depth impacts of the SED and associated regional cost effects.

Stratecon has taken a different tact. There would be a wide range of potential regional economic impact outcomes due to SED implementation based on: A) alternative considerations for how regional business and community may mitigate the resulting potential impacts of reduced local agricultural production and increased depths to groundwater; B) how groundwater depths in the region's aquifers may be effected by projected increases in groundwater pumping; and C) the incremental costs of pumping water from greater depths. As such, the probability of specific outcomes within that range are, in truth, extremely difficult to pinpoint. Accordingly, Stratecon doesn't attempt to produce an exact answer as to the potential output and employment impacts of SED effects on regional dairy and livestock production or farmer and community water costs. Instead, Stratecon focuses on developing economic impact estimates assuming there to be limited opportunities available for local dairy and livestock businesses to mitigate for reduced local crop production, and the high end of estimated potential increases in groundwater depths and the observed cost of pumping groundwater, to provide an "upper bound" assessment of the SED 40's potential regional economic impacts.

Dairy Sectors. Before SGMA implementation when groundwater pumping can increase to partly offset lost surface water supplies, land fallowing will result in reduced Study Area dairy-related output and, thus, revenues (including revenues from both milk production and downstream dairy product manufacturing sectors) potentially on the upper bound by as much as $151 million on average annually in 2008$, $173 million on average in 2015$. SWRCB staff did not estimate any dairy sectors impacts. Estimates of average annual impacts mask the volatility of lost annual dairy-related revenues, where upper bound annual revenue losses may often exceed as much as $200 million and peak at as much as $763 million in 2008$, $844 million in 2015$. After SGMA implementation, land fallowing will reduce dairy-related revenues potentially on the upper bound by as much as $212 million on average annually in 2008$, $237 million in 2015$. Annual upper bound revenue losses will then often exceed $200 million and may peak at over $1.0 billion in a single year in 2008$, $1.1 billion in 2015$.

Livestock Sectors. Before SGMA implementation, when groundwater pumping can increase to partly offset lost surface water supplies, land fallowing will result in reduced Study Area livestock-related output and, thus, revenues (including revenues from both livestock production and associated livestock product packing and processing) potentially at the upper bound by as much as $36 million on average annually in 2008$, $41 million in 2015$. SWRCB staff did not estimate any livestock sectors impacts. Average annual impacts mask the volatility of lost annual livestock revenues, where annual revenue losses may often exceed $50 million and peak at the upper bound at as much as $180 million in 2008$, $199 million in 2015$. After SGMA implementation, land fallowing will reduce livestock-related upper bound revenues by as much as

$50 million on average annually in 2008$, $56 million in 2015$. Annual revenue losses may often exceed as much as $70 million and on the upper bound peak at about $239 million in 2008$, $265 million in 2015$.

Other Sectors. SED decreases in regional crop production will not only have downstream impacts on dairy-related and livestock-related revenues but also on other food manufacturers such as tomato processors and snack food producers as well as regional crop and commodity transportation companies. While these impacts may be significant, limitations in available data on these sectors within the region precluded any quantification of these impacts.

Communities. The SWRCB does little to evaluate the potentially significant impacts on the region's domestic, commercial, industrial and municipal water users (collectively "urban" water users) of the SED. The principal anticipated effects of the SED on regional communities in addition to surface water supply losses for those communities such as Modesto and Stockton that rely on surface water from the region's Irrigation Districts for a portion of their water supplies, are the potential impacts to all urban water users of increased groundwater depths. All of region's urban water users rely in some part, or entirely on, groundwater for their community water supplies. Already regional urban water service providers and businesses, households and municipal service providers such as schools operating their own wells are facing significant water cost escalation and reduced access to water due to steadily increasing well depths accelerated by the recent drought. The estimated average annual upper bound direct effect on the region's urban water users due to SED-related increases in groundwater depths is increased annual water costs of about $7.2 million to $21.0 million on average in 2008$, $8.0 to $23.0 million in 2015$. In the peak year of SED-related surface water supply reductions, annual region community water costs are projected at their upper bound to increase by as much as $28.0 to $81.0 million in 2008$ due to increased groundwater depths, $31.0 to $89.0 million in 2015$. This translates to about $56.0 to $160.0 annually in 2008$, $62 to $177 in 2015$, per Study Area household and must be considered conservative as they only account for increased power and maintenance expenses associated with anticipated SED-related increases in regional groundwater depths. The estimates do not account for the anticipated necessary investment in new well infrastructure by communities and individual businesses and households to reach water at greater depths and address anticipated worsening groundwater quality.

Recreation. The SED would negatively impact regional reservoir/lake elevations that will in turn be expected to reduce recreation visitation and associated recreator spending within the Study Area. This reduction in spending would, in turn, have negative regional economic output and employment impacts that begin with visitor serving business sectors such as food & beverage, lodging and fuel services. SWRCB acknowledged these potential impacts but dismissed them as minor. While Stratecon was unable to obtain the data necessary to quantify the potential regional recreation activity effects and associated economic impacts of reduced reservoir elevations from the SED, Stratecon believes that those impacts are material.

An excellent case in point is Woodward Reservoir, an important lake-based recreation destination in Modesto County that will experience SED-related reductions in its surface elevations, particularly during the peak recreation summer months. Woodward has strict water quality standards in place that terminate body contact in the reservoir when elevations decline to their lows following the irrigation season in late summer and early fall. With the recent drought this threshold has most recently been reached in September as opposed to the typical sometime in October. The SED, in drier hydrologic years, would be expected to trigger this body contact threshold earlier than otherwise, all else being equal, which would have a marked impact on recreation at the reservoir and, accordingly, regional recreation-related spending and associated economic output. Other of the region's reservoirs that would see their surface elevations and associated recreation adversely impacted, include Lake Don Pedro in Tuolumne County and Lake McClure in Mariposa County. While Don Pedro and McClure do not have the same body-contact usage thresholds as Woodward, Don Pedro and McClure would be expected to experience visitation reductions as reservoir visitation is strongly correlated to lake surface levels due to aesthetics and access, the latter particularly important for boating.

Hydropower. Hydropower generation on the Merced, Stanislaus and Tuolumne Rivers will also be adversely impacted by the SED. These impacts will be attributed both to generation timing and generation production effects. With respect to the former, lower flexibility to manage reservoir releases for generation under the SED will reduce the ability of regional power system operators to maximize higher valued power generation during peak demand periods (peaking power) over lower valued base load power demand periods. As hydropower can be generated instantaneously with the opening of gates releasing water through generation facilities, it is a superior source for peaking power compared to other electrical generation sources. The SWRCB estimates that under the SED 40, the reduction in hydropower production/timing is valued at less than $1.0 million per year. Accordingly, the resulting impacts on regional power service prices for households and businesses should be small. The underlying assumption is that the cost of the replacement power for the power lost will be reasonable and, accordingly, have little effect when passed through to ratepayers. Stratecon was unable to acquire the necessary data to assess the impact of SED on hydropower.

Economic Impacts. The impacts of the SED on agricultural production, dairy, livestock and other production activities reliant on that agricultural production, agricultural water costs, urban water costs, recreation spending and hydropower values will all have impacts on the Study Area's economic output and employment. These impacts, other than recreation and hydropower, are evaluated using the standard modelling tool IMPLAN. The IMPLAN dataset for the three counties was acquired for the year 2010 consistent with the modelling year used by the SWRCB. The model was then adjusted to reflect certain specific conditions within the Study Area to account for the potential economic impacts on business sectors that operate downstream of, and rely on, production by the region's farm sector such as grain and hay/pasture production for the region's dairy and livestock sectors. These downstream affects were not quantified by the SWRCB but will comprise a substantial component of the total potential economic impacts of the SED due to those sectors' importance to the regional economy and reliance on locally produced feed crops.

Crop Production

Stratecon estimates that the impacts of the SED 40 prior to SGMA implementation on crop production in the Study Area irrigation districts that rely on surface water ("Irrigation Districts") would result in an average regional decline in economic output of $91 million in 2008$, $101 million in 2015$, and in a peak year of surface water supply reductions, potentially as much as $413 million in 2008$, $457 million in 2015$, representing about 3.5% and 16.5% of estimated baseline regional economic output generated directly and secondarily by crop production within the Irrigation Districts, respectively. Stratecon further estimates that the impacts of the SED 40 on agricultural production in the Irrigation Districts would result in an average regional decline in employment of about 632 jobs and in a peak year of surface water supply reductions, potentially as much as approximately 3,060 jobs, representing 3.3% and 16.6% of estimated baseline employment generated directly and secondarily by crop production within the Irrigation Districts, respectively.

Stratecon estimates that the impacts of the SED 40 with SGMA implementation on crop production in the Irrigation Districts would result in an average regional decline in economic output of $159 million in 2008$, $176 million in 2015$, and in a peak year of surface water supply reduction potentially as much as $712 million in 2008$ and $788 million in 2015$, representing about 6.1% and 27.4% of estimated baseline economic output generated directly and secondarily generated by crop production within the Irrigation Districts, respectively. Stratecon further estimates that the impacts of the SED 40 with SGMA implementation on crop production within the Irrigation Districts would result in an average regional decline in employment of about 1,100 jobs and in a peak year of surface water supply reduction potentially as much as almost 5,000 jobs, representing about 5.8% and 26.2% of estimated baseline employment generated directly and secondarily by crop production within the Irrigation Districts, respectively.

Dairy Sectors

Stratecon estimates that the impacts of the SED 40 prior to SGMA implementation on the dairy sectors in the Study Area (including milk production and dairy product manufacturing sectors), which rely heavily on regional grain and hay feed production could result in an upper bound average regional decline in economic output of as much as $273 million in 2008$, $303 million in 2015$, and in a peak year of surface water supply reductions, potentially as much as $1.33billion in 2008$, $1.48 billion representing about 3.6% and 17.7% of estimated baseline economic output generated directly and secondarily by the dairy sectors within the Study Area, respectively. The upper bound represents the assumption that the region's dairies would not be able to substitute reductions in available local feed with outside of region sources due to lack of available supply, unsupportable pricing and high transportation costs. The region's dairies are already grappling with extremely tight margins due to the challenges of ever increasing environmental and other regulatory constraints along with the cost of labor and transportation. According to the owner of one dairy in the region, any material increase in his operation's cost of feed will result in him having to shut down because the economics of the operation will no longer be viable. Stratecon further estimates that the impacts of the SED 40 on dairy activities in the Study Area would result in a upper bound average regional decline in employment of as much as about 1,015 jobs on average and in a peak year of surface water supply reductions, potentially as much as approximately 4,944 jobs, representing about 3.2% and 15.4% of estimated baseline employment generated directly and secondarily by the dairy sectors within the Study Area, respectively.

Stratecon estimates that the impacts of the SED 40 with SGMA implementation on the dairy sectors in the Study Area would result in a upper bound average regional decline in economic output of as much as $374 million in 2008$, $414 million in 2015$, and in a peak year of surface water supply reductions, potentially as much as $1.77 billion in 2008$, $1.96 billion in 2015$, representing about 5.0% and 23.6% of estimated baseline economic output generated directly and secondarily by the dairy sectors within the Study Area, respectively. Stratecon further estimates that the impacts of the SED 40 on dairy activities in the Study Area would result in an upper bound regional decline in employment of as much as about 1,386 jobs on average and in a peak year of surface water supply reductions, potentially as much as approximately 6,576 jobs, representing approximately 4.3% and 20.5% of estimated baseline employment generated directly and secondarily by the dairy sectors within the Study Area, respectively.

Livestock Sectors

Stratecon estimates that the impacts of the SED 40 prior to SGMA implementation on the livestock sectors in the Study Area (including livestock production and livestock packing and processing sectors), which rely heavily on regional grain and hay crop production would result in a upper bound regional decline in economic output of as much as $65 million on average in 2008$, $72 million in 2015$, and in a peak year of surface water supply reductions, potentially as much as almost $317 million in 2008$, $351 million in 2015$, representing about 3.6% and 17.7% of estimated baseline economic output generated directly and secondarily by the livestock sectors within the Study Area, respectively. Stratecon further estimates that the impacts of the SED 40 on livestock output in the Study Area would result in an upper bound regional decline in employment of as much as about 255 jobs on average and in a peak year of surface water supply reductions, potentially as much as approximately 1,244 jobs, representing 3.3% and 15.8% of estimated baseline employment generated directly and secondarily by the livestock sectors within the Study Area, respectively.

Stratecon estimates that the impacts of the SED 40 with SGMA implementation on the livestock sectors in the Study Area would result in an upper bound average regional decline in economic output of as much as about $88 million in 2008$, $98 million in 2015$, and in a peak year of surface water supply reductions, potentially as much as $422 million in 2008$, $466 million in 2015$, representing about 4.9% and 23.3% of estimated baseline economic output generated directly and secondarily by the livestock sector within the Study Area, respectively. Stratecon further estimates that the impacts of the SED 40 on livestock production in the Study Area would result in an upper bound average regional decline in employment of about 349 jobs on average and in a peak year of surface water supply reductions, potentially as much as approximately 1,654 jobs, representing approximately 4.4% and 21.1% of estimated baseline employment generated directly and secondarily by the livestock sectors within the Study Area, respectively.

Increased Water Costs

In the case of the SED 40 before SGMA, not only will the associated crop production losses adversely impact regional output and employment so will the higher anticipated water costs incurred by the region's irrigators and communities due to increased groundwater depths and associated pumping costs. The increases in Study Area water costs will reduce farm and other business incomes as well as household disposable incomes resulting in a regional decline in consumption and associated impacts on output and employment.

Stratecon estimates that the increased cost of water for regional irrigators could result, at their upper bound in average output and job losses within the region of as much as about $96 million in 2008$, $106 million in 2015$ and 866 jobs, respectively, and peak year output and job losses within the region on the upper bound of as much as about $363 million in 1998$, and 3,269 jobs, respectively.

Stratecon further estimates that the increased cost of water for regional communities (households, businesses, etc.) due to increased SED-related groundwater depths could result, at their upper bound, in average output and job losses within the region of as much as about $23 million in 2008$, $25 million in 2015$, and 203 jobs, respectively, and peak year output and job losses within the region on the upper bound of as much as about $87 million in 2008$, $97 million in 2015$ and 787 jobs, respectively. Due to a lack of data, Stratecon did not estimate the potential additional costs due to groundwater depth and potential additional pumping that may be incurred by region communities reliant on surface water of reduced surface water supplies resulting from the SED 40's implementation.

Recreation

The SED 40 is expected to adversely impact surface elevations of many of the Study Area's reservoirs such as Woodward and Modesto Reservoirs as well as reservoirs just adjacent to the area, such as Lake Don Pedro and Lake McClure, that are important outdoor recreation destinations for both residents within and outside the Study Area. These recreators make an important contribution to the Study Area economy, particularly those visitors from outside the area, through local recreation-related spending on lodging, food & beverage and fuel services. Correspondingly, recreation visitation to reservoirs tend to be sensitive to variability in lake water levels. As the SED 40 will have noteworthy impacts on reservoir elevations along the Merced, Stanislaus and Tuolumne Rivers, particularly during peak recreation summer months, it is likely for there to be material reductions on recreation at those reservoirs and associated impacts on regional economic output and employment. Though Stratecon was unable to obtain the visitation and other data necessary to quantify these impacts they may prove to be notable, particularly in years with drier hydrologic conditions when the SED's impacts on reservoir surface elevations could provide most significant.

Hydropower

Though the SED 40 will reduce the flexibility in management of the affected San Joaquin River tributaries for hydropower generation, the resulting anticipated impacts on power generation values and quantity are estimated by SWRCB to be small, less than $1.0 million. While the SWRCB analysis did not specifically analyze the implications for electricity costs incurred by regional power consumers of replacement power supplies, Stratecon agrees that the economic impacts of the SED 40 associated with hydropower effects are likely to be minimal and defers to the SWRCB hydropower impact analysis.

2. STUDY AREA

Any effort to measure the magnitude, significance and severity of the potential economic impacts of the SED on the Study Area necessarily includes a baseline characterization of existing socioeconomic, water supply and water demand conditions within the region. Accordingly, this section provides a broad overview of salient recent historical and current demographic, economic and water use statistics available for the Study Area most relevant to assessing the potential regional economic impacts of anticipated SED-related changes in the region's surface water supply availability.

The specific topics addressed include:

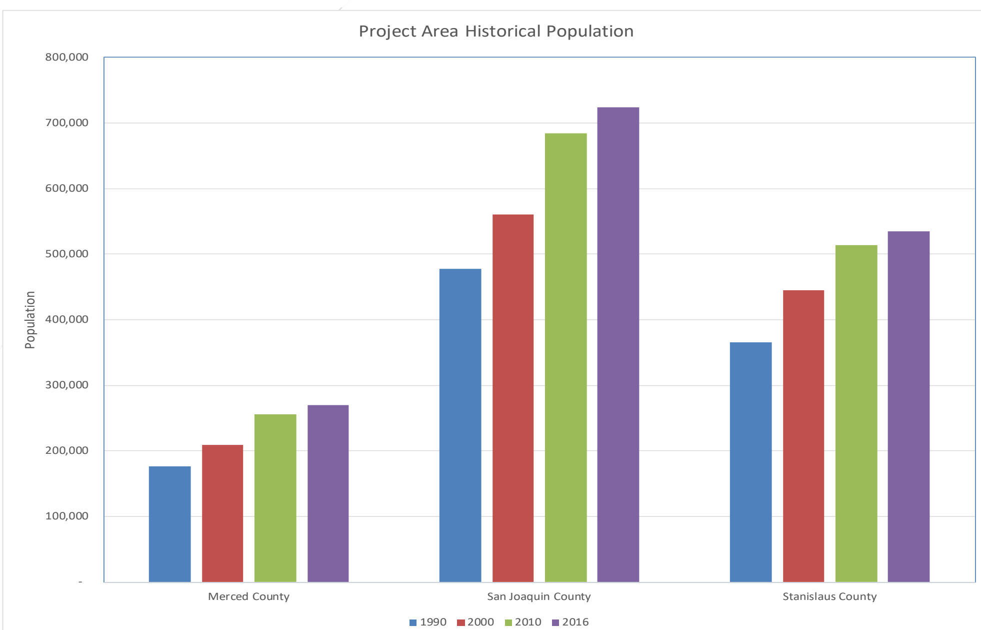
- Population and Housing
- Regional Economy
- Household Incomes (including discussion of disadvantaged communities)
- Poverty
- Regional Farm Economy

Refer to Attachment 2 for additional data on the Study Area's baseline conditions, including crop production information specific to each of the Irrigation Districts.

A. Population and Housing

Figure 2.1 shows the current and past population within the Study Area. Estimated total population within the region in early 2016 was about 1.5 million, up from about 1.0 million in 1990.

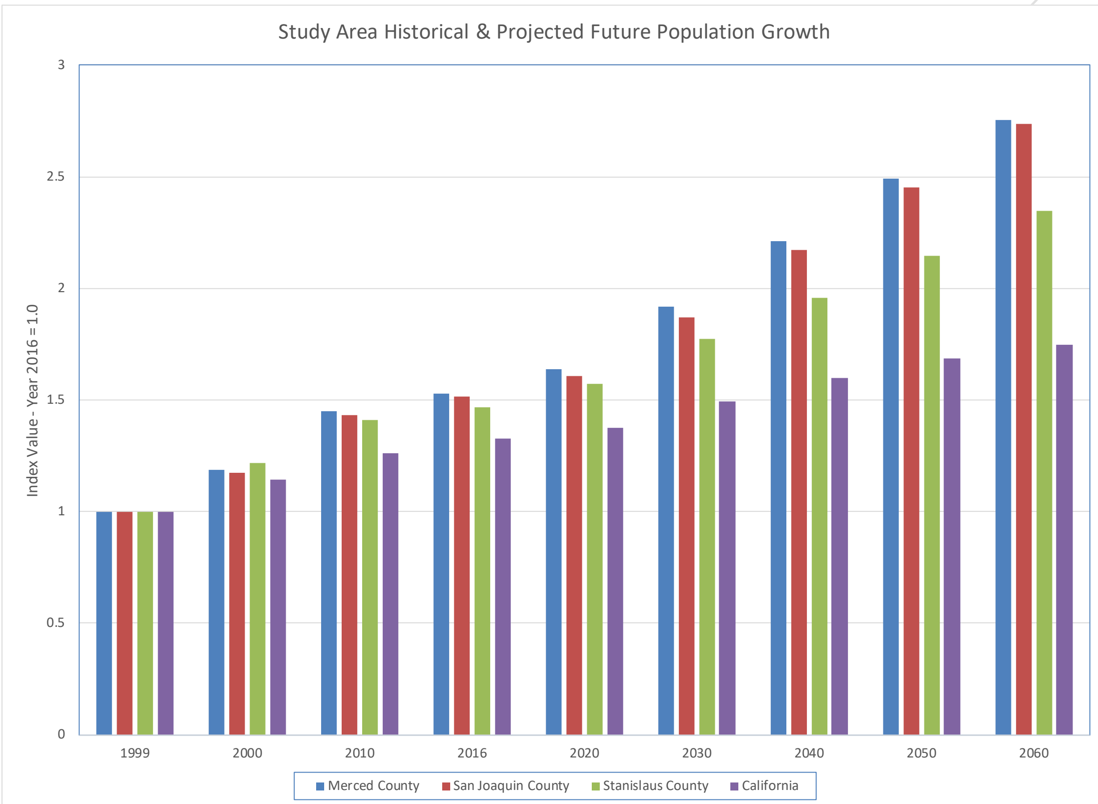
Figure 2.1



The above graphic shows steady recent historical population growth in all three counties. This has had important implications for past growth in regional urban and commercial/industrial water demand, water conservation measures notwithstanding.

Figure 2.2 compares the Study Area's historical and projected future population to that of the State of California. To facilitate the comparison the projected population figures are translated to an index value with each of the Study Area's and the State's 2016 estimated population set to a value of 1.0.

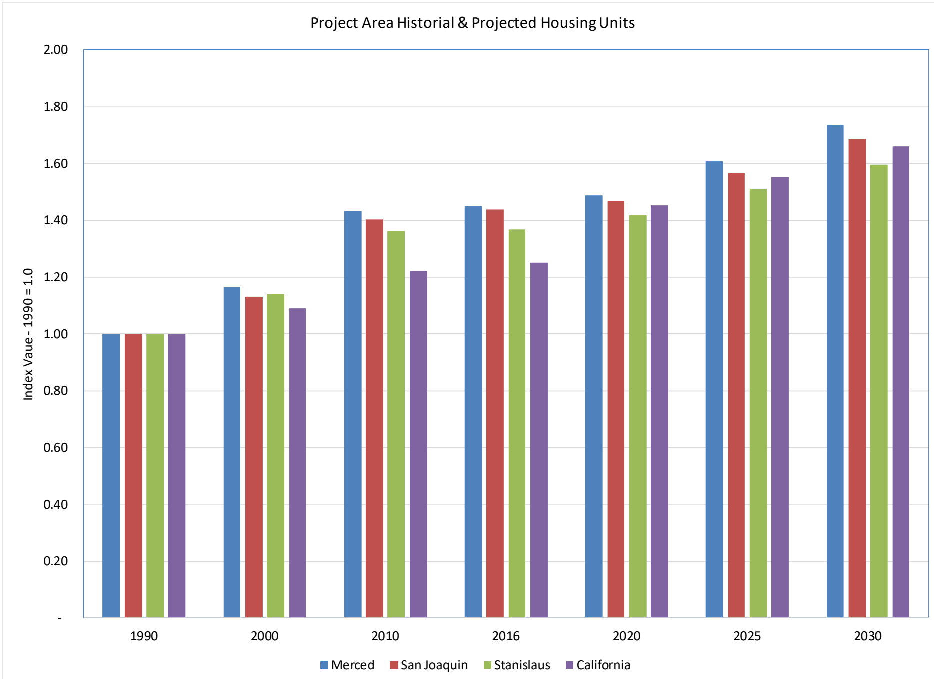
Figure 2.2



The above graphic shows not only that the region's historical population growth has significantly outpaced that of the state but also that future population growth out through the year 2060 is projected to do as well. This will have very important implications for the region's already stressed groundwater supplies as the region's communities rely primarily on groundwater for their water supplies.

Figure 2.3 compares the Study Area's historical and projected future housing inventory to that of the State of California. To facilitate the comparison, the projected population figures are translated to an index value with each of the Study Area's and the state's 2016 estimated population set to a value of 1.0.

Figure 2.3



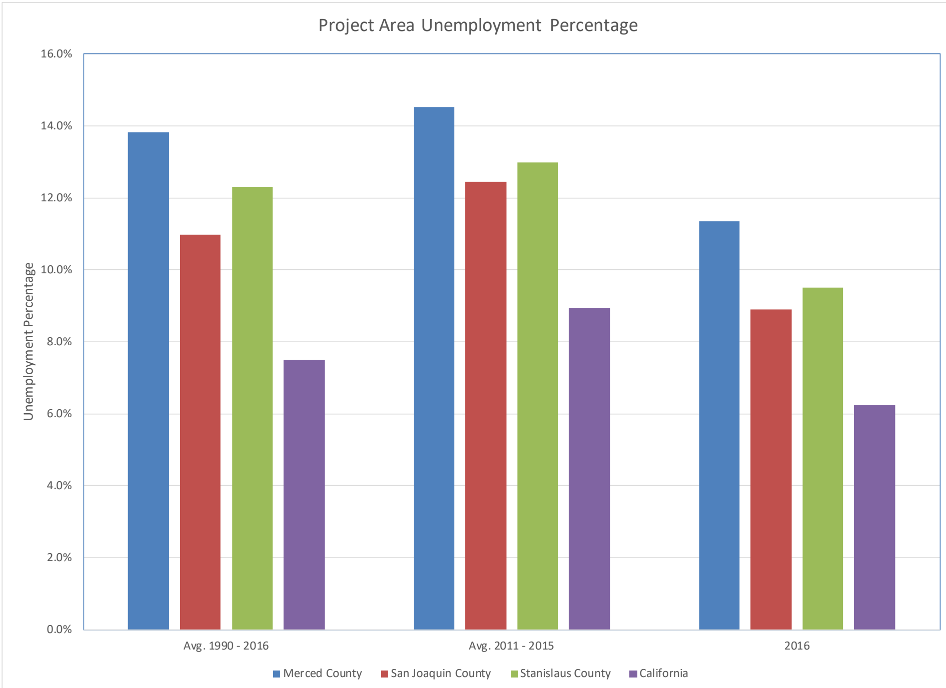
The figure reveals that while the region's historical growth in its housing inventory has somewhat kept pace with its population growth and outpaced the state, future projected housing growth for the region out through the year 2030 is at a pace that is much slower than projected population growth for that same period. This suggests a tightening of the region's housing market, and associated increases in household size (i.e., the number of occupants per household), and occupancy rates (a declining rate of housing vacancy). This trend would be expected to result in rising housing prices for a region that has a disproportionate share of its communities compared to the state that are already designated as economically disadvantaged by the state, as discussed below. Rising housing prices will only exacerbate community affordability challenges with any actions such as the SED that are likely to cause a future material rise in water service cost both for households and businesses.

B. Regional Economy

Generally, the economies of the three Study Area counties are characterized by relatively high rates of unemployment, large agricultural and agricultural-dependent sectors, low household incomes and associated high rates of poverty, helping to explain why so many are designated as economically disadvantaged by the state.

Figure 2.4 compares the average unemployment rate for the Study Area as compared to the state's for the period 1990 through 2016 and the unemployment rate for 2015.

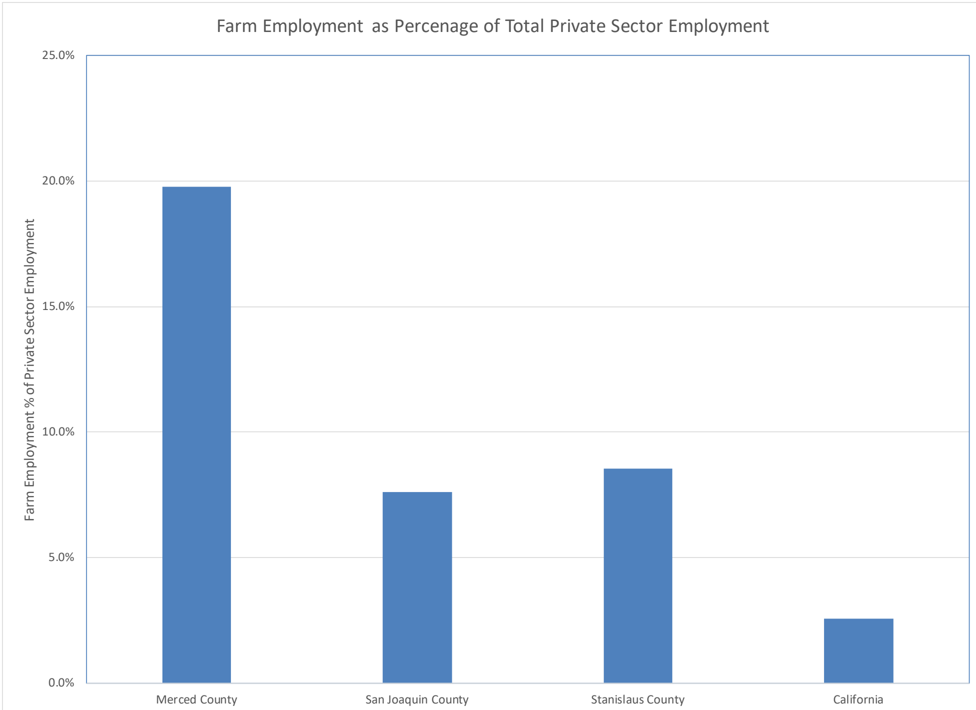
Figure 2.4



The figure shows that Study Area unemployment rate has long been high and continues to be quite a bit higher than the unemployment rate for the state. There are a variety of reasons for the disparity including the region's lack of economic diversity (i.e., reliance on a relatively limited number of sectors). Such a lack of diversification translates to an economy that has greater potential sensitivity/vulnerability to events and regulatory actions that adversely impact specific primary economic sectors on which the regional economy relies such as agriculture.

Figure 2.5 compares the share of current employment in the Study Area within the agricultural sector as compared to the State. The table illustrates the relative importance of that sector to the Study Area's economy, particularly that of Merced County. It is also important to emphasize that the graphic substantially understates the relevance of the agricultural sector to the region's employment base as many related businesses and associated employment in agricultural product transportation, manufacturing (such as dairies, which are a significant contributor to the regional economy) and trade, are down stream of and rely directly on crop and livestock production of the region's agricultural sector.

Figure 2.5

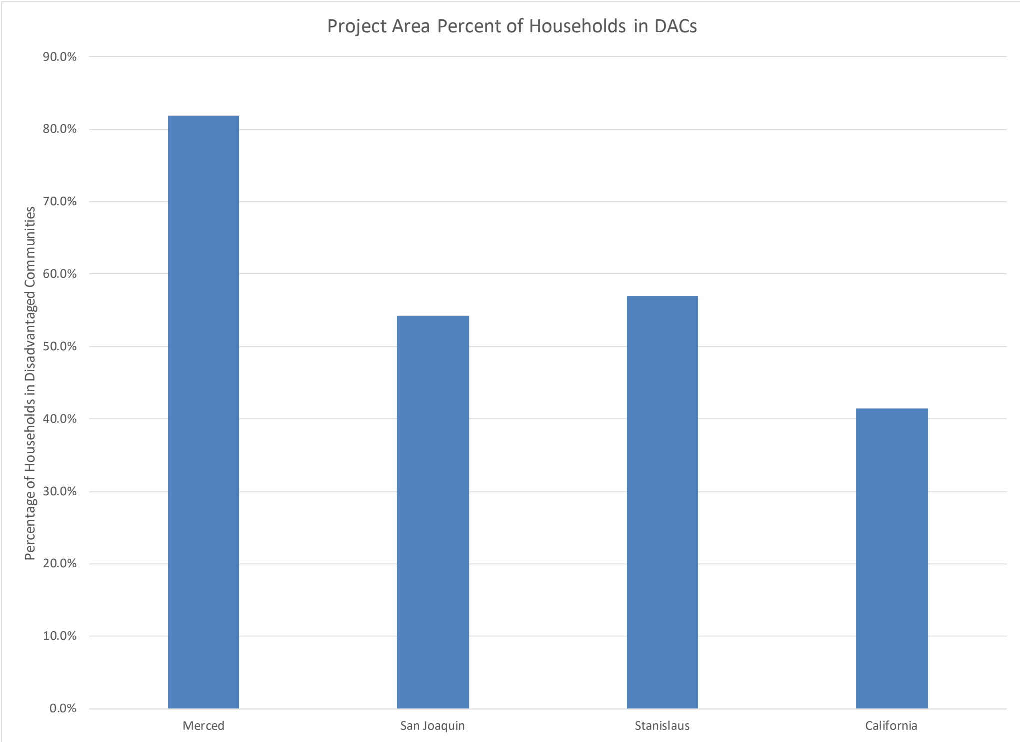


C. Median Household Income

Median household income ("MHI") is frequently used to evaluate community economic conditions within a defined geographic area. In fact, the California Department of Water Resources ("CDWR") for the purposes of water resource development and management planning uses MHI to determine if communities are considered economically disadvantaged and, thus, warrant certain special considerations in the spatial allocation of limited natural and financial resources, mitigating actions or in how cost burdens are allocated ("Disadvantaged Community" or "DAC"). Communities are considered economically disadvantaged by CDWR if their MHI is lower than 80% of the state's MHI and considered severely economically disadvantaged if community MHI is less than 60% of the state's MHI. Figure 2.6 compares the percentage of households in the Study Area that are within DAC communities based on 2014 MHI data.

The figure shows that a much larger share of the region's population resides in DACs than for the state. Merced County has a significant portion of its populace living in DACs, over 80%. DACs in the region include the cities of Merced, Modesto and Stockton, which are the largest incorporated communities in each of the Study Area counties based on population. The extent of lower incomes in the region has important implications for the presumed ability of households in the region to pay (the affordability of) any potential additional costs for water that may result from SED-related reductions in available surface water supplies. In the case of the region's communities, for those that rely entirely on groundwater, these costs will be expected to derive from increased depths to groundwater as the region's irrigators that rely on surface water are anticipated to pump more groundwater from the regions already depleted aquifers to offset SED-related reductions in surface water supplies. And, some communities, such as the City of Modesto, which relies on both surface and ground water, may not only face the cost burden of SED-related increases in groundwater depths but also a large decline in their existing water supplies. On average, Modesto receives about half of its water supplies from the Stanislaus River by way of agreement with and delivery from the Modesto Irrigation District. The remainder of the City 's water supplies are groundwater.

Figure 2.6



D. Poverty

Concurrent with the relatively low MHIs within the Study Area are high rates of poverty, which also brings to the forefront concerns regarding the affordability for regional communities to pay for anticipated increases in water costs resulting from SED implementation.

Figure 2.7

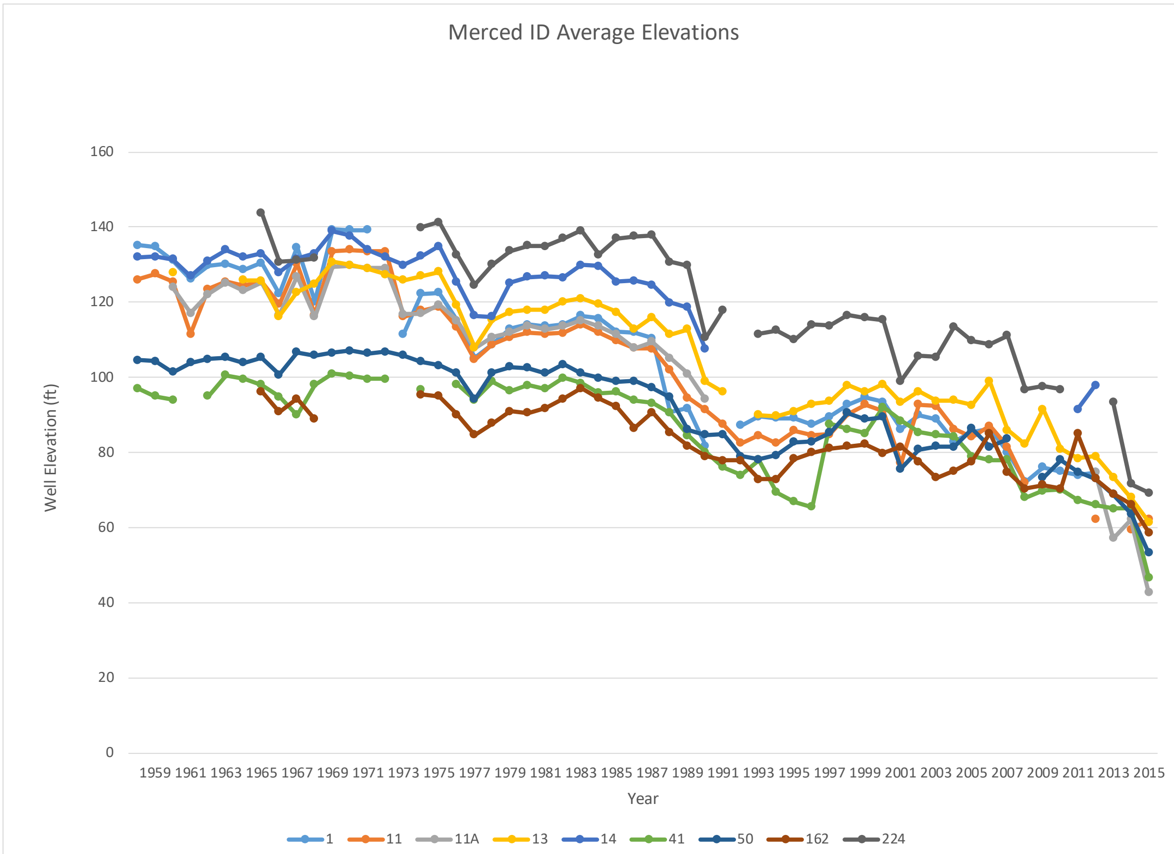
E. Regional Farm Economy

Agriculture is a fundamental component of the Study Area's economy and employment base, and the primary user of the region's surface water supplies. Accordingly, the direct effects of SED surface water supply cutbacks on the regional economy are expected. Farm sector may adjust to SED-related reductions in surface water supply availability and reliability by adopting efficiency and conservation measures and pumping more groundwater.

Study Area farmers have already made significant investments over time in response to water supply challenges in irrigation and other technologies to improve water management efficiencies and meet conservation objectives. They have also generally invested in less water consuming crops. Additional efforts on this front may increasingly prove to have diminishing returns. Furthermore, growing plants need a certain amount of water and no amount of technology can change this immutable fact.

Increased groundwater pumping in a region with already severely over-drafted and declining aquifers provides the same challenges faced by the region's urban communities; rising costs due to increasing well depths. Additional groundwater pumping, which has been the short-term response of many of the region's irrigation districts to drought-related reductions in surface water supplies with the current drought, is not a sustainable model for offsetting SED reductions in surface water supplies. The costs associated with such pumping may rise quickly for the reasons previously discussed. Figure A2.3, which shows the historical trend in elevations for a number of wells in the Merced Irrigation District, is a illustrative example of what has happened already with well depths in the region over time. Significant SED-driven increases in agricultural pumping will only make matters worse and, regardless, will run full stop into pending regulations to stop these types of declines.

Figure 2.8



County Level Agriculture

Table 2.1 summarizes the contribution of the Study Area to California's agricultural economy. The table shows that in 2014 the three Study Area counties were the 5th, 6th and 7th largest producers of farm commodities in the State based on total value of production.

Table 2.1
California County Agricultural Rankings

County	2014 Rank	Total Value of Agricultural Production	Leading Commodities
Tulare	1	$ 8,084,478	Milk, Cattle & Calves, Oranges, Grapes (Table)
Kern	2	$ 7,552,160	Grapes (Table), Almonds, Milk, Tangerines
Fresno	3	$ 7,037,175	Almonds, Milk, Grapes (Raisin), Tomatoes
Monterey	4	$ 4,493,427	Lettuce, Strawberries, Broccoli, Grapes
Merced	5	$ 4,429,987	Milk, Almonds, Cattle & Calves, Chickens
Stanislaus	6	$ 4,397,286	Almonds, Milk, Walnuts, Chickens
San Joaquin	7	$ 3,234,705	Almonds, Milk, Walnuts, Grapes (Wine)
Kings	8	$ 2,471,746	Milk, Cotton, Cattle & Calves, Almonds
Madera	9	$ 2,265,641	Almonds, Milk, Pistachios, Grapes (Raisin)
Ventura	10	$ 2,133,589	Strawberries, Lemons, Raspberries, Celery

Table 2.2 provides a summary of cropping over the past ten years for Merced County. The table show that acreage in production has consistently increased over time driven by increasing production of corn silage and other field crops for livestock feed and growing investment in permanent crops, most notably almonds. Vegetable crop acreage in the County has also shown strong increases. At the same time water intensive irrigated pasture acres have shown a significant decline over time. Merced County's most important commodities based on gross value are milk and almonds. The table shows for example an over 20% increase in the County's production of milk over the past ten years and an almost 20% increase in the acreage of almonds. Almonds account for a significant share of the County's cropping pattern. These levels and trends have important implications for the challenges faced by County's famers with the substantial SED reductions in surface water supplies. The investment in almond orchards and milk production infrastructure, including cows is substantial. Accordingly, this limits the flexibility of regional farmers to respond to changes in their water surface water supplies putting at great risk these investments as foundations of the County's agricultural economy.

Table 2.2
Merced County Cropping Pattern

	Merced County	2005	2010	2014	2015	Change 2005 to 2015
Acres[2]	Field Crops[1]	354,408	365,635	397,473	419,814	18%
	Corn Silage	82,114	90,119	100,394	106,380	30%
	Irrigated Pasture	59,000	30,719	25,030	25,030	-58%
	Tree and Vine	122,706	130,261	132,245	136,617	11%
	Almonds	87,123	98,895	99,907	101,835	17%
	Walnuts	5,948	5,326	5,909	6,123	3%
	Vegetables	47,197	59,910	62,422	63,706	35%
	Seed Crops	2,708	5,072	3,730	5,039	86%
	TOTAL	**586,019**	591,597	620,900	**650,206**	11%
cwt[3]	Milk Production	50,852,947	58,750,476	64,602,204	62,633,664	23%

1. Excludes Pasture and Rangeland
2. Harvested Acres (excludes relatively small acreages for nursery and organic products)
3. cwt = one hundred pounds

Table 2.3 provides a summary over the past ten years of cropping for San Joaquin County. The table shows a similar trend as with Merced County with respect to the steady expansion of acreages of almonds and walnuts. However, acreages in the County over the past five years have been declining for a number of other crops including, in particular, vegetables, resulting in a substantial decline in the region's overall farmed acreage.

Table 2.3
San Joaquin County Cropping Pattern

	San Joaquin County	2005	2010	2014	2015	Change 2005 to 2015
Acres[2]	Field Crops[1]	264,547	411,500	332,000	297,000	12%
	Corn Silage	41,240	57,100	50,200	40,200	-3%
	Irrigated Pasture	14,500	14,500	14,500	14,500	0%
	Tree and Vine	209,230	228,000	255,000	258,000	23%
	Almonds	43,000	48,200	59,200	65,300	52%
	Walnuts	43,200	55,374	62,500	64,100	48%
	Vegetables	84,328	63,900	61,300	58,700	-30%
	Seed Crops	1,969	1,640	1,500	1,170	-41%
	TOTAL	**574,574**	**719,540**	**664,300**	**629,370**	10%
cwt[3]	Milk Production	22,352,000	23,169,000	24,602,000	24,026,000	7%

1. Excludes Pasture and Rangeland
2. Harvested Acres (excludes relatively small acreages for nursery and organic products)
3. cwt = one hundred pounds

Table 2.4 provides a summary over the past ten years of cropping for Stanislaus County. Trends in farmed acreage in Stanislaus County has also been like the other Study Area counties with respect to nut acreage. In 2015, Almonds and walnuts accounted for about 40% of the County's overall cropping pattern. Increases in nut acreages over the past five years have been more than offset by declines in vegetable and field crop acres resulting in an overall decline in the County's acreage.

Table 2.4
Stanislaus County Cropping Pattern

	Stanislaus County	2005	2010	2014	2015	Change 2005 to 2015
Acres[2]	Field Crops[1]	184,000	293,861	237,112	215,033	17%
	Corn Silage	63,500	88,732	90,890	81,040	28%
	Irrigated Pasture	72,000	33,700	32,500	32,500	-55%
	Tree and Vine	152,000	207,999	231,027	240,280	58%
	Almonds	97,300	144,690	164,394	177,719	83%
	Walnuts	26,700	32,035	35,580	34,647	30%
	Vegetables	39,900	71,979	25,608	25,608	-36%
	Seed Crops	525	560	558	472	-10%
	TOTAL	**448,425**	**608,099**	**526,805**	**513,893**	15%
cwt[3]	Milk Production	38,920,000	40,354,000	42,803,000	41,471,000	7%

1. Excludes Pasture and Rangeland
2. Harvested Acres (excludes relatively small acreages for nursery and organic products)
3. cwt = one hundred pounds

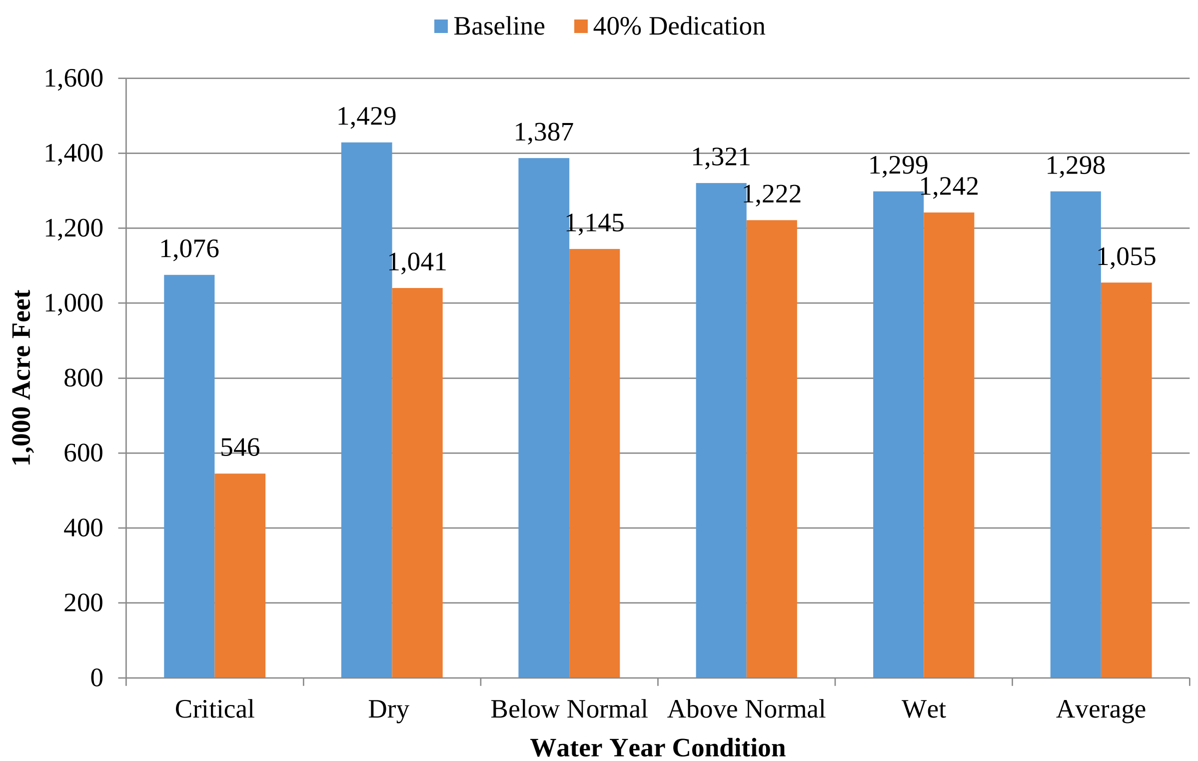
Information regarding the crop production of the Irrigation Districts is contained in Appendix 2.

3. THE WATER SUPPLY IMPACT OF PROPOSED FLOW OBJECTIVES

The proposed flow objectives for the San Joaquin River will fundamentally change the character of surface water rights to the Stanislaus, Tuolumne and Merced rivers. The SWRCB discussion focuses on the average annual impact of the flow objectives by type of water year. The focus on those averages provides, at best, an incomplete characterization of the potential impact of flow objectives on surface water rights. As discussed below, a critical impact of the flow objectives is a major reduction in the reliability of surface water supplies.

Figure 3-1 compares average annual applied surface water in the Study Area under the Baseline versus the 40% dedication of unimpaired flows.[5] The impact on applied surface water is more severe, the more severe are hydrologic conditions.

Figure 3-1
Average Annual Applied Surface Water for Study Area



Supply reliability relates to the amount of water available from a water right with a certain frequency. In assessing the water delivery reliability of the State Water Project, California's Department of Water Resources defines "water delivery reliability" as "the likelihood (probability)

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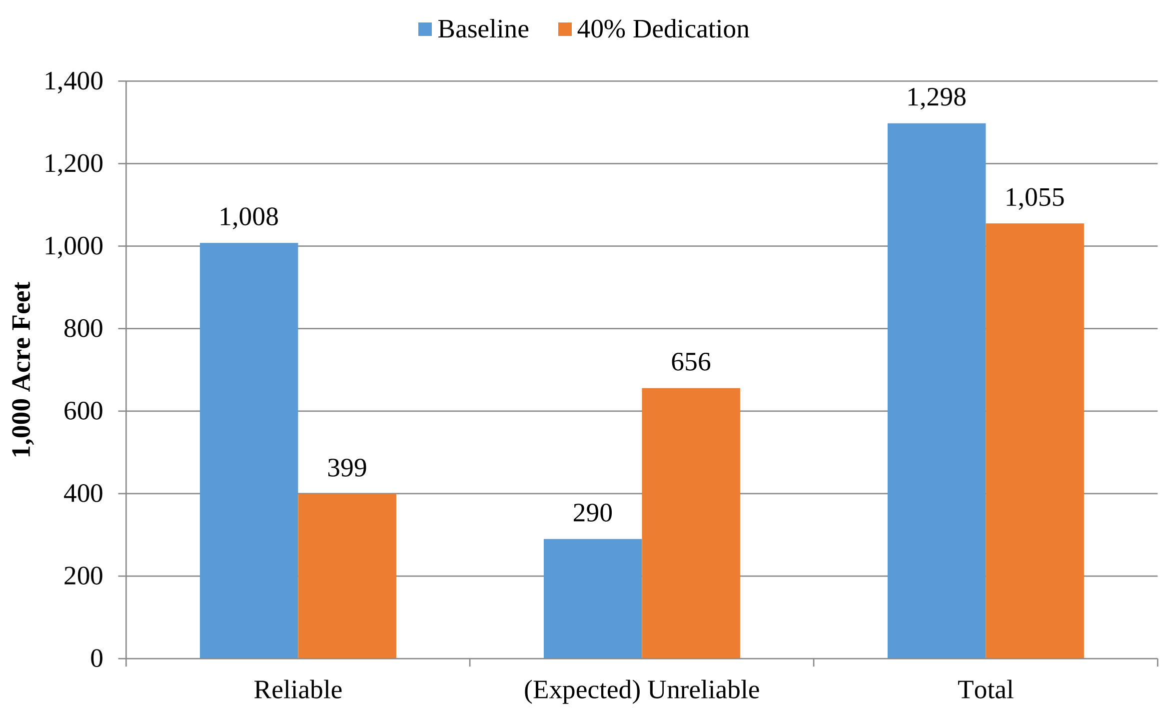
[5] Applied surface water measures the useable yield from surface water rights. Data from SWRCB Spreadsheet "GW and SW Use Analysis 09142016", tab "Applied SW".

that a certain amount of water will be delivered by the SWP in a year."[6] From this perspective, the reliable supply from a water right is measured by the amount of water available with an acceptably small likelihood of interruption.

Stratecon quantifies the reliable supply of surface water rights at the volume of surface water available with only a 10% likelihood of interruption. In other words, the volume of available water will fall short of the reliable supply at an expected frequency of once a decade. Unreliable supply is the volume of water available above the reliable supply.

The 40% dedication of unimpaired flows reduces both the volume of available surface water and its reliability. Figure 3-2 compares the reliable and (expected) unreliable annual applied surface water for the Study Area under the Baseline versus the 40% dedication of unimpaired flows.[7] Under the Baseline, almost 80% of the average annual amount of applied surface water would be a reliable supply. With 40% dedication of unimpaired flows, less than 40% of the average amount of applied surface water would be a reliable supply.

Figure 3-2
Annual Reliable and (Expected) Unreliable Applied Surface Water for Study Area



[6] "The State Water Project, Final Delivery Reliability Report 2013", State of California, Natural Resources Agency, Department of Water Resources, at p. 1.

[7] Applied surface water will exceed reliable supply in 90% of the years. Analysis based on data from SWRCB Spreadsheet "GW and SW Use Analysis 09142016", tab "Applied SW".

In comparison to the Baseline, the 40% dedication of unimpaired flows reduces the Study Area's annual reliable applied surface water from 1 million AF to 400 thousand acre-feet ("TAF") AF, a 60% reduction. The loss of an annual reliable supply of 600 TAF is partly offset by an increase in (expected) annual unreliable supply of 366 TAF. The focus on only the average impact on available applied surface water ignores the significant shift from reliable to unreliable surface water supplies.

Table 3-1 shows the reliable and (expected) unreliable annual applied surface water for the three rivers in the Study Area. For the Stanislaus River, the 40% dedication of unimpaired flows reduces average annual applied surface water by 62 TAF, with a reduction of annual reliable supply by 218 TAF partly offset by an increase in (expected) annual unreliable supply by 156 TAF. For the Tuolumne River, the 40% dedication reduces the average annual applied surface water by 111 TAF, with a reduction of annual reliable supply of 253 TAF partly offset by an increase in (expected) annual unreliable supply of 142 TAF. For the Merced River, the 40% dedication reduces the average annual applied surface water by 138 TAF, with a reduction of annual reliable supply of 253 TAF partly offset by an increase in (expected) annual unreliable supply of 68 TAF.

Table 3-1

Annual Reliable and (Expected) Unreliable Applied Surface Water (TAF)

River	*Scenario*	*Reliable*	*(Expected) Unreliable*	*Total*
Stanislaus	Baseline	329	78	407
	40% Dedication	111	234	345
Tuolumne	Baseline	484	121	605
	40% Dedication	231	263	494
Merced	Baseline	195	91	286
	40% Dedication	57	159	216

The significant reductions in supply reliability means that owners of water rights from the three rivers will face frequent, severe, and sustained losses of surface water—see Figure 3-3(a) to Figure 3-3(c).[8] The reduction in applied surface water has multi-year successive losses more than 150 TAF on the Stanislaus River, 250 TAF on the Tuolumne River, and 150 TAF on the Merced River. Water losses occur in about half the years included in SWRCB's study (48% on the Stanislaus River, 51% on the Tuolumne River and 52% on the Merced River).[9] The focus on

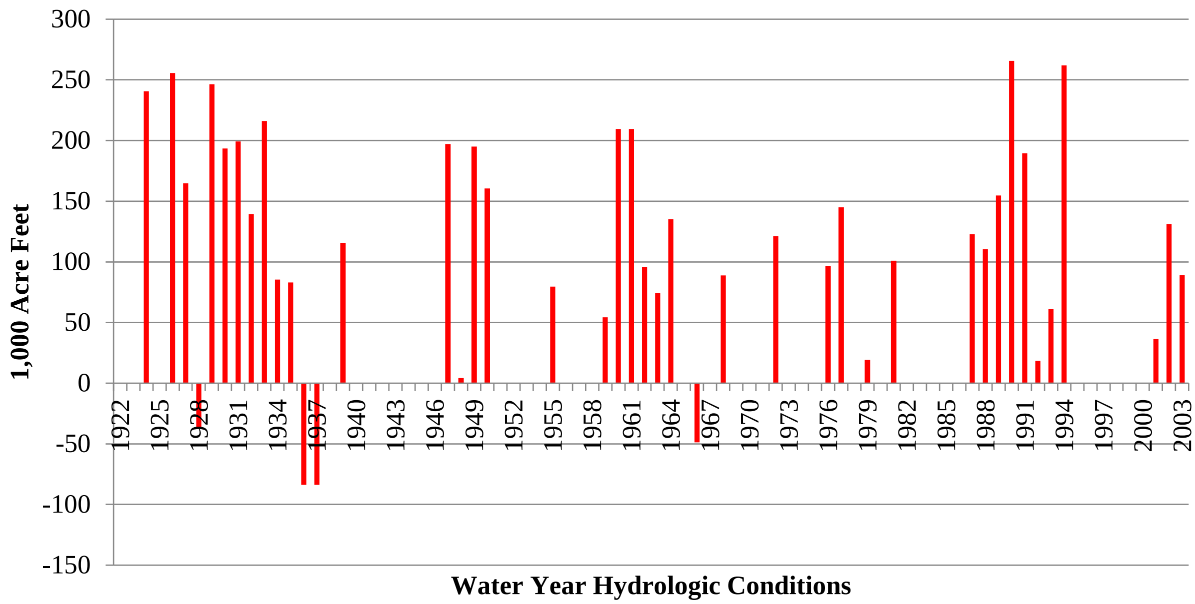
[8] Analysis based on data on applied surface water under the Baseline versus 40% dedication from SWRCB Spreadsheet "GW and SW Use Analysis 09142016", tab "Applied SW".

[9] The frequencies in the text calculated by the proportion of years in Figure 2-3(a) through Figure 2-3(c) with water losses.

average annual losses even by water year hydrologic conditions as in Figure 3-1 masks how much the 40% dedication of unimpaired flows increases the underlying volatility in available surface water supplies.

Assessing the economic consequences of the changes in the surface water rights on the Stanislaus, Tuolumne and Merced rivers requires more than (i) looking at each water year in isolation and (ii) averaging over the different water years. Using SWRCB's own analysis of available surface water under the Baseline versus a 40% dedication of unimpaired flows, the flow objectives for the San Joaquin River will reduce the volume and more significantly reduce the reliability of surface water supplies. Partially offsetting the loss of reliable surface water supplies with an increase in unreliable surface water supplies is not an attractive bargain.

Figure 3-3(a)
Annual Reductions in Applied Surface Water from Stanislaus River



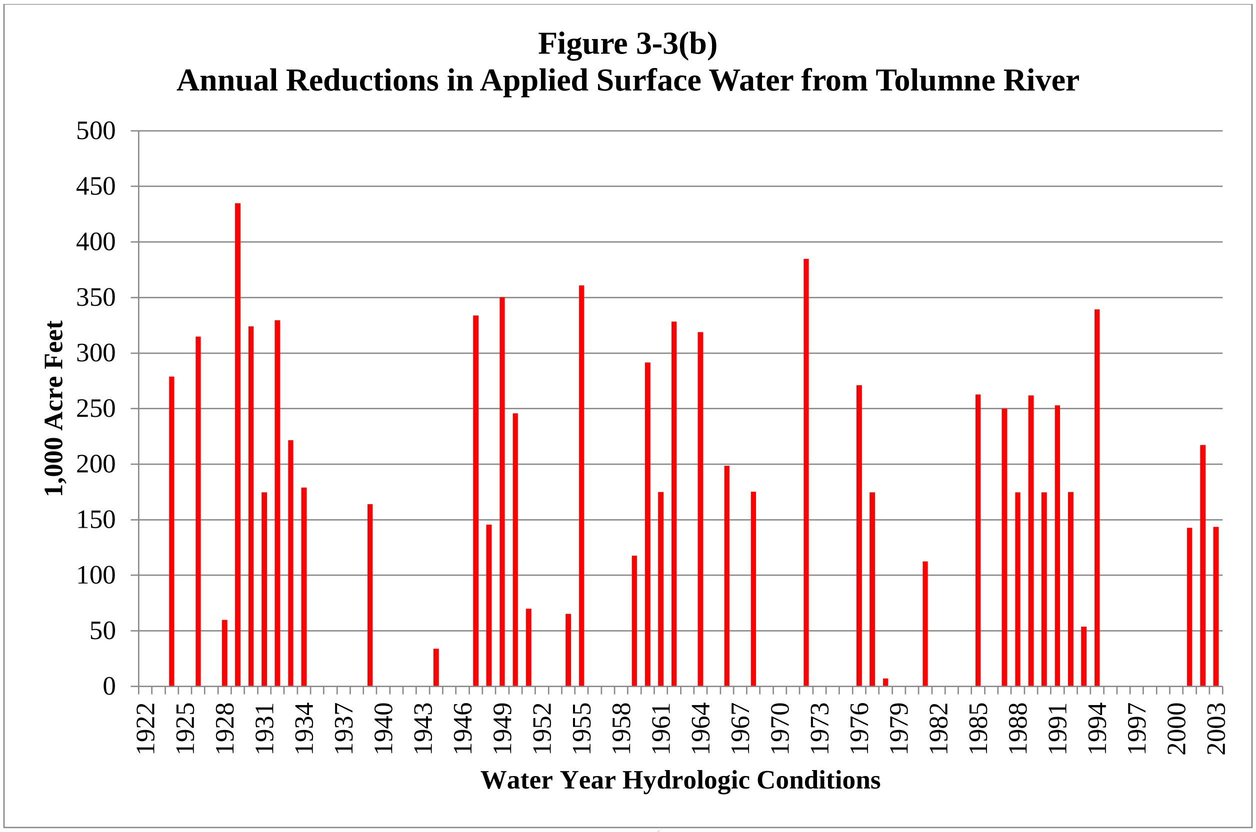


Figure 3-3(b)
Annual Reductions in Applied Surface Water from Tolumne River
1,000 Acre Feet
500
450
400
350
300
250
200
150
100
50
0
1922
1925
1928
1931
1934
1937
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
Water Year Hydrologic Conditions

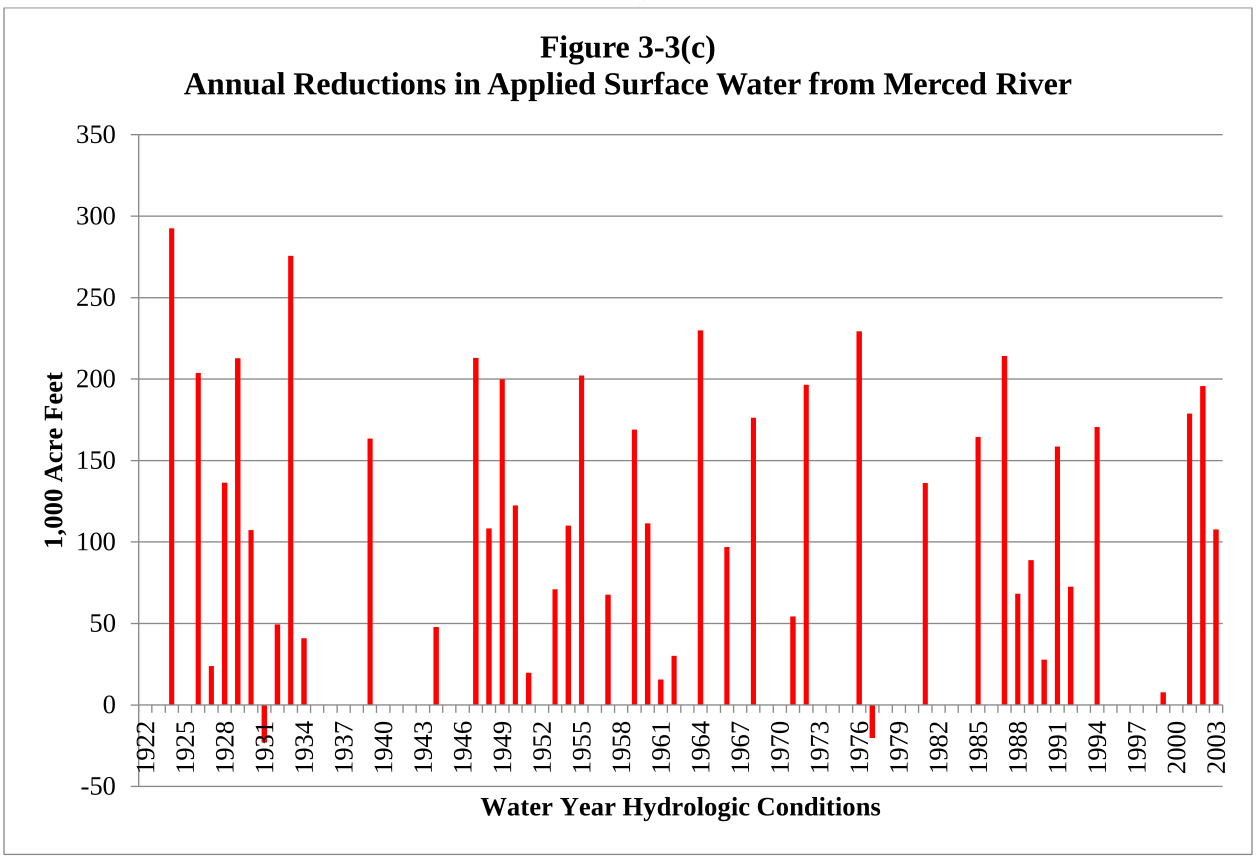


Figure 3-3(c)
Annual Reductions in Applied Surface Water from Merced River
1,000 Acre Feet
350
300
250
200
150
100
50
0
-50
1922
1925
1928
1931
1934
1937
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
Water Year Hydrologic Conditions

The reduction in the value of surface water rights is significant. Depending on the relative value of reliable water supplies to unreliable water supplies, implementation of SED 40 reduces the value of surface water rights by 40% to more than 50% due to the loss of reliable water supplies even though partly offset by increased unreliable water supplies (see Table 3-2).[10] With little if any Central Valley Project ("CVP") water available in 2015 and 2016, the prices Westlands Water District paid for transfer water exceeded $1,000/AF, three times the amount Westlands paid in 2013 (when CVP Allocation was 20%) and five times the amount paid during 2000-2012 (when water was more plentiful as CVP Allocations averaged 60%).[11] The annual value of reliable water supplies year in and year out, of course, is less than the value of water in years of peak values. Assuming the annual value of reliable water supplies is in the range of a 10% to 20% discount off the annual value of water in peak years, the relative value of reliable water supplies to unreliable water supplies is about 4x to 5x—near the bottom of Table 3-2.

Table 3.2

Impact of SED 40 Implementation on Value of Surface Water Rights

Relative Value of Reliable/Unreliable Water Supplies	*Lost Economic Value*
2	41%
3	48%
4	52%
5	54%

[10] The percentage reduction in the value of surface water rights from the substitution of unreliable for reliable water supplies depends on the relative value of reliable versus unreliable water supplies. Lost Economic Value equals the Economic Value under the Baseline less the Economic Value under SED 40, expressed as a percentage of the Economic Value under the Baseline. See Figure 3-2 for the quantities of reliable and expected unreliable water supplies under the Baseline and SED 40. In calculating Table 3.2, the value of unreliable supplies was set at $1 and the value of reliable supplies set at the multiple specified in the first column.

[11] "Westlands Again Pays High Price for Supplemental Water Due to Drought," *Journal of Water*, March 2016, http://journalofwater.com/jow/westlands-again-pays-high-price-for-supplemental-water-due-to-drought/.

4. SWRCB ANALYSIS

SED documentation includes chapters and appendices assessing the impact of the proposed flow objective on groundwater resources, agriculture, local economy, service providers, disadvantages communities, recreation, and hydropower resources. This section summarizes the SWRCB conclusions and key underlying assumptions.

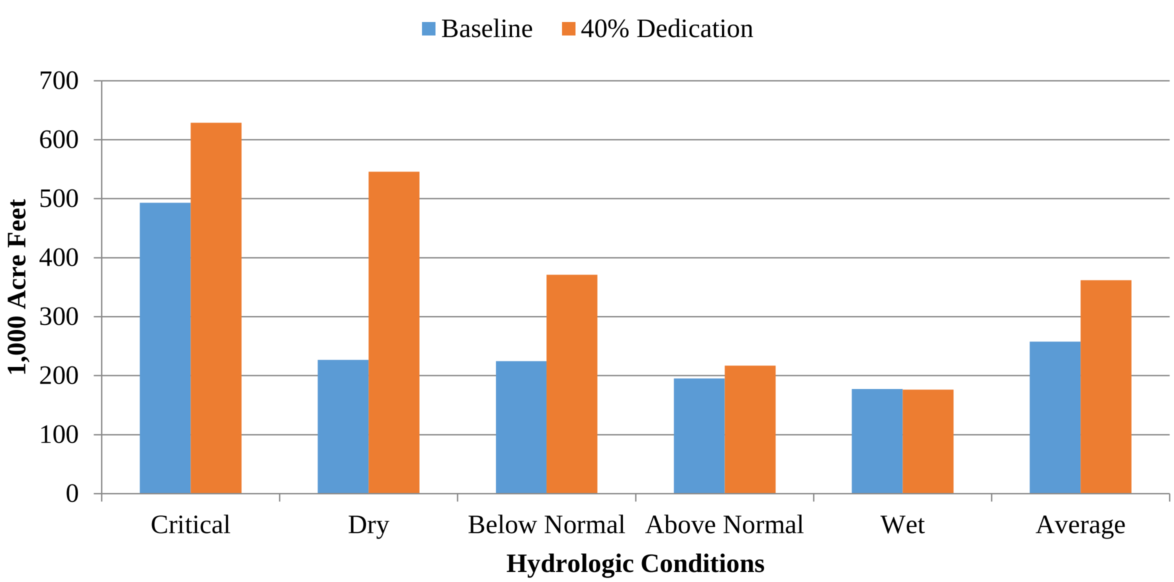
A. Groundwater Resources

There are two impacts of the proposed flow objective on groundwater resources: increased groundwater pumping and reduced groundwater recharge from the use of surface water. Each impact translates into increased stress on the Study Area's groundwater basins.

Groundwater Pumping

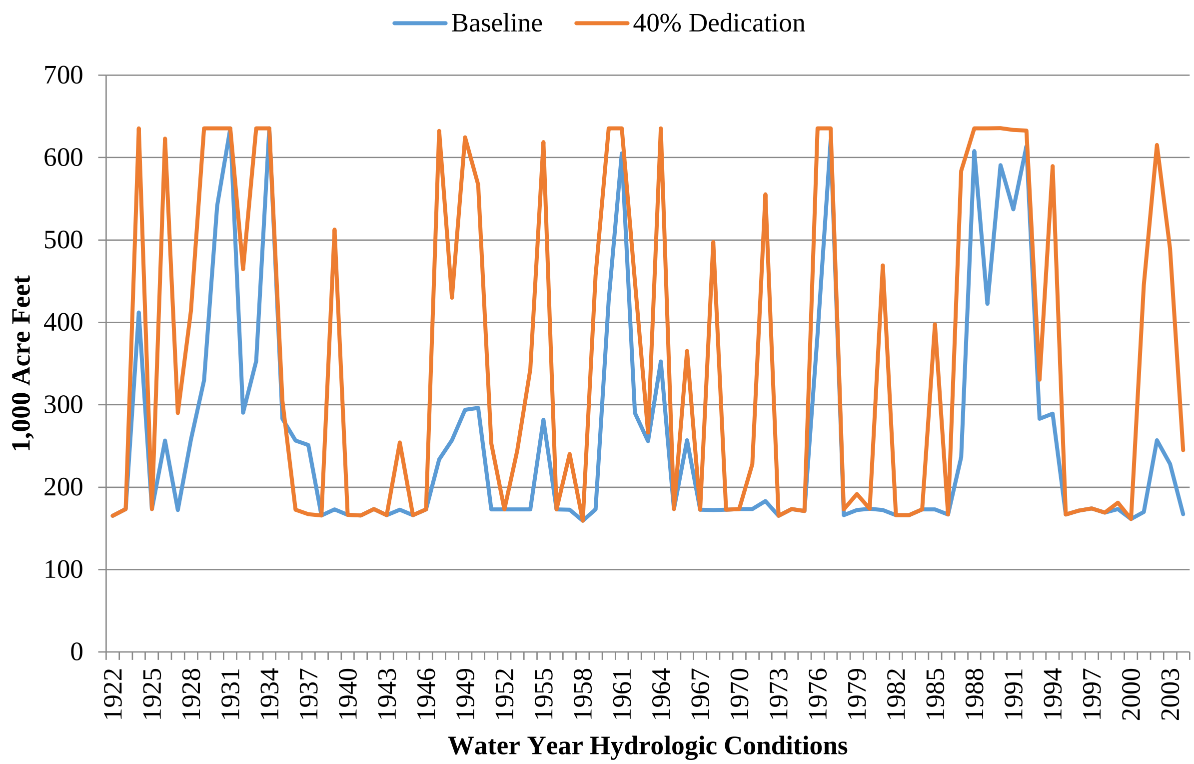
SWRCB staff project that implementation of the proposed flow objective will significantly increase groundwater pumping, especially when hydrologic conditions are critical, dry, or below normal (see Figure 4.1). Under the baseline, groundwater pumping hovers around 200,000 AF per year in all hydrologic conditions other than critical water years, when groundwater pumping increases to almost 500,000 AF per year. Under the proposed flow objective, groundwater pumping exceeds 600,000 AF per year in critical water years, 500,000 AF per year in dry water years, and almost 400,000 AF per year in below normal water years.

Figure 4.1
Average Annual Groundwater Pumping by Surface Water Users in Project Area



SWRCB staff project increased volatility in groundwater pumping (see Figure 4.2). Under the Baseline, groundwater basins are subjected to increased pumping only in years of critical hydrologic conditions. Under the proposed flow objective, the stress from spikes in groundwater pumping are more frequent. As discussed in Section 6, this increased frequency of spikes in groundwater pumping intensifies existing overdraft conditions and will not be viable once the Sustainable Groundwater Management Act is implemented.

Figure 4.2
Groundwater Pumping by Surface Water Users in Study Area



The above structure of how the proposed flow objective transforms the nature of groundwater pumping cascades down to all three rivers. For users of surface water from the Stanislaus River, groundwater pumping increases by 25% during critical years (when groundwater basins are already stressed by spikes in pumping), doubles in dry years and increases by 23% in below normal years (see Figure 4.3). As with the Study Area generally, there is a greater frequency of spikes in groundwater pumping by users of Stanislaus River surface water (Figure 4.4).

For users of surface water from the Tuolumne River, the increases in groundwater pumping are largest during years of dry conditions (49% increase) and below normal conditions (40% increase)—see Figure 4.5. Where baseline average annual groundwater pumping ranges between 80 TAF and 100 TAF under hydrologic conditions other than critical years, average annual groundwater pumping exceeds 130 TAF in below normal conditions and jumps to 150 TAF in critical and dry conditions. SWRCB staff project increased frequency in spikes in groundwater pumping (see Figure 4.6).

Figure 4.3
Average Annual Groundwater Pumping by Surface Water Users from Stanislaus River

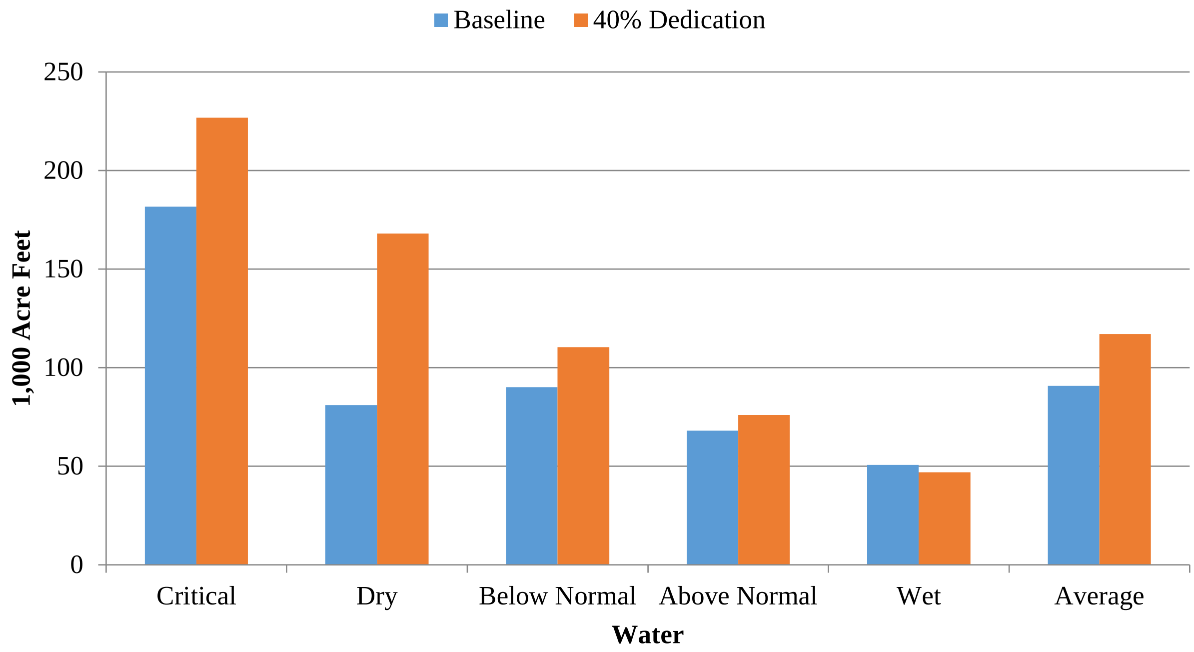


Figure 4.4
Groundwater Pumping by Surface Water Users from Stanislaus River

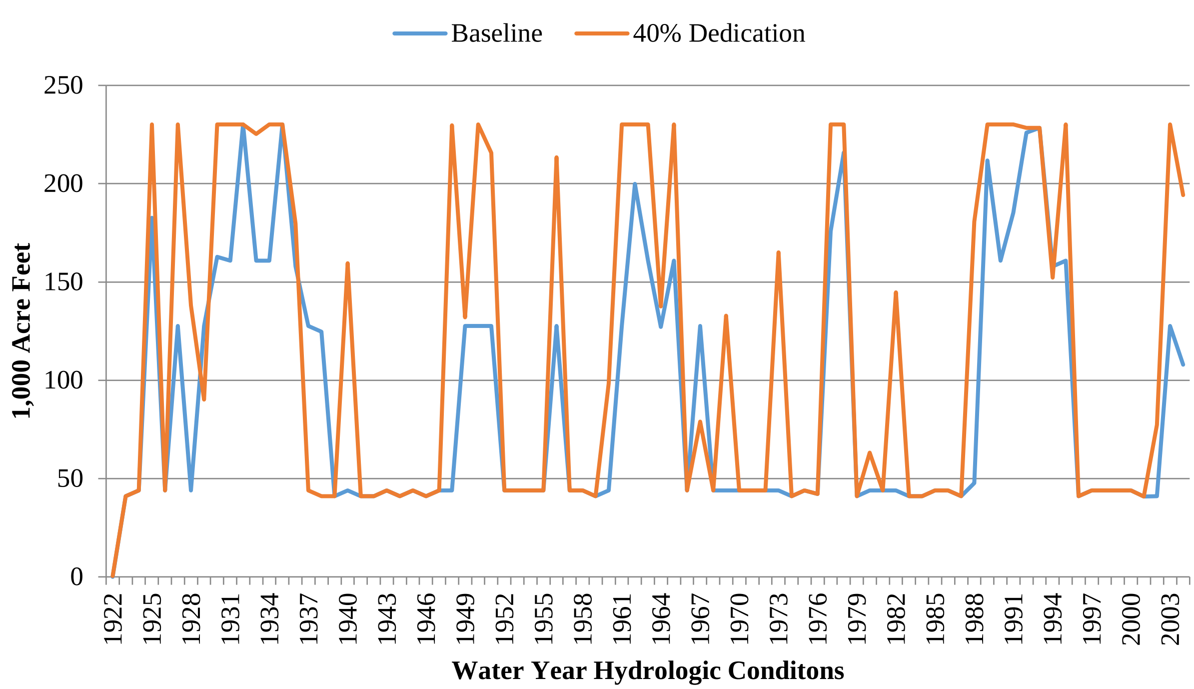


Figure 4.5
Average Annual Groundwater Pumping by Surface Water Users from Tuolume River

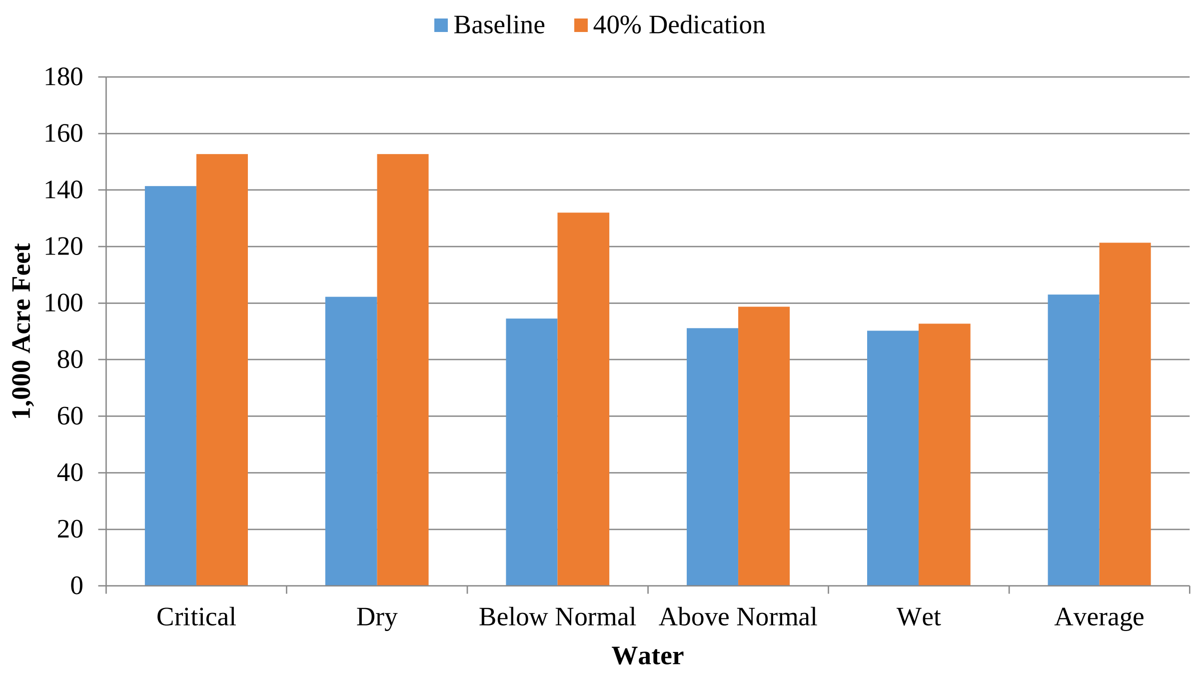
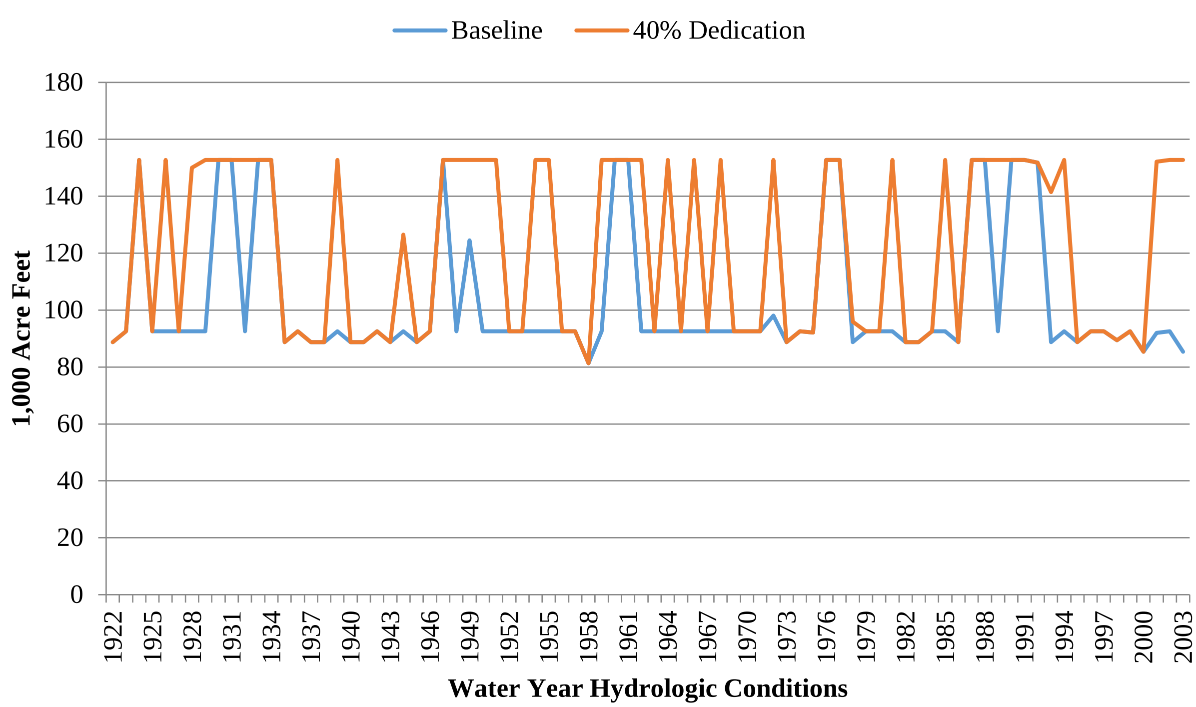
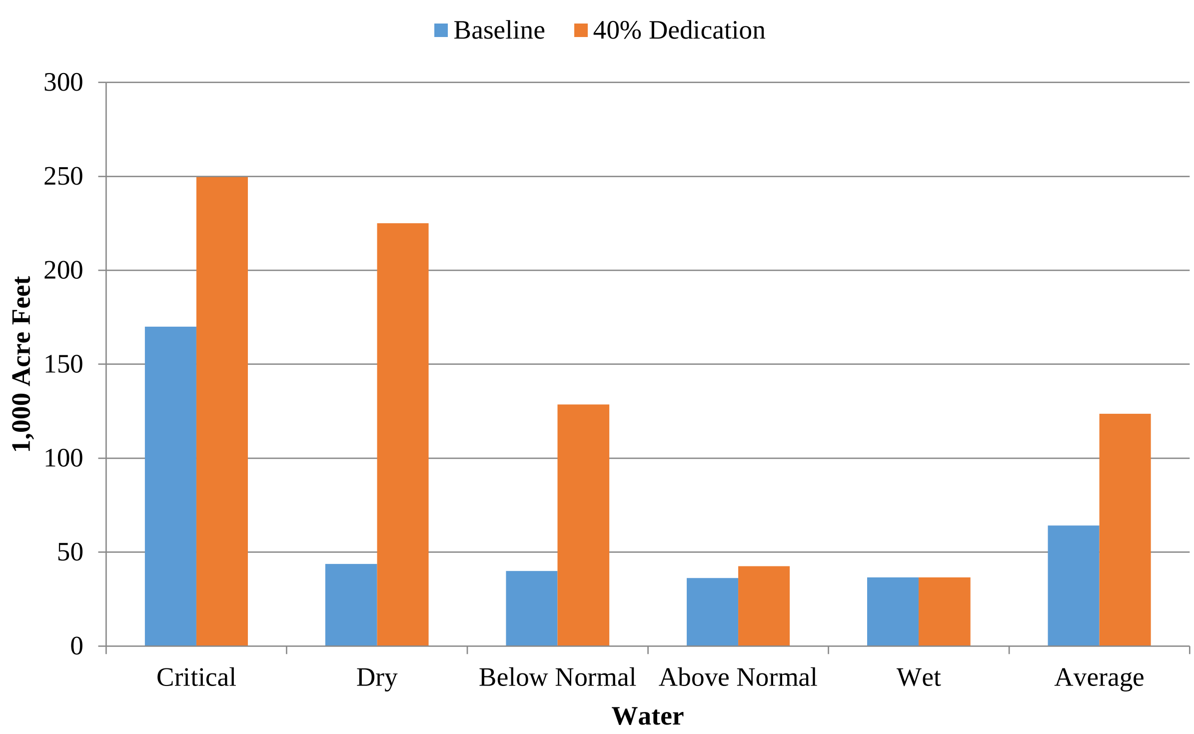


Figure 4.6
Groundwater Pumping by Surface Water Users from Tuolumne River

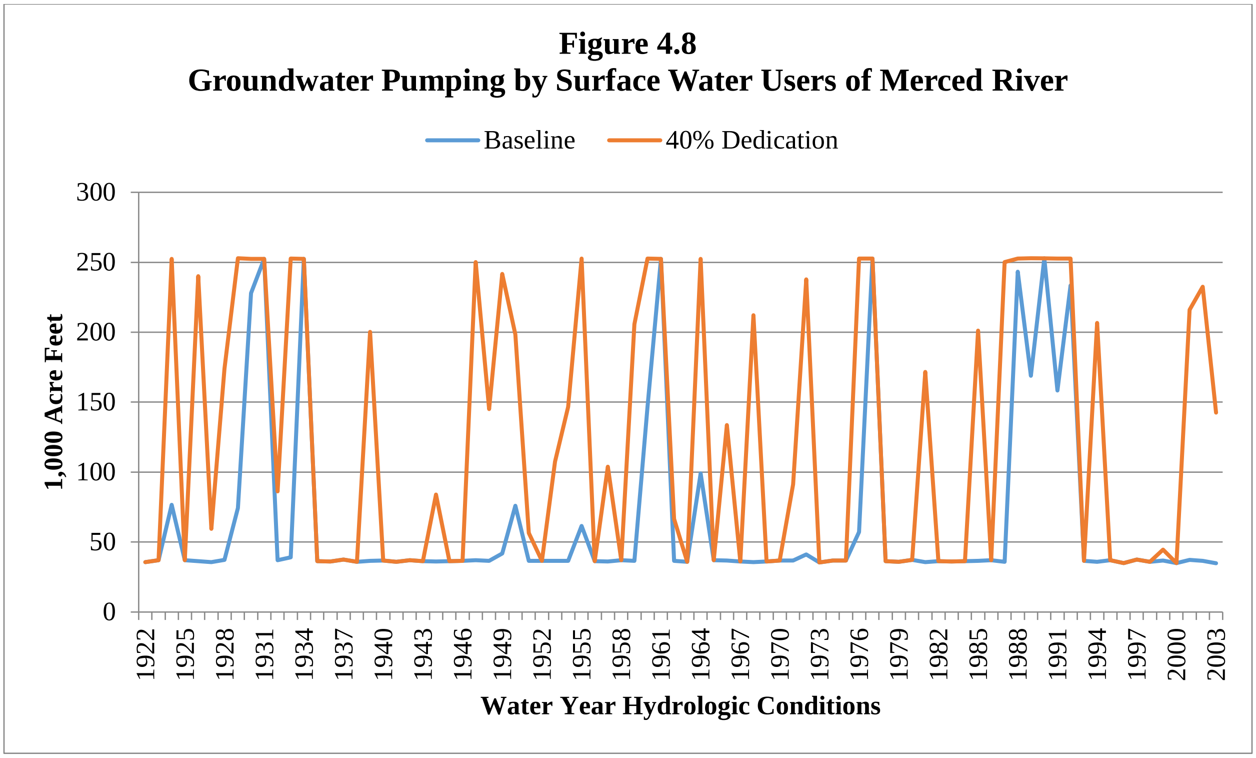


The projections are similar for users of surface water from the Merced River. Under the Baseline, annual groundwater pumping averages less than 50 TAF under all hydrologic conditions other than critical conditions (see Figure 4.7). Average annual groundwater pumping more than triples to 170 TAF in critical years. Implementation of the proposed flow objective increases average annual groundwater pumping by an additional 47% in critical years, 414% in dry years and 222% in below normal years. The proposed flow objectives increase the frequency and spikes in projected groundwater pumping (see Figure 4.8).

Figure 4.7
Average Annual Groundwater Pumping by Surface Water Users from Merced River



In sum, SWRCB projects that the proposed flow objective increases groundwater pumping by surface water users on all three rivers. Under the Baseline, groundwater pumping hovers around relatively low levels in all hydrologic conditions other than critical years. Average annual groundwater pumping spikes during critical years reflecting conjunctive use of groundwater to back stop reductions in available surface water. With the proposed flow objective, groundwater pumping steps up further to offset the loss of available surface water in critical, dry and below normal years.



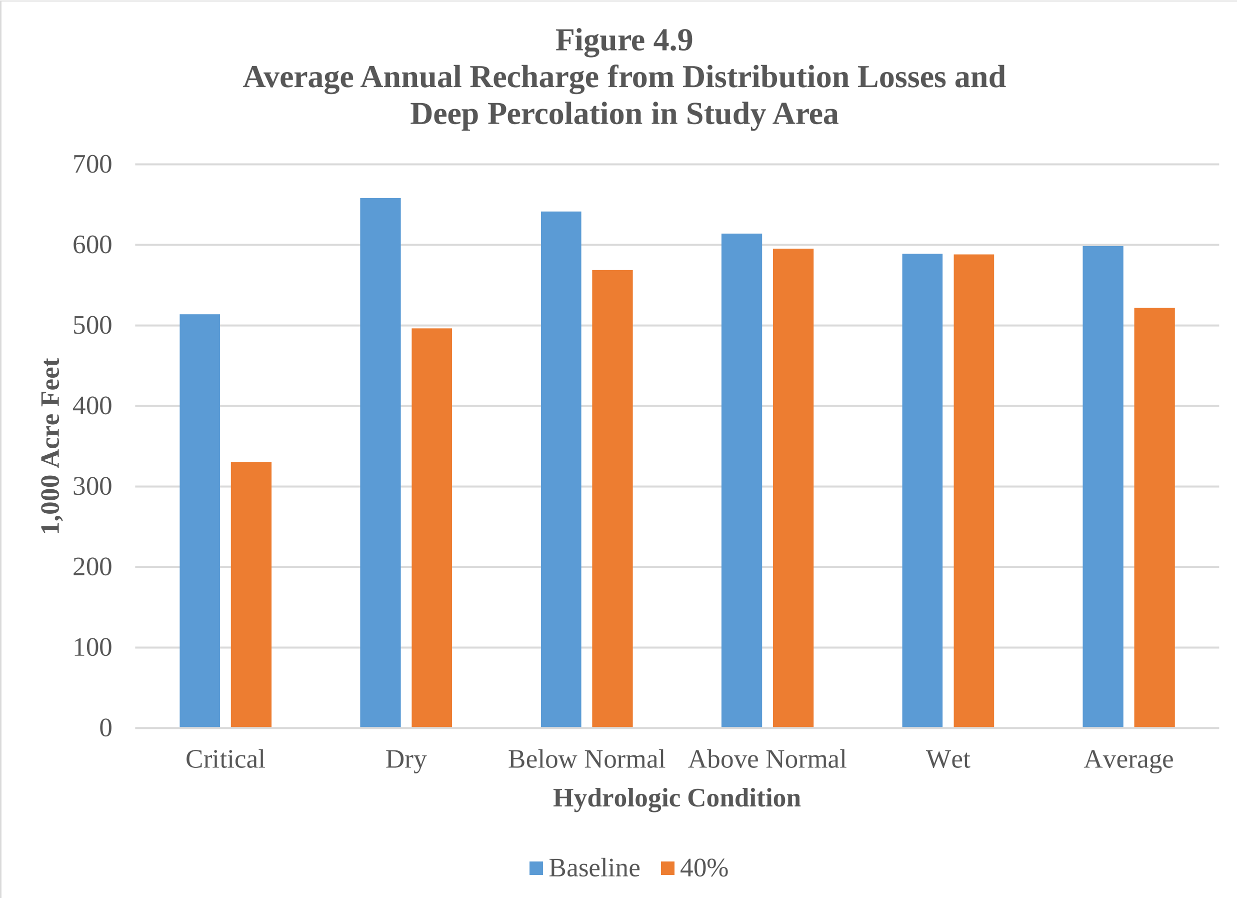
Reduced Groundwater Recharge

The use of surface water results in groundwater recharge from distribution seepage losses and deep percolation of water applied to crops. By reducing available surface water supplies, the proposed flow objective reduces groundwater recharge. For the entire Study Area, average annual recharge over all hydrologic conditions declines from 598 TAF to 522 TAF (see Figure 4.9). The loss of recharge is greatest during critical and dry years where the average annual loss of recharges is almost 200 TAF and more than 150 TAF respectively. Given the distribution losses and percolation rates from applied water, the lost groundwater recharge is proportional to the amount of lost surface water (see Table 4.1).[12] The volatility in lost recharge mirrors the volatility in lost surface water supplies.

Table 4.1
Proportional Impact of Losses in Applied Surface Water on Groundwater Recharge

District	*Impact of Surface Water on Recharge*
Central San Joaquin Water Conservation District	31%
Stockton East Water District	6%
South San Joaquin Irrigation District	32%
Oakdale Irrigation District	37%
Modesto Irrigation District	29%
Turlock Irrigation District	35%
Merced Irrigation District	32%

[12] The proportional impact in Table 4.1 is the estimated coefficient of statistical models relating annual losses of groundwater recharge for water years 1922-2003 to the annual loss of applied surface water.



B. Agriculture

The SWRCB analysis of the impact of the proposed flow objective is driven by the reduction in farming caused by the reduction in available water supplies. Given the assumption that groundwater pumping increases to offset the loss of surface water until groundwater pumping reaches maximum capacity, SWRCB staff assumes that the proposed flow objective only results in a loss of water supplies when groundwater reaches maximum capacity and cannot expand sufficiently to fully offset the loss of surface water supplies.

Significant reductions in crop acreage only occur during critical years under SWRCB's analysis (see Figure 4.10). In critical years, the average annual crop acreage in the Study Area declines from about 490,000 acres under the baseline to about 410,000 acres under the proposed flow objective. In dry years, the average annual crop acreage in the Study Area declines from about 517,000 acres under the baseline to about 486,000 acres under the proposed flow objective. As was the case with lost surface water supplies, focus on averages even by hydrologic condition obscures the underlying variability in SWRCB's estimated impact of the proposed flow objective on crop acreage (see Figure 4.11).

Figure 4.10
Crop Acreage in Study Area by Hydrologic Condition

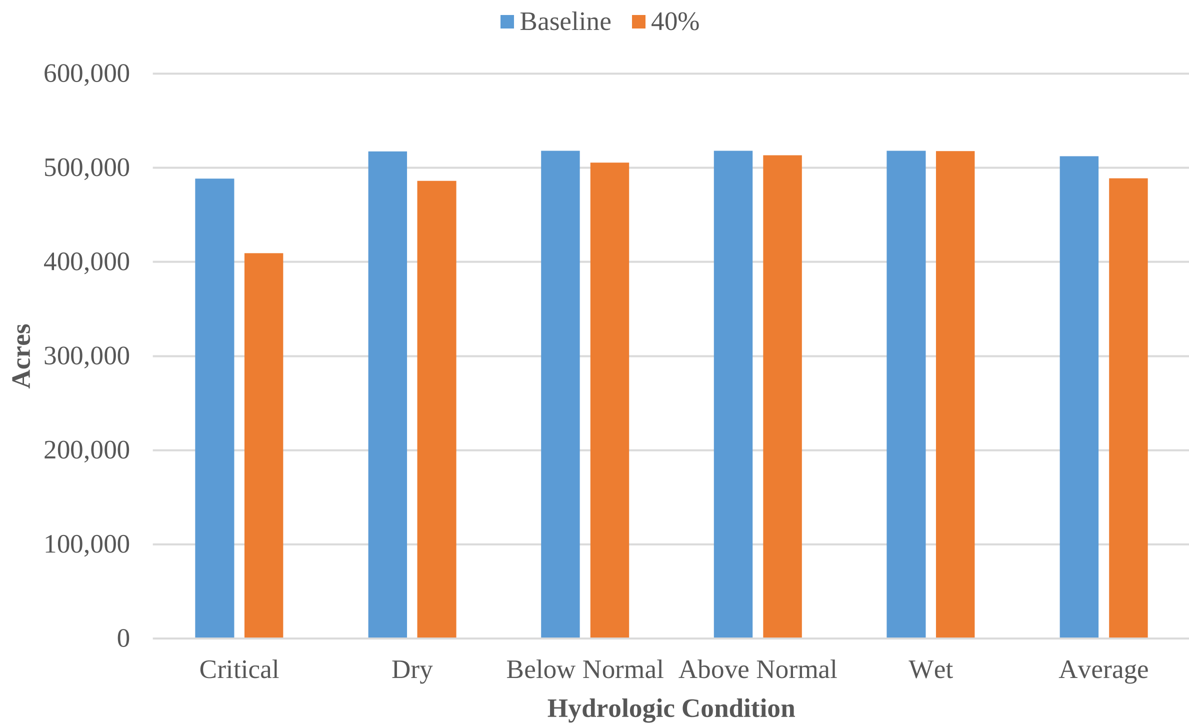
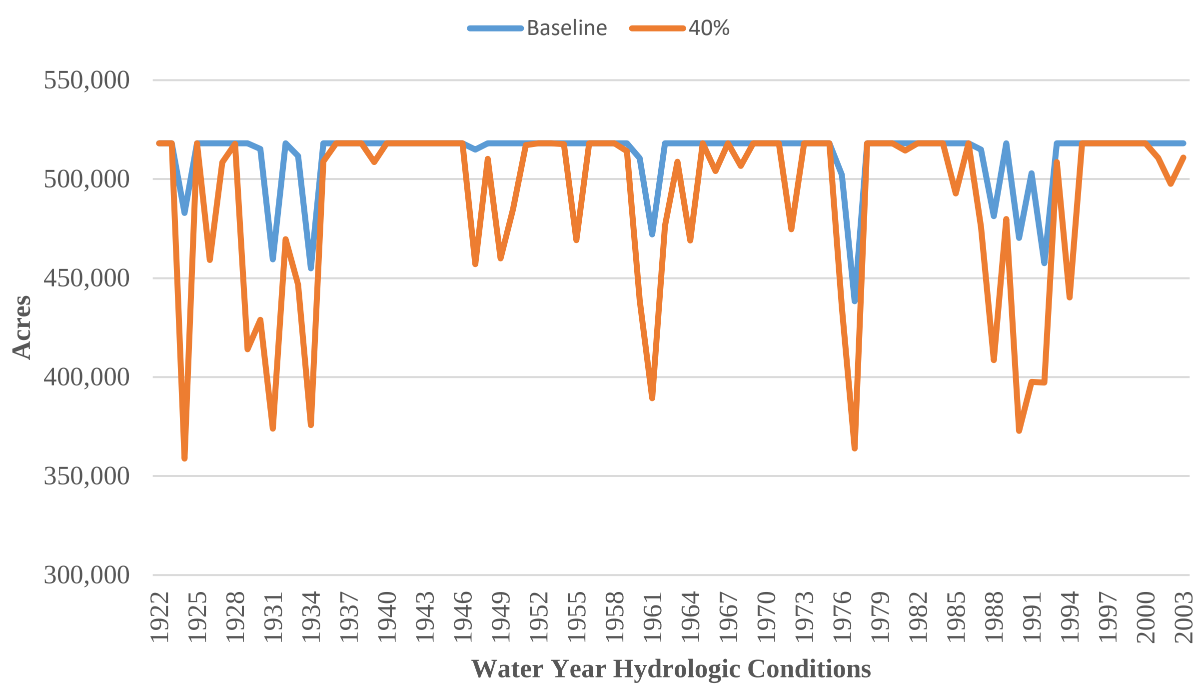


Figure 4.11
Crop Acreage in Study Area



The reduction in acreage is concentrated in grains, alfalfa, pasture and other field crops (see Table 4.2).[13] The reduction in acreage in vegetables and tree nuts is minor. This response is consistent with the findings from the Westlands Case Study (see Attachment 1).

Table 4.2
Distribution of Acreage Reductions by Crop and Hydrologic Condition

Hydrologic Condition	*Oil Seed*	*Grains*	*Vegetables*	*Fruit*	*Tree Nuts*	*Cotton*	*Sugar Beets*	*Alfalfa*	*Pasture*	*Other Field*	*Acreage Loss*
Critical	0.1%	22.0%	2.3%	1.2%	2.3%	0.1%	0.0%	16.2%	17.5%	38.3%	79,104
Dry	0.1%	11.6%	1.8%	1.1%	2.2%	0.0%	0.0%	27.2%	39.0%	16.9%	31,158
Below Normal	0.0%	10.5%	1.6%	1.2%	2.2%	0.0%	0.0%	25.7%	45.7%	13.1%	12,537
Above Normal	0.1%	8.6%	1.3%	1.3%	2.1%	0.0%	0.0%	23.4%	55.4%	7.7%	4,837
Wet	0.2%	8.1%	1.2%	1.9%	2.6%	0.0%	0.0%	5.3%	76.9%	3.9%	393
Average	0.1%	18.2%	2.1%	1.2%	2.3%	0.0%	0.0%	19.6%	26.2%	30.3%	23,421

How does one reconcile the average annual loss of about 300,000 acre feet per year of surface water (see Section 3) with the small average annual reductions in crop acreage of 23,421 acres (see Figure 4.10 and Table 4.2)? The answer is found in the SWRCB's assumption that increased groundwater pumping fully offsets the loss of surface water until pumping reaches maximum capacity. In effect, the loss of surface water is fully offset by increased groundwater pumping except in a few years such as when hydrologic conditions are critical.

The SWRCB assumption is not consistent with the experience of Westlands Water District who has been facing volatile surface water supplies since the 1990s (see Attachment 1). Groundwater pumping in Westlands offsets 50% of the change in surface water supplies, not 100%. In its analysis of the impact of the proposed flow objective, Stratecon assumes that groundwater pumping increases to offset half the loss of surface water supplies until pumping reaches its maximum capacity. Thus, Stratecon predicts that implementation of the proposed flow objective will result in more land fallowing than reported in the SED (see Section 6).

The view that use of the SWAP model under predicts land fallowing is illustrated by comparing estimates of drought impacts on crop acreage in the Tulare Lake Basin using the SWAP model with land fallowing in Westlands (see Table 4.3).[14] Crop acreage in Westlands accounts

[13] The percentages in Table 4.2 show the reduction in acreage for a crop relative to the total reduction in crop acreage (the last column) for the hydrologic condition (the first column). For example, during critical years the average annual reduction in crop acreage is 79,104 acres. The annual reduction in alfalfa acreage during critical years averaged 16.2% of 70,104 acres.

[14] Richard Howitt, Josua Medellin Aruara, Duncan MacEvan, Jay Lund and Daniel Sumner, "Economic Analysis of the 2014 Drought for California Agriculture", U.C. Davis Center for Watershed Sciences and eraeconomics, July 23, 2014, Table 4, p. 6 for estimated acreage reductions in Tulare Lake Basin. For Westlands land fallowing, Westlands Water District, District Water Supply Charts, http://wwd.ca.gov/wp-content/uploads/2016/06/Water-Supply-Charts.pdf. About 50,000 acres are fallowed independent of the availability of surface water (see Attachment 1).Therefore, land fallowing due to surface water availability equals acres fallowed less 50,000 acres.

for 19.6% of crop acreage in the Tulare Lake Basin.[15] In 2014, Westlands land fallowing from water availability (170,000 acres) equals 45.5% of the estimate for the drought impact for the entire Tulare Lake Basin, or 2.3 times Westlands share of crop acreage.[16] If the rate of land fallowing in Westlands was comparable to the rate of land fallowing in the Tulare Lake Basin, then actual land fallowing would be 2.3 times the estimated drought impact. For 2015 and 2016, Westlands actual land fallowing due to water availability exceeds the estimated drought impact for the Tulare Lake Basin. While groundwater pumping increases to offset losses of surface water supplies, the SWAP modeling efforts are assuming larger increases in groundwater pumping than occurs in practice.

Table 4.3

Estimated Drought Impacts on Crop Acreage in Tulare Lake Basin and Westlands Land Fallowing (thousand acres)

Year	Drought Impact Tulare Lake Basin	Westlands Land Fallowing	Westlands Land Fallowing Due to Water Availability
2014	373	220	170
2015	123	218	168
2016	108	225	175

C. Local Economy

The SWRCB staff estimates the impact of the proposed flow objective on the local economies of Stanislaus, San Joaquin and Merced counties (see Figure 4.12). The proposed flow objective is estimated to reduce the average annual economic output of the Study Area by $64 million (2008$).[17] Reflecting the fact that (i) the proposed flow objective reduces surface water supplies in critical, dry and below normal years, and (ii) the assumption that increased groundwater pumping will offset the loss of surface water supplies up to a maximum groundwater capacity, the loss of economic output in the Study Area is estimated to occur during below normal years, $50 million (2008$), about $100 million (2008$) in dry years and more than $200 million (2008$) in critical years.

To extent that the ability to expand groundwater pumping to offset the loss of surface water supply is overstated (see prior section), the economic impact of implementation of the proposed flow objective is understated.

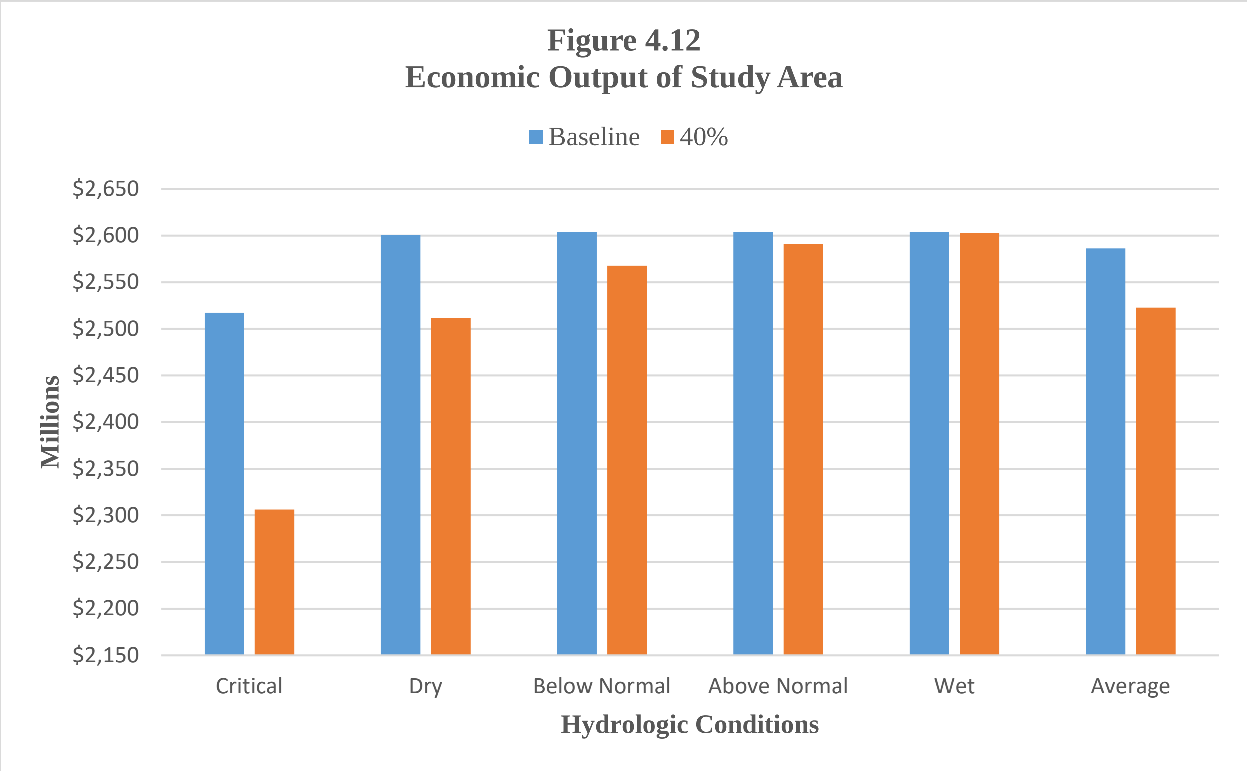
As with the loss of surface water supplies, focus on average impacts even by hydrologic conditions obscures the volatility of the estimated impact of the proposed flow objective on Study

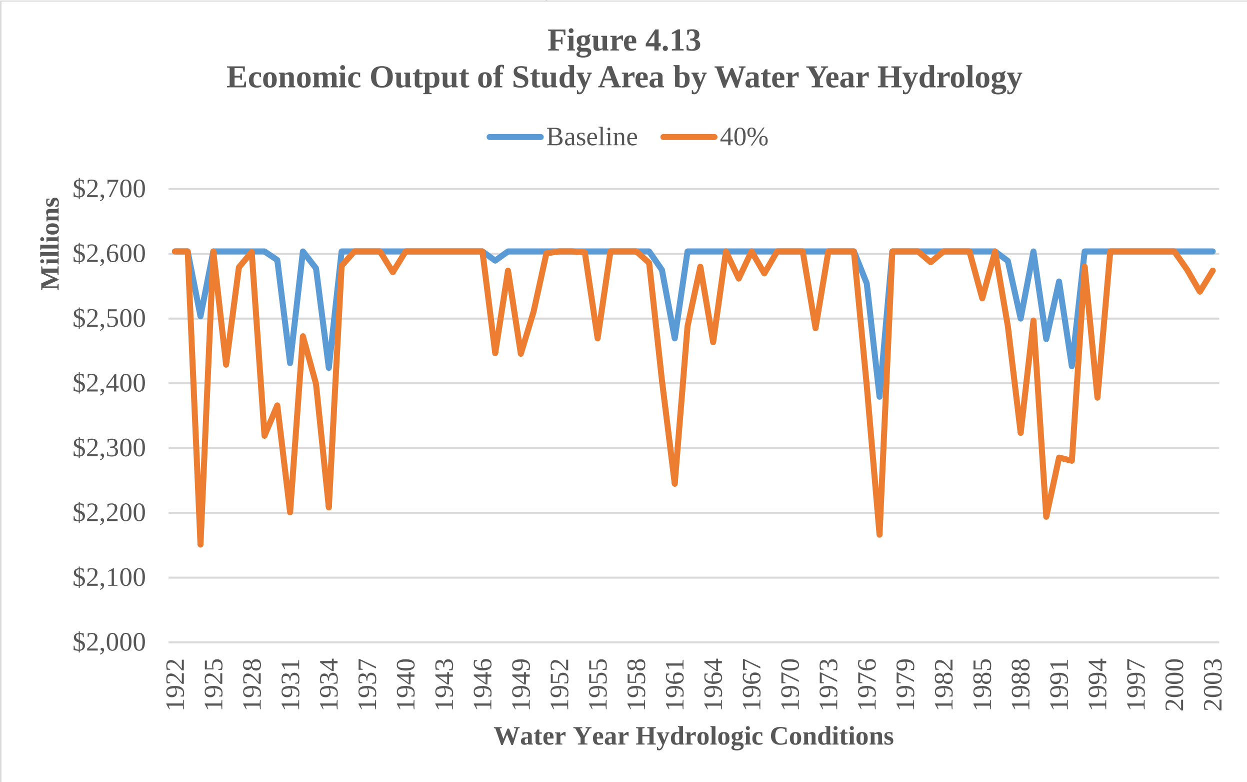
[15] In 2010, crop acreage in the Tulare Lake Basin totaled 2,892,700 acres (California Water Plan Update, Tulare Lake Hydrologic Region, Table TL-13, p. TL-40). Westlands crop acreage in 2010 equaled 568,700 acres (see Westlands Water District, District Water Supply Charts).

[16] 2.3 ≈ 45.5%/19.6%

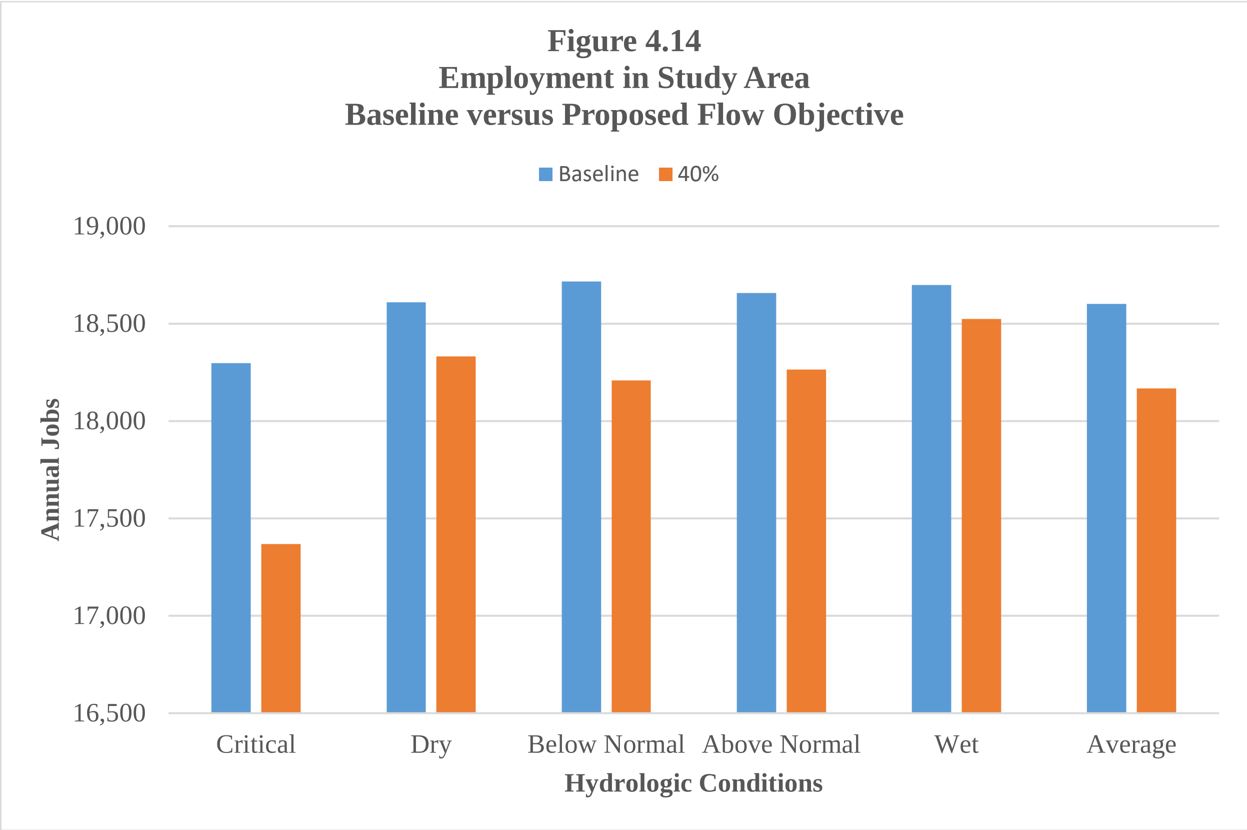
[17] Appendix G, Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives: Methodology and Modeling Results (hereinafter cited “Appendix G”), Table G.5-4, p. G-67.

Area's local economy (see Figure 4.13). The spikes of estimated losses in economic output exceed $300 million (2008$), or *five* times the average annual impact reported in the SWRCB staff report.

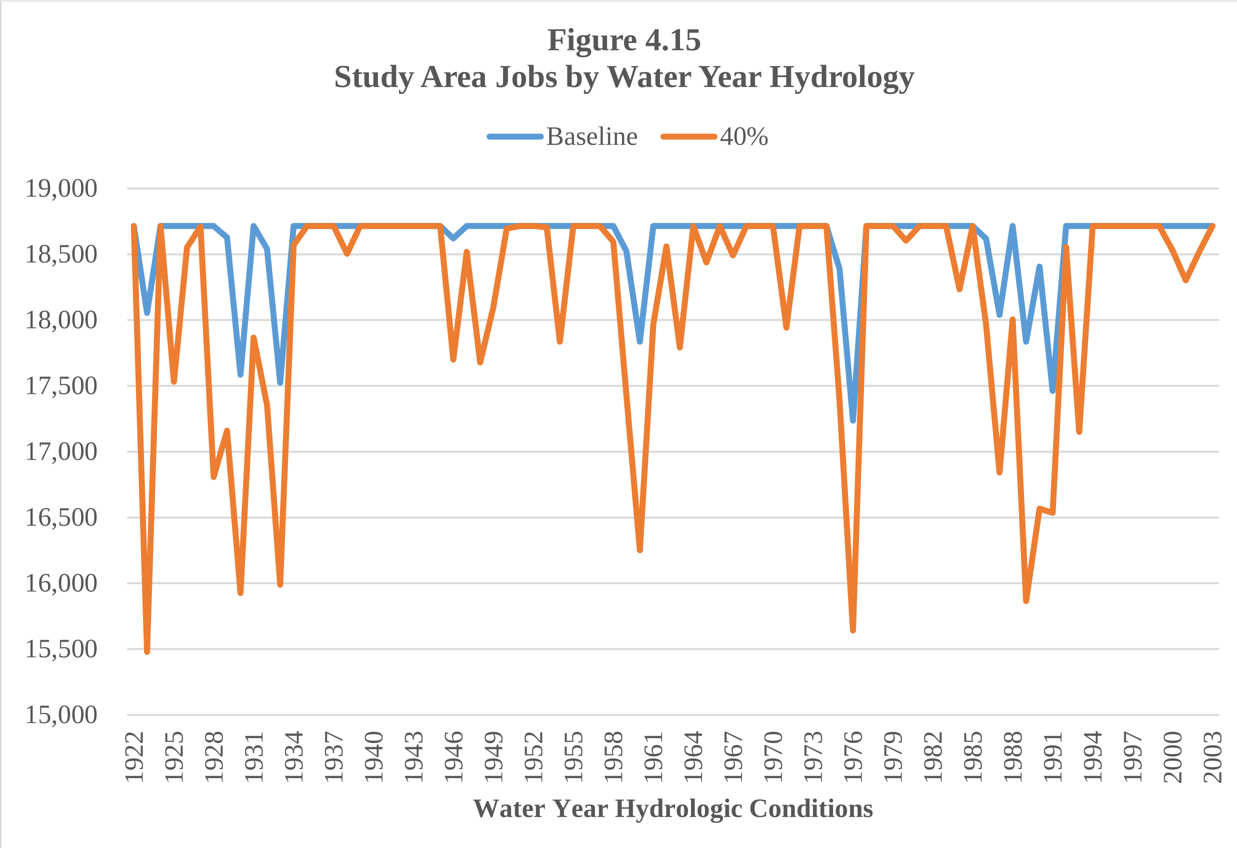




The SWRCB provides estimates of the job losses under their assumptions about the impact of the loss of surface water supplies on groundwater pumping (see Figure 4.14). The proposed flow objective is estimated to reduce jobs in the Study Area by 433.[18] Job losses average 929 in critical years. As with other impacts, focus on average annual impacts by even hydrologic conditions understates the volatility of the impact on the proposed flow objective on jobs in the Study Area (see Figure 4.15). The estimated annual job loss spikes at 1,500, or more than three times the average annual impact reported in the SWRCB staff report.



[18] Appendix G, Table G.5-6, p. G-70.



D. Service Providers

SWRCB staff discussion of the impact of the proposed flow objective on municipal water service providers center on the consequences of increased groundwater pumping for water systems reliant on groundwater. They expect significant and unavoidable impacts from substantial depletion of groundwater resources and need for construction of new or expanded water supply and treatment facilities.[19] They find less than significant that increased groundwater pumping will reduce groundwater quality sufficiently to violate water quality standards in public water systems.[20] They expect significant and unavoidable impacts from increased groundwater pumping will reduce groundwater quality sufficiently to violate water quality standards in domestic wells.[21]

The findings generally reflect a qualitative discussion with two exceptions. First, the conclusion about groundwater quality is based on the absence of water quality violations for a sample of public systems in 2014 when groundwater pumping increased.[22] Second, while well

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[19] Chapter 13, Service Providers, Table 13-1, p. 13-3.

[20] *Ibid*, Table 13-1, p. 13-5.

[21] *Ibid*, Table 13-1, p. 13-7.

[22] *Ibid*, Table 13-7, p. 13-19.

elevations are anticipated to fall with increased groundwater pumping, few public water systems have well depths less than 100 feet below the depth to groundwater.[23]

Neither factor is dispositive. Implementation of the proposed flow objective increases the frequency and magnitude of spikes in groundwater pumping relative to baseline (see groundwater resource discussion above). Therefore, to use the recent experience of the drought, which groundwater pumping increases in critical years under the baseline, does not provide any insight into whether implementation of the proposed flow objective will not create groundwater quality problems. In addition, public water systems undertake actions to address violation of water quality standards. Thus, the issue involves whether public water systems must undertake additional actions to meet water quality standards to avoid violations.

The difference between well depths and depth to groundwater does provide a cushion against increased groundwater pumping requiring deepening wells. However, there are many municipal water users not served by public water systems. One needs to assess specific circumstances of (a sample of) well users to assess the situation; something the SWRCB did not do.

[23] *Ibid*, p. 13-67.

5. GROUNDWATER RESOURCES

Reductions in surface water supplies due to the SED will impact groundwater resources in the Study Area by way of: (A) reduced percolation (groundwater recharge) from applied surface water, and (B) increased groundwater pumping to offset the loss of surface water supplies. The SWRCB assessment concludes that implementation of the SED flow objective will result in a significant and unavoidable decline in regional groundwater elevations, depletion of groundwater supplies, substantial interference with groundwater recharge and potential migration of groundwater contamination.[24] Despite these conclusions, however, the SWRCB quantifies none of the impacts.

It is common knowledge that all sub-basins in the Study Area are experiencing steadily declining well elevations (increasing depths to groundwater) and are over drafted (see Table 5.1).[25] Furthermore, other than the Eastern San Joaquin Sub basin, well elevations within the Study Area have declined faster the first approximately 15 years of this century than over the last three decades of the 20th century.[26] Accordingly, any SED-related expansion of groundwater pumping will only exacerbate the existing overdraft conditions resulting in greater depths to groundwater; i.e.; further material declines in regional well elevations.

Table 5.1
Average Annual Decline in Well Elevation and Overdraft in Study Area

Sub basin	Well Level Decline (inches/year)	Well Level Decline (inches/year)	Overdraft (TAF/year)
Eastern San Joaquin	20.0	5.3	88
Modesto	6.0	17.0	11 to 15
Turlock	2.8	20.0	9 to 85
Merced	12.0	27.0	22 to 44
Time Period	1970-2000	2005-2010	

But for a notable exception discussed below, the irrigation districts in the Study Area do not have the historical experience with enough surface water supply variability and associated offsetting variability of their groundwater pumping and the associated effects on well elevations to effectively evaluate the potential regional response to the substantial reductions in surface water supplies associated with SED implementation.[27] The one exception is the historical experience of the Stockton East Water District and Central San Joaquin Water Conservation District with respect to their surface water supplies from New Melones Reservoir, whose past experience with surface water supply variability is instructive on what might be expected with regards to the

[24] Chapter 9, Groundwater Resources, p. 9-4.

[25] *Ibid*, Table 9-4, p. 9-17.

[26] See discussion below of the Eastern San Joaquin Sub basin.

[27] See discussion in Section 2 of water district data and in Section 3 on the reliability of surface water supplies under the baseline.

response of the Study Area's irrigation districts that rely on surface water to SED-related reductions in those districts' surface water supplies. This past experience and that of Westlands, which is located outside of the Study Area, but also is instructive on potential irrigation district response and resulting impacts, within the Study Area to substantial and sustained surface water supply reductions, are referred to herein as "natural experiments" as they are inferences not based on complex models built on a myriad of assumptions but straightforward assessments of what actually has been empirically observed.

A. The New Melones Reservoir Natural Experiment

The litigation between Stockton East Water District and Central San Joaquin Water Conservation District versus the United States over water deliveries from New Melones Reservoir represents a "natural experiment" for characterizing the relationship between volatility in surface water availability and associated variability in groundwater pumping and the resulting impacts on local well elevations.[28] As background, Stockton East and Central San Joaquin entered into a water delivery contract with the Bureau of Reclamation for the delivery of up to 155,000 acre feet per year of water from the New Melones Reservoir. The central issue of the litigation came with the passage of the Central Valley Project Improvement Act, and the Bureau of Reclamation's decision that except in wet years it would not be able to deliver the water specified in the contract due to other demands for the water.[29] As discussed below, the Bureau's breach of its contract with the irrigation districts resulted in a volatile surface water supply for Central San Joaquin.

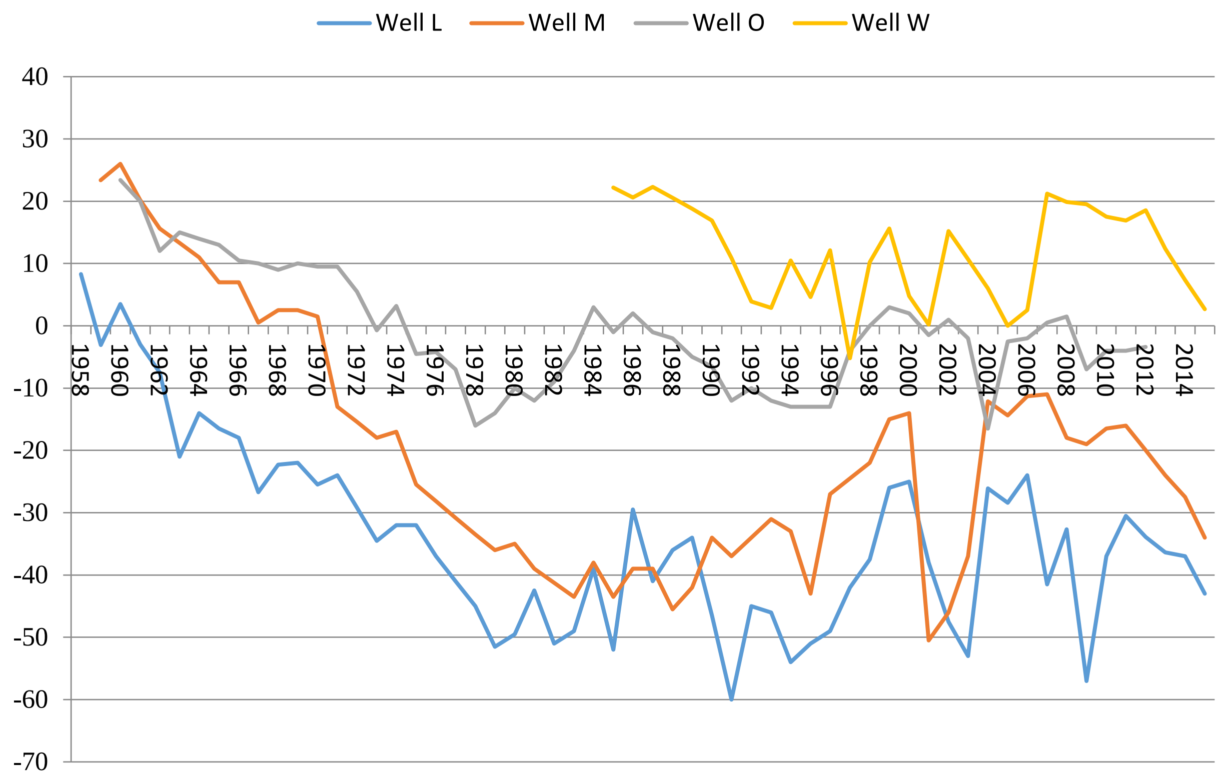
Well elevations in Central San Joaquin have been steadily declining since the late 1950s to the point that the elevations of district wells with long histories have been below sea level for decades (see Figure 5.1 for the historical trend in a sample of the district's wells).[30] In fact, efforts to protect the area's groundwater resources from declining well elevations and from resulting salinity intrusion was a primary reason for the formation of Central San Joaquin Water Conservation District and the contract for water from the New Melones Reservoir.

[28] See the most recent federal appellate decision for discussion, *Stockton East Water District and Central San Joaquin Water Conservation District v. United States*, U.S. Court of Appeals for the Federal Circuit, 2013-5078.

[29] *Ibid, p.*

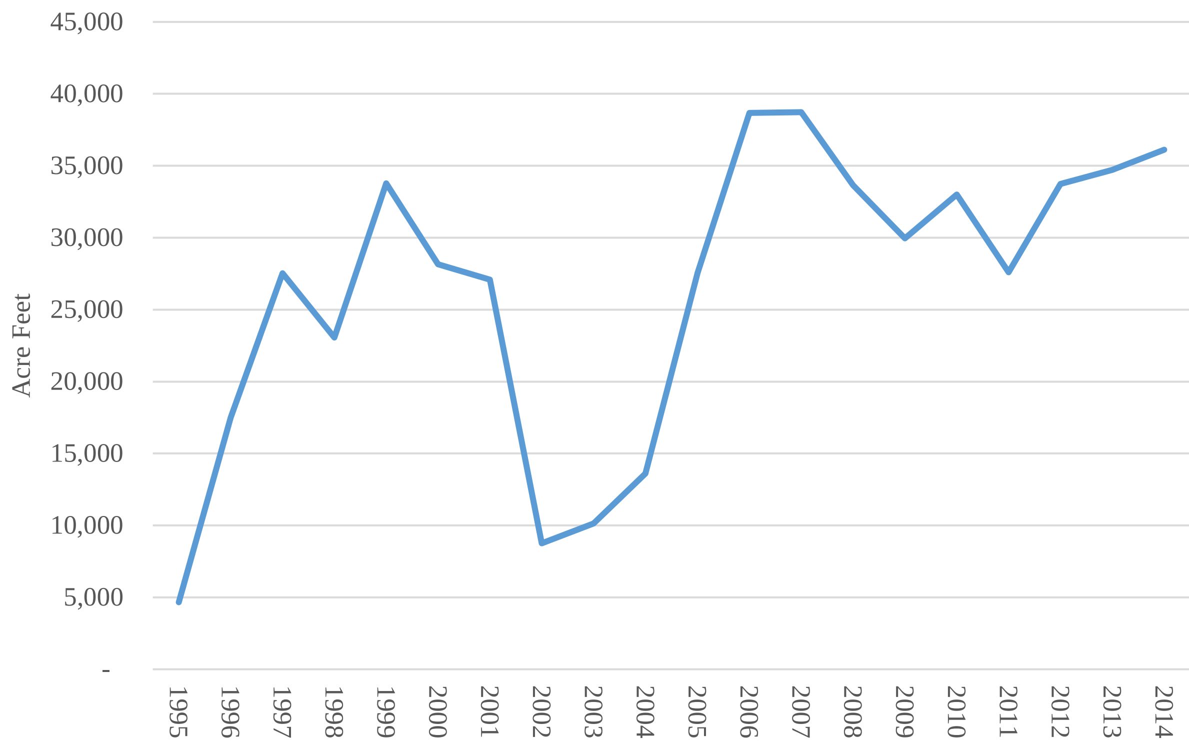
[30] Figure 5.1 presents the wells in Central San Joaquin presented in San Joaquin County Flood Control and Water Conservation District's Spring 2016 Groundwater Report. The location of the wells can be found in Figure 2-1 Well Hydrograph Locations at p. 2-15.

Figure 5.1
Spring Well Hydrographs in Central San Joaquin



The declining trend in well elevations bottomed out in the mid-1990s with the commencement of New Melones surface water deliveries (see Figure 5.1). Since then, well elevations have varied up and down from year to year, as has the delivery of surface water (see Figure 5.2).

Figure 5.2
Bureau of Reclamation Water Deliveries to Central San Joaquin



Stratecon conducted a statistical analysis of the historical data for a number of wells within Central San Joaquin to estimate the impact of surface water deliveries on well elevations. Data on groundwater pumping by landowners is not available. The models relate annual well elevations to surface water deliveries (measured in 1,000 acre feet, "TAF"), the annual change in well elevation over time and Stockton rainfall.[31] The analysis indicates that: A) surface water deliveries increased well elevations significantly for Well L, Well M and Well O where there has been a significant declining trend in well elevations; B) surface water deliveries have no effect on the elevation of Well W, which has had no declining trend in elevation over time; C) Stockton rainfall has no impact on elevations for the first three wells in the table and D) the elevation of the relatively stable Well W declines with rainfall.

Table 5.2
Statistical Analysis of Spring Well Hydrograph in Central San Joaquin

Item	*Well L*	*Well M*	*Well O*	*Well W*
Intercept				
Coefficient	-7.29	17.29	17.48	31.21
T-Statistic	-1.72	3.36	6.01	2.65
P-Value	10%	<0.1%	<0.1%	<0.1%

[31] Stockton Rainfall at Fire Station No. 4. Spring 215 Groundwater Report, p. 1-2, data provided by San Joaquin County Flood and Water Conservation District.

Item	*Well L*	*Well M*	*Well O*	*Well W*
Surface Water (TAF)				
Coefficient	1.04	1.52	0.57	-0.00
T-Statistic	7.07	8.43	5.79	-0.01
P-Value	<0.1%	<0.1%	<0.1%	99%
Trend				
Coefficient	-1.21	-1.67	-0.74	-0.19
T-Statistic	-9.94	10.67	-8.42	-0.65
P-Value	<0.1%	<0.1%	<0.1%	52%
Rainfall				
Coefficient	-0.07	-0.18	-0.13	-0.78
T-Statistic	-0.29	-0.62	-0.79	-2.92
P-Value	77%	54%	44%	0.7%
R^2	0.65	0.70	0.61	0.26

T-statistic: ratio of coefficient to the standard deviation of estimated coefficient

P-Value: probability of the estimated coefficient if its true value were zero

B. Impact of Proposed Flow Objective on Well Elevations

Stratecon applied the findings from the New Melones "natural experiment" to estimate the impact of the proposed flow objective on well elevations in the Study Area as a result of the SED at the 40% unimpaired flow levels. As shown by the Central San Joaquin experience, the impact of surface water deliveries is not uniform (undoubtedly reflecting non-uniform aquifer characteristics and water usage patterns). The estimated range of impacts for areas with a declining trend in well elevations is defined by the findings for Wells L, M and O in Central San Joaquin. Before presenting the findings, the discussion addresses why findings from Central San Joaquin may be informative for circumstances elsewhere in the Study Area.

Table 5.3 shows the Spring 2016 elevations for key wells in San Joaquin County.[32] Like Central San Joaquin, well elevations are below sea level in Stockton East. The annual decline in elevations are a little slower in Central San Joaquin than Stockton East.[33] Therefore, application of the findings from the Central San Joaquin "natural experiment" to Stockton East may understate the impact of the proposed flow objectives on well elevations in Stockton East.

The situation of South San Joaquin Irrigation District may be different. Well elevations are currently above sea level with a greater variability in the current annual rate of decline in

[32] Data compiled from Spring 2016 Groundwater Report, San Joaquin County Flood and Water Conservation District.

[33] The San Joaquin County Flood and Water Conservation District computes the annual change by relating well elevation to trend. As discussed above, the declining trend in well elevations in Central San Joaquin bottomed out with the introduction of surface water. As a result, the calculation of annual change in well elevations reported in Table 5.2 includes the impact of the introduction in surface water.

elevations. The circumstances of Well T is most comparable to the circumstances of the most stressed wells in Central San Joaquin. The other wells are most comparable to the least stressed wells in Central San Joaquin.

Table 5.3
Spring 2016 Well Elevations in San Joaquin County

District	*Well*	*Spring 2016 Elevation (feet msl)*	*Depth to Groundwater (feet)*	*Annual Change (feet)*
Central San Joaquin Water Conservation District	L	-42.0	106.1	-0.6
	M	-34.0	132.5	-0.6
	O	-3.4	51.4	-0.3
	W	6.2	118.8	-0.1
South San Joaquin Irrigation District	P	54.0	81.0	-0.4
	T	1.5	73.5	-0.8
	V	21.0	50.0	-0.1
Stockton East Water District	F	-68.0	132.0	-0.9
	G	-13.3	145.5	-0.9
	I	-56.8	129.8	-0.9
	J	-60.6	135.6	-0.8
	X	-1.0	8.5	+0.1

Well elevations in the other sub basins are declining considerably more rapidly and those declines accelerating as compared to the Eastern San Joaquin (see Table 5.1). The rate of decline is slowing in the Eastern San Joaquin. To the extent that declines in surface water availability have greater impacts on sub basins experiencing the most rapid declines in well elevations, application of the findings from the Central San Joaquin "natural experiment" to the other districts in the Study Area may under-estimate, rather than over-estimate, the impact on well elevations of reduced surface water availability due to the SED.

C. Central San Joaquin Water Conservation District

Figure 5.3 shows the impact of the proposed SED flow objective on elevations of Well L, Well M and Well O.[34] The impact on well elevations is greatest in dry years ranging between 20 feet and almost 50 feet (when reduction in available surface water is the greatest) and between almost 10 feet and 20 feet in critical years (when the reduction in available surface water supplies is less than in dry years). The focus on average impacts even by water year hydrologic conditions fails to capture how much the proposed flow objective may increase the volatility in well elevations (see Figure 5.4). The reduction in well elevations spike between 60 feet to 90 feet.

[34] Reduced well elevation estimated by multiplying the reduction in available surface water (measured in TAF) by the coefficient for the surface water variable in Table 5.2 (rounded values 1.0 for Well L, 1.5 for Well M, and 0.6 for Well O).

Figure 5.3
Impact of Proposed Flow Objective on Well Elevations
Central San Joaquin Water Conservation District

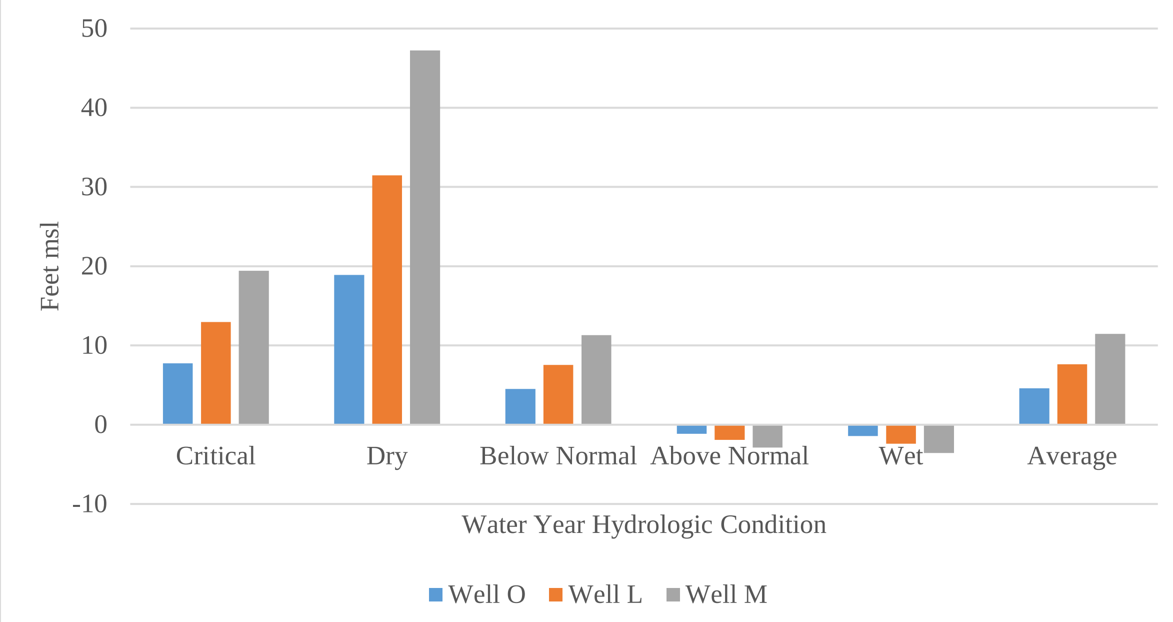
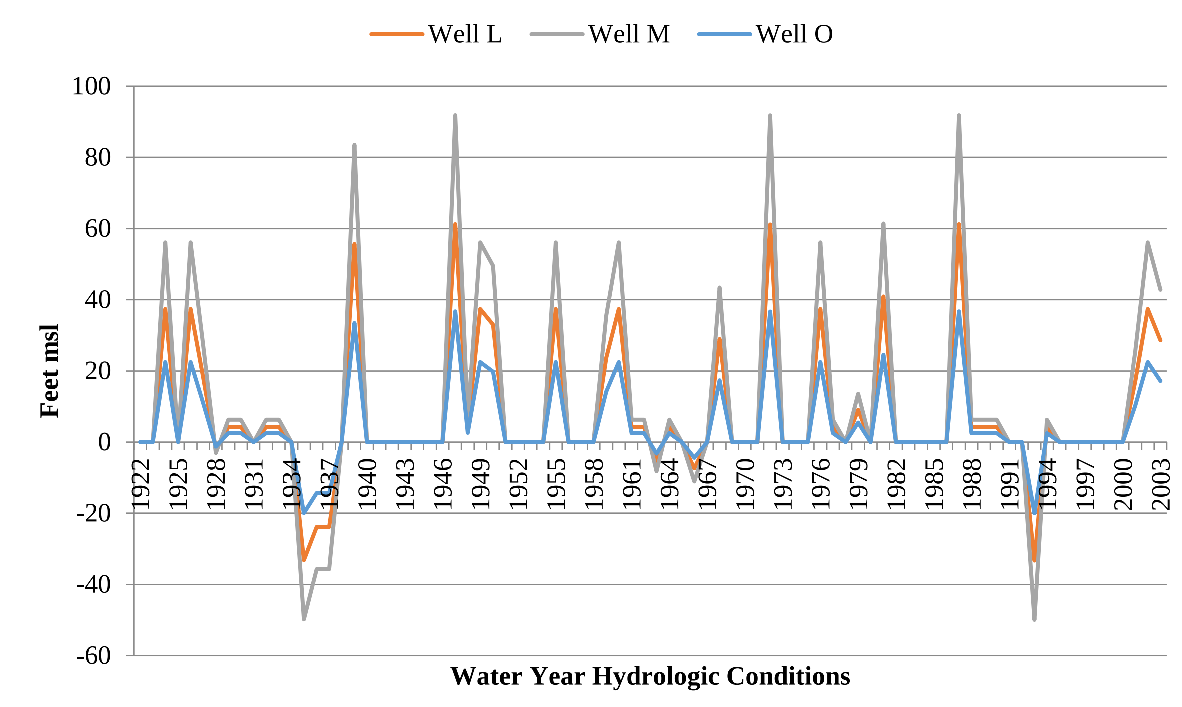


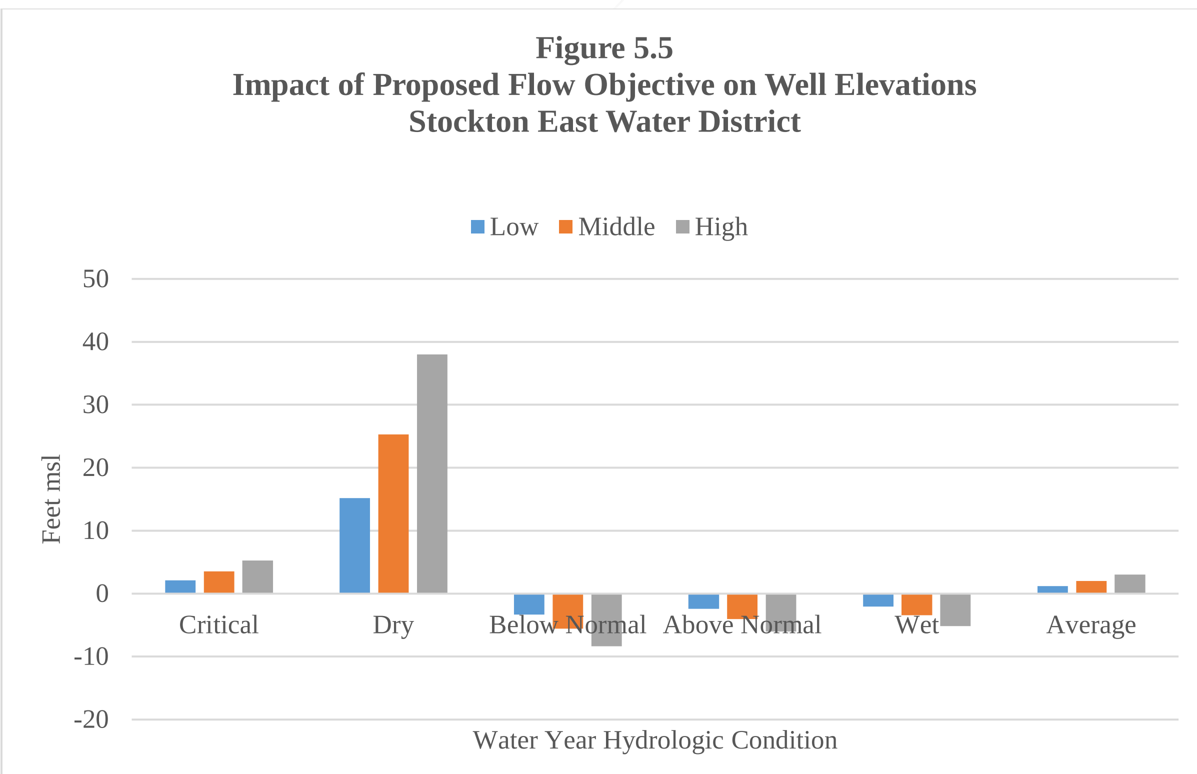
Figure 5.4
Reduced Well Elevations in Central San Joaquin



For the other water districts, the range of impacts on well elevations is defined on the low end by Well O impacts, middle by Well L impacts and the high end by Well M impacts. Reduction in well elevations are estimated by multiplying the reduction in available surface water (measured in TAF) by the coefficient for the surface water variable in Table 5.2 (rounded values 1.0 for Well L, 1.5 for Well M, and 0.6 for Well O). The results are adjusted (multiplied) by the irrigated acreage in Central San Joaquin relative to the irrigated acreage in other water districts.[35] In effect, the estimated impacts vary among the districts reflecting differences in the amount of surface water lost per irrigated acre.

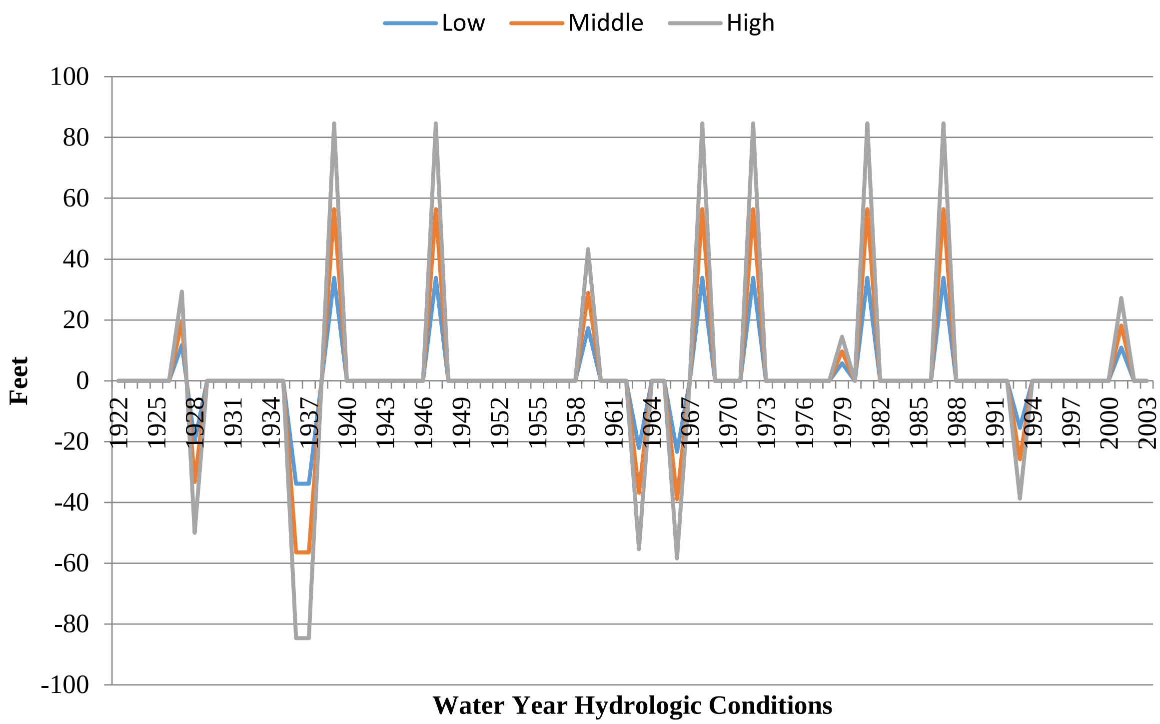
D. Stockton East Water District

Figure 5.5 shows the range of impacts of the proposed flow objective on well elevations in Stockton East. Stockton East suffers smaller losses of surface water per acre than Central San Joaquin. The impact on well elevations is greatest in dry years ranging from between 15 feet and almost 40 feet (when reduction in available surface water is the greatest) and up to 5 feet in critical years (when reduction in available surface water is lower than in critical years). The focus on average impacts even by water year hydrologic conditions fails to capture how much the proposed flow objective increases the volatility in well elevations (see Figure 5.6). The reduction in well elevations spike between 40 feet to 80 feet.



[35] Source for irrigated acreage, *Appendix G: Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives: Methods and Modeling Results* (hereinafter cited as Appendix G). Table G.4-1, p. G-44.

Figure 5.6
Reduced Well Elevations in Stockton East Water District



E. Southern San Joaquin Irrigation District

Figure 5.7 shows the range of impacts of the proposed flow objective on well elevations. Southern San Joaquin suffers larger losses of surface water per acre than Central San Joaquin. The impact on well elevations is greatest in critical years ranging between 30 feet and 80 feet (when the reduction in available surface water is the greatest) and between 10 feet to 30 feet in dry years (when the reduction in available surface water is lower than in dry years). The focus on average impacts even by water year hydrologic conditions fails to capture how much the proposed flow objective increases the volatility in well elevations (see Figure 5.8). The reduction in well elevations spike between 60 feet to 120 feet.

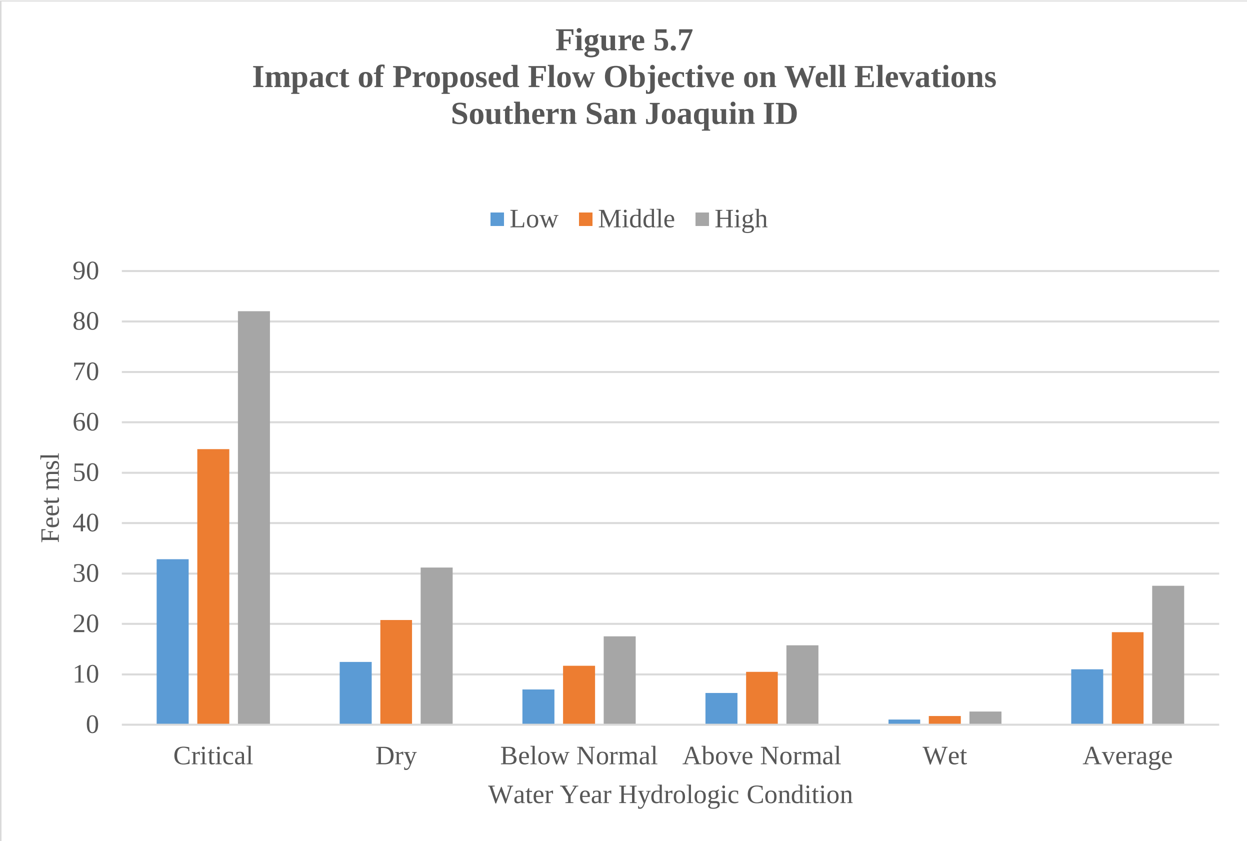


Figure 5.7
Impact of Proposed Flow Objective on Well Elevations
Southern San Joaquin ID
Low
Middle
High
Feet msl
90
80
70
60
50
40
30
20
10
0
Critical
Dry
Below Normal
Above Normal
Wet
Average
Water Year Hydrologic Condition

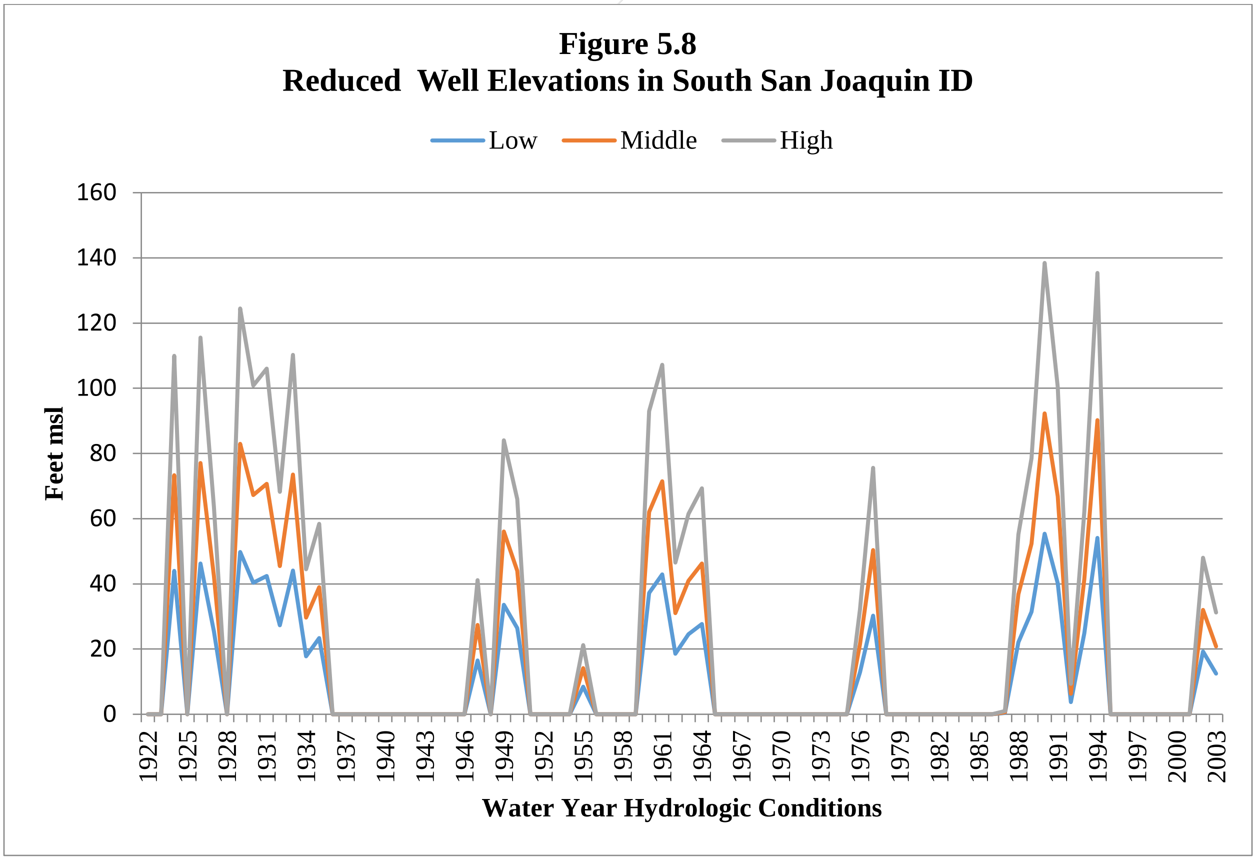
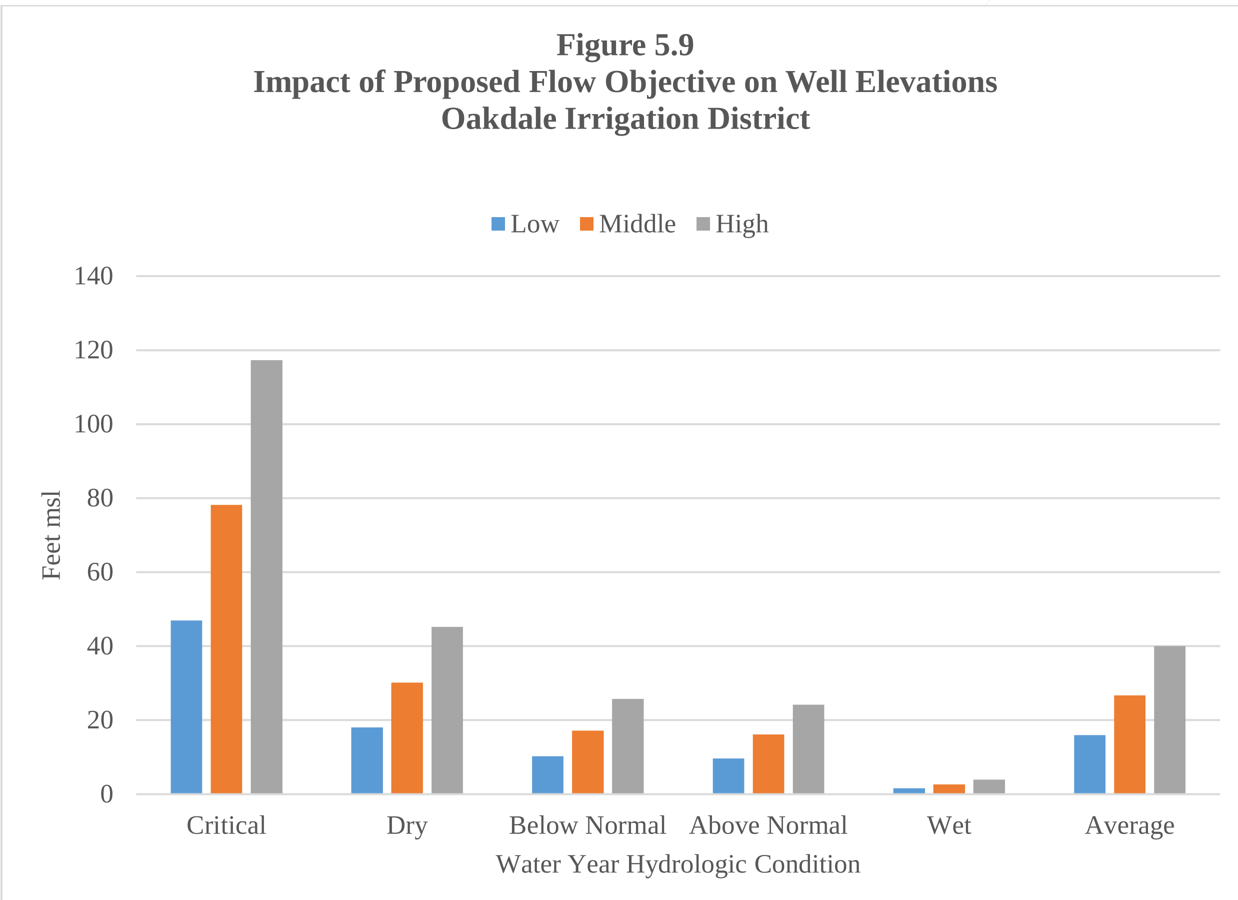
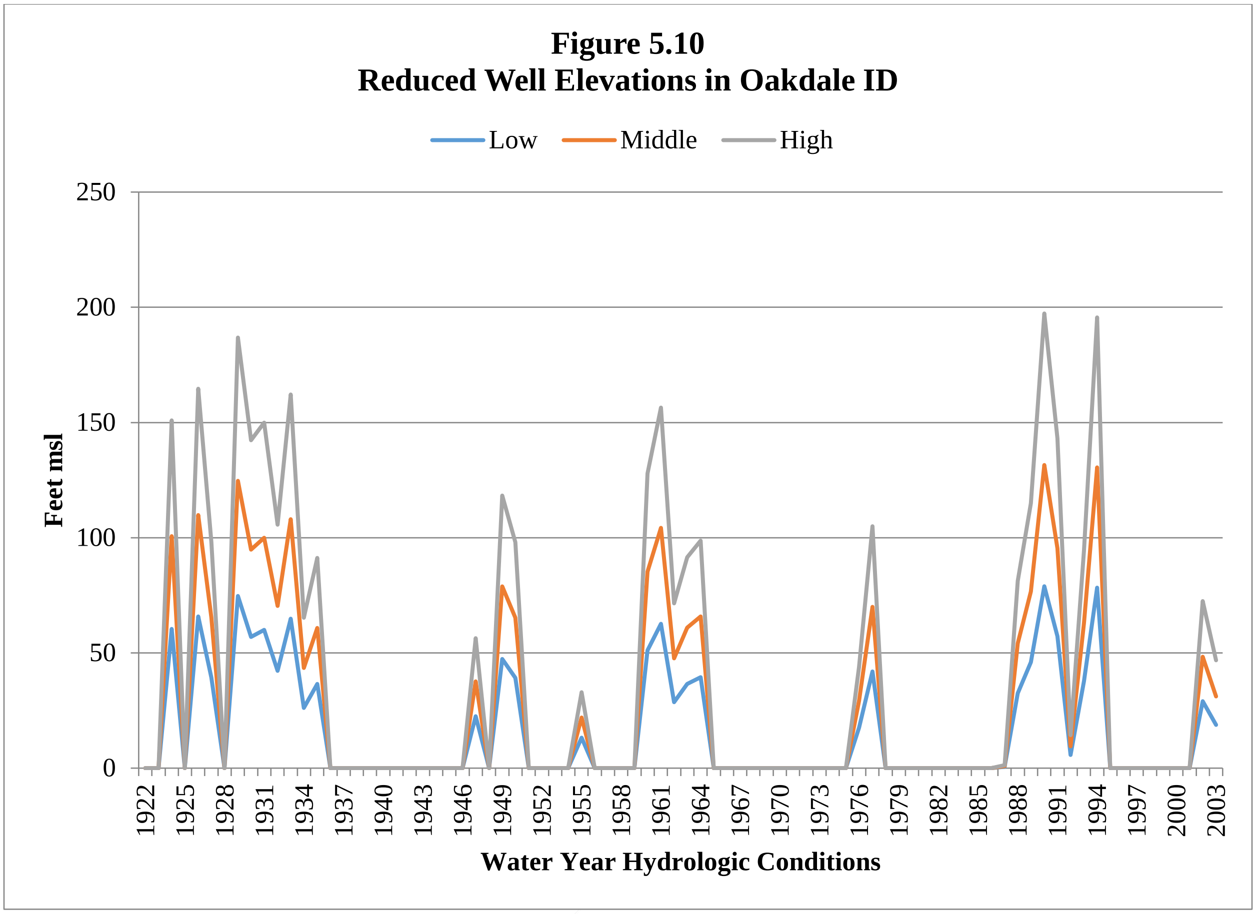


Figure 5.8
Reduced Well Elevations in South San Joaquin ID
Low
Middle
High
Feet msl
160
140
120
100
80
60
40
20
0
1922
1925
1928
1931
1934
1937
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
Water Year Hydrologic Conditions

F. Oakdale Irrigation District

Figure 5.9 shows the range of impacts of the proposed flow objective on well elevations. Oakdale suffers larger losses of surface water per acre than Central San Joaquin. The impact on well elevations is greatest in critical years ranging between 40 feet and 120 feet (when reduction in available surface water is the greatest) and between 20 feet to 40 feet in dry years (when reduction in available surface water is lower than in dry years). The focus on average impacts even by water year hydrologic conditions fails to capture how much the proposed flow objective increases the volatility in well elevations (see Figure 5.10). The reduction in well elevations spike between 75 feet to 200 feet.





G. Modesto Irrigation District

Figure 5.11 shows the range of impacts of the proposed flow objective on well elevations. Modesto suffers larger losses of surface water per acre than Central San Joaquin. The impact on well elevations is greatest in critical and years ranging between 40 feet and 90 feet. Well elevations decline by 20 feet to 40 feet in below normal years. The focus on average impacts even by water year hydrologic conditions fails to capture how much the proposed flow objective increases the volatility in well elevations (see Figure 5.12). The reduction in well elevations spike to more than 60 feet to 160 feet.

Figure 5.11
Impact of Proposed Flow Objective on Well Elevations
Modesto Irrigation District

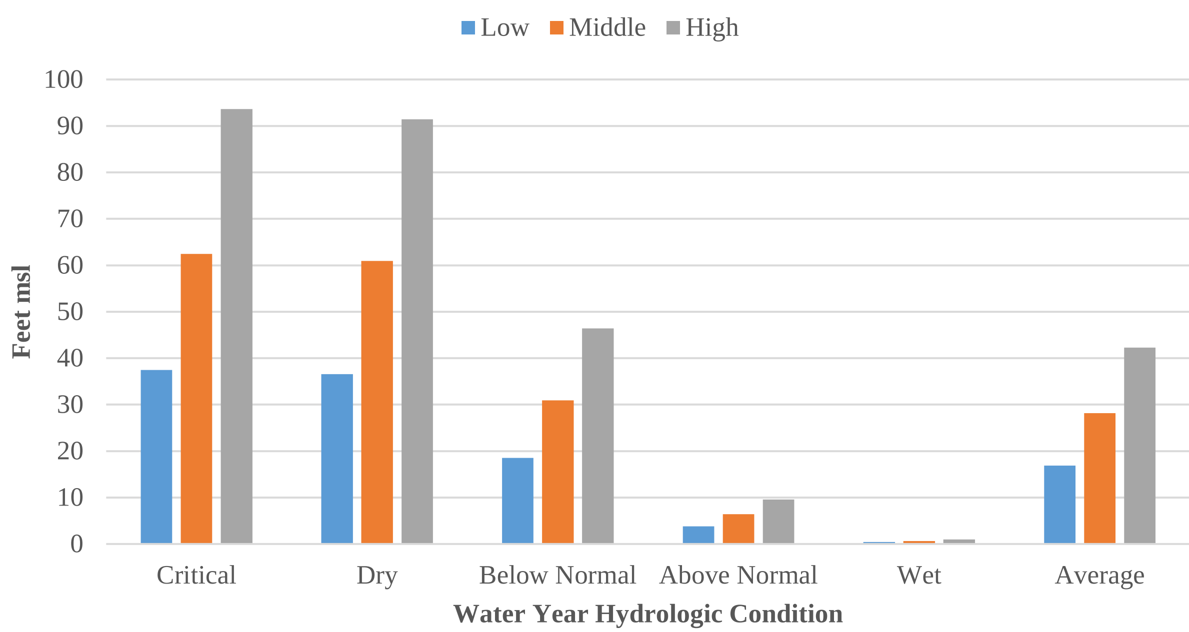
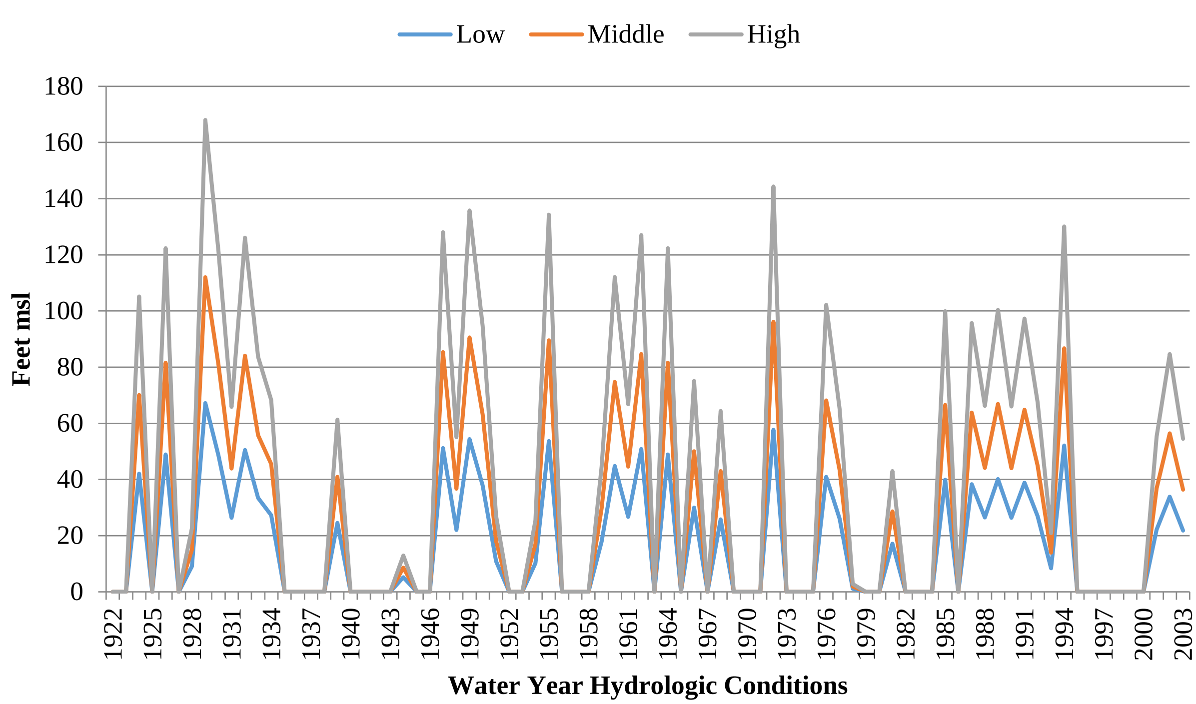


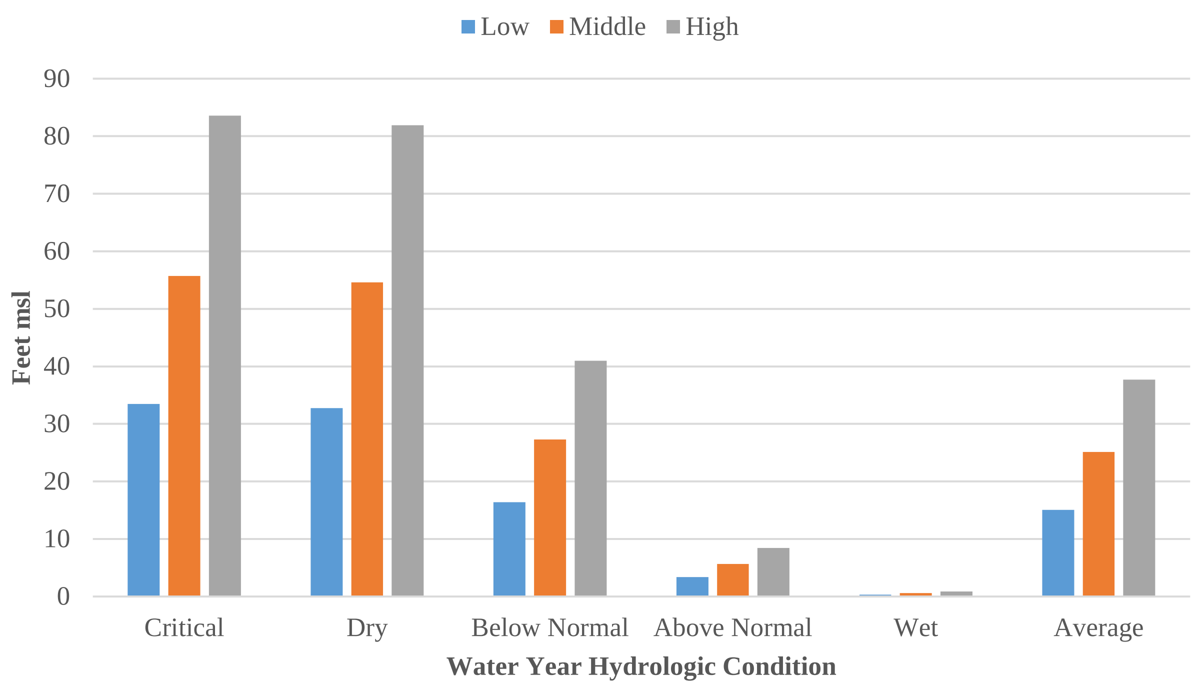
Figure 5.12
Reduced Well Elevations Modesto Irrigation District

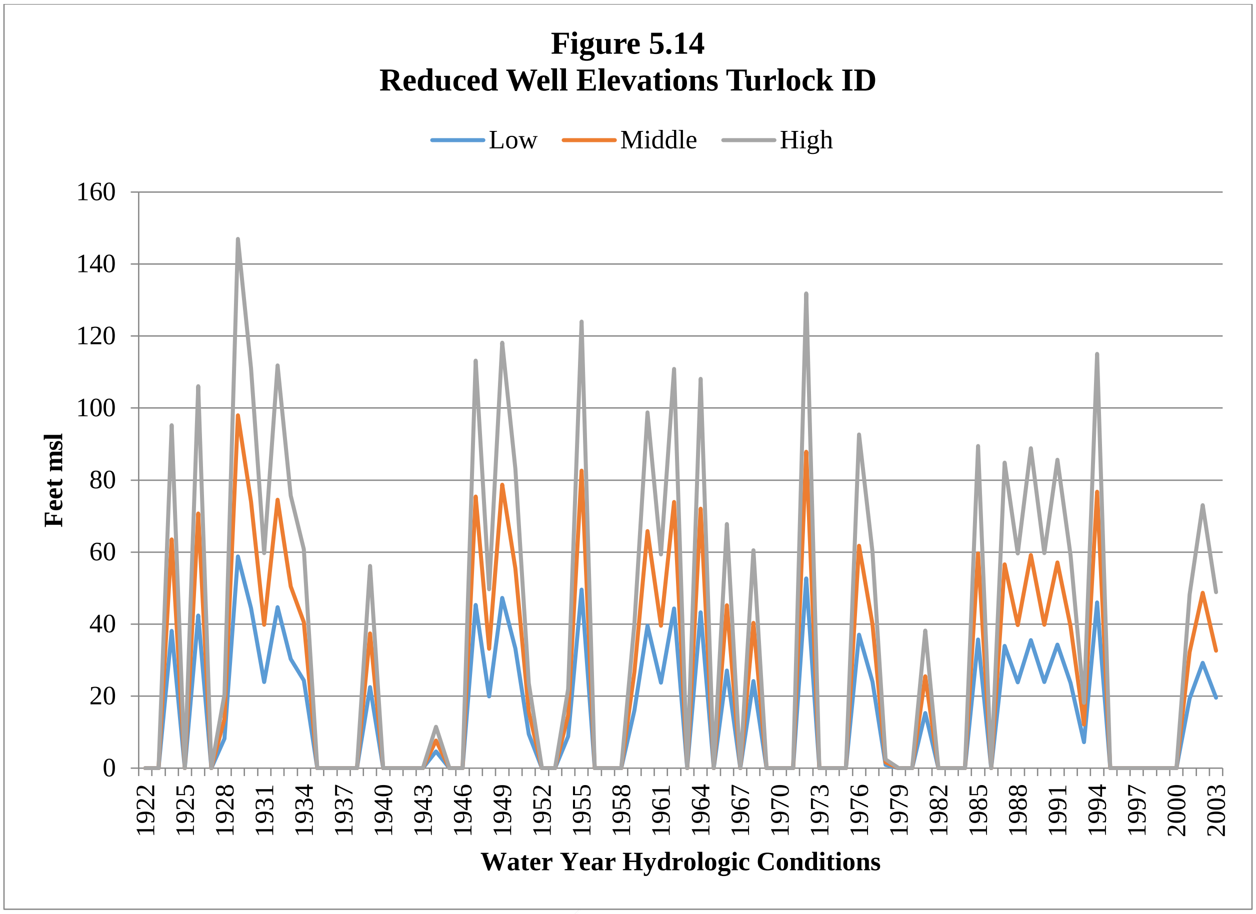


H. Turlock Irrigation District

Figure 5.13 shows the range of impacts of the proposed flow objective on well elevations. Turlock suffers larger losses of surface water per acre than Central San Joaquin. The impact on well elevations is greatest in critical and dry years ranging between 30 feet and 80 feet. Well elevations decline by 16 feet to 40 feet in below normal years. The focus on average impacts even by water year hydrologic conditions fails to capture how much the proposed flow objective increases the volatility in well elevations (see Figure 5.14). The reduction in well elevations spike to more than 60 feet to 140 feet.

Figure 5.13
Impact of Proposed Flow Objective on Well Elevations in Turlock Irrigation District





I. Merced Irrigation District

Figure 5.15 shows the range of impact of the proposed flow objective on well elevations. Merced suffers larger losses of surface water per acre than Central San Joaquin. The impact on well elevations is greatest in dry years ranging (when reduced surface water is greatest) between 60 feet and 100 feet. Well elevations decline by 35 feet to 80 feet in critical years. Well elevations decline by 20 feet to 60 feet in below normal years. The focus on average impacts even by water year hydrologic conditions fails to capture how much the proposed flow objective increases the volatility in well elevations (see Figure 5.14). The reduction in well elevations spike to more than 80 feet to 200 feet.

Figure 5.15
Impact of Proposed Flow Objective on Well Elevations
Merced Irrigation District

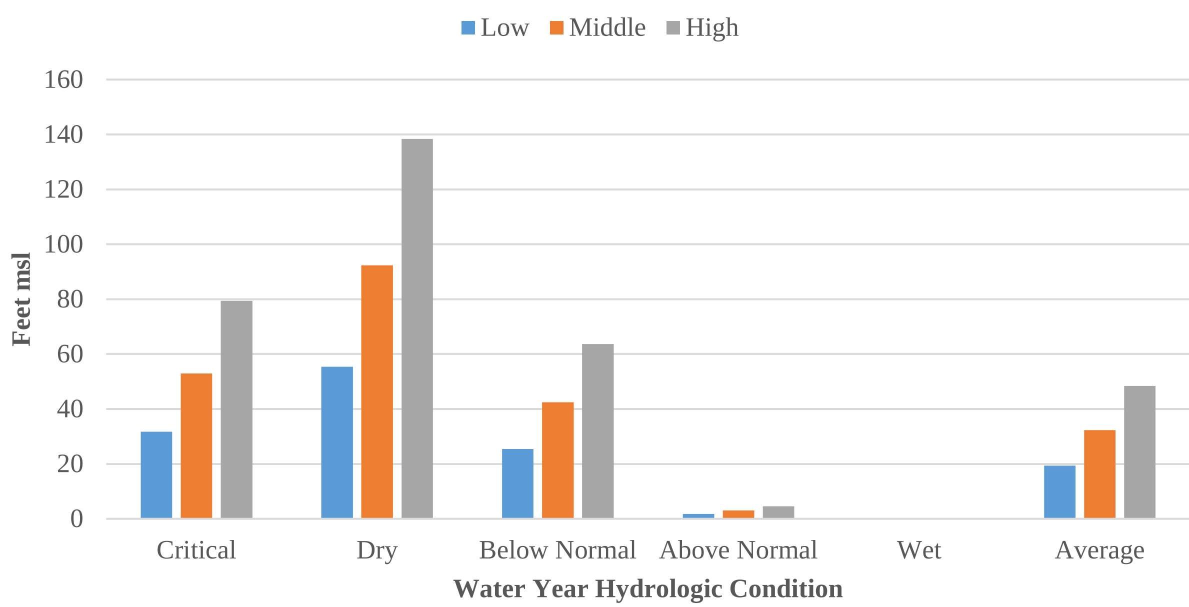
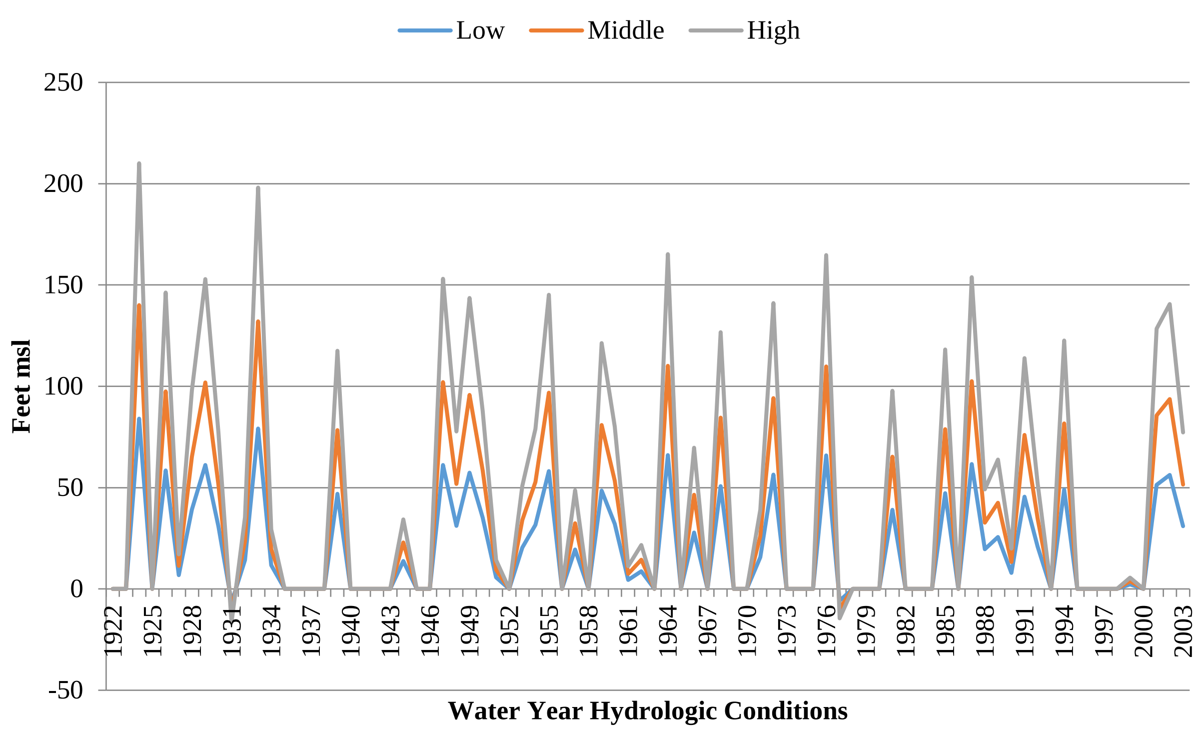


Figure 5.16
Reduction in Well Elevations in Merced Irrigation District



J. Conclusion

The proposed flow objective will lower well elevations in the Study Area significantly. Given the volatility in the annual loss of surface water supplies, the spikes in declining well elevations will be severe. Pumping costs will increase with greater lifts. Wells may have to be deepened to accommodate the severe volatility in elevations that will be outside the range of the operational experience in the Study Area.

6. AGRICULTURE

The potential economic impacts to the Study Area's agricultural economy of fulfilling the SED-mandated unimpaired flow objectives are anticipated to result from: A) reductions in Merced, Stanislaus and Tuolumne River diversions for irrigation; and B) SED-related changes in each river system's water storage facility/reservoir management. The latter, SED-related water storage management changes, and the associated temporal and volume impacts on Merced, Stanislaus and Tuolumne River flows, are expected to primarily impact the Study Area economy through resulting changes in reservoir-based regional recreation activity and hydropower generation. These impacts are discussed in later sections of this report (Sections 8 and 9, respectively).

This section summarizes the potential impacts of the anticipated SED-related reductions in Study Area surface water supplies for irrigation on crop production, crop and associated gross revenues and irrigation groundwater pumping costs. The potential urban water supply-related impacts on the region's communities, including its economically disadvantaged communities, are addressed in Section 7.

The direct impacts associated with SED-related increases in the unimpaired flows of the Merced, Stanislaus and Tuolumne Rivers will be driven primarily by the response to SED reductions in the Study Area's surface water supplies available to those irrigation districts in the Study Area that receive surface water supplies (collectively referred to as the "Irrigation Districts"). As previously discussed, the Irrigation Districts would be expected, all else being equal, to offset any reductions in their surface water supplies through a combination of increased groundwater pumping and reduced crop production (land fallowing[36]). Reductions in crop production would be anticipated as it is not expected that the Irrigation Districts (or their irrigators) would fully offset any SED water supply reductions with groundwater even before considering the pending need to reduce regional groundwater pumping from even current levels to help achieve State-mandated ground water sustainability objectives for the region under pending implementation of the State's Sustainable Groundwater Management Act (or "SGMA"). Ultimately, implementation of measures to achieve the SGMA objectives may substantially eliminate the ability of the Irrigation District farmers to offset much, if any, of their SED surface water supply reductions with additional groundwater. The result of both SED reductions in surface supplies and pending restrictions in groundwater pumping due to the SGMA will squeeze from both sides the Irrigation Districts' water supplies and, necessarily, result in even greater reductions in Irrigation District crop production as compared to a situation of SED implementation but without any specific limitations on groundwater pumping. In its analysis of SED, the SWRCB assumes unfettered groundwater pumping by the Irrigation Districts up to the districts' estimated maximum capacity of groundwater pumping with no account for the SGMA. This, even though the SGMA was established by the State.

[36] While land fallowing refers to the idling of farm land due to reductions in water supplies it also is intended to account land that is not idled but instead deficit irrigated due to those same reductions in water supplies with the resultant same presumed overall economic impact.

The above noted, any increases in Irrigation District groundwater pumping to offset SED surface water supply reductions would be expected to cause regional depths to groundwater to increase (and, correspondingly, well elevations to decline). Increases in groundwater depths will not only lead to higher water costs within the Irrigation Districts, which all rely already on groundwater for a portion of their water supplies but also: A) irrigation districts and irrigators in the Study Area outside of the Irrigation Districts that rely solely on groundwater; and B) the region's communities which almost all rely entirely, and a few in part, on groundwater for their urban water supplies (including water for households, businesses and landscape use). Higher depths to groundwater increase groundwater costs per unit of water pumped due to a combination of factors including the following:

- Increased electricity or other power consumption to lift pumped water further out of the ground;
- Increased pump equipment maintenance due to longer durations for operating wells to yield the same amount of water;
- Increased capital investment in well equipment, either new wells or to deepen existing wells, as some existing wells don't have the depth to reach water at the greater depths anticipated; and
- Overall declines in water quality pumped from greater depth or with greater pressure and associated increases in the amount of water treatment required.

A. Direct Impacts on Irrigation Districts

As previously noted, the Irrigation Districts that rely on surface water supplies from the Merced, Stanislaus and Tuolumne Rivers include:

- South San Joaquin Irrigation District ("SSJID")
- Stockton East Water District ("SEWD")
- Central San Joaquin Water Conservation District ("CSJWCD")
- Oakdale Irrigation District ("OID")
- Modesto Irrigation District ("Modesto ID")
- Turlock Irrigation District ("TID")
- Merced Irrigation District ("Merced ID")

To evaluate the potential agricultural production impacts of the SED within each of the above districts and for a range of water supply conditions, the SWRCB overlaid the Irrigation Districts' respective 2010 cropping patterns, 2009 groundwater pumping capacities and SED unimpaired flow objectives onto each district's surface water supply conditions for every year of the period 1922 through 2003 ("Study Period"). Stratecon adopted this same framework and built directly off the SWRCB's underlying estimates of the relationship between water supplies and cropping patterns within the Irrigation District to estimate the impacts of the SED at the 40% unimpaired flow level ("SED 40") on cropping patterns and associated gross revenues from crop sales ("crop gross revenues") under alternative assumptions regarding the SED's Irrigation District water supply impacts. Stratecon performed this analysis assuming two scenarios on how the districts and their farmers would have responded to the SED surface water supply cutbacks with respect to groundwater pumping in lieu of the SWRCB estimates on the groundwater pumping response.

The first scenario assumes no specific constraints on groundwater pumping other than the capacity of existing well infrastructure as of 2009 (consistent with the SWRCB's analysis) and assumes groundwater pumping levels that are consistent with Stratecon's assessment of Westlands Irrigation District's historical groundwater pumping and land fallowing rates in response to surface water supply reductions (see Attachment 1-1).[37] Stratecon's estimates of groundwater pumping response are lower than the SWRCB's and, correspondingly, Stratecon's estimates of the farmer land fallowing response within the Irrigation Districts to SED-related reductions in surface water supplies higher than SWRCBs. Table 6.1 summarizes the results of this analysis for the Irrigation Districts. Consistent with the SWRCB's assessment of the SED impacts, Stratecon evaluates the impacts on the SEWD and CSJWCD collectively, referred to herein as SEWD/CSJWCD.

Table 6.1

Summary of Lost Gross Crop Revenues (2008$)

Irrigation District	Reduction in Surface Water Supplies	Baseline	40% Unimpaired Flows	Revenue Loss (2008$)	% of Baseline
SSJID	Peak Reduction	$ 227,340,824	$ 180,598,016	$ 46,742,808	21%
	Average	$ 228,801,088	$ 222,053,045	$ 6,748,043	3%
Oakdale ID	Peak Reduction	$ 129,762,737	$ 96,224,934	$ 33,537,802	26%
	Average	$ 128,933,646	$ 123,814,745	$ 5,118,901	4%
SEWD/CSJWCD	Peak Reduction	$ 333,944,545	$ 280,822,511	$ 53,122,035	16%
	Average	$ 333,944,545	$ 327,507,259	$ 6,437,286	2%
Modesto ID	Peak Reduction	$ 136,192,551	$ 101,940,199	$ 34,252,353	25%
	Average	$ 147,767,555	$ 140,310,943	$ 7,456,612	5%
Turlock ID	Peak Reduction	$ 346,000,742	$ 277,006,247	$ 68,994,495	20%
	Average	$ 341,166,439	$ 323,806,519	$ 17,359,920	5%
Merced ID	Peak Reduction	$ 297,937,830	$ 249,481,682	$ 48,456,149	16%
	Average	$ 296,461,839	$ 287,736,625	$ 8,725,214	3%
Total	Peak Reduction	$ 1,429,872,508	$ 1,194,951,895	$ 234,920,613	16%
	Average	$ 1,477,075,112	$ 1,425,229,136	$ 51,845,976	4%

Table 6.1 shows, for example, that during the Study Period in any one year the SED 40 would have resulted in a reduction in crop gross revenues generated by the Modesto Irrigation District by about 25% from approximately $136 million to about $102 million. Over the entire Study Period the estimated average impact of the SED 40 would have been a reduction in gross

[37] To estimate the crop production impacts of the SED 40 for Stratecon's estimates of SED 40 water supply impacts, Stratecon extrapolated directly from the SWRCB's estimates for each Irrigation District of the relative impacts on crop production by crop type as a result of SWRCB's estimates of water supply changes by matching the proportionality of impacts between crop groups modeled by the SWRCB each year of the Study Period.

crop revenues in the Modesto Irrigation District by about 5%. The table further shows that in the Study Period year that the surface water supply reduction would have been at its highest (peak) for the Study Period due to the SED 40, the Irrigation Districts' combined crop revenues would have been an estimated approximately 16% lower than baseline in the absence of the SED 40. This compares to an average reduction in crop gross revenues for the Study Period due to the SED of about 4%. The large difference reveals that the consideration of only averages substantially mutes the indicated inter-year impacts of the SED 40. While the average impacts to crop revenues may not appear particularly severe, there are numerous years where the estimated impacts are substantially larger and could have significant detrimental impacts on the economics of the Irrigation Districts' farmers.

Figure 6.1 shows Stratecon's estimates of lost crop gross revenues due to the SED 40 each year during the Study Period for the Irrigation Districts combined. The graphic reveals many years that those lost crop gross revenues would have been substantial, including many years over $100 million.

Figure 6.1

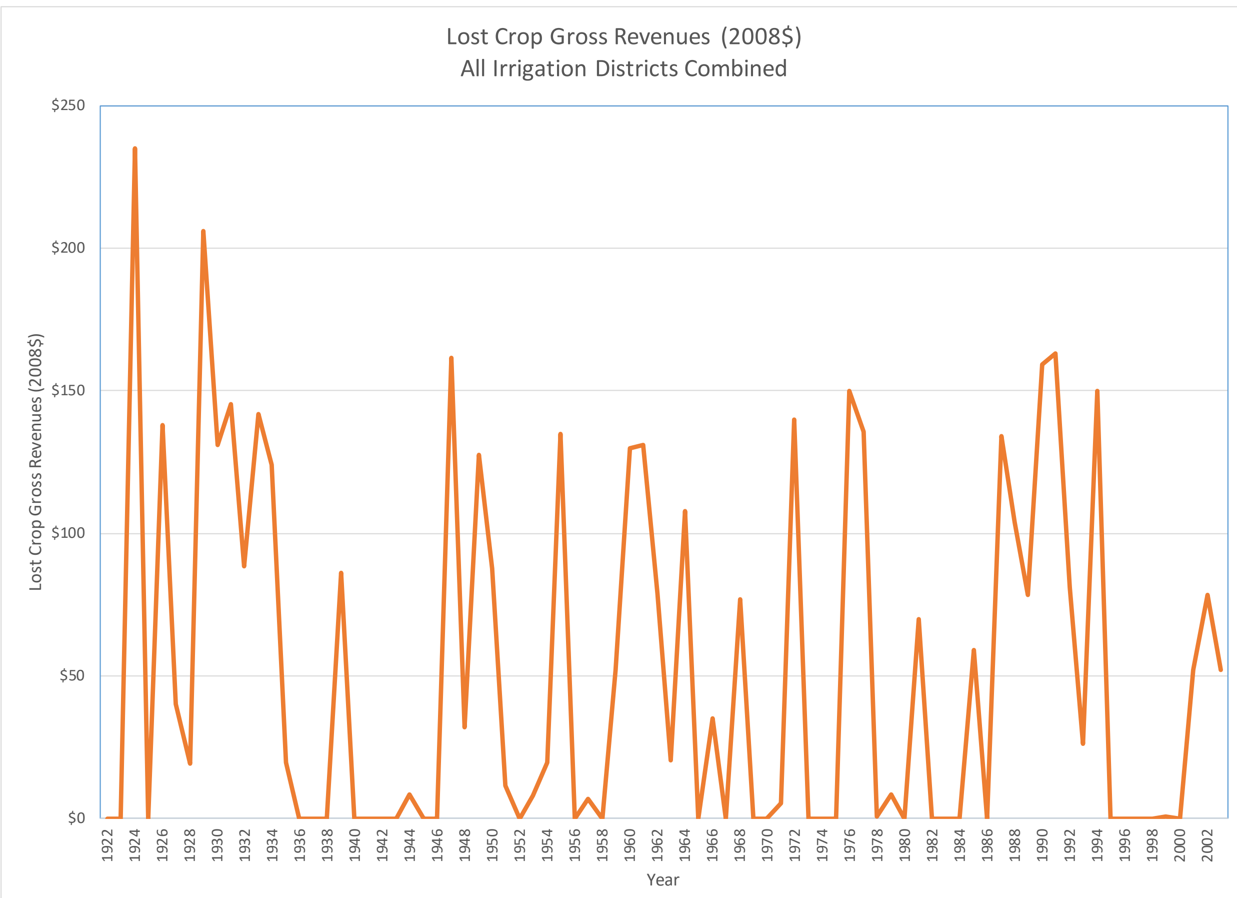


Figure 6.2 presents the same information shown in Figure 6.1 but consolidates it as averages across each water year type during the Study Period (e.g., critically dry, dry, above normal, etc.). The figure clearly shows that the SED 40 impacts on crop production and associated

crop gross revenues within the Irrigation Districts would be most severe during critically dry and dry years. This is to be expected as those are years in which overall Irrigation District surface water supplies are most reduced.

The second scenario assumes that the implementation of measures to meet the SGMA objectives would keep the Irrigation Districts from responding to surface water supply reductions with any groundwater pumping. Accordingly, the second scenario concludes much greater reductions in crop production due to the SED as compared to the first scenario due to the former's more severe assumptions on total water supply reductions. Table 6.2 summarizes the results of this analysis for the Irrigation Districts.

Figure 6.2

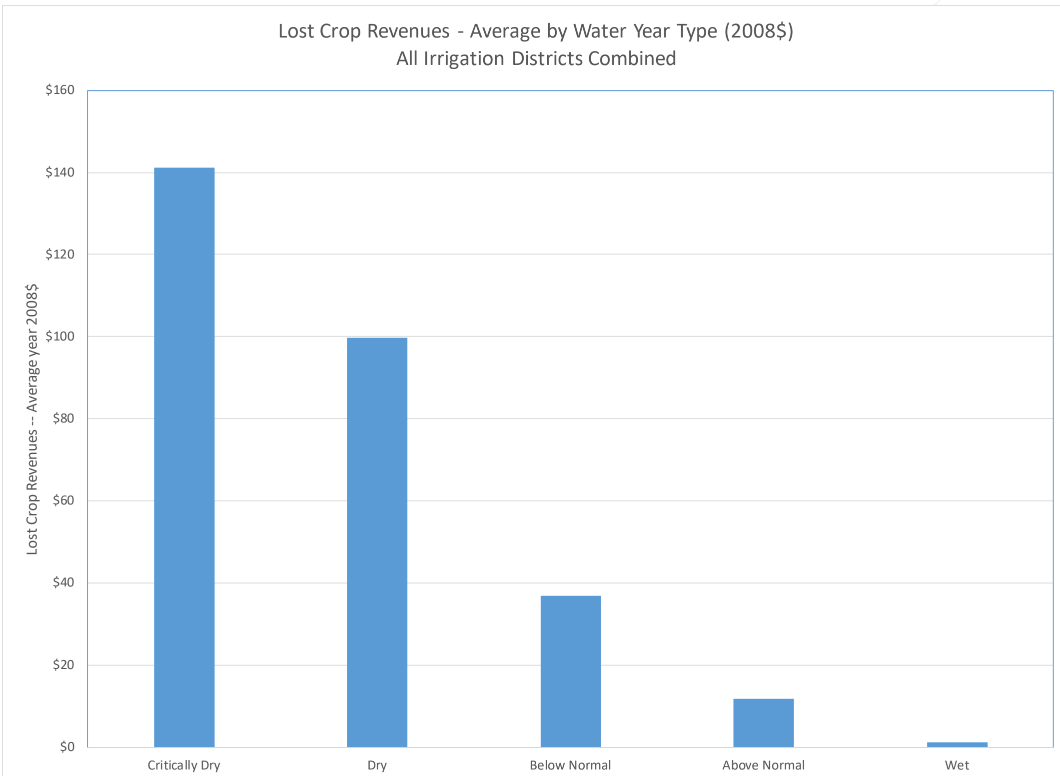


Table 6.2

Summary of Lost Gross Crop Revenues (2008$)

Irrigation District	Reduction in Surface Water Supplies	Baseline	40% Unimpaired Flows	Revenue Loss (2008$)	% of Baseline
SSJID	Peak Reduction	$ 229,523,554	$ 126,662,869	$ 102,860,685	45%
	Average	$ 228,801,088	$ 212,475,927	$ 16,325,161	7%
Oakdale ID	Peak Reduction	$ 129,762,737	$ 82,644,121	$ 47,118,616	36%
	Average	$ 128,933,646	$ 121,470,102	$ 7,463,543	6%
SEWD/CSJWCD	Peak Reduction	$ 333,944,545	$ 227,700,476	$ 106,244,069	32%
	Average	$ 333,944,545	$ 321,069,973	$ 12,874,572	4%
Modesto ID	Peak Reduction	$ 149,761,947	$ 100,011,083	$ 49,750,865	33%
	Average	$ 147,767,555	$ 138,175,570	$ 9,591,985	6%
Turlock ID	Peak Reduction	$ 346,000,742	$ 242,042,147	$ 103,958,595	30%
	Average	$ 341,166,439	$ 318,812,129	$ 22,354,310	7%
Merced ID	Peak Reduction	$ 297,937,830	$ 112,010,174	$ 185,927,656	62%
	Average	$ 296,461,839	$ 274,710,763	$ 21,751,076	7%
Total	Peak Reduction	$ 1,486,931,356	$ 1,080,736,562	$ 406,194,794	27%
	Average	$ 1,477,075,112	$ 1,386,714,464	$ 90,360,648	6%

The Table shows for the Modesto Irrigation District, for example, that in the peak year of surface water supply reductions during the Study Period due to the SED 40 and with SGMA groundwater pumping limits, that the district would have generated an estimated third less (33%) in crop gross revenues. This compares to a 25% loss of crop gross revenues without accounting for the SGMA as discussed above and shown in Table 6.1. Furthermore, the average for the Study period for Modesto with the SED 40 is a 6% annual reduction in crop gross revenues when accounting for the SGMA as compared to 5% without the SGMA, as discussed above and shown in Table 6.1.

Additionally, the table shows that in the peak surface water reduction year for all the Irrigation Districts collectively, crop revenues would have been an estimated approximately 27% lower had the SED 40 been in place along with SGMA restrictions on increased groundwater pumping to offset surface water supplies. This compares to an average for the Study Period of 6%. The large difference reveals again that the consideration of only averages masks the indicated potential impacts of the SED 40. While the average impacts to crop revenues may not appear particularly severe even with SGMA-related groundwater pumping restrictions, there are numerous years where the impacts are substantially larger and could have significant detrimental impacts on the economics of the Irrigation Districts' farmers not only in those specific years but also in the longer run as a result of the response by farm investors, lenders, service providers and other stakeholders in the regional agricultural economy to an overall sizable permanent increase in the risk and uncertainty of farming within the region due to reduced surface water supply reliability and availability

Finally, it should be noted that while Stratecon's estimates of the amount of fallowing and, thus, reductions in crop production by the Irrigation Districts as a result of the SED are in all cases higher than the SWRCB's, Stratecon's fallowing estimates specifically for the SEWD and CSJWCD stand out in particular, as the SWRCB concluded no impacts of the SED 40 on those two districts. This is because the SWRCB analysis assumed that the anticipated reductions in the two districts' surface water supplies would be 100% offset with groundwater pumping by the districts (reflecting the assumption that both districts have the groundwater pumping infrastructure in place and it makes economic and logistical sense for them to pump at that level). No other of the Irrigation District's is assumed by the SWRCB to fully offset their surface water losses with groundwater. On the other hand, Stratecon assumes, as discussed previously, that the SEWD and CSJWCD, like the other Irrigation Districts, will offset 50% of their SED-related reductions in surface water with groundwater resulting in a greater level of fallowing. Accordingly, the Stratecon crop production impact analysis with regard to the two districts is in particularly sharp contrast to the SWRCB's analysis.

Figure 6.3 shows Stratecon's estimates of lost crop gross revenues during the Study Period for the Irrigation Districts combined due to the SED 40 and assuming SGMA groundwater pumping limits. The graphic reveals that those lost crop gross revenues would have been substantial, exceeding $200 million in many years.

Figure 6.3

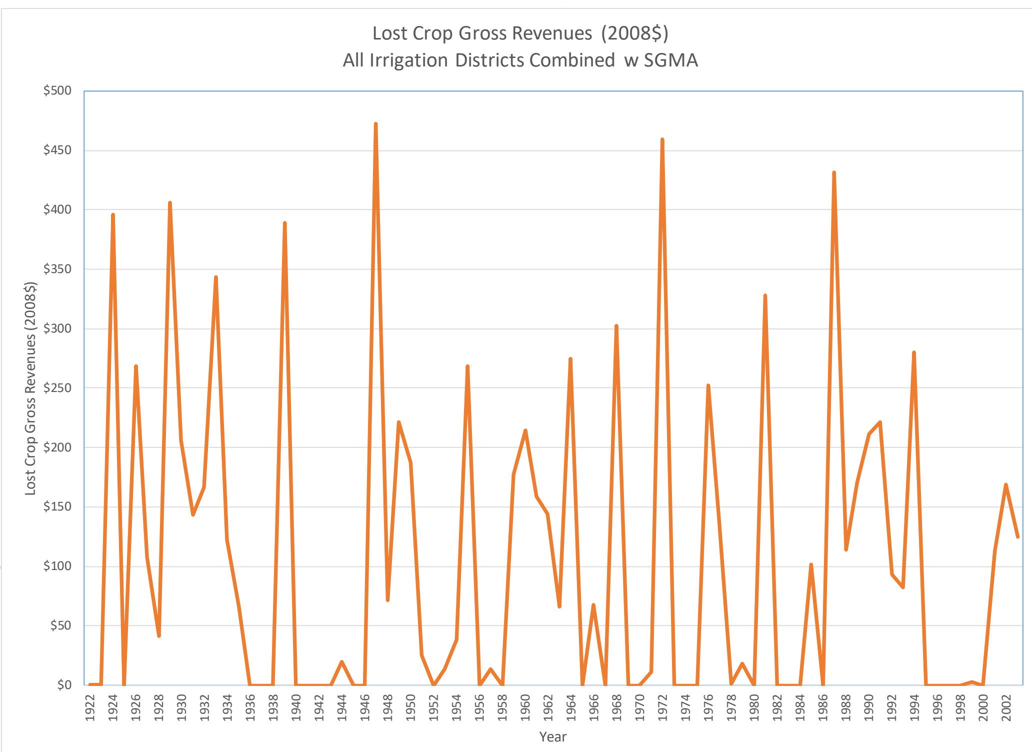
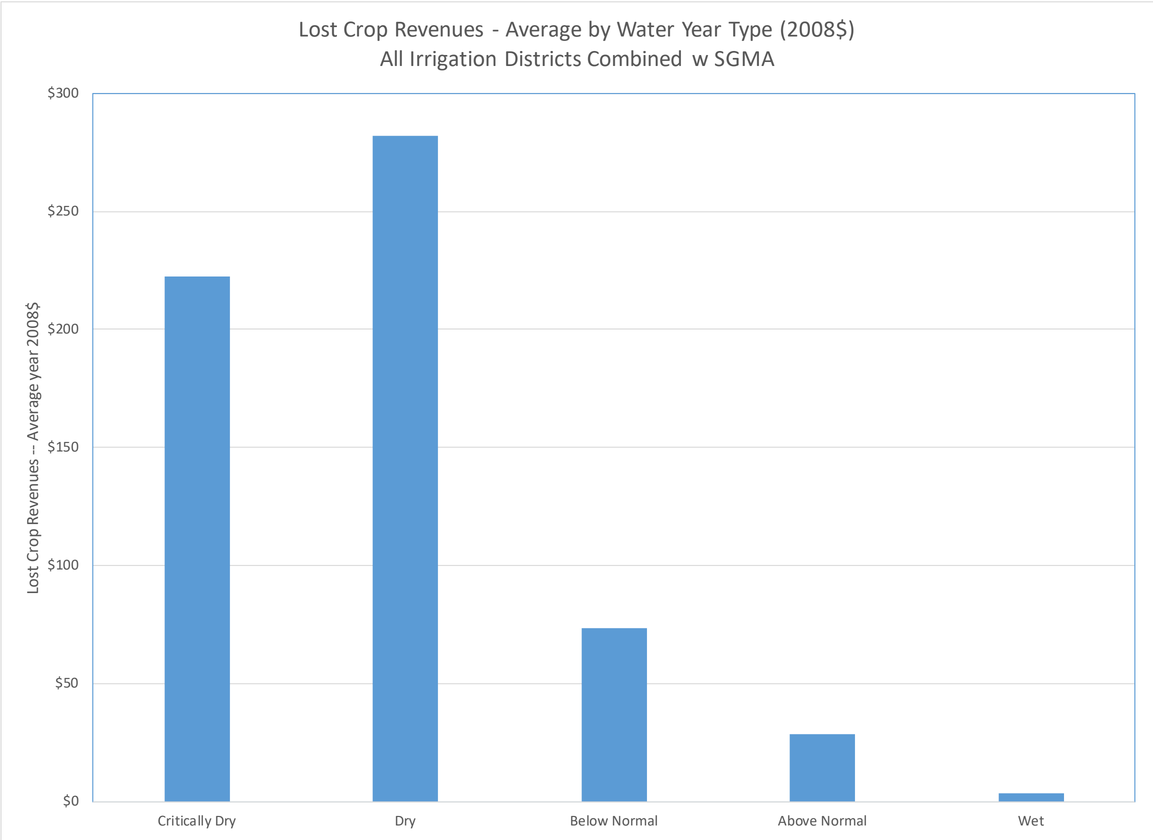


Figure 6.4 presents the same information shown in Figure 6.3 but consolidates it as averages across each water year type during the Study Period (e.g., critically dry, dry, above normal, etc.). The figure clearly shows that the SED 40 impacts with the SGMA on crop

production and associated crop gross revenues within the Irrigation Districts would be most severe during critically dry and dry years.

Figure 6.4



It should additionally be noted for both scenarios that the substantial reduced reliability of surface water supplies under the SED and associated substantial risk of significant water shortages and, thus, crop revenue declines in any given year, is likely to have a chilling impact on regional farm investment and long term average crop production within the Irrigation Districts. This is not captured in the impact analyses by SWRCB or in the above, which examines the short-run, single year potential impacts in each year of the Study Period not the impacts of the potential multi-year experience of farmers faced with a permanent reduction in surface water supplies due to the SED, a situation that is expected to be significantly exacerbated by SGMA constraints on groundwater pumping.

Additional details on the potential impacts of the SED 40 on each district's crop revenues are provided in Attachment 1-3. The estimated lost crop gross revenues presented the above tables and in greater detail in the Attachment are used in a later section of this report to estimate the overall potential economic output and employment impacts of the SED 40 with and without consideration for the potential constraints on regional groundwater pumping of the SGMA.

B. Forward Linkage Effects of SED Impacts on Regional Crop Production

Not only will SED 40 implementation directly cause a reduction in crop production by the Irrigation Districts but have additional, what are termed "downstream", impacts on regional businesses reliant on that crop production including dairies, livestock enterprises, food processors and agricultural commodity transportation enterprises, among others. The challenge in evaluating these impacts is to determine the extent to which dairies, for example, that purchase feed inputs from local farmers may substitute reduced supplies of certain types of feed from local sources with sources outside of the area. While the SWRCB does comment on these potential impacts it does not provide any quantification based on the argument that it is difficult to perform such a calculation. Though it is in fact challenging to quantify impacts on these downstream sectors, an examination of the upper bound of certain of these potential impacts is instructive regarding their potential severity. Such an upper bound would be a situation where the identified downstream sectors are unable to offset declines in local crop production on which they rely with outside-of-the area sources for those crops due to limitations on outside supply and transportation costs as well as general transportation challenges. The result of reductions in crop input supplies would be corresponding potential declines in production by those downstream sectors and associated employment loss. Stratecon focused specifically on the dairy and livestock production and manufacturing sectors, though other economic sectors, including other food processing such as tomato processing and transportation services would also be impacted. Both the Study Area dairy and livestock sectors rely heavily on locally produced hay and grain feed crops. Some of those crops, most notably corn silage, which is an important part of the region's dairy and livestock rations due to its high nutrient load and cattle digestibility characteristics, is very heavy and difficult to store and transport. Accordingly, the region's dairies and livestock producers dependent on local corn silage and hay would have a difficult time replacing offsetting reductions in locally produced corn and other silage and hay products.

To provide an order-of-magnitude estimate of the potential output and employment impacts of the SED 40 on the Study Area's dairy and livestock sectors, Stratecon evaluated the implications of a presumed one-to-one reduction in those sectors' production and, thus, revenues corresponding to the estimated SED 40-related percentage reduction in regional grain and hay production contained within the figures presented in Tables 6.2 and 6.3. For example, if in any year the anticipated reduction in Study Area grain and other crop (hay and pasture) production due to the SED 40 was estimated to be 15% it was assumed, at the upper bound, that the region's dairy and livestock sectors would contract by that same 15%. Accordingly, the approach implicitly assumes that the dairy sector would have no other feed options to offset the reduction of locally produced grain and hay. The analysis then accounts for the additional potential impacts of reduced local dairy production (milk) on local dairy product manufacturing, including notably fluid milk and butter, cheese and frozen dairy dessert manufacturing as it is the singular most important commodity input to dairy product manufacturing. This additional downstream impact on dairy manufacturing is modeled assuming that the impact of the upper bound reduction in Study Area milk production will at its upper bound result in that same percentage reduction in regional dairy product manufacturing. With respect to livestock the downstream effects start with the estimated lost Study Area grain and hay production and the resultant assumed proportional impacts on regional livestock production as an upper bound, which in turn, is presumed to reduce proportionally the supply of livestock available to local livestock slaughter, rendering and processing enterprises and, thus, at the upper bound, also proportionally reduce the output of those enterprises.

Table 6.3 shows Stratecon's estimates of upper bound lost Study Area combined dairy sectors revenues during the Study Period due to the SED 40 before and with SGMA groundwater pumping limits.

Table 6.3

Summary of Upper Bound Lost Dairy Sector Revenues (2008$)		Lost Direct Ouput SED 40%	Percent of Total Sector Output	Lost Direct Ouput SED 40% with SGMA	Percent of Total Sector Output
Total	Peak Reduction	$ 762,879,328	17.7%	$ 1,014,698,281	23.6%
	Average	$ 156,554,166	3.6%	$ 213,858,799	5.0%

The table shows, for example that the Study Area's dairy sectors, upper bound, could experience as much as a nearly 23.6% decline in production and, thus, revenues in any one year under SED 40 implementation with SGMA restrictions on groundwater pumping.

Figure 6.5 shows Stratecon's estimates of upper bound lost dairy sectors revenues during the Study Period due to the SED 40 and assuming SGMA groundwater pumping limits. The graphic reveals many years that those lost dairy sectors revenues would have been substantial, exceeding $50 million in many years.

Figure 6.5

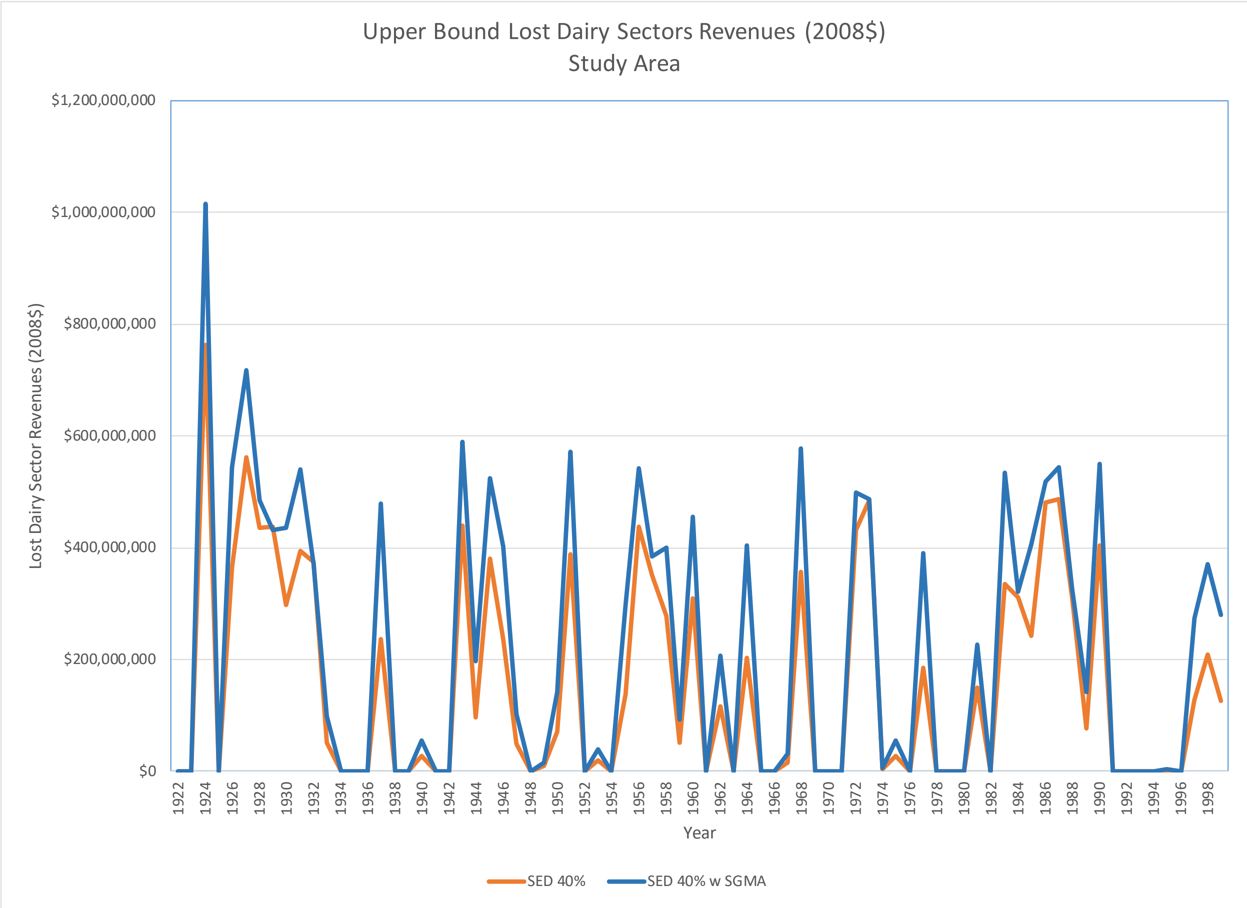


Table 6.4 shows Stratecon's estimates of the upper bound lost Study Area livestock sectors revenues during the Study Period due to the SED 40 before and with SGMA groundwater pumping limits.

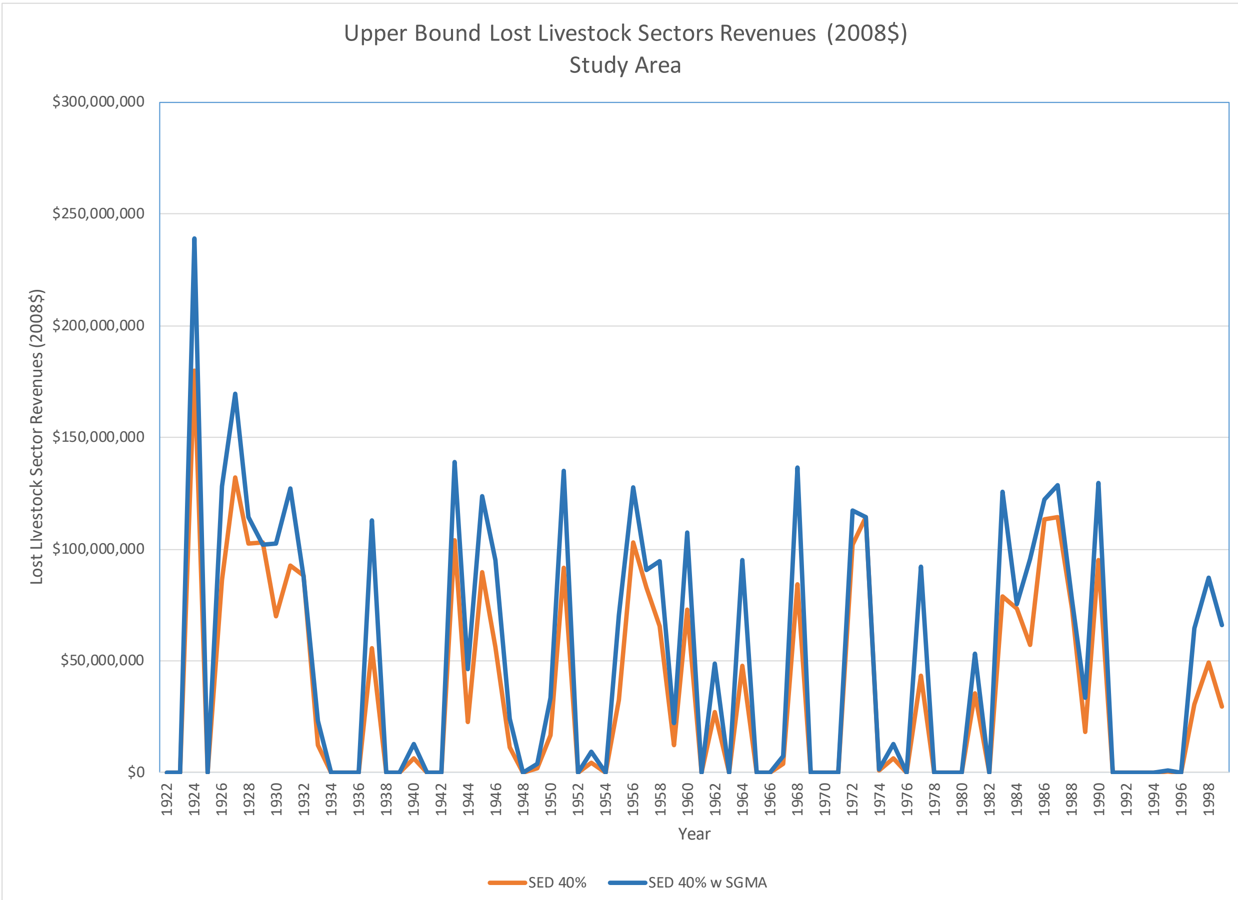
Table 6.4

Summary of Upper Bound Lost Livestock Sector Revenues (2008$)		Lost Output SED 40%	Percent of Total Sector Output	Lost Output SED 40% with SGMA	Percent of Total Sector Output
Total	Peak Reduction	$ 179,846,483	17.7%	$ 239,212,036	23.6%
	Average	$ 36,907,169	3.6%	$ 50,416,562	5.0%

The table shows, for example that the Study Area's livestock sectors, at the upper bound, could experience as much as a nearly 23.6% decline in production and, thus, revenues in any one year under SED 40 implementation with SGMA restrictions on groundwater pumping.

Figure 6.6 shows Stratecon's estimates of the upper bound lost livestock sectors revenues during the Study Period due to the SED 40 and assuming SGMA groundwater pumping limits. The graphic reveals many years that those livestock sectors revenues would have been substantial, exceeding $50 million in many years.

Figure 6.6



C. Indirect Impacts of SED Due to Impacts on Groundwater Elevations

As discussed previously, the increases in groundwater pumping that would be expected to result from SED-related reductions in surface water supplies available to the Study Area irrigation districts ("Irrigation Districts") that rely on surface water from the Merced, Stanislaus and Tuolumne Rivers will result in increased groundwater pumping and, correspondingly, average depths to groundwater, the implementation of ground water pumping restrictions to meet SGMA objectives notwithstanding. The increased average depths to groundwater will in turn result in higher pumping costs for the Irrigation Districts as well as all other irrigation districts and irrigators in the region almost all of whom rely entirely on groundwater for their water supplies.

1. Study Area Irrigation Districts Reliant on Surface Water Supplies

Table 6.5 summarizes the estimated lower and upper bound Study-Period: A) peak single year; and B) average additional cost of groundwater pumping that would have been incurred by each of the Irrigation Districts reliant on surface water supplies assuming the high estimate of potential increases in groundwater depths were to occur with SED 40 implementation, as discussed previously. The pumping cost estimates are based on an assumed range of $0.39 (lower bound) to

$1.12 (upper bound) of combined cost for electricity and well maintenance for each acre foot pumped one foot of elevation. The electricity cost estimates are based on the recent electricity expenses for groundwater pumping experienced by the Cities of Turlock ($0.39) and Modesto ($1.12). The well maintenance costs estimates are based on the assumptions adopted by the SWRCB in its assessment of SED economic impacts. The cost estimates do not account for the additional potential costs that the Irrigation District's might incur to add new wells or extend existing wells to reach groundwater at average depths that have increased due to SED-related increases in groundwater pumping. The costs do not account for the potentially significant additional costs that the Irrigation Districts are likely to incur due to SED-related increases in groundwater depths for pumping and water treatment infrastructure. Though the districts all have a number of deep wells many individual irrigators in the districts that supplement their irrigation with their own pumping do not and may face increased well infrastructure investment to meet their water needs when offsetting SED reductions in their surface water supplies.

Table 6.5

Summary of Cost Impacts of SED 40% Groundwater Depth and Increased Pumping

Irrigation District	Scenario	Depth	Additional Lift Over Baseline[1]	Incremental Cost @0.39 AF/FT	Incremental Cost per Acre	Incremental Cost @1.12 AF/FT	Incremental Cost per Acre
SSJID	Baseline	128.0	0.0	$ -	$ -	$ -	$ -
	Peak w SED 40% (High Estimate)	266.5	138.5	$ 4,832,087	$ 83	$ 13,876,761	$ 237
	Average w SED 40% (High Estimate)	155.6	27.6	$ 959,425	$ 16	$ 2,755,273	$ 47
Oakdale ID	Baseline	88.0	0.0	$ -	$ -	$ -	$ -
	Peak w SED 40% (High Estimate)	285.3	197.3	$ 3,741,017	$ 68	$ 10,743,434	$ 196
	Average w SED 40% (High Estimate)	128.0	40.0	$ 789,338	$ 14	$ 2,266,818	$ 41
SEWD	Baseline	83.3	0.0	$ -	$ -	$ -	$ -
	Peak w SED 40% (High Estimate)	168.0	84.7	$ 1,963,048	$ 41	$ 5,637,472	$ 118
	Average w SED 40% (High Estimate)	86.4	3.1	$ 49,515	$ 3	$ 142,196	$ 10
CSJWCD	Baseline	83.3	0.0	$ -	$ -	$ -	$ -
	Peak w SED 40% (High Estimate)	175.1	91.8	$ 2,090,933	$ 41	$ 6,004,730	$ 118
	Average w SED 40% (High Estimate)	94.8	11.5	$ 281,555	$ 3	$ 808,568	$ 10
Modesto ID	Baseline	90.7	0.0	$ -	$ -	$ -	$ -
	Peak w SED 40% (High Estimate)	258.7	168.0	$ 2,396,881	$ 41	$ 6,883,352	$ 117
	Average w SED 40% (High Estimate)	133.0	42.3	$ 617,133	$ 10	$ 1,772,280	$ 30
Turlock ID	Baseline	90.7	0.0	$ -	$ -	$ -	$ -
	Peak w SED 40% (High Estimate)	237.7	147.0	$ 8,351,666	$ 57	$ 23,984,271	$ 164
	Average w SED 40% (High Estimate)	128.4	37.7	$ 2,139,463	$ 15	$ 6,144,100	$ 42
Merced ID	Baseline	90.7	0.0	$ -	$ -	$ -	$ -
	Peak w SED 40% (High Estimate)	300.8	210.1	$ 23,439,996	$ 240	$ 67,314,861	$ 688
	Average w SED 40% (High Estimate)	139.1	48.4	$ 3,977,047	$ 41	$ 11,421,263	$ 117
Total	Baseline	93.2	0.0	$ -	$ -	$ -	$ -
	Peak w SED 40% (High Estimate)	N/A	N/A	$ 35,348,408	$ 69	$101,513,377	$ 197
	Average w SED 40% (High Estimate)	126.7	33.5	$ 8,813,476	$ 17	$ 25,310,496	$ 49

1. Accounts for years during Study Period that SED 40% is estimated to cause reductions in well depths.

The table suggests that of the irrigation districts reliant on surface water Merced will likely be the most impacted by the SED due to the extent to which the district, as a result, will need to depend on additional groundwater pumping to meet its water supply needs, limitations on pumping due to the SGMA notwithstanding. The table indicates, for example, that the estimated additional cost of pumping incurred by the Merced ID in any one year covering the hydrologic record of the Study Period, due to SED-related increases in groundwater depths and increased pumping, ranges from a lower bound of about $23 million to an upper bound of over $67 million district-wide, which translates to about $240 to $680 per baseline irrigated acre in the district in 2015$. This added cost per acre would represent a significant escalation of costs for the district's farmers and eliminate or put tremendous pressure on existing farmer profitability and even viability in any given year, particularly producers of relatively lower value grain and hay crops. The table further shows that the high estimate average annual impact on cost per acre across the entire Study Period ranges from $17 to $49 in 2015$. As with crop gross revenues, a focus on averages masks the severity of potential impacts in any given year.

Figure 6.7 shows Stratecon's estimates of the upper bound of increased pumping costs during the Study Period for the Irrigation Districts combined due to the range of estimated SED 40-related increases in regional groundwater depths, low, middle and high estimates. The graphic reveals significant inter-year variability in those cost impacts and many years that those added costs would have been substantial.

Figure 6.7

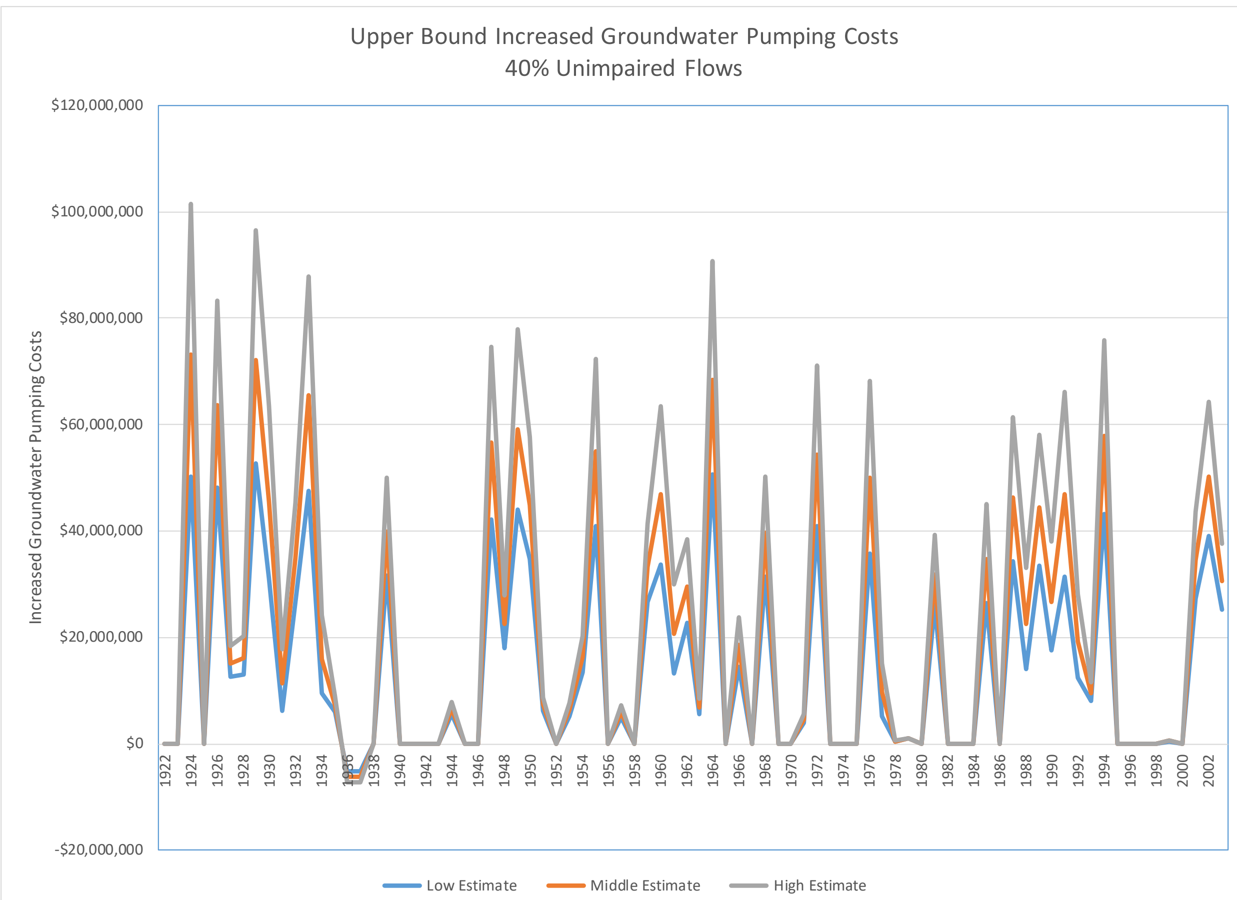
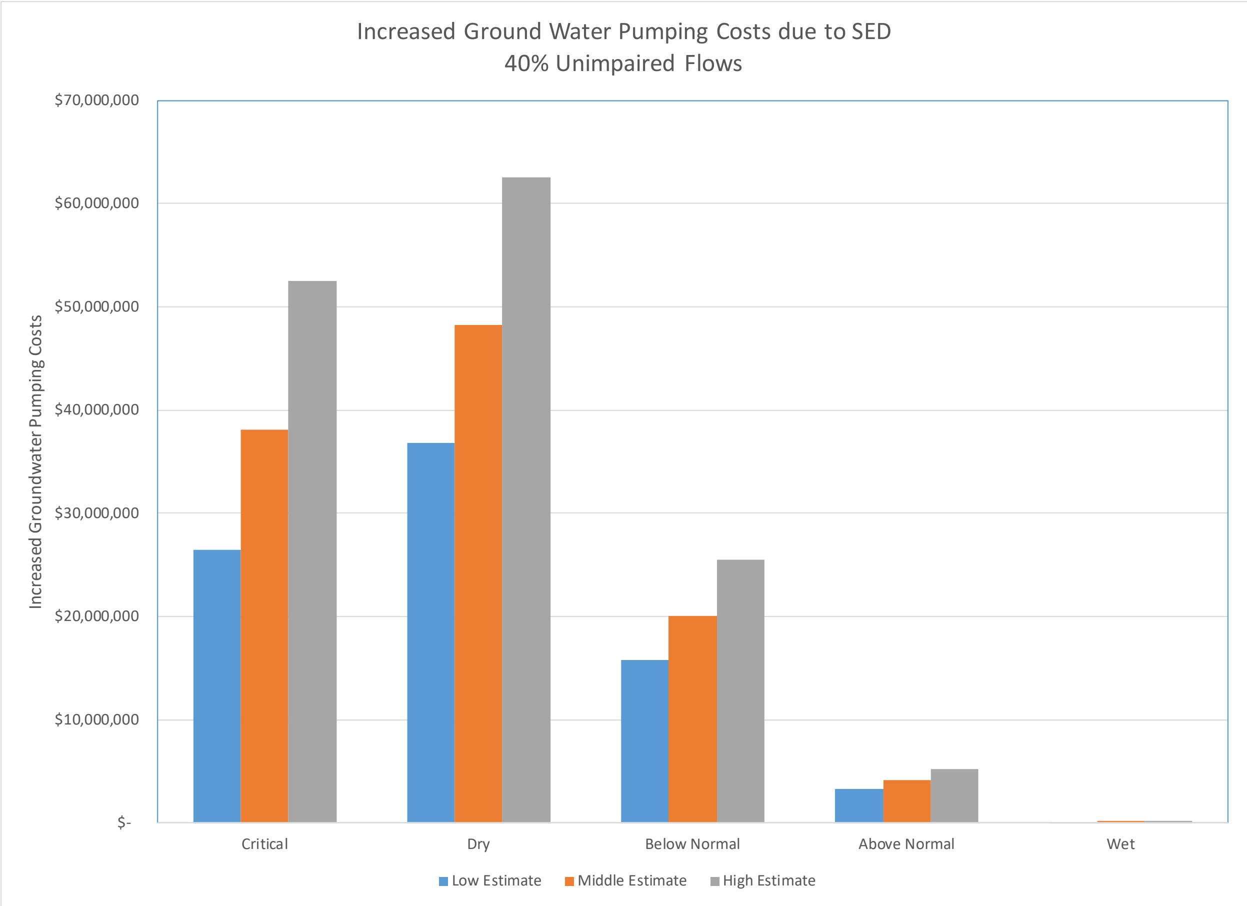


Figure 6.8 presents the same information shown in Figure 6.7 but consolidates it as averages across each water year type during the Study Period (e.g., critically dry, dry, above normal, etc.). The figure clearly shows that the SED 40 impacts groundwater pumping costs within the Irrigation Districts would be most severe during critically dry and dry years. This is to be expected as pumping in low surface water supply years is estimated to be higher than in other years.

Figure 6.8



2. Irrigation outside of the Irrigation Districts.

Irrigation districts and irrigators outside of the Irrigation Districts but within the same water basins as the Irrigation Districts rely entirely on groundwater for their water supplies. Table 6.6 summarizes SWRCB's estimates of the total baseline groundwater pumping by these irrigation districts and irrigators. The table shows total annual baseline pumping of about 1.47 million acre feet on about 531,000 irrigated acres.

Table 6.6

Sub-Basin	Baseline Groundwater Pumping Outside of Irrigation Districts (000's of Acre-Feet)	Irrigated Acres Outside of Irrigation Districts (Acres)
Eastern San Joaquin	476	204,634
Modesto	83	26,675
Turlock	351	117,759
Merced	556	182,363
Total	1,466	531,431

Table 6.7 calculates the estimated groundwater pumping cost impacts of the SED 40 on these irrigators assuming three different associated increases in well depths during the Study Period because of increased Irrigation District pumping: A) the weighted average increase in lift of 33.50 feet; B) the lower bound single year high estimate in increased in lift among the Irrigation Districts (see Table 6.5 peak change in groundwater depth for SEWD); and C) the upper bound single year high estimate increase in lift among the Irrigation Districts (see Table 6.5 peak change in groundwater depth for Merced ID).

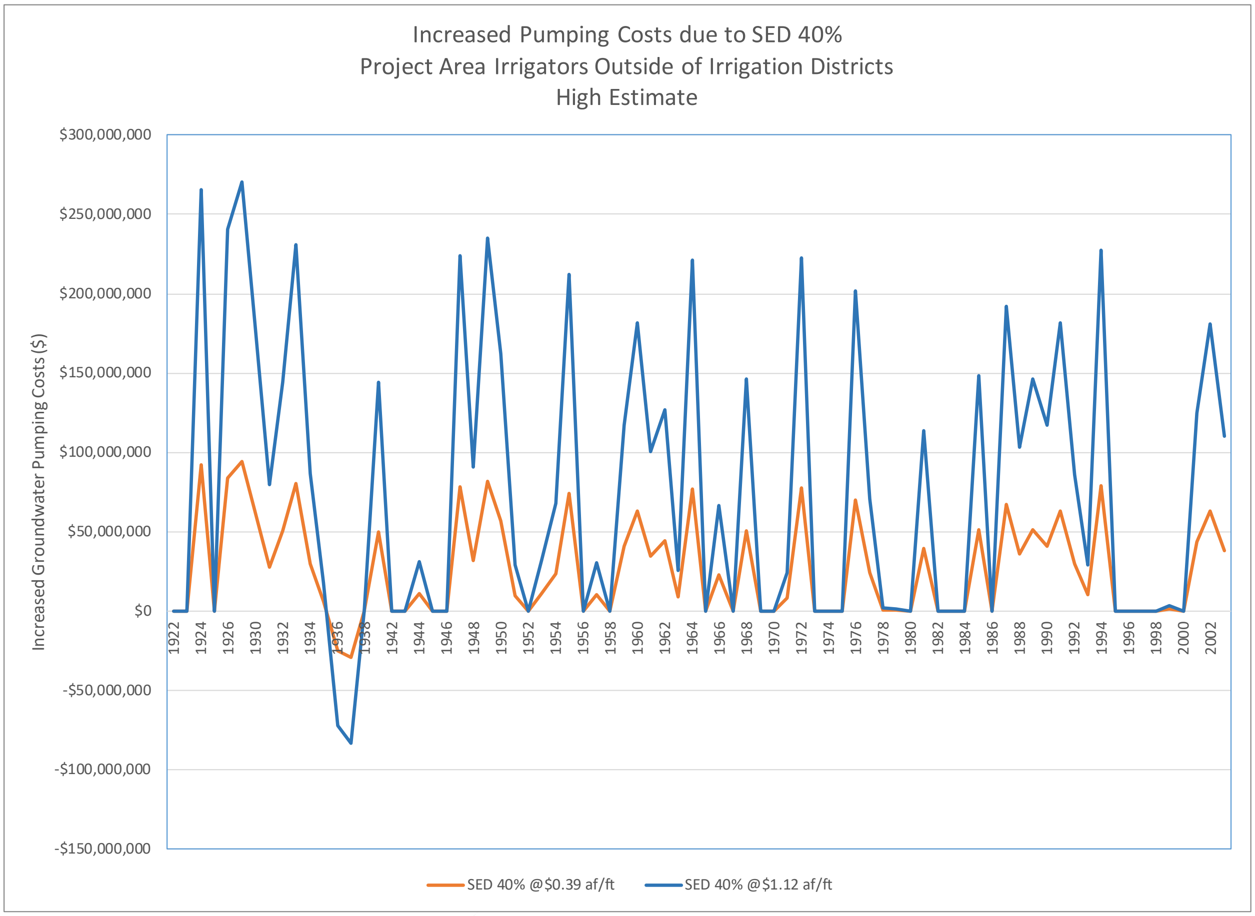
Table 6.7
SED 40 Impact on Outside Irrigation District Groundwater Pumping Costs

	Average	Lower Bound of High Estimate	Upper Bound of High Estimate
Ag. Groundwater Pumping Outside of ID's (000s of acre-feet)	1,466	1,466	1,466
Average Increase in Groundwater Depths (ft)	33.50	84.65	210.09
Cost per AF Pumped Per Foot of Depth	$ 0.39	$ 0.39	$ 0.39
Total Incremental Cost	$ 19,152,690	$ 48,398,792	$ 120,117,244
Total Acreage Irrigated	531,431	531,431	531,431
Average Incremental Cost per Acre	**$ 36.04**	**$ 91.07**	**$ 226.03**
Cost per AF Pumped Per Foot of Depth	$ 1.12	$ 1.12	$ 1.12
Total Incremental Cost	$ 55,002,598	$ 138,991,404	$ 344,952,086
Total Acreage Irrigated	531,431	531,431	531,431
Average Incremental Cost per Acre	**$ 103.50**	**$ 261.54**	**$ 649.10**

The table indicates an average added cost per acre for these irrigators ranging from $36.04 to $103.50 per acre over the Study Period. This is a significant potential increase in the average cost of irrigation, which could have important impacts on the viability of regional farming. In addition, this estimate does not account for inter-year variability in groundwater depth increases due to the SED that could in certain years result in incremental impacts on per-acre groundwater pumping costs that are substantially higher. For example, and as shown in the table, were the average well depth in the region due to the SED increase by 84.7 feet in any one year (see Table 6.5) consistent with the lower bound high estimate of potential well depth increases in any one year of the Study Period among the Irrigation Districts, the average per acre increase in water costs for irrigators in the Study Area outside of the Irrigation Districts would be estimated in a range of about $91 to almost $262. This goes up to $226 to almost $650 per acre were the well depth increases in any year equal to the upper bound high estimate for the Irrigation Districts during the Study Period of about 210.1 feet (see Table 6.5). This level of cost increase would more than wipe out the profits for a large portion of the region's farmers and have a severely adverse impact on the regional economy. Furthermore, even the risk of this outcome would result in a fundamental structural change to the region's economy in the long run as the financial risks of farming for most would become untenable.

Figure 6.9 shows Stratecon's estimates of increased groundwater costs during the Study Period for the irrigators outside of the Irrigation Districts based on the cost per foot of lift ranging from $0.39 to $1.12. The graphic reflects]the high estimates of the potential impacts on groundwater depths for each basin of the Study Area based on the high estimates of groundwater depth impacts for the Irrigation Districts within those basins. For example, the Modesto Basin groundwater depth assumptions are based on the estimated SED 40 impacts on groundwater depths in the Modesto Irrigation District. For the Turlock Basin, Stratecon assumed depth changes consistent with the estimates for the Turlock Irrigation District. For the Merced Basin, Stratecon assumed depth changes consistent with the estimates for the Merced Irrigation District. For the Eastern San Joaquin Basin, Stratecon assumed depth changes consistent with the weighted average groundwater pumping of the Oakdale ID, Stockton East WD and the Central San Joaquin WCD. The graphic reveals significant inter-year variability in the potential pumping cost impacts and many years that those added costs would have been substantial.

Figure 6.9


Increased Pumping Costs due to SED 40%
Project Area Irrigators Outside of Irrigation Districts
High Estimate
Increased Groundwater Pumping Costs ($)
$300,000,000
$250,000,000
$200,000,000
$150,000,000
$100,000,000
$50,000,000
$0
-$50,000,000
-$100,000,000
-$150,000,000
1922 1924 1926 1930 1932 1934 1936 1938 1942 1944 1946 1948 1950 1952 1954 1956 1958 1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002
SED 40% @$0.39 af/ft
SED 40% @$1.12 af/ft

7. DOMESTIC, COMMERCIAL, MUNICIPAL AND INDUSTRIAL WATER USE

Except for several communities within the Study Area that rely on surface water for a portion of their Domestic, Commercial, Municipal and Industrial water supplies ("DCMI" water supplies), the majority of communities within the Study Area rely entirely on groundwater for their DCMI water supplies. Accordingly, the potential impacts of the SED as it relates to community DCMI water supplies will be both direct as it relates to those communities in the region that rely on surface water for some portion of their DCMI water supplies as well as indirect as it relates to anticipated increases in regional groundwater depths and associated pumping costs due to expected increases in groundwater pumping by irrigators and communities to offset some portion of their SED-related reductions in surface water supplies, potential SGMA-associated pumping limitations aside.

A. Surface DCMI supplies

A number of the Study Area's communities rely heavily on surface water conjunctively with groundwater to meet their overall water supply needs. These communities, which include Stockton and Manteca in San Joaquin County and Modesto in Stanislaus County, among others, receive surface water under contract from the region's Irrigation Districts. In its assessment of potential SED impacts, SWRCB assumed that the region's communities reliant on surface water would not experience any reductions in those supplies as a result of SED under the presumption that the communities' surface water needs would take priority over Irrigation District demands. Accordingly, the SWRCB provided no estimates of the regional economic impacts of reduced Study Area community surface water supplies. However, it is Stratecon's understanding that the region's communities that rely on surface water do not have such priority and, therefore, along with their Irrigation District suppliers, will share in the burden of significant SED-related reductions in their surface water supplies. At the time of this report's preparation, Stratecon did not have the SED water supply impact information needed to accurately assess the potential economic implications of these potential changes in community surface water supplies, which certainly warrant quantification and emphasis. However, it should be understood that Stratecon's (and the SWRCB's) assessment of SED-related reductions incrop production and associated economic impacts implicitly accounts for the economic impacts of the surface water that might be lost by the region's communities due to the SED though only in terms of farm production losses and associated impacts of that reduced water supply, not the increased costs that would be incurred by the affected communities to mitigate for the loss of water and associated impacts. Thus, while the potential economic impacts of reduced community surface water supplies due to the SED are not explicitly quantified by Stratecon, an assessment of the impacts of the loss of this water, regardless of its amount, is embedded elsewhere in Stratecon's overall economic impact analysis and, therefore, reflected in Stratecon's overall impact conclusions.

B. Groundwater DCMI supplies

Already the Study Area is facing significant DCMI water supply challenges due to long term chronic overdraft of its aquifers that over time has reduced community water supply reliability and increased the cost of water. These cost impacts have affected community water systems as well as businesses, school districts and individual homeowners operating their own wells for water supply According to the California Department of Water Resources ("CDWR") the San Joaquin River Basin is one of a number of basins in California that have experienced recent large increases in groundwater depths during the current drought as the combined result of increased pumping and reduced aquifer recharge (natural and artificial). For example, CDWR reports that the Merced Groundwater Basin is already being depleted at a rate of 54,000 acre-feet per year for urban uses and 492,000 acre-feet per year for agricultural uses and that the Turlock Groundwater Basin is being depleted at a rate of 65,000 acre-feet per year for urban uses and 387,000 acre-feet per year for agricultural uses. The result has already been many wells going dry and substantial water quality issues in certain areas. The Planada Community Services District in Merced County, as an example, has recently dealt with major challenges in meeting its community water service needs as several of its wells have gone dry due to the drought and it has had to find emergency funding to put in new wells in response. Planada, a farming town whose population is around 4,500, is designated as a Severely Disadvantaged Community by the State of California due to its very low household incomes. Further, potentially large reductions in groundwater elevations in the area of Planada due to the SED could place untenable additional financial hardship on that community.

With the above as context, SED reductions in surface water supplies will only exacerbate the region's already existing serious problem with urban water supply reliability and rising water costs. The latter will be the result of: A) the need in some cases for the deepening of existing wells or development of new wells to access groundwater such as Planada's, Modesto's and other communities' water systems and individual businesses and households have already experienced with the recent drought; B) additional incremental energy and other costs associated with pumping water from greater depths; C) additional incremental expenses for increased chemical treatment and other actions necessary to resolve anticipated deterioration in water quality resulting from increased well depths and D) water conservation mandates to reduce water demand. Along with Planada and Modesto, a very large portion of the region's communities are designated as DACs, including the cities of Merced and Stockton, the two largest cities in Merced and San Joaquin Counties, respectively. Thus, the economic challenges in many Study Area communities posed by potential necessary increases in water rates or other financing initiatives to offset well-depth-related increases in water costs may prove particularly material and these communities simply may not have the financial and human resources to adequately mitigate for the impacts.

Unfortunately, there is limited information available from many of the region's communities regarding their existing well depths and the incremental costs associated with pumping groundwater. This noted, Table 7.1 provides certain fiscal year 2015 summary water use and average pricing statistics for a number of the region's communities most likely to be highly impacted by SED-related increases in groundwater depths. This information provides a baseline for evaluating the potential implications of added DCMI costs. The table shows, for example, that the average monthly charge for water per connection (including residential, commercial, landscape, etc.) in Planada, a DAC, was about $2.00 per thousand gallons in 2015. Upward pressure on the communities' water costs this year and in the near future term even without the SED is significant due to drought-related response.

Table 7.1
Study Area Community Water Statistics

Community	County	DAC?	Fiscal 2015 Water Use (MG)	Fiscal 2015 Water Service Revenues	Average Charge per 1k gallons
Merced	Merced	Y	7,313	$ 13,238,388	$ 1.81
Le Grand	Merced	Y	105	$ 263,465	$ 2.51
Winton	Merced	Y	575	$ 721,057	$ 1.25
Delhi	Merced	Y	430	$ 751,978	$ 1.75
Atwater	Merced	Y	2,057	$ 3,169,763	$ 1.54
Planada	Merced	Y	293	$ 572,916	$ 1.96
Livingston	Merced	Y	2,101	$ 2,639,298	$ 1.26
Modesto All	Stanislaus	Y[1]	14,113	$ 49,862,608	$ 3.53
Modesto Residential Only	Stanislaus	Y	9,154	$ 37,449,856	$ 4.09
Turlock	Stanislaus	N	5,562	8,527,483	$ 1.53
Turlock Residential Only	Stanislaus	N	3,055	6,751,861	$ 2.21

More detailed information than is presented in Table 7.1 was obtained for the cities of Modesto (a DAC) and Turlock, both in Stanislaus County. Given the recent drought, this data provides some insight to the potential response of Study Area communities to SED-related reductions in regional surface water supplies and associated anticipated increases in well depths.

Table 7.2 summarizes the recent water supply situation in Modesto, which relies on both surface and groundwater to meet its water supply needs.

Table 7.2
Modesto Water Supply

Calendar Year	Surface Supplies	Groundwater Supplies	Total Water Supplies	Average Depth to Groundwater Pumped (feet)	Electrical Power Cost/Million Gallons
2010	30,645	29,228	59,873	56	$209
2011	27,606	31,925	59,531	55	$208
2012	32,776	28,377	61,153	55	$214
2013	34,635	26,783	61,417	56	$220
2014	20,981	35,227	56,208	57	$190
2015	15,401	29,981	45,382	65	$219

The table shows that Modesto most recently has experienced drought-related decreases in its surface water supplies and not actually offset those reductions through increases in its groundwater pumping. To address the drop off in water supply the City has aggressively sought to implement conservation measures. Such measures can only go so far as to mitigating for water supply reductions. With even greater reductions in its surface supplies as a result of the SED the City expects to have no other option than to increase its groundwater pumping. In fact, as the City has grappled with its recent drought-related water supply challenges, it has just funded the addition of a new deep well to its groundwater system at a cost of $1.5 million.

Table 7.3 summarizes the City of Modesto's recent residential water demand. The table shows a decline in household connections and household water use into fiscal year 2016 that corresponds to drought-related residential water use cutbacks/conservation.

Table 7.3
Modesto Residential Water Demand

Fiscal Year July to June	Average # of Residential Connections	Average Residential Customer Revenues	Average Monthly Residential Water Bill	Average Daily Household Consumption (gallons/day)
2008	71,300	35,580,421	$ 41.59	129.31
2009	71,046	36,867,692	$ 43.24	392.15
2010	71,101	36,104,250	$ 42.32	278.76
2011	71,584	36,481,469	$ 42.47	295.74
2012	71,590	37,902,598	$ 44.12	340.69
2013	71,605	39,343,312	$ 45.79	379.57
2014	71,726	39,427,966	$ 45.81	381.66
2015	71,873	37,449,856	$ 43.42	348.96
2016	69,505	35,510,583	$ 42.58	325.16

Table 7.4, which summarizes the City of Modesto's recent commercial, industrial, etc. water demand ("non-residential" water use), reveals a similar decline as residential water use into 2016.

Table 7.4
Modesto Non-Residential Water Demand

Fiscal Year July to June	Average # of Commerial, Industrial and Other Non-Residential Connections	AverageCommerial, Industrial and Other Non-Residential User Revenues	Average Monthly Non-Residential Water Bill	Average Daily Non-Residential Consumption (gallons/day)
2008	4,842	11,930,520	$ 205.32	2,782
2009	4,866	12,382,453	$ 212.08	2,710
2010	4,876	11,455,860	$ 195.78	2,517
2011	4,883	11,638,467	$ 198.62	2,545
2012	4,900	12,575,504	$ 213.86	2,660
2013	4,916	13,091,462	$ 221.93	2,644
2014	4,932	12,963,331	$ 219.06	2,526
2015	4,940	12,412,752	$ 209.41	2,399
2016	4,947	11,385,945	$ 191.79	2,156

Table 7.5 summarizes the recent water supply situation in the City of Turlock, which relies entirely groundwater to meet its water supply needs.

Table 7.5
Modesto Water Supply

Calendar Year	Groundwater Supplies	Average Depth to Groundwater Pumped (feet)	Electrical Power Cost/Million Gallons
2010	7,094	N/A	N/A
2011	6,846	130	N/A
2012	7,012	132	N/A
2013	7,432	132	$161
2014	6,565	149	$161
2015	5,562	160	$178

The table shows that Turlock most recently has experienced drought-related decreases in its groundwater pumping and use in conjunction with increased depth to groundwater.

Table 7.6 summarizes the City of Turlock's recent historical residential water use. The table shows a drop-off in household water consumption from calendar year 2013 into the current drought through 2015. As with the region's other communities, measures to reduce water use and encourage conservation can only go so far in helping to offset rising pumping costs. This is especially true as the Study Area's population is projected to continue its strong growth, well outpacing the rate of growth for the State of California, as previously discussed.

Table 7.6
Turlock Residential Water Demand

Calendar Year	Average # of Residential Connections[1]	Average Residential Customer Revenues	Average Monthly Residential Water Bill	Average Daily Household Consumption (gallons/day)
2011	17,095	5,954,065	$ 29.02	613.9
2012	17,095	5,935,917	$ 28.94	552.9
2013	17,095	6,220,556	$ 30.32	668.6
2014	17,095	6,006,627	$ 29.28	579.7
2015	17,095	6,751,861	$ 32.91	489.6

1. Reported residential connections for 2015 assumed for all other years.

Based on data provided by the Cities of Modesto and Turlock and as previously discussed, the added cost per acre-foot of water pumped per foot of elevation in the region is estimated to range from $0.39 to $1.12. This cost includes expenses for both power (electricity, diesel, etc.) and maintenance. It does not include added costs of capital investment to reach greater depths or costs of added treatment due to the lower quality of water at greater depths.

According to the SWRCB, the annual baseline DCMI pumping from the Study Area's four groundwater sub-basins is 247,000 acre feet. Table 7.7 summarizes the implications for the cost of this groundwater for a range of potential regional well elevation declines based on Stratecon's assessment of the impacts on depth to groundwater of the SED 40.

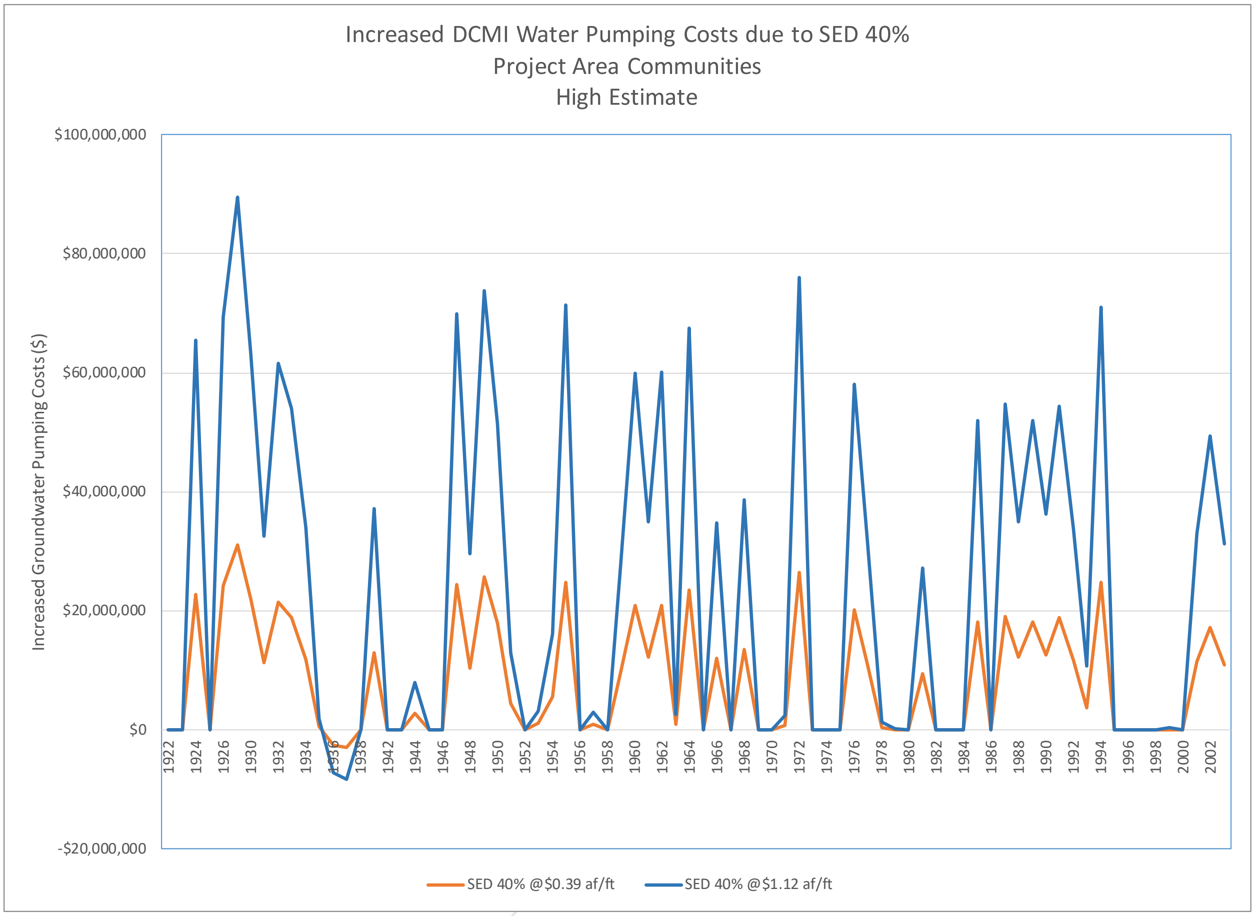
Table 7.7
Water Cost Impacts

	Average		Min of High Estimate		Max of High Estimate	
Total Average DCMI Pumping (Acre-Feet/Yr)		247,000		247,000		247,000
Average Increase in Groundwater Depths (ft)		33.50		84.65		210.09
Cost per AF Pumped Per Foot of Depth	$	0.39	$	0.39	$	0.39
Total Incremental Cost	$	3,226,954	$	8,154,503	$	20,238,035
Total Households in Region		504,842		504,843		504,844
	$	**6.39**	**$**	**16.15**	**$**	**40.09**
Cost per AF Pumped Per Foot of Depth	$	1.12	$	1.12	$	1.12
Total Incremental Cost	$	9,267,440	$	23,418,061	$	58,119,485
Total Households in Region		504,842		504,843		504,844
	$	**18.36**	**$**	**46.39**	**$**	**115.12**

The table shows that for the projected average well depth impact for the Irrigation Districts during the Study Period of about 33.5 feet, the estimated additional cost burden on DCMI water users in the region ranges from about $3.2 to $9.3 million. This translates to about $6.39 to $18.36 per household (about $0.50 to $1.50 a month) within the region to provide some order of magnitude perspective (though of course some of the estimated cost would be incurred by non-residential users of water including commercial users, schools, etc.). Concurrently, within the range of projected well depth increases as a result of SED-related increases in pumping for any one year during the Study Period, the estimated lower and upper bound, high estimate pumping cost impacts range from about $8.2 million to $58.1 million or about $16 to $115 per region household. This again highlights the fact that in many hydrologic years during the study period the impacts on well depths and resulting associated increases on community water costs could be substantial.

Figure 7.1 shows Stratecon's estimates of increased groundwater costs during the Study Period for the Study Area's communities based on the cost per foot of lift ranging from $0.39 to $1.12. The graphic reflects estimates of the lower and upper bound, high estimate potential impacts of the SED 40 on groundwater depths for each basin based on the estimates for the Irrigation Districts within those basins. For example, the Modesto Basin groundwater depth assumptions are based on the estimated SED 40 impacts on groundwater depths in the Modesto Irrigation District. For the Turlock Basin, Stratecon assumed depth changes consistent with the estimates for the Turlock Irrigation District. For the Merced Basin, Stratecon assumed depth changes consistent with the estimates for the Merced Irrigation District. For the Eastern San Joaquin Basin, Stratecon assumed depth changes consistent with the weighted average groundwater pumping of the Oakdale ID, Stockton East WD and the Central San Joaquin WCD. The graphic reveals significant inter-year variability in the pumping cost impacts and many years that those added costs would have been substantial for the region's communities.

Figure 7.1


Increased DCMI Water Pumping Costs due to SED 40%
Project Area Communities
High Estimate
$100,000,000
$80,000,000
$60,000,000
$40,000,000
$20,000,000
$0
-$20,000,000
Increased Groundwater Pumping Costs ($)
1922
1924
1926
1930
1932
1934
1936
1938
1942
1944
1946
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
SED 40% @$0.39 af/ft
SED 40% @$1.12 af/ft

8. RECREATION

The SED 40 would be expected to result in material declines in Study Area reservoir elevations as less spring snow pack run-off will be allowed to be captured by the region's dams and held for later release for irrigation and other purposes. A number of the Study Area reservoirs (Woodward Reservoir and Modesto Reservoir, as primary examples) and reservoirs adjacent to the Study Area operated by the Irrigation Districts (Lake Don Pedro and Lake McClure, as primary examples) are important regional water-based recreation destinations. Accordingly, SED-associated declines in reservoir elevations during the spring and, particularly, summer months, which are peak periods for water-based recreation regionally is expected to have an adverse effect on recreation at the region's reservoirs and, thus, adverse economic impacts due to associated declines in local recreation-associated spending and job creation. This is potentially particularly true of Woodward, which has a strict surface elevation threshold for terminating body contact activities within the reservoir. Historically, this threshold has been reached in October but recently, with the drought, has been triggered in September. Any SED-related reductions in the reservoir's elevations could result in the threshold being reached earlier, particularly in drier years, having a definitive adverse impact on recreation at the reservoir and associated regional recreation-related spending and economic output and employment effects. Stratecon was unable to obtain the data it sought to perform statistical analyses relating the region's lake recreation visitation to lake levels as a basis to estimate the recreation effects of the SED 40. This noted, the SWRCB dismissed those impacts as minor with no empirical foundation for that conclusion. Stratecon believes that while the recreation-related impacts may be substantially less than the impacts associated with crop production and water costs the SED 40's potential recreation-associated economic impacts are likely to be material, particularly during drier hydrologic years when the unimpaired flow requirements will have particularly substantial impacts on summertime reservoir elevations. As such, the SWRCB should explicitly seek to quantify those impacts as part of its programmatic assessment of the SED.

9. HYDROPOWER

The SED's impacts on hydropower generation are estimated by the SWRCB to be less than $1 million attributed to a combination of lost power production and reduced power value. While the SWRCB does not address the implications for regional power consumers (households, businesses, etc.) of the cost of replacement power and associated economic impacts, Stratecon believes those impacts to likely be relatively small. Accordingly, Stratecon defers to the SWRCB evaluation of power production effects and, accordingly, does not evaluate the associated economic impacts.

10. ECONOMIC IMPACTS

The economic impacts of implementation of the SED on the Study Area economy will result primarily from the following:

A. Reduced agricultural production and associated crop revenue generation by the Irrigation Districts due to the SED-related reduction of the districts' surface water supplies and the fact that not all of those surface supply reductions are expected to be offset with increased groundwater pumping (See Section 6).
B. Reduced dairy and livestock sectors production due to a reduction in Irrigation District feed production (See Section 6).
C. Increases in the cost of groundwater for irrigation both within and outside of the Irrigation Districts due to increased groundwater depths resulting from increased Irrigation District groundwater pumping to offset SED reductions in their surface water supplies (See Section 6).
D. Increases in community costs of water, including water costs incurred by the region's Disadvantaged Communities, due to increased groundwater pumping and depths resulting from reduced surface water supplies and increased Irrigation District and community groundwater pumping to offset SED reductions in their surface water supplies (See Section 7).
E. Changes in regional reservoir operations and associated effects on reservoir surface elevations and, correspondingly, recreation visitation and recreation-related local spending (See Section 8).
F. Changes in regional reservoir operations and associated effects on hydropower generation (See Section 9).

Stratecon quantified the impacts of A, B, C and the groundwater depth component of D on the Study Area's economic output and employment using the economic input-output modelling tool IMPLAN.

The application of IMPLAN and associated economic impact indications are as follows.

A. Reduced Agricultural Production by Irrigation Districts

As previously discussed, Stratecon examined the implications of the SED 40 on Study Area agricultural production under two scenarios related to Irrigation District response to the anticipated SED 40 surface water supply reductions (See Section 6). The first assumed that the Irrigation District's would increase their groundwater pumping to offset the water supply reductions. It is assumed that the rate of replacement of surface water lost with groundwater would be consistent with the observed historical response of the Westlands Irrigation District to surface water supply delivery variability. This resulted in estimates of groundwater pumping by the Irrigation Districts during the Study Period were the SED 40 in place that were less than estimated by the SWRCB. Accordingly, Stratecon's analysis concluded greater reductions in overall Irrigation District water supplies during the Study Period due to the unimpaired flow requirements than did the SWRCB and, correspondingly, greater crop land fallowing/idling and associated declines in crop production and gross revenues.

1. SED 40 without SGMA limitations on Groundwater Pumping

Table 10.1 shows Stratecon's estimates of lost gross crop revenues for each of the Irrigation Districts in the peak Study Period year of total supply reductions and on average. These lost gross crop revenues represent the estimated direct economic output losses of the SED 40 without account for potential groundwater pumping restrictions associated with the SGMA. The table shows an average estimated annual loss of direct economic output in 2008$ of $52 million or about 4% of the Irrigation Districts' estimated average economic output. This compares to the SWRCB's estimate of $36 million. Perhaps more importantly, however, the table shows a peak single year expected decline in economic output by the Irrigation Districts in 2008$ of about $235 million or 16% of the Irrigation Districts' direct economic output. The severity of the impacts on output of this single year and other years during the Study Period also with very significant estimated losses of economic output is masked by a focus on the average impacts over the entire Study Period with a number of years with small or no expected impacts due to more favorable hydrological conditions (wet or above normal years).

Table 10.1

Summary of Lost Direct Output (2008$)

Irrigation District	Reduction in Surface Water Supplies	Baseline	40% Unimpaired Flows	Revenue Loss (2008$)	% of Baseline
SSJID	Peak Reduction	$ 227,340,824	$ 180,598,016	$ 46,742,808	21%
	Average	$ 228,801,088	$ 222,053,045	$ 6,748,043	3%
Oakdale ID	Peak Reduction	$ 129,762,737	$ 96,224,934	$ 33,537,802	26%
	Average	$ 128,933,646	$ 123,814,745	$ 5,118,901	4%
SEWD/CSJWCD	Peak Reduction	$ 333,944,545	$ 280,822,511	$ 53,122,035	16%
	Average	$ 333,944,545	$ 327,507,259	$ 6,437,286	2%
Modesto ID	Peak Reduction	$ 136,192,551	$ 101,940,199	$ 34,252,353	25%
	Average	$ 147,767,555	$ 140,310,943	$ 7,456,612	5%
Turlock ID	Peak Reduction	$ 346,000,742	$ 277,006,247	$ 68,994,495	20%
	Average	$ 341,166,439	$ 323,806,519	$ 17,359,920	5%
Merced ID	Peak Reduction	$ 297,937,830	$ 249,481,682	$ 48,456,149	16%
	Average	$ 296,461,839	$ 287,736,625	$ 8,725,214	3%
Total	Peak Reduction	$ 1,429,872,508	$ 1,194,951,895	$ 234,920,613	16%
	Average	$ 1,477,075,112	$ 1,425,229,136	$ 51,845,976	4%

Figure 10.1 shows the substantial inter-year volatility in crop gross revenue losses due to the SED 40. These losses are expected to often exceed $100 million annually.

Figure 10.1

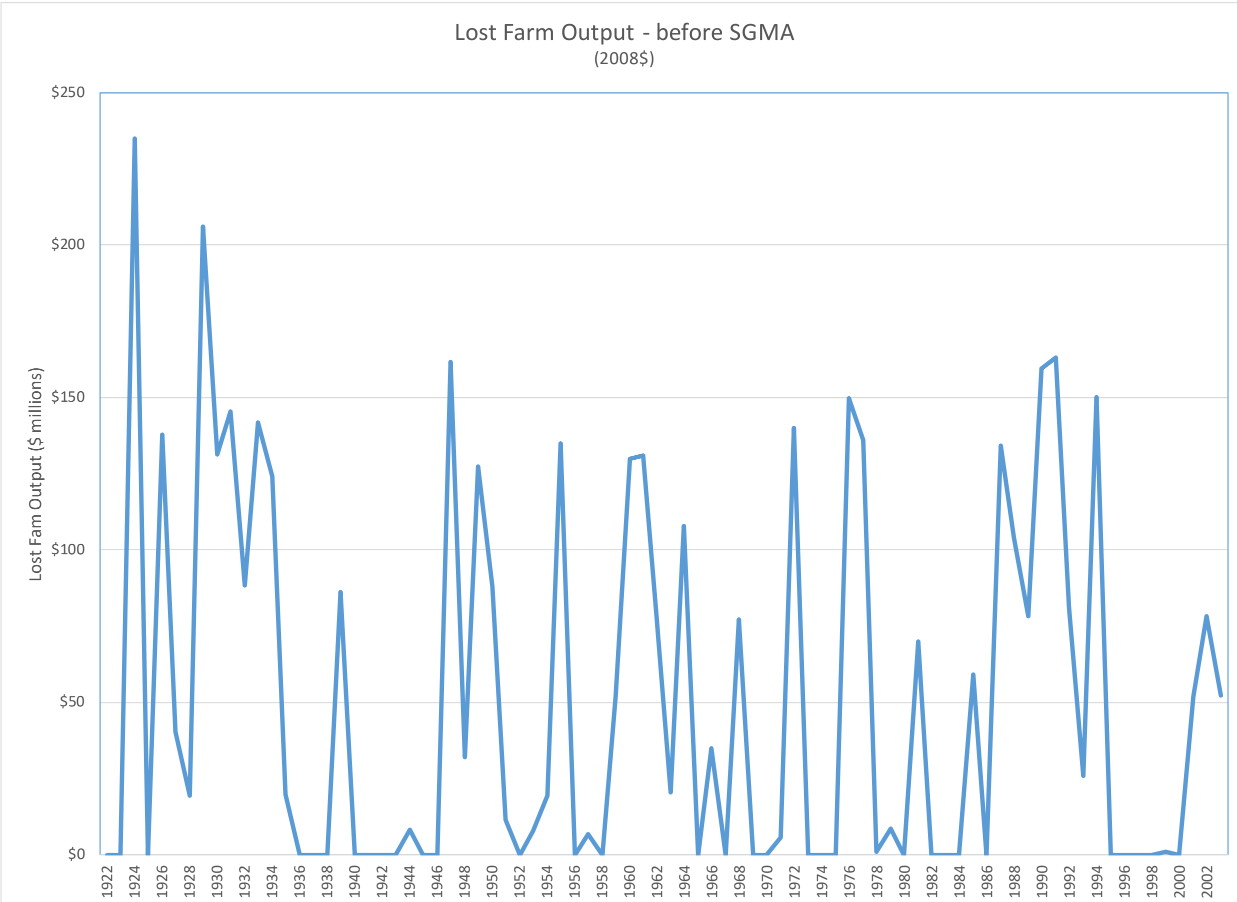


Table 10.2 summarizes the estimated direct farm sector employment impacts in the Irrigation Districts of the direct output impacts shown in Table 10.1. The estimates of employment impacts were derived applying the IMPLAN employment multipliers for the Study Area specific to each of the primary agricultural commodity sectors identified in the IMPLAN model. The table shows an average direct employment loss of about 276 jobs and a peak year employment loss nearing 1,450 jobs, which represents about 18% of the estimated crop production employment within the Irrigation Districts.

Table 10.2

Direct Employment

Irrigation District	Scenario	Baseline	40% Unimpaired Flows Output Loss	% of Baseline
SSJID	Peak Reduction	1,407	297	21%
	Average	1,413	40	3%
Oakdale ID	Peak Reduction	784	201	26%
	Average	779	30	4%
SEWD/CSJWCD	Peak Reduction	1,251	279	22%
	Average	1,251	34	3%
Modesto ID	Peak Reduction	791	237	30%
	Average	846	39	5%
Turlock ID	Peak Reduction	2,241	439	20%
	Average	2,217	88	4%
Merced ID	Peak Reduction	1,753	264	15%
	Average	1,746	45	3%
Total	Peak Reduction	8,014	1,448	18%
	Average	8,250	276	3%

Figure 10.2 shows the substantial inter-year volatility in estimated crop production reduction-related job losses due to the SED 40. These losses are expected in many years to exceed 400.

Figure 10.2

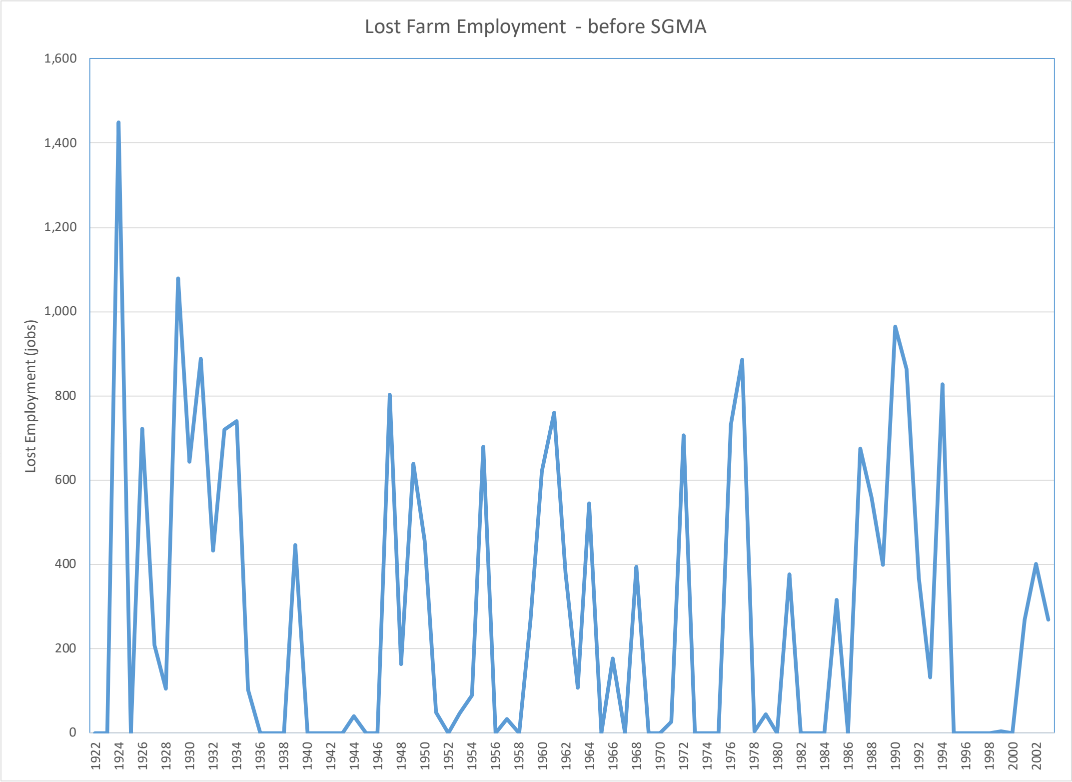


Table 10.3 summarizes the estimated total output impacts associated with the estimated reduction in Irrigation District crop production and, correspondingly, crop gross revenues during the Study Period because of the SED 40. These impacts include both the direct farm sector output impacts as shown in Table 10.1 and the additional secondary impacts because of the direct farm output impacts as farmers spend money in different sectors of the regional economy in support of their crop production activities and farm workers spend their income within the regional economy.

Table 10.3

Total Industrial Output (2008$)

Irrigation District	Scenario	Baseline	40% Unimpaired Flows Output Loss	% of Baseline
SSJID	Peak Reduction	$ 393,634,325	$ 81,848,785	21%
	Average	$ 396,197,635	$ 11,823,938	3%
Oakdale ID	Peak Reduction	$ 226,757,610	$ 59,123,091	26%
	Average	$ 225,296,538	$ 9,022,483	4%
SEWD/CSJWCD	Peak Reduction	$ 593,180,647	$ 94,250,753	16%
	Average	$ 593,180,647	$ 11,421,232	2%
Modesto ID	Peak Reduction	$ 237,398,786	$ 60,380,899	25%
	Average	$ 257,742,179	$ 13,111,388	5%
Turlock ID	Peak Reduction	$ 602,354,262	$ 121,274,862	20%
	Average	$ 593,853,035	$ 30,521,655	5%
Merced ID	Peak Reduction	$ 518,035,414	$ 84,810,822	16%
	Average	$ 515,441,215	$ 15,323,572	3%
Total	Peak Reduction	$ 2,498,712,060	$ 413,406,652	17%
	Average	$ 2,581,711,248	$ 91,203,277	4%

The table shows, for example, that the estimated contribution of the Irrigation Districts to Study Area total economic output averages almost $2.6 billion per year and the average reduction due to the SED 40 over the Study Period is estimated at about $91 million or approximately 4% of that total output contribution. Concurrently, in the peak reduction year during the Study Period for the Irrigation Districts combined the total impact on economic output is estimated at about $413 million or approximately 17% to the total output contribution of the Irrigation Districts.

Figure 10.3 shows the substantial inter-year volatility in total Study Area output losses due to the SED 40's impacts on the Irrigation Districts' farm production. These losses are expected in many years to exceed $200 million.

Figure 10.3

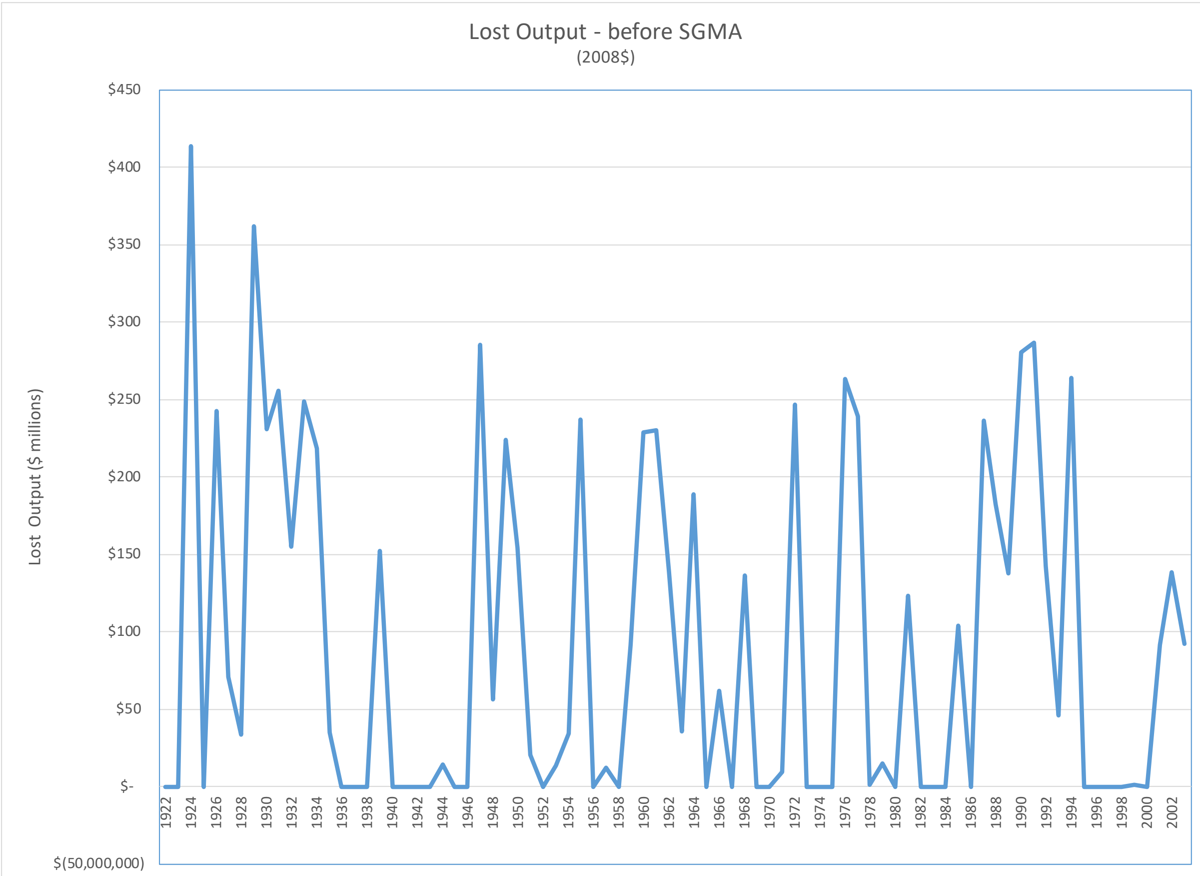


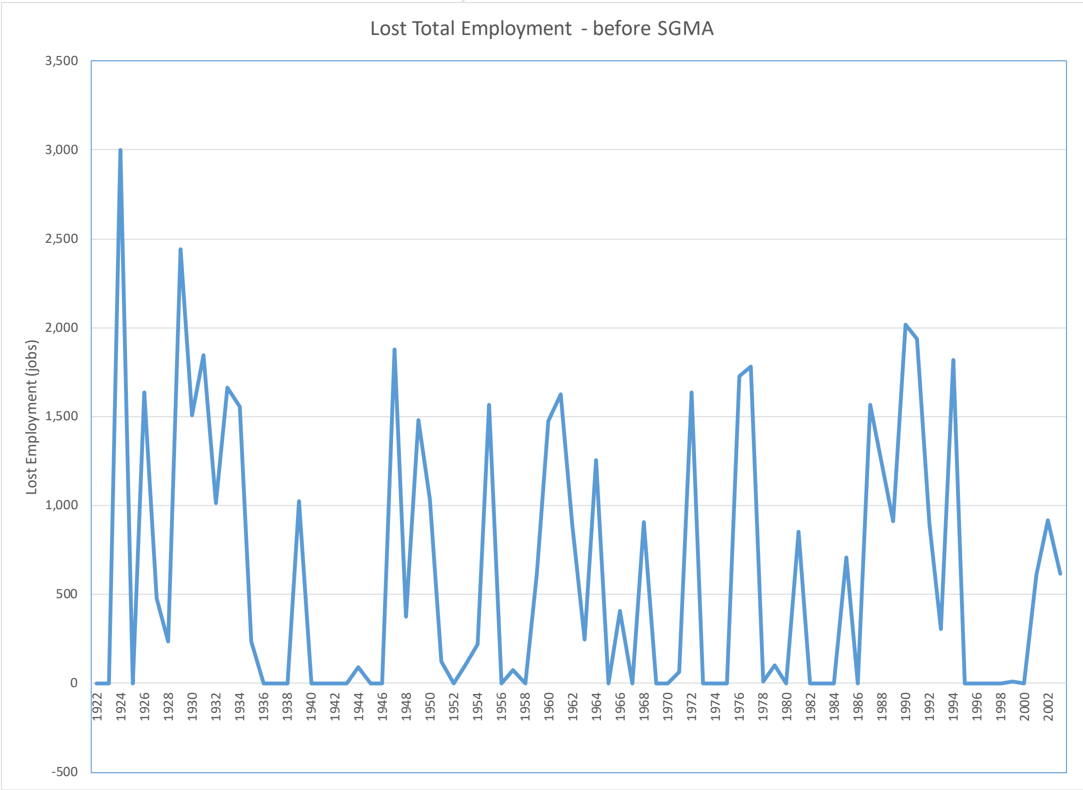
Table 10.4 summarizes the estimated total employment impacts within the Study Area of the SED 40 because of Irrigation District reductions in crop production. The jobs include the direct farm jobs shown in Table 10.2 as well as additional jobs within the economy (secondary employment impacts) associated with Irrigation District spending on non-labor inputs for farming and farm worker spending of their wages. The table shows, for example, that the estimated contribution of the Irrigation Districts to Study Area total employment averages about 19,000 jobs and the average reduction due to the SED 40 over the Study Period is estimated at about 700 or approximately 4% of those total jobs. Concurrently, in the peak water supply reduction year during the Study Period for the Irrigation Districts combined, the total impact on employment is estimated at about 3,000 jobs lost or approximately 17% of the total employment contribution to the Study Area by the Irrigation Districts.

Table 10.4

Irrigation District	Scenario	Baseline	40% Unimpaired Flows Output Loss	% of Baseline
SSJID	Peak Reduction	3,077	629	20%
	Average	3,093	88	3%
Oakdale ID	Peak Reduction	1,714	427	25%
	Average	1,703	64	4%
SEWD/CSJWCD	Peak Reduction	3,776	653	17%
	Average	3,776	79	2%
Modesto ID	Peak Reduction	1,781	469	26%
	Average	1,914	90	5%
Turlcck ID	Peak Reduction	4,681	905	19%
	Average	4,624	205	4%
Merced ID	Peak Reduction	3,882	602	16%
	Average	3,864	105	3%
Total	Peak Reduction	18,419	3,059	17%
	Average	18,975	632	3%

Figure 10.4 shows the substantial inter-year volatility in total Irrigation District output losses due to the SED 40. These losses are expected in many years to exceed 1,000 jobs.

Figure 10.4



3. SED 40 with SGMA Limitations on Groundwater Pumping

Table 10.5 shows Stratecon's estimates of lost gross crop revenues for each of the Irrigation Districts in the peak Study Period year of total supply reductions and on average. These lost gross crop revenues represent the estimated direct economic output losses of the SED 40 accounting for potential groundwater pumping restrictions associated with the SGMA. The table shows an average estimated annual loss of direct economic output in 2008$ of about $90 million or about 6% of the Irrigation Districts' average economic output. This compares to the SWRCB's estimate of $36 million. Perhaps more importantly, however, the table shows a peak single year expected decline in economic output by the Irrigation Districts of about $406 million or 27% of the Irrigation Districts' direct economic output from crop production. The severity of the impacts on output of this single year and other years during the Study Period also with very significant estimated losses of economic output is masked by a focus on the average impacts over the entire Study Period, which includes a number of years with small or no expected impacts due to more favorable hydrological conditions (wet or above normal years).

Table 10.5

Summary of Lost Direct Output (2008$)

Irrigation District	Reduction in Surface Water Supplies	Baseline	40% Unimpaired Flows	Revenue Loss (2008$)	% of Baseline
SSJID	Peak Reduction	$ 229,523,554	$ 126,662,869	$ 102,860,685	45%
	Average	$ 228,801,088	$ 212,475,927	$ 16,325,161	7%
Oakdale ID	Peak Reduction	$ 129,762,737	$ 82,644,121	$ 47,118,616	36%
	Average	$ 128,933,646	$ 121,470,102	$ 7,463,543	6%
SEWD/CSJWCD	Peak Reduction	$ 333,944,545	$ 227,700,476	$ 106,244,069	32%
	Average	$ 333,944,545	$ 321,069,973	$ 12,874,572	4%
Modesto ID	Peak Reduction	$ 149,761,947	$ 100,011,083	$ 49,750,865	33%
	Average	$ 147,767,555	$ 138,175,570	$ 9,591,985	6%
Turlock ID	Peak Reduction	$ 346,000,742	$ 242,042,147	$ 103,958,595	30%
	Average	$ 341,166,439	$ 318,812,129	$ 22,354,310	7%
Merced ID	Peak Reduction	$ 297,937,830	$ 112,010,174	$ 185,927,656	62%
	Average	$ 296,461,839	$ 274,710,763	$ 21,751,076	7%
Total	Peak Reduction	$ 1,486,931,356	$ 1,080,736,562	$ 406,194,794	27%
	Average	$ 1,477,075,112	$ 1,386,714,464	$ 90,360,648	6%

Figure 10.5 shows the substantial inter-year volatility in crop gross revenue losses due to the SED 40 assuming SGMA groundwater pumping restrictions. These losses are expected to often exceed $200 million annually.

Figure 10.5

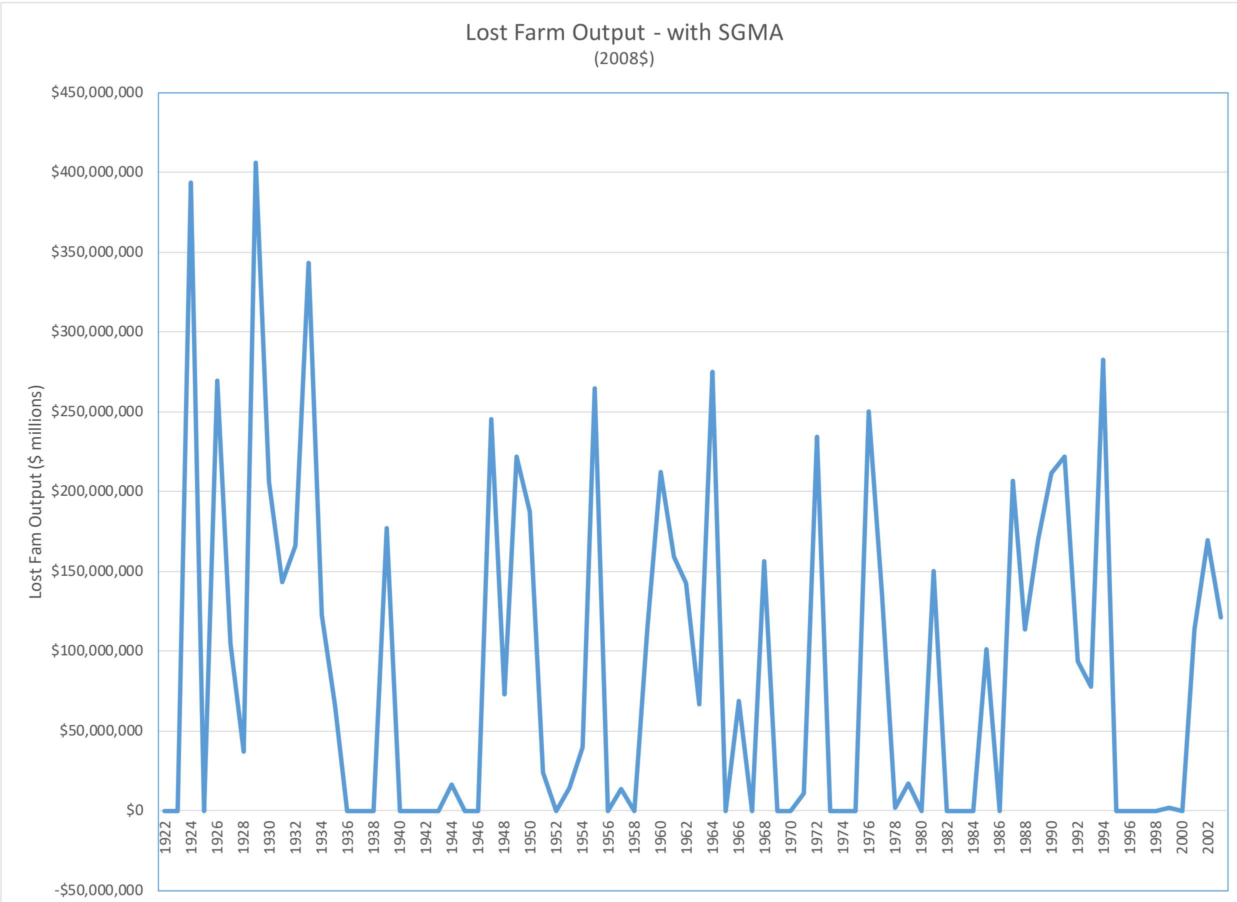


Table 10.6 summarizes the estimated direct farm sector employment impacts in the Irrigation Districts of the direct output impacts shown in Table 10.5. The estimates of employment impacts were derived applying the IMPLAN employment multipliers for the Study Area specific to each of the primary agricultural commodity sectors identified in the IMPLAN model. The table shows an average direct employment loss of about 467 jobs and a peak year employment loss of about 2,200 jobs, which represents about 28% of the estimated crop production employment within the Irrigation Districts.

Table 10.6

Direct Employment

Irrigation District	Scenario	Baseline	40% Unimpaired Flows Output Loss	% of Baseline
SSJID	Peak Reduction	1,417	599	42%
	Average	1,413	91	6%
Oakdale ID	Peak Reduction	784	284	36%
	Average	779	42	5%
SEWD/CSJWCD	Peak Reduction	1,251	558	45%
	Average	1,251	68	5%
Modesto ID	Peak Reduction	855	237	28%
	Average	846	49	6%
Turlock ID	Peak Reduction	2,241	490	22%
	Average	2,217	115	5%
Merced ID	Peak Reduction	1,753	943	54%
	Average	1,746	111	6%
Total	Peak Reduction	8,014	2,205	28%
	Average	8,250	467	6%

Figure 10.6 shows the substantial inter-year volatility in estimated crop production reduction-related job losses due to the SED 40 with SGMA groundwater pumping restrictions. These losses are expected in many years to exceed 1,000.

Table 10.7 summarizes the estimated total output impacts associated with the estimated reduction in Irrigation District crop production and, correspondingly, crop gross revenues during the Study Period because of the SED 40. These impacts include both the direct farm sector output impacts as shown in Table 10.5 and the additional secondary impacts because of the direct farm output impacts as farmers spend money in different sectors of the regional economy in support of their crop production activities and farm workers spend their income within the regional economy.

Figure 10.6

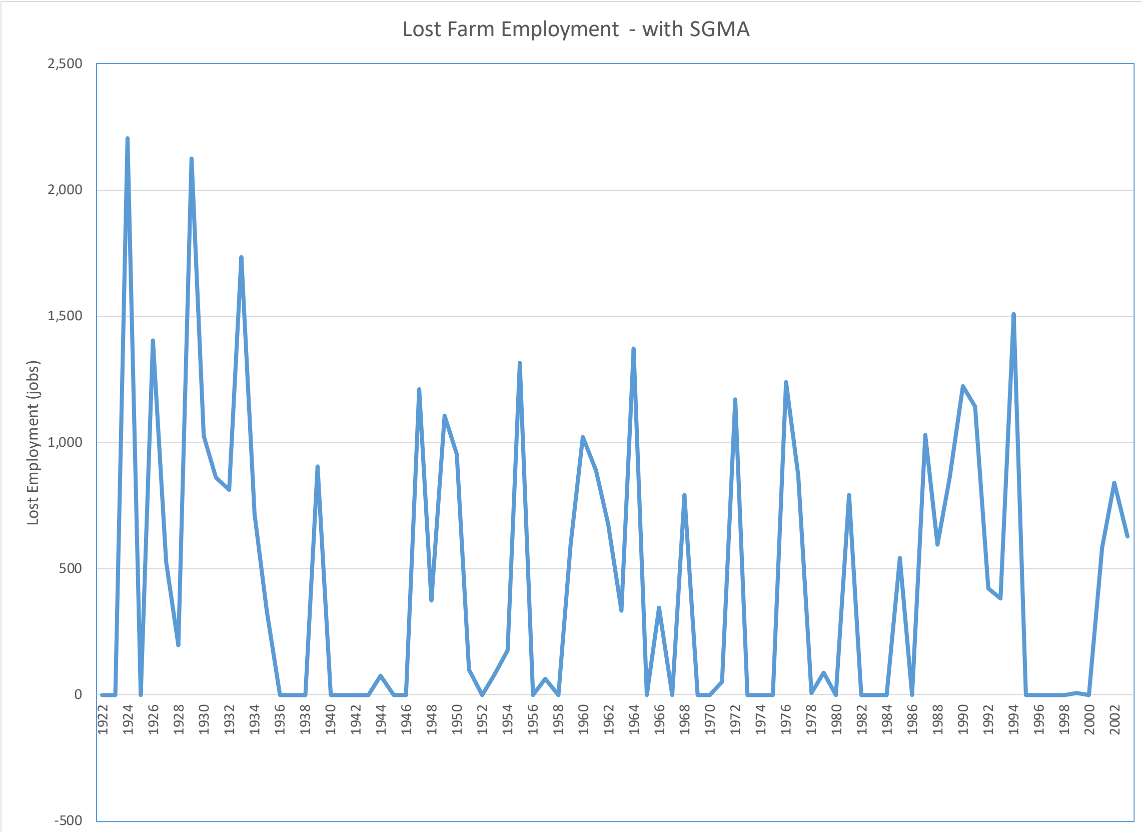


Table 10.7

Total Industrial Output (2008$)

Irrigation District	Scenario	Baseline	40% Unimpaired Flows Output Loss	% of Baseline
SSJID	Peak Reduction	$ 397,462,862	$ 179,548,022	45%
	Average	$ 396,197,635	$ 28,549,078	7%
Oakdale ID	Peak Reduction	$ 226,757,610	$ 83,002,887	37%
	Average	$ 225,296,538	$ 13,139,468	6%
SEWD/CSJWCD	Peak Reduction	$ 593,180,647	$ 188,501,506	32%
	Average	$ 593,180,647	$ 22,842,463	4%
Modesto ID	Peak Reduction	$ 261,247,277	$ 87,342,742	33%
	Average	$ 257,742,179	$ 16,855,846	7%
Turlock ID	Peak Reduction	$ 602,354,262	$ 182,501,504	30%
	Average	$ 593,853,035	$ 39,269,127	7%
Merced ID	Peak Reduction	$ 518,035,414	$ 325,879,007	63%
	Average	$ 515,441,215	$ 38,195,644	7%
Total	Peak Reduction	$ 2,599,038,072	$ 712,096,522	27%
	Average	$ 2,581,711,248	$ 158,827,683	6%

The table shows, for example, that the estimated contribution of the Irrigation Districts to Study Area total economic output averages almost $2.6 billion per year and the average reduction due to the SED 40 over the Study Period accounting for the SGMA is estimated at about $160 million or approximately 6% of that total output contribution. Concurrently, in the peak reduction year during the Study Period for the Irrigation Districts combined, the total impact on economic output is estimated at about $712 million or approximately 27% to the total output contribution of the Irrigation Districts.

Figure 10.7 shows the substantial inter-year volatility in total Irrigation District output losses due to the SED 40 with the SGMA. These losses are expected in many years to exceed $400 million.

Figure 10.7

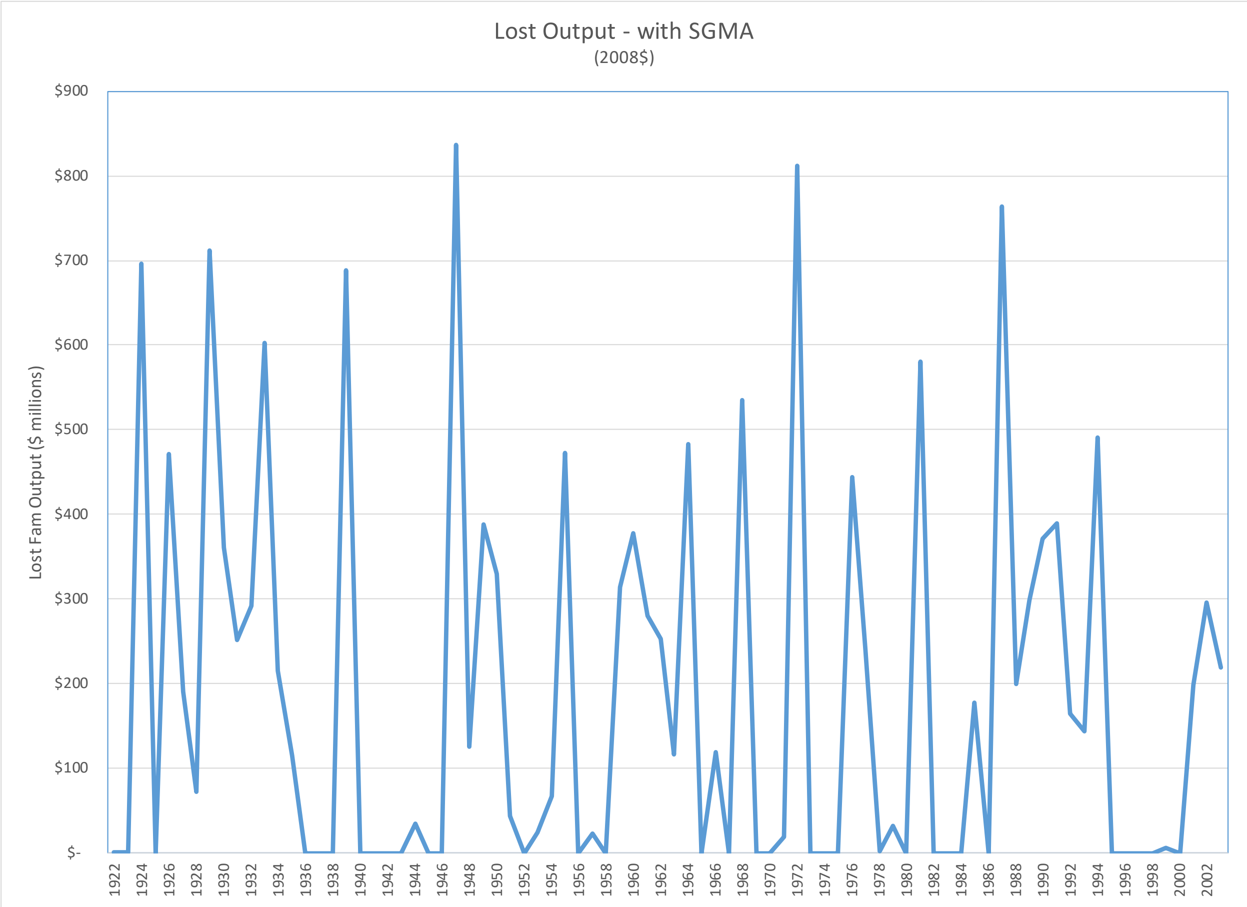


Table 10.8 summarizes the estimated total employment impacts of the SED 40 with the SGMA because of Irrigation District reductions in crop production. The jobs include the direct farm jobs shown in Table 10.6 as well as additional jobs within the Study Area economy (secondary employment impacts) associated with Irrigation District spending on non-labor inputs for farming and farm worker spending of their wages.

Table 10.8

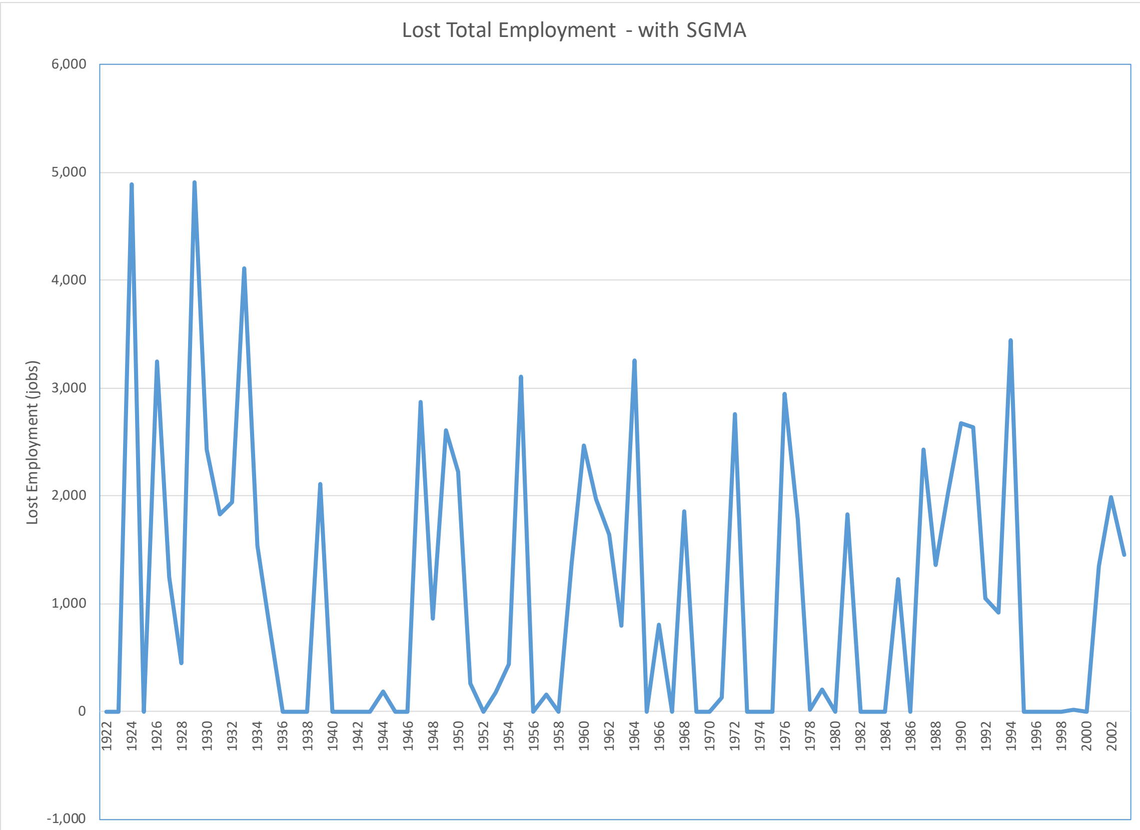
Total Employment

Irrigation District	Scenario	Baseline	40% Unimpaired Flows Output Loss	% of Baseline
SSJID	Peak Reduction	3,102	1,348	43%
	Average	3,093	209	7%
Oakdale ID	Peak Reduction	1,714	606	35%
	Average	1,703	93	5%
SEWD/CSJWCD	Peak Reduction	3,776	1,307	35%
	Average	3,776	158	4%
Modesto ID	Peak Reduction	1,937	583	30%
	Average	1,914	115	6%
Turlcck ID	Peak Reduction	4,681	1,204	26%
	Average	4,624	267	6%
Merced ID	Peak Reduction	3,882	2,259	58%
	Average	3,864	262	7%
Total	Peak Reduction	19,092	4,909	26%
	Average	18,975	1,082	6%

The table shows, for example, that the estimated contribution of the Irrigation Districts to Study Area total employment averages about 19,000 jobs and the average estimated reduction due to the SED 40 over the Study Period is estimated at 1,082 or approximately 6% of those total jobs. Concurrently, in the peak water supply reduction year during the Study Period for the Irrigation Districts combined, the total impact on employment is estimated at about 4,900 jobs lost or approximately 26% of the total crop production employment contribution to the Study Area by the Irrigation Districts.

Figure 10.8 shows the substantial inter-year volatility in total Irrigation District output losses due to the SED 40 accounting for SGMA restrictions on additional groundwater pumping. These losses are expected in many years to exceed 2,000 jobs.

Figure 10.8



B. Reduced Production by Dairy and Livestock Sectors

In addition to the Study Area economic impacts resulting directly from SED 40-related reductions in the Irrigation Districts' crop production and associated crop gross revenues, Stratecon also examined the resulting associated downstream impacts on the region's dairy and livestock production sectors who purchase feed from local grain and hay farmers and in turn provide milk and livestock to the region's dairy product manufacturers and meat processors, among other manufacturing activities. The region's milk production and downstream associated dairy processing sectors are collectively referred to herein as the "dairy sectors." The region's livestock production and downstream associated livestock slaughter, rendering and processing sectors are collectively referred to herein as the "livestock sectors."

4. Direct Output Impacts

Table 10.9 shows Stratecon's estimates of the upper bound average and peak year lost dairy and livestock sectors revenues expected to result from SED 40 reductions in regional feed crop availability both before and with SGMA implementation. These lost revenues represent the estimated upper bound potential direct economic output losses of the SED 40 within both sectors. For example, the table shows an average estimated annual loss of direct economic output in 2008$

for the region's dairy sectors before the SGMA of $156 million or about 3.6% of the region's estimated average dairy sectors economic output and a peak single year expected decline in dairy sectors economic output of about $763 million, about 17.7% of the region's estimated average dairy sectors output. The table also shows an average estimated annual loss of direct economic output in 2008$ for the region's livestock sectors before the SGMA of about $37 million or about 3.6% of the region's estimated average livestock sectors economic output and a peak single year expected decline in livestock sectors economic output of about $180 million, about 17.7% of the region's estimated livestock sectors output.

Table 10.9

Summary of Upper Bound Lost Dairy Sector Output (2008$)		Lost Direct Ouput SED 40%	Percent of Total Sector Output	Lost Direct Ouput SED 40% with SGMA	Percent of Total Sector Output
Total	Peak Reduction	$ 762,879,328	17.7%	$ 1,014,698,281	23.6%
	Average	$ 156,554,166	3.6%	$ 213,858,799	5.0%
Summary of Maximum Lost Livestock Sector Output (2008$)		**Lost Output SED 40%**	**Percent of Total Sector Output**	**Lost Output SED 40% with SGMA**	**Percent of Total Sector Output**
Total	Peak Reduction	$ 179,846,483	17.7%	$ 239,212,036	23.6%
	Average	$ 36,907,169	3.6%	$ 50,416,562	5.0%

Figures 10.9 and 10.10 show the substantial inter-year volatility in anticipated dairy and livestock sectors revenue losses due to the SED 40. Figure 10.9 indicates that dairy sectors direct output losses frequently exceed $100 million. Figure 10.10 indicates that livestock sectors direct output losses frequently exceed $40 million.

Figure 10.9

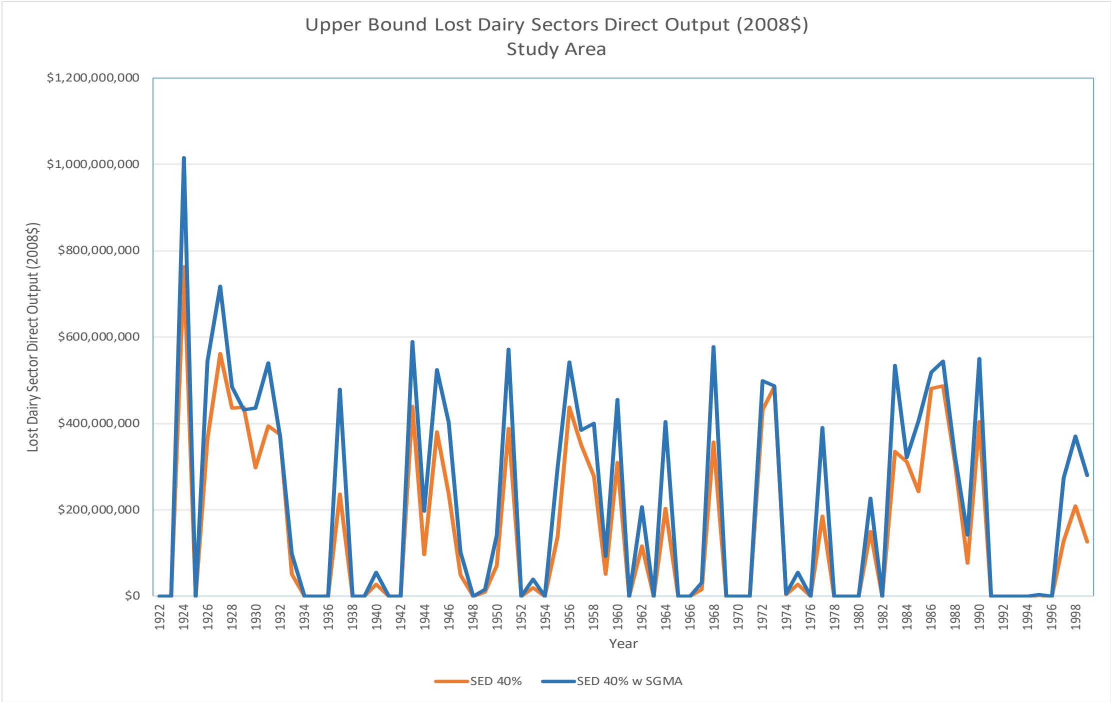
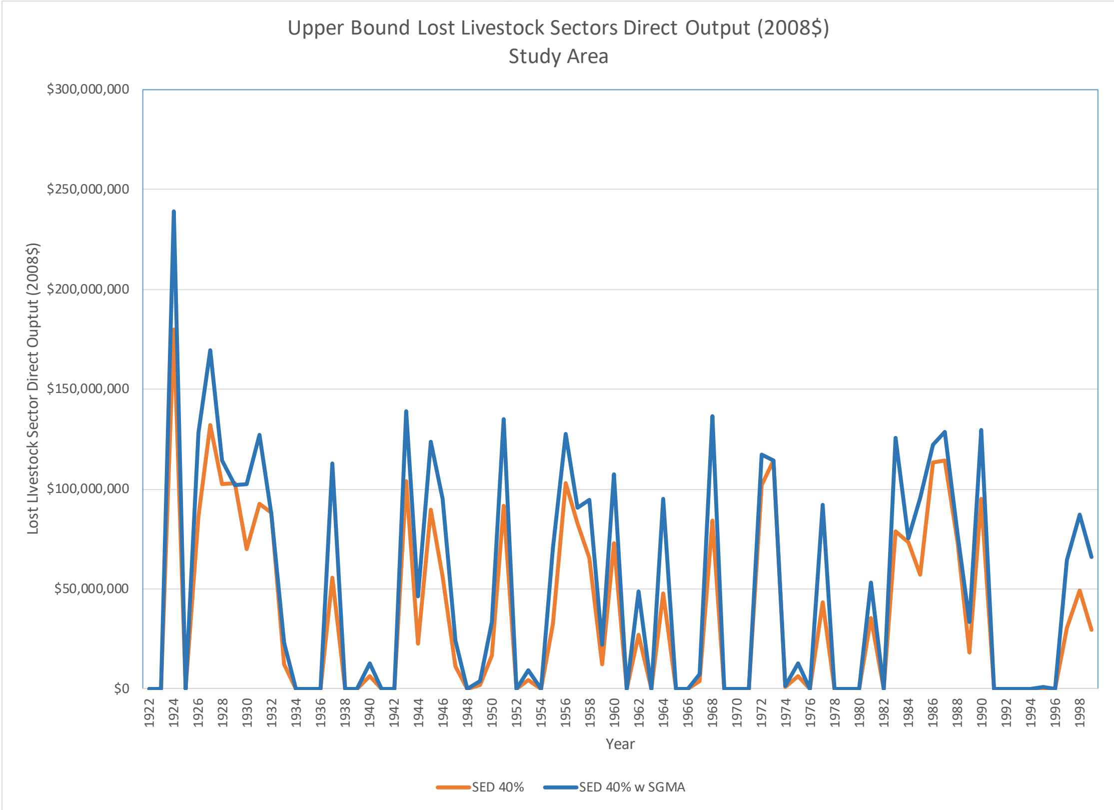


Figure 10.10



5. Direct Employment Impacts

Table 10.10 summarizes the estimated direct dairy and livestock sectors employment impacts of the direct output impacts shown in Table 10.9. These lost jobs represent the estimated upper bound potential direct economic employment losses of the SED 40 within both sectors. For example, the table shows an average estimated annual upper bound potential loss of direct employment for the region's dairy sectors before the SGMA of 415 jobs or about 3.6% of the region's estimated average dairy sectors economic employment and a upper bound peak single year expected decline in dairy sectors employment of about 2,021, about 17.7% of the region's estimated average dairy sectors employment. The table also shows an average estimated annual upper bound loss of direct employment for the region's livestock sectors before the SGMA of about 112 jobs or about 3.6% of the region's estimated average livestock sectors employment and a peak single year expected decline in livestock sectors employment of about 544 jobs, about 17.7% of the region's estimated livestock sectors employment.

Table 10.10

Summary of Upper Bound Lost Dairy Sectors Direct Employment		Lost Direct Employment SED 40%	Percent of Total Sector Employment	Lost Direct Employment SED 40% with SGMA	Percent of Total Sectors Employment
Total	Peak Reduction	2,021	17.7%	2,688	23.6%
	Average	415	3.6%	567	5.0%
Summary of Upper Bound Lost Livestock Sector Direct Employment		**Lost Direct Employment SED 40%**	**Percent of Total Sector Employment**	**Lost Direct Employment SED 40% with SGMA**	**Percent of Total Sector Employment**
Total	Peak Reduction	544	17.7%	724	23.6%
	Average	112	3.6%	152	5.0%

Figures 10.11 and 10.12 show the substantial inter-year volatility in estimated dairy and livestock sectors job losses due to the SED 40. Figure 10.11 indicates that dairy sectors direct employment losses frequently exceed 500 jobs. Figure 10.12 indicates that livestock sectors direct employment losses frequently exceed 150 jobs.

Figure 10.11

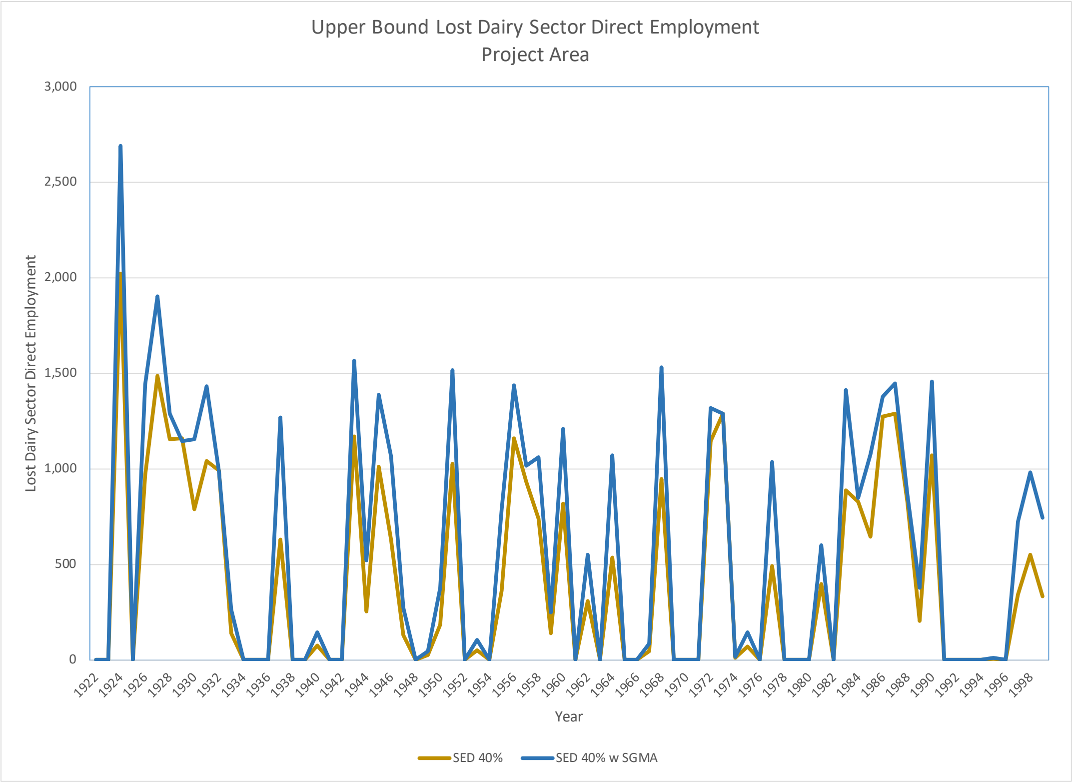
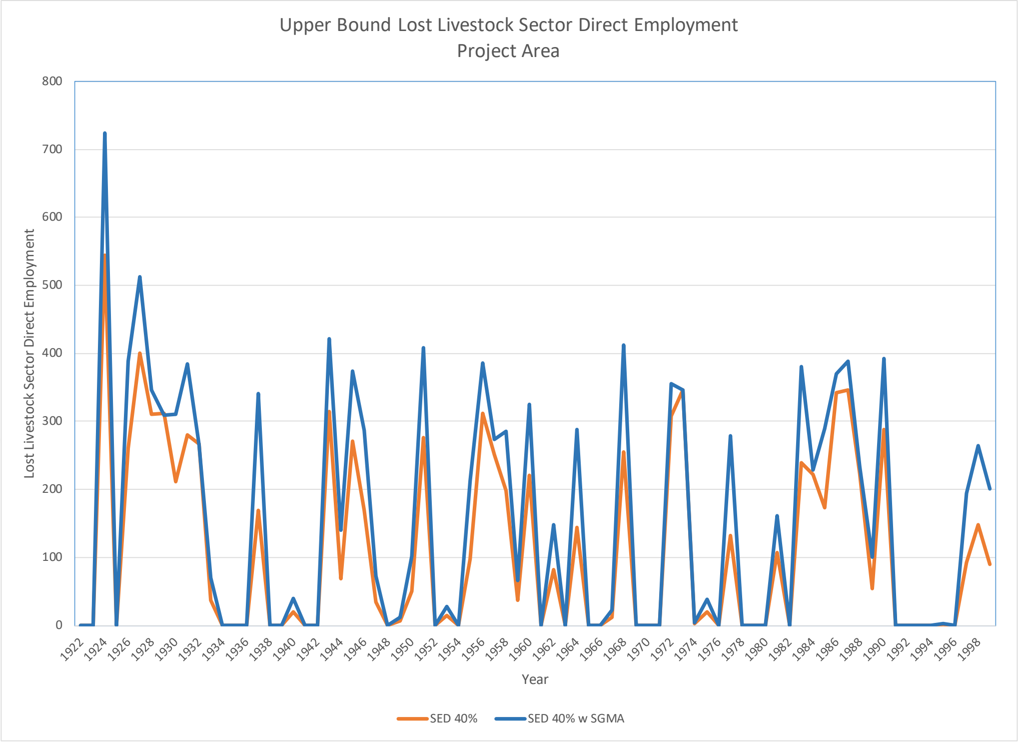


Figure 10.12



6. Total Output Impacts

Table 10.11 summarizes the total estimated Study Area economic output impacts of SED 40-related upper bound potential declines in regional dairy and livestock sectors production. These impacts include both the direct dairy and livestock sectors output impacts as shown in Table 10.10 and the additional secondary impacts because of the direct dairy and livestock sectors impacts as dairy and livestock enterprise operators spend money in different sectors of the regional economy in support of their dairy and livestock production activities, respectively, and workers within those sectors spend their income within the regional economy. To derive these secondary impacts, Stratecon made several adjustments to the IMPLAN model for 2010 for the three county Study Area. These adjustments included:

- Replacing the IMPLAN model's baseline data for output by the region's grain and other crop sectors (the latter includes hay crops) as the IMPLAN grain sector baseline output was substantially lower (~$80 million) than reported within the agricultural statistics for the three counties (~$350 million) and the other crop sector production about 15% lower than reported within the agricultural statistics for the three counties in 2010.
- Adjusting the Study Area's dairy sector (raw milk production) production function to remove the sector's flow through demand for grain and other crops (hay) so that the analysis of the impacts of the SED 40 on the dairy sector would not account for any portion of the impacts on the grain and other crops sectors separately addressed in the analysis of crop production impacts (to avoid double counting).
- Adjusting the Study Area's livestock sector (cattle and other livestock production) production function to remove the sector's flow through demand for grain and other crops (hay) so that the analysis of the impacts of the SED 40 on the livestock sector would not account for any portion of the impacts on the grain and other crops sectors separately addressed in the analysis of crop production impacts (to avoid double counting).
- Combining the four sectors within the IMPLAN model associated with dairy product manufacturing including the fluid milk and butter, cheese, ice cream and frozen dessert sector and ice cream and frozen dessert production sectors – collectively referred to as dairy manufacturing sectors.
- Adjusting the Study Area's dairy manufacturing sectors production function to remove the sectors' flow through demand for raw milk from the dairy sector so that the analysis of the impacts of the SED 40 on the dairy manufacturing sectors would not account for any portion of the impacts on the dairy sector separately addressed in the analysis of dairy sector impacts (to avoid double counting).
- Adjusting the Study Area's livestock slaughtering, rendering and processing sector ("livestock processing sector") production function to remove the sector's flow through demand for livestock (live cattle and other livestock) from the livestock sector so that the analysis of the impacts of the SED 40 on the livestock processing sector would not account for any portion of the impacts on the livestock sector separately addressed in the analysis of livestock sector impacts (to avoid double counting).

Table 10.11

Summary of Lost Output due to Upper Bound Dairy Sectors Production Reductions (2008$)		Lost Incremental Total Ouput SED 40%	Percent of Total Output due to Sector	Lost incremental Total Ouput SED 40% with SGMA	Percent of Total Output due to Sector
Total	Peak Reduction	$ 1,334,302,631	17.7%	$ 1,774,742,790	23.6%
	Average	$ 273,818,712	3.6%	$ 374,046,520	5.0%
Summary of Lost Output due to Upper Bound Livetock Sectors Production Reductions (2008$)		**Lost Incremental Total Ouput SED 40%**	**Percent of Output due to Sector**	**Lost Incremental Total Ouput SED 40% with SGMA**	**Percent of Output due to Sector**
Total	Peak Reduction	$ 316,952,658	17.5%	$ 421,575,610	23.3%
	Average	$ 65,043,392	3.6%	$ 88,851,686	4.9%

Note: Estimated incremental total output losses in addition to lost output due to SED-associated reductions in regional grain and other crop (grain and hay) production

The table shows, for example, that the estimated upper bound average reduction during the Study Period in regional economic output due to the estimated upper bound potential SED 40-related reduction in regional dairy sectors (includes dairy sector (raw milk production) and dairy manufacturing sector combined) production before SGMA implementation is about $274 million or 3.6% of the dairy sectors' estimated total output contribution to the regional economy. Concurrently, in the peak reduction year during the Study Period the upper bound total loss of regional economic output due to declines in dairy sectors production is estimated at about $1.33 billion or 17.7% of the dairy sectors' total estimated contribution to regional output.

The table further shows, for example, that the estimated average reduction during the Study Period in regional economic output due to the upper bound potential SED 40-related reduction in regional livestock sectors production before SGMA implementation is about $65 million or 3.6% of the livestock sectors' total output contribution to the regional economy. Concurrently, in the peak reduction year during the Study Period the upper bound total loss of regional economic output due to declines in in livestock sectors production is estimated at about $317 million or about 17.5% of the livestock sectors' total estimated contribution to regional output.

Figures 10.13 and 10.14 show the substantial inter-year volatility in estimated upper bound dairy and livestock sectors-driven output losses due to the SED 40. Figure 10.13 indicates that the estimated dairy sectors-related output losses frequently exceed $200 million. Figure 10.14 indicates that the estimated livestock sectors-related output losses frequently exceed $100 million.

Figure 10.13

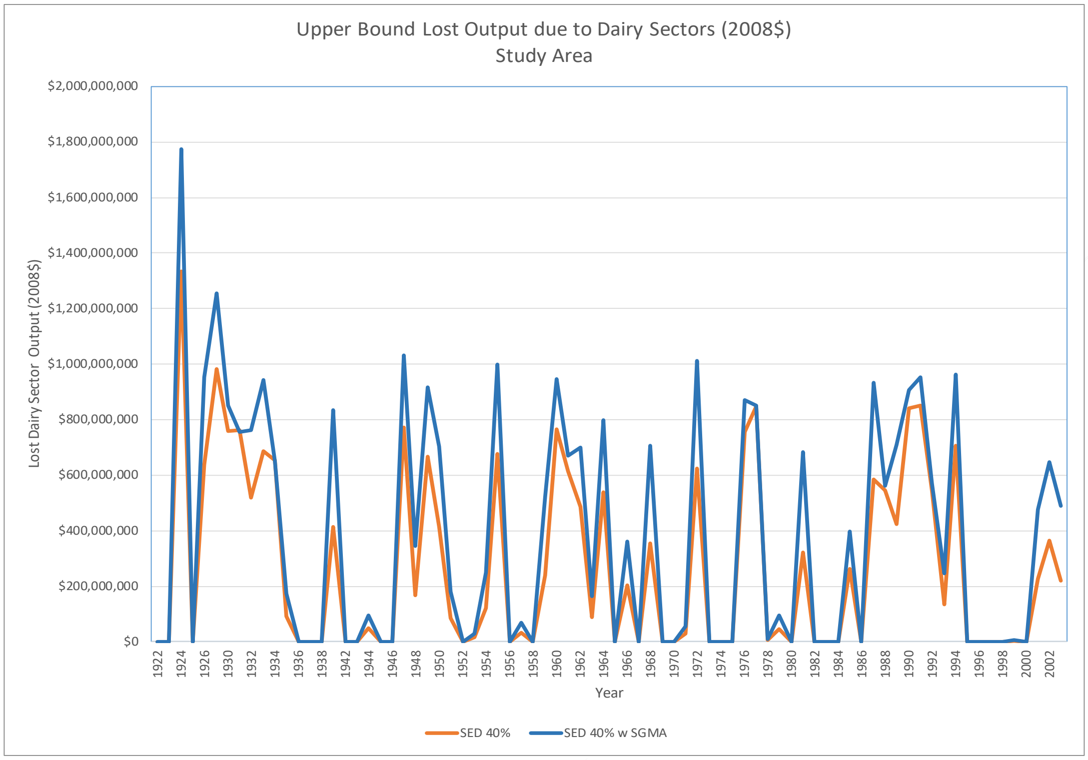
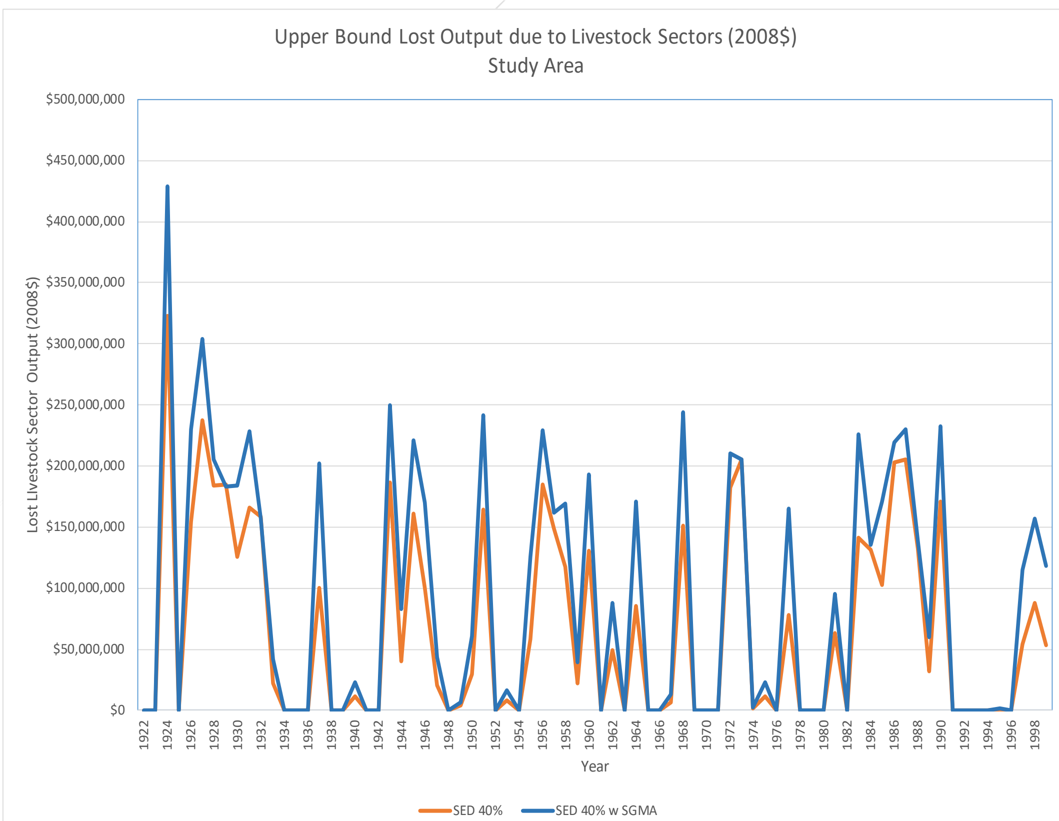


Figure 10.14



7. Total Employment Impacts

Table 10.12 summarizes the total estimated regional employment impacts of the direct output impacts shown in Table 10.9. These lost jobs represent the estimated upper bound potential economic employment losses within the Study Area economy due to the SED 40's impact on the region's dairy and livestock sectors. For example, the table shows an average estimated annual loss of employment associated with the region's dairy sectors before the SGMA of 1,015 jobs or about 3.2% of the region's estimated average dairy sectors economic employment and a peak single year potential upper bound decline in dairy sectors employment of about 4,944 jobs, about 15.4% of the region's estimated average dairy sectors employment. The table also shows an average estimated upper bound potential annual loss of direct employment for the region's livestock sectors before the SGMA of about 255 jobs or about 3.3% of the region's estimated average livestock sectors employment and a peak single year upper bound expected decline in livestock sectors employment of about 1,244 jobs, about 15.8% of the region's estimated livestock sectors employment.

Table 10.12

Summary of Upper Bound Lost Employment due to Dairy Sectors Production Reductions		Lost Incremental Total Employment SED 40%	Percent of Total Sectors-Generated Employment	Lost Incremental Total Employment SED 40% with SGMA	Percent of Total Sectors-Generated Employment
Total	Peak Reduction	4,944	15.4%	6,576	20.5%
	Average	1,015	3.2%	1,386	4.3%
Summary of Upper Bound Lost Employment due to Livestock Sectors Production Reductions		**Lost Incremental Total Employment SED 40%**	**Percent of Total Sectors-Generated Employment**	**Lost Incremental Total Employment SED 40% with SGMA**	**Percent of Total Sectors-Generated Employment**
Total	Peak Reduction	1,244	15.8%	1,654	21.1%
	Average	255	3.3%	349	4.4%

Note: Estimated incremental total employment losses in addition to lost employment due to SED-associated reductions in regional grain and hay crop production

Figures 10.15 and 10.16 show the substantial inter-year volatility in estimated regional job losses due to the SED 40's estimated potential upper bound impacts on the dairy and livestock sectors. Figure 10.15 indicates that the employment losses associated with the dairy sectors frequently exceed 500 jobs. Figure 10.16 indicates that livestock sectors direct employment losses frequently exceed 300 jobs.

Figure 10.15

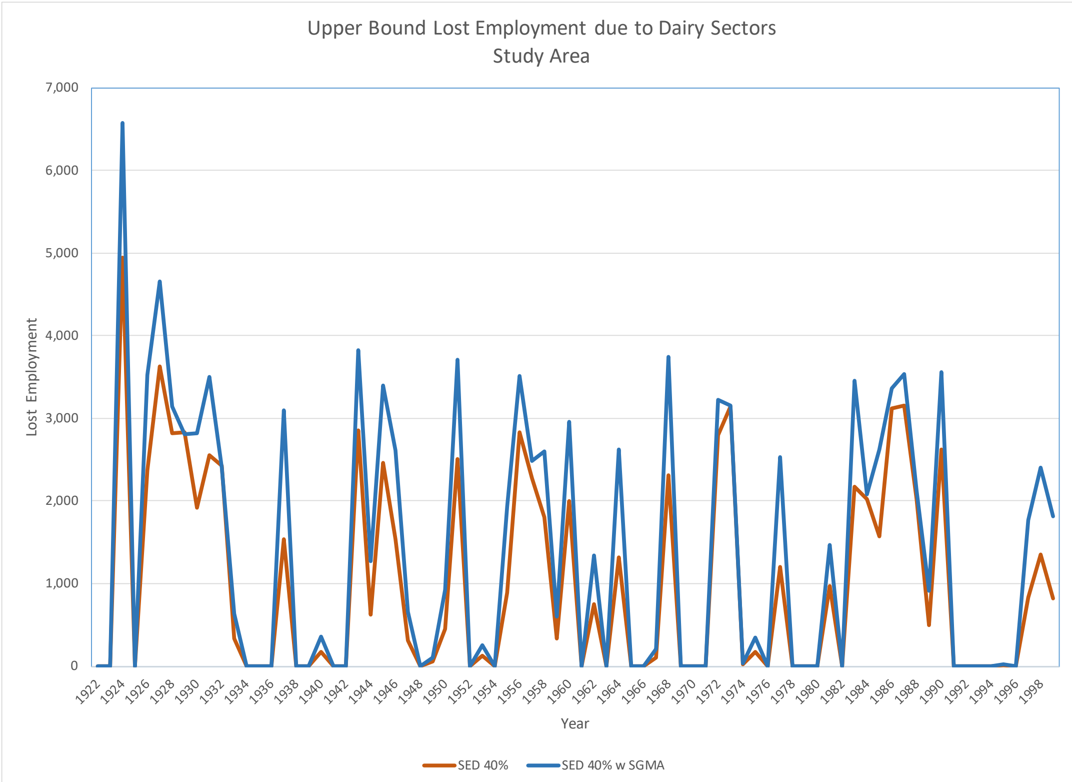
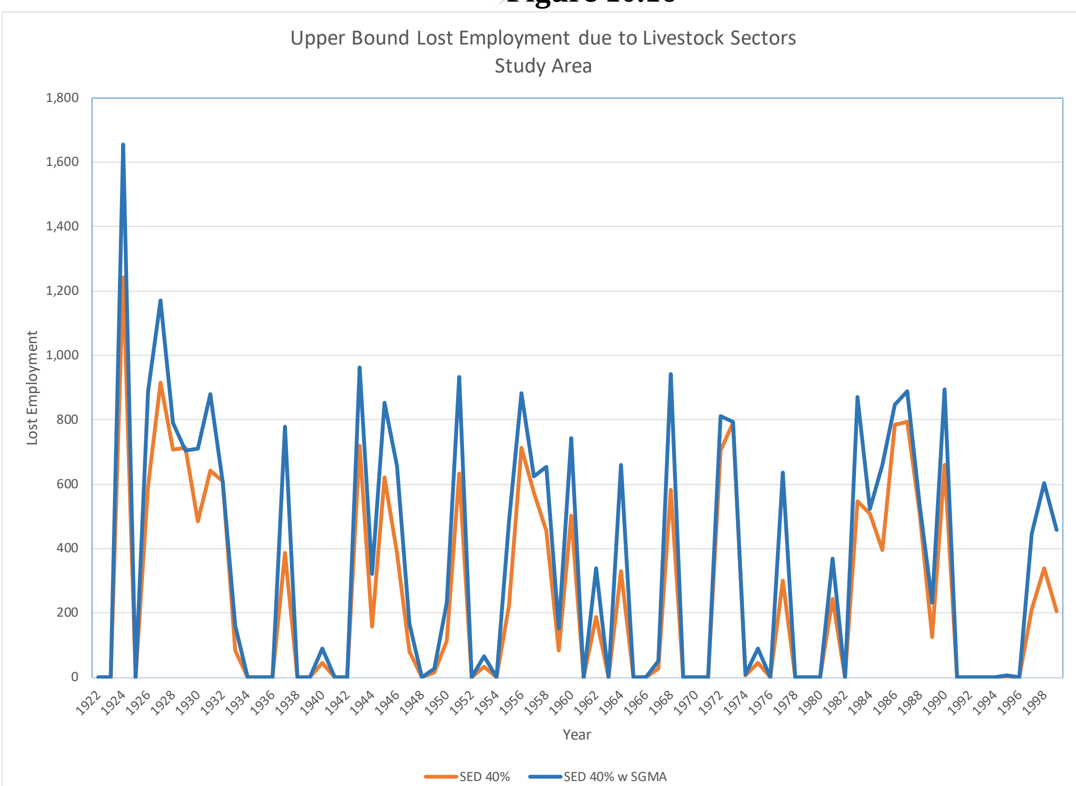


Figure 10.16



C. Increases in Irrigator Groundwater Costs

Implementation of the SED 40 before the SGMA could have substantial impacts on Study Area groundwater depths and, accordingly, groundwater pumping costs. These added costs extend not only to the Irrigation Districts existing pumping and additional pumping to offset lost surface water supplies but also irrigators outside the Irrigation Districts that rely entirely on groundwater for their water supplies. The increases in costs, as discussed and estimated previously, will result in corresponding decreases in farmer profit and farmer disposable incomes. The result will be reduced consumer spending regionally and associated lost regional economic output and employment. To evaluate these impacts Stratecon used the IMPLAN model household sector spending profiles to determine the weighted average regional output and employment impacts (multipliers) of each dollar spent by households. Stratecon then applied these multipliers to the estimated upper bound potential cost impacts on irrigators (lost income) in the Study Area of SED 40-related increases in groundwater depths. This translates the estimated lost income into regional spending and associated economic effects. Table 10.13 summarizes the results of this analysis.

Table 10.13

Upper Bound ID Cost of Irrigator Increased Groundwater Depths	Increased Cost	Total Ouput Impacts	Total Employment Impacts
Peak Increase in Cost	$101,513,377	$ 109,807,236	893
Average Increase	$ 25,310,496	$ 27,378,418	223
Upper Bound Outside Irrigator Cost of Increased Groundwater Depths	**Increased Cost**	**Total Ouput Impacts**	**Total Employment Impacts**
Peak Increase in Cost	$270,177,684	$ 292,251,778	2,376
Average Increase	$ 73,065,124	$ 79,034,700	643
Total Max Irrigator Cost of Increased Groundwater Depths	**Increased Cost**	**Total Ouput Impacts**	**Total Employment Impacts**
Peak Increase in Cost	$367,227,938	$ 397,231,244	3,230
Average Increase	$ 98,375,620	$ 106,413,118	865

The table indicates that the total output and employment impacts of the anticipated SED 40-related increases in irrigator groundwater pumping costs are estimated to be as much as about $106 million and 865 jobs on average per year, respectively, with peak single year impacts of as much as about $397 million and 3,230 jobs.

Figures 10.17 and 10.18 show the substantial inter-year volatility in estimated regional estimated output and job losses due to the SED 40's estimated potential upper bound impacts on irrigator groundwater costs. Figure 10.17 indicates that the output losses frequently exceed $100 million but in one year during the Study Period would have seen an increase due to reduced irrigator pumping costs due to lower groundwater elevations. Figure 10.18 indicates that the job losses frequently exceed 500 but in one year during the Study Period would have seen an increase due to reduced irrigator pumping costs due to lower groundwater elevations.

Figure 10.17

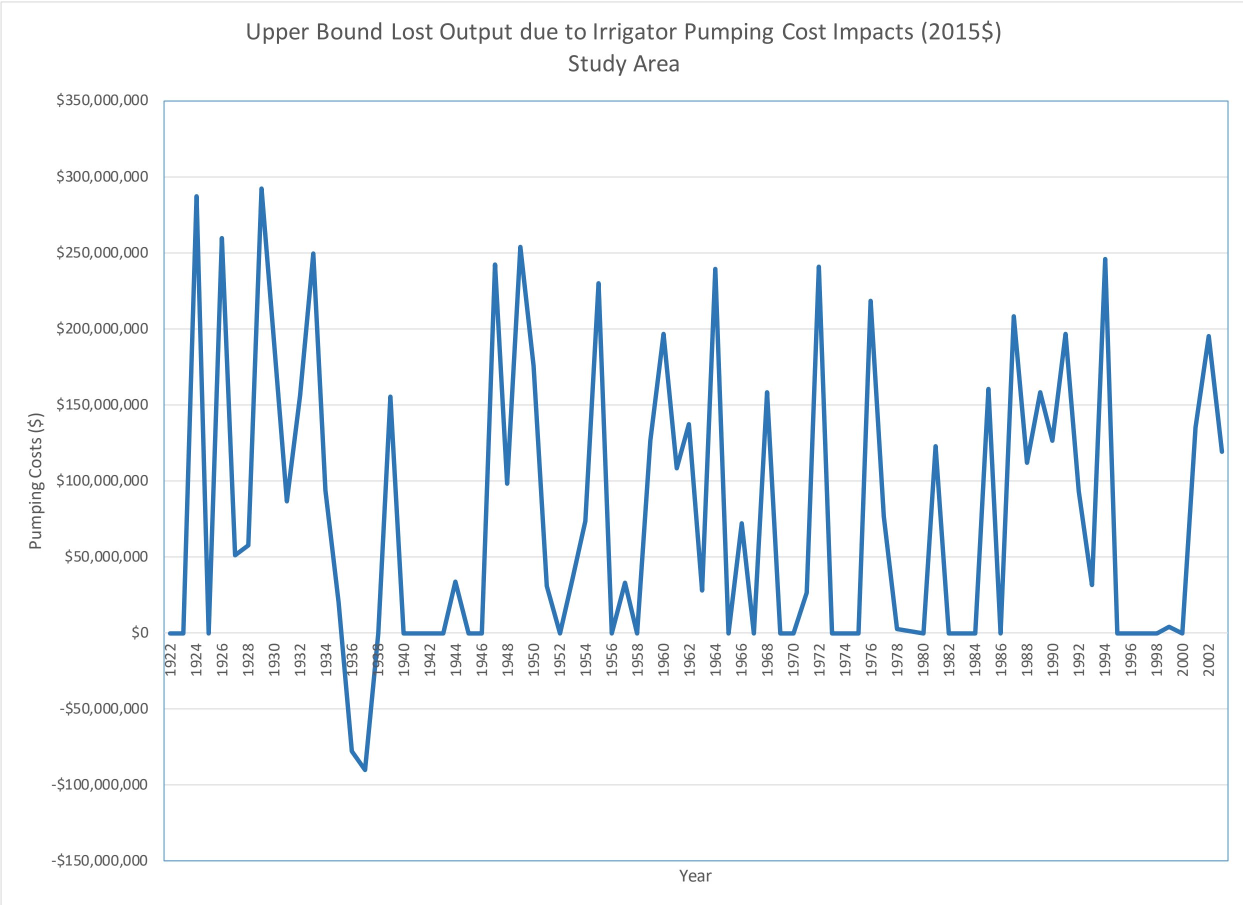
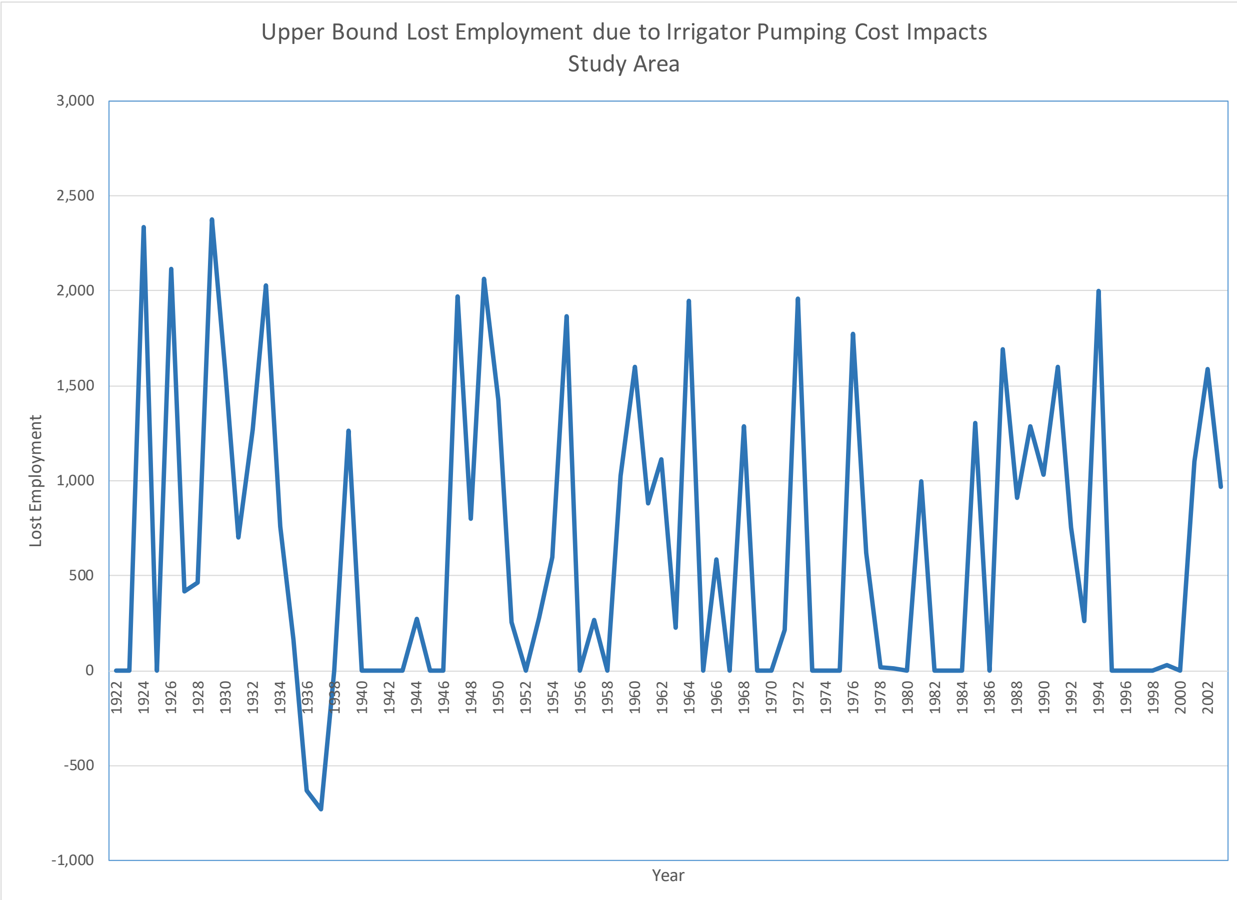


Figure 10.18



D. Increases in Community Groundwater Costs

SED 40-related impacts on groundwater depths and associated pumping costs will extend not only to the Study Area's irrigators but also its communities that rely mostly all, some in part, on groundwater for their water supplies. These added costs would be expected necessarily to ultimately be incurred by households and business and result in corresponding decreases in household disposable incomes and business incomes, respectively. The result will be reduced consumer spending regionally and associated lost regional economic output and employment. To evaluate these impacts Stratecon applied its estimates of the upper bound potential cost impacts on households in the Study Area of the SED 40 to its IMPLAN-based multipliers for regional economic effects of household spending. Table 10.14 summarizes the results of this analysis.

Table 10.14

Upper Bound DCMI Cost of Increased Groundwater Depths	Increased Cost	Total Ouput Impacts	Total Employment Impacts
Peak Increase in Cost	$ 89,462,327	$ 96,771,590	787
Average Increase	$ 23,025,416	$ 24,906,642	203

The table indicates that the upper bound output and employment impacts of the anticipated SED 40-related increases in community groundwater pumping costs are estimated to be as much as about $25 million and 203 jobs on average per year, respectively, with peak single year upper bound impacts of as much as almost $97 million and 787 jobs.

Figures 10.19 and 10.20 show the substantial inter-year volatility in estimated regional estimated output and job losses due to the SED 40's estimated potential upper bound impacts on community groundwater costs. Figure 10.19 indicates that the output losses frequently exceed $20 million but in one year during the Study Period would have seen an increase due to reduced community pumping costs due to lower groundwater elevations. Figure 10.20 indicates that the job losses frequently exceed 100 but in one year during the Study Period would have seen an increase due to reduced community pumping costs due to lower groundwater elevations.

Figure 10.19

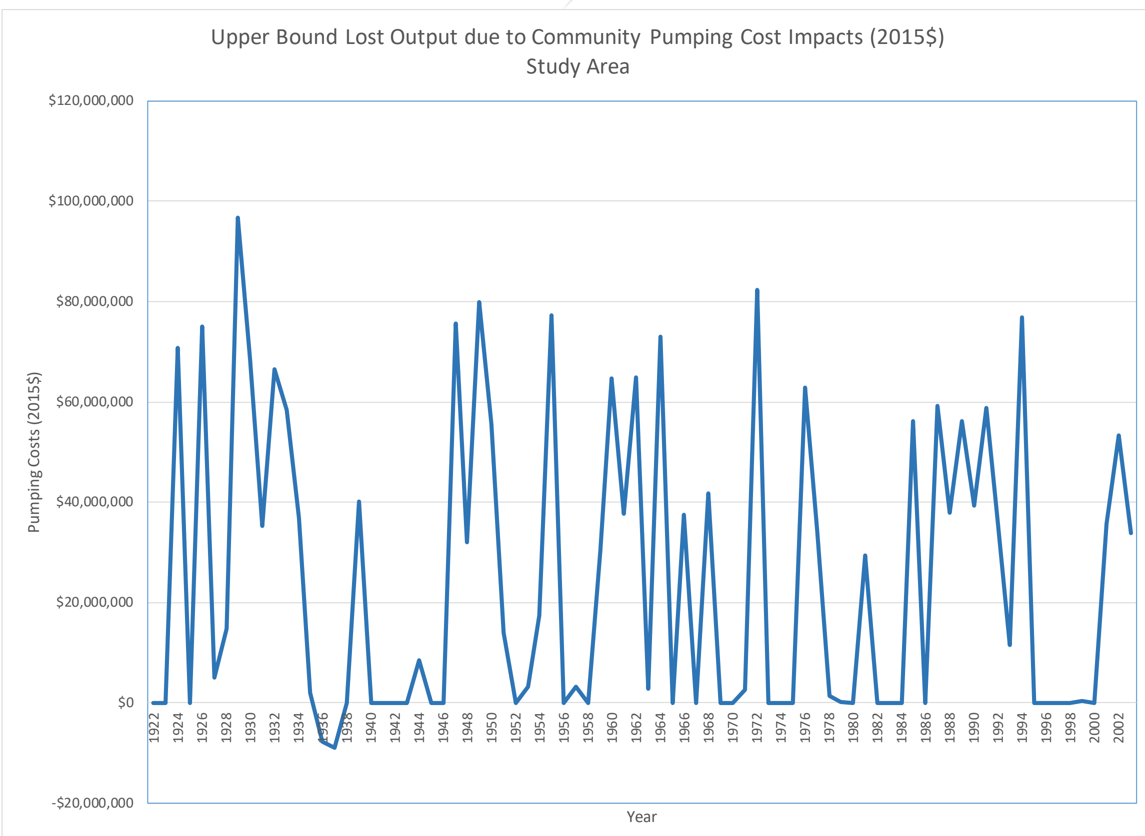
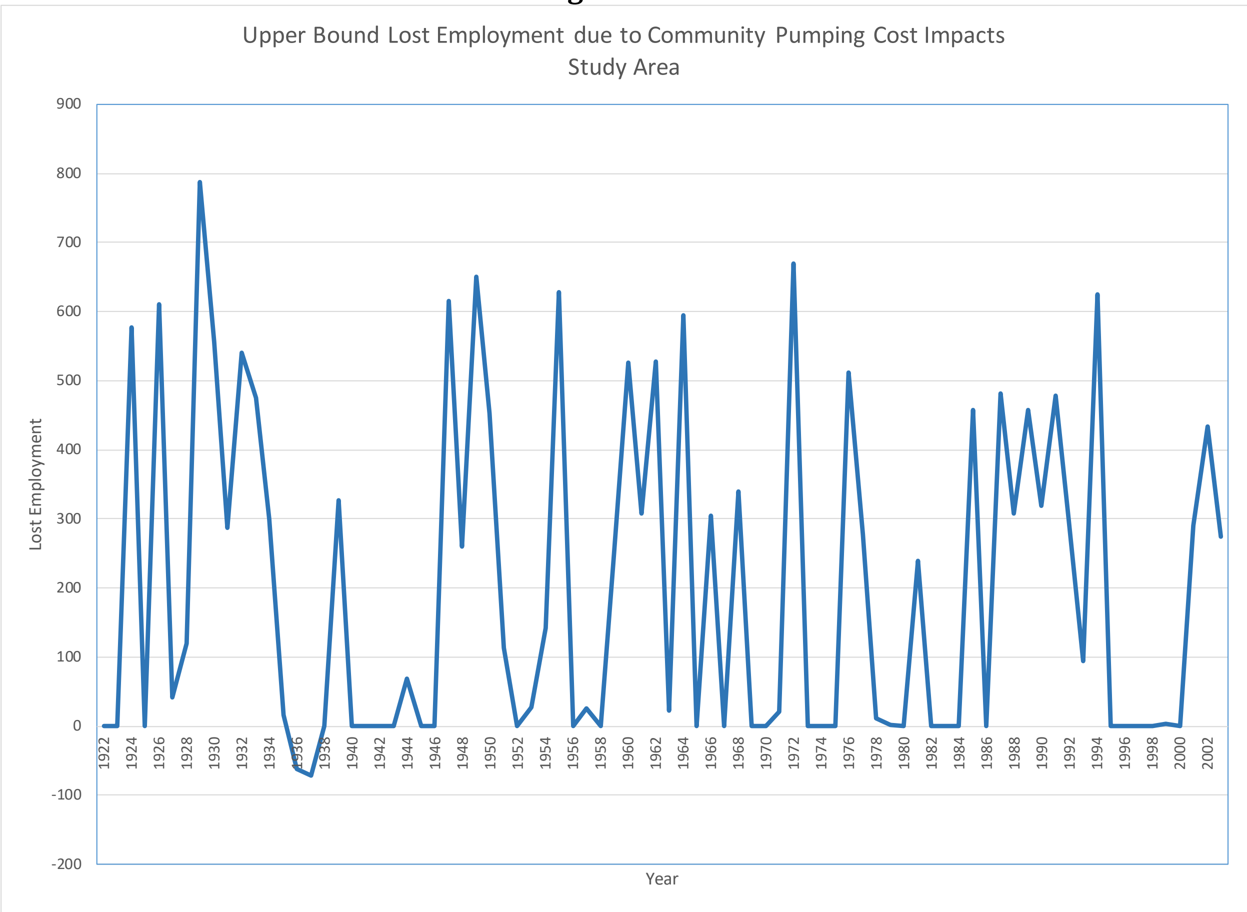


Figure 10.20



E. Conclusion

Tables 10.15 and 10.16 summarize the total upper bound output and employment impacts as estimated by Stratecon due to the SED 40 both before and with SGMA implementation. Table 10.15 shows, for example, that the estimated upper bound average annual total lost economic output and job losses within the Study Area that will result from the SED 40 before SGMA is as much as about $607 million (2015$) and 2,976 jobs, respectively. Table 10.16 shows, for example, that the estimated upper bound peak total lost economic output and job losses within the Study Area that will result from the SED 40 with SGMA is as much as almost $3.2 billion (2015$) and 13,206 jobs, respectively. These impacts don't account for a number of potential SED 40 impact sources including production reductions in sectors other than dairy and livestock downstream of, and that rely on, the farm sectors that will be directly impacted and regional community loss of surface water supplies (though as previously discussed, potential impacts from the loss of the subject surface water are embedded in the impact estimates associated with reduced crop production within the Irrigation Districts).

Table 10.15

Average During Study Period	Before SGMA			With SGMA		
Impact Category	Lost Revenues/ Increased Cost (2015$)	Total Lost Output (2015$)	Total Lost Jobs	Lost Revenues/ Increased Cost (2015$)	Total Lost Output (2015$)	Total Lost Jobs
Reduced Crop Production Irrigation Districts	$ 57,589,316	$ 101,026,280	638	$ 100,024,842	$ 175,842,740	1,101
Reduced Dairy & Livestock Sectors Production (Upper Bound)	$ 213,996,694	$ 374,831,334	1,270	$ 292,327,424	$ 512,033,510	1,735
Increased Irrigation District Costs (Upper Bound)	$ 25,310,496	$ 27,378,418	223	N/A	N/A	N/A
Increased Other Irrigation Costs (Upper Bound)	$ 73,065,124	$ 79,034,700	643	N/A	N/A	N/A
Increased Urban Water Costs (Upper Bound)	$ 23,025,416	$ 24,906,642	203	N/A	N/A	N/A
Total	**$ 392,987,047**	**$ 607,177,374**	**2,976**	**$ 392,352,266**	**$ 687,876,250**	**2,835**

Table 10.16

Peak Year of Impacts During Study Period	Before SGMA			With SGMA		
Impact Category	Lost Revenues/ Increased Cost (2015$)	Total Lost Output (2015$)	Total Lost Jobs	Lost Revenues/ Increased Cost (2015$)	Total Lost Output (2015$)	Total Lost Jobs
Reduced Crop Production Irrigation Districts	$ 259,856,755	$ 457,288,570	3,050	$ 449,311,194	$ 787,683,503	4,996
Reduced Dairy & Livestock Sectors Production (Upper Bound)	$ 1,042,793,423	$ 1,826,531,252	6,188	$ 1,387,009,263	$ 2,429,451,230	8,230
Increased Irrigation District Costs (Upper Bound)	$ 101,513,377	$ 109,807,236	893	N/A	N/A	N/A
Increased Other Irrigation Costs (Upper Bound)	$ 270,177,684	$ 292,251,778	2,376	N/A	N/A	N/A
Increased Urban Water Costs (Upper Bound)	$ 89,462,327	$ 96,771,590	787	N/A	N/A	N/A
Total[1]	**$ 1,735,395,477**	**$ 2,751,921,335**	**12,739**	**$ 1,822,286,141**	**$ 3,194,565,527**	**13,206**

1. Represents peak year for all categories combined so may differ from sum of peak year figures for each category.

11. CONCLUDING OBSERVATIONS

The proposed SED will fundamentally alter the water resource portfolios of Merced, San Joaquin and Stanislaus counties. In its assessment of the impacts of the SED unimpaired flow proposals, SWRCB staff failed to address the resulting water supply reliability, sustainability and volatility issues that will confront the counties.

Instead, the SWRCB economic analysis assumes that groundwater pumping will expand to fully offset the loss of surface water supplies until groundwater pumping capacity is exhausted. This full offset assumption is inconsistent with the evidence from Westlands Water District's actual response to increased variability in, and lower levels of, available surface water supplies. Large increases in groundwater pumping is also inconsistent with the fact that groundwater basins in the Study Area are severely over-drafted, well elevations are on a declining trend and all Study Area sub-basins have been designated as "high priority" for action under SGMA.

The SWRCB staff severely underestimated the economic impacts of the proposed flow objective on the local economies. Land fallowing will initially be 60% higher than predicted by SWRCB staff. Once SGMA is implemented, the impact will be almost three times higher. This will result in substantial declines in regional agricultural production and associated economic output.

The proposed flow objective introduces a new factor into the local economy—increased volatility in surface water supplies. With reliable surface water supplies falling by 60%, the foundation of the regional agricultural and associated sector investment is completely undermined. Water users can manage their losses by engaging in increased conjunctive use of the highly variable surface water supplies with groundwater. Perhaps the 366 TAF increase in the expected annual yield of unreliable surface water supply under the proposed flow objective can be managed conjunctively to yield 180 TAF of firm water supplies. Surface water users and the local economy more generally still stand to lose more than 400 TAF of reliable surface water supplies. This will result in a structural change to the regional economy that will result in lost jobs, income and tax revenues.

The impact of the proposed flow objective on the local economies is obscured by averages. Peak estimated impacts are more than four-fold the averages. Economic risks are severe. The proposed flow objective will change the course of investment and growth far beyond the impacts on which SWRCB focuses, that of relatively small average reductions in lower valued crops such as grains, alfalfa and pasture.

The proposed flow objective will put the local economies in the three counties on the pathway to retrenchment. The large reduction in reliable surface water supplies and long-term cutback in groundwater pumping under SGMA is at odds with the rapid population growth for the region predicted by the Department of Finance and any meaningful associated and necessary economic growth. Disadvantaged and severely disadvantaged communities where most households in the region reside will face water supply challenges comparable to other communities in the Central Valley struggling with the loss of surface water supplies from the Central Valley

Project. Residents in these communities will experience job losses from the reduced farm economy and escalating water rates caused by lost water supplies.

Future Economic Impacts

The future economic impact of the SED on the local economies in the Study Area depends on the timing of SED implementation and SGMA implementation. With the SWRCB currently anticipated to decide by Summer 2017, SED implementation is assumed to start in 2018. Since the Department of Water Resources has designated all sub-basins in the Study Area as high priority and over drafted, SGMA implementation would start in 2020 and must be fully implemented within 20 years (2039).[38] Therefore, the economic impact of the SED would be captured by the pre-SGMA scenario for 2018 and 2019. Thereafter, the economic impact of the SED would be a mix of the pre-SGMA and post-SGMA scenario during the SGMA implementation period (2020-2039) and only the post-SGMA scenario after full implementation.[39]

As discussed in Section 10, the economic impact of SED depends on hydrologic conditions. Stratecon conducted a Monte Carlo study of future hydrologic conditions for a 40-year time horizon starting in 2017 based on the Sequential Index Method.[40] The impact of SED over the 40-year time horizon is measured by the present value of lost economic output.[41]

Figure 11-1 presents how the present value of lost economic output from the SED varies with actual 2017 hydrologic conditions. The expected present value of lost economic output over the 50-year horizon totals $14.49 billion. Depending on actual 2017 hydrologic conditions, the present value of lost economic output revenues range from a low of $10.45 billion (if 2017 hydrologic conditions are the same as water year 1934 and hydrologic conditions in subsequent years follow the sequence in the historical record) to a high of $18.43 billion (if 2017 hydrologic

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[38] See Sustainable Groundwater Management Act of 2015, Frequently Asked Questions, Association of California Water Agencies, http://www.acwa.com/sites/default/files/post/groundwater/2014/04/2014-groundwater-faq-2.pdf.

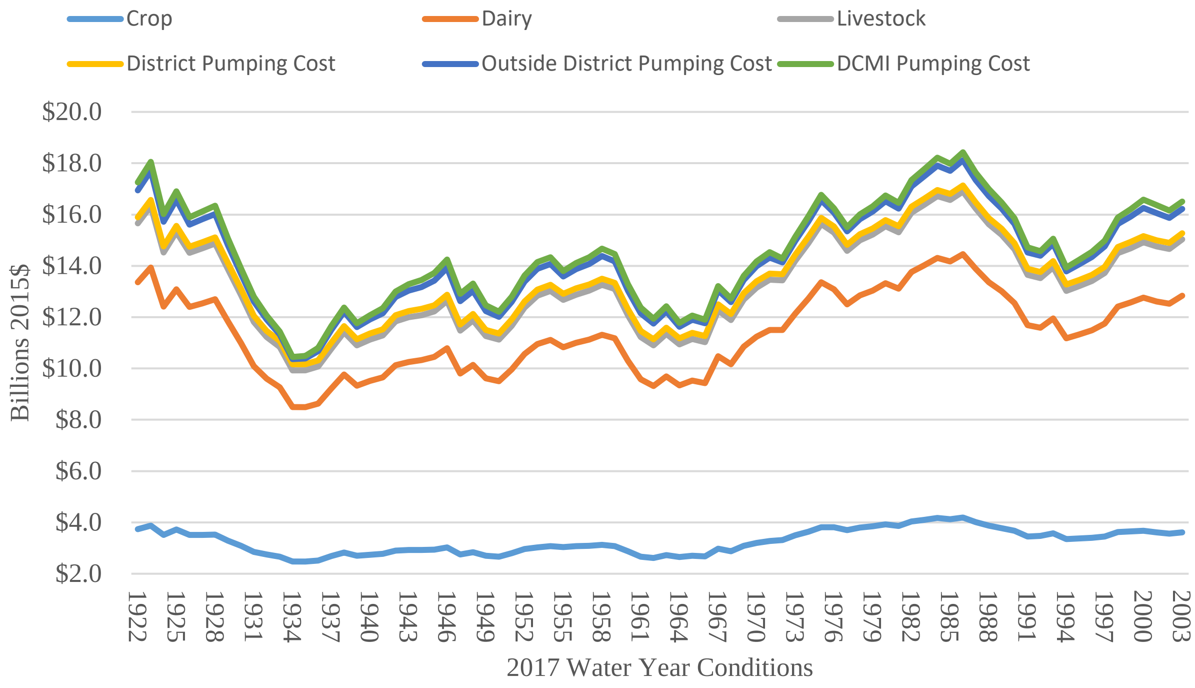
[39] The analysis assumes that SGMA implementation steadily builds up over the 20-year period with a 5% weight given to the post-SGMA scenario in 2020, 10% weight for 2021, with the weight on the post-SGMA scenario growing by 5% each year until a 100% weight is given to the post-SGMA scenario by 2039.

[40] A Monte Carlo study uses repeated random sampling from statistical distributions to obtain numerical results, see ttps://en.wikipedia.org/wiki/Monte_Carlo_method. In this instance, the numerical result is the present value of the annual loss of economic output from the SED. The sequential index method uses the hydrologic record as the statistical distribution for future water year conditions. It assumes that the hydrologic conditions for 2017 are equally likely to be any of the water years in the historic record 1922-2003. Hydrologic conditions in subsequent years follow the sequence of hydrologic conditions in the historic record. When the sequence reaches the last year of the historic record (2003), hydrologic conditions "wrap around" to the water year condition for 1922 and subsequent years for the remainder of the 40-year time horizon.

[41] The calculation uses an interest rate of 5.5%, 100 basis points above the long-term yield on 10-year Treasury Notes. The projections assume that the annual impact of SED is constant in real terms. Therefore, the estimated annual output loss is increased by 2.5% per year, the long-term expected rate of inflation. The discount rate used in the calculation of present value is the real interest rate (2.9%) implied by an interest rate of 5.5% and expected inflation of 2.5%. For discussion of interest rates and expected inflation, see http://hydrowonk.com/blog/2013/01/11/project-evaluation-ii-thoughts-about-interest-rates/.

conditions are the same as water year 1986 and hydrologic conditions in subsequent years follow the sequence in the historical record).

Figure 11-1
Present Value of Lost Economic Output from SED
by 2017 Water Year Condition
(40-Year Valuation Horizon)



The economic loss related to reduced crop output accounts for less than one-fourth the total loss (see Table 11-1). The downstream impact on dairy sectors is the largest source of loss in economic output, accounting 56.0 percent of the total loss. The downstream impact on the livestock sectors accounts for 13.3 percent of the total loss. The lost output from the increased cost of groundwater pumping, while material, represents only 8.1 percent of total losses. This small share reflects the fact that increased groundwater pumping will only occur during the short run until SGMA is fully implemented.

Table 11-1
Composition of Lost Economic Output from SED Implementation

Component	*Expected Present Value (billions 2015$)*	*Share*
Crop Output	$3.26	22.5%
Dairy Sectors	$8.12	56.0%
Livestock Sectors	$1.93	13.3%
Increased Pumping		

Irrigation Districts	$0.24	1.6%
Outside Irrigation Districts	$0.71	4.9%
DCMI	$0.23	1.6%
Total	$14.49	100.0%

Delay in the start of SGMA implementation or a faster period for SGMA to reach full implementation has a secondary effect on the expected present value of lost economic output (see Table 11-2). Delay in the start of SGMA implementation from year 2020 to year 2025 reduces the expected present value of lost economic output by about $300 million (2015$). Faster SGMA implementation increases the expected present value of lost economic output by about $300 million (2015$).

Table 11-2
Expected Present Value of Lost Economic Output from SED and SGMA Timing
(billion 2015$)

Years to Full SGMA Implementation	Year SGMA Initiated	
	2020	2025
10	$14.82	$14.49
15	$14.66	$14.33
20	$14.49	$14.18

SED implementation will fundamentally transform the investment environment for agriculture and related industries. Lost water supplies reduce locally produced inputs for livestock and dairy operations. The volatility in locally produced inputs will more than triple the risk of shortfalls in available local inputs (see Table 11-3).[42] For hay and pasture, expected unused capacity increases from 4% under baseline conditions to 23% under SED implementation before SGMA and 29% after SGMA implementation. For grain, expected unused capacity increases from 1% under baseline conditions to 7% under SED implementation before SGMA and 11% after SGMA implementation. The average unused capacity for hay and pasture inputs when shortfalls happen increase from 4% under baseline conditions to 23% under SED implementation before SGMA and 29% under SED implementation after SGMA. The average unused capacity for grain inputs when shortfalls happen increase from 3% under baseline conditions to 11% under SED implementation before SGMA and 17% under SED implementation after SGMA. Peak unused capacity almost doubles for hay and pasture inputs and increases four-fold for grain inputs.

[42] Local capacity estimated by the maximum amount of locally produced inputs (measured by acreage in alfalfa and irrigated pasture for livestock and silage for dairy). Capacity utilization measured by ratio of crop acreage for each water year hydrologic condition to local capacity. Shortfall risk equals percentage of years crop acreage is less than local maximum. Unused capacity measured by 100% less capacity utilization.

Table 11-3
Risk of Shortfalls in Locally Produced Inputs for Livestock and Dairy

Item	Hay/Pasture			Grain		
	Baseline	SED-Pre SGMA	SED-Post SGMA	Baseline	SED-Pre SGMA	SED-Post SGMA
Shortfall Risk	18%	61%	61%	18%	61%	61%
Average Unused Capacity	4%	23%	29%	1%	7%	11%
Average Unused Capacity When Shortfall	21%	37%	48%	3%	11%	17%
Peak Unused Capacity	53%	89%	94%	11%	43%	56%

This increased risk in unused capacity reduces the economic incentive for investment. The impact on the local economy from the reduced investment is not considered in this study. Therefore, this study understates the economic consequences of SED implementation for the local economies.

Attachment 1

Westlands Water District:
A Case Study of the Impact of Reduced Surface Water Supplies on Agriculture and Groundwater

Central Valley Project ("CVP") agricultural water users south of the Delta have experienced substantial and regular reductions in the availability of surface water supplies since the early 1990s. The almost quarter century of experience of the Westlands Water District provides evidence on how reduced availability of surface water impacts land fallowing, cropping patterns, groundwater pumping and groundwater elevations.

CVP Water Allocations

The history of CVP water allocations can be divided into two eras (see Figure A1.1).[43] Before the 1990s, CVP allocations for South of Delta agricultural water users were 100% of contractual entitlements other than during the severe 1977 drought. Water allocations fell again during the early 1990s drought. Despite recovery in hydrologic conditions, CVP water allocations have reached 100% in only three years in the last twenty years. There has been a fundamental change in the availability of CVP surface water.

Availability of Surface Water and Land Fallowing

Reduced availability of surface water has resulted in increased land fallowing (see Figure A1.2).[44] About 50,000 acres are fallowed annually regardless of the availability of surface water (this represents about once in a decade fallowing as part of rotational cropping plans). Land fallowing varies between 50,000 acres and 100,000 acres for CVP allocations above 40%. The amount of fallowing at least doubles when CVP allocations fall below 40%.

Availability of Surface Water and Cropping Patterns

Westlands cropping patterns respond to the availability of surface water (see Figure A1.3).[45] A 10 percentage point increase in CVP water allocations expands acreage in field crops by 7.2%, hay crops and pasture by 7.1%, fruit by 4.3%, vegetables by 2.3% and trees and vines by

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[43] Summary of Water Supply Allocations, http://www.usbr.gov/mp/cvo/vungvari/water_allocations_historical.pdf

[44] Westlands Water District, District Water Supply Charts, http://wwd.ca.gov/wp-content/uploads/2016/06/Water-Supply-Charts.pdf.

[45] Chart A1-3 summarizes the findings of a statistical study of Westland cropping patterns (see Attachment 1-1).

0.1%. Acreage in double cropping increases by 13.5%. Acreage not harvested and fallowed declines, respectively, by 23.8% and 13.5%.

Availability of Surface Water and Groundwater Pumping

The availability of CVP surface water has a large effect on groundwater pumping by Westlands landowners (see Figure A1.4).[46] A 10 percentage point increase in CVP allocations reduces groundwater pumping by about 60,000 AF. With a CVP contractual entitlement of 1,195,000 acre feet, groundwater pumping falls by 50% of the increase in available surface water supplies.[47]

Impact on Well Elevations

Well elevations in Westlands are driven by groundwater pumping and local rainfall (see Table A1.1).[48] Well elevations fall by 0.90 feet per 10,000 acre-feet of groundwater pumping. Well elevations increase with local rainfall at the rate of 3.29 feet per inch of rainfall. Both of these estimated effects are statistically significant as reflected in the high T-statistics and low P-values. The annual variation in groundwater pumping and local rainfall generally explains the annual variation in the annual change in well elevations in Westlands (see Figure A1.5).

Table A1.1
Statistical Model of Annual Change in Average Well Elevations in Westlands (1988-2015)

Item	*Coefficient*	*T-Statistic**	*P-Value***
Intercept	-18.93	-0.92	36.6%
Groundwater Pumping (10,000 acre-feet)	-0.90	-3.44	0.2%
Local Rainfall (inches)	3.29	2.26	3.3%
$R^2 = 0.52$			

***** ratio of coefficient to the standard deviation of estimated coefficient

** probability of the estimated coefficient if its true value were zero

A sustained 10 percentage point reduction in CVP allocations will have a large impact on well elevations. As discussed above, groundwater pumping increases by 60,000 acre-feet per year

[46] Deep Groundwater Conditions Report, Westlands Water District, April 2016, p. 10.

[47] A 10 percentage point increase in CVP allocation results in a 119,500 acre-foot increase in available CVP surface water supplies, which is approximately half the estimated impact of a 10 percentage point increase in CVP allocation on groundwater pumping (-59,761.7 acre feet).

[48] Deep Groundwater Conditions Report, p. 10 for change in annual average well elevations in Westlands. Data based on measured elevations in wells not operating in December of each year. Local rainfall measured at Fresno Yosemite International Airport.

in the face of this surface water supply reduction. Average well elevations will fall by 5.4 feet per year for the duration of the supply loss.[49] Within a decade, well elevations will be 54 feet lower.

Lessons from the Westlands Case Study

The fall in the level and increased variability in Westlands' CVP allocations provides evidence on the impact of surface water availability on land fallowing, cropping patterns, groundwater pumping and well elevations. Landowners respond to reduced surface water along many dimensions: land fallowing, cropping patterns and increased groundwater pumping. The quantitative impacts from variability in surface water supplies are material and statistically significant.

The circumstances of Westlands, of course, may not be strictly comparable to the circumstances of the Study Area. Groundwater elevations in Westlands are lower than in the Study Area. Differences in the quality of surface water and groundwater may differ. Westlands has been an active participant in the water transfer market. In contrast, the districts in the Study Area have not, although that undoubtedly reflects the historical reliability of their surface water rights backstopped by groundwater during critical years. Adjusting the evidence from the Westlands experience for differences in circumstances between Westlands and the Study Area requires a major investigation outside the scope of the Stratecon study. Nonetheless, the Westlands experience provides information on the actual impacts of variability in available surface water supplies. In contrast, the SWRCB assumption that lost surface water supplies are fully offset by increased groundwater pumping until capacity is exhausted lacks any empirical foundation.

[49] 5.4 feet = -0.90 x 6

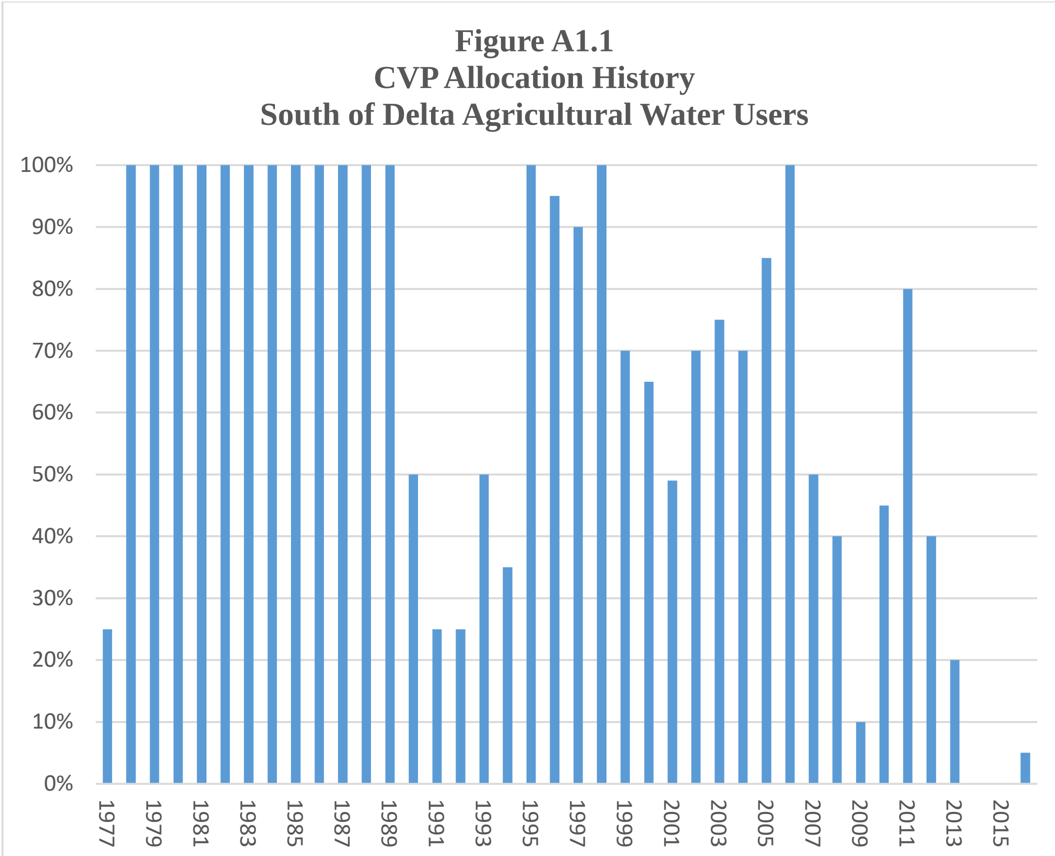


Figure A1.1
CVP Allocation History
South of Delta Agricultural Water Users
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015

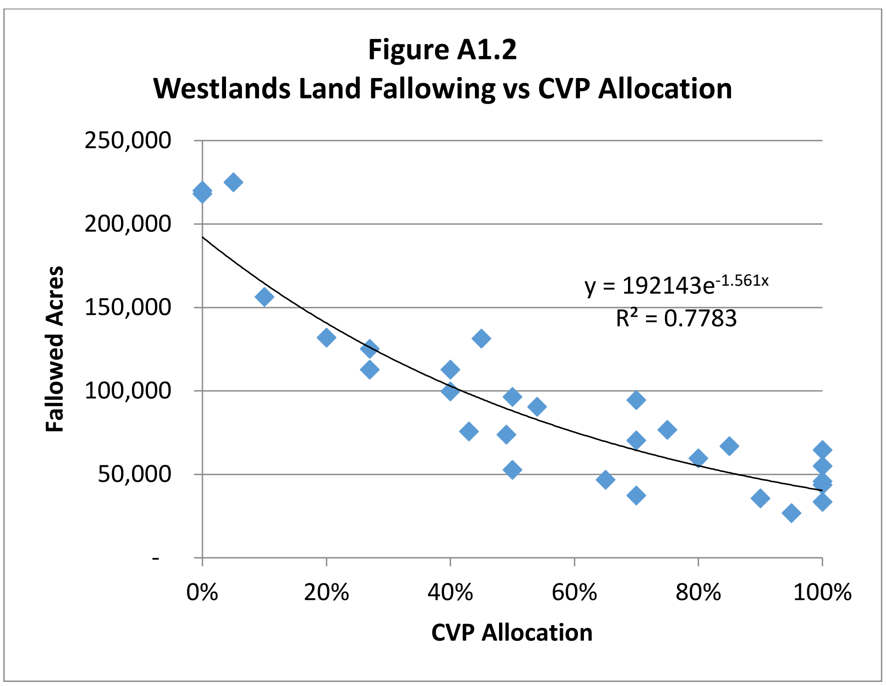


Figure A1.2
Westlands Land Fallowing vs CVP Allocation
250,000
200,000
150,000
100,000
50,000
-
Fallowed Acres
y = 192143e-1.561x
R² = 0.7783
0%
20%
40%
60%
80%
100%
CVP Allocation

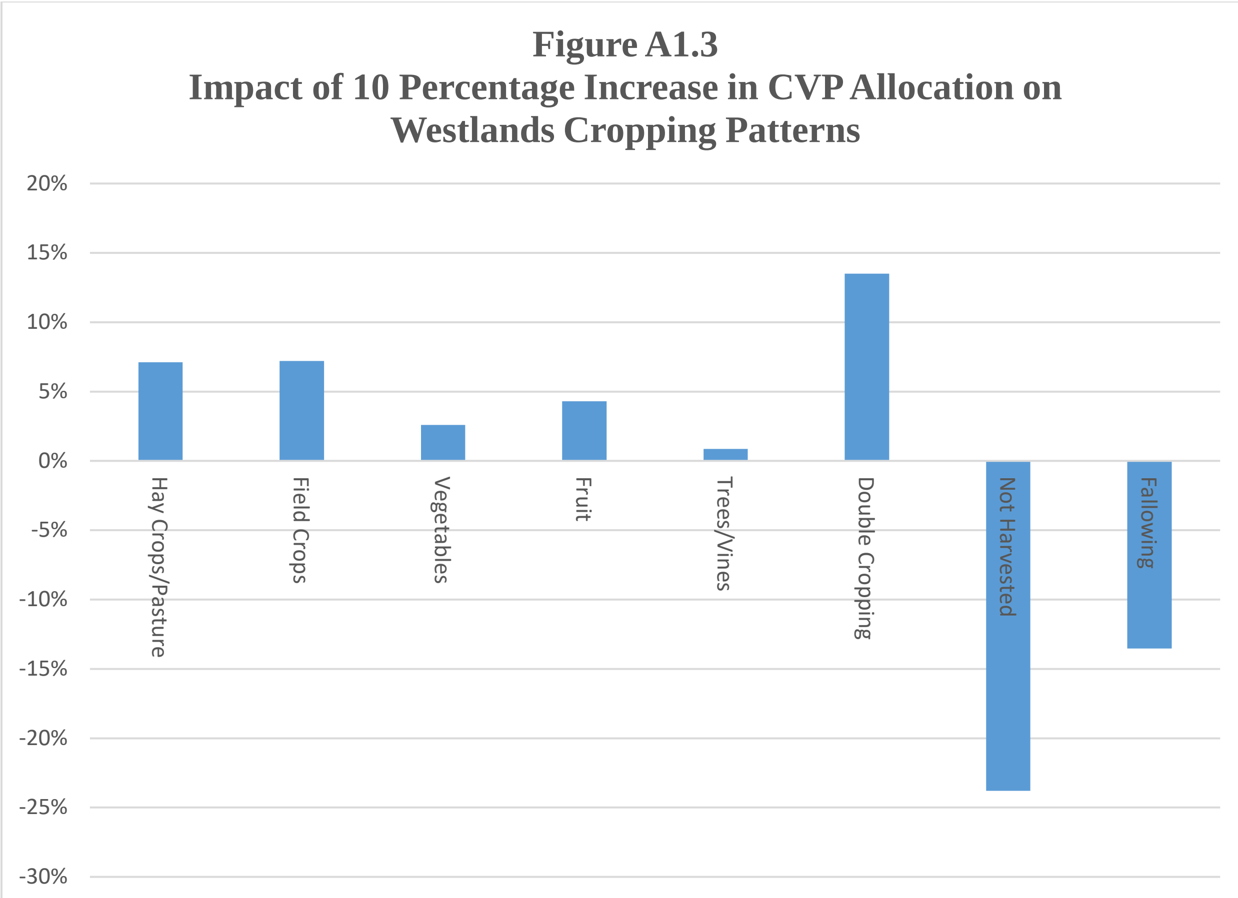


Figure A1.3
Impact of 10 Percentage Increase in CVP Allocation on Westlands Cropping Patterns
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
-25%
-30%
Hay Crops/Pasture
Field Crops
Vegetables
Fruit
Trees/Vines
Double Cropping
Not Harvested
Fallowing

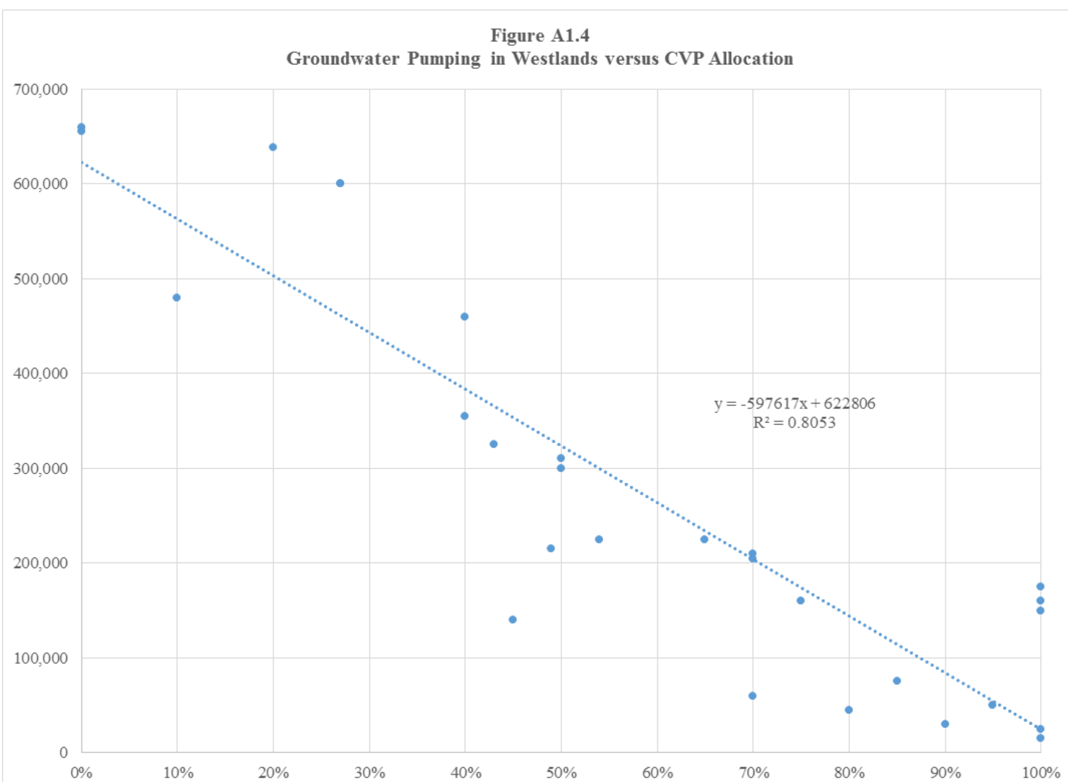


Figure A1.4
Groundwater Pumping in Westlands versus CVP Allocation
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
y = -597617x + 622806
R² = 0.8053

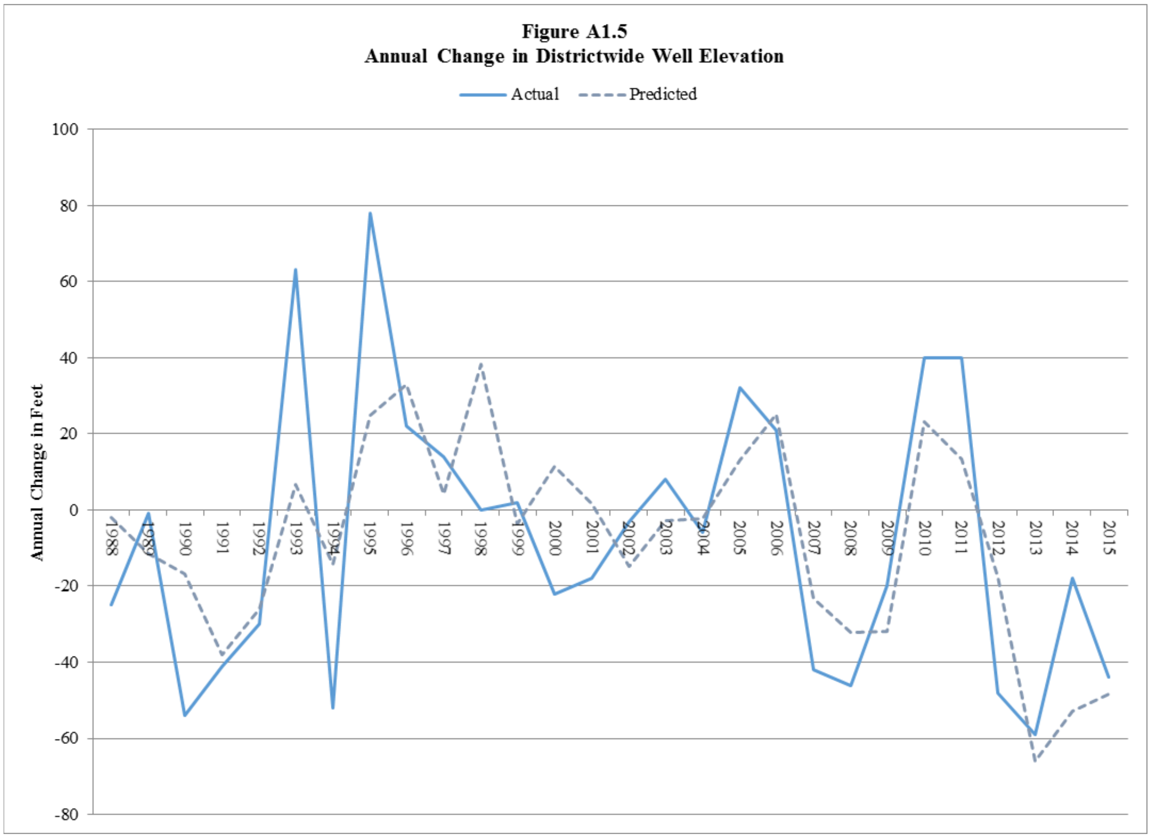


Figure A1.5
Annual Change in Districtwide Well Elevation
Actual
Predicted
Annual Change in Feet
100
80
60
40
20
0
-20
-40
-60
-80
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

Attachment 1-1
Statistical Study of Westland's Annual Cropping Patterns

This attachment presents the statistical analysis identifying the impact of CVP water allocations on Westlands cropping patterns. The models explain the annual acreage in major crop categories by CVP water allocations and trend (see table). The dependent variables are the natural logarithm of acreage. Therefore, the coefficients for CVP water allocations measure the proportionate impact on acreage from a change in the level of the CVP water allocation. The coefficient for the trend variable measures the annual growth in acreage. R^2 measures the proportion of the annual variation in (the natural logarithm) of acreage is explained by the annual variation in CVP water allocations and trend growth.

Statistical Models of Westlands Cropping Patterns
(2000-2015)

Crop Category	*Intercept*	*CVP Allocation*	*Trend*	R^2
Hay Crops/Pasture	8.36 (21.7) [<0.01%]	0.71 (2.04) [5.2%]	0.03 (2.45) [2.2%]	0.22
Field Crops	12.4 (93.9) [<0.01%]	0.72 (5.55) [<0.01%]	-0.04 (-7.35) [<0.01%]	0.86
Vegetables	11.74 (149.9) [<0.01%]	0.26 (3.36) [0.3%]	-0.00 (-0.51) [61.5%]	0.40
Fruit	9.74 (54.0) [<0.01%]	0.43 (2.46) [2.1%]	-0.01 (-1.03) [31.1%]	0.33
Trees/Vines	9.60 (156.3) [<0.01%]	0.09 (1.41) [17.1%]	0.09 (37.4) [<0.01%]	0.99
Double Cropping*	8.86 (37.37) [<-.01%]	1.35 (5.57) [<0.01%]	-0.05 (-2.93) [0.01%]	0.89
Not Harvested	8.69 (14.62) [<0.01%]	-2.38 (-4.09) [38.9%]	0.17 (2.52) [<0.01%]	0.55
Fallowing	11.87 (63.26) [<0.01%]	-1.35 (-7.35) [<0.01%]	0.01 (1.37) [18.1%]	0.77

* Sample period: 2000-2015. Westlands started collecting data on double cropping at the request of the Bureau of Reclamation in 2000.

Note: T-Statistics in parentheses and P-Values in brackets.

Attachment 2
Background Data on Baseline Conditions of Study Area

The following provides additional data underlying the baseline conditions assessment in Section 2 of the report.

A. Population

Table A2.1 provides historical population estimates for each of the three counties as reported by the California State Department of Finance ("CDoF"). The table shows that the total population for the Study Area in early 2016 was estimated at over 1.5 million, approximately 50% higher than in 1990. This compares to total estimated population growth for the State during the same period of about 33%. Correspondingly, the Study Area counties' population grew at a compound average annual rate of 1.5% to 1.6%, as compared to 1.1% for the State, respectively, during the approximately 25-year period of study.

Table A2.1
Population

County	1990	2000	2010	2016	Compound Annual Growth 1990-2016
Merced	176,300	209,522	255,399	269,280	1.6%
San Joaquin	477,700	560,634	684,057	723,761	1.6%
Stanislaus	365,100	444,967	514,003	534,902	1.5%
Total	1,019,100	1,215,123	1,453,459	1,527,943	1.6%
California	29,558,000	33,721,583	37,223,900	39,255,883	1.1%

Figure A2.1 illustrates the recent historical trend in the Study Area counties' separate and collective population growth since 1990 as compared to the State as a whole. To facilitate comparison between the counties and State, all values are converted to an index with the 1990 index value set to 1.0. The figure clearly shows that the population in the Study Area grew faster than the State during the period, especially since 2000, which has had important implications for regional water demand.

Figure A2.1

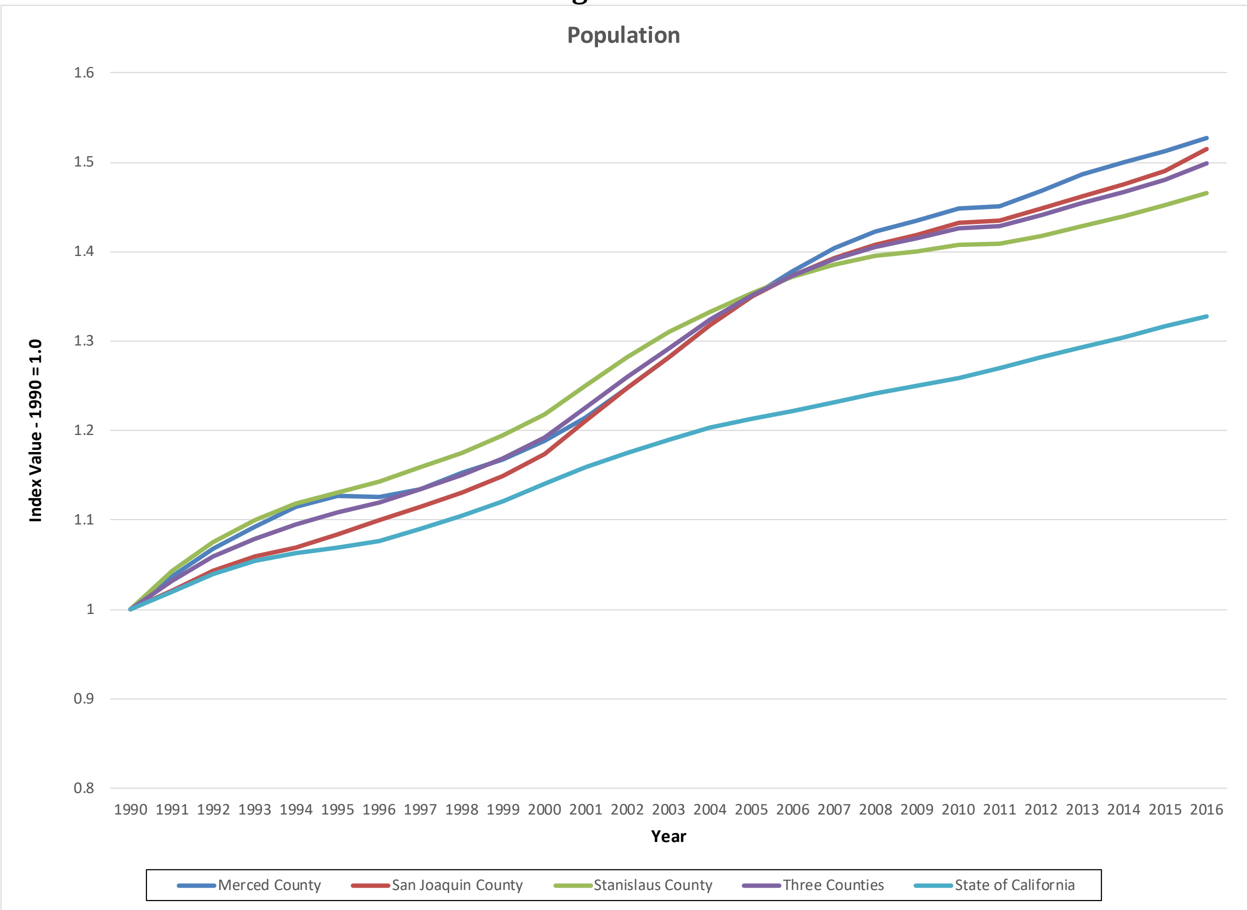


Table A2.2 provides historical population estimates for the largest city by population in each of the three Study Area counties as reported by CDoF. The table shows that the population of the cities of Merced (Merced County) and Stockton (San Joaquin County) grew at compound average annual rates of about 1.6% from 1990 through 2016, in line with the overall growth for that period in Merced and San Joaquin Counties, respectively, as shown in Table 1. Population rates of growth in the smaller communities of these two counties lies in a range both higher and lower than the county averages.

Separately, the City of Modesto, where about 40% of Stanislaus County's population resides, experienced slower overall population growth during the period of study, 1.0%, than Stanislaus County as a whole. Accordingly, Stanislaus County's historical population has grown at a rate similar to the other two Study Area counties has been driven by relatively high population growth outside of Modesto. In fact, the County's communities other than Modesto have experienced compound annual population growth during the study period that is higher than the County's overall population rate of growth. Further, it is the smaller Stanislaus County incorporated communities such as Newman, Riverbank and Patterson, as examples, that have experienced the highest rates of growth in the County. All three of these communities had more than double the estimated population in early 2016 as compared to 1990.

Table A2.2
Population Select Cities

City	County	1990	2000	2010	2016	Percentage of 2016 County Population	Compound Annual Growth 1990-2016
Merced	Merced	55,700	63,667	78,860	83,962	31%	1.6%
Stockton	San Joaquin	209,700	242,827	291,275	315,592	44%	1.6%
Modesto	Stanislaus	162,100	187,816	201,911	211,903	40%	1.0%

Table A2.3 summarizes recent population growth projections for the Study Area counties and the State of California through 2060 as reported by the CDoF. The table shows that the population growth of the Study Area going out approximately 40 years into the future is projected to be more than double the rate for the State. This has important implications for future regional DCMI (Domestic, Commercial, Municipal and Industrial) demand for water regionally, which relies mostly on groundwater supplies, particularly with consideration for pending regulations to stabilize declining regional groundwater levels in conjunction with possible SED-associated reductions in surface water supplies.

Table A2.3
Population Projections

County	Actual (Est.)	Projections					
	2016	2020	2030	2040	2050	2060	Annual Growth 2016-60
Merced	269,280	288,991	337,798	389,934	439,075	485,712	1.3%
San Joaquin	723,761	766,644	893,354	1,037,761	1,171,439	1,306,271	1.4%
Stanislaus	534,902	573,794	648,076	714,910	783,005	856,717	1.1%
Total	1,527,943	1,629,429	1,879,228	2,142,605	2,393,519	2,648,700	1.3%
California	39,255,883	40,619,346	44,085,600	47,233,240	49,779,362	51,663,771	0.6%

B. Housing

As would be expected, housing development in the Study Area has tracked closely the region's population growth, though, as with the State overall, growth in the number of housing units within the Study Area counties, particularly in the past decade, has lagged behind its population growth. The result has been a combination of declining vacancies and increased average household occupancies (see Table A2.4 for historical housing statistics). For example, in Merced County housing vacancies at the start of 2016 were 6.1% down from over 9.0% in 2010. Concurrently, during the same period average household sizes in the County increased slightly.

Table A2.4
Housing

County	1990	2000	2010	2016	Compound Annual Growth 1990-2016
Merced	58,410	68,103	83,728	84,660	1.4%
San Joaquin	166,274	188,139	233,449	239,405	1.4%
Stanislaus	132,027	150,389	179,826	180,777	1.2%
Total	356,711	406,631	497,003	504,842	1.3%
California	11,182,513	12,186,125	13,669,076	13,981,826	0.9%

Table A2.5 summarizes projections out through the 2030 on housing development in the Study Area as reported by CDoF. The table indicates projected growth in regional housing lags the projected rates of population growth (see Table 3), suggesting anticipated further declines in vacancies and/or increases in average household sizes. The table also shows that the future projected rates of increase in the housing inventory of all three Study Area counties is forecast at more than double the projected rate for the California. This may be in part driven by the region's proximity to the San Francisco Bay Area, one of the most supply constrained and high cost housing markets in the country. Relatively inexpensive housing within the region as compared to the San Francisco Bay Area combined with improved regional transportation infrastructure, is a key driver of population growth and associated housing demand within the Study Area.

Table A2.5
Housing Projections

County	2016	2020	2025	2030	Compound Annual Growth 2016-2030
Merced	84,660	86,866	93,920	101,393	1.3%
San Joaquin	239,405	243,902	260,405	280,423	1.1%
Stanislaus	180,777	187,358	199,366	210,875	1.1%
Total	504,842	518,126	553,691	592,691	1.2%
California	13,981,826	13,864,699	14,449,955	15,021,712	0.5%

C. Economy

Generally, the economies of the three Study Area counties in comparison to the rest of California are characterized by relatively high rates of unemployment, large agricultural and agricultural-dependent sectors, low household incomes and associated high rates of poverty. The following provides general economic information for each of the three counties that helps to illustrate these characterizations.

1. Unemployment

The rate of unemployment in an area is a key metric for measuring the economic conditions within that area. Table A2.6 summarizes the historical unemployment rate in each of the three

Study Area counties as compared to California based on data provided by the California Employment Development Department ("CEDD"). The table shows that the unemployment rate in all three counties has historically been significantly higher than the for California, often more than double in the case of Stanislaus County

Table A2.6
Historical Unemployment

Year	Merced County	San Joaquin County	Stanislaus County	California
1990	12.9%	9.9%	11.9%	5.8%
1991	15.5%	12.0%	14.7%	7.7%
1992	17.3%	14.1%	16.4%	9.3%
1993	17.3%	14.1%	16.8%	9.5%
1994	16.1%	12.8%	15.8%	8.6%
1995	17.0%	12.3%	15.4%	7.9%
1996	16.6%	11.4%	14.3%	7.3%
1997	15.7%	10.8%	13.2%	6.4%
1998	15.1%	10.6%	12.3%	5.9%
1999	13.4%	8.8%	10.6%	5.2%
2000	9.7%	7.0%	7.8%	4.9%
2001	10.2%	7.5%	8.4%	5.4%
2002	10.9%	8.8%	9.6%	6.7%
2003	11.4%	9.1%	9.8%	6.8%
2004	10.9%	8.7%	9.2%	6.2%
2005	10.0%	7.9%	8.4%	5.4%
2006	9.4%	7.4%	8.0%	4.9%
2007	10.1%	8.1%	8.7%	5.4%
2008	12.6%	10.4%	11.1%	7.3%
2009	16.6%	14.9%	15.5%	11.1%
2010	17.9%	16.5%	16.9%	12.2%
2011	17.6%	16.2%	16.5%	11.7%
2012	16.3%	14.4%	14.9%	10.4%
2013	14.5%	12.3%	12.9%	8.9%
2014	12.8%	10.5%	11.1%	7.5%
2015	11.3%	8.9%	9.5%	6.2%

2. Employment

While the unemployment rate in the three Study Area counties has historically been substantially higher than for the State, employment growth regionally has, for extended periods, outpaced that of the State. That said, during the most recent period coming through the end of, and then out of, the most recent recession, employment growth in San Joaquin County has been higher and in Merced and Stanislaus Counties slightly lower as compared to the State (see Table A2.7 which provides data provided by the CEDD). The fact that unemployment remains relatively high across the Study Area despite job growth indicates that while job growth in the region might be considered fairly robust, it is not keeping pace with regional population growth.

Table A2.7
Historical Employment

Year	Merced County	San Joaquin County	Stanislaus County	California
1990	67,044	204,600	159,118	14,264,618
1991	65,217	203,651	156,339	13,960,485
1992	68,652	205,813	160,351	13,881,509
1993	68,882	207,922	161,666	13,818,087
1994	70,141	209,344	162,764	13,945,782
1995	68,605	210,513	162,466	14,048,843
1996	68,222	212,960	166,799	14,301,361
1997	70,247	218,162	171,713	14,786,588
1998	72,225	220,933	176,638	15,185,715
1999	72,442	227,970	180,605	15,556,782
2000	81,704	241,118	191,752	16,033,633
2001	82,446	246,205	196,248	16,197,501
2002	85,278	250,053	198,073	16,108,618
2003	85,787	253,439	200,013	16,103,008
2004	87,003	256,936	203,135	16,304,474
2005	88,902	261,344	207,611	16,583,884
2006	88,690	262,590	206,480	16,790,468
2007	89,804	265,311	207,226	16,932,015
2008	89,250	262,265	206,026	16,854,316
2009	87,873	253,315	198,110	16,181,532
2010	93,208	259,983	202,215	16,092,641
2011	94,512	261,030	202,390	16,259,012
2012	96,393	267,466	206,271	16,628,276
2013	98,258	275,277	210,328	17,001,707
2014	100,257	280,884	215,022	17,419,245
2015	102,035	288,811	219,665	17,799,336
Annual Growth (1990 - 2015)	1.7%	1.4%	1.3%	0.9%
Annual Growth (2010 - 2015)	1.8%	2.1%	1.7%	2.0%

Figure A2.2 illustrates the trend in the Study Area counties' employment growth since 1990 as compared to the State as a whole. To facilitate comparison between the counties and with the State, all values are converted to an index with the 1990 index value set to 1.0. The figure clearly shows that over the period employment in the region has risen faster than for the State, especially since 2000.

Figure A2.2

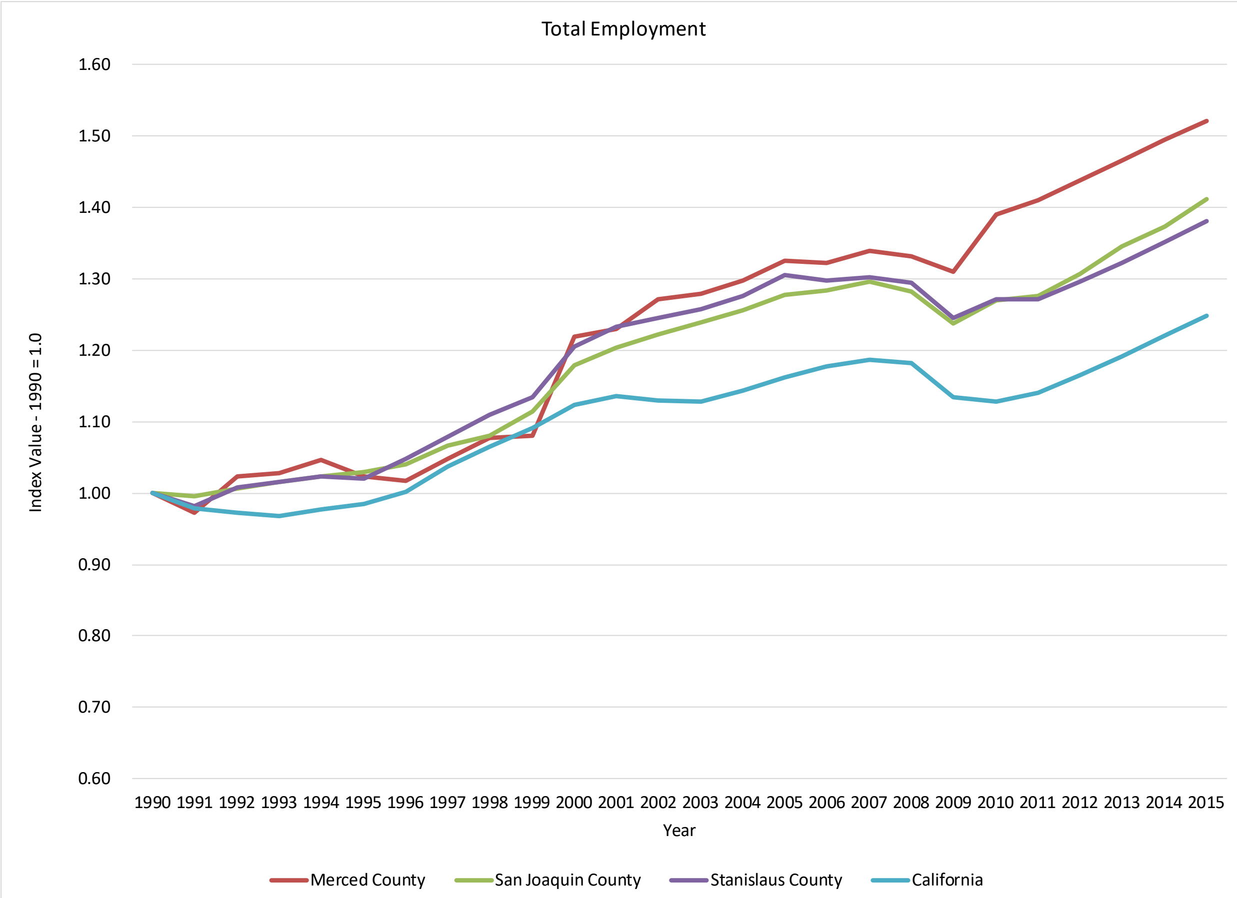


Table A2.8 summarizes the estimated breakdown of farm versus non-farm employment in the Study Area and for the State in 2015 as reported by the CEDD. Non-farm employment is all employment excluding public/government sector employment and farm employment. The table shows the importance to regional employment of the farm sector in the Study Area as compared to the State. Merced County, in particular, relies on farming as a substantial source of employment. As farming is the primary consumer of surface water within the Study Area, there is little question that the substantial reduction of surface water supplies for irrigation resulting from the SED will have a material adverse impact on the Study Area economy.

Table A2.8
Farm v. Non-Farm Employment

Geography	Total Farm Employment	Total Non-Farm Employment	Farm as Employment Percentage of Total
Merced County	15,200	61,600	19.8%
San Joaquin County	17,400	211,000	7.6%
Stanislaus County	15,200	162,600	8.5%
California	423,573	16,053,031	2.6%

It is important to note that the figures in Table A2.8 substantially understate the importance of agriculture to the Study Area's economy since a large portion of the region's non-farm employment is associated with manufacturing, wholesale trade and transportation involving regionally produced farm commodities. Examples include firms that process, package and distribute fruits and vegetables and others that purchase/use local feed in support of livestock-related activities such as cheese production. Table A2.9 provides examples of some of the larger of the agriculture-related companies operating in the Study Area as reported by the CEDD that are important contributors to the region's employment base, and thus economy.

Table A2.9
Downstream Companies

Company	# of Employees	Sector	Business Activity
Merced County			
Foster Farms	1,000 - 4,999	Manufacturing	Poultry Production and Processing
Hilmar Cheese	500 - 999	Manufacturing	Cheese Production
Live Oak Farms	250 - 499	Wholesale Trade	Merchant Wholesale of Fresh Fruits and Vegetables
Gallo Cattle	250 - 499	Manufacturing	Cheese Production
Liberty Packing Company	250-499	Transportation	Packing and Transport of Farm Products
E & J Gallo Winery	100 - 249	Manufacturing	Wine Production
San Joaquin County			
Company	**# of Employees**	**Sector**	**Business Activity**
Leprino Foods Company	1,000 - 4,999	Manufacturing	Cheese Production
Morada Produce Company	500 -999	Wholesale Trade	Merchant Wholesale of Fresh Fruits and Vegetables
O - G Packing & Cold Storage	1,000 - 4,999	Wholesale Trade	Merchant Wholesale of Fresh Fruits and Vegetables
Pacific Coast Producers	1,000 - 4,999	Manufacturing	Canning and Food Processing
Stanislaus			
Company	**# of Employees**	**Sector**	**Business Activity**
Cabo Rossi Wineries	1,000 - 4,999	Manufacturing	Wine Production
Del Monte Foods	1,000 - 4,999	Manufacturer	Canning and Food Processing
Con Agra Foods	1,000 - 4,999	Manufacturing	Canning and Food Processing
Ecco Domani	1,000 - 4,999	Manufacturer	Wine Production
Foster Farms	1,000 - 4,999	Manufacturer	Poultry Production and Processing
Frito-Lay	500 - 999	Manufacturer	Merchant Wholesale of Nuts, Potato Chips, etc.

3. Median Household Income

Median household income ("MHI") is metric frequently used to evaluate economic conditions within a defined geographic area. In fact, the California Department of Water Resources ("CDWR") for the purposes of water resource development and management planning uses MHI to determine if communities are considered economically disadvantaged and, thus, warrant certain special considerations in the spatial allocation of limited natural and financial resources, mitigating actions or in how cost burdens are allocated ("Disadvantaged Community" or "DAC"). Communities are considered economically disadvantaged if their MHI is lower than 80% of the State's MHI and considered severely economically disadvantaged if community MHI is less than 60% of the State's MHI. While the CDWR does not apply this household income evaluation at the county level, Table A2.10 indicates that Merced County collectively would be considered a DAC based on the MHI criteria. Concurrently, San Joaquin and Stanislaus Counties have median household incomes slightly higher than the 80% threshold.

Table A2.10
County Household Income

Geography	2014 Median Houshold Income	As Percent of State Median Household Income
Merced County	$ 44,084	72%
San Joaquin County	$ 51,659	84%
Stanislaus County	$ 51,084	83%
California	$ 61,489	100%

Given the indications of Table A2.10 and the unemployment statistics previously presented (see Table A2.6), it is not surprising that a larger portion of households in the Study Area reside in DACs than is the case of the entire State of California. Table A2.11 presents this comparison.

Table A2.11
Disadvantaged Communities

County	Total Households	Total Households within Disadvantaged Communities	As Percent of Total Households	Total Households within Severely Disadvantaged Communities	As Percent of Total Households	Total Households within Disadvantaged and Severely Disadvantaged Communities	As Percent of Total Households
Merced	76,516	57,398	75.0%	5,249	6.9%	62,647	81.9%
San Joaquin	217,343	114,546	52.7%	3,291	1.5%	117,837	54.2%
Stanislaus	168,090	91,090	54.2%	4,741	2.8%	95,831	57.0%
California							~41.5%

The table shows that over 80 percent of households in Merced County are located in DACs as compared to about half that number for the State. While San Joaquin and Stanislaus counties have a lower percentage of their households within DACs than does Merced County, that percentage is still above 50%. This has important implications for the presumed ability of households in the region to pay any potential additional costs for water that will be required by SED-related reductions in available surface water supplies.

4. Poverty

Consistent with the DAC assessment and the indications of other measures of economic conditions within the Study Area discussed above, poverty levels in Merced, San Joaquin and Stanislaus counties exceed those for the State. Table A2.12 summarizes poverty rates for 2015 within the Study Area as reported by the U.S. Census Bureau. The table shows, for example, that 26.7%, or over 1/4th, of the population of Merced County was living below the poverty line in 2015. This compares to 15.3% for the State.

Table A2.12
Poverty

Geography	% of Population Below Poverty Line	% of Population under 18 Yrs of Age Below Poverty Line
Merced County County	26.70%	38.50%
San Joaquin County	17.40%	23.90%
Stanislaus County	19.70%	27.70%
California	15.30%	21.20%

5. Farm Economy and Water Use

The farm sectors of each of the Study Area counties rely on a combination of surface and groundwater source for their irrigation water supplies. While many independent famers and smaller irrigation districts within the Study Area have limited data on water use, the bigger districts do to varying degrees. Historical water use and cropping pattern information for the region's irrigation districts that rely on surface water supplies is instructive on the potential response of those districts to the SED, particularly shifts in water use and cropping during the current drought. The following summarizes available recent historical water use and cropping information for large Study Area irrigation districts. The data shows that the region's irrigation districts respond to changes in surface water supply availability with a mix of additional groundwater pumping, changes in cropping and on-farm measures such as deficit irrigation. It is also important to note that other than with the most recent drought, the region's larger irrigation districts have not experienced substantial surface water supply variability. Accordingly, it is difficult to anticipate long-run responses to permanent surface water supply reductions due to the SED based on the historical observed responses of regional irrigation districts to limited and short term water supply variability.

Oakdale Irrigation District

Table A2.13 summarizes recent historical cropping pattern and water supply data for the Oakdale Irrigation District. The table indicates that the district's cropped acreage has recently risen and that drought-related reductions in surface water supplies have been addressed through increased groundwater pumping.

Table A2.13
Oakdale ID

Year	2005	2010	2014	2015
Total Cropped Acres	49,681	50,827	59,008	N/A
Pasture	31,158	29,845	28,064	
Oats and Corn	7,623	8,150	7,954	
Almonds	3,544	5,825	16,080	
Walnuts	1,983	2,508	3,310	
Total Surface Diversions (Acre-Ft)	223,867	216,957	199,945	
Total Pumped Groundwater (Acre-Ft)	18,019	23,673	64,164	
Total Surface and Groundwater (Acre-Ft)	241,886	240,630	264,109	

Modesto Irrigation District

Table A2.14 summarizes recent historical cropping pattern and water supply data for the Modesto Irrigation District. The district's cropped acreage has held steady at least through 2014 and that at least a portion of its drought-related reductions in surface water supplies have been addressed through increased groundwater pumping. Cropping pattern shifts away from high water consuming filed crops such as pasture and hay together with improved water supply management may explain how, for example, the District's farmers in 2014 absorbed an approximately 15% reduction in their water supply as compared to 2010.

Table A2.14
Modesto ID

Year	2005	2010	2014	2015
Total Cropped Acres	67,129	66,287	66,397	N/A
Pasture	10,030	8,234	6,970	
Corn Silage	3,261	8,997	8,449	
Almonds	18,957	20,772	24,067	
Walnuts	8,327	8,086	8,700	
Total Surface Diversions (Acre-Ft)	326,943	261,888	174,447	149,526
Total Pumped Groundwater (Acre-Ft)	17,653	12,054	58,186	61,540
Total Surface and Groundwater (Acre-Ft)	344,596	273,942	232,633	211,066

Turlock Irrigation District

Table A2.15 summarizes recent historical cropping pattern and water supply data for the Turlock Irrigation District. The table indicates that the district's acreage has held steady the past six years however, the district has responded to recent substantial drought-related reductions in its surface water supplies with significant reductions in double-cropping. In fact, the district reported over 45,000 acres of second crop production in 2013 composed mostly of corn. In 2015, with 30% less surface water supplies as compared to 2013 due to the drought the district reported no double cropping while pumping less groundwater than in 2013.

Table A2.15

Turlock ID

Year	2010	2011	2012	2013	2014	2015
Total Acres	145,521	145,600	144,426	145,024	144,031	143,205
Total Cropped Acres (Includes Double Cropping)	193,377	194,953	193,594	192,583	148,741	143,205
Total Surface Diversions (Acre-Ft)	531,610	537,282	446,668	460,482	319,695	281,484
Total Pumped Groundwater (Acre-Ft)	64,476	66,062	113,130	113,395	89,702	93,395
Total Surface and Groundwater (Acre-Ft)	596,086	603,344	559,798	573,877	409,397	374,879
Average Acre-Feet per Acre	3.1	3.1	2.9	3.0	2.8	2.6

Figure A2.3 presents the data in Table A2.15 graphically. The district's crop production acres including double-cropping has dropped the past few years in conjunction with drought-related reductions in surface water supplies without offsetting increases in groundwater pumping.

Figure A2.3

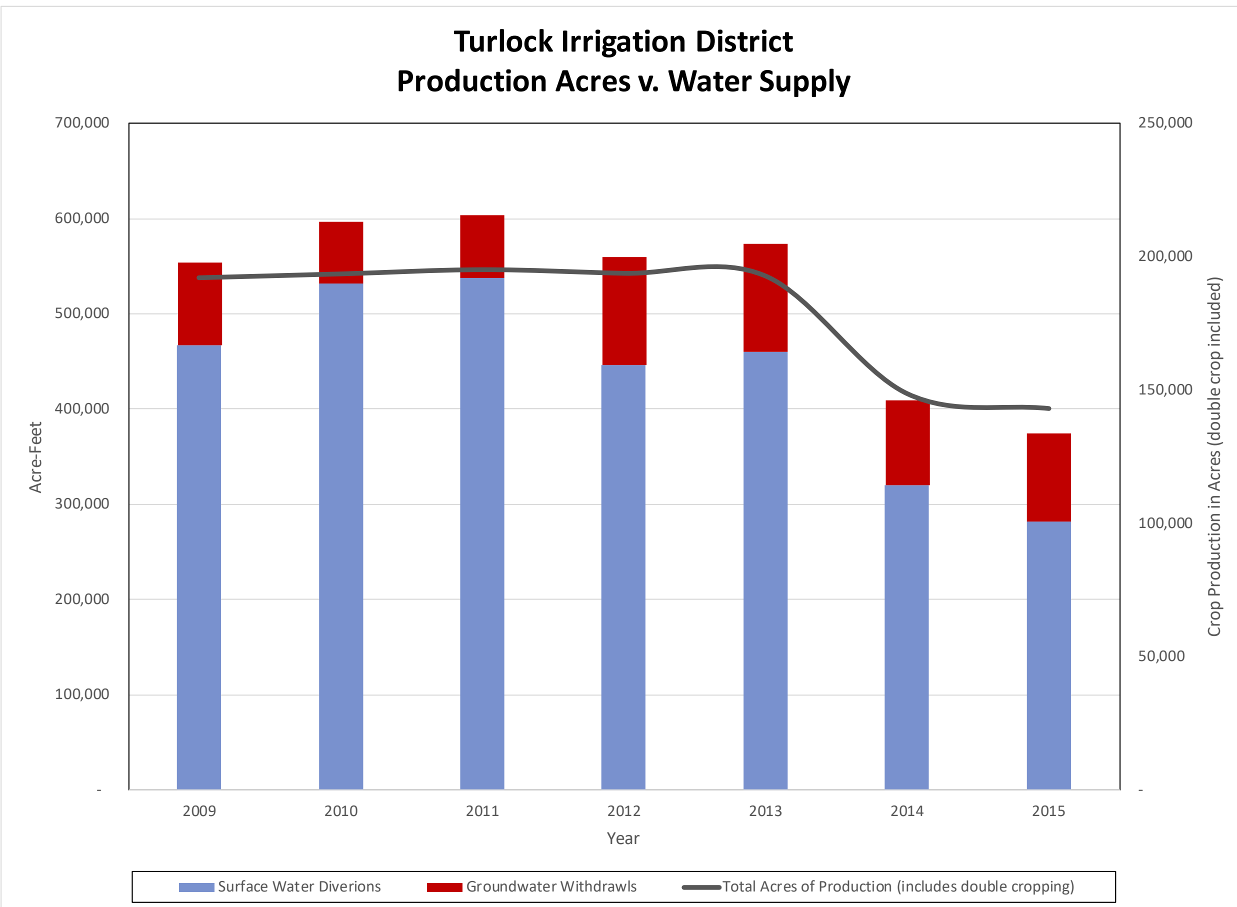
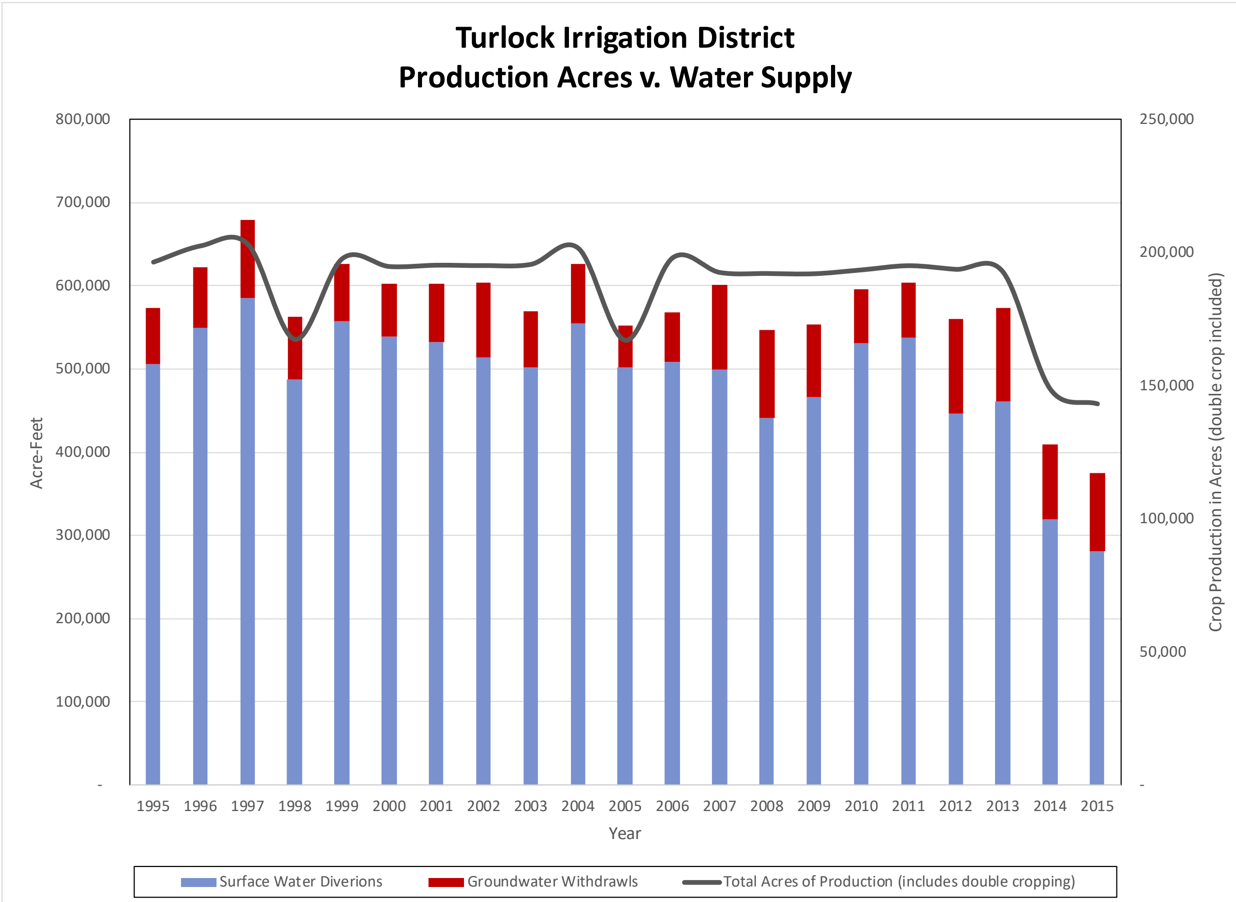


Figure A2.4 extends the graphic in Figure A2.3 back through 1995. The graphic reveals several additional instances (1998 and 2005) where the District responded in year-over-year declines in its surface water supplies with a reduction in crop production and not increased groundwater pumping.

Figure A2.4



South San Joaquin Irrigation District

Table A2.16 summarizes recent historical cropping pattern and water supply data for the South San Joaquin Irrigation District. The district's cropped acreage has held steady at least through 2014 and appears to manage what has been fairly limited variability in its surface water supplies through increased groundwater pumping.

Table A2.16
South San Joaquin ID

Year	2005	2010	2014	2015
Total Cropped Acres	51,998	50,368	51,035	N/A
Semi-Permanent	5,944	4,757	4,465	
Annual	6,240	6,758	6,653	
Almonds	32,774	32,923	33,868	
Other Permanent	7,041	5,929	7,113	
Total Surface Diversions (Acre-Ft)	204,761	223,462	213,060	
Total Pumped Groundwater (Acre-Ft)	48,328	41,081	68,611	
Total Surface and Groundwater (Acre-Ft)	253,089	264,543	281,671	

Merced Irrigation District

Table A2.17 summarizes recent historical cropping pattern and water supply data for the Merced Irrigation District. The district's cropped acreage that the District's surface water supplies dropped to near zero in 2015 due to drought conditions and that the district largely offset this decline with groundwater pumping. Such a significant amount of groundwater pumping is not sustainable and, thus, not a model for how the district might respond to the substantial surface water supply cutbacks under the SED. Furthermore, the degree to which Merced's surface water supplies were reduced in 2015 speaks to the importance for considering reliability and volatility in evaluating the potential impacts of the SED. An impact evaluation based on long term averages fundamentally ignores this volatility.

Table A2.17

Year	2007	2010	2014	2015
Total Irrigated Acres	Waiting for Accurate Data			
Alfalfa				
Pasture				
Corn and Corn Silage				
Almonds				
Walnuts				
Total Surface Deliveries (Acre-Ft)	250,740	272,560	103,068	2,544
Total Pumped Groundwater (Acre-Ft)	160,101	127,717	336,693	392,171
Total Surface and Groundwater (Acre-Ft)	410,841	400,277	439,761	394,715

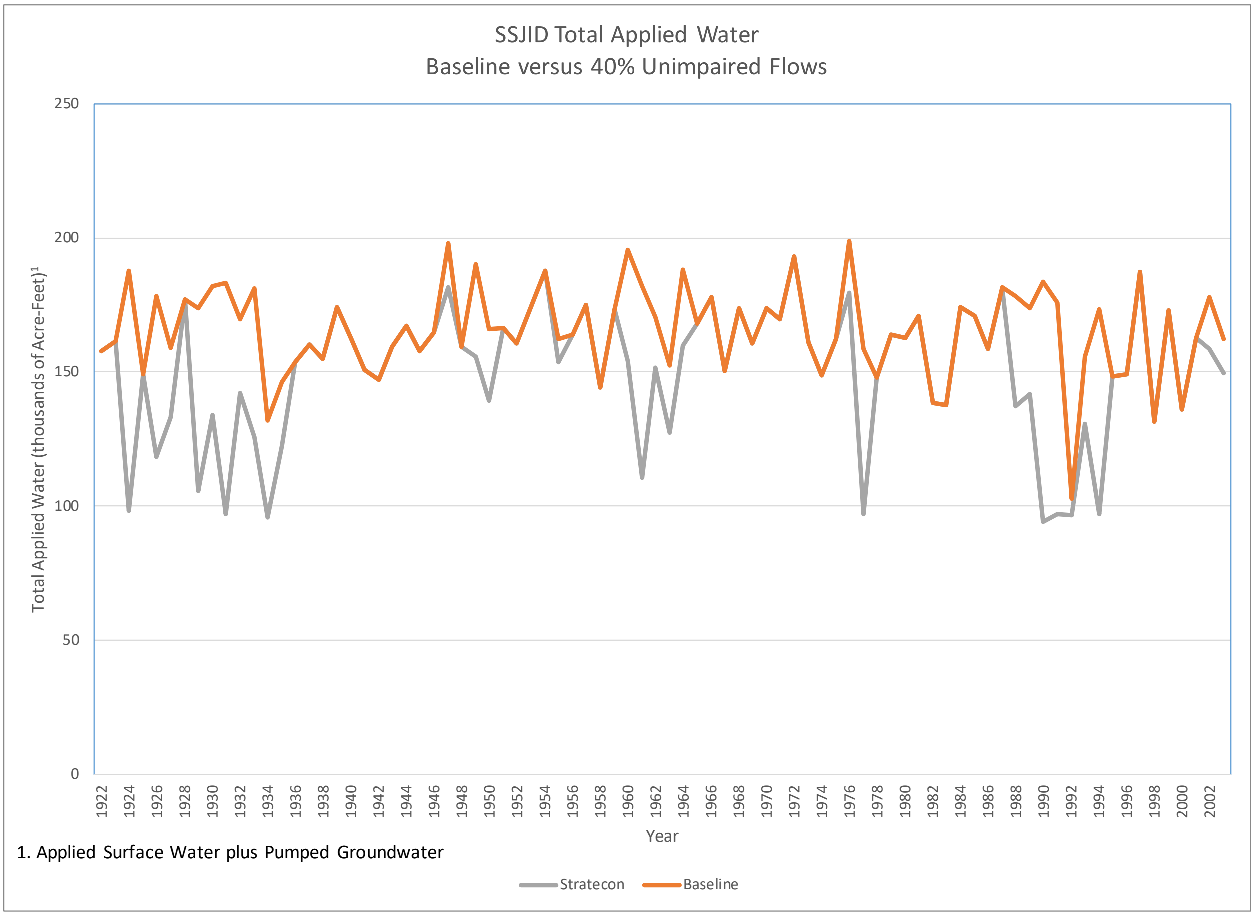
Attachment 3
Estimated SED 40 Impacts on Groundwater Pumping and Crop Gross Revenues

Irrigation District level detail on Estimated SED 40 impacts on groundwater pumping and crop gross revenues due to surface water supply reductions.

1. SSJID

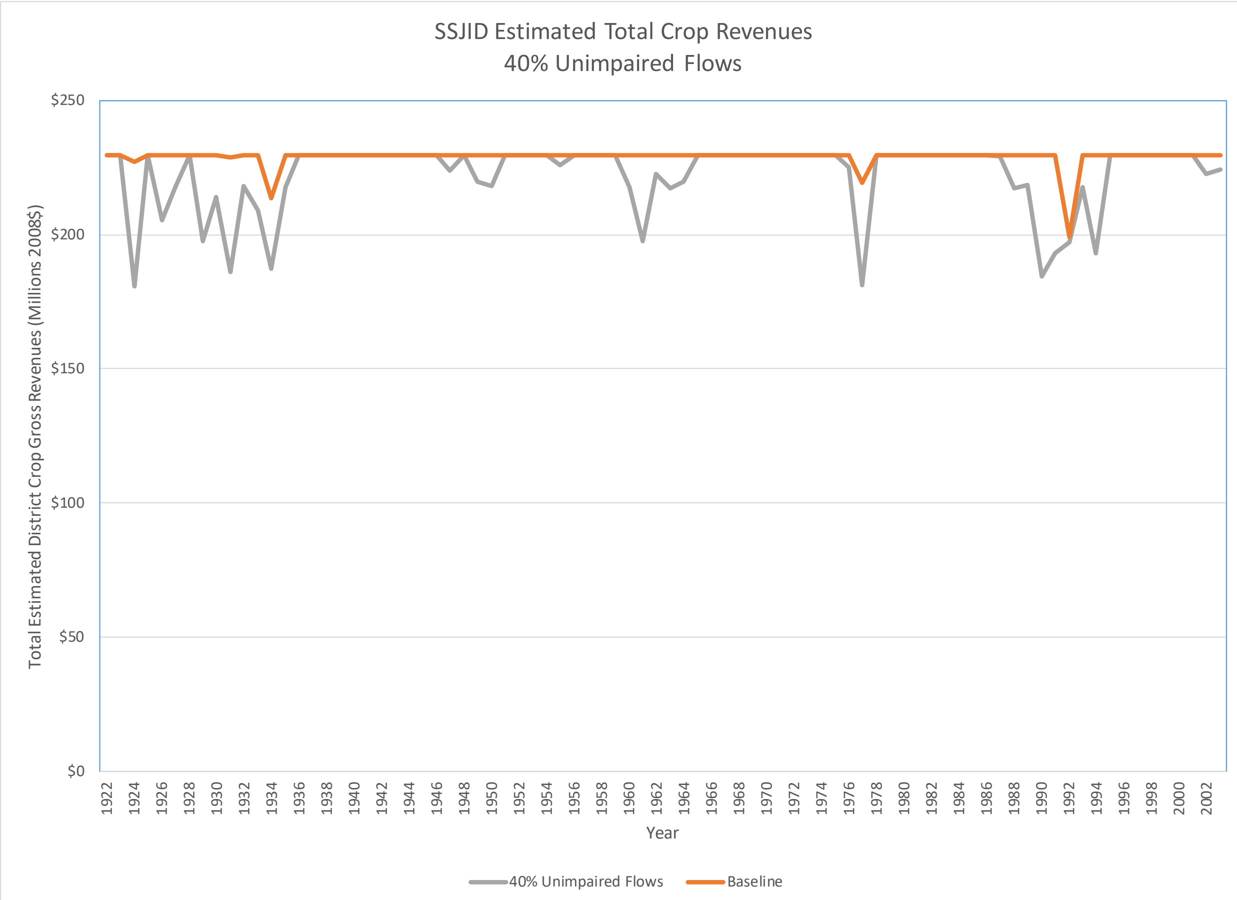
Figure A3.1 summarizes the estimated water supply impacts within the SSJID during the Study Period were the SED in place at the SED 40. The figure shows that in many years during the Study Period, there would have been no anticipated impact on the availability of water for the district and, accordingly, the district's overall water supplies because of the SED 40; i.e., the combined total surface and groundwater supplies under the SED 40 would have been equal to those combined totals in the absence of the SED 40. Generally, this is the case in years that are designated by SWRCB to be wet years, above normal precipitation years and even below normal precipitation years depending on prior year precipitation conditions. Concurrently, the figure shows several years during the study Period where SSJID's water supplies with the SED 40 in place would have been lower than the district's baseline water supplies in the absence of the SED. These are years generally designated by SWRCB as dry or critically dry. In these years, it is estimated that SED reductions in the district's surface water supplies would not have been fully offset by additional groundwater pumping. In 1977, for example, designated a critically dry year by the SWRCB that followed another critically dry year, it is estimated that the applied water in the district would have been about 97,000 acre-feet with the SED in place, down almost 40% from the baseline 159,000 acre-feet that would have been available to the district in the absence of the SED that year. The difference would have resulted in a reduction in crop production that year by the district.

Figure A3.1



In each of the years shown in Figure A3.1 that the SSJID's water supplies would have been reduced below baseline due to the SED there would have been expected reductions in cropping and associated crop sales revenues (gross revenues). Figure A3.2 illustrates the years when the crop gross revenues generated by the district during the Study Period would have been lower than baseline were the SED in place. The revenue figures are in common 2008 dollar terms consistent with the SWRCB's SED assessment. The difference between the two lines, where they diverge, represents the estimated lost revenues associated with the SED in that year.

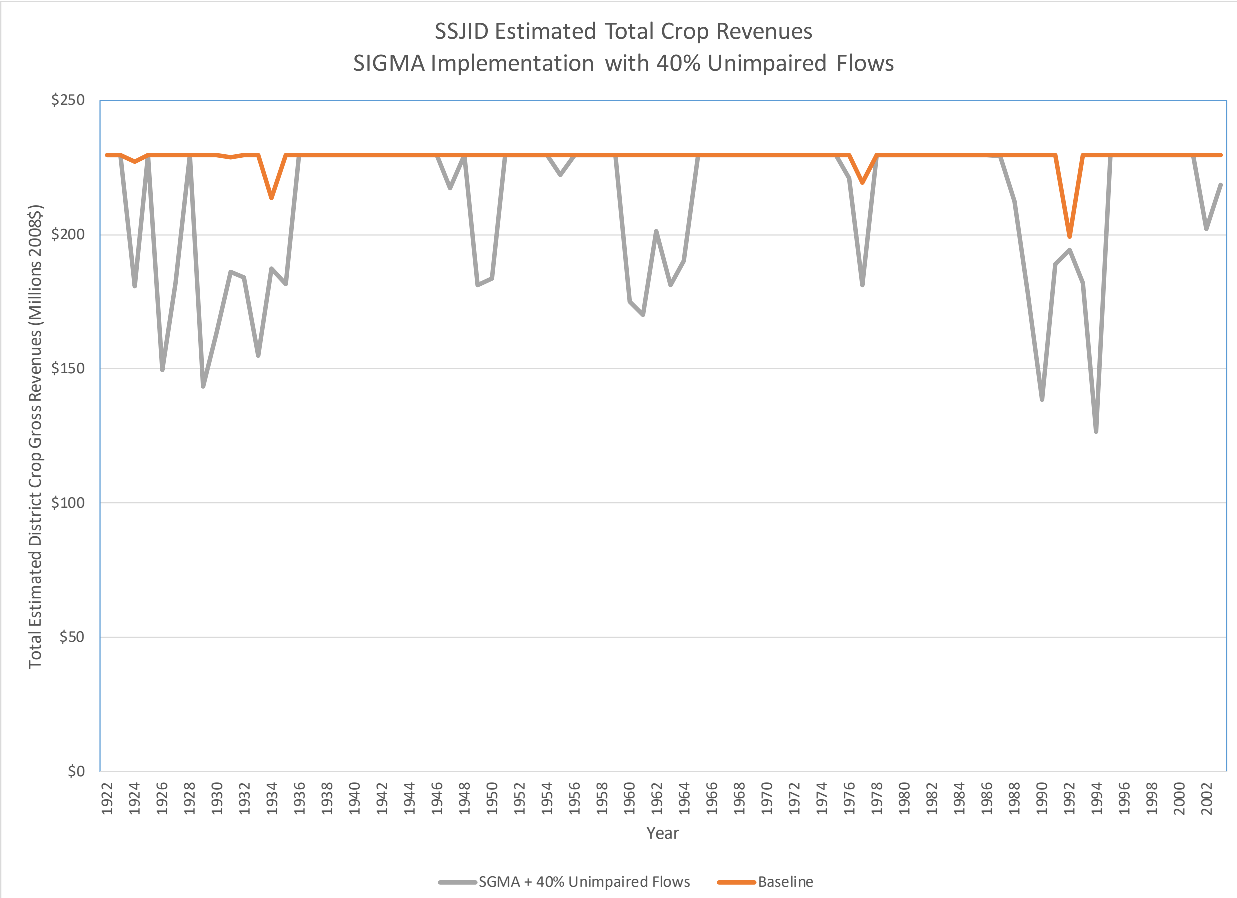
Figure A3.2



The figure shows that the magnitude of lost revenues in years that would have experienced below baseline water supplies due to the SED are less than for water supply shown in Figure A3.2. This is because the analysis of the fallowing of crops due to SED water supply reductions reflects the fact that in the face of water supply reductions farmers tend to fallow relatively lower-valued, higher water consuming annual crops such as pasture in much greater proportion than higher valued crops such as almonds.

Figure A3.3 revisits the crop gross revenue analysis presented in Figure A3.2 with the imposition of the SGMA and associated assumption that in years that the district's surface water supplies would have been reduced below baseline due to the SED 40 the district would not have been able to offset any of those surface supply reductions with groundwater. The result is much more significant impacts on crop gross revenues due to the SED surface water supply reductions as can be observed by a comparison of the larger differences between the two lines in Figure A3.3 where the lines diverge as compared to in Figure A3.2.

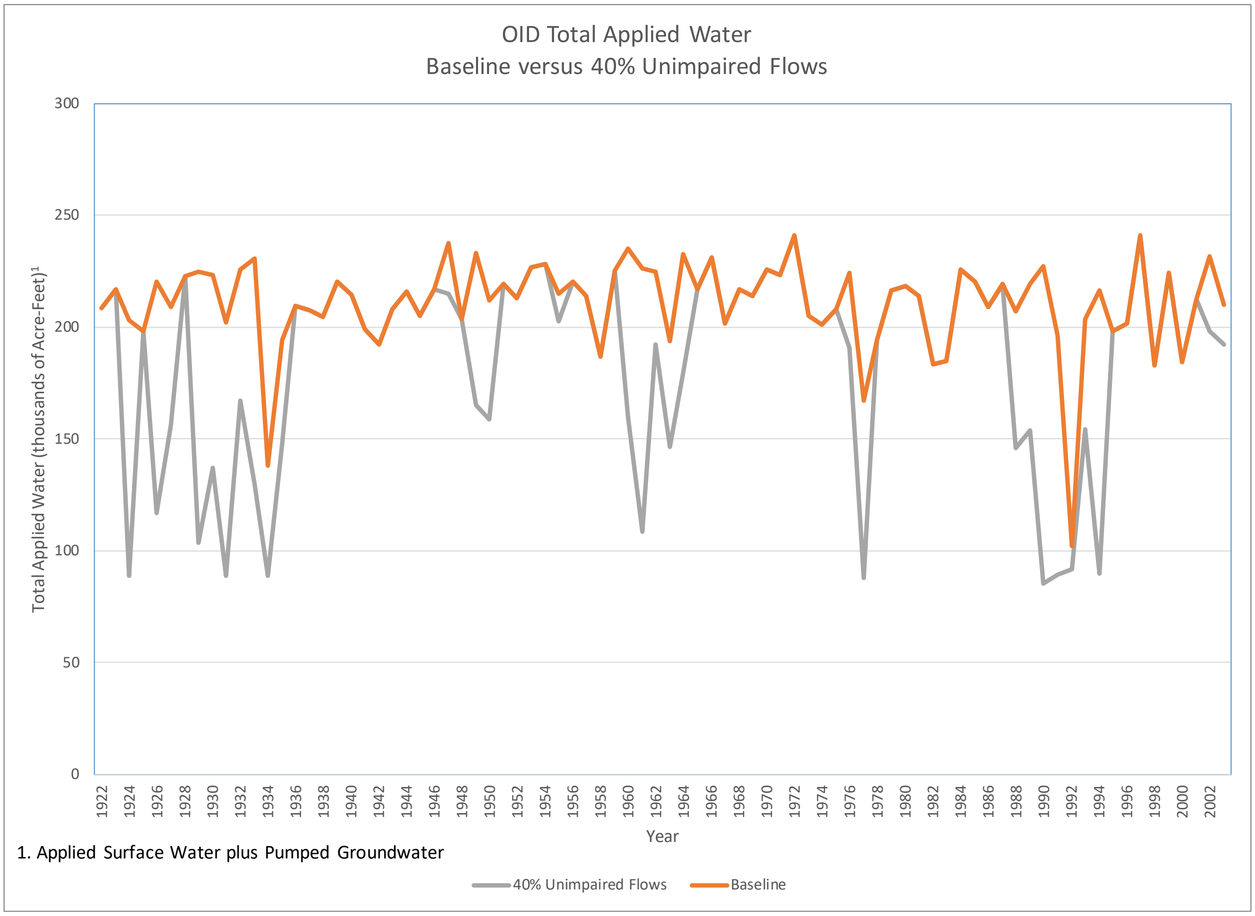
Figure A3.3



2. OID

Figure A3.4 summarizes the estimated water supply impacts within the OID during the Study Period were the SED in place at the SED 40. The figure shows that in many years during the Study Period, there would have been no anticipated impact on the availability of water for the district and, accordingly, the district's overall water supplies because of the SED 40; i.e., the combined total surface and groundwater supplies under the SED 40 would have been equal to those combined totals in the absence of the SED 40. Concurrently, the figure shows several years during the study Period where OID's water supplies with the SED 40 in place would have been lower than the district's baseline water supplies in the absence of the SED. In these years, it is estimated that SED reductions in the district's surface water supplies would not have been fully offset by additional groundwater pumping. In 1977, for example, designated a critically dry year by the SWRCB that followed another critically dry year, it is estimated that the applied water in the district would have been about 88,000 acre-feet with the SED in place, down about 47% from the baseline 167,000 acre-feet that would have been available to the district in the absence of the SED that year. The difference would have resulted in a reduction in crop production that year by the district.

Figure A3.4



In each of the years shown in Figure A3.4 that OID's water supplies would have been reduced below baseline due to the SED there would have been expected reductions in cropping and associated crop sales revenues (gross revenues). Figure A3.5 illustrates the years when the crop gross revenues generated by the district during the Study Period would have been lower than baseline were the SED in place. The revenue figures are in common 2008 dollar terms consistent with the SWRCB's SED assessment. The difference between the two lines, where they diverge, represents the estimated lost revenues associated with the SED in that year.

Figure A3.5

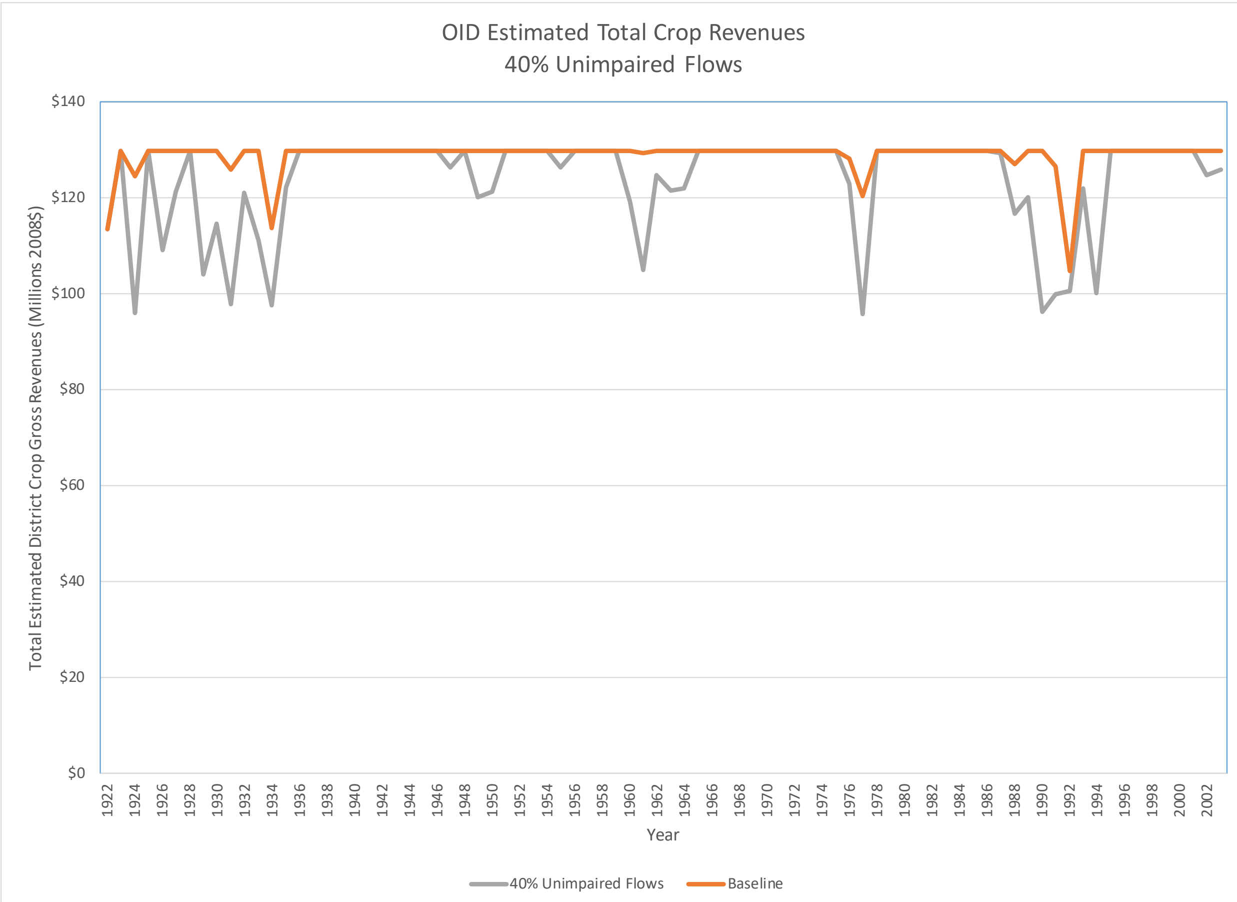
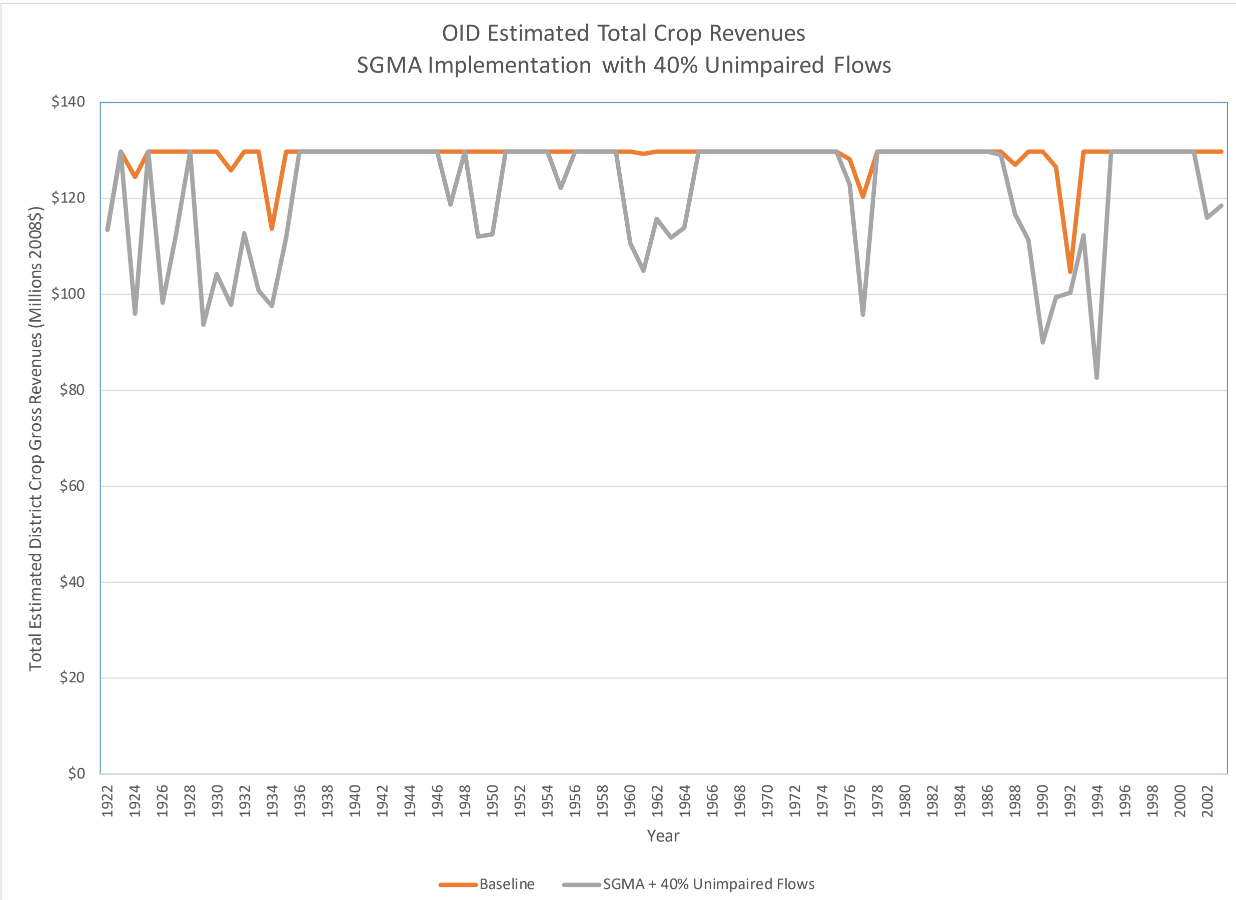


Figure A3.6 revisits the crop gross revenue analysis presented in Figure A3.5 with the imposition of the SGMA and associated assumption that in years that the district's surface water supplies would have been reduced below baseline due to the SED 40 the district would not have been able to offset any of those surface supply reductions with groundwater. The result shows some additional impacts on crop gross revenues due to the SED surface water supply reductions as can be observed by a comparison of the differences between the two lines in Figure A3.6 where the lines diverge as compared to in Figure A3.5. The magnitude of the additional impacts appears less significant compared to the SSJID case because of OID's lower reliance on groundwater in general as compared to SSJID.

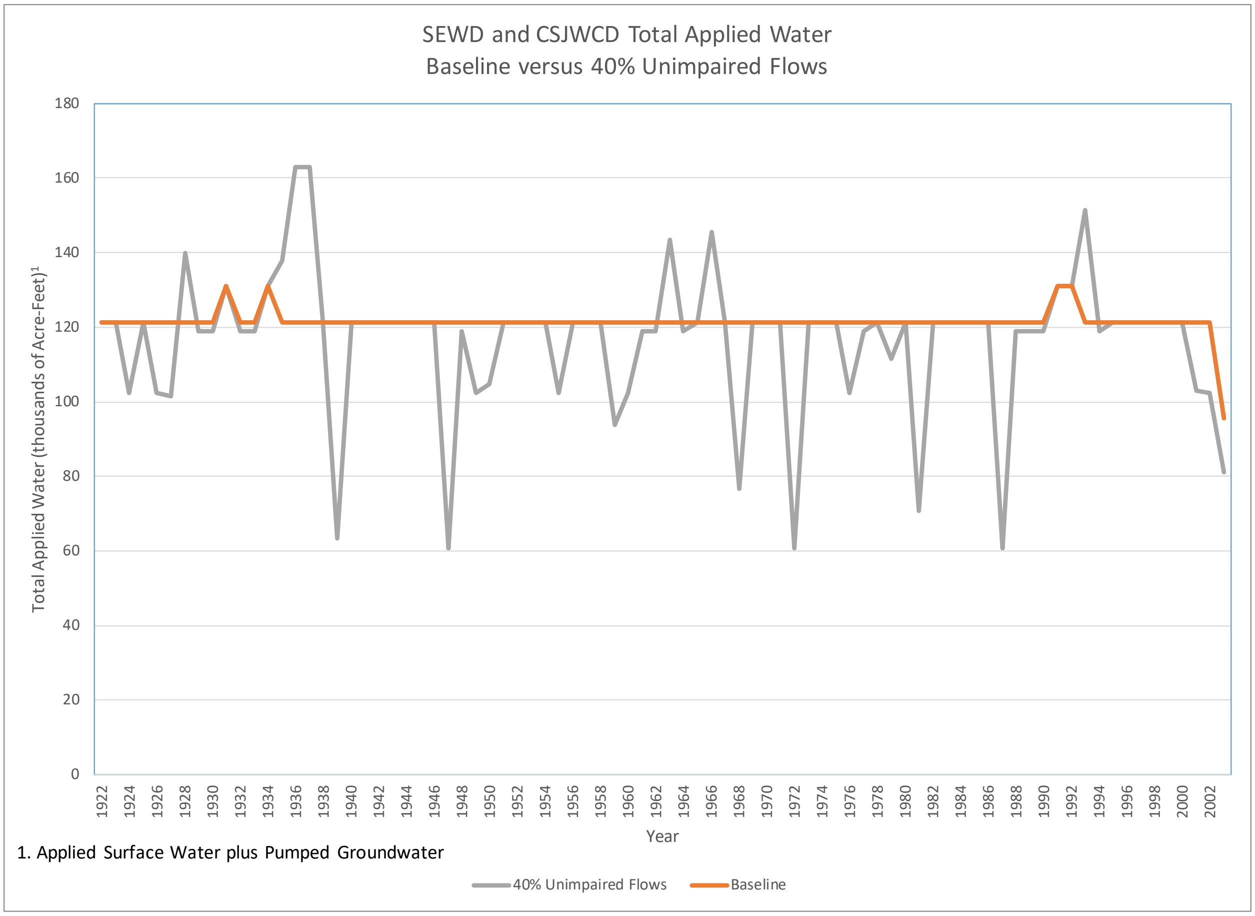
Figure A3.6



3. SEWD/CSJWCD

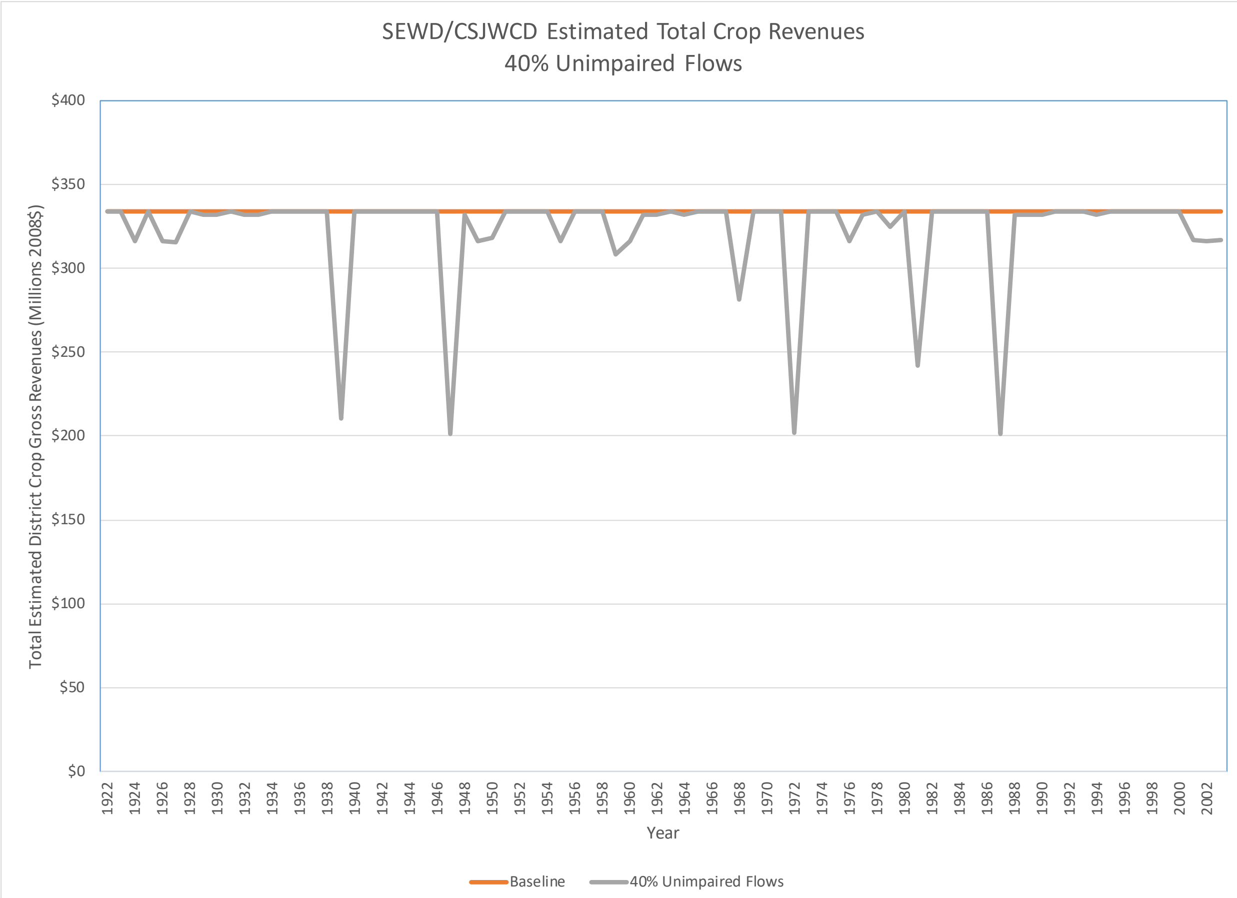
Figure A3.7 summarizes the estimated water supply impacts within SEWD and CSJWCD combined during the Study Period were the SED in place at the SED 40. The figure shows that in many years during the Study Period there would have been no impacts on the availability of surface water for the districts and, accordingly, the district's overall water supplies because of the SED 40. Concurrently, the figure shows a near equal number of years during the study Period where OID's water supplies with the SED 40 in place would have been lower or, in fact, higher than the district's baseline water supplies in the absence of the SED. In the years with lower supplies, it is estimated that SED reductions in the district's surface water supplies would not have been fully offset by additional groundwater pumping. In 1987, for example, designated a critically dry year by the SWRCB that actually followed a wet year, it is estimated that the applied water in the district would have been about 61,000 acre-feet with the SED in place, down about 50% from the baseline 121,000 acre-feet that would have been available to the district in the absence of the SED that year. The difference would have resulted in a reduction in crop production that year by the district.

Figure A3.7



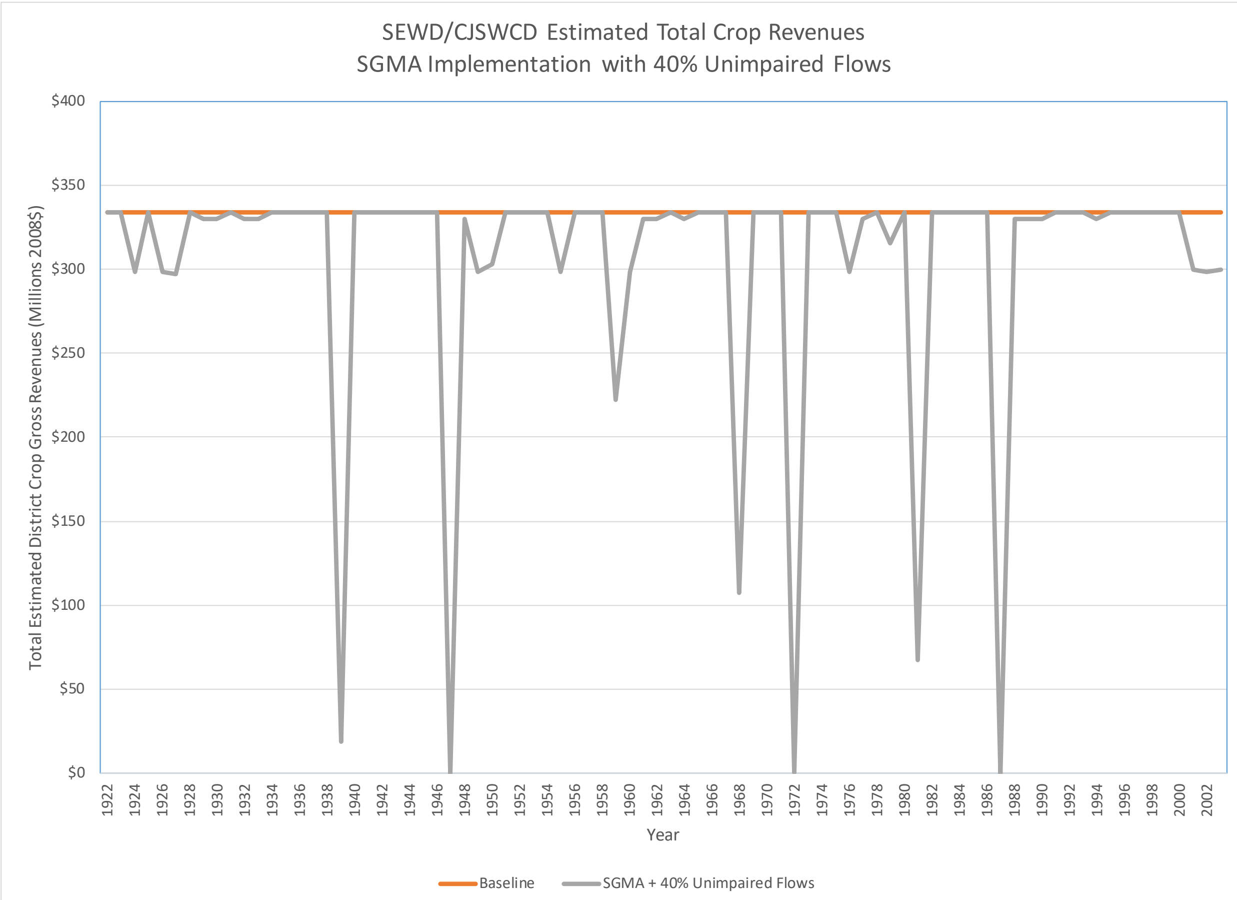
In each of the years shown in Figure A3.7 that SEWD/CSJWCD water supplies would have been reduced below baseline due to the SED there would have been expected reductions in cropping and associated crop sales revenues (gross revenues). Figure A3.8 illustrates the years when the crop gross revenues generated by the districts during the Study Period would have been lower than baseline were the SED in place. The revenue figures are in common 2008 dollar terms consistent with the SWRCB's SED assessment. The difference between the two lines, where they diverge, represents the estimated lost revenues associated with the SED in that year.

Figure A3.8



The figure shows some instances of fairly substantial decreases in the districts' crop gross revenues in four years during the Study Period in excess of 30%. Figure A3.9 revisits the crop gross revenue analysis presented in Figure A3.8 with the imposition of the SGMA and associated assumption that in years that the district's surface water supplies would have been reduced below baseline due to the SED 40 the district would not have been able to offset any of those surface supply reductions with groundwater. The result show significant additional impacts on crop gross revenues due to the SED surface water supply reductions as can be observed by a comparison of the differences between the two lines in Figure A3.9 where the lines diverge as compared to in Figure A3.8. In fact, Figure A3.9 shows for three years during the Study Period that in theory the districts' crop gross revenues will be driven to zero due to a complete lack of local water supply.

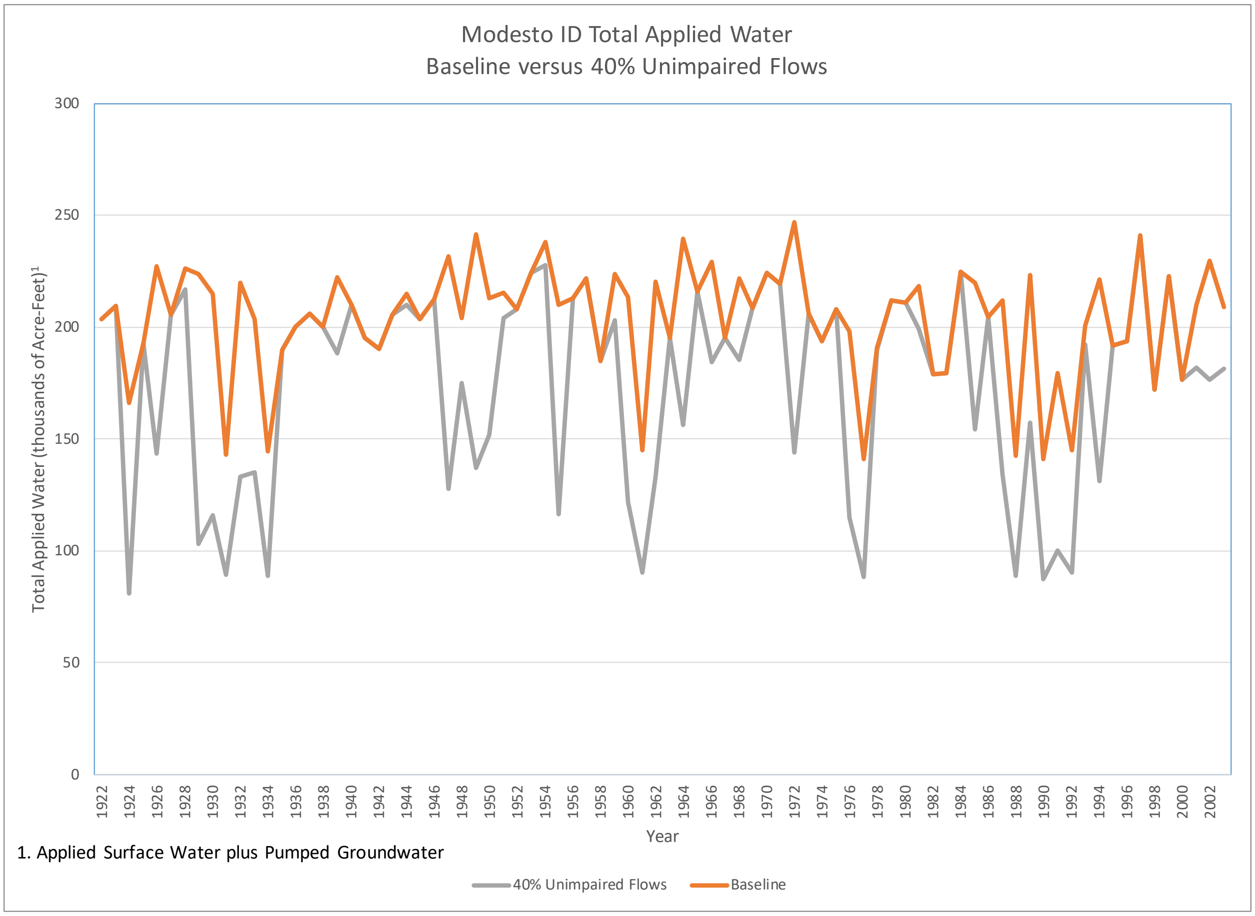
Figure A3.9



4. Modesto ID

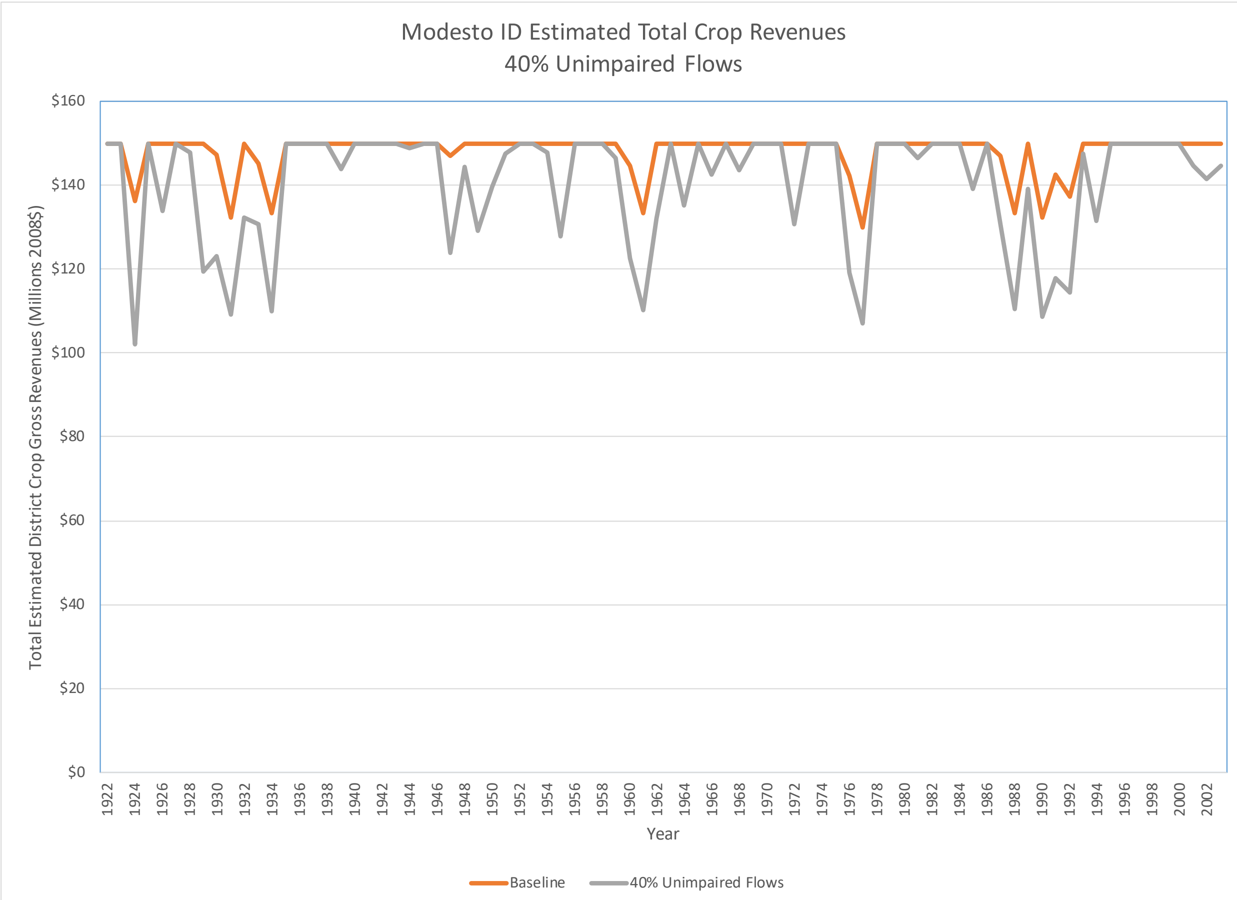
Figure A3.10 summarizes the estimated water supply impacts within the Modesto ID during the Study Period were the SED in place at the SED 40. The figure shows that the baseline water supply during the Study Period is highly variable due to the lack of district groundwater pumping infrastructure and, thus, limited ability to respond to normal inter-year surface water supply changes with offsetting groundwater pumping. The figure further shows many years during the Study Period that the SED would have caused substantial reductions in the district's water supplies below the baseline. In 1977, for example, designated a critically dry year by the SWRCB that followed another critically dry year, it is estimated that the applied water in the district would have been about 88,000 acre-feet with the SED in place, down almost 40% from the baseline 141,000 acre-feet that would have been available to the district in the absence of the SED that year. The difference would have resulted in a reduction in crop production that year by the district.

Figure A3.10



In each of the years shown in Figure A3.10 that the Modesto ID's water supplies would have been reduced below baseline due to the SED there would have been expected reductions in cropping and associated crop sales revenues (gross revenues). Figure A3.11 illustrates the years when the crop gross revenues generated by the district during the Study Period would have been lower than baseline were the SED in place. The revenue figures are in common 2008 dollar terms consistent with the SWRCB's SED assessment. The difference between the two lines, where they diverge, represents the estimated lost revenues associated with the SED in that year.

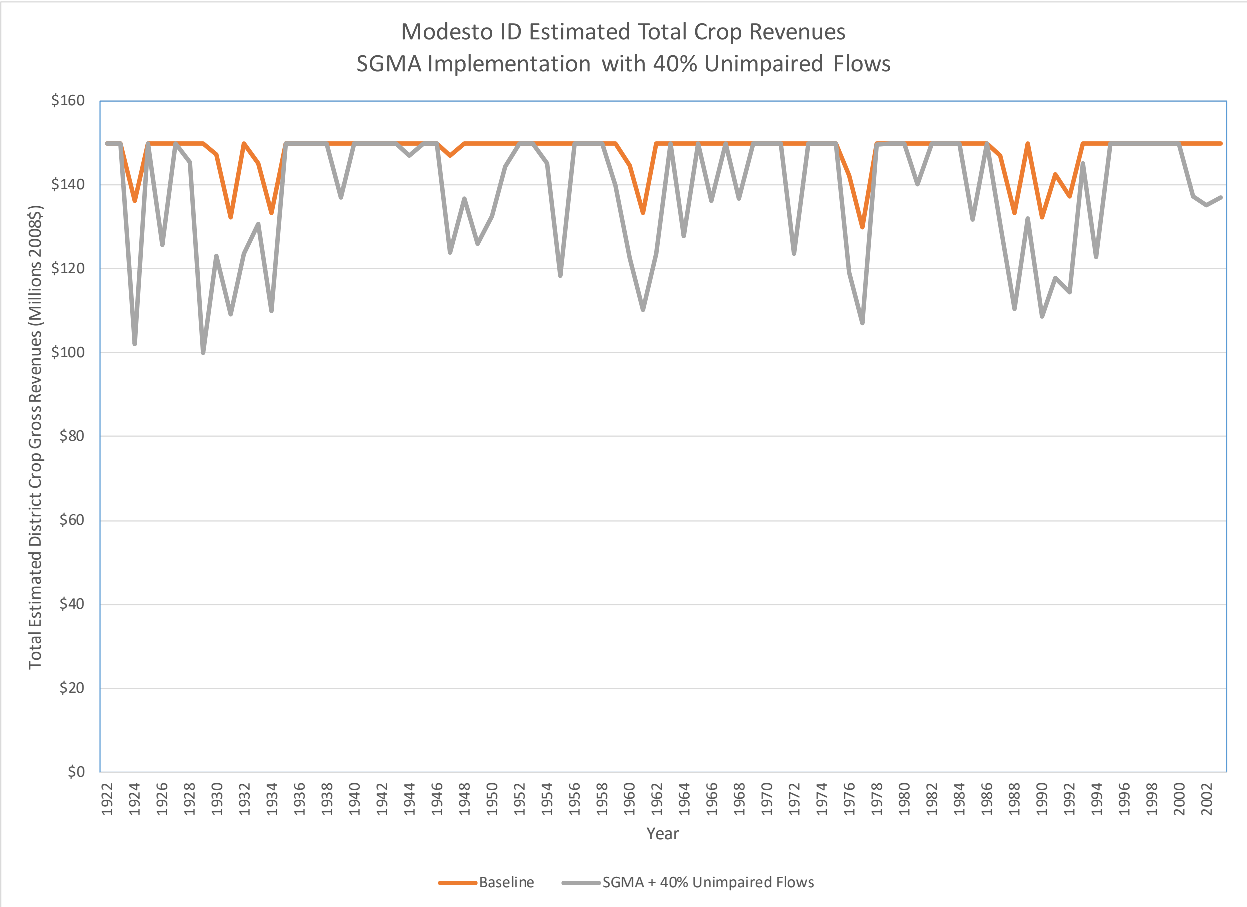
Figure A3.11



The figure shows that the magnitude of lost revenues in years that would have experienced below baseline water supplies due to the SED are less than for water supply shown in Figure A3.10. This is because the analysis of the fallowing of crops due to SED water supply reductions reflects the fact that in the face of water supply reductions farmers tend to fallow relatively lower-valued, higher water consuming annual crops such as pasture in much greater proportion than higher valued crops such as almonds.

Figure A3.12 revisits the crop gross revenue analysis presented in Figure A3.11 with the imposition of the SGMA and associated assumption that in years that the district's surface water supplies would have been reduced below baseline due to the SED 40 the district would not have been able to offset any of those surface supply reductions with groundwater. The result is much more significant impacts on crop gross revenues due to the SED surface water supply reductions as can be observed by a comparison of the larger differences between the two lines in Figure A3.12 where the lines diverge as compared to in Figure A3.11.

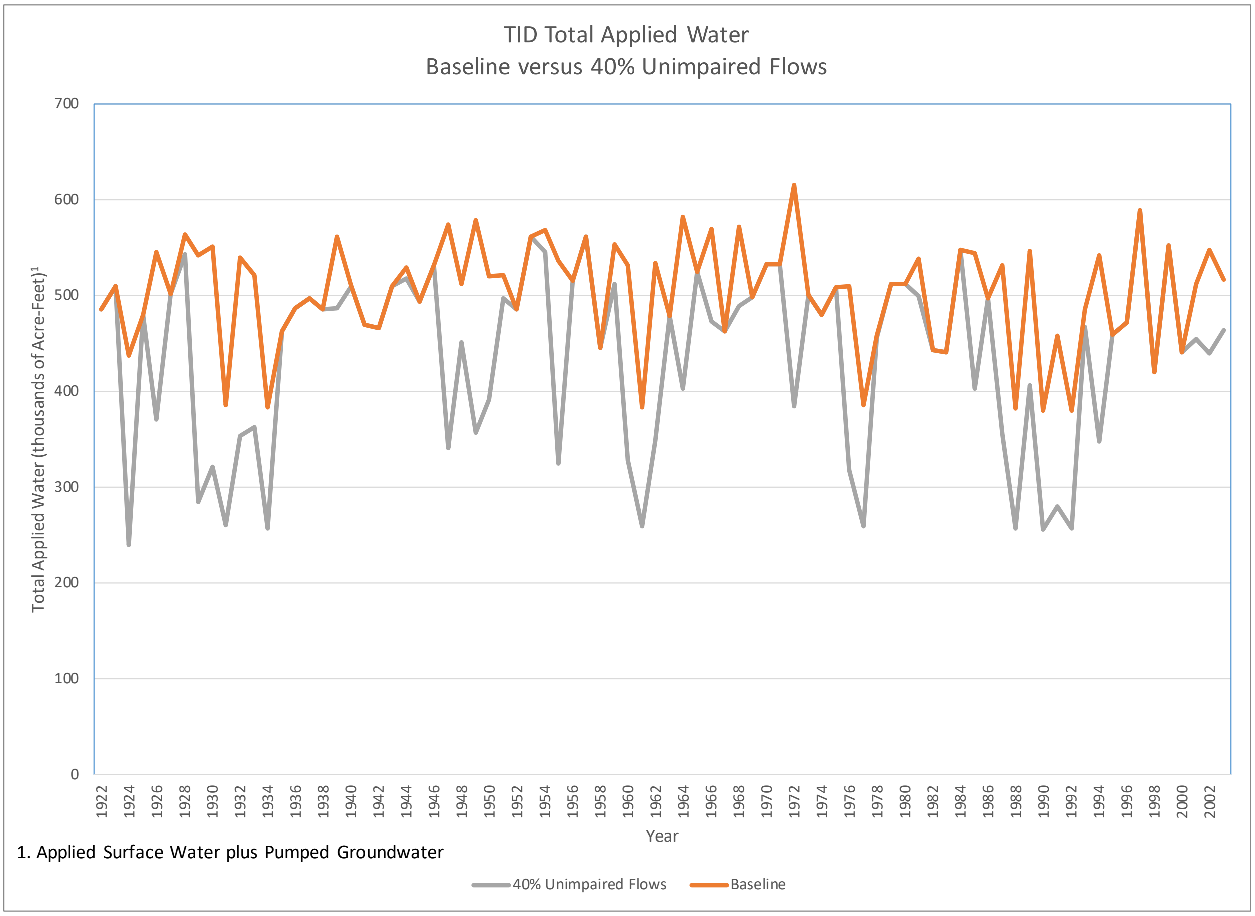
Figure A3.12



5. TID

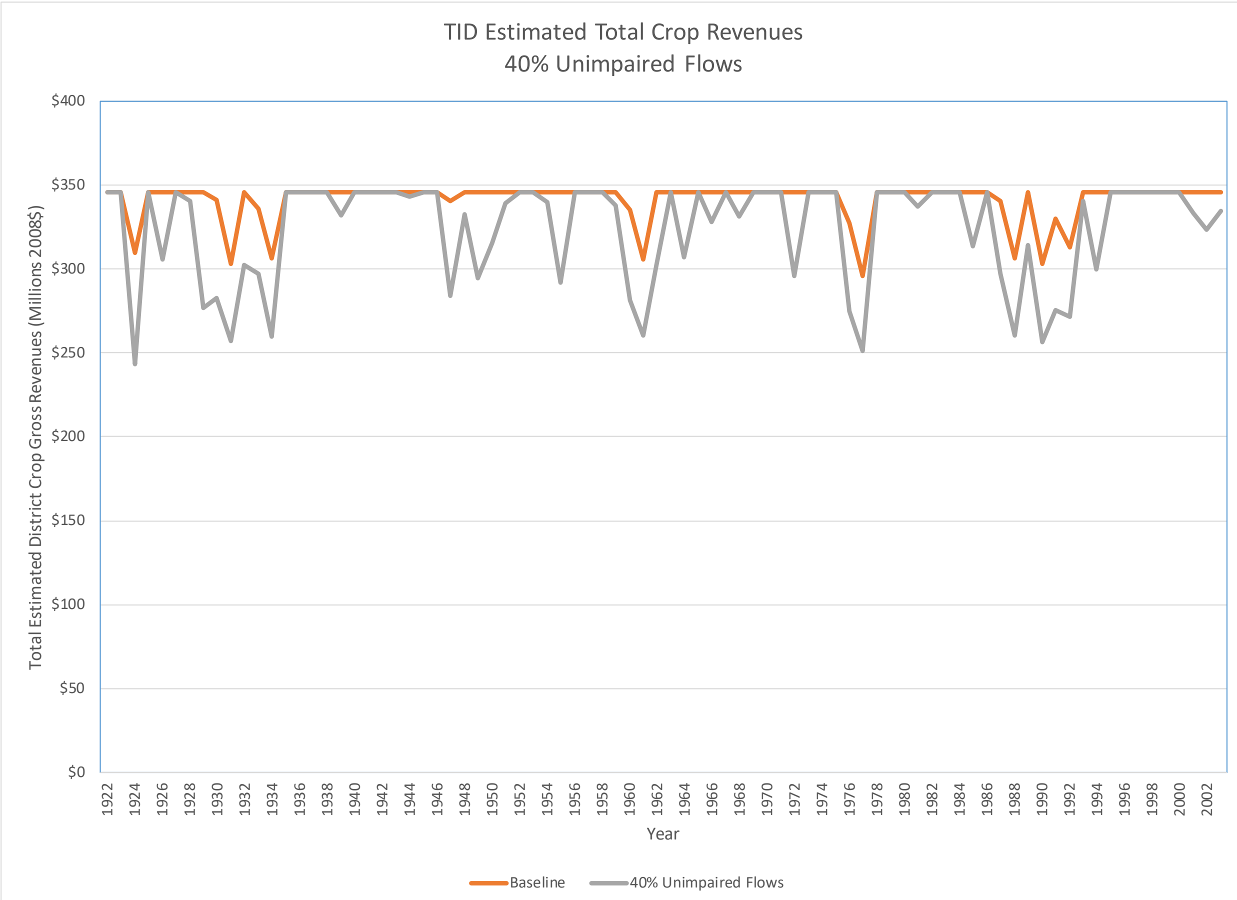
Figure A3.13 summarizes the estimated water supply impacts within TID during the Study Period were the SED 40 in place. The figure shows that the district's baseline water supply during the Study Period is highly variable due to the lack of district groundwater pumping infrastructure and, thus, limited ability to respond to normal inter-year surface water supply changes with offsetting groundwater pumping. The figure further shows many years during the Study Period that the SED would have caused substantial reductions in the district's water supplies below the baseline. In 1977, for example, designated a critically dry year by the SWRCB that followed another critically dry year, it is estimated that the applied water in the district would have been about 259,000 acre-feet with the SED in place, down almost 1/3rd, 33%, from the baseline 385,000 acre-feet that would have been available to the district in the absence of the SED that year. The difference would have resulted in a reduction in the district's crop production and associated crop gross revenues.

Figure A3.13



In each of the years shown in Figure A3.13 that the Modesto ID's water supplies would have been reduced below baseline due to the SED there would have been expected reductions in cropping and associated crop gross revenues. Figure A3.14 illustrates the years when the crop gross revenues generated by the district during the Study Period would have been lower than baseline were the SED in place. The revenue figures are in common 2008 dollar terms consistent with the SWRCB's SED assessment. The difference between the two lines, where they diverge, represents the estimated lost revenues associated with the SED in that year.

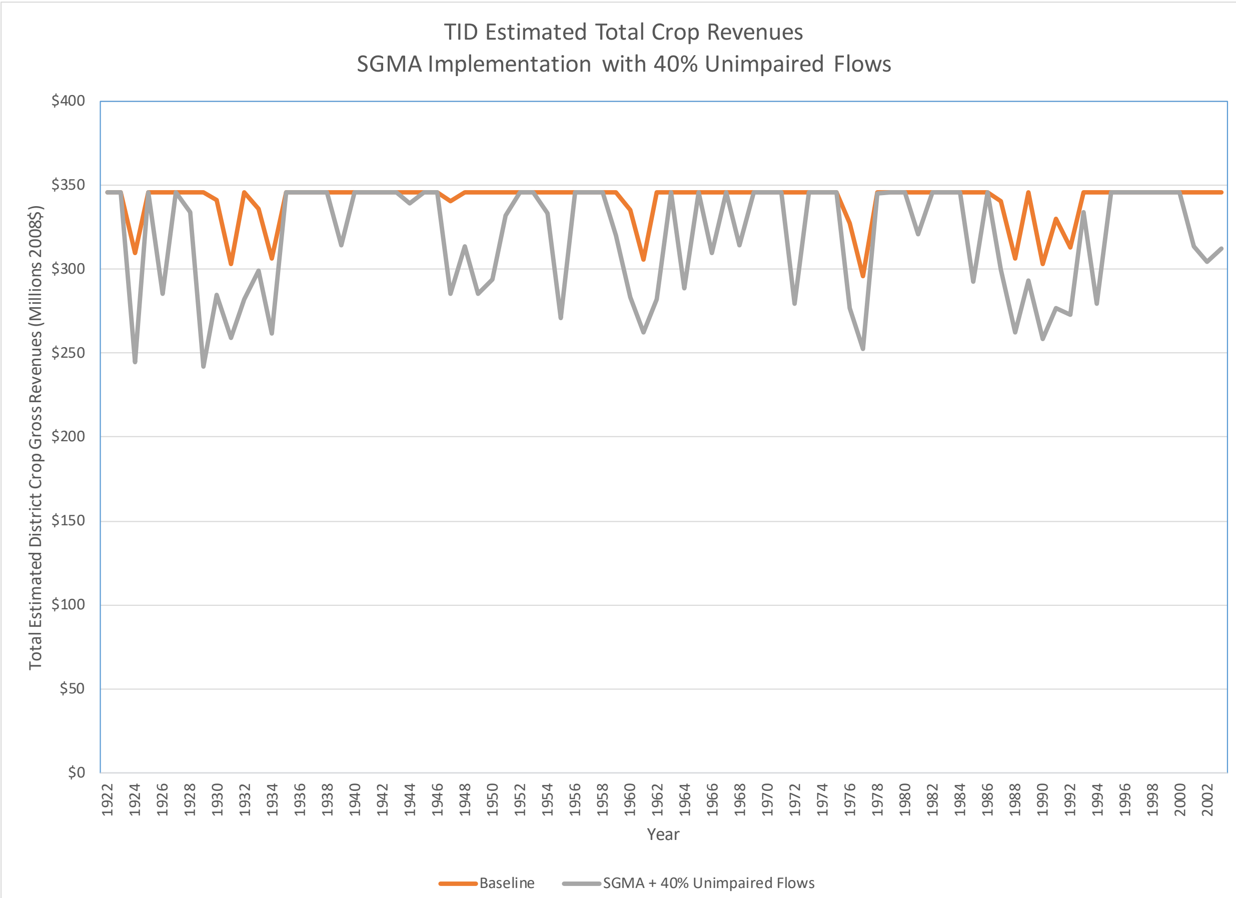
Figure A3.14



The figure shows that the magnitude of lost revenues in years that would have experienced below baseline water supplies due to the SED are less than for water supply shown in Figure A3.10. This is because the analysis of the fallowing of crops due to SED water supply reductions reflects the fact that in the face of water supply reductions farmers tend to fallow relatively lower-valued, higher water consuming annual crops such as pasture in much greater proportion than higher valued crops such as almonds.

Figure A3.15 revisits the crop gross revenue analysis presented in Figure A3.14 with the imposition of the SGMA and associated assumption that in years that the district's surface water supplies would have been reduced below baseline due to the SED 40 the district would not have been able to offset any of those surface supply reductions with groundwater. The result is greater impacts on crop gross revenues due to the SED surface water supply reductions as can be observed by a comparison of the larger differences between the two lines in Figure A3.15 where the lines diverge as compared to in Figure A3.14. However, the impact of SGMA on the crop revenue results is not as significant as for some of the other districts as TID is relatively less reliant on groundwater to manage is surface water supply variability.

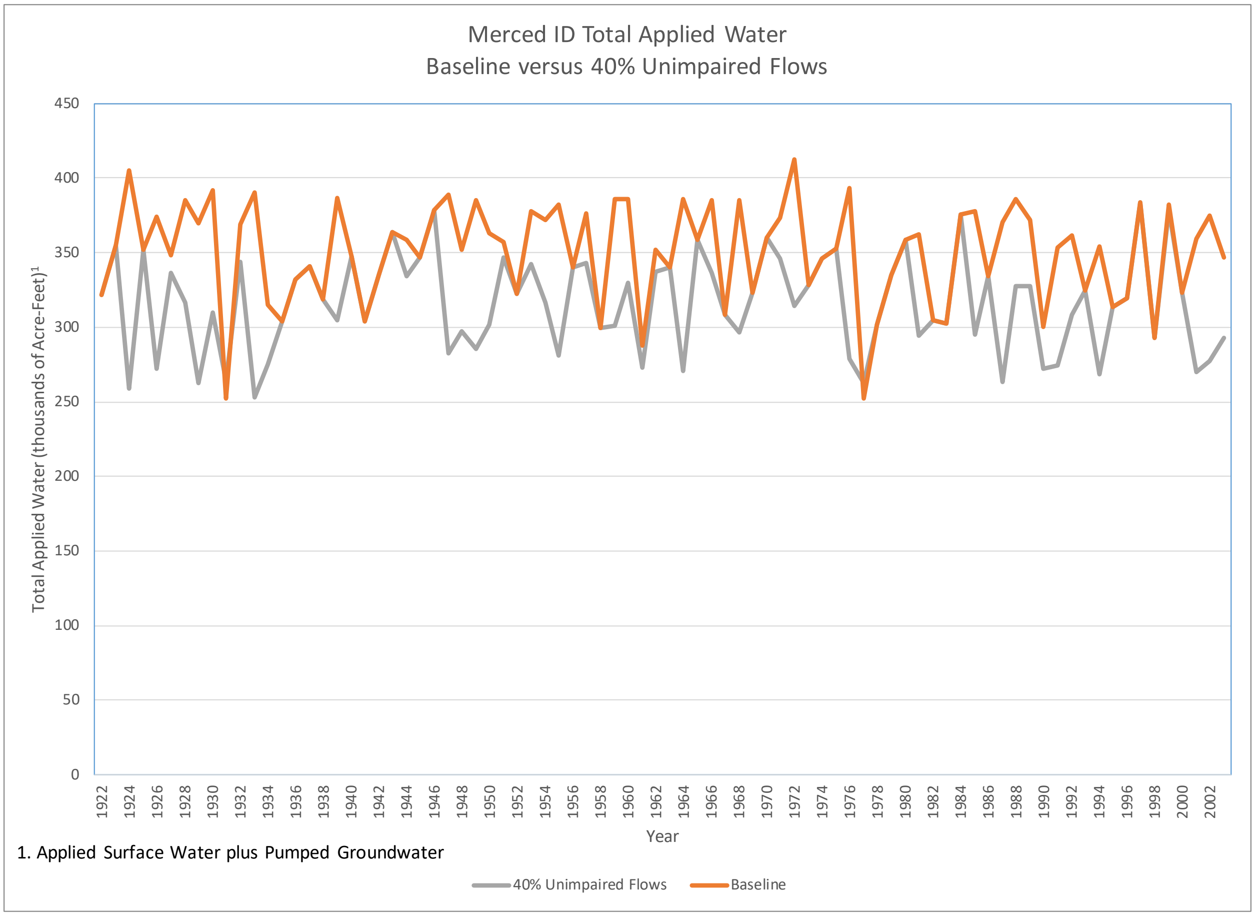
Figure A3.15



6. Merced ID

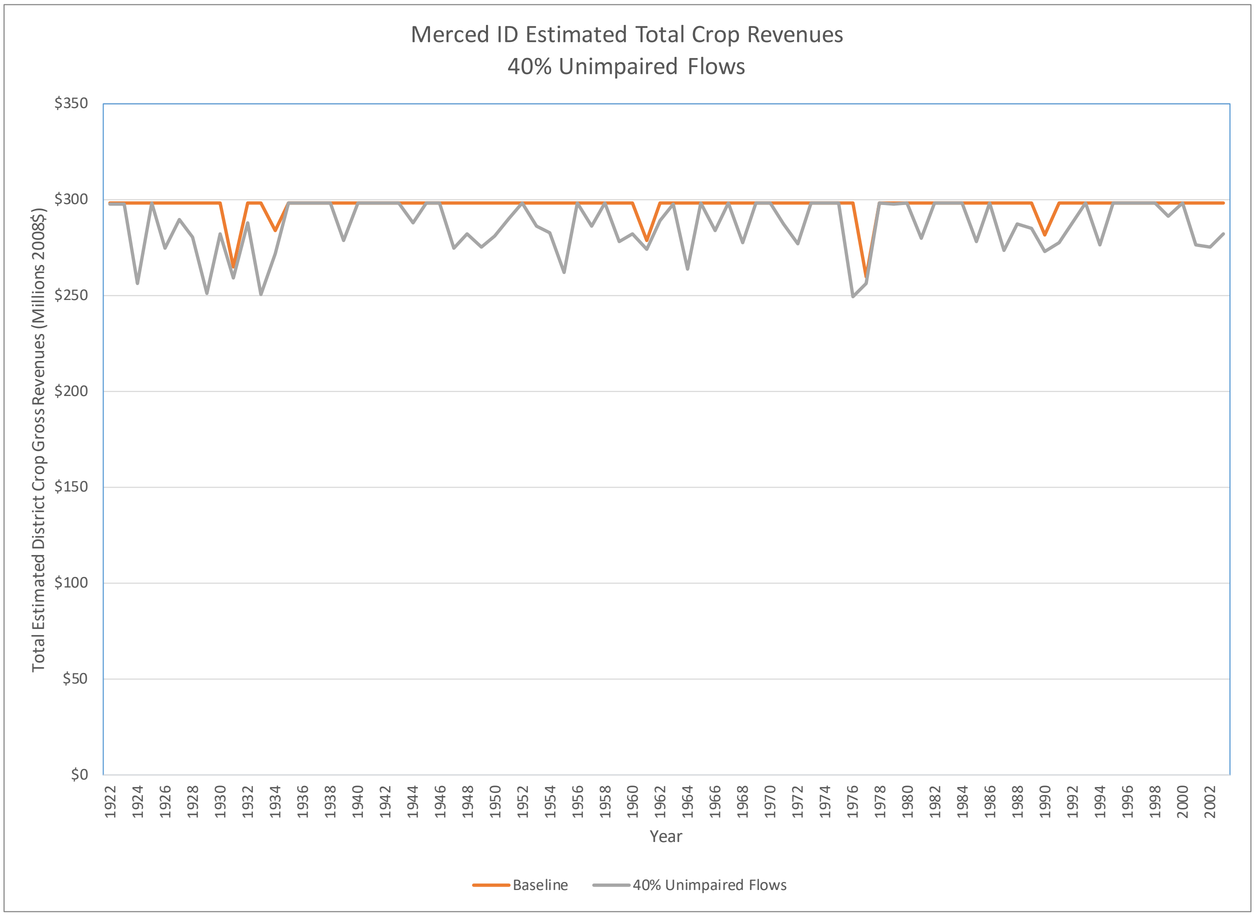
Figure A3.16 summarizes the estimated water supply impacts within Merced ID during the Study Period were the SED 40 in place. The figure shows that the district's baseline water supply during the Study Period is highly variable. The figure further shows many years during the Study Period that the SED would have caused substantial reductions in the district's water supplies below the baseline. In 1947, for example, designated a critically dry year by the SWRCB that followed another critically dry year, it is estimated that the applied water in the district would have been about 282,000 acre-feet with the SED in place, down almost 28% from the baseline 389,000 acre-feet that would have been available to the district in the absence of the SED that year. The difference would have resulted in a reduction in the district's crop production and associated crop gross revenues.

Figure A3.16



In each of the years shown in Figure A3.16 that the Merced ID's water supplies would have been reduced below baseline due to the SED there would have been expected reductions in cropping and associated crop gross revenues. Figure A3.17 illustrates the years when the crop gross revenues generated by the district during the Study Period would have been lower than baseline were the SED in place. The revenue figures are in common 2008 dollar terms consistent with the SWRCB's SED assessment. The difference between the two lines, where they diverge, represents the estimated lost revenues associated with the SED in that year.

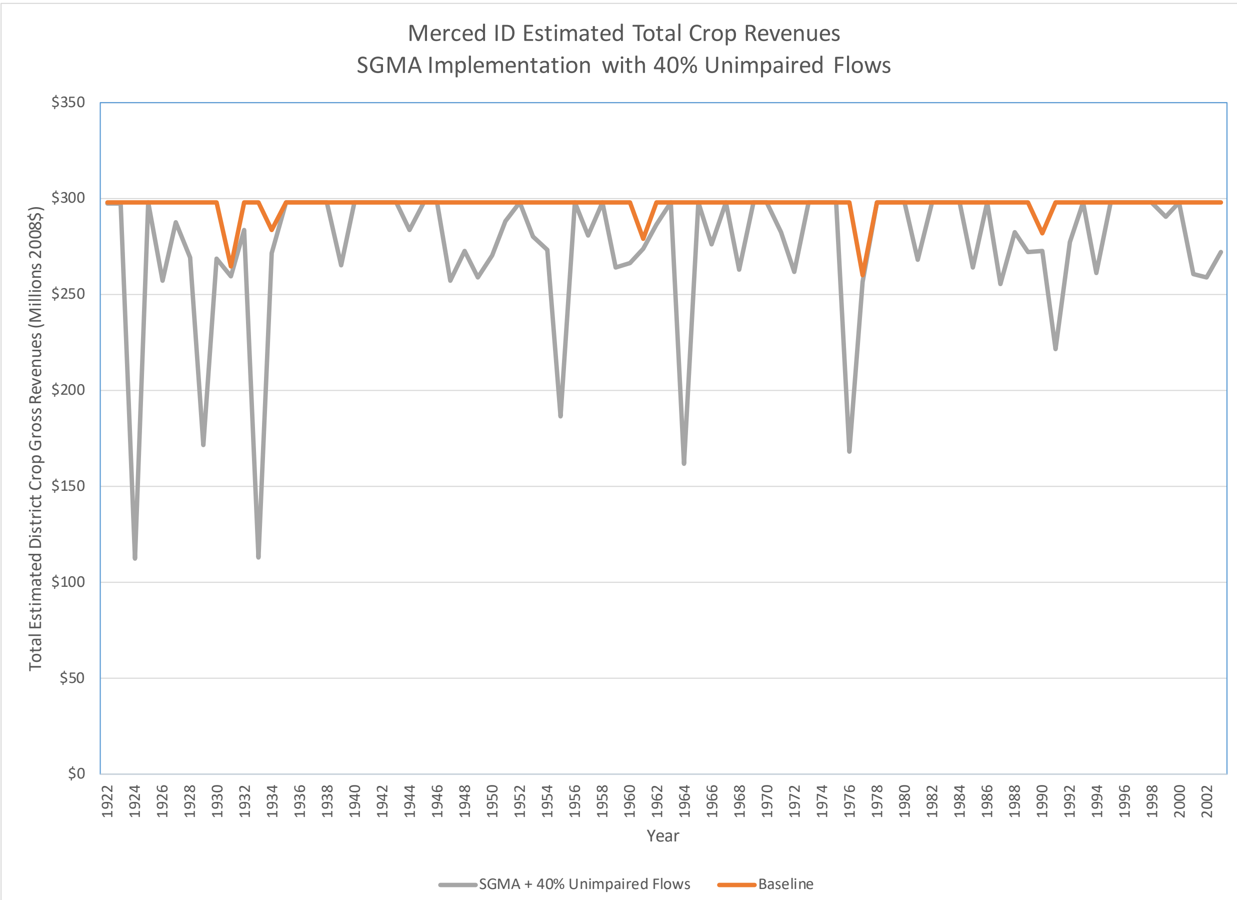
Figure A3.17



The figure shows that the magnitude of lost revenues in years that would have experienced below baseline water supplies due to the SED are less than for water supply shown in Figure A3.16. This is because the analysis of the fallowing of crops due to SED water supply reductions reflects the fact that in the face of water supply reductions farmers tend to fallow relatively lower-valued, higher water consuming annual crops such as pasture in much greater proportion than higher valued crops such as almonds.

Figure A3.18 revisits the crop gross revenue analysis presented in Figure A3.17 with the imposition of the SGMA and associated assumption that in years that the district's surface water supplies would have been reduced below baseline due to the SED 40 the district would not have been able to offset any of those surface supply reductions with groundwater. The result is substantially greater impacts on crop gross revenues due to the SED surface water supply reductions as can be observed by a comparison of the larger differences between the two lines in Figure A3.18 where the lines diverge as compared to in Figure A3.17. The much greater impact reveals the substantial reliance of the Merced ID on groundwater to offset surface water supply variability.

Figure A3.18

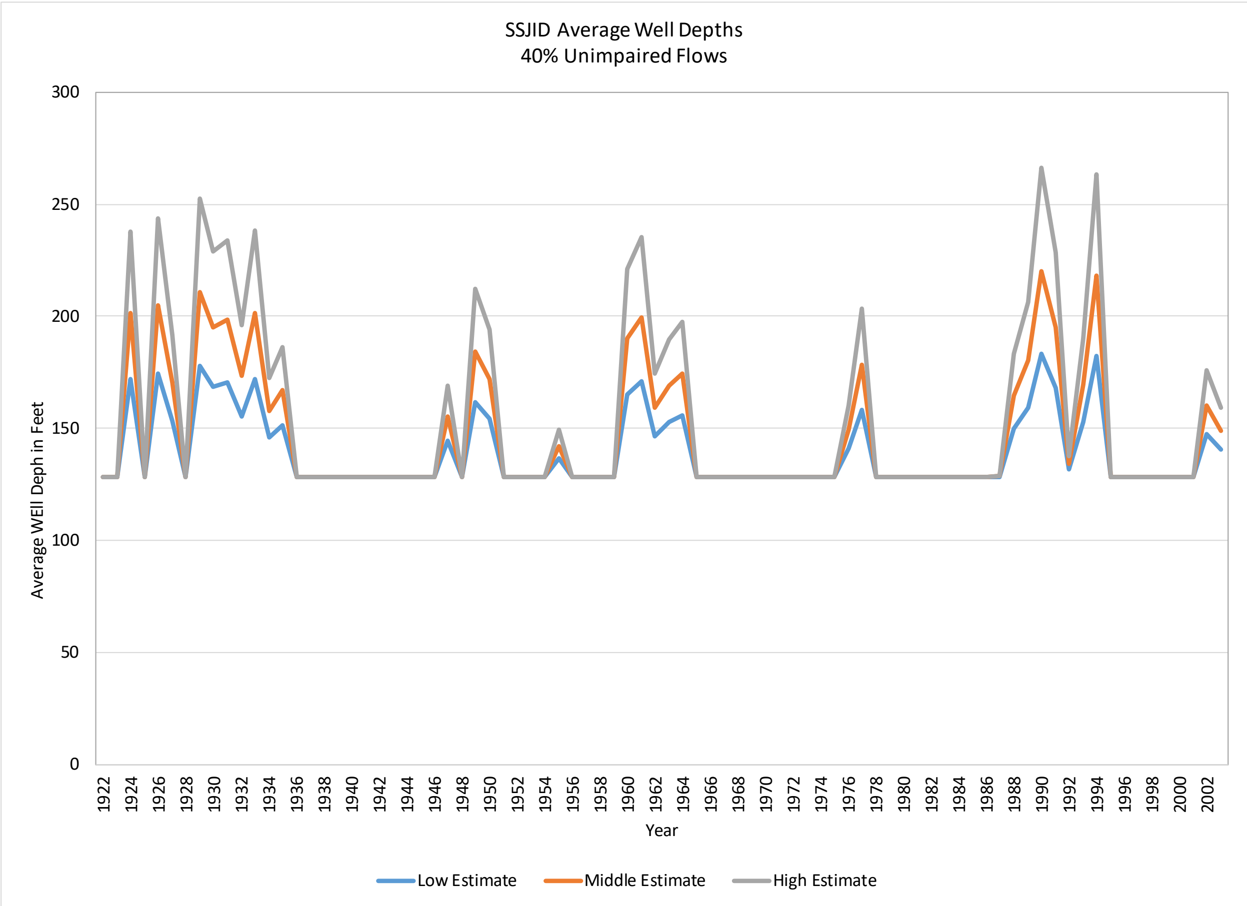


The following examines the groundwater depth and pumping cost impacts of the SED 40 were it in place during the Study Period for each of the Study Area irrigation districts that rely on surface water.

- SSJID

Figure A3.19 characterizes the estimated low, medium and high potential impacts on groundwater depths within the SSJID during the Study Period because of the district's SED-related increases in groundwater pumping to offset reduced surface water supplies assuming the SED 40 was implemented.

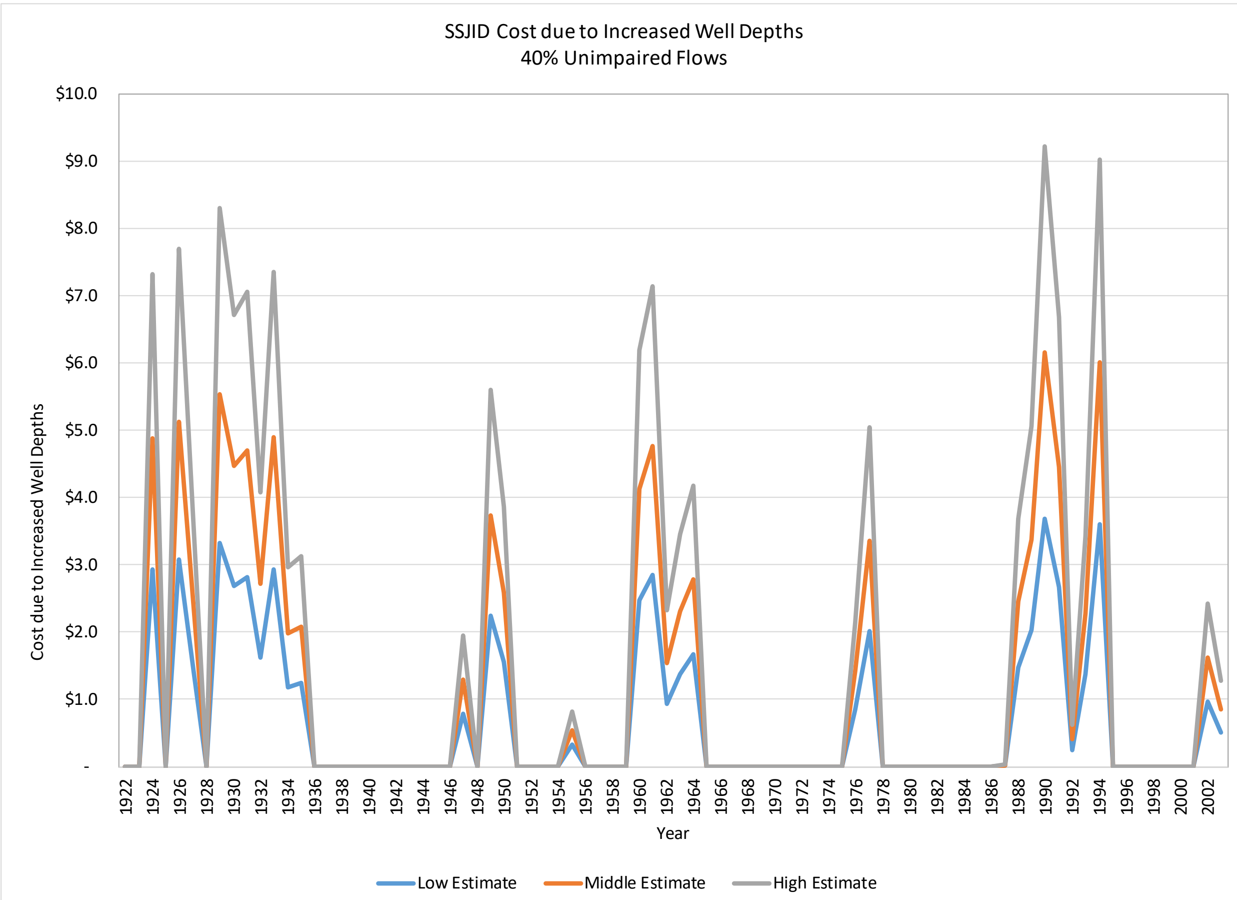
Figure A3.19



The figure shows potentially significant increases in the district's average depth to groundwater and accordingly, groundwater lifts as a result of SED 40 implementation for a number of the years during the Study Period. This includes in several of the Study Period years a near doubling of the average depths to groundwater based on the high estimate for increased lifts.

Figure A3.20 shows the estimated pumping cost incurred by the district and its farmers during the Study Period as a result of the anticipated increases in well depths shown in Figure A3.19.

Figure A3.20

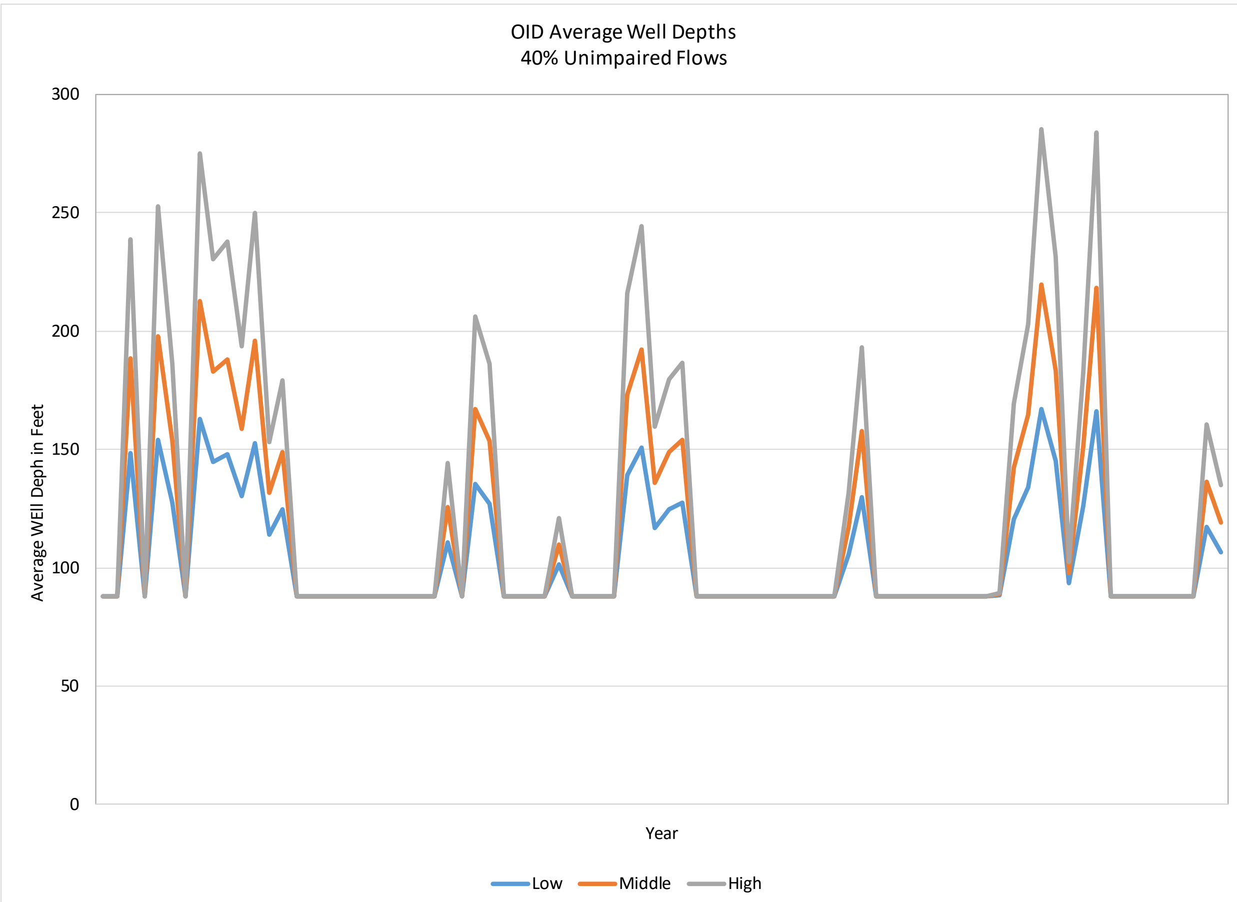


The figure shows increased costs of pumping in SSJID as much as $9.0 million in some years based on the high estimate for those years of increased pumping lifts due to increased pumping resulting from the SED 40.

- OID

Figure A3.21 characterizes the estimated low, medium and high potential impacts on groundwater depths within the OID during the Study Period because of the district's SED-related increases in groundwater pumping to offset reduced surface water supplies assuming the SED 40 was implemented.

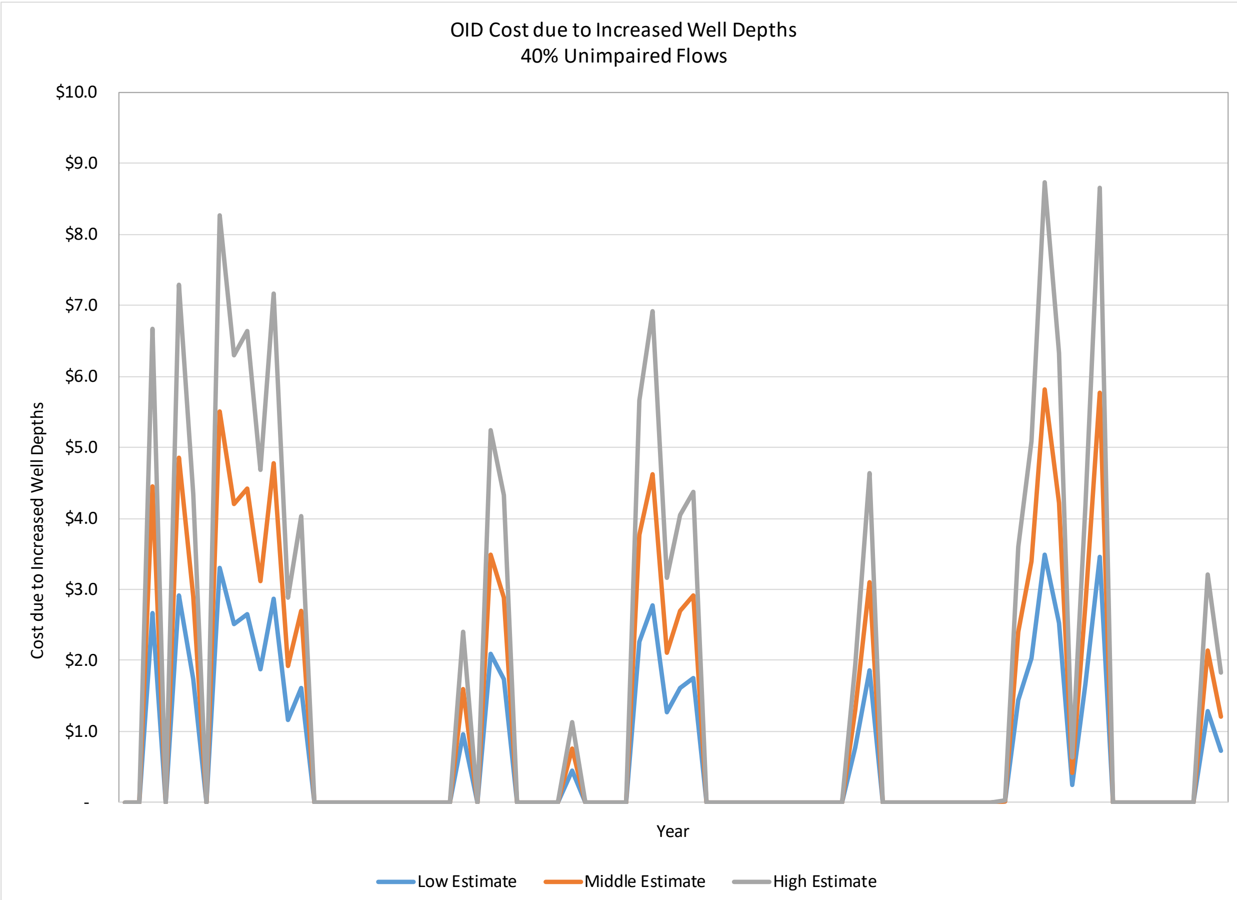
Figure A3.21



The figure shows potentially significant increases in the district's average depth to groundwater and accordingly, groundwater lifts as a result of SED 40 implementation for a number of the years during the Study Period. This includes in several of the Study Period years a more than doubling of the average depths to groundwater based on the high estimate for increased lifts.

Figure A3.22 shows the estimated pumping cost incurred by the district and its farmers during the Study Period as a result of the anticipated increases in well depths shown in Figure A3.21 based on the same assumptions and limitations assumed for SSJID above.

Figure A3.22

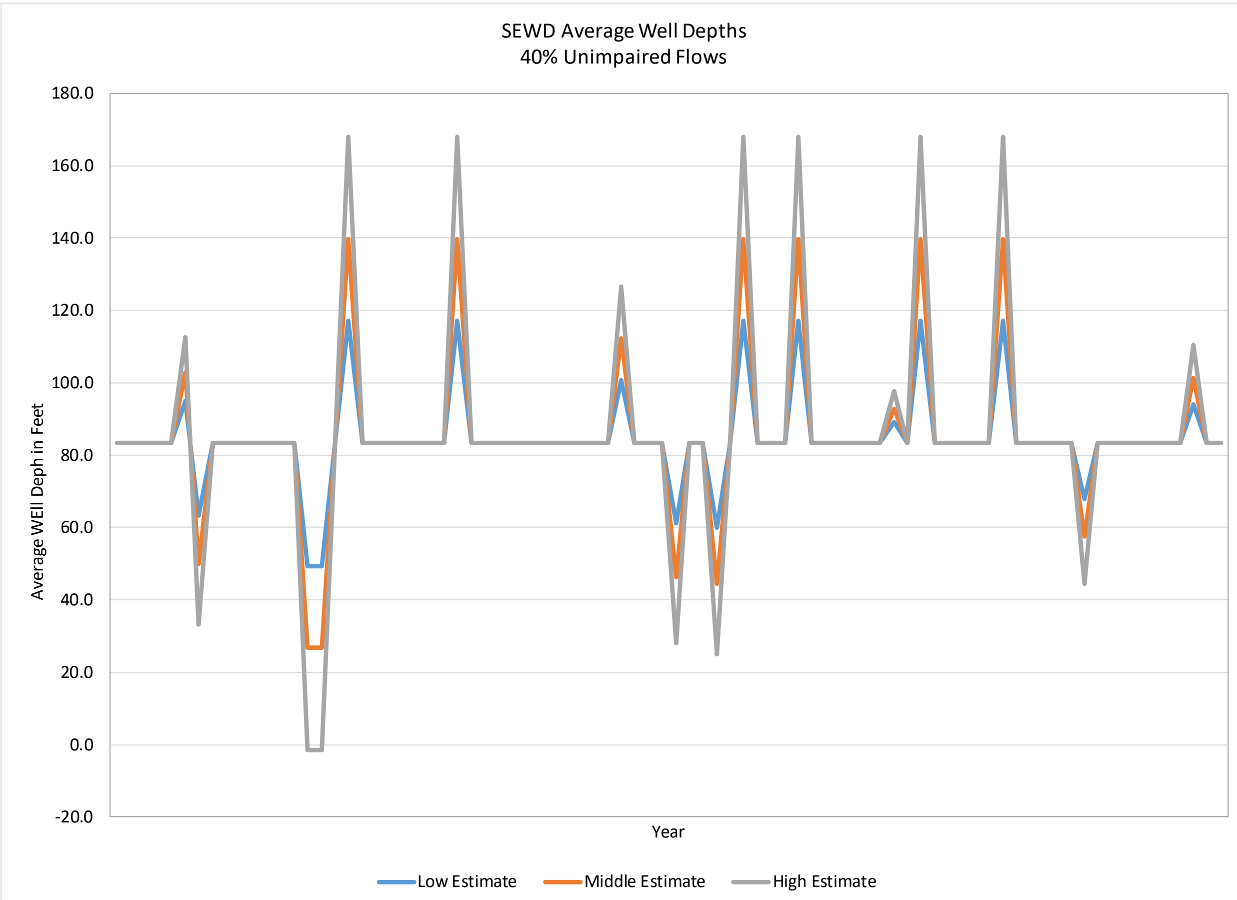


The figure shows increased costs of pumping in SSJID as much as $9.0 million in some years based on the high estimate for those years of increased pumping lifts due to increased pumping resulting from the SED 40.

- SEWD

Figure A3.23 characterizes the estimated low, medium and high potential impacts on groundwater depths within the SEWD during the Study Period because of the district's SED-related increases in groundwater pumping to offset reduced surface water supplies assuming the SED 40 was implemented.

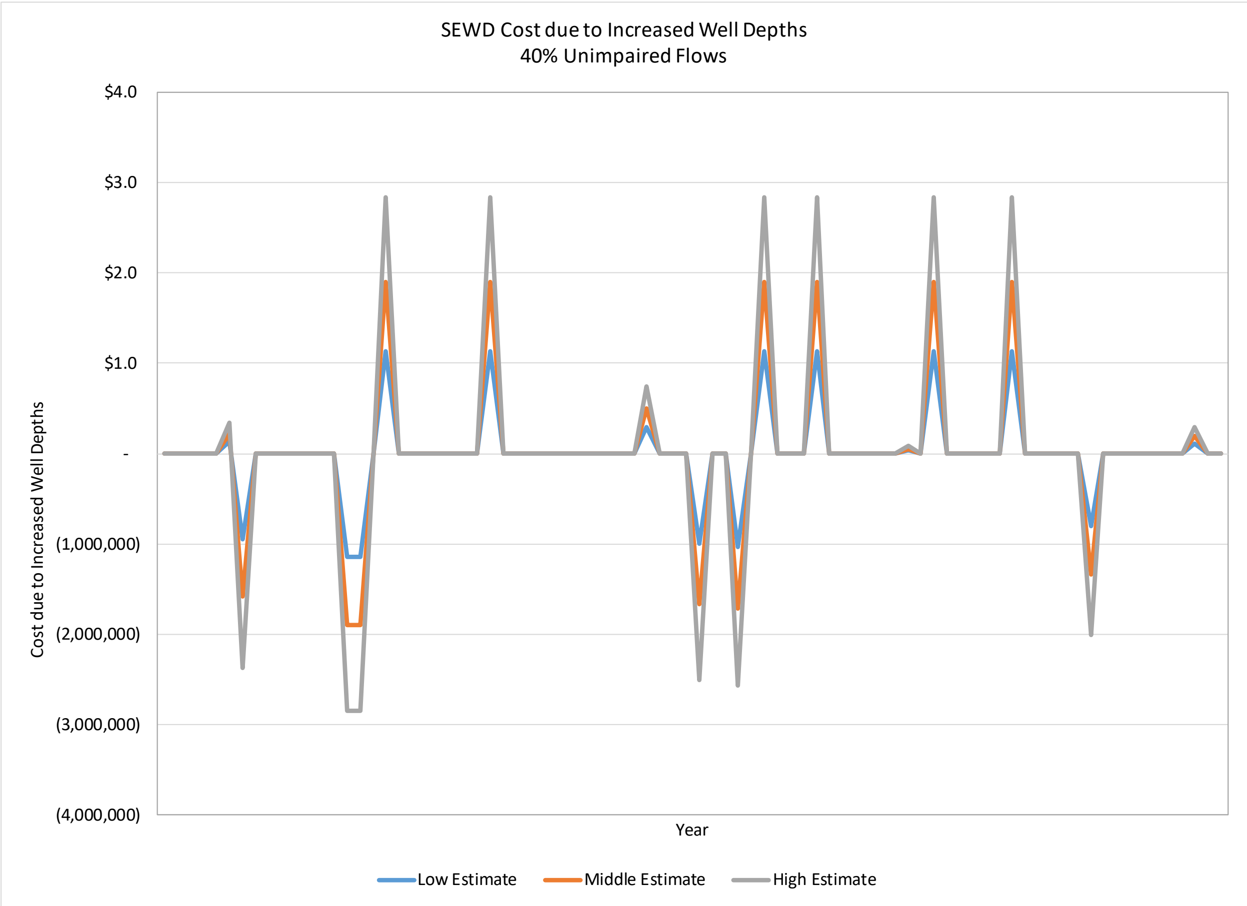
Figure A3.23



The figure shows potentially significant increases in the district's average depth to groundwater and accordingly, groundwater lifts as a result of SED 40 implementation for a number of the years during the Study Period. This includes a number of the Study Period years a more than doubling of the average depths to groundwater based on the high estimate for increased lifts. Concurrently, as SEWD's surface water supplies would be expected to increase over baseline in some years under the SED 40, the expected impact will actually be a reduction of district average groundwater depths certain of those years.

Figure A3.24 shows the estimated additional and reduced pumping costs incurred by the district and its farmers during the Study Period as a result of the anticipated increases and decreases, respectively in well depths shown in Figure A3.23.

Figure A3.24

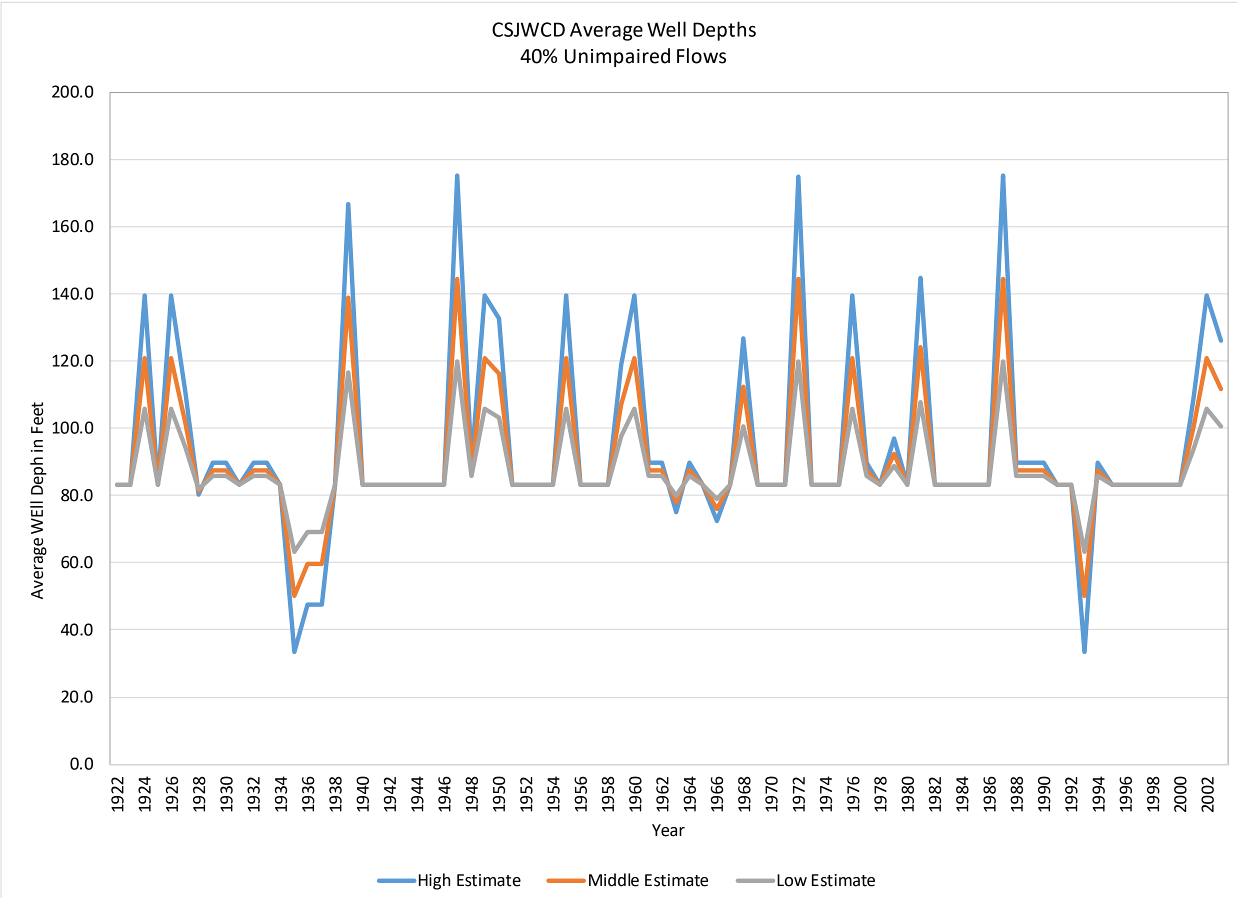


The figure shows increased costs of pumping in SEWD by as much as almost 3.0 million in some years based on the high estimate for those years of increased pumping lifts due to increased pumping resulting from the SED 40. The figure also shows, conversely, estimated decreases in pumping costs by nearly $3.0 million with anticipated SED-related well depth declines in some years.

- CSJWCD

Figure A3.25 characterizes the estimated low, medium and high potential impacts on groundwater depths within the CSJWCD during the Study Period because of the district's SED-related increases in groundwater pumping to offset reduced surface water supplies assuming the SED 40 was implemented.

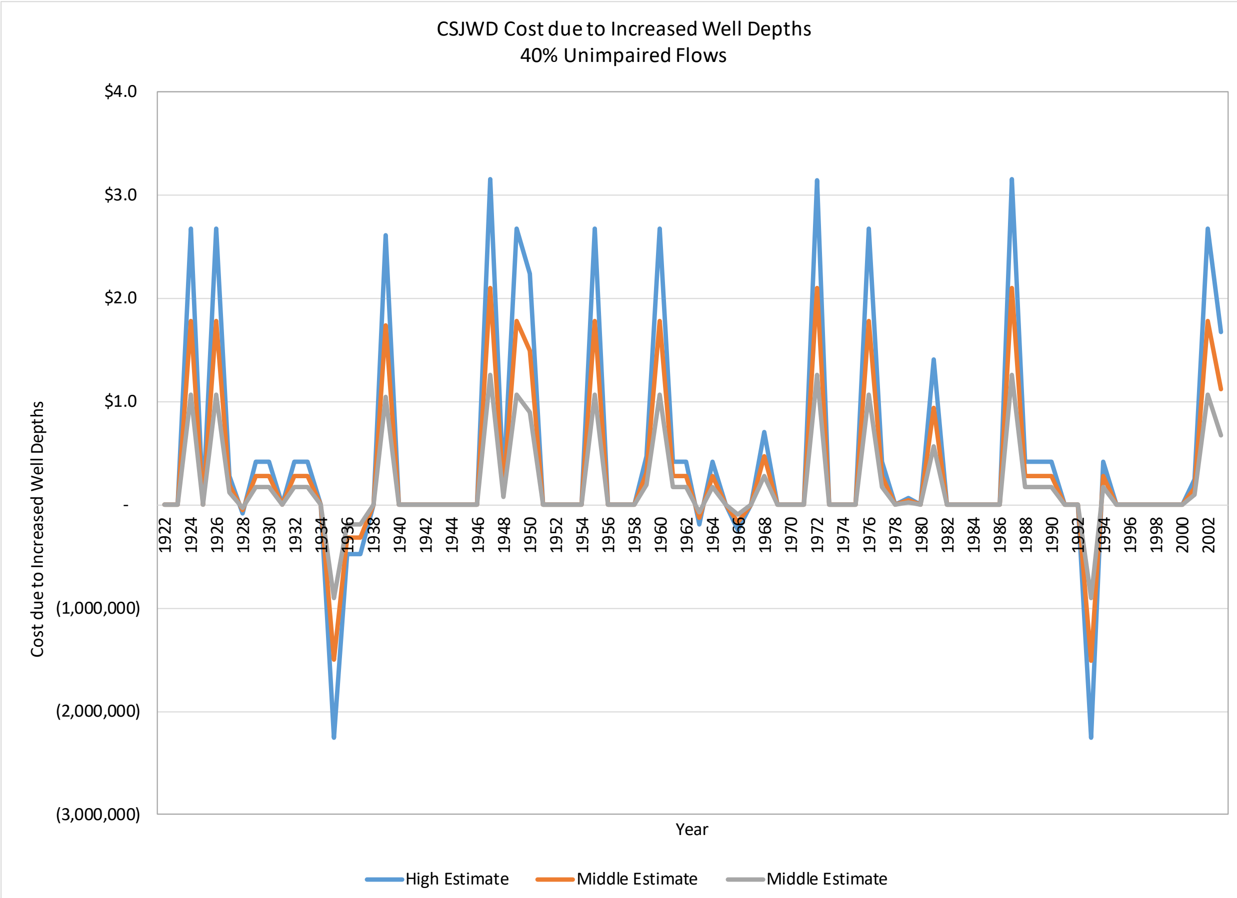
Figure A3.25



The figure shows potentially significant increases in the district's average depth to groundwater and accordingly, groundwater lifts as a result of SED 40 implementation for a number of the years during the Study Period. This includes in several of the Study Period years a more than doubling of the average depths to groundwater based on the high estimate for increased lifts. Concurrently, as CSJWCD's surface water supplies would be expected to increase over baseline in some years under the SED 40 as with the SEWD, the expected impact will actually be a reduction of district average groundwater depths in those years. The frequency and magnitude of years with reduced groundwater depths is lower for CSJWCD than for SEWD (see Figure A3.23

Figure A3.26 shows the estimated additional pumping cost incurred by the district and its farmers during the Study Period because of the anticipated increases in well depths shown in Figure A3.25.

Figure A3.25

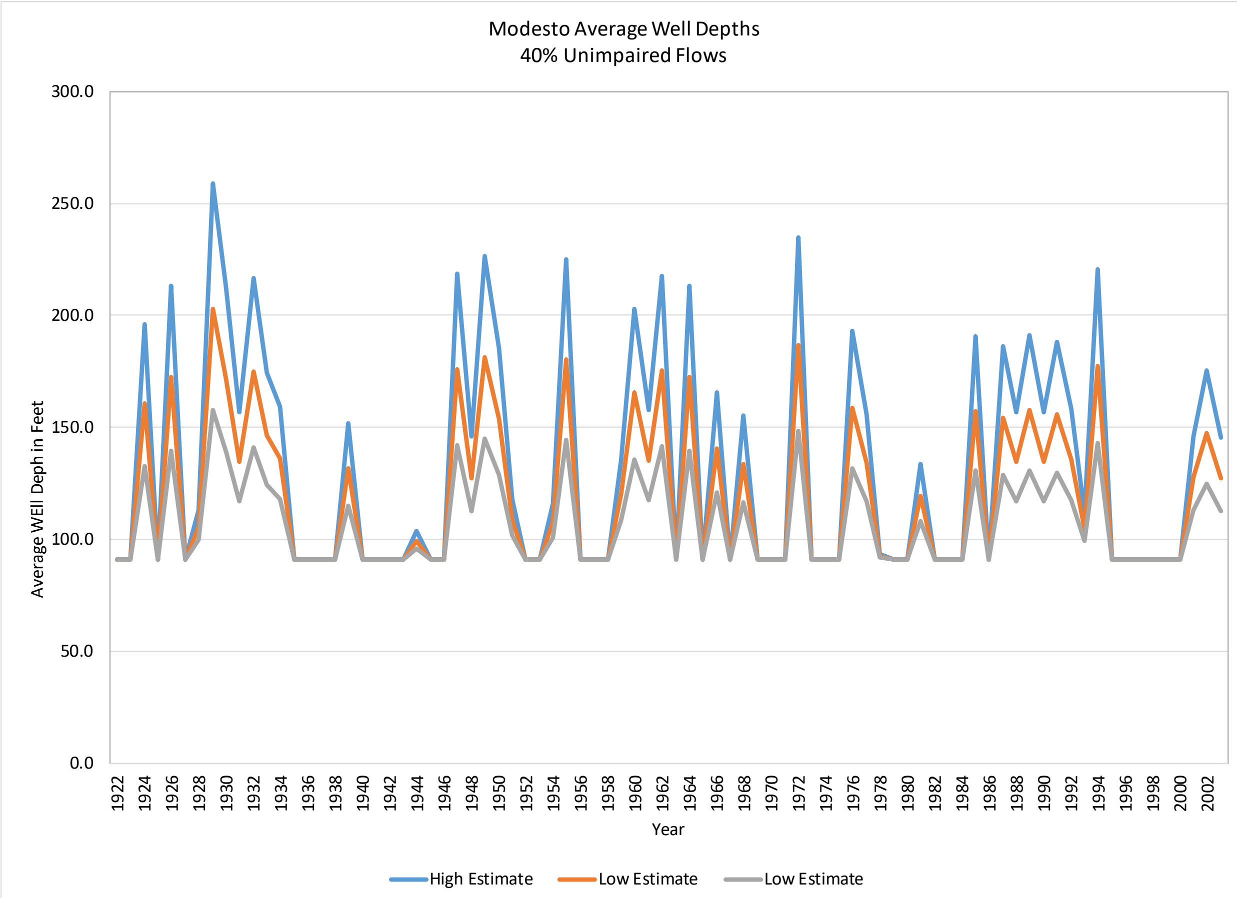


The figure shows increased costs of pumping in CSJWCD by over $3.0 million in some years based on the high estimate for those years of increased pumping lifts due to increased pumping resulting from the SED 40. The figure also shows, conversely, estimated decreases in pumping costs by$2.0 million in two of the Study Period years when there would have been anticipated SED-related well depth declines.

- Modesto ID

Figure A3.26 characterizes the estimated low, medium and high potential impacts on groundwater depths within the Modesto ID during the Study Period as a result of the district's SED-related increases in groundwater pumping to offset reduced surface water supplies assuming the SED 40 was implemented.

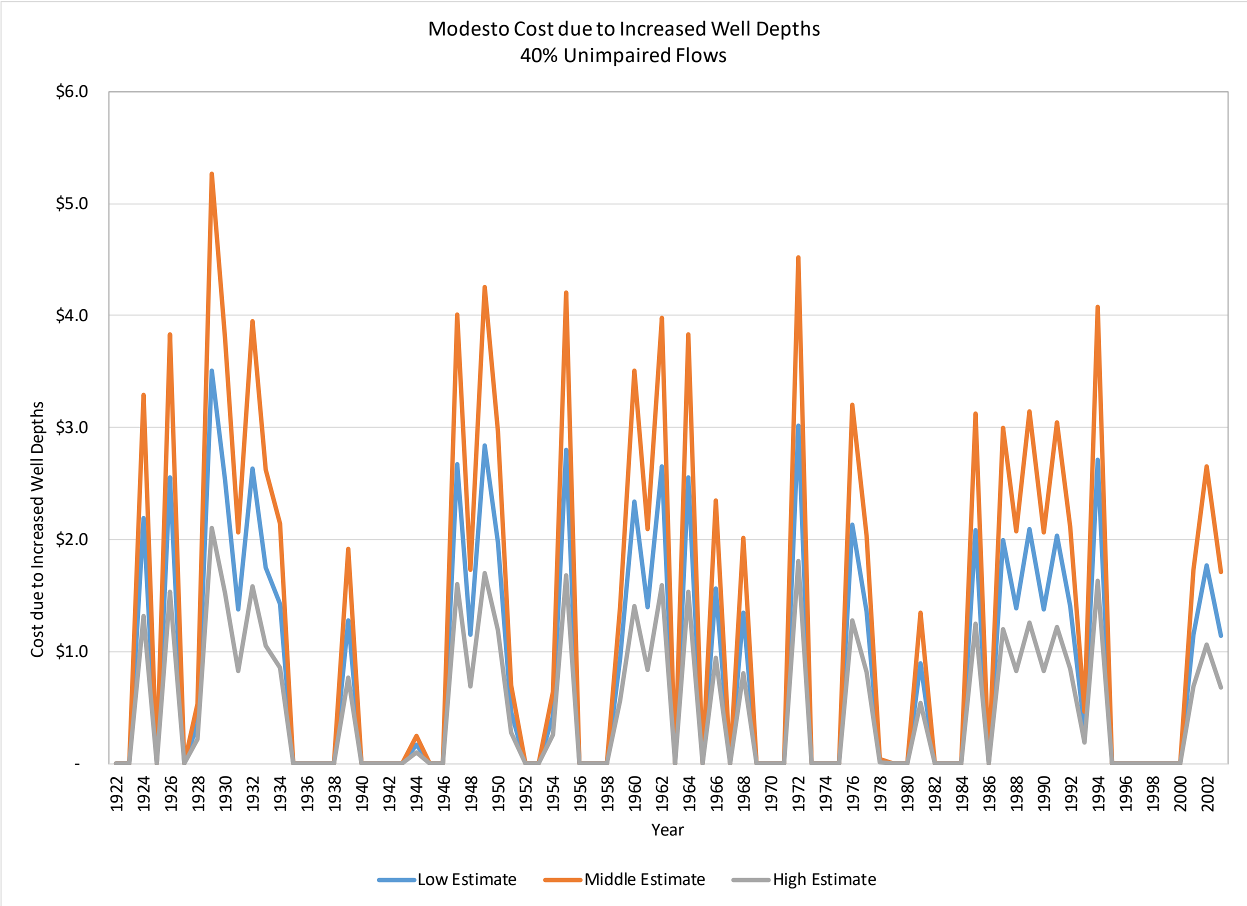
Figure A3.26



The figure shows potentially significant increases in the district's average depth to groundwater the majority of the Study Period years and, accordingly, groundwater lifts, as a result of SED 40 implementation. This includes in several of the Study Period years well more than a doubling of the average depths to groundwater based on the high estimate for increased lifts.

Figure A3.27 shows the estimated additional pumping cost that would have been incurred by the district and its farmers during the Study Period as a result of the estimated increases in well depths shown in Figure A3.28.

Figure A3.27

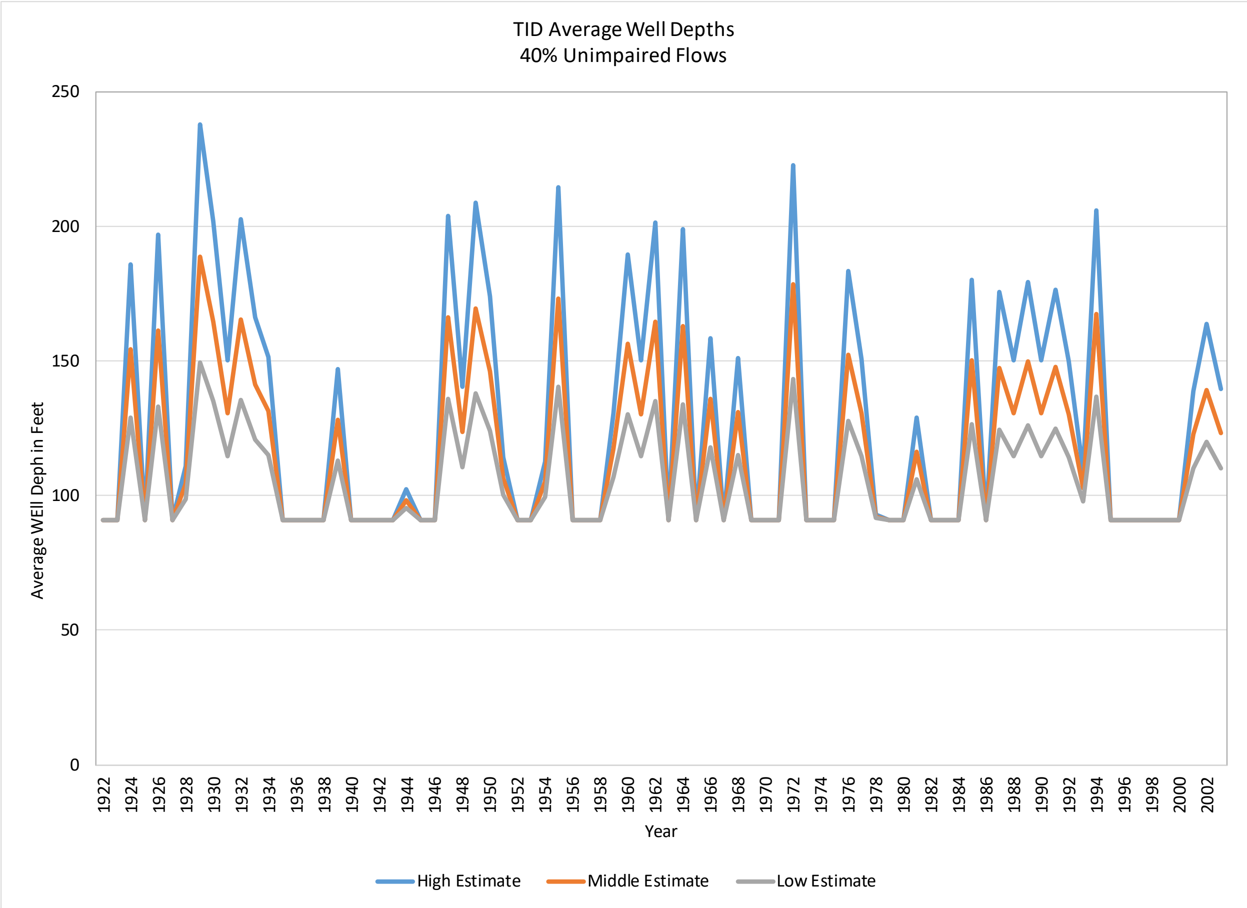


The figure shows increased costs of pumping in Modesto ID by as much as $5.0 million based on the high estimate for those years of increased pumping lifts due to increased pumping resulting from the SED 40.

- TID

Figure A3.28 characterizes the estimated low, medium and high potential impacts on groundwater depths within the TID during the Study Period because of the district's SED-related increases in groundwater pumping to offset reduced surface water supplies assuming the SED 40 was implemented.

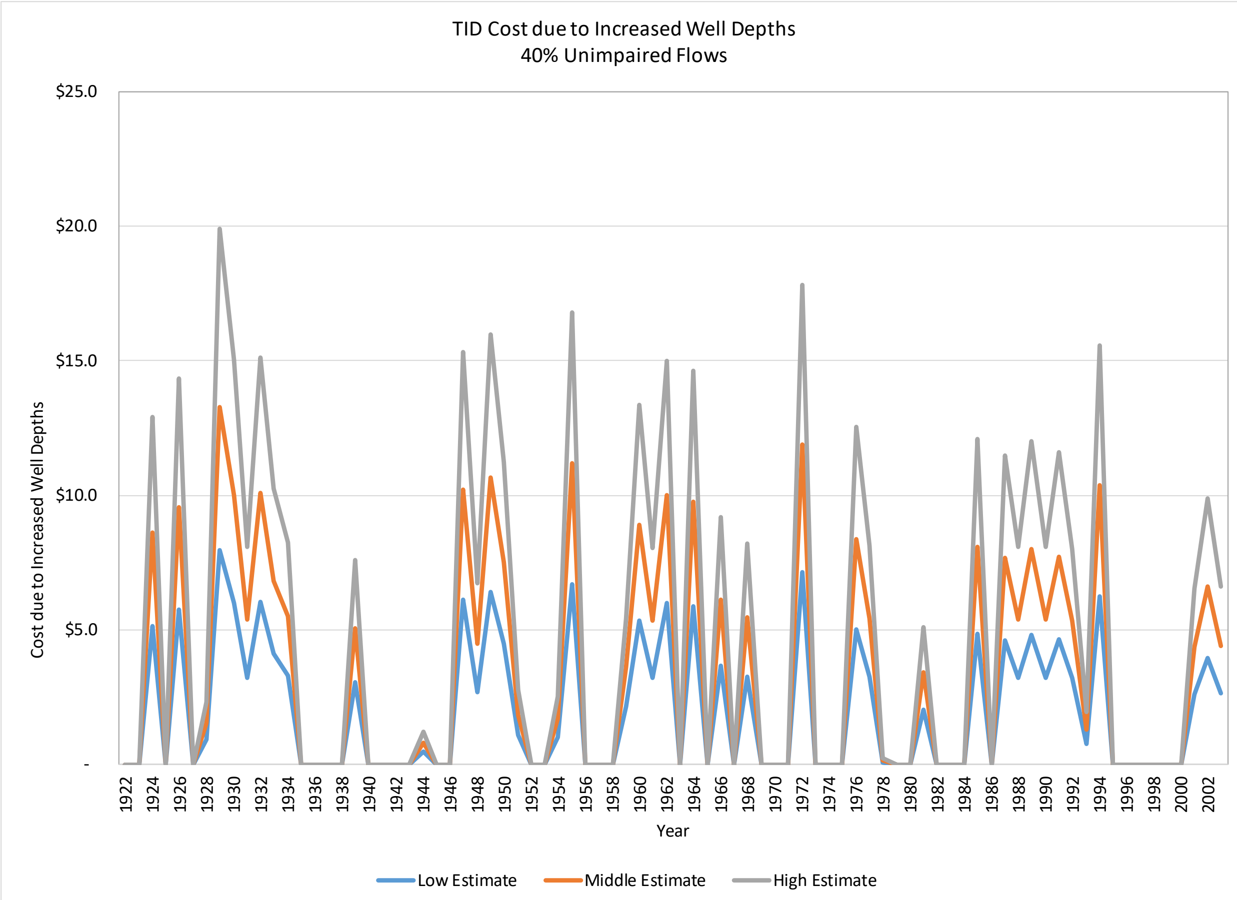
Figure A3.28



The figure shows potentially significant increases in the district's average depth to groundwater the majority of the Study Period years and, accordingly, groundwater lifts, as a result of SED 40 implementation. This includes a number of the Study Period years well more than a doubling of the average depths to groundwater based on the high estimate for increased lifts.

Figure A3.29 shows the estimated additional pumping cost that would have been incurred by the district and its farmers during the Study Period because of the estimated increases in well depths shown in Figure A3.28.

Figure A3.29

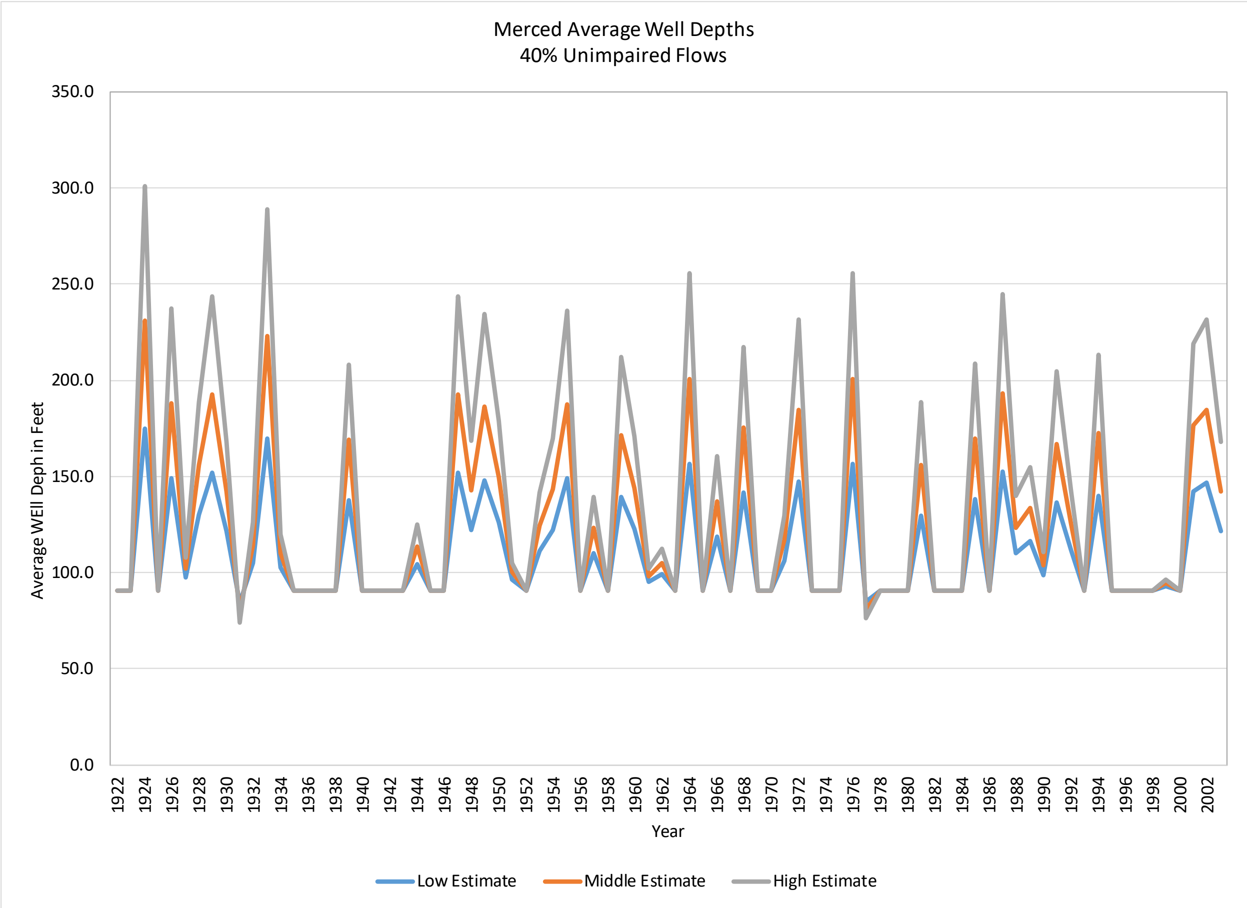


The figure shows increased costs of pumping in TID by as much as $20.0 million in one year and above $15.0 million in several years during the Study Period based on the high estimate for the increased pumping lifts due to increased pumping resulting from the SED 40.

- Merced ID

Figure A3.30 characterizes the estimated low, medium and high potential impacts on groundwater depths within the Merced ID during the Study Period because of the district's SED-related increases in groundwater pumping to offset reduced surface water supplies assuming the SED 40 was implemented.

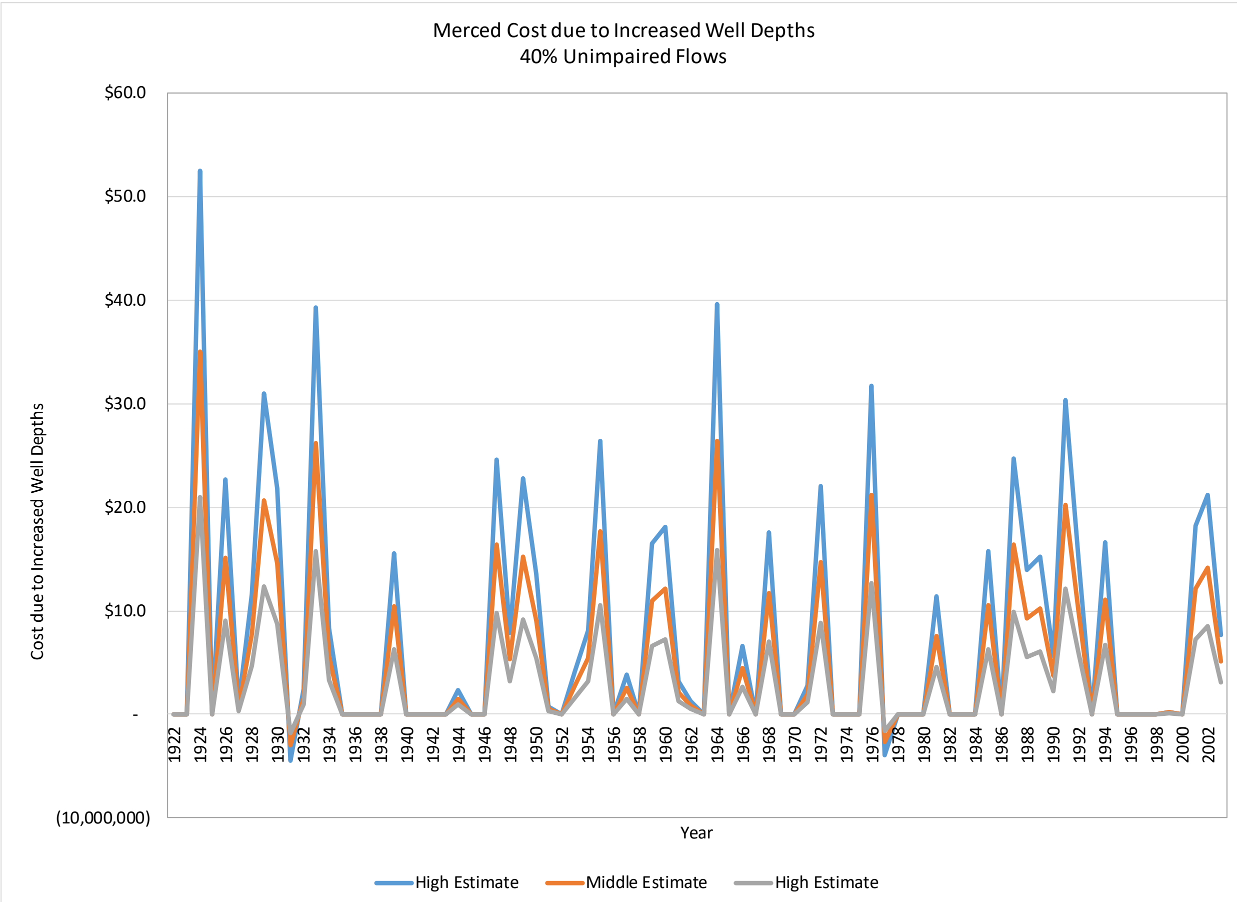
Figure A3.30



The figure shows potentially significant increases in the district's average depth to groundwater the majority of the Study Period years and, accordingly, groundwater lifts, as a result of SED 40 implementation. This includes one of the Study Period years with a threefold estimated increase in well depths based on the high estimate for increased average groundwater depths and many of the Study Period years with at least a doubling of the average depths to groundwater based on the high and middle estimates for increased lifts.

Figure A3.31 shows the estimated additional pumping cost that would have been incurred by the district and its farmers during the Study Period as a result of the estimated increases in well depths shown in Figure A3.30.

Figure A3.31



The figure shows increased costs of pumping in Merced ID by as much as $40.0 million in one year and in the $30 to $0 million in a number of additional years during the Study Period based on the high estimate for the increased pumping lifts due to increased pumping resulting from the SED 40.

Attachment 3

Technical State Water Board Staff / Community Water Interests Meeting
November 18, 2016

Transcript prepared by
Lisa S. Coelho
Palermo Reporting Services

TECHNICAL STATE WATER BOARD STAFF/

COMMUNITY WATER INTERESTS MEETING

November 18, 2016

9:00 AM - 3:30 PM

Meeting held at:

City of Modesto/Stanislaus County Administration Building

Board Chambers, Basement Floor

1010 Tenth Street

Modesto, CA

Audio transcribed by:

LISA S. COELHO, CSR #9487

PALERMO REPORTING SERVICES
1301 G Street, Suite A
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SUPERVISOR WITHROW: Good morning, guys, everyone. Thank you for being here today. I'm going to -- we're going to get started. We appreciate all of you being here. We appreciate the State Water Resource Control Board being here, and we appreciate our technical panels that we're going to have here today.

This is -- this is going to be a day -- hopefully very informational day for all of us. We hope to -- to really go through this document and with our experts and with the State Water Resource Control Board and to -- and to really get into the -- into the weeds a little bit here today. This won't be a back-and-forth/question-and-answer session here at all. It will be -- it will be with the technical panels that we have here and the State Water Resource Control Board. So we're looking to get a lot of -- get into a lot of the details, like I said, here this morning.

I want to thank the county for putting this together. I want to thank Walt Ward, Keith Boggs, all our staff here at the county that helped put this meeting together. It took a lot of work to get everybody here this morning. So I appreciate all of you being here today. So we're going to start off this morning with -- we've got an agenda here. Hopefully we're going to stick to this. Everybody hopefully has this.

And we're going to start off with the State Water Resource Control Board staff, and they will start off with a ten-minute presentation here and then we'll move into groundwater, drinking water. So off we go here, guys. Thank you. You're up.

MR. GROBER: Good morning. My name is Les Grober. I'm the deputy director for water rights and here today to talk with some of the team that has worked on the development of the water quality control plan update for San Joaquin River flow and Southern Delta salinity objectives.

To my right is Tim Nelson. To his right is Xuan Gao. Over at the other table, Will Anderson, Anne Huber, and Mark Roberson.

So just a very brief introduction about what we're covering today. Where it seems the focus is, one part of this update of the water quality control plan, in particular having to do with San Joaquin River flow objectives for the protection of fish and wildlife in the San Joaquin River, looking specifically at the Merced, the Tuolumne, and Stanislaus rivers, the salmon-bearing tributaries of the San Joaquin River.

In the interest of time, that's the brief introduction. I'm going to move to just a few key points that -- those of you who have seen the presentations that we've been making up and down the Valley, just to make -- to put context on this proposal is that we're doing it because the current plan is significantly out-of-date. The last big update was 21 years ago, 1995, and we've identified the need for doing an update for several years, including in the minor update of the plan in 2006.

There's been Endangered Species Act, water restrictions. There's been this update of the plan as part of the administration's water action plan, and it's really part of the state's overarching goals of attaining the co-equal goals of fish and wildlife protection, ecosystem protection, and water supply.

Oops. Sorry.

Why are we focusing on flow? Flow -- because flow is really the -- a major element of the protection for fish and wildlife. Lots of scientific studies have shown that it's a major factor in the protection of fish and wildlife and survival of fish like salmon, steelhead. There's many benefits to flow, including, as you'll see as we describe it, habitat. It provides temperature, outmigration, many other things.

That being said, the document we prepared -- and the board is mindful that there's other things that can be done, nonflow measures that can be brought to bear, which gets at how the proposal was crafted. It has adaptive implementation that allows adjustment with an adaptive range of 30 to 50 percent of unimpaired flow.

The board is also very mindful that this is very, very hard. This is going to come at a significant water supply cost, which is why we're here today is to look at really -- and some of the focus for today's discussion is for the technical elements of the analysis that was done to inform this update of the water quality control plan because these are large blocks of water that we're talking about providing for augmenting instream flow, and that would come from water supply in this affected area.

So the board is quite mindful of how hard that balancing is, and the proposal isn't even going all the way towards what the science supports is needed, the 60 percent of unimpaired flow. When we do this water quality control plan, we do the analysis that informs, well, how do you reasonably protect the fish and wildlife? It's not an absolute protection.

So that's a lot of what this document is about. It's about informing that selection of the adaptive range. And because it's hard, settlements are encouraged because settlements might prefer -- may provide more durable solutions to the proposal and allow for the smartest possible implementation of the proposal and potentially at the lower end of flows.

So with that, and to provide context for today's discussion, we start with the very big problem in a very large area here looking at Google map, looking at the affected area. To try to impose some order on the analysis, you take this large area. This just shows -- and I'll show in a moment the highlights -- the schematic of where the Merced, the Tuolumne, and the Stanislaus rivers are from south to north and the major reservoirs. And on the left side, the up arrow, the San Joaquin River.

So to provide order to the analysis, this is con -- provides the conceptual model, if you will, of how to understand this very difficult problem. And on top of this, we know we have -- it is on the key there. Yeah, we have existing requirements shown in green for different flows, part of FERC flows. We also have in the San Joaquin River Vernalis that shows the current flow objectives that are currently in place in various forms as part of RPAs for FERC licenses or conditions on the permits for the reservoirs and the current water quality control plan objectives.

But this proposal is proposing unimpaired flows at the confluences of the Merced, the Tuolumne, and Stanislaus. So what to do if you have -- now you want to understand the nature of this problem and quantitatively assess it? Well, this spaghetti network, this is the CalSim model which has -- for those of you familiar with it, has a lot of detail. We've chosen to amplify this model to more directly understand and assess how ag water management plans, operations of the local districts could potentially affect water supplies both with regard to surface water and groundwater.

So we've used this thing called the Water Supply Effects Model, which takes the logic of CalSim and improves on it by adjusting it to what's in the more recent ag management plans and other information. And from that, we get to understand some of the physical changes that can occur to the environment. We understand surface water supply deficits, applied water needs. We can come up with -- and groundwater use estimates to make up for lost water supply.

We can then use the SWAP model and ag production model to see what kind of cropping would be affected as a result of the net water supply deficit and then finally IMPLAN to understand the economics that fall out from that change in cropping pattern. So there's a -- that's the method to the Water Supply Effects and in a nutshell all of the analysis that inform the -- the SED and the environmental document.

It also informs the other part of it. What are the benefits? You can take that output from the Water Supply Effects Model, see how you have the flow augmentation, run it through a temperature model, also see how it affects floodplain. So you get outputs for fish benefits. That provides that balancing of what's the water supply effect for current uses as opposed to the benefit for fish and wildlife.

So to punch and provide context for the rest of the discussion for today, we've done a programmatic analysis. We've (unintelligible) the quantitative information using models and formed physical changes that could result from the plan amendments and have the potential for quantifiable impacts on environmental resources including river flows, reservoir operations, surface water diversions, groundwater pumping. And the potential environmental impacts then of these physical changes are evaluated in Chapters 5 through 17 of the SED.

Before I hand it off to Tim Nelson to drill down to more detail on the groundwater, and Xuan for the drinking water, I just want to remind folks that this is an opportunity today for a technical discussion, and we hope to have a lot of good, productive questions so that folks, the panel and the public, can understand the nature of the proposal. But the time to hear comments is at these five days of hearing: two days in Sacramento on January -- on November 29th, the first day, and finishing up on January 3rd, as well as three days down in Stockton, Merced, and Modesto.

So with that, I'm going to hand --

MR. WARD: Can you hear me now?

MR. GROBER: Can hear you now.

MR. WARD: Okay. All right. That was perfect, Les. Right at the ten-minute mark.

So we're not going to interject any questions at this point. We just want to move right into the next part.

Tim, you're going to pick that up?

MR. GROBER: We like perfect. Thank you.

MR. NELSON: Oh, hello.

UNIDENTIFIED SPEAKER: Hello.

MR. NELSON: My name is Tim Nelson, and I'm an engineer at the State Board and I will be introducing our groundwater and drinking water analysis as part of -- that was used as part of the SED.

So the topics I'm going to cover include the purpose of the analysis, an overview of the geographic area we covered in the modeling, the agricultural groundwater assessment including the methods, assumptions, and results, and then the analysis of potential impacts to drinking water.

So the purpose of this analysis was, one, to estimate the relative effects of the (unintelligible) alternatives on the groundwater subbasins and, two, to support other quantitative and qualitative analyses throughout the Substitute Environmental Document. So most of the groundwater modeling related to the assumptions, methods, and results are presented in Appendix G. While in other chapters, such as Chapter 9 and 11, we applied those results as part of impact determinations or qualitative analyses, support for qualitative analyses.

So what is the logic behind this modeling? So we know from the Water Supply Effects Model that surface water diversions could be reduced in implementing the proposed unimpaired flow objectives. With the -- with the reduction in surface water diversions, there's less water available for irrigating crops and, if possible, the affected water users would likely increase groundwater pumping to compensate for lost surface water.

Now, there are negative effects associated with increasing groundwater pump -- potentially negative effects associated with increasing groundwater pumping, including falling groundwater tables, which could affect wells used for drinking water. Groundwater pumping would currently be limited by the infrastructure capacity of the irrigation districts, but in the future, it may be limited by the Sustainable Groundwater Management Act, SGMA.

So here's a map of our modeling area. It includes four groundwater subbasins: the Merced, Turlock, Modesto, and Eastern San Joaquin. The boundaries here are defined based on DWR's Bulletin 118 from 2003. All four basins are considered high-priority basins in need of management to maintain sustainability, and the Merced and Eastern San Joaquin are considered critically overdrafted.

Overlying these four basin -- subbasins are seven irrigation districts that are responsible for the -- most of the surface water diversions from the east side tributaries, the Merced, Tuolumne, and Stanislaus rivers. These districts are Merced Irrigation District, Turlock Irrigation District, Modesto Irrigation District, Oakdale Irrigation District, and South San Joaquin Irrigation District, and two CVP contractors, the Central San Joaquin Water Conservation District and Stockton East Water District.

So as part of this analysis, we performed a simple groundwater balance for in-district water use. So here we have a tributary and groundwater subbasin at the bottom and then a generic irrigation district and its irrigated area. So it begins with the district making surface water diversions into its distribution system. From the distribution system, there will be some losses for evaporation and surface water returns to the tributary and then some distribution seepage into the subbasin as our first recharge (unintelligible).

Some districts may make deliveries from municipal use, but most of their water will be delivered as applied surface water to irrigation for crops. Now, if there's a shortage in applied surface water, we assume that they will pump groundwater to avoid unmet demands and then the total applied surface and groundwater will be used consumptively by the crops through evapotranspiration and with some portions seeping past (unintelligible) zone and back into the groundwater subbasin.

And to provide context for the in-district groundwater use, we also looked at a subbasin-wide groundwater balance. So for this we include the recharge terms and groundwater pumping from the district as well as potential municipal groundwater pumping and agricultural groundwater pumping from private wells in areas outside the districts and associated deep percolation.

So what are the assumptions of this analysis? So for -- within a district, we assumed that groundwater pumping occurring at the farm-gate is only used to satisfy the crop applied water demand. It's a consumptive use and deep percolation. We assume that the districts can pump as much as they need up to their maximum pumping capacity. And for SEWD and CSJWCD, only the -- we only modeled the portion that they contract for on the Stanislaus River assuming that -- and assume that the districts can fully replace any shortage of this amount.

For areas outside of the districts but within the groundwater basins, we include estimates of municipal pumping based on the 2003 version of Bulletin 118 and we assume agricultural areas are supplied complete with groundwater with a few exceptions such as areas in the Merced Irrigation District's sphere of influence.

So for this analysis, we wanted to use the best available information, the most accurate information to represent these irrigation districts. So the first -- so one of the most important sources of information were the district agricultural water management plans. In addition, we also -- in September 2015 we sent out informational request letters to each of the modeled irrigation districts asking them for more detailed information about their operations and groundwater use.

So some of the parameters that are based on these sources include district M & I deliveries, seepage from regulating reservoirs such as Turlock, Modesto, and Woodward, the minimum annual groundwater pumping estimate for each of the districts which represents groundwater pumping regardless of year type to supply areas that don't have access to surface water distribution system because the area's on a hill, the maximum groundwater pumping capacity of each district as of 2009, distribution loss factors that relate the distribution seepage and evaporation to the total diversions made by the district, and deep percolation factors that determine what portion of the total applied water will be lost -- will seep past (unintelligible) and into the groundwater subbasin.

So here we have a time series from 1922 to 2003 of Merced Irrigation District average annual applied water demand under baseline conditions and with the source used to satisfy that demand. So at the bottom there's a purple section that represents the minimum annual groundwater pumping formed by the district. It's regardless of year type. And the blue -- or the light blue section are the district's surface water diversions. And, of course, those get cut in these severe drought years such as 1977, 1991.

During these shortage times, surface water shortage times, the district will increase its groundwater pumping up to its groundwater pumping capacity, which is represented by the red section, and if the district reaches its pumping capacity but there's still unmet demand, well, then there's a shortage, which is represented by the white portion beneath the black line. So that was under baseline conditions.

Under a 40 percent unimpaired flow objective, there is a lot more surface water shortage and, correspondingly, a lot more groundwater pumping. Now, with this increase in groundwater pumping, the district reduces its potential agricultural impact, but it's transferring impacts to the groundwater subbasin.

So here we have the modeled groundwater pumping across all the irrigation districts. So for baseline conditions and the 40 percent unimpaired flow objective, the X axis is year types and the Y axis is the total annual -- or the average annual groundwater pumping in each of these corresponding year types. So overall in all year types under baseline, there's about 260,000 acre-feet of groundwater pumping with most of that occurring in critically dry years as that's when there's the surface water shortage.

With a 40 percent unimpaired flow objective, the average annual groundwater pumping increases by about 100,000 acre-feet, with most of the increase in dry critical -- or below normal, dry, and critical years. On the other side -- in addition, there is also groundwater recharge. So here we have the model groundwater recharge across all the irrigation districts, or baseline and 40 percent objective.

Under baseline conditions there is about 730,000 acre-feet of recharge, and under our unimpaired flow objective, this decreases by about 80,000 acre-feet because of the reduced surface water deliveries for applied water. So there's less deep percolation and less distribution losses with the reduced diversions. Most of this reduction in recharge comes in dry and critical years.

So if you subtract the district's groundwater pumping from its -- from recharge associated with the operations, you get an estimate of the net input to the groundwater basin associated with district operations. So here we have the average annual net input to the basin for each irrigation district under each of the potential unimpaired flow objectives. What's important to notice here is that even under a 40 percent unimpaired flow objective, all the districts remain positive contributors to the groundwater subbasin. And even under a 50 percent unimpaired flow objective, only Merced Irrigation District becomes a net user of groundwater.

So with that, I'm going to hand it over to Xuan Gao who will go over our potential impacts to drinking water.

MS. GAO: Good morning, everyone. My name is Xuan Gao, and I am also an engineer. I am going to give you an overview of the drinking water in the four groundwater subbasin and how it might be impacted by our proposal.

According to the 2010 U.S. Census, there were approximately 1.25 million people living in the area overlying the four subbasin. Of that population, 1.12 million peoples are connected to public water system. The rest of the -- the rest of the populations relies on domestic, that is, private wells for their drinking water supply. And the population -- the percentage of population connected to public water system is about 89 percent, and population that relies on domestic well solely is about 11 percent.

So we identified 93 public water suppliers within the four groundwater subbasin. In year 2014, these public water supplier delivered 323,000 acre-feet of water. Of that, about 48 percent is surface water and 52 percent is groundwater. If we assume that the people that are --

that are not connected to a public water supply system and rely solely on domestic well for their drinking water supply have similar per capita usage of drinking water, like those connected to a public water supplier, then they would have produced -- or consumed 8 -- 38 TAF in 2014, and together the total water production in 2014 would be 361 TAF.

The reduction in surface water supply would, therefore, affect entity that rely upon groundwater by increasing the need to deepen their wells or build more wells in order to continue to assess -- access groundwater, increasing groundwater pumping cost, degrading groundwater quality, making groundwater unavailable in some area when the groundwater dropped to a level that makes pumping no longer economically feasible.

Our 40 percent unimpaired flow requirement would reduce net groundwater input by about 186,000 acre-feet per years as compared to baseline. And what does this potentially means to groundwater supply? As you know, the Eastern San Joaquin and Merced subbasins are listed as critically overdrafted. Actually, all of the four subbasins have experienced groundwater level declines and overdraft in the past. The rates of overdraft for the four subbasins are estimated to be 155,000 acre-feet per year, so if we pick this number -- if you pick this number, this is 100 and -- okay. So if we pick the 186 and add it to the 155, then we would get 341 TAF per year as the resulted overdraft.

And so in (unintelligible) such level of overdrafts can be sustained, and a study on a total groundwater storage carried out by USGS in 1960 estimated that the total groundwater storage in the four subbasin was about 125 million acre-feet. So the existing draft of -- rate of overdraft, 155, is about 0.12 percent of the total groundwater storage, and the combined 341 TAF per years of overdraft is about 0.7 percent of the total -- total groundwater storage.

These low percentage, however, do not means that we still have a long way to go to complete -- to deplete the groundwater resource -- resources because there would be substantial subsidence that occur long before our water in aquifer could be removed; therefore, actions are needed to address groundwater overdraft which for without our proposal and SGMA will help.

So in our SED, we provided a range of existing overdrafts in the four subbasin. The 155 that I mentioned just now, it's presented in Chapter 9 in another estimate which is 144 -- 144 TAF per year is presented in the executive summary.

Lowering the groundwater table would affect groundwater quality in the following way. It could accelerate migration of surface contaminant to the well. It could increase saline -- saline water intrusion to the aquifers, and it could mobilize naturally occurring trace elements and elevate their concentration in the aquifer.

However, the impact of groundwater pumping on groundwater quality depends upon many factors. Such example of those factors are location (unintelligible) of the well, the amount of groundwater pumped, and the frequency at which pumping occurred, hydrogeological characteristics of the aquifers, and contaminant characteristics.

In addition, it is impossible to predict how the affected party could respond to the reduction of surface water. They might deepen the existing well or build a new well. If they build new wells, we wouldn't know the number of new wells and their location; therefore, while it is true groundwater pumping might affect groundwater quality -- groundwater quality and flow, it is speculative to determine the exact impact on groundwater quality due to our proposal.

So during the recent drought, the amount of groundwater pumped greatly increased, as we know, and yet there was no greater number of violations of the maximum contaminant level as compared to wet year based on the consumers' confidence reports prepared by the service provider. This suggests that for public water systems, a substantial increase in groundwater pumping would not necessarily result in more violation of drinking water quality standard. This is because service provider are required to take action that -- to ensure that water is in compliance with relevant drinking water standards before it serves to the public. If any exceedance -- exceedances are detected, service providers are required to bring the contaminated well off-line and treat the water.

There might be potential impact on domestic well users because unlike public water system, there's no systematic monitoring of water quality in domestic well. As such, it is a very important for the domestic well owners to test their water and follow the recommended best practices as set forth in the SED. It is also important for the local groundwater agency to implement SGMA to address overpumping and avoid water quality degradation.

In the past, the State Water Board provided financial assistance to help schools, communities, and public water suppliers to address drinking water issues. Examples of those financial programs are shown here. For example, a well in an elementary school in Merced County went dry, and the board provided $180,000 for them to build a new well nearby. And another program that we had been providing water funding to the public is the Drinking Water State Revolving Fund. In 2015 we provided about $6,060,000 to the City of Hughson for them to replace a well that had arsenic problem.

For further informations about impact on groundwater resources, service providers, and service providers, you can refer to Chapter 9, 13, 22, and Appendix G of our SED. These chapters and associated analysis can be downloaded at this link. Think you can see. Okay. Thank you.

MR. WARD: Is this on still?

UNIDENTIFIED SPEAKER: Yes.

MR. WARD: Don't push anything. All right. Can you hear me? All right. Thanks.

You know, one of the aspects of this entire approach is that you folks have been working on this for quite a few years. At least four; right? Go back to 2012 in the first version, and I don't know how many years before the first version; right? Our community has essentially had, you know, maybe the last 60 days. Certainly you've been working with some of the other irrigation districts for longer than that.

But what we're tasked with is, you know, looking at in-depth a heck of a lot of information, and imbedded in it, a lot of assumptions and approaches and methodologies that were used in your analysis. And so I was asked -- and a whole bunch of people volunteered to step forward to assemble some technical teams to begin to explore that -- those questions.

We realized that today is not enough time to resolve any of this, and we're just really at the beginning point. We appreciate and recognize that there's other opportunities coming up with the workshops in Sacramento on the 5th and the 12th, the number of public hearings, and ultimately the written comments. So I don't want to talk too much because I'm going to use up our time, so I won't.

With me today is some professional folks that stepped forward to begin talking to you about the analysis. We don't have anybody here today to talk about fisheries and flows. That's not the discussion. It's not taken as a given that there's the foundational science for that, but that will be explored in a different forum. What we're here today to is to talk about the groundwater and the drinking water impacts and basically in four areas: One of those is the analysis itself and CEQA compliance; the other is agricultural impacts; and then breaking the drinking water into two parts, the large urban -- the cities and then the small urban and the rural.

So I -- today over on the audience's left is Ali Taghavi with RMC. Next to Ali, Ron Rowe with Merced County. Ms. Valerie Kincaid with O'Laughlin & Paris, and Mike Tietze with Jacobson James & Associates. Mike is -- is the sub team leader for this, and so I'll just turn it over to Mike to begin the discussion.

MR. GROBER: Mr. Ward, if I may?

MR. WARD: Yes.

MR. GROBER: Just a comment. Because this is a very rich, deep topic, you know, we raced through a lot of information here. And I just want to let the panel know -- I think they know, but also the public -- we're going to have two days of technical workshop. I don't think I pointed that out. On December 5th and 12th.

MR. WARD: Right.

MR. GROBER: So there will be additional opportunity. This is an initial opportunity to ask some questions.

MR. WARD: Right.

MR. GROBER: Really the focus should be -- because there's going to be a lot of differences of opinion, thoughts on policy, and I think you mentioned CEQA compliance, things like that. But really the purpose here today is to make sure that the nature of our technical work is understood so we can exchange that information.

MR. WARD: Right.

MR. GROBER: So we just want to kind of circle back to that kind of core -- you know, core intent here because we have our technical people here today. We don't -- though our attorneys are in the audience, I just -- you know, and I see we have an attorney on your panel, but I want to make sure that we circle back to and focus on the technical elements of what we've prepared today.

MR. WARD: That's the idea, yes.

MR. TIETZE: Yeah, Les, I think you -- you stole my opening remarks and I couldn't have said it better myself. The intent is to focus on technical issues regarding the analysis and supporting science. This first panel is focused on the resource analysis and supporting science piece. And specifically, you know, we all agree that unimpaired flow will have significant impacts that reach far beyond the rivers, and the purpose of this SED is to characterize and understand those impacts. And we want to understand better the analysis that went into that.

So with that said, I'll turn it over to Ron to start with our first questions.

MR. ROWE: Am I -- can you guys hear me? Good morning. Les, thank you very much, and your team. Appreciate you coming down to Modesto.

The general topic area that I have to discuss is CEQA impact analysis and evaluation for potential and desirable results under Sustainable Groundwater Management Act. And I have an interest in how or where the SED evaluated the potential for significant adverse impacts related to subsidence in water quality in particular. And we have concerns about drawdown, as you've mentioned, storage depletion, surface water depletion, and impacts to groundwater-dependent ecosystems of course, like in Appendix G.

But how did the SED account for the fact that these adverse impacts in these areas are typically dependent on and understood in our terms which are local conditions? Was there specificity in that?

MR. GROBER: That's -- that's a good question and that's kind of -- it will be important to identify. And I think that was in one of my lead slides the programmatic nature of our analysis because the proposal, what we are -- at the core of the proposal is a proposed change in flow objectives in the Merced, the Tuolumne, and Stanislaus River. So that's the physical change that would be occurring.

But then the analysis identifies that in response to the physical change, we observe what's happened in the area in the past during times of water shortage. So as -- as Tim had pointed out, it kind of has that next step. If you reduce that surface water supply, the response that we would be seeing -- and actually, Walt, you made the comments about the number of intervening years. Some of those intervening years have been very instructive because those were the very hard drought years which hopefully were -- those are -- the worst of those years are behind us.

But we got the additional information to observe what happens during drought, and it's that graphic that Mr. Nelson presented showing, well, in response to surface water shortage, there would be additional groundwater pumping. Because that's what happens now already during times of scarcity. So what we'd take into account from those ag water management plans, maximum pumping, you know, capacities, things like that, that's then that next step, you know, once removed from the initial proposal for augmenting instream flows resulting in reduced surface water supplies. But in response to reduced surface water supplies, we expect what's the most likely outcome. That would be additional groundwater pumping.

And I think it's worth noting for those that have been tracking this for a number of years, when we went out with the original SED, we took a different approach to that. We said, well, if there is a reduced surface water supply, you could have one of two things happening in the extreme: You could have no additional groundwater pumping on the one hand or you replace it all with groundwater pumping. Neither one of those -- I think we got comments from the area, and we've got comments from our board members. Neither one of those is realistic.

So in this round, we (unintelligible), well, what's the most likely response to reduced surface water supplies? And that most likely response is some increased level of groundwater pumping. And I understand the SGMA concerns that we talked about, you know, what can happen over the long term and the requirements under SGMA, but it's a -- it's a problem that we've wrestled with, which is why in our documents we looked at even different possible maximum rates of groundwater pumping.

We looked at what was available in 2009, what was possible in response to the drought 2014 levels of groundwater pumping. You get different answers if you look at it in those two different ways, and the different answer is reflective of what we did the first time. If you have more groundwater pumping, you'll have a greater effect on the groundwater resources but a lesser effect on the agricultural production and ag economic resources and vice versa. If you do less pumping, then you'd have more of a reduction in the overall water supply and a greater effect on cropping, you know, reduced cropping and fallowing and economic effects.

So what we've done is we've tried to strike a balance in what we thought based on the observed is the most likely outcome. And -- and this is the opportunity to hear if we got it wrong, if it should be some other number. That's going to be important to hear. But an important take-home from all of that, this is a programmatic analysis, so we don't look at a high level of detail because we can't know what the response is going to be, the local response is going to be. It's going to depend on crop prices, the value of water, how much additional development there is.

We identify things like additional groundwater recharge, active recharge, more than just the conjunctive use that's currently going on. So many of those things start becoming speculative. So we tried to strike a balance. I'm curious to hear your thoughts on if we got that balance right or what else we should be looking at or what else it should be.

MR. ROWE: Thanks, Les. More specifically, I think for Merced County, one of our larger concerns is subsidence. It's not so much of an issue that we currently observe north of the Merced River, but as we potentially impact water supply and its relationship to depth to groundwater, upper unconfined zones become less reliable over time. Wells potentially going deeper below the -- let's say the Corcoran clay layer and further potentially impacting subsidence is a major concern of ours.

And we don't need to look too far further south than the Tulare basin to look at accumulated salt problems. It's something -- we have some work that we're doing now, and it is difficult to quantify, but it would appear to us that salinity in general will increase over time. And our concern is was it analyzed and is the programmatic level assessment really appropriate in the first place, because without the detail, you really don't see the localized impact.

We had over 125 wells go dry that went on a tanked water program for emergency water in that short time frame for this drought period, so we see what shortage does. And our concern is the long-term horizon and how it may exacerbate that over time.

MR. GROBER: So (unintelligible) what's the question in that? I mean because that's -- I mean those are -- we share those overarching concerns, and SGMA is going to be part of the solution obviously. And SGMA is going to be something that will have to be locally implemented because I think, as the information we presented initially, there's already a groundwater problem.

But this -- if this added stressor occurs in terms of greater reliance on groundwater, there's going to be, even at least an initial response, greater reliance on groundwater pumping. But all of those problems you identify appear possible, and I think we've identified those: the potential for subsidence, the potential for, you know, water quality issues, things like that. But it's at a programmatic level and some of the further information that's in the chapters that are still on the screen.

MR. ROWE: All right. So I think more specifically is we'd like to see more analysis of water quality, and we'd like to see more analysis related to subsidence specifically. And the most sensitive entities for us are disadvantaged communities that may be disproportionately affected.

MR. GROBER: And this is -- and I'm -- sorry if I refer back to other slides. And then it's important, I mean, for comments like that, that's then -- those are certainly comments that should be made at the -- you know, at the hearing certainly, because the board needs to hear -- needs to hear those things.

MR. ROWE: So for -- you know, to summarize it from a technical perspective, our most interest is in water quality and how that may be impacted, not just on the short term but long term.

MR. GROBER: And short term and long term, it's the --

MR. ROWE: Go ahead. I mean that was another question is, you know, what was the planning horizon considered for the impact analysis?

MR. GROBER: We update our water quality control plan on my intro slide. It's been 21 years since the last round for the major update. We did a minor update in 2006. We are required under federal law to do, you know, a triannual review. We do periodic reviews and periodic updates. So if there's new information in -- within -- after this plan is adopted to suggest that there are additional problems, say, with groundwater and having to do with water quality and things like that, then the plan can be opened up to make changes.

But the -- the planning horizon here is over the next several years and based on what -- based on the current condition. But this is a plan that is periodically updated, so if there is a change -- and now looking at the SGMA time frame in terms of as that's developed and implemented, there's certainly opportunity to make changes in the plan.

MR. ROWE: All right. Thank you.

MR. TIETZE: You know, I think, Les, you may have misunderstood the question. The planning horizon question was regarding how long a forecast period did the SED contemplate when evaluating impacts. You know, in other words, usually in environmental impact assessment, you have -- you evaluate a project or a program over a certain number of years and assess what the impacts will be over that time. Can you clarify for us what that time period was over which the impacts were forecasted?

MR. GROBER: I don't know that we have -- I'm looking over to -- to Anne and Tim. I don't think that we had an explicit time horizon, but -- Anne and Will, uh-huh.

MS. HUBER: Our assumption is that the

groundwater impacts will continue until the -- oops -- how about now?

UNIDENTIFIED SPEAKER: Talk into it.

MS. HUBER: Now?

UNIDENTIFIED SPEAKER: Yep.

MS. HUBER: Okay. Our assumption is that the groundwater impacts would continue through time up until the point at which SGMA is fully implemented. So it's a little difficult to say exactly when that point in time will be, but the groundwater sustainability plans are supposed to be completed by 2020 or 2022, depending on the status of the subbasin. And then sustainability is supposed to be achieved by the year 2040 or 2042. So the exact transition point at which groundwater pumping may become more restricted is -- it's hard to say.

MR. GROBER: So another way to get at this --

MR. WARD: There's a, in my mind, a fundamental point of discussion right here. The cart and the horse; right? Is SGMA leading this and the SED follows it, or in your mind and your approach is the SED the leader and SGMA has to conform? I mean there's a disconnect. I mean --

MR. GROBER: I don't see that as a --

MR. WARD: Hold on, hold on, hold on. There's a significant disconnect between SGMA compliance and all the things that we've been working on through the drought with the impacts of dry wells. And now loss of additional surface supply is going to exacerbate the situation, cause more groundwater pumping.

The question of scale and the impact analysis, apparently you guys didn't do that; right? Because it's programmatic, so a lot of averaging, a lot of smoothing things out because it's impossible, quote, your word, too speculative; right? One has to lead before the other, and in our mind, SGMA is the driver. And we've got a whole lot of work to do to better understand our groundwater system, No. 1, and the long-term impacts of utilizing that resource in conjunction with surface water.

You know, if you look at the map of the basins in the Valley and you look at those that are not high priority but those that are critical condition of overdraft, why do you think it is that the Modesto and Turlock basins are not listed as critical condition of overdraft and every other basin north and south of it are? That's a question.

MR. GROBER: Well, you have -- you have excellent surface water supplies, and you will continue to have excellent surface water supplies. But actually the question gets at some of the difficulty of providing that answer and knowing what the future is many years out. Because SGMA's before you. It's before us. It's before the people of the State of California. It's intended to provide, you know, a good thing, to develop sustainable groundwater basins.

And I hear your point. Is it here from -- the perspective is like here we have sustainable basins. This is what this report acknowledges. This is adding another stressor because this is saying that a certain quantity of surface water is now proposed to augment instream flows for the reasonable protection of fish and wildlife. That makes it at least in part unavailable for uses, which is what this document is all about.

That being said, as identified in the document, there is even greater opportunities for doing enhanced groundwater recharge during wet times, to do more efficiency in both ag and urban. So there is so many things that are happening, will happen, that as unsatisfying as it is, it is speculative to try to figure out all of those elements.

SGMA -- and complying with SGMA and developing sustainable groundwater is a local issue, as it should be. This proposal adds that other stressor of less water available during that February through June period. And we've described that general effect in trying to get at the time value because I hear the -- -- I hear the concern with the time horizon, but things are going to be changing very quickly.

We've based the analysis on -- and, actually, that's looking back, but it's on an 82-year record using the current levels of demand, current infrastructure, things like that. So it's what's happening in the moment and would be continuing to happen over the next 10 or 20 years, and that's within the planning horizon of revisiting this water quality control plan when we have more information about how the local area has responded to

SGMA, how this water quality control plan is implemented, where we are within the adaptive range of 30 to 50 percent. So it's just a lot of -- there's a lot of details and a lot of potential outcomes, so that's --

MR. WARD: Yeah, there are.

MR. GROBER: -- that's why.

MR. WARD: Absolutely. So in your mind and from your approach, the SED is driving the locals' response to now SGMA? You don't see SGMA as the lead and the SED fits in and conforms behind it?

MR. GROBER: I'm not -- I don't see one so much as a lead. They're both -- they are two things that are happening, and the change related to the SED informs other things. It's another stressor, another thing to consider for SGMA.

MR. WARD: Okay. All right. Thank you. Let's move on. I'm sorry. I just wanted to explore that a little bit.

MR. TIETZE: So we had some questions about drawdown significance threshold of 1 inch -- or the significance threshold of 1 inch of storage reduction or water level reduction. But to -- it's related to the questions regarding CEQA analysis really, and one of the things that we're interested in is this is programmatic. There's a lot of uncertainty, a lot of generalization about the analysis outside of the rivers.

Typically when you have uncertainty, if you want to evaluate what that means, you do some kind of a sensitivity analysis so that you can say that, well, if we're wrong about this or if we're wrong in terms of where we place the impact, this is what could happen to a particular receptor, particular disadvantaged community, a particular adverse outcome.

Was there any sensitivity analysis that was done as part of the investigation in terms of the range of possible impacts that could actually occur?

MR. GROBER: Your question was first asking about the threshold, but then was there a sensitivity in terms of picking different thresholds?

MR. TIETZE: Well, let me -- let me be clear. The threshold we think generalizes the impact analysis and makes it very nonspecific. With a 1-inch threshold established for a very large area, it's impossible to evaluate what areas will be adversely affected by subsidence, for example, or what disadvantaged communities may be impacted adversely.

And I think I'm hearing you are saying that, yep, that's the case. We know those impacts may occur, but we don't know where. And so I'm saying the threshold raises the question of uncertainty. How did you deal with that uncertainty?

MR. GROBER: Well, I think -- and, Anne, correct me if I'm wrong, but -- you speak to the 1-inch, please.

MS. HUBER: Well, you may already know this, but the 1-inch threshold was developed to -- in order to prepare the different alternatives, and we focused on the main part of the water budget that was likely to change in response to the alternatives. And we wanted to assess that change in the budget in terms of real units, namely, volume of water compared to subbasin area. And the main goal was to get an idea of the magnitude of the change.

Now, it's true that some areas will be more affected than others, and I think in a lot of places we tried to address the potential unevenness in impacts with qualitative discussion of those impacts. For a subsidence, for example, we primarily considered the Merced subbasin, the southern edge of the sub -- Merced subbasin and northern edge of the Chowchilla subbasin, which we had combined together -- well, let me go back.

We combined the northern edge -- northern portion of the Chowchilla subbasin in with this Merced subbasin because we felt that it needed to be included in our assessment, and that region is the region that's most likely susceptible to subsidence. So there's some discussion of that in the document.

MR. TIETZE: But in terms of understanding the impact, say, understanding what the actual potential is for damage to public infrastructure and risk to public safety from subsidence, for example, do you provide a range of what the possible outcomes would be and how serious those consequences might be to the public?

MR. GROBER: So you're saying a range within -- so how it might range in specific areas from a high to a low based on different levels of pumping and response to lack of available --

MR. TIETZE: Yeah, from my limited read, I understand that you're saying that additional subsidence is possible and may be more likely in certain areas, but I don't understand how much subsidence, what the potential impacts are on public safety and public infrastructure. So that's -- that's -- where is that analysis or how was it handled in the SED, or was it not handled in the SED?

MR. GROBER: Just in terms of -- without knowledge of what the specific responses would be and making, you know, assumptions about many other things, it would start becoming speculative to come up with that level of detail.

MR. TIETZE: Okay. And then one final question on -- it's kind of along the same lines. When you have fairly specific science that's being applied to assess what's happening in the streams and the science is very broadly applied to what's happening outside of the streams, how have you dealt with the possibility of having the science be -- or maintaining policy neutrality in your analysis? In other words, if what's happening outside of the stream is generalized and what's happening inside of the stream is not, how do you protect against favoring a particular policy in your analysis overall?

MR. GROBER: Well, I don't understand. When you say "inside the stream" or "outside the stream," what are you -- what are you referring to?

MR. TIETZE: You know, I think that the state has very specific studies and in-depth studies regarding the potential benefits to fish of implementing unimpaired flow, which is why this is being proposed, and yet the effects outside of the streams are being very generally evaluated. So the potential exists for the science to be applied in a policy-biased fashion, and I'm wondering how the SED has accounted for that.

MR. GROBER: Well, actually, and that gets -- the direct physical change that would occur would be changes in flow with an increase in flow in February through June. So that's -- that's the thing that is closest to the proposal, the requirement, the proposed project, if you will, so we have the most certainty and information about that.

So it's not a bias. It's rather just that's what we know. You know, that's the proposal. It's the nature of the proposal. Everything else starts -- as it moves further away, that becomes once, twice, several times removed from the proposal and starts becoming more speculative.

MR. TIETZE: Okay. So with that, I think, Ali, you were going to ask some questions.

MR. TAGHAVI: Thank you again for being here to -- to be addressing our questions. I would like to approach my questions in two folds: one is the scale of the problem and then the tools, technology that has been used to evaluate the conditions. And the question with regards to the scale kind of piggybacks on what Mike was alluding earlier, and that is even though the problem is addressed in a programmatic -- at a programmatic level, it appears that, A, looking at either hydrologic variability within the reverse systems and, B, evaluation of benefits to the fish, requires a lot more detailed analysis at even on a daily basis looking at daily fish flows and daily fish conditions.

And so to that end, I -- my question, I guess, is would programmatic evaluation of this condition, would that address the benefits to the fisheries at the very, very highest scale? And looking at the charts that Tim presented earlier, looking at the hydrology level and the water balance and the water budget at the long-term average annual case, it just seems to me that it doesn't do the right level of justice in terms of evaluation of the benefit, whether that's a 30 percent, 40, or 50 percent unimpaired flow to the -- to the -- you know, from the -- from the river system. So that's my first question, the scale of the issue and whether or not the programmatic level actually does justice to looking at the benefits.

And my second question then is, again, related to that is the CalSim, the HEC 5 models, these are operations models. The state uses them for looking at the operations of the system. They do not necessarily reflect the hydrology. Even though it does have 1922 to 2000 -- I believe CalSim is now to 2013 just about, it simulates the operations of the system, but the hydrology in the baseline is pretty much fixed. That's the accretions, the depletions within the river system. And so any changes to the river system and any changes to the groundwater system and the interaction between the river and the groundwater system are not necessarily reflected dynamically within the CalSim system. And so that's why the state typically relies on the C2VSim which is their hydrology model that supports the CalSim-III, which is not published yet or released yet, as well as the state -- the feds rely on CVHM, the Central Valley Hydrological Model, to look at the hydrology of this system.

And so to that end, my question is has there been any attempt on using either of those two models or models of similar nature that would look at the groundwater and the surface water system on hydrologic level rather than operational flow and also the impacts on the river system and the groundwater system.

MR. GROBER: Let me start with your first question, which actually is curious because it's not -- we don't have our fish experts here. It seems to be that's tied to a fish question, but I think I can provide the general answer of scale and maybe combine it with the second question.

The reason -- and I'll ask Will for some -- he'll give us all the details about it, but one of the reasons we moved from CalSim to -- well, there were several reasons, but one of the reasons we moved to the Water Supply Effects Model is to better capture the changes that we would be proposing, something that CalSim couldn't handle, but also to take into account the more local and updated operations information. And I'll let Will expand on that, and then I'd like to return to the fish question.

UNIDENTIFIED SPEAKER: Microphone.

MR. ANDERSON: In terms of the question of scale -- can you hear me? Is that working? Okay. I'll just go to his first point and then try to elaborate on Les's point. But when we present to you here, we've rolled up the summary statistics of the long-term impacts, and those include annual impacts over 82 years in terms of the temperature model. It runs on a sub daily time step, and so you'll see temperature effects. We have 28 years of that, but then we have to roll it back up and summarize it to present it in the report in these other fashions.

So there's -- again, we're not here to talk fish, but the summary statistics of benefits really do have to be examined at that level. That's an accurate point. But then we'll come back and summarize them for you. We've used estimates of the water balance from the ag water management plans which are a snapshot in time from the reports in 2012 that look back. Some look at just a few years; some look at more than a dozen years and have had to generalize that into, more or less, an average condition of where it goes, is it percolated or what the particular field efficiencies are. I think it's a valid point that these could change in time, so we can't really speculate on how the numbers exactly would play out, but we could certainly continue to work on that.

MR. GROBER: I just was talking to Dan Worth, and he could provide an expanded answer. But getting to the -- what I think is the thrust of your question about the first one, you certainly have to evaluate some of these things at a shorter duration time step, and we did. We have that in our -- several chapters of the report, appendices, and the executive summary. We talk about the increased frequency of complying with temperature standards in terms of, you know, number of days and spatially, also floodplain inundation.

That being said, to try to understand, you know, you have to roll this back up, as Will had said, into monthly averages to the bigger numbers. But it is frequently a question of scale and what level of detail do you go into to assess certain problems, and we tried to strike that balance to -- enough to inform the decisions, enough to inform the effects.

But if there's -- if there's a thought behind -- you know, if there's a comment or an observation behind the question, even though that's going to be important to provide as a written comment or oral comment before the board, this is intended to be a workshop; I'll be interested to hear, you know, what -- what should we be doing different or better in terms of this analysis.

But also as Will had said for the hydrology, we looked at, you know, the 82 years of hydrology and we actually augmented it with some more recent years even.

We looked at, you know, all of the dry years and we tried to roll this up. We have summary statistics, but we also -- in the executive summary, we look at what happens during critically dry years, dry years. So we try to look at that and present that in a number of different ways, including in terms of how far the ag -- you know, the cropping effects and all of that.

So we've -- we presented this in any number of ways, but if you have comments on what else would be useful, please ask because maybe it is in the document. And, if not, it might be an important question to pass along to the board.

MR. TAGHAVI: And, again, not having had sufficient time or -- you know, since the document has been released to go through all the details, I guess my thoughts are analysis at a programmatic level, yet dropping down to a, you know, localized level, those are the scale issues. And so the unimpaired flow imposition during the critical years, those are exact same years that typically we've observed, and it is natural that the groundwater pumping is increased. And so then the circulation of the -- effects of the groundwater pumping on the stream system, that needs to be evaluated on a much more level of detail. And so is there actually the benefits that you expect is realized? That's No. A. And then how is that system evaluated? What tools -- the technology has been used and that's my question. That goes back to the Central Valley Hydrologic model, or as opposed to the CalSim which has a very, very static and unflexible, I would say, hydrology within it.

MR. GROBER: And that's a very simple answer. We did not -- this is not -- the modeling that we did doesn't have that dynamic component to see the response or changes in recharge, the interaction of surface water, groundwater. It does not have that.

MR. WARD: Yeah, we understand it's just the -- a volume smoothed-over an area, which is not groundwater analysis. Right?

MR. GROBER: I'm sorry. Which is not what?

MR. WARD: It is not a groundwater impact analysis. It's just water budget approach, water balance.

MR. GROBER: Well, it's using the water budget to determine what the --

MR. WARD: I mean is it -- it doesn't take into account heterogeneity. It didn't take into account scale. It doesn't take into account local impacts. Doesn't take into account water quality degradation, subsidence. Everything is, in your words, just too speculative to use those kind of available tools.

MR. GROBER: It's to come up with the detail, but what the report acknowledges for many of those things, there would be a significant and unavoidable --

MR. WARD: Right.

MR. GROBER: -- impact. But, yes, the details --

MR. WARD: Well, actually, probably beyond that.

MR. GROBER: And for much of that, it's the nature of the CEQA documents and the analysis, it -- you know, there are -- there are things that are identified such as additional groundwater recharge and, as I said, increased efficiencies, conservation, things like that that can be brought to bear that can reduce those impacts. But those too, though they are available, the effect of those has become speculative in terms of how much could be achieved.

MR. WARD: Yeah, just time check. I'm going to ask Debbie if you'd go ahead and bring up your ag group, and we'll have this panel still sit, but we want to make a smooth transition. Valerie happens to be on both, so we can continue on. There's much more to explore. It's just barely scratching the surface. I mean there's a lot more. You'll be seeing more of us and others, you know, at the other -- at the upcoming workshops and the -- certainly with the written comments, but...

Thank you, Mike.

And, Valerie, why don't we just go ahead --

MS. KINCAID: Sure.

MR. WARD: -- and continue with your question with regards to the ag --

MS. KINCAID: Sure. That sounds good.

Can everyone hear me? One of the -- as I go through the document, one of the fundamental issues for me is the assumption of how much groundwater pumping will happen. And as Les mentioned, and I think provided some explanation, those assumptions have changed since the 2012 document. And I guess I just want to run -- run through and unpack those technical assumptions, meaning how -- I guess my two questions are how you calculated what I think is referred to as the 2009 minimum and the 2009 maximum groundwater extractions. And I don't mean generally. I mean specifically how -- what is your calculation to get to those numbers.

MR. NELSON: Well, the 2009 minimums, they're all -- so some of them are from the agricultural water management plans based on the reported minimum of whatever time period they're reporting, and some were from the 2015 response letter -- information request responses from the districts themselves on their annual minimum groundwater pumping.

MS. KINCAID: So that's a static number in the SED and, as you noted, that purple band at the bottom of one of your charts. So if that's a static number -- you said some of them are from ag water management plans. Are you saying that's a number that represents in the SED just the minimum amount of groundwater that would be pumped in a year?

MR. NELSON: Yes.

MS. KINCAID: And that's calculated by the reports from ag water management plans in -- and that doesn't vary by year?

MR. NELSON: No.

MS. KINCAID: And how do you calculate your maximum 2009 groundwater pumping?

MR. NELSON: So the maximum -- so the annual maximum is also a static value. It -- some of them are from -- so all the 2009 values are from the agricultural water management plans. They are -- so --

MR. WARD: What ag plan? What date?

MR. NELSON: Do I have --

MS. KINCAID: The 2012.

MR. NELSON: 2012 version. I don't think I have the page number with me.

MR. WARD: Okay.

MS. KINCAID: Go ahead.

MR. NELSON: So I guess whatever time period they represented, we looked at whatever their maximum pumping historically was, and that's what we used as the maximum possible. And it includes both district capacity and private capacity for pumping within a district.

MS. KINCAID: But in the SED, the number changes depending on average year, dry year. On page G15 you guys have a chart that talks about the average annual groundwater use, and it's an interesting chart. And it provides baseline estimates, and then it provides how much increased groundwater pumping will be under the project. And you note for the 40 percent, the preferred project, it's 105 increased groundwater pumping in average years, and then those numbers change. So it looks like it's a calculation rather than just an importation from ag water management plan numbers. Do you have a calculation for that?

MR. NELSON: Yeah. The -- so it's a static capacity to pump, but they pump either up to that -- they pump what they need up to that capacity. So like on this chart here -- I don't know if you can see it. So when there's a surface water shortage, so it checks what's the shortage of surface water up to their demand? And they will pump that, unless that number is greater than the capacity we took from the agricultural water management plans.

MS. KINCAID: But I guess that's my question. So the capacity in this chart is 626,000 acre-feet. Okay? Not this chart, which is interestingly inconsistent with your --

MR. NELSON: Well, no. This is just for Merced Irrigation District.

MS. KINCAID: Okay.

MR. NELSON: This is for all the districts combined.

MS. KINCAID: Great. So the 626 number, as you can see in the top of the chart, is the actual maximum capacity.

MR. NELSON: Yes.

MS. KINCAID: So my question is what is the calculation you came up with to get the 105 for average years and the 302,000 acre-feet increase in critically dry years? How did you come up with those numbers? What's the -- there must be a calculation in there, and I don't -- I don't find it.

MR. NELSON: It's exactly what I said. So we --

MR. GROBER: Let me -- let me take a -- say it a different way, and this gets back to, you know, the general schematic. There's -- the proposal will cause a surface water supply deficit.

MS. KINCAID: Right.

MR. GROBER: So when there's -- now currently there's surface water supply deficit that happens in critically dry years, and that's in this chart that's shown here, that's when there's the biggest augmentation of groundwater pumping.

MS. KINCAID: That's right.

MR. GROBER: With the proposal, there would be --

MS. KINCAID: Increased.

MR. GROBER: -- more times when there would be a surface water supply deficit, so --

MS. KINCAID: Right.

MR. GROBER: -- there would be more groundwater pumping.

MS. KINCAID: Right.

MR. GROBER: Those numbers, 105, that's the average over all those years.

MS. KINCAID: Right.

MR. GROBER: So you get the 82-year record --

MS. KINCAID: Yeah.

MR. GROBER: -- and then the other number you (unintelligible), then you can come up with the average, what it is for critically dry years.

MS. KINCAID: Right. And I understand the numbers, but I'm wondering how you came up with those numbers, how you came up with 105. Remember, in 2012 the assumption was it was a one-to-one. If you shorted us one, we'd pump groundwater one.

MR. GROBER: It's an average. So if you take -- so this is -- this next one is just for the Merced. So if you just took that -- the numbers that are in the red, so you'd see if you came up with this now, just the time series over the 82 years, you'd come up with some very big years of groundwater pumping --

MS. KINCAID: Right.

MR. GROBER: -- some years of no groundwater pumping. If you take that long-term average, that's the 105.

MS. KINCAID: No, I understand how you got the average. I'm wondering how you figured -- how you estimated what people would pump. It's not -- I mean the ag water management plan could be kind of a basis for the numbers, but why did you estimate that an average -- I understand in average years that you got the numbers, but in each specific year, how did you estimate -- what is the calculation by which you estimated what people would pump and wouldn't pump? It's not a maximum capacity number.

MR. ANDERSON: Les, can I help?

MR. GROBER: Yes. So -- sure.

MR. ANDERSON: Specifically it's a calculation of the applied water needed to meet a demand in a certain year, and that's at the field scale. So first we translate surface water availability at the diversion from the stream, and then we have a certain -- we've got water that's lost through percolation, through regulating reservoirs and conveyance systems --

MS. KINCAID: Sure.

MR. ANDERSON: -- and taken for other uses. But what's actually a crop demand is compared to the surface water that can be conveyed to the farm-gate, and then if there's a shortage in that, that would be the field scale demand that would then translate into if there's enough capacity at that point.

MS. KINCAID: Right. So I guess my question is when there's capacity to pump more groundwater but the SED assumes that it's not pumped, who -- what -- where did that assumption come from or where did those numbers come from? So when you have 105 -- if you look at this chart, you have 105 in average years; right?

MR. ANDERSON: Right.

MS. KINCAID: You have only six in wet years, but you're --

MR. ANDERSON: Right. That's because there's adequate surface water in those wet years that's used.

MS. KINCAID: Right. But then as you get into dryer years, there's a point where there is more demand than you're making up with surface water; right? So maybe -- maybe large scale numbers are better. So the SED generally says there is about a 294,000 acre-foot in average year shortfall of surface water. Okay? So about 300,000. And the estimate is that there will be an increase in those average years of 100,000 acre-feet of groundwater pumping; right?

So why didn't -- I guess my question is how did you come up with the 100? Why isn't it 150? Why isn't it 200? And there's a mathematical algorithm that goes in here that I don't think is disclosed in your SED. I'm asking to explain it or disclose it later.

MR. ANDERSON: Right. Les is --

MR. GROBER: It's a simple long-term average. It's just averaging some years just like you would just -- you would take the numbers -- sorry I don't have the table here -- and you'd -- that's the average.

MS. KINCAID: I understand how you get the average. How do you get the inputs?

MR. GROBER: So the first step is if there's a surface water supply deficit, you make up that surface water supply deficit to meet crop water use needs up to the capacity that can be provided through groundwater pumping.

MS. KINCAID: But that's my question. Where -- how did you put the capacity of the groundwater pumping? Because it's not the capacity of the facilities, which in this chart, it is 626. It's static. So there's a group of numbers in here that are assumptions --

MR. GROBER: So if it's --

MS. KINCAID: -- and I'm wondering --

MR. GROBER: -- a deficit -- so if the deficit is 500, it can be fully met. If the deficit is 700, it cannot.

MS. KINCAID: Right, but that's a good example. If the deficit is 700, it can't be fully met.

MR. GROBER: Yes.

MS. KINCAID: But you're stopping short at, like, 4 and not going to the -- to maximum capacity. I don't know if you guys have this chart in front of you, but I guess one of the questions -- and obviously you don't have it on hand here, but going forward --

MR. GROBER: And which chart are you referring to? Because perhaps -- because maybe we should pull up the chart.

MS. KINCAID: You should.

MR. GROBER: You have it or we can pull it up from the document.

MS. KINCAID: It's Table G2-5.

MS. HUBER: I just want to add a minor point, which is the calculation is done irrigation district by irrigation district and --

MR. GROBER: (Unintelligible).

MS. HUBER: -- some have a minimum -- well, have little ability to replace a water supply shortage with groundwater pumping. So the result for each year depends on sort of which district has the shortage and whether or not they can replace their water.

MS. KINCAID: And is that calculation provided in the SED or is that --

MS. HUBER: Appendix G has a detailed description of that calculation. It's summarized in Chapter 9, but Appendix G has --

MS. KINCAID: All right. And --

MS. HUBER: -- a lot of details.

MR. WARD: Let me make sure I understand. So you've got a 300,000 acre-foot on average, and I've got some questions about that. But 300,000 acre-foot shortfall of surface water made up by 100,000 acre feet of groundwater pumping because you've reached some sort of maximum withdrawal capacity; right? And --

MS. HUBER: Yeah.

MR. WARD: Am I getting that right?

MS. HUBER: I don't have the numbers memorized, but yes.

MR. WARD: So there's still the shortfall -- right? -- of 200,000. It gets back to speculative responses are unpredictable and unknown. Don't you think a reasonable response would have been for local -- the local community to drill more wells and pump additional groundwater, and that was not analyzed?

MS. HUBER: Well, we used 2009 as the --

MR. WARD: Yeah, but I'm talking about response to --

MS. HUBER: Well, so the -- for that reason, we also did evaluate the 2014 maximum groundwater pumping numbers.

MR. WARD: I'm talking about beyond that. Did you analyze making up the entire shortfall?

MR. GROBER: So if I may, since we -- this is -- is this the table that --

MS. KINCAID: Yeah, that's the table. And sorry. I'll try to be quick on this, but to be honest, I don't want to act like I'm belaboring a point. This is a fundamental -- this is the fundamental assumption of our groundwater.

MR. GROBER: So I think this might -- I think I understand what the concern is, what the question might be now. These are still averages of those year types. So the response is not the same at all, dry years not the same, nor critically dry years. So you're not up to the maximum in any one of those because you're meeting -- there's still -- there's going to be a mix of different augmentation of groundwater -- additional groundwater pumping. So those are taking the average of just a subset of years in the record, so --

MS. KINCAID: Right.

MR. GROBER: -- 20 years roughly for each --

MS. KINCAID: Okay. Let me make --

MR. GROBER: So you would -- so --

MS. KINCAID: -- sure I have this right.

MR. GROBER: So there's not a number -- so this isn't like a target number.

MS. KINCAID: No, I know.

MR. GROBER: These are also averages of the --

MS. KINCAID: It's an estimated 2009 groundwater pumping capacity, which is what it's called. So --

MR. GROBER: Based on estimated 2009 groundwater pumping capacity. So it's still using that maximum. It's saying over that 82-year record.

MS. KINCAID: Can you explain that -- that's my question. Can you explain the maximum? So when you have this 105, 302, so I'm looking at the Alt 3, 40 percent unimpaired flow. In average year -- and I understand how you get the average year of 105 increase. That obviously is not the maximum capacity. So clearly there's an assumption made that there is groundwater pumping but not to the capacity.

My question is what is the assumption or what is the calculation that was used to assume when groundwater pumping would stop, if it stops short of the full capacity?

MR. GROBER: It's -- so the example that I gave initially, so let's just assume -- just use easy, round numbers. If the surface water supply deficit is 700,000 acre-feet, the maximum groundwater pumping capacity is 600,000 acre-feet, then the -- then you would --

MS. KINCAID: How did you get the 600? If the 600 --

MR. GROBER: That's based on the information that we have. That's a fixed number. That's the maximum rate that we have. Based on the plans and the information we solicited in 2015, what's the maximum pumping capacity within each district? It's the sum of all of that. So that's the maximum. We assume it can't be any higher than that.

MS. KINCAID: Right. But if it's a fixed number, then why does it differ by critical, dry, and below normal year? I mean are you saying that you just took the ag water management plan numbers and imported them here? It looks like there's a calculation that's --

MR. GROBER: Yeah, the calculation is -- and Tim just pointed it out. It's -- this is why math is good. So that -- this reminds me when I did my master's and part of my dissertation coming up with a full page of partial differential equations. This is not a partial differential equation, but it is an equation, nonetheless, that actually answers your question. So it's taking --

MS. KINCAID: Can you walk me through it?

MR. GROBER: Yes. So it's saying the additional groundwater is the minimum of the additional demand minus the applied surface water demand and the minimum groundwater -- is that the groundwater -- minimum groundwater pumping?

UNIDENTIFIED SPEAKER: Yeah.

MS. KINCAID: And that's my question. So what's the minimum groundwater pumping? It's just a number straight out of ag water management plans?

UNIDENTIFIED SPEAKER: Yeah.

MS. KINCAID: And there's no calculation behind that?

MR. GROBER: Because it's simpler than looking at the equation. It's saying it's -- basically it's that -- it's the example that I've given. It's like the demand in any given year. You have to look at that demand that you have because you don't have the surface water supply, and then you say, can I meet it with the -- within the max pumping? If I can, great. If not, you go up to the max pumping, but your demand might be less than the max pumping and then you'll come up with something less.

So for all years and for all year types, you'll get a range that goes up to the max pumping, the additional groundwater pumping, but it could be something also very close to zero. And you take an average of all those year types, and you'll come up with the numbers that are in that table.

MS. KINCAID: Okay. So that -- so that what you're saying is that minimum groundwater pumping or the maximum groundwater pumping, those are not calculations. Those are literally just imported from the ag water management plans?

MR. GROBER: That's correct. Those are -- those are caps, basically, on those two numbers.

MS. KINCAID: And did you guys provide that calculation in the SED? And, if not, can you provide that?

MR. GROBER: That's -- here it is.

MS. KINCAID: No, no. I mean the actual numbers.

MR. GROBER: Oh, the numbers? They're in the

SED, yes. And, actually, we've -- and --

MS. KINCAID: They're not.

MR. GROBER: -- this is -- yes, and --

MS. KINCAID: The calculation is in there, but if you could provide the numbers of how you got to that number because, obviously, all the ag water management plans didn't come up with the same number.

MR. GROBER: Is that in here? Is that in here?

MS. KINCAID: We don't have to take it now, but if you could provide that, those numbers, off-line. They're not in the SED.

MR. GROBER: Sure, sure.

MS. KINCAID: That would be great.

MR. GROBER: We've actually -- and we've gone, you know, one step even beyond this. Because as arduous as this is, especially looking -- looking at math in a public meeting is always kind of hard.

MS. KINCAID: You wanted technical; right?

MR. GROBER: Yes, this is technical. It's great, but we didn't look at it just for 2009 as this next table shows. These are here. This is the annual maximum groundwater pumping based on 2009 and 2014 estimates. So that shows it district by district. And depending on then what you use, you come up with different results, and these results are important.

And a lot of thought went behind using the 2009 because, as I think I said early in the presentation, if you use the 2014, it has the effect of reducing the unmet demand. So it reduces the ag -- it reduces the crop fallowing. It reduces that ag economic impact, but it puts more of a burden on groundwater. And it's also looking at numbers that are less sustainable.

Even 2009, as the numbers we present, is that sustainable over the long term? That's going to be a big issue for SGMA, but we've presented it two different ways. I think one of the questions is have we done sensitivity analysis for things like this? This is an example of like we can't know exactly what the answer is.

And arguments could be made, well, that's not the right 2009 -- you know, that's not sustainable pumping. Well, we've looked at it a couple of different ways, and it will counterbalance in the end. And if there's better information in terms of what's currently going on and what's expected to go on in the future, that's good information to receive. But we're showing our work as to how this all comes together in terms of groundwater effects versus cropping and economic impacts.

MR. ANDERSON: I believe we've also provided a spreadsheet that covers all the calculations, and it's not a -- it's a fairly simple calculation, but there's a lot of years and a lot of different areas that it goes through.

Just to clarify on your original question on the year types, it's important to remember that those year types are composites, so we don't -- we don't average the dry year demand and then take the capacity off of that.

It's a composite of multiple years, some of which will reach capacity, some of which won't need it. If that makes sense.

MS. KINCAID: It does. And I guess that's the calculation I was asking about and how you got to those composite numbers. Because they look awfully round, but they're obviously calculation, so...

MR. WARD: I have a question about the -- and then I'll let Debbie kick off the ag, although we're kind of skewing into that. We're talking about averages; right? And it kind of smooths things out from the real year-to-year, what we might realize. So we talked about this 293,000 acre-feet shortfall and available surface water. So let's just call that 300,000. Where in your document is that distribution and what does that look like?

First of all, what is your average? Can you show me the formula? Can I derive from your data? Can I get to the answer of 293,000 as an average? Is that a mean? Is it a middle of the range? Is it a -- what is it? That's a question.

The other one would be what does the distribution of that look like? Is it uniform? I bet it isn't. So is it skewed which way? Is it skewed to the left? Is it skewed to the right? It would be helpful for us to understand that because I think it might be more revealing than using averages.

And with that, what would be that standard deviation? Over what range -- you know, statistics can be very misleading. And so looking at the actual numbers, notwithstanding the premise in the first place, but just recognizing and taken as a given for our part that 300,000 acre-feet of less surface water is going to be available to this region, our response is going to be pumping more groundwater.

I mean that's what we're faced with, and that is going to affect all the ag communities, all the cities, all the rurals, all the domestic wells. And we're trying to understand what that impact is going to be because ultimately that merges into economy. This ultimately becomes an economic impact to this region, to the entire vitality of this region.

So helping us understand that would be very beneficial, to help us frame some questions so we can explore with you better means, perhaps, of trying to analyze and respond to -- to what you're proposing.

MR. GROBER: So here I've just pulled up a couple of tables just from the executive summary which is still --

MR. WARD: I don't want to see a table. I want to see a histogram, No. 1.

MR. GROBER: We have exceedance plots and full data sets. We have the full model and --

MR. WARD: Okay. Where is that? Where -- what -- can you tell me where in your document?

MR. ANDERSON: Well, do you want to go to --

MR. WARD: (Unintelligible) we can spend some time with it.
MR. ANDERSON: Right. Appendix F1 will be --
MR. WARD: F1?
MR. ANDERSON: Yes.
MR. WARD: What is it, size font 2?
MR. ANDERSON: It is fairly sizable.
MR. WARD: I had to say that.
MR. ANDERSON: Right. And I understand the agenda today is to focus on -- on these items, and we've kind of set aside the larger, you know, hydrologic modeling aspects of that, but the -- this 293,000 acre-foot number is an annual average and --
MR. WARD: Is it a mean or a median, or what's an average?
MR. ANDERSON: That is an average of supply volume, so we've got -- it's --
MR. WARD: You just took total years, added up what that cumulative was, and divided by the number of years? What did you do?
MR. ANDERSON: Right. So in order to evaluate the system, we have -- we've got the CalSim hydrology. We've got a set baseline, and then there's -- we're comparing 82 years under baseline conditions versus the 40 percent flow alternative. And to do that, we have to reoperate the entire system. We've got to evaluate each year for the surface water demand that's required based on the climate, how much rain there is that year, and CalSim

gives us a basis for that.

MR. WARD: And you have an output number for each year.

MR. ANDERSON: So for each year we see what's -- what's needed for diversion, and then if there's available supply that's met. And then that requires operational constraints such as carryover storage guidelines just for the sake of the analysis so that no particular years are -- well, to minimize the years of low supply, we have to kind of -- we have to reoperate the system. And so I think that --

MR. WARD: Does that include reservoir flood space?

MR. ANDERSON: It does. It does include what's available, flood space and so on. Just how CalSim would do it, we've used those parameters and basically had to come up with an allocation scheme saying, well, if we've got to put this, you know, amount in the river instead of 20 percent of unimpaired flow, how it might be under an existing condition, a biological opinion or so on, up to 40 percent, then that water would not be available for use.

And it would -- and so each month, not just annual but monthly operations of the reservoir would be considered in that. And so that's the topic of the December 5th workshop that we will be presenting, and so --

MR. WARD: Or we can spend some time with

Appendix F (unintelligible).

MR. GROBER: So, Will, if you wanted to come here and do some driving on the -- on F1 to find any other specific table. And I'm not sure if this is -- if this is -- the short answer to your question is at least twofold. We have provided the models which were available when we released the SED, which has not just all of the information, but it allows anyone to duplicate that information and also check the model logic to see how these calculations are made.

These appendices have all of the -- I'm showing example of a form, of tabular information just for one tributary at 1 percent of unimpaired flow so we have that type of information. What I think is far more useful, though you didn't want to see a summary table, is something from the executive summary which really gets at your point which I think is that averages can be misleading.

So this is a table from the executive summary showing the mean annual water supply effects. It's showing it for the Stanislaus, the Tuolumne, and the Merced. And that's where you have then -- for the total for the plan area, you get where I'm showing here where that occurs, or that average, that overarching average of 293,000 acre-feet per year. That's the reduction in water supply that would be available.

So that's a 14 percent reduction, and we show it then for each 5 percent of unimpaired flow, shows how it varies. So it's important to see how it varies within that 30 to 50 percent range of the proposal. That's why we highlighted for the 40 percent, but also for the plan area, it ranges from a 7 percent to a 23 percent reduction. Those are big numbers, and that's not all of the story.

But getting directly at your point, on the next page of the executive summary, we have another summary chart that shows it again for the Stanislaus, the Tuolumne, and the Merced for the total plan area but shows under the 40 percent flow proposal what the variation is by year. So not all the years are the same. In wet years for the overall plan area, it's only a 2 percent reduction because there's plenty of water available for everything.

But when you get to those dry and critically dry years, those are much bigger than the annual average. That's a 673 and 624 thousand acre-foot, respectively, reduction in water supply in those years. And that gets directly at what the proposal is doing, because though we don't have the fish panel here today, we're not talking about the fish rate, but it's those years when the percent of unimpaired flow in the tributaries can be in the single digits during that February through June period, rather than what would be flowing down under an unimpaired condition without consumptive use and storage.

Where you'd have 100 percent, you're getting 5, 6, 7 percent of the flow that would actually normally occur. So that gets at the crux of the impetus for the proposal, why you need some level of flow to protect fish and wildlife, and that's also because that's when there's consumptive use needs, that's why you see the biggest water supply effects.

MR. WARD: Okay. There's something we need to further explore.

MR. GROBER: Sure. But I assure you --

MR. WARD: A statistical approach --

MR. GROBER: I assure you that all the numbers, all the numbers -- there's a lot of numbers in the executive summary.

MR. WARD: Yeah, I'd like to see if the 20 percent through whatever it was for each of the 82 years of hydrology, that needs to be teased out somewhere because I believe --

MR. GROBER: Is that something --

MR. WARD: It's not a uniform distribution; right?

MR. GROBER: Right.

MR. WARD: You're going to have more years where there's going to be greater impact to the region than when you just look at it as an average.

MR. GROBER: What would you like me to pull up, Will?

MR. ANDERSON: Page F179 for Mr. Ward.

MR. WARD: And, Debbie, I'm sorry. I -- I told you ahead this would be sort of organic and we'd be free flow. So let's move on to this next panel. I apologize.

And we'll get back with you, Will.

We have Eric Thorburn over on audience's left with Oakdale Irrigation District, Julianne Phillips with the San Joaquin County Farm Bureau, Mr. David Robinson who is the ag commissioner for Merced County, Valerie Kincaid with O'Laughlin & Paris, and Debbie Liebersbach, water manager with Turlock Irrigation District. So Debbie is the sub lead on this one, and she can maybe kick it off with one of her group's questions as it pertains to agricultural impacts directly attributed to the proposed unimpaired flow proposal.

MS. LIEBERSBACH: Thank you, Walt.

MR. GROBER: And if I -- if I may, just because I've been intervening time. You know how engineers are. So since I pulled it up, I have to draw attention to the exceedance plots because --

UNIDENTIFIED SPEAKER: Can you zoom in?

MR. GROBER: Sure. So for the -- for engineers, this is the -- you know, this is the way to view the data.

MR. WARD: Okay. We'll look at it.

MR. GROBER: So that's an example of showing for the different proposals, and this actually shows for what percent of the time. That's why the -- it's the exceedance plot, what percent of the time you have reductions in diversions on each of the three tributaries, so -- sorry.

MS. LIEBERSBACH: It's all right. Thank you.

Okay. So we have a variety of questions, and thank you again for coming to talk with us. I guess I thought I'd start by asking, you know, you've recognized in your presentation that we have varying levels of overdraft existing within the basins already, and that combined with the requirement that SGMA bring this into the requirements for groundwater sustainability.

One thing that occurred to me is that the groundwater -- or the agricultural impacts were evaluated based on a variety of groundwater pumping scenarios. You know, you proposed 2009 as a possible amount of water that could be pumped and 2014 volumes with an amount that could potentially be pumped, but you didn't really look at what it might be if groundwater isn't able to be used to make up the difference. And that would in my mind kind of bracket what the impacts may or may not be. Unless, perhaps, it's in the SED someplace and I didn't find that.

Could you -- could you talk about that?

MR. GROBER: Sure. So I think, as I said, that's -- in the last round, that's what we looked at. We looked at no pumping or full pumping. This time, based on many of the comments that we received in this area from others, we'd rather answer the question as, well, what's likely? Because neither seems likely that there would be no additional pumping or full pumping. So, no, we don't have that in the SED. We don't look at a scenario where there is no additional pumping.

MS. LIEBERSBACH: But from an agricultural impact perspective, that would be the worst-case scenario; would it not be?

MR. GROBER: That would have a bigger -- that continuum that I referred to, if you didn't replace the supplies with groundwater, there would be a bigger effect on -- in terms of reduced cropping and economic.

MS. LIEBERSBACH: Okay.

MS. PHILLIPS: To that point, while you were discussing the last item of interest, you did say that, you know, the relationship between the agricultural economic impact and the groundwater impact, and I think that to the extent that those are two divorced ideas in the SED is to the detriment of the local communities because -- especially in agriculture.

If you're looking at a groundwater impact, that is an agricultural economic impact, and those have not been fully vetted in the SED. And if they have, we would like to know what is the worst-case scenario. If under SGMA there's not allowed to be any more additional pumping in these high-priority basins, what is that economic impact going to be?

MR. GROBER: Well, and this is -- you know, this is one of the questions that we had in the last round. It becomes -- to make determinations about what the specific responses will be and over what time frame, combining that with what other additional groundwater recharge that could be, increases in water use efficiency, water conservation, change in cropping patterns. That starts becoming all quite speculative.

We're confident in the analysis that we've done, and that's why the intervening drought, if there's anything good about it, it provided useful information on what -- how would this area specifically respond to reduced water supply, surface water supply. And we used the information on what the response was, recognizing that there's that question, that big question about sustainability and for how long.

But that's why we've provided all of this -- the information that we have. That's the big, open question. That's something this local area is going to have to wrestle with, long-term groundwater sustainability. But in the moment, the analysis shows this is a likely response to the -- to reduced surface water supplies.

MR. THORBURN: Sorry. Can we talk about inputs a little bit here? What assumptions did you make for land conversion? Because I know that in our district, we've seen 3,000 acres of ground being converted to permanent crops every year. So what assumptions did you make on those trends?

MR. GROBER: I'm sorry. Assumptions about land conversion --

MR. THORBURN: Conversion to permanent crops.

MR. GROBER: That there was certain thresholds -- can I pass this one off in terms of when -- when determination in terms of conversion as opposed to fallowing?

MR. ANDERSON: Well, we're starting with a 2010 baseline of crop use, and perhaps Tim can say it. We don't address --

UNIDENTIFIED SPEAKER: I feel like this is more of a Josué question.

MR. GROBER: Yeah.

MR. ANDERSON: We may have to defer that.

UNIDENTIFIED SPEAKER: He couldn't make it here today, but he'll be at the technical meetings, so...

MR. THORBURN: So it seems like you're using a lot of old data. So in your presentation, you used an estimate of what the available groundwater supply was in the basin. That was from 1960; is that correct?

MR. GROBER: That's -- that was provided to just -- there's always a concern in providing a number, big numbers like what's the current level, estimated levels of overdraft. And we presented those numbers, you know, what we came up with, two different ways, and then what is -- what could potentially happen with the increased levels of groundwater pumping based on the 2009.

There's a lot of assumptions in there, but to try to add perspective to those numbers, those levels of groundwater overdraft, that's the reason we just provided the only number that we're aware of in terms of what's the total, you know, yield of the -- the combined of the aquifer in the area. It's a very big number, but that's -- again, that's -- we disclaimed what -- how that can be used and how not. It shouldn't be taken as just a bank account that you can drain down.

MR. THORBURN: Right. But you did -- but you did do -- later in your presentation, you stated the amount that is currently being drafted from the aquifer, assuming that all the other assumptions that you made and inputs were correct, you stated a percentage per year that we're pulling now and a percentage that we're pulling in the future and gave us a perspective that basically this is how many years you have. But did you account for the years that have been pumped since 1960 and the draft --

MR. GROBER: This was just -- that's why I was just looking at those. That's the number that was out in the literature. Just --

MR. THORBURN: But if you don't -- if you don't correctly account for those, then you aren't correctly accounting for the economic impacts; correct?

MR. GROBER: Well, no. This is to provide -- this is a very big question. This gets to be the SGMA question, which is why this and other areas have a lot of work to do to determine what are the current numbers in terms of sustainability yield and how the groundwater will be managed. That's -- that's a much bigger question than what we have here with regard to the SED. This is adding one stressor to the overall SGMA question in terms of ground water sustainability.

MR. THORBURN: So getting back to the quantity question, the 2003 Bulletin 118 boundary analysis was used as the basis for estimating the agriculture that is outside the improvement -- or the irrigation districts; is that correct? So was there any look considering the fact that a lot of that east side ag and that -- in our area specifically -- and some other districts around us outside of this district, there's been a lot of development. You used 2003 numbers to estimate that ag and that demand; is that correct?

MR. ANDERSON: It was the 2003 boundaries that were established by Department of Water Resource but 2010 land use data.

MR. THORBURN: So there were no trends since 2010, and no one else has -- since 2010 of what has occurred out in those areas?

MR. GROBER: This is -- this project -- this project -- this is -- the proposal in this project is not SGMA, and it's not about --

MR. THORBURN: But it goes into the impacts and how those impacts are quantified; right?

MR. GROBER: But --

MR. THORBURN: So the information's important in utilizing those --

MR. GROBER: Well, what we have to find is the relative impact, the relative change. We don't know those absolute numbers, and to the extent those absolute numbers, that would certainly inform SGMA and other things that need to happen. But we're showing how the relative number -- and we've provided some relative numbers. I think your point is, well, the -- I think what you're saying is that the level of overdraft is actually much greater than some number that we've presented. And that --

MR. THORBURN: But my point is the number that you used doesn't appear to be accurate. If you're using a snapshot in time and it's 2003 and 1960 --

MR. GROBER: I would ask what --

MR. THORBURN: You have 2012 plans versus the 2015 plans.

MR. GROBER: What is the -- what is the intent or what's -- how does that question inform what we're doing? Because I'm -- and, again, I'm not -- I don't want to put words in your mouth, but I think what you're suggesting, and I think I've heard others discuss that, that there's been much more groundwater pumping going on the east side in areas that don't have surface water supply and, therefore, some of the information we have isn't the latest in terms of the current level of overdraft that's happening in the basin.

That -- perhaps that's the case, but if there's information like that, I'd say two things. That's going to be very important for SGMA, and in terms of informing the policy decisions, that would be a comment to make as part of this process, but I don't think that it changes the nature of the assessment or the impact analysis for what we've done for the -- for the SED.

MR. THORBURN: Yeah, I disagree. I think that if you have old data for supply that's available and for really the demand on the aquifer, I think that's a big problem with -- affecting your economic analysis.

MS. GAO: Just to clarify it, we didn't use the 1960's total storage number in any of our models. That number was provided in this presentation to give everybody a general context of how the -- our estimated overdraft compared to the total available water. So we never used that number in our assessment. And, also, we -- we never used the estimated overdraft in our assessment. It's just to provide us a context of what is happening.

MS. LIEBERSBACH: Could you explain why in the agricultural impacts analysis it wasn't considered what impacts there might be outside of the five irrigation district boundaries? Because the other analyses recognized that there's a larger basin and those areas rely upon the groundwater that's being recharged within those districts. And so it seems to be missing as a part of the impact analysis.

MR. GROBER: You probably will -- if you haven't -- if you're not hating it already, you'll probably hate it even more. This is -- it's a programmatic analysis. We've done much more detail than generally is done for such things, but the -- when we look at the effect, it's a total water supply deficit. And we've looked at the ag -- the cropping effects and their -- the ag economic effects focusing on the districts. To the extent that that would be -- there would be a shortage, something outside of that area, it would be similar but not significantly different or bigger effect is what's built into the analysis. So it's --

MS. LIEBERSBACH: But isn't it a cumulative? I mean, if you're going to have the impacts in the district, you're also going to have impacts outside of the district and so it's -- you're missing --

MR. GROBER: I wouldn't (unintelligible) it's cumulative for that. It's the total -- we've identified the total water supply effect, and from that, the total cropping and economic effect. Where exactly that will be happening, it could shift. Some might be more out of district and not within district. Because it's an important point both for this but also for SGMA, it's curious.

This is why it's another thing to wrestle with is I'm not sure if the point was driven home in the slide that Tim had shown. The districts themselves for the most part currently now provide significant recharge to the aquifers, and even under this proposal would continue to do so until you get to the higher end. And particularly Merced Irrigation District would start drifting into not necessarily recharge at the 50 percent, but where exactly these water supply effects and where the ag effects would occur, it's going to be somewhere within the plan area but where exactly is getting into a detail that would be speculative to determine.

MR. WARD: Just a time check. We're five minutes -- we've slipped five minutes on our schedule. So we're doing pretty well.

Dave, do you have any follow --

MR. ROBINSON: Yeah, I do. I'm interested in crop production. You know, the groundwater within the area is of varying quality. What process did you undertake to assess the impacts on ag production from the increased use of poor quality groundwater?

MR. GROBER: You know, I think we might need to check that. I don't think that we -- we looked at that, we determined anything about the quality, though I'd have to check that. That's a -- that's -- I don't believe -- someone correct me if I'm wrong, but I don't think that we made determinations about changing water quality with regard to the surface -- the flow element of the proposal.

MR. ROBERSON: Yeah, hi. Mark Roberson with ICF, and I worked on the ag resources chapter. And regarding a change in groundwater quality for suitability for irrigation, we did look at what -- I believe it's in Bulletin 118 -- we had for background information and did not see that it was a significant issue with irrigation. But if there's other information, you are welcome -- we welcome it.

MS. PHILLIPS: That's very curious to me because my growers also have to pay Water Quality Coalition to measure the quality of their groundwater, and they're consistently being told that they need to do better and that dilution is the solution to the problem. Now you're not getting any surface water that we can recharge that groundwater with, and then you're having to recycle it and pump it -- and pump the lower quality groundwater onto the land. And that's going to cause an impact in crop production.

MR. WARD: I had a question, and then I think we'll take about a ten-minute break and then we'll bring up the large urban -- Michael, I saw you out there somewhere. Yeah, here you are.

In your demand forecast, and you show the deficit, lack of surface water, pumping more groundwater up to the capacity, 2009, 2014, that discussion, that demand forecast is fixed; right? And so that crop demand, is it ET replacement with applied water efficiency? In other words, in your SED, do you take into account -- do you do anything on the demand side? Do you assume some conversion of the irrigated method to drip and micro away from what is irrigated today by flood? That's one question. And if there's a yes to that, did you consider then the loss of recharge to the basin as a result of the shift in irrigation methodology?

MR. ROBERSON: I'll go ahead with the irrigation question. We -- we assume using the DWR's applied water, which encompasses different efficiency practices and kept those --

MR. WARD: Okay.

MR. ROBERSON: -- as they were --

MR. WARD: But did you assume any demand reduction in the region as a result of -- as one of the speculative responses to the lack of surface water, that there would be, I'll just call it, a reasonable response to shift to more efficient application methods, therefore, reducing groundwater recharge?

MS. HUBER: I'm pretty sure that there's a discussion of how increased efficiency is a likely response to reduce water supply.

MR. WARD: Did you assume (unintelligible)?

MS. HUBER: It's not built into the calculations.

MR. WARD: It isn't? Okay.

MR. GROBER: No, and --

MR. WARD: Will looks like he wants to say something.

MR. ANDERSON: I'm not sure that it will be satisfying, but the need for applied water incorporates the actual ET demand and then excess either, you know, leaching or otherwise a percolation that does occur as part of the process. The surface water has efficiency issues to get there, but we've assumed the rates that we've seen published based on that snapshot in time in the management plans. The groundwater application is at the field and without -- it's assumed to be at the field, just to simplify things; whereas, some of it might be into a conveyance system and lost, but there is a greater efficiency there. But, again, the rates are the same.

Back to Les's original point. If we take the reduced surface water, it's either going to have an effect, so if -- if the district takes the cut, then they'll -- there would be a major -- you see the maximized economic impact. If the district gets more efficient, then that passes the impact along to the groundwater basin.

MR. GROBER: And this is an interesting and very important question. And I heard this came up with -- you know, I was fortunate -- a meeting just earlier this week in front of the San Joaquin County Board of Supervisors, where, you know, an observation was made. You know, lot of investment inefficiencies and drip and conversion, things like that. Then all of a sudden you start noticing, well, now groundwater reach (unintelligible) has gone down, so this is -- but it's a zero sum gain with that. And it's like, though, you can -- you could achieve some goals by becoming more efficient, but in an area like this where there's already successful conjunctive use of water going on, that, you know, it only gets you so much.

There's the efficiencies, of course, and that's -- you know, and there's methods there when -- I think we're going to be hearing that, you know, we should have identified some of those things to show how you would reduce the costs and the economic costs and ag costs here because, as we know, there are some methods of applying water inefficiency where you can do both. You can just cut down on the, you know, the evaporation of water so you're -- you know, you're not cutting down on groundwater recharge and you're using more just to satisfy directly the drop ET requirements. But those are the smaller margins, you know.

It's like it's not as simple as saying move from flood irrigation and everything is great because, well, you'll maybe use less water, less water in the moment, but you'll also get less recharge. So it's a problem this and other areas will have to wrestle with, but we didn't -- and for that reason, because this all gets very complicated and what exactly is going to happen with this, we did not look at that level of detail.

That being said, I think we make a comment in there to the extent that you can employ water efficiency methods that don't result in the reduced recharge, or if it does, at least you're gaining those gains in terms of reducing evaporation. That's where the gain is. If you improve efficiency in that way, you can get more with less.

MR. WARD: All right. Let's take a ten-minute break. By the clock on the wall, it's 12:04. Let's be back here -- 11:04. Let's be back here at 11:15 and reconvene with the -- and we're going to shift gears to drinking water.

(Recess.)

MR. WARD: Okay. Everybody take your seats. We're going to get going again. Okay. We're going to get started now with a smaller panel, but that doesn't mean that it's any less important; right? And this is the -- what we're calling the large urban. This is the city water supply.

And representing here today to your left is Ken

Elwin who's public works director with the City of Merced. Sitting next to Ken is Larry Parlin with the City of Modesto, and then Michael Cooke with the City of Turlock. And they've been asking and graciously agreed to sit on this panel to talk about impacts of the SED and the shift in additional groundwater pumping and how that would impact their city water supply.

So, Michael, I'll let you kick that --

MR. COOKE: I'll be happy to kick it off. I want to start -- and (unintelligible) I want to thank you to the State Board. We met with you a couple years ago and found that the earlier version of the SED didn't even consider impacts to urban suppliers of the -- of the proposed flow proposal. So thank you for Chapters 13, 16, and 22. They provide a lot of information on how we would be impacted, but with that thank you comes a concern that when you start analyzing those impacts, they're significant and, as you say, they're unavoidable, and that raises some significant concerns for us.

With my background, I'm a geographer by trade. As a little kid I used to like watching *National Geographic* shows. And I always remember watching the shows of those poor African kids with a standpipe pumping the water and care -- with coffee cans and milk jugs, whatever else to carry water around. And when I read this SED, I see something very, very similar that you say people in rural areas may have to switch to bottled water. There will be significant impacts to residents, declining groundwater quality, a whole cavalcade of events, and we're knowingly and deliberately creating that impact in the San Joaquin Valley. And that to me is beyond the CEQA impacts, and that stuff is very concerning as a resident, someone who lives here.

So I want (unintelligible) to Larry Parlin to start with and talk about how water under the California Water Code, that the highest and best use is municipal supply.

MR. PARLIN: Thanks, Michael.

Well, one of the things that we're concerned with primarily in Modesto is we contract for surface water for treatment for our water supply with the Modesto Irrigation District. And under reading the water code, when you're contracted to an irrigation district, then that water is not considered the highest protected water for domestic use for your urban suppliers. So, you know, how -- did you address that in the SED or why did you not look at what the highest and best use of water is?

Because the water code recognizes that drinking water is the highest, best use, but it's not necessarily the case when it's supplied by contract from a supplier. Did anybody take a look at that, how the drinking water is procured in the region and whether or not the irrigation districts could, in fact, reduce the supply to the urban water community?

MR. GROBER: I'm not sure -- when you say, "take a look at that," meaning what would be the effects of reduction in water supply or --

MR. PARLIN: Reductions in water supply to the urban users. Because the primary focus that everybody is talking about and is appropriate is the agricultural community, and that's important. However, there are not -- Modesto is not the only urban water user that gets from an irrigation district in the local area. You have the cities of Manteca and others that get it from South San Joaquin Irrigation District.

So did you look at the protection of that drinking water supply going forward as -- for the urban water users, or are you just considering this all as agricultural water use and not looking at the fact that the urban water users do use some of that water supply?

MR. GROBER: As you pointed out, we identify the use in the -- in the documents, and that's why we identify -- and, again, it's the -- much of the same unsatisfying answer in terms of, you know, the speculative elements. We talk about, you know, water conservation, you know, what's happened in recent drought periods in terms of, you know, reduced reliance on water, what can be achieved. We also talk about water transfers and sales of water and the costs of water, marketing of water. So those were all things that -- you know, what the exact mix of that will be is, you know, cannot be determined with specificity so it would be speculative.

But there for the cities, because it is the highest use of water, and I think we even have language in our water quality control plan in terms of, you know, protecting health and safety, things like that, there's -- there are opportunities for purchasing water and for water to get to cities.

MR. PARLIN: Well, I would -- yeah, I think to frame it a little bit better, we might -- we might comment that we've had to be very specific in the cities in long-term planning (unintelligible) regional water management invested hundreds of millions of dollars, still are currently working with the State Water Resources Control Board on these projects. Also looking forward to -- which entails our growth. We have hundreds of millions of dollars worth of infrastructure existing, and so going forward, this was all planned and accommodated, not only the available surface water supplies that we have contracted for, but the conjunctive use, protection of the groundwater, the delivery of recycled water to the agriculture community. All these things were planned on, conditions that were ascribed, and now a change in that surface water will have a dramatic impact on that.

And then earlier you mentioned the groundwater. Well, you really didn't consider water quality, but at the same time we've tried to do the integration, groundwater quality is a huge concern for the cities because on the other side of your building, they're implementing new MCLs for new constituents which are going to further limit the groundwater supply or require hundreds of millions of dollars more in treatment. And I don't even think the SED addressed the future MCLs that are coming or the potential for future water quality issues. And those have a huge economic impact going forward for the city.

MR. GROBER: We did consider, you know, the general plans in terms of cumulative impacts, you know, growth that's going to occur in the area, but I mean I just -- just because of the comments that I heard, you know, this is -- because there's an audience here as well, I just want to bring us back to the proposal and the -- the background upon which that proposal is being made.

The current withdrawals from the river are at times taking out 90 plus percent of the February through June flows. So this proposal, getting back at its core, is about maintaining a certain percent of unimpaired flow, 30 to 50 percent, for February through June. That's just a portion of the year. So it's just putting a portion of the total water supply back towards the fish and wildlife beneficial use to reasonably protect the fish and wildlife beneficial use.

Stemming from that then, it has a water supply effect on the entire area for ag and municipal that we identify, but I just want to make sure to make that comment because that still means that there are going to be the opposite of that, that range of unimpaired flow, that 30 to 50 percent. It means that the opposite of that, that means 50 to 75 percent of the flow February through June, plus the whole rest of the year, is still available for consumptive uses: for agriculture, municipal. So this is a very rich water area. Add to it that you have storage capacity in wet years, things like that.

So this -- the whole SED and the analysis does not get away from what are very real impacts to ag and water supply, but there is a lot of water in this basin to work with, and we think that we've identified the potential effects, the costs. We identify the costs of purchasing water for cities, things like that. But if you have more -- if you have comments and policy considerations that the board should know about, that's something that should be provided in written and oral form at the upcoming hearings.

MR. PARLIN: And it will. I appreciate that. You know, the fact is, we are blessed with a good water supply in this basin; however, just since 2011, because of the reduction in surface water supply due to the drought, our groundwater levels have dropped about 10 feet. And that's after tremendous recovery when the surface water went into conjunctive use in 1995.

On the economic front -- and our people have done a great job managing the water around here as well, but they're also paying a premium price now for the cost of water because of mandated reductions by the state on the other hand.

So I think those are important things that will be addressed at the board hearing and as a policy, but they -- also they play into the availability of water and all the planning going forward for the future vitality of the city, the existing population, the existing businesses which, by the way, is prime -- the biggest employers are food and beverage processors here, ag-based industries, is really important to consider, and it looks like -- it doesn't look like it got due consideration in the SED, so...

MR. GROBER: And, again, for the policy considerations, it's going to be important to make that then -- those comments before the board. But I can't emphasize enough -- because we agree about a lot, but this is -- really gets at how much we collectively as a society value water. And we value it for doing, you know, lots of things.

In the parlance of our board chair, which he says all the time, how do we maximize the beneficial use of water? It's really how do we get the best bang for the buck. And here we have this very real need to protect fish and wildlife, and this document, if it does nothing else, it shows what the costs are of doing so. But it's a cost that the policy decision before the board, is that -- are those costs reasonable?

And some of that cost will fall, as we described, to the affected area, but when I hear about the costs of water, we work -- you know, throughout statewide, this area, because of foresight and developing the water projects here is very fortunate to have very good water supply, but we've also seen during the drought how both in the cities and ag rises to the challenge, you know. I've seen some of the high crop production numbers, you know, values that, you know, through the drought we survived and actually excelled. And we've seen water conservation happening here in the cities, and I'm confident that that will continue to happen. This is -- but this is clearly adding another stressor to the area.

MR. COOKE: I'm going to add to Larry's point. You know, the cities around here have cut back use over the last 20 years probably 40 percent on a -- (unintelligible) per capita per day basis, but we're still seeing the aquifer decline. Like you said, it's a new stressor. The state, basically to mitigate that stress is -- you know, the local agencies need to involve this problem for us and there's two ways: one, through reduced consumption through SGMA, so things like that. And if you know the -- you know the SGMA deadlines as much as I do. You have until 2040 to reach sustainability. You add this in, I don't know how we get to that point. And that's a long -- a lot of bad things could happen by 2040.

The other issue is it talks about in a number of projects the cities need to undertake to keep supplying water to their citizens, like transfer sale of service water, substitution service water, groundwater, aquifer storage and recovery, recycled water sources, in-Delta diversions, desalination, and new surface water supplies. I don't know how we build those in an area that's economically depressed like this one. Okay? People can't afford 100, $200 for their water bill. It's simply not feasible.

So the economic impact and analysis hasn't been done. But if we're looking at -- I would love to be able to purchase some surface water, but after this proposal goes into effect, I don't know where we get that water from. I think the SED has failed significantly in that chapter to look at, okay, if the cities want to bring in new supplies of surface water to (unintelligible) transfers, where does that water come from? It certainly doesn't come from any tributaries of the San Joaquin River, and it can't -- it won't in the future come from tributaries to the Sacramento River because you're working on Phase 2 already of this.

So I don't know where there's this huge pile of water sitting around that somehow cities can magically transfer to their region and turn its drinking water to offset the impacts of the SED. And Larry and I have been involved in one of the single largest recycled water conveyance projects in the country, not just the state. If you ever tried to get one of these things approved, permitted, and developed, it's incredibly expensive and incredibly time-consuming. And just to say, hey, just go solve it with these -- with these answers, I don't see how we can necessarily do that. I know it's policy and CEQA wrapped up together but, again, the state says, you know, the -- we -- you know, we're creating this issue, but we can't solve it because we're not in charge unless these local agencies drill wells, local agencies develop drinking water plants and, therefore, it's up to them -- up to them to solve that problem.

And that's a fundamental problem with the SED, just keeps deferring that mitigation for someone else to take care of. And, you know, you really need to follow up with your legal counsel because CSU Monterey Bay went through this exact same thing with the City of Marina. They said: We're expanding our campus. There will be horrendous traffic problems in the City of Marina. They'll need new traffic signals. There will be new impacts.

But CSU Monterey Bay said: You know what? We have no -- we have no control outside of the campus. That's up for the city to solve that problem. And they lost in court, and the state -- state appeals court said, you know, it's up to the state agencies that's creating that problem to go to the state legislature and ask for funding to mitigate their impacts. And I think you really need to consider that. It's called the Marina dictum.

Now it's just upheld again in City of San Diego. Same thing, university trying to expand, not offset its impacts. And what you're trying to do is push the mitigation for your impacts onto other people without willing to kick in the money. And I know in Chapter -- a chapter at the end, it talks about, hey, there's Prop 1 money. There's Prop 64. There's Prop 84. Just apply for that money. If you've tried in this region to get that money, you know how hard that is. It's competitive. It helps to be politically connected, and unfortunately we're not. We struggle with that.

So to say: Here's the impacts, it's significant and unavoidable, here's what the cities need to do to solve this problem, I think you're really missing something there in the document. And that's what we'll be following up with later with our written comments.

MR. WARD: Could you repeat the question? It was a joke.

MR. COOKE: The question is what -- is specifically how much money will the State of California give these three cities to solve the problem associated with the SED to improve their drinking water supply that you admit will start to suffer once the SED goes into effect -- or the flow proposals go into effect?

MR. GROBER: We can't provide a dollar amount. We provided in one of the earlier slides, you know, different prop money, water that -- money that would be available. I'd rather like to answer the question, because I didn't spend a lot of time on it in my introduction, if the cities are not part of the discussions that are happening with regard to settlement -- because that's an important part of this. The -- it's important part of settlement. I encourage you to do so because it's important to the administration. It's not something that the State Water Board is leading. We're proposing flow objectives here.

There's also -- there's actions going on, as you referred to, in Phase 2, the rest of the Bay-Delta. The administration is very interested in achieving settlement with regard to these because, as I said, that will provide the durable solutions to these problems, both to reasonably protect the fish and wildlife but also how -- how do you get at some of these big-picture solutions?

So if you in the cities have not been involved in those discussions, I know there's -- in reaching out to the districts and the counties, that I encourage you to do so because I think the cities are an important part of those discussions.

MR. ELWIN: I'd like to add to -- can you hear me? Sorry. I've been sitting in the audience this morning listening to all the comments from the -- from you and the panelists. And living in the city of Merced and the county, unlike Modesto, the city relies solely upon groundwater. I mean we do have a urban water (unintelligible) plan that talks about conjunctive use of the Merced Irrigation District. I guess for the most part what I've been hearing, it seems to go back to, well, your plan is speculative, it's programmatic. Yet still we have a nonspeculative take of 40 percent of surface water that impacts us starting from the agricultural point of view. If there isn't surface water for them, they're going to be pumping more groundwater, which affects us, affects us as a city from a groundwater quality perspective, also from lowering of the groundwater table.

We do have our general plan that goes to 2030. I know earlier I think Ron Rowe sort of asked what is the timing that you guys evaluated, and I (unintelligible) said that you guys went up until probably 2020 because it got punted to the SGMA. Everything sort of falls back to SGMA. You guys didn't really evaluate what the worst case might be with SGMA kicking in. It seems that it was left to the cities to come up with the details on how we're going to mitigate against the 40 percent take of surface water.

I really think that's really unacceptable because if we were doing a project like that, we couldn't say we have speculative and it's programmatic. We have to be more conclusive on the long-term effects, and I don't think the SED does any justice in trying to figure out what those long-term effects are going to be for cities like ours which (unintelligible) communities.

And you said you can't quantify what those long-term water quality effects might be in the localized areas, which is still unacceptable because what that does for us is we have to know -- have more for the treatment facilities to treat those waters, and that's going to impact (unintelligible) which we are in economically disadvantaged communities. That's going to affect those people. How -- how do we mitigate against that? It doesn't address it. It just says there's going to be significant and unavoidable consequences. I don't think that's acceptable, so...

MR. GROBER: The document does describe, you know, a suite of actions. I already mentioned, you know, transfers, you know, there -- you know, there's different aquifer storage recovery. I just had a side conversation here. Again, these are things that are positive, but they are still in the details certainly speculative. But the area is water rich, and so one of the solutions would be enhanced groundwater recharge in wet years. There's been kind of basically a passive conjunctive use that has occurred in the area just because of the nature of the distribution systems and the way water is used. But with more active recharge, there can be gains there.

That all being said, what's continued to be the unsatisfying answer is that this is all speculative. But the point I would make again is that as SGMA identified and as you're very well aware, they were -- already there are some issues, depending where you are in terms of groundwater and overdraft, things like that. As disclosed in this document, this will increase some of that. It adds to that stressor based on our observation of the response to the reduced surface water supply. So that is something that I think is best and must be handled by the local area.

MR. PARLIN: Yeah, I guess I'd follow up with the fact that we -- which is a good thing. We measure every drop of water now. We know where every drop of water goes. We report that to the state now. So we have to be very detailed in our numbers. And what I heard earlier was that, well, you have these averages and you have this and that number, and it's going to spread out over that. And the level of detail that we're dealing with to manage our water supply in our local water area is incredible, yet the SED is going forward with these numbers that are -- just appear to be pulled out of air. Well, that number works so we'll use that number, and we'll estimate this number and that number. There's a real disconnect there from the cities' perspective.

And I'd also just follow up with in your groundwater recharge in Modesto, we already did a large storm drain project with (unintelligible) and will be accepting a $5 million Prop 84 grant next week to do another one, similar recharge of the park. There are issues going forward with water rights battles over storm water. So -- and I don't know that the state's even considered that yet.

But there are large water districts in this state that consider runoff that's been historically there as part of their water right. It's been appropriated or riparian. That's -- that's something else that has to be looked at as well before we go and invest hundreds of more millions of dollars in different projects and someone else up in Sacramento: Well, that's not your water; you can't take that water. So we have a number of concerns that those things haven't been looked at.

MR. COOKE: You mentioned new water -- new surface water supplies. Chapter 16, starting on page

16-75 talks about new surface water supplies cities can maybe invest in to augment their water supplies. And the City of Turlock's a partner with the City of Ceres and the Turlock Irrigation District looking at a project that may now potentially not be happening because of the unimpaired flows.

But one of the things you don't consider is raising the height of some of the local dams like Don Pedro, Exchequer, New Melones to increase storage in existing reservoirs, which could then be captured and used for cities and irrigation districts for municipal and irrigation supply. So you talk about developing new reservoirs and how that's speculative and difficult (unintelligible). We have existing reservoirs that (unintelligible) irrigation districts talked with over the years that potentially increasing the capacity in those by raising the height of the dams. So, again, that's something that I think really should be analyzed in the document.

MR. GROBER: Though we didn't explicitly look at those, again, specific projects, we did look at and evaluate just increased storage in general. But, yeah, we didn't look at the, you know, any specific proposals to enhance the storage of any existing reservoirs. So I think that might be covered in terms of that's one mechanism is increased storage.

MR. PARLIN: Also would just like to point out on the cost basis, once again, another arm of your agency is now putting together a low-income statewide water rate discount program. So while you're -- you're recommending in the SED that we go out and do these projects and go ahead and fund these things, you're also going to require us now to not be able to charge the full cost of service for a certain constituency.

So, once again, we have -- you know, on one hand we have you telling us build these projects. We can't fund it but, by the way, you can't collect as much money. We've got you telling us don't use, you know, use more groundwater but, by the way, we're going to increase the water quality requirements so that water may not be available, but it's going to cost you a lot more money.

So there's diametrically opposed objectives coming out of the State Board right now, not to mention the SGMA, that they're really -- as an urban water supplier, you can't manage those objectives the way they're being proposed.

MR. COOKE: And just -- one of the things the SED really misses, it kind of brushes over groundwater quality. It says, well, we looked at your Consumer Confidence Reports for 2014. We didn't see an impact from the drought. We assume there's no -- there's no relationship between declining aquifer levels and water quality. I disagree with that. The 2014 CCR's will be 2013 water data. We've had three years of drought since then that have exacerbated water quality conditions, at least I know for the City of Turlock and other cities in our region.

So we have seen an impact from the drought. It's not captured in the SED because the data you used was too old, is when the drought was just kind of starting to take hold. But if you look at -- we keep track of our wells to see which ones are within 80 and 90, 95 percent of the MCL. Those numbers of wells have increased. So we've definitely seen a decline in groundwater quality as aquifer levels have dropped. I don't think that's picked up.

And as we mentioned earlier, since that time we've had (unintelligible) six regulations proposed, 1, 2, 3-trichloropropane regulations. So those things are known issues. They have not shown up in the SEDs. It's that -- again, that gets brushed over really quickly, the groundwater quality stuff using that general assumption that we looked at some cities. The 2014 Consumer Confidence Reports didn't show anything. I think you need to spend a little bit more time with that. And, again, the Division of Drinking Water has a ton of water quality data through the electronic data transfers we do. You could delve into that and see some of the trends.

MR. GROBER: We -- we -- I thought we did look at the Division of Drinking Water water quality data, the recent reports, but I mean we'll take your comment and we'll -- we'll review that. But I was under the understanding that we checked the recent information, even a response to the drought, but I think I'm hearing you saying that even the most recent now, just in the last year or two. Okay.

MR. ELWIN: I think that we --

MR. WARD: I have a question. Can you hear me now? Okay. A little bit different than their concerns and back on the ag side. And you looked at the planning horizon, 2040, 2042, sort of tied to SGMA; right? A fixed demand ag that was unmet surface water depletion made up by groundwater. On the urban side, did you do any demand forecasts growth like tied to the general plans or -- and is that addressed in the SED or is the demand for urban flat?

MR. GROBER: No. We considered that and in the general plans and the cumulative impacts.

MR. WARD: Okay. So growth is included in there?

MR. GROBER: Yes. Yep.

MR. WARD: Okay. I -- and that's where? In what section?

MR. GROBER: In the cumulative impacts.

MR. WARD: Cumulative impacts. The other one was the -- in relation to this 125 million acre-feet, the 1960, you know, that's a pretty darn gross number. So did you look into the -- as a means of mitigation, ASR you mentioned. Did you evaluate the base to freshwater and recalculate what that actual available yield might be? Did you consider -- I mean the 125 million acre-feet is just a very gross calculation over -- you know, it hardly makes sense. But what did you -- did you really take a look at the reasonableness of these alternatives that you're expecting these people to explore?

MR. GROBER: That seemed to change the question. We -- the -- we provided that number, and a citation to that number provide some perspective in terms of -- and limited. That's why we just --

MR. WARD: But did you look at the base to freshwater? Did you consider that in any part of your analysis?

MR. GROBER: Well, that -- that was in part of some of those estimates, looked to the base of freshwater, but we didn't try to independently calculate our own or -- and we're not aware of information that has come up with a better recent estimate.

MR. WARD: Okay.

MR. GROBER: To the extent you have that or that's available, certainly providing it, but also providing it, the relevance of it, becomes important because what we've already described that though that's a big number, we would expect to start seeing problems like subsidence and water quality --

MR. WARD: Well, before --

MR. GROBER: -- and lack of available well before. That's not -- so it's -- but it's -- but the reason for the perspective is that -- and there's some sense, I think, and this is not a SGMA -- this is not a SGMA project proposal. I think we've made that clear. But there's opportunity, especially in this area, that has, you know, generally good water conditions compared to many other areas of the state, depending -- and depending on the specific area, but both within the horizons of SGMA and also within the planning horizons of when we update the plan, there's -- there's both opportunity to make major improvements, respond to and in the implementation of the flow objectives to see what happens, and then we would be updating the plan, as we periodically do, based on new information and new conditions.

MR. WARD: Okay. Thank you.

Michael, you got --

MR. COOKE: No.

MR. PARLIN: Well, I just want to follow up on the comment. It's not luck that this region has a good solid supply of water. It's through good management and proper management throughout the region that we're in the situation that we're in right now. And, you know, it's similar to the 20 by 2020 that we went through before where we all reduced and we -- we all conserved water and we met that goal ten years ahead of time almost. And what do we get for that? A 36 percent mandated reduction in drinking water. Where if we would have dragged our feet like a lot of the other areas in the state, we wouldn't have been penalized again in further reduction.

So I think it's important not to look at, well, this area's got water so that should be a prime source of unimpaired flows, when, in fact, the reason we have water is because the people that have been here in the past and are here today have done an excellent job protecting that water resource, and they've also done an excellent job of planning the future with the availability of water resources. And what the -- what the unimpaired flows will do will pull the rug out from under all those efforts going forward and have a huge, devastating economic impact. Sorry for editorializing.

MR. GROBER: But I -- I have to loop it back to the proposal again, especially because we're not discussing the fish benefits part. We're not really discussing the nature of the proposal, but this speaks to why this is so hard. This area has done a fantastic job of developing the local water supplies. You know, you've got three great reservoirs, great supply, conjunctive use of surface water, groundwater. But in some ways what this proposal is saying, you've done such a good job but you've taken too much of the water out of the system so that the fish and wildlife beneficial use is no longer being reasonably protected. So that gets at the crux of this proposal. How do you bring it more back into the balancing? And that's the very hard thing this board does.

And to put that in perspective, again, the numbers that I'm citing for the San Joaquin River where a small fraction of the flow that would have otherwise occurred, that unimpaired flow, when I say again that sometimes in this critical period it's less than 10 percent; in contrast, the Sacramento River provides 40, 50 percent of unimpaired flow now under current conditions. So we're not even talking about bringing it up to that level.

But the San Joaquin has been so highly developed, that it's taken so much water out of these tributaries, that's why we have such a problem. And that's why the Merced, the Tuolumne, and Stanislaus, those are the tributaries that have the lowest returns of salmon, the lowest populations, the most critical condition anywhere in the Central Valley. So that's at the crux of this proposal.

And it's all about the balancing. How do you provide not absolute protection, but reasonable protection? And the entirety of this document acknowledges and discloses what we think would be the costs and how to inform this decision. So I -- so I hear all of your comments, but it's going to be important to bring that before the board, but that's what the board is wrestling with.

MR. PARLIN: Okay.

MR. WARD: Okay.

MR. COOKE: Just to make a final point. Page 1365. Drinking water source from domestic wells will be affected similarly, and it's assumed that those affected will need to find alternative drinking water supply such as bottled water or drill additional wells and the impacts will be significant. And then one of the side issues of this is it increases flows to the Delta, allows for increased CVP and state water contract removal of water. So basically what you're saying to people in the San Joaquin Valley, (unintelligible) bottle of water or leave that water in the river, and then that can go down to L.A. and Bel Air and the wet Prince of Bel Air can put more water in his lawn and you guys can suck up bottled water. It's just not acceptable.

MR. WARD: Okay. Thank you.

MR. GROBER: And I wouldn't be doing my -- what I think is my responsibility -- because I hear -- I hear a lot of local areas and concerns for water, but one thing that I hear, and I have to point out, we're all very good at, in our individual areas, of vilifying or pointing the finger at the other area. So that's one, and that doesn't serve us well because this is -- particularly here. How do we -- it's all about reasonably protecting the use in the San Joaquin.

What you just mentioned, Mr. Cooke, it's suggestive of opportunities for how can this be managed, how could it provide the seeds of settlement. But I see statewide all areas trying to do a better job at using water. So I just need to point that out because this isn't about -- because I've -- I hear the conspiracy concerns all the time that this is about something else. This is certainly not about something else. This is about reasonably protecting fish and wildlife in the San Joaquin River.

MR. ELWIN: I do have a question too. You say it's all about balance. In Merced County we're already designated as being critically overdrafted. And in some of the slides you have earlier this morning, with the 40 percent unimpaired flows, the recharge is being less. So how do you balance that? I mean without curtailing water use.

MR. GROBER: I'm not sure I (unintelligible) the question. How would you --

MR. ELWIN: Balance it. You say it's all about the balancing act.

MR. GROBER: Well, no. When I -- oh, when I was referring to balancing, now this is -- and that's maybe using shorthand. The tough job that the board has before it, it's balancing how do you protect -- reasonably protect fish and wildlife, recognizing that there is costs to other uses of water for agriculture, for cities. The decision the board -- before the board is that is it reasonable to provide 30 to 50 percent of unimpaired flow to protect the fish and wildlife beneficial use given these costs and effects on other beneficial uses of water. So that's the balancing that the board has to wrestle with.

MR. PARLIN: I would just add that I'm not sure everybody, at least in the urban range, has done that great of a job. You saw what happened when the State Board lifted the mandatory conservation rates, and 300 of the 400 urban water users went to zero conservation standard. And I don't know that that's necessarily a great job by all the urban water suppliers. And I think the people in this area did a remarkable job holding the line and making sure that people do treat it as a valuable resource. And they also did that at an increased cost, a significant increased cost here in the City of Modesto as our ratepayers. Rates went up 25 percent just this year, so...

MR. COOKE: And Turlock and Modesto, one of the few cities in the state that still have required reduction of water use based on the stress tests and the things the State Board developed. So most cities right away went to zero conservation. We have maintained our level, and I know the City of Modesto did. And I appreciate, you know, comments. This is a difficult balancing act.

MR. ELWIN: So did the City of Merced too.

MR. COOKE: Yeah, City of Merced, so...

MR. GROBER: Say good job.

MR. COOKE: Yeah, thank you. We're trying -- and, again, we're using less water than we did 25 years ago even though our population's grown 25 percent. I know TID hasn't expanded their service area. Don Pedro's the same size it was in 1976. But for whatever reason, something's changed, and you feel there's -- with the salmon, fisheries, I understand that and there's a need to look at that. But just recognize it does have impacts. They are significant, they are right now unavoidable, and I think we do need to work together to figure out how do we balance the competing interests so fewer people are harmed.

MR. WARD: Okay. I want to thank you guys. Obviously you'll be hearing more from the urban suppliers as we move into the future phases of our, you know, investigation and discovery.

So let's bring up the last group. We've slipped a little bit off the schedule, but I think we're okay. You know, as I'm hearing this discussion, there's a lot of overlapping themes and redundancies. I mean these issues all sort of merge; right? You can't just distinctly take them apart and put them in, you know, nice little boxes because they all link.

And so this last group is -- for the morning session represents the smaller urban and rural water suppliers. And Stan Feathers right next to me is with the Delhi County Water District. And Rachel Riess is with the Stanislaus County Department of Environmental Resources, and she handles a lot of the permits of these smaller systems and water quality issues and all sorts of water supply issues. David Odom is with Denair Community Services District, and Michael Jones is with the Keyes Community Services District.

So these are the faces of people that have the daily job of taking care of a lot of unrepresented people who have very limited resources, and these are the people that do that. And so they've got some information to share with you and some questions and, like I said, probably some overlapping themes. And that's okay because if you -- you probably need to hear it again from a different angle.

So, Stan, I'll let you --

MR. FEATHERS: (Unintelligible). How about now?

MR. WARD: Yeah.

MR. FEATHERS: Great. Well, you know, first of all, thanks for members of the state coming down to talk with us and hear us and hear us. And I guess, first of all, I'd just like to say that I'd like to echo some of the comments by the larger urban users because we have the same problems they do, but -- and, again, we have sort of a special set of problems that are different than theirs. And I say that because I've worked for some larger cities and I'm a general manager for a small water district, but I'm also a former retired city manager too. So I have a little bit of a diverse experience.

And small water districts, small entities kind of have a special set of issues they have to deal with, and part of that involves a limited technical capacity because we just don't have the staffs to deal with some of these issues as they come along. We do hire consultants, but we also are constrained by our financial abilities. My district in particular had huge rate increases on the water and the sewer side not more than a couple years ago.

And, you know, we've been doing capital planning for, you know, ten plus years, infrastructure development, and now we see these impacts as huge obstacles to continuing. You know, if -- from a practical perspective, if we have to go back to our ratepayers in another two years with huge, huge impacts, I mean, I don't even know if we can get that through the 218 process. And then where do we go from there? It places us at a tremendous risk.

We've also made tremendous efforts in -- to attract development, and if we cannot serve new development, then our area can be -- is devastated. And we're an economically disadvantaged area. We need jobs. We need influx of commercial. Under those kind of conditions, that's probably not going to happen. So just with that as an introduction, I'm going to go ahead and open some questions for members of this group. But it presents a huge problem for us, and we don't see any of those issues addressed in the SED, especially where it relates to small entities with those kind of constraints, so...

MS. RIESS: As Walt mentioned previously, I do facilitate the regulation of small water systems within Stanislaus County, and it's with that that I would like to frame some of my questions because in -- though I do admit that the SED is a very large document and a place where things can get hidden and maybe I didn't come across it, but as I was reading the applicable sections for the SED, I had great concern that the small water systems, and specifically meaning under 200 service connections, those that might be regulated by local agencies such as our counties do not seem to be reflected in this document.

And I appreciate the comments -- or the updates that you have made to reflect the large water systems, as Mr. Cooke had mentioned, but I'd like you to maybe talk to us a little bit about where in this document you're addressing the potential ramifications to water systems with under 200 service connections.

And I also wanted to ask about the 93 public water systems that you identified in your presentation earlier this morning. Where did you determine that number? Because in Stanislaus County alone, we have -- well, we have over 170 small water systems that are reported to the water boards. So just taking a snapshot of the small water systems within Stanislaus County, we have a very large portion that are not being represented in this SED, let alone in the additional counties affected by this SED.

MS. GAO: The 94 public water supplier that were mentioned in the slide were identified by -- through a GIS database published by the Department of Environmental Health, and they now integrated that portion now integrated with the Division of Drinking Water (unintelligible). And they have developed a database that shows all the public water suppliers in different -- throughout California, but that is a self-reporting database, meaning the service provider would supply that information to them and then they put them in that database.

So some of the small service provider might not have reported to them, and we might miss those service provider. That's why we said that we identified 94. We didn't say that (unintelligible) 94 in the four subbasins. And we -- and, also, we try to -- actually, less than 94 were identified in that database, but we try our other ways to identify more community water supplier there. And the point is that the -- those -- about 28 of them account for 90 percent of the entire water productions.

So there might be some that we miss, but the point is that we try our best to identify them. And those that we identify represent the majority of the water production in the four subbasins, and that number didn't really impact our determinations of the significance of our proposal -- significant impact of our proposal.

MS. RIESS: Okay. Well, I can appreciate that, but I will challenge that it should be looked at again because the data is available to the water boards. A hundred -- over a hundred -- I think it's 173 water systems in Stanislaus County are regularly reported to the water boards in the drinking water division. This is data that is available for you to examine and easily examined.

MS. GAO: We could identify those are within the counties, but we -- we don't really know if they fall into our planned area. But if -- but thanks for the comment, and we will go back and take a closer look at it.

MR. GROBER: Yeah, if you have that information, please, you know, provide that. But as Xuan was saying, this is -- it wasn't so much to get the count right but the total population within the plan area and the nature of small water supplies and getting that across. But if you have information about more of them within the plan area that should be name listed, please provide that.

MS. RIESS: Absolutely. I'll give you the contact with the water boards. I can give you that information. But the reason why I bring that matter up, why it's so important is, as you know, small water systems have a reduced number of BATs or best available treatment technologies that they can utilize in order to compensate for potential contamination to groundwater. That limits their ability to actually rectify any impacts on groundwater quality.

So I am bringing up the fact that these water systems are not fairly represented in this document because they are more severely impacted than the larger water systems. A large water system has increased number of BATs that they can utilize in order to bring their water into compliance with drinking water standards that aren't reflected with these small water systems. They also have increased number of sources that they may utilize in order to blend, to put off-line, or to bring online.

I think in your presentation you had mentioned that one applicable way of handling water quality issues would be to take a source off-line. Of those 173 water systems, there is a good majority of them that rely on a single source as their drinking water supply. It is not feasible for them to take a source off-line due to contamination and move forward.

And so, again, I implore you guys to drill down on the matter of small water systems and to reflect on the effects that it might have and, you know, understand that drinking water is something that people cannot go without. It is not Starbucks coffee; it's not optional. You must have that water to drink. You must have that water to flush your toilets. So it is very, very important that these 170 water systems be examined for Stanislaus County and for Merced County and any other county that's affected by this SED.

MR. GROBER: Okay. Thank you.

MR. WARD: I think that again kind of gets back to this question of scale and the lack of specificity with regards to the impact analysis and kind of overlooking these small systems that are really rigid and inflexible to absorb these kinds of hits. As Stan was pointing out, you know, just the economic resources, the staff resources are so limited, but yet they're -- you know, they count as much as -- these people count as much as anybody else; right? And we feel that in this analysis, they've -- they've either been just totally ignored or just sort of pushed to the side. We think they need a little bit more recognition.

David, I don't know if you want to --

MR. ODOM: Yeah.

MR. WARD: -- add into the Denair situation, but...

MR. ODOM: We just -- to echo what Michael Cooke said earlier about the water quality. We do -- we do have the same issue with certain contaminants becoming more -- increasing to the MCL level or half the MCL level. For us nitrates is the biggest issue, and we're wanting to know if there's any proof or disproof to using groundwater as the primary irrigation. Because less surface water, is that going to be something that you guys can see or deny is going to be an increase in our nitrates? To just irrigate with nitrated water over and over, as far as our data shows, is being a major cause in the nitrate increase for us.

MR. GROBER: Yeah, and I think we've identified that there can be water quality problems, subsidence problems, the need to deepen wells, but we don't get granular in terms of where, you know, those specific effects are.

MR. ODOM: Is there going to be -- is the state going to be giving some of these smaller urban communities a little easier way to get some of the grant money to do on-site treatment? Because they're very costly.

MR. GROBER: And that's -- I mean that would be good, to provide that comment. We've identified what -- their current funding sources, but I think this will be an important point to make to the board.

MR. JONES: So funding for -- we have an arsenic treatment facility about to start, and we are absorbing some of these small systems Rachel was talking about. And it took us close to -- I think it's almost ten years for this to happen. So is that type of thing going to -- I mean is it going to be able to be faster? Some of the small agencies don't have, you know, the expertise to handle all these things, and I'm just wondering if we're going to end up -- we're absorbing some small communities. Are we going to end up being absorbed by another water system? I don't know how that's going to work out.

We've raised rates on our community probably 200 percent in the last ten years. We're just going to have a lot of people coming back, you know, very, very upset. I don't -- how do we know that we're not going to get -- it's not going to cause us to be part of another water community down -- taking away the local control?

MR. GROBER: Well, this is -- again, we've described the overall -- you know, the overarching area-wide effects, and part of the solutions and part of the issues that you're raising are your current water quality problems and problems with overdraft. And it's related to SGMA, but this will be -- a lot will be falling on the local areas. But I think the big comment that I'm hearing is that there's concerns about how to pay for these things and the need for, you know, some help.

So I think communicating that -- communicating that to us is good. When I keep saying refer to the board, I'm not trying to say or suggest that we're not hearing it here in the moment, by the way, but it's just important -- this isn't part of the hearing. So it will be important to make those written and oral comments before the board at the hearing.

MR. FEATHERS: Well, you know, there's really no doubt that we'll -- we will do that because we see it as a hugely important issue for us, but, you know -- you know, what about the past infrastructure we've put in? What about our own capital planning that's been going on? What about the individuals in a disadvantaged community that will reach a point where basically they can't afford the rates impacts? I mean it's dev -- it would be devastating to a community.

You know, where do they go from there, you know? The uncertainty involved with it, you know, it's -- you know, I think that's an area that should be examined within the context of this report too. And, you know, how -- what kind of rate increases are we going to be looking at? I mean are we -- you know, is -- will it reach a point where, as Michael said, that we'll have to be out there looking at consolidation options? You know, is that our only viable solution?

And then at what point would -- would any entity want to combine with a smaller jurisdiction? You know, you see a lot of consolidations in the fire district area, but you don't see a lot in the water area. So it presents us with a huge level of uncertainties to deal with in terms of where we go and how we approach this issue to our boards and to our -- to our customers.

MS. RIESS: If I may, I'd like to circle back a little bit to the topic that Mike was talking about in regards to contaminants and resolution of that. In your presentation today, you stated that there's really not been data that suggested that there's been an increase in contamination due to the drought and, therefore, these -- increase in pumping to offset surface water supplies really shouldn't have any effect on water quality and, therefore, drinking water standards. And then I would like to reiterate Mr. Cooke's concerns in regards to that because I don't think that that is supported in the public -- the small public water system data.

We have been seeing an increase in contaminants, and a number of compliance orders have been issued within the last year, specifically for contamination resulting uranium, arsenic, nitrates. And, of course, the new regulations for the chromium hexavalent. And I think that those things need to be examined. Yes, there are funds for small water systems, but these projects that you have highlighted in your presentation today have been long, long in the waiting and still have not come full fruition for the water systems.

In Stanislaus County I worked on a number of projects for consolidation through several prop fundings, and of those, the six remain, you know, in -- on the track, and they're not in the foreseeable future coming to a close. That's a significant concern when we have clearly documented in this SED that there are potential problems and they're significant and, you know, not really something that will be mitigated and it will be the local agency's responsibility for resolving. But that means money. And if the Water Board's is not capable of getting that money out to the necessary parties, that is of great concern and should be examined.

MR. GROBER: Okay. Again, making those comments will be a good idea before the board. You know, just -- I -- another just overarching, you know, response to all this. We've used, you know, the best available information and, again, at a programmatic level. I'm hearing what you're saying, but if you think that there's information that we've missed that should be -- inform the decision, please provide that to us.

MS. RIESS: Certainly will do that.

MR. ODOM: And, Walt, I got one more.

MR. WARD: Yeah.

MR. ODOM: The other question is how can the State Board knowingly be the main cause of our basin, in particular being out of SGMA regulations for our GSP? So if we do go out of what the Department of Water Resources allows our GSP regulations to be to avoid the six undesirable results, how can the state be -- knowingly be the major cause of our basin going into probationary status and then ultimately paying the fees for extracted water to the state?

MR. GROBER: That's an interesting way of posing the question because to circle back again, the board proposal, the action is for an increase in flows in the San Joaquin River to protect fish and wildlife. In our analysis we analyze what would be a likely response to reduced surface water supplies, which would be additional groundwater pumping. So the additional groundwater pumping is not the action. That's not -- the board is not doing the additional groundwater pumping. That's our assessment of what would be the response to reduce surface water supplies.

It's an important distinction because it's -- so the short answer to the question, it's like the board is not causing the groundwater, you know. It's not a -- it's not a factor in the SGMA beyond what we've described here, what we think is a likely result and response to reduce surface water supplies. So the challenge for local committee or -- local community even before the SED, before the flow proposal is how to sustainably manage the groundwater resource. And now we have an added stressor of reduced surface water availability for February through June in certain years.

MR. WARD: That's the wildest thing I've ever heard you say because what you're saying there is that -- you're not recognizing the conjunctive use programs in this area that have been successful for decades and decades and decades isn't in part because of surface water. So now you're saying you take away the surface water, that's not causing increased groundwater because that's the local's response to not having surface water?

Just --

MR. GROBER: It's the way the question was phrased where --

MR. WARD: Well, I know.

MR. GROBER: -- it suggested that this is where causing us stressor something to --

MR. WARD: Well, no. What he was getting at was the disconnect between your proposal and the other side of the state through the legislature directing us to be in compliance with SGMA. It's back to the SGMA cart and horse. Is this driving SGMA? Is the surface -- is the SED behind SGMA? I need to figure that out.

MR. FEATHERS: Yeah, I don't know how you can deny that there's a causal link between the two things, you know. Because absent one, everything continues like normal. So there is an absolute link between the two.

MR. WARD: Yeah. Well, let's take a break for lunch.

MR. GROBER: It's the link that we've identified. We have current overdraft we believe as we've described, and we think it likely that this would increase the level of overdraft because of increased reliance on groundwater pumping.

MR. WARD: Probably so. I -- we're right on schedule. So let's take a -- stay on schedule. Let's take lunch. Everybody be back here at 1:00 o'clock. Those of you who have all served on the panels, only you, please join me in the back here. We'll give you some lunch.

We'll all get back here at 1:00 o'clock, and we've got from 1:00 o'clock to 3:30 to do the economic session this afternoon. I know I saw Dr. Smith and Jason Bass, and they'll be leading that discussion.

(Luncheon recess.)

MR. WARD: All right. Thank you for your promptness in being back right at 1:00 o'clock. It's always a good thing to start meetings at the prescribed time because then those that are late know they're late; right? Never wait for them.

DR. SMITH: Exactly.

MR. WARD: That's my motto. So this is the last -- well, the afternoon session. It's going to be broken into two pieces, both on the economic impacts, which is -- when you kind of roll all this together, it sort of becomes that question.

And so immediately to my right is Dr. Rod Smith with Stratecon. Dr. Smith is a -- an economist.

DR. SMITH: Yes.

MR. WARD: Right?

DR. SMITH: Economist.

MR. WARD: That's what you call yourself?

DR. SMITH: University of Chicago.

MR. WARD: University of Chicago.

DR. SMITH: Yeah.

MR. WARD: And then to his right is his compatriot at Stratecon, Jason Bass. And then farther over is Mark Hendrickson with the CEO's office, Merced County.

Is that correct?

MR. HENDRICKSON: Close enough. I'm the director of community and economic development for the County of Merced.

MR. WARD: All right. For Merced County. And are we expecting Don White from -- Dave White, excuse me, (unintelligible) business (unintelligible)? All right. We're going to get started. And with that, I'll just -- I don't have any other comments to open other than welcome back.

And, Dr. Smith --

DR. SMITH: Well, I believe -- what, they got 20 minutes or -- the agenda?

MR. WARD: That's exactly right.

DR. SMITH: Well, why don't --

MR. WARD: So you guys have an open 20 minutes --

DR. SMITH: You can save time.

MR. WARD: You have an open 20 minutes to make --

DR. SMITH: Right.

MR. WARD: -- a presentation.

DR. SMITH: And hopefully we don't have to put you on a timer.

MR. WARD: Thank you.

DR. SMITH: You're on the clock.

MR. WEGGE: Good afternoon. My name is Tom Wegge. I'm a resource economist for the consultant team for the State Water Board and was responsible for coordinating the various economic analyses that comprise Chapter 1A, economic analysis.

As a lead-in for our panel discussion, I wanted to first --

UNIDENTIFIED SPEAKER: Could you please use the microphone?

MR. WEGGE: Sorry. Testing. Better? Sorry. Did you hear the first part?

UNIDENTIFIED SPEAKER: Yeah.

MR. WEGGE: Okay. Well, like I say, as a lead-in for our panel discussion, we wanted to first provide you with an overview of the analytical process for the economic analysis, and then we're going to dive into in more detail the analysis of potential effects on agricultural production and the associated economics. This first slide provides a roadmap of the topics to be covered in our presentation this afternoon.

As indicated, I will first briefly address the regulatory requirements for the economic analysis. Then I will identify the purposes and goals for the economic analysis and describe the key resources that were evaluated. After that I will briefly explain the study areas that were used with a focus on the characteristics that we considered in developing the different study areas. And, lastly, I will identify the types of evaluations that we conducted with an example of the different components evaluated.

At that point I will turn things over to Tim Nelson of the State Water Board to walk through the specifics of the ag economic evaluation, a topic that we anticipated would be of primary interest today.

This next slide summarizes the regulatory requirements for the economic analysis. These requirements include both CEQA and the Porter-Cologne Act. Under CEQA, as many of you know, economic analysis of effects is not required except in certain situations where economic and physical effects are closely linked. An example of this would be a highway realignment project in which a downtown area -- downtown business area may not be directly affected by the highway project but could lead to reduced economic activity in the downtown area which then could result in some subsequent physical deterioration of the area. So this would be a situation where CEQA would expect there to be an economic analysis.

Also under CEQA, the lead agency for the environmental compliance document can decide to expand the scope of the economic analysis. In California, the Porter-Cologne Act has codified -- has been codified into the California Water Code, and there are two provisions of the water code that specifically address the need for economic analysis.

The first is Section 13141 which states that estimates of the total cost of a program and sources of funding need to be considered when developing new water quality objectives. The second relevant provision in the water code is Section 13241 which states that economic considerations need to be addressed when developing new water quality objectives. In practice what this typically means is identifying and estimating costs to affected parties and looking at potential effects on local and regional economies.

The next slide identifies key underpinnings of the analysis. First, the purpose of the analysis is to compare potential economic effects on a particular resource across the project alternatives. As shown in bullet 2 on this slide, the primary goal or reason for doing the economic analysis is to inform the State Water Board in its consideration of potential changes to the 2006 Bay-Delta plan.

The next slide identifies the different resources that the economic analysis focuses on. As shown, the first one hydrologic conditions which provides the driver for analyzing a range of other resources that include agriculture, hydropower, M & I, water supply, fisheries, and recreation.

As far as identifying study areas for the economic analysis, we determined that having unique -- one unique study area for all evaluations was not appropriate, this being because our main objective was to compare resource effects of the different alternatives and not to add up costs and benefits. So we ended up having individual study areas for different topics.

To identify each of the appropriate study areas, we considered important temporal and geographic characteristics of each resource and then the geographic extent that they affected the local economy. So while in some cases the study area was generally the same as the plan area, in other cases the study area extended beyond the boundaries of the plan area. An example of this certainly would be the commercial and recreational fishery analysis, which trends well out of the plan area.

My last slide addresses the types of valuations conducted, more specifically whether the analyses were quantitative or qualitative based. As shown on the slide, we considered both direct and indirect effects at the local and regional level. For evaluating the quantitative topics or the quantitative base methods, we employed different analytical tools to address individual components of the analysis. And the example that's up on this slide runs through a series of four components for the agricultural economic analysis that now I'll turn over to Tim to brief you on that.

MR. NELSON: All right. So what's the logic behind our economic analysis? So we begin with given the proposed unimpaired flow objectives, there will likely be more frequent agricultural water shortages. As a result, crop production could be lower in certain years, particularly during the dryer periods. This could lead to increased fallowing of crops which would reduce the gross economic revenue for the farmers. Some changes in pricing and adjustment to cropping patterns could reduce the losses that they receive.

Because of the reduced revenue, it could affect employment as well in the agricultural industry. If there's not as many crops grown, farmers may not need as much help during the harvesting or planting seasons. And then because all sectors of the economy are so interconnected, that any revenue impacts to the agricultural industry could ripple out to many other industries causing revenue or employment impacts in those.

So for this analysis, there was a suite of models used. So it begins with the Water Supply Effects Model. From that we -- that models our potential unimpaired flow requirements, and from that we determine our surface water availability. The surface water availability is in post-process to determine the applied surface water for the irrigation districts that we modeled, which is used in a groundwater analysis to determine how much extra groundwater pumping that the districts can perform or need to perform.

The total applied surface and groundwater is then used as the primary input to the Statewide Agricultural Production model, which outputs the agricultural revenues and cropping patterns. The revenue output from SWAP is then used with IMPLAN multipliers to estimate the relative effect on other sectors of the economy in terms of employment and total output.

So what is this SWAP model? So SWAP is an agricultural economic optimization model that assumes farmers operate to maximize their net economic returns. It was developed in the 1990s at UC Davis and is still being updated today. It covers about 93 percent of the state's agricultural area and represents all of the crop types grown in the state.

Its inputs are a base cropping pattern for whatever you're modeling, water use intensities, a total land area, and the water use. The outputs are agricultural production acreage, the crop revenue, and the optimized cropping patterns. So it has been used in many other studies in the USA, in Central and Southern America, and the Middle East to explore water scare -- the effects of water scarcity and salinity on agricultural production.

So how do we set up our model? So this analysis covers six areas representing the seven irrigation districts that receive surface water or that account for most of the surface water diversions on the east side tributaries. So Merced Irrigation District, Turlock Irrigation District, Modesto, Oakdale, South San Joaquin Irrigation Districts, and then the two CEP contracting districts, Stockton East Water District and Central San Joaquin Water Conservation District, which are combined for the analysis.

It has 19 crop categories following DWR classification for land and water use, and base land and applied water are calibrated at 2010 levels using DWR, DAU crop survey data from 2010. So the primary input for SWAP is the total applied water that is estimated based on (unintelligible) results and results of the groundwater use analysis. So applied water is whatever water is used to irrigate the crops. Some portion will be consumptively used in evapotranspiration and some portion will see (unintelligible) zone and into the subbasin.

So here we have a table of average annual applied water demand and then applied water deficits, so unmet demand under baseline and some of the unimpaired flow or potential unimpaired flow objectives. So under baseline conditions, there's about 45,000 acre-feet of unmet demand, although it is misleading as most of that unmet demand occurs in the 20 percent of years that are critically dry. Under the 40 percent unimpaired flow objective, this unmet demand increases by about 140,000 acre-feet on average for all years, with most of the increase coming in critically dry years.

So this -- after inputting this information into SWAP, it outputs the relative -- the acres grown for each of the irrigation districts. So here we have annual average irrigated acres over all the districts for all -- averaged for all years and for just critically dry years. So the X axises are alternatives, and under baseline, we have on average for all years about 512 acres grown. And under the 40 percent alternative, this decreases by about 23,000 acres. For critical years, the decrease is more significant. There's about -- there's a loss of 80,000 acres on average.

And how does this translate into revenue? So under -- so this is the annual average revenue from crop production over all of the irrigation districts as output by SWAP, average for all years and critically dry years. So under baseline there's about a billion and a half dollars in economic output, and under 40 percent scenario, this decreases by about 40 million. For critical years, the decrease is about three times bigger, 120 million. So that was the direct economic impacts for the crop produc -- irrigation districts themselves.

Now, how does that affect the economy around them? So one model that looks at this is IMPLAN, which is an input/output model that provides a snapshot of the region's economy. So for our regional economic analysis, we used marginable multipliers derived from the IMPLAN model that relate to the direct change in crop revenue output from SWAP to the changing revenue and employment for other industries. We used IMPLAN data from 2010 to derive these multipliers, and they were extracted to cover a larger area around them for the three-county system of Merced and Stanislaus and San Joaquin counties. And the crop groups from SWAP were aggregated into eight IMPLAN crop groups.

So what do these IMPLAN (unintelligible)? So in SWAP, the revenue output represents the direct revenue impacts associated with the reduced crop production. IMPLAN (unintelligible) multipliers to estimate indirect and induced impacts throughout the regional economy. So indirect impacts could result in industries that provide inputs to the agricultural industry. So if farmers don't grow as many crops, they won't need as much fertilizer, as many pesticides, and there could be impacts in those industries.

Induced impacts could result because of changes in spending throughout the economy as labor income has changed. So farmers aren't growing as much. They don't need as much help, especially during the harvesting and the growing seasons. And then is that -- those workers may need to relocate or change their spending habits.

So some results, the direct effect produced by SWAP was the direct economic impact, the baseline (unintelligible) impact -- or economic output was about one and a half billion dollars. And with the multipliers, the induced effect is about another billion -- another billion dollars. So in total, there's $2.6 billion output related to the economic activity in the districts. Under the 40 percent unimpaired flow objective, this decreases by about 64 million, about 2 and a half percent of that baseline value.

And then jobs. So the direct employment for the agricultural areas is about 8,000 jobs with another 10,000 jobs just related to that. And under the 40 percent unimpaired flow scenario, there's decrease of 433 jobs, about 2.3 percent. And so all of this information is contained in Chapters 11, 20, and Appendix G, which this -- these along with the agricultural economic analysis spreadsheet can be found at -- on the SED website. Thank you.

MR. WARD: Okay. Right on time. Thank you.

MR. NELSON: Thank you.

MR. WARD: May I make a request that we receive copies of these Power Points? Is that something that you can provide?

You're going to leave it on that system? Okay. Great. Because then I can make it available, put it on our website.

Dr. Smith?

DR. SMITH: Okay.

MR. WARD: I wanted to make sure Milton (unintelligible).

DR. SMITH: (Unintelligible).

MR. WARD: Milton O'Haire is the Stanislaus County Ag Commissioner.

MR. O'HAIRE: Sorry for being late. I really messed up.

MR. WARD: And Dave White --

MR. O'HAIRE: We read the schedule wrong.

MR. WARD: -- Dave White to my left with the Business Alliance. Is that what it's called?

MR. GROBER: And may I make a request also? Is this -- this is being -- is this being webcast or --

MR. WARD: No.

MR. GROBER: But it's being recorded?

MR. WARD: Yes.

MR. GROBER: Can we get a recording of the meeting as well?

MR. BOGGS: It will be on the county's website on Monday.

MR. GROBER: Thank you.

MR. WARD: I'll get you the address.

Go ahead.

DR. SMITH: Okay. Again, my name's Rod Smith. I'm president of Stratecon, Inc., and my colleague is Jason Bass. We have been retained by the three counties to provide an economic study of the economic consequences of the proposed flow regime on the local economy.

Jason and I were actually involved in the IID/San Diego proceedings for the State Board. I was the main economic witness for IID and Jason providing a lot of the economic input analysis at the programmatic level that looked at bookends of a deal based on fully land (unintelligible) as well as efficiency conservation. So I just want to give you all a sense. You probably don't know who I am. I just thought I'd, you know, share a little. Okay?

What I'm going to try to do in our two sessions of this final panel is just have a dialogue with you on your thought process, our thought process, what you thought about, how did you think about it, what type of evidence did you turn to. And certainly there's a lot of unknowns here, and so how do we bracket our unknowns? In terms of themes, we'll have discussions about some applied reliability, sustainability, volatility, all this for the -- what it says about investment incentives.

We're also going to have a discussion on the fact that there's a vertical structure to the economy which -- and I do appreciate the presentation, where what you saw is you started at the farm level, you look at outputs and you look sort of below there, you know, fertilizers, employment, things of that sort. But there's also -- as you'll hear from our panel today, there's also a -- we go down the supply chain. Outputs have impacts on dairies, has impacts on feed lots. There's processing that goes on here. Some of it goes to the (unintelligible) processing that's located here.

And full disclosure. My stepdaughter is a regional vice president of Frito-Lay, so some of the stuff goes to Frito-Lay too. So -- so we're going to have a discussion about broadening our scope of understanding of this local economy and think through what will be the implications for how to assess as best we can best available information, best analytical techniques.

So I'm going to start with some questions. I'm going to move it around here to my panel. I will swear under oath we have not over-prepared here, so if we have some rough transitions, I hope you hang with us. The last question: Should I just be asking you as a three and then let whoever decide who wants to talk, or should I start addressing individuals? How would you like to proceed?

MR. GROBER: I think you can just ask the general question and we'll --

DR. SMITH: I think that's the most efficient way.

MR. GROBER: We're also not very rehearsed here.

DR. SMITH: There you go. Well, I'm going to start with some really simple questions. Whenever Stratecon looks at any water resource situation, as we all know, supply reliability's a key concept about what a water resource is. We know reliable water supplies aren't worth as much as -- unreliable water supplies aren't worth as much as reliable water supplies. Certainly, as we'll hear later, industrial recruitment depends on supply reliability. So I'm going to start with what I think is a softball question, but I could be wrong.

What is the reliability of this area's surface water supplies under the baseline?

MR. GROBER: You'll have to expand on what you mean in terms of "reliability." We've shown -- and we have the time series showing how the water supply varies over time.

DR. SMITH: Correct.

MR. GROBER: In fact, that was one of the charts that we show.

DR. SMITH: Right.

MR. GROBER: We show during periods of drought, multi-year drought in particular, then there is less water available, and that's when there's been additional groundwater pumping.

DR. SMITH: Yeah. Well, for example, as you know, State Water -- the Department of Water Resources puts out biannually an assessment of the delivery of the state water project. Did you gentlemen look at their definition of supply reliability, or was that just something you didn't look at?

MR. GROBER: What's the purpose of the question?

DR. SMITH: Purpose of the question is what's the reliability of the surface water rights under baseline conditions?

MR. GROBER: The reliability of the surface water --

DR. SMITH: Rights.

MR. GROBER: Rights. So now you --

DR. SMITH: Of the -- of the irrigation districts.

MR. GROBER: I'm not understanding the question.

DR. SMITH: Okay. Well, then why don't we move on. Sure. You don't understand the relevance of supply reliability.

MR. GROBER: We showed -- we showed what the water availability has been over -- based on a model over an 82-year --

DR. SMITH: Yeah. And a very simple, straightforward calculation would be -- in fact, you used -- one could use your data to say what's the reliability of that surface water. And I guess what I'm hearing you say is you didn't do that; that's all. I just wanted to know. Because I couldn't find it and so I didn't overlook it. Okay.

Okay. Next question then, it's sort of related to your chart. You see a lot of volatility there, and certainly you've produced a chart where you show what's the average of the baseline versus the 40 percent by, you know, hydrologic conditions. And you made a really good comment this morning when you said there's volatility beyond those averages, and that gets you back to your 82-year chart. How did the volatility of that available water get considered in your analysis?

MR. GROBER: And I don't recall using the "volatility" term, but I -- we show that there's a variability, and that variability is built into all of the numbers that we generate based on averages and year types.

DR. SMITH: Yeah. So, in other words, you averaged. You didn't think about what the implications would be of that volatility. Is that what -- I think that's what I'm hearing you say.

MR. GROBER: I don't think I said that. I think we presented the information in terms of both averages and also in terms of year types, but I guess you're looking for something more.

DR. SMITH: Okay. So you did nothing more. Got it. Okay. That's good. I think that's the purpose. We're trying to understand what you did and your thought process. So thus far, mission accomplished.

I want to pick up now -- and I know some of our panelists can't stay here for the full time. As I said earlier, there's a vertical structure to this economy. It's at the farm level and it goes down to who they, you know, purchase from, but there's also a flow up into the dairies, into the feed lots, into the food processing.

If I may call on the ag commissioner maybe to opine on the relevant importance of this element of the ag economy.

MR. O'HAIRE: Oh, yeah, sure. As we know, there's a basic farm-gate value, you know, for all these counties here, and there's a huge supply chain that affects that. There's a multiplying factor. For instance, in our county, eight out of the ten top manufacturers are ag based. 38 percent of the jobs in our county are either direct ag or ag related, and those are studies that have been done by the UC -- we've sort of done our own little anecdotal little studies here and actually confirmed that. So there's -- I mean there's a multitude of jobs that are tied to that. And that doesn't even affect -- that doesn't even count for, for instance, those that directly work in the ag field, when they go down to the local Wal-Mart or Macy's or the car wash and spend money. That doesn't even account for that money.

So, you know, how much -- how much is that taken into effect as far as economic impact? And I guess that's the -- that's just part of it. I guess I've got some other questions on top of that, but --

DR. SMITH: Yeah, I think, if I may, I think what it is, I think, if I heard you correctly, what you're saying is like the tomato processors, Frito-Lay, things that are downstream from the focus --

MR. O'HAIRE: Yeah, Foster Farms.

DR. SMITH: -- of their study are ultimately linked back to what is produced at the farm field. Is that what you're saying?

MR. O'HAIRE: For sure, yeah. There's many, many components: manufacturing, equipment, you know, services, advisory services. You know, it just is a multitude of other entities that are directly tied to agriculture. And I know I said like 38 percent of the jobs are in all three -- it's like 37, actually, all three counties, are tied to agriculture. So, you know, any -- it's going to be a huge ripple effect through the -- every job, you know.

So one of the things I wanted to -- maybe this will give you a little -- maybe just give you an idea of what I'm thinking about. When you look at the amount of acres that we produce, just in Stanislaus County, if you take our harvested acres and you look at the number of jobs that are directly or indirectly tied to agriculture, every ten acres -- roughly every ten acres supports a job.

Now, may -- that, you know, depends on what ten acres you're taking out, you know, whether it's almonds or peaches or apricots or whatever. But basically every ten acres represents a job, so -- and this one page, you -- this one page in there talks about 23 acres -- 23,000 acres going -- being fallowed and only affecting I think it's 400 and -- you have it right here, 433 jobs. And that doesn't really add up to me. As I'm looking at that going, wow, how would it only be 433 jobs? And you're going to, you know, possibly fallow 23,000 acres and just rough statistics is every ten acres equals a job. Doesn't even come close, so --

DR. SMITH: Maybe one way of thinking about it is it's, again, as I said -- as I said up in (unintelligible) go back (unintelligible), they said -- and this is the logic. You start -- and this is not a critic. You do have to start with the impacts on the farm. There's no doubt about that.

MR. O'HAIRE: Sure.

DR. SMITH: And by looking at what goes down below the farm in terms of the employers, the farm services, the farm advisors, and that's what IMPLAN is taking care of. But we also have to understand that within this community, impacts on the farm have flow of inputs up -- or downstream, if you will, the vertical structure and -- so it's possible that one way to reconcile the difference between your understanding of how your economy works and their estimates may be that they didn't trace the downstream impacts.

MR. O'HAIRE: Yeah, that's the question.

DR. SMITH: Right, yeah. It's just a question, and we can't answer -- I think we're here today to talk about questions anyway, if you have a response.

MR. WEGGE: Sure. Let me address that. First of all, to the commissioner's point about the averages, you know, I think you said ten acres support one job, or eight acres, something to that effect.

MR. O'HAIRE: Around ten. It's just a calculation I pulled up just looking at online data and from UC studies and looking at our crop report.

MR. WEGGE: Well, as you pointed out, that is an average, and clearly if we're talking about almonds as opposed to alfalfa, there's a big difference there. And, you know, what -- what we found in our analysis based on optimizing farmer operation is what -- what would go out first as far as out of production would be the lower value crops. So, you know, the relationship between the 400 jobs and the number of acres wouldn't, you know, hold true if you're looking at, you know, just the lower value crops. So I just wanted to point -- point that out.

MR. BASS: Might I jump in? Did you consider, though, the impacts of the loss of production of those lower value crops, though, on downstream activities? Dairies, for example, use a lot of hay, corn silage, et cetera, which are fundamental parts of the local economy. Was there any consideration for those downstream effects?

MR. WEGGE: Absolutely there was. I think that's a different question, the forward linkages, downstream effects from what the commissioner was mentioning. But we did look at the effects on down -- forward linkages, effects on dairies and on cattle growers, on other processors. It was our feeling that -- and I think you would concur with this -- IMPLAN is, as most input/output models, is not designed to look at forward linkages.

Now, it can be used for that and data from IMPLAN can be used for that, but it's not a model designed to look at forward linkages. So with that limitation, we tried to work with the information that we had. And, absolutely, we looked at effects both on dairies and other processors.

DR. SMITH: Where is that information discussed in the documents? I'm talking specifically on the forward linkage issue.

MR. WEGGE: It is described in both Chapter 20 and in Appendix G. And I think Chapter 11. Yes.

DR. SMITH: Now you confused me, even though I'm very familiar with forward linkages and IMPLAN.

MR. WEGGE: Okay.

DR. SMITH: You pointed out that the off-the-shelf IMPLAN model does not do forward linkages, and then you said that you addressed forward linkages.

MR. WEGGE: Yes.

DR. SMITH: So you, therefore, must have taken the off-the-shelf IMPLAN model and adapted it. And where in the document do you discuss how that was done?

MR. WEGGE: We didn't do that.

DR. SMITH: Okay. That's what I --

MR. WEGGE: We took information from IMPLAN, as well as information from other sources, and looked at the relationship between production of alfalfa and other grains to the dairies and other processors.

DR. SMITH: And all that information is in the documents you cited?

MR. WEGGE: Yes.

DR. SMITH: Okay. We'll double-check. That's fine. Just want to be sure we don't have to look elsewhere, that's all. Appreciate --

MR. GROBER: And I just want to point out we should continue this conversation as well when we have the other workshops on the 5th and the 12th. The other economist that we had working on this and working with IMPLAN was unavailable today, is out of the country. So that will be helpful to have that.

DR. SMITH: Yeah.

MR. GROBER: Continue the conversation.

DR. SMITH: Yeah, that would be.

MR. GROBER: And in the meantime, also, if you have any -- any other comments and observations, to bring those forward.

DR. SMITH: You'll be getting them. Today. We're starting. As you say, it's start of a dialogue, and I think it's a productive dialogue. And I forgot to say what I wanted to say. I appreciate this forum. This is a great opportunity, rather than just people reading documents and writing studies, you know. It's sort of good to have some dialogue, just as I found in my career it's good to get out of your office and get out on the ground and on the road too. So that's also good. So it's great that we're out of our offices today.

Let's see. I'm going to go to Mark because I know you have to move because you are doing economic development in Merced. And I would like you -- I want to pick up on what -- the implications of volatility in terms of the availability of be it silage, tomatoes, corn, or whatnot does to the food processors and other -- other downstream business use you have already recruited and what would happen if instead of a relative -- as was testified earlier today, this area has done a great job of managing and developing resources so they have a relatively stable supply situation. Yeah, they get critical years; they backstop with groundwater. You have a relatively stable situation. What happens if -- if on annual basis things start jumping around a lot?

MR. HENDRICKSON: Well, first of all, thank you for the question and thank you for each of you being here today. I think generally speaking -- and Dave can certainly speak to this as well as I can from a Stanislaus County perspective -- one of the greatest challenges we have here in the State of California is obviously trying to recruit people this direction.

Unfortunately, California, due to either urban legend or myth has got a pretty bad rap. As being a place that creates jobs just happens to be the states of Arizona, Nevada, Texas, and everywhere else. The reality is is, you know, the volatility that you spoke to in terms of the fluctuations, in terms of availability is absolutely going to discourage, you know, companies from which are either here and wish to grow or trying to attract new industry this direction.

You know, any time that we in the economic development world are trying to recruit somebody to this region, to our respective counties, it's really imperative that we are able to share with them, you know, a clear picture as to what they should expect. And so I think to really address the -- to address the question from just one single perspective, I think it's vitally important that we figure out some creative way here as a part of this to give some certainty to businesses that we've brought here and who were expecting to have a certain amount of available water to meet their needs.

But then, you know, also as a part of what we're trying to do when we've got, you know, regional economies that have, you know, double-digit unemployment most times of the year, what can we do to provide some comfort to those that we're trying to recruit as well at a time when, you know, obviously, you know, the San Joaquin Valley's economic recovery is quite a bit slower than most of the economies around the state?

So I guess if there was, you know, a question that I would pose is to what degree can you provide some comment as to what comfort can we provide folks that are either here that are, you know, looking to grow or expand their business or what can -- what can you help us with in terms of information that we could provide, you know, people outside the state looking to grow a business here? What would you encourage us to tell them?

MR. GROBER: It doesn't sound like a technical question --

MR. HENDRICKSON: Not at all.

MR. GROBER: -- to how we've done our analysis, so I think that's best a policy question or comment to make before the board. But the answer we'll provide, and I think this kind of speaks to perhaps the theme of some of what you're discussing here, is if you're suggesting -- and tell me if I'm inferring too much. You're suggesting that when you see that choppy water supply now because you have times when you can't meet the demand because the supply is constrained by the more variable hydrology more often, another way of looking at that -- we didn't look at that. Another way of looking at that would be, well, just have -- actually have cuts that occur that are in all years so you don't have the same level of agricultural development in all years, I guess would be another way of looking at it. And perhaps that's going to be the nature of some of your comments that you make.

So that would be another way of saying, well, you can have -- if you're going to try to keep the reservoirs fuller to maintain a certain reliability of water, that's different from that patchiness that's seen there. I think that would be an excellent comment to make and also an excellent comment to make and say how that would change the economics of the situation. Because we've looked at it one way, but there's, you know, maybe other ways to look at it.

DR. SMITH: Yeah, I appreciate that.

But go ahead.

MR. BASS: Yeah, I'd like to interject on that because it seems like built into your answer with that is this presumption that we can go from here and impose sort of an artificial lower level to keep stability and to avoid this sort of dramatic up-and-down curve that we're looking at.

But fundamentally what you're saying is you're going to shift the water supply situation lower. That's what's going to happen. And the analysis you've done is to look at everything on a year-by-year basis. To say, okay, in year 2 -- in 1937 here's what the hydrologic year was. Let's impose all these assumptions on that year in terms of what would have happened in terms of surface water supply availability, what would have therefore happened in terms of groundwater response, what would happen in terms of fallowing in that year. And you do that year by year and show, yes, a sort of up-and-down curve of impacts, and then you take some averages and present that, 2 and a half unemployment as a result on average. We can dig into the document and find that there's at some point 7, 8 percent loss of jobs in peak critical dry years.

From my perspective, the problem with that and/or the oversight, and I want to know if you look on this -- this is my question. Did you take on the issue of that sort of lack of reliability, as we call it, or variability in your water supply that you would expect going forward as a result of SED implementation? The long-term effects of regional perception of the economic stability in this region, the long-term water supply situation, it changes drastically.

And what you have now is you have an economy which relies significantly on dairies, on food processors who have investigated hundreds of millions of dollars in infrastructure. You also have thousands -- tens of thousands of acres of tree crops which are permanent crops, significant investment in those assets. So you have an economy which is built on a significant amount of infrastructure and farm development infrastructure and development investment, yet now you're taking away the very reason that those investments occurred. You're saying, well, you used to have this water supply situation, a reliable surface supply that even in bad years we still got most of that water. And that was the world. That was the --

DR. SMITH: Baseline.

MR. BASS: -- the baseline, the context in which all of this development occurred.

You have population growth. You have job creation, et cetera. Now what you're saying is we're going to take away that reliable water supply, a big chunk of it. Yes, we can do things to try to smooth it by holding water back and trying to manage it, and we're going to replace it as best we can with what is really an unreliable groundwater supply that's faced with significant issues already declining, declining water quality, all of the issues that have been brought up today.

So how are you going to try to reconcile that longer-term or bigger-picture question? We can talk all day long with IMPLAN and each year, oh, okay, ten more jobs, ten less jobs, et cetera, but the bigger picture of what this does to the structure of the regional economy, I don't see anywhere that that's considered. And I want to know, are you going to consider it? Did you consider it? You know, because everything I'm hearing in talking to people in the community, listening to these gentlemen is about our economy is built on this water supply. And now you're taking it away. What are we going to do?

And you're saying, well, we'll just pump more groundwater. Well, groundwater is not the solution necessarily because of reliability, quality issues, et cetera. And even there we have SGMA coming, which it doesn't sound like that was necessarily addressed. So what is really the analysis that you can do to sort of give some comfort maybe to what -- all these values?

I mean people have invested a lot of money in this economy and relied on this for many years, and now you're saying: We're going to take it away.

DR. SMITH: (Unintelligible) let's defer any discussion of groundwater, not because we're not going to get to it, but we get to that later. So (unintelligible) take the remaining part of Jason's question for now.

MR. GROBER: Sure. Well, I mean, we're presenting -- and this is great to have this conversation and look forward to getting more comments. We presented one way of looking at this. You know, he's not in the room, but I always hear in my head, you know, working with Dr. Jay Lund says, "All models are wrong; some are useful." This -- you know, you look at water -- you know, the initial water supply. Then you run it through groundwater, and then you're running it through economics. There's -- you know, it's the dismal science. There's a lot of things, a lot of assumptions that one needs to make. I hear your point now about, you know, reliability and, you know, what's the -- is there a new equilibrium or perhaps something, if you will. Well, this is just imposing this -- this new constraint in terms of limited surface water availability and looking at it one way, what would be the economic effect.

I'm hearing that a lot of work has gone into why you think the answer might not be wrong -- might not be correct and --

DR. SMITH: Yeah.

MR. GROBER: -- you will have alternatives, and I think you should provide that because there is probably other ways that you can look at it. But one here is we've just kind of tracked the variability that already occurs and how the system responds to it, and now we're imposing greater variability --

DR. SMITH: Right.

MR. GROBER: -- and how that -- the system may respond to it. And I think I'm hearing in your comments --

DR. SMITH: Right.

MR. GROBER: -- that it would do something else then again, and that's -- please --

DR. SMITH: And I want you to take this because I'm going to finish to the end of our session with your fundamental question you posed this morning: What could you do differently and better? We'll have some ideas to share at that time. But I do appreciate you understanding now why we raised the reliability question.

And maybe to put the tie on the bow on this part of the subject matter, you're looking -- your analysis looks as into -- year by year independently and averaging by water year type or whatever, but says that that is, you know, the way you're looking at it and that is the way you looked at it. The whole issue we want you to think about at -- from a purpose of analysis is think about what the reliability and volatility implications are from an investment perspective. I think that's -- I think that's --

MR. BASS: And a value perspective.

DR. SMITH: And from a valuation of economic impact. I would think that is -- would be possibly the take-away. I know the commissioner wants to add something.

MR. O'HAIRE: Yeah, I just wanted to -- that you guys are hitting on it, but, you know, it's the -- it's the reliability of water for the growers, you know. When they go into -- they go in and they're going to invest and they're going to get loans for this property to farm, that's going to be -- that's going to be very important that they have a reliable source of water. And what you're doing to the system is making it less reliable.

So have you studied what that is going to do all the way down to the grower level when they get ready to go in and try to get money to expand or to purchase property or to farm and now they have a -- maybe a not-so-much reliable water source? Has that been evaluated?

MR. GROBER: And your question is in terms of long term --

MR. O'HAIRE: Long term, right. They make long-term investments. They don't make, you know, a one-year investment. They're looking at it for, you know, generations. So what is that -- what's the economic impact there?

MR. GROBER: Any -- any responses? Thoughts?

MR. WEGGE: I can take a crack at that. We didn't look at that issue of how this would affect investment over a long period of time. I think, you know, there -- it's a very difficult question to answer in that it requires a lot of assumptions about how resilient the economy is.

And so I think in order to address that issue, probably the first place to start would be to look at what's happened during the drought and how -- because that's -- the drought has incurred reductions in water and how -- how has the community, the economy been able to adapt to that. And, you know, that's sort of looking at the past history to help inform the -- what could happen in the future. But I think, you know, it's being able to specifically say how increasing reliability of water supplies might affect the community -- the business community's ability to borrow, to invest, is really a difficult task to do.

MR. O'HAIRE: And I would agree with that and -- 100 percent. It's a very difficult task to do. But when you're talking about taking away a -- something that this community totally relies upon, this economy we have here, I think it's upon the Water Board to not, you know -- no stone should not be overturned. You should be able to drill down to every situation that we're bringing up or that we're not. This is a huge impact on us. It's not like, you know, just something that's going to happen very easily.

So you guys have the resources; you have the staff. We're asking the questions. But, you know, I think it's really -- the onus is on you all to really drill down to everything. And that's what I think we would expect, we would want. We want to see all the details, all the numbers, everything looked at because we're -- you know, this is our livelihood, you know. So it's not, you know -- I think that's what needs to be done.

MR. GROBER: Well, and this is why -- this is part of the process. So you have that information; please provide it. And don't have to wait until the end of the comment period. We have opportunity on the 5th and the 12th of December and anytime in between.

MR. WHITE: I have a question. I'm Dave White from the Stanislaus Business Alliance, Opportunity Stanislaus. And our organization has conducted hundreds of interviews of employers here in this county, and we know our economy really well as a result of that. We know what the issues are, what the challenges are because we've -- not only have we interviewed, but we've used a scientific tool to help us understand our economy. So I have a couple of questions for you.

Now, I see -- you know, I've seen your presentation. I also am worried about the downstream effect because I don't know if you've seen the California League of Food Processors Study, 2015. Our county -- Stanislaus County per capita is the No. 1 food production county in the State of California. In pure volume we're only second to Los Angeles County, and that's a county of 7 million people. So it's critically important to us. It's our lifeblood.

I used to live in Colorado. Our lifeblood there was aerospace, and when the Defense Department shut down programs, it had a crippling effect on our economy. You turn off the lifeblood, you turn off the economy. So my question is how well do you know our economy? Have you conducted interviews with employers? Have you conducted interviews with farmers? Or are you just using statistics that the State of California produces to make your analysis?

Because I think -- I agree with the commissioner. This is a really important issue. You need to dig down deep. You need to really understand our economy. What's -- can I ask, do you know what our unemployment rate is today in Stanislaus County? Any of you guys? Do you know what it is? You don't? Any? Do you know what it is? Okay. Well, then you don't know our economy. Our unemployment rate is 8 percent as of today.

And how many -- are you from the Bay Area? Raise of hands? Okay. What county are you from, sir?

UNIDENTIFIED SPEAKER: Contra Costa.

MR. WHITE: Okay. You know then 4 percent unemployment in Contra Costa County.

And what county are you from?

UNIDENTIFIED SPEAKER: Sonoma.

MR. WHITE: Sonoma. Okay. That's about 4.2 percent. If you're from Santa Clara County, it's about 3.3 percent.

So I hope that you will dig deep, that you will take -- that you won't hurry through this process; that you'll interview the employers, you'll interview the farmers, you'll really learn our economy. Because this is our livelihood. And like Mark said, we can't -- you know, it's hard to attract business into California because our regulatory environment here is not like the regulatory environment in Arizona or Texas.

And so what we have to rely on, companies to expand, 80 percent of all the new jobs here. If we want to cut that unemployment rate down, we've got to have local companies expand. And that's -- that's the lifeblood of -- it's not like we're going to get Silicon Valley to move out to Modesto. So we have to rely on our excellent, exceptional companies here to expand. And you guys don't know our economy. If you did, you'd know what the unemployment rate is today. Who's our -- do you know what our -- who are No. 1 employer is?

MR. GROBER: If I may say, I just want to provide --

MR. WHITE: I'm not -- yeah.

MR. GROBER: -- context. Well, this is -- this is -- I'm hearing a number of good questions, but I don't know that the pop quiz on the statistics is that helpful to inform. But I would --

MR. WHITE: Well, my point is, sir -- my point is --

MR. GROBER: This is a programmatic analysis, and we're -- and we are considering economics. And we've done an economic analysis that -- to inform this decision. And not to diminish how important this is for the area, but again, we've done more than really we're required in terms of doing programmatic analysis and for consideration of economics. That being said, we've done more because this is terribly important for the board, and the board recognizes how hard this is and how important it is and how they want to inform that balancing decision.

MR. WHITE: Well, all I'm asking is --

MR. GROBER: That being said, so --

MR. WHITE: -- I'm asking you to get to know our economy.

MR. GROBER: And I've acknowledged a number of times already that if there's pertinent information that we should be considering, then please get it to us as soon as possible, even before the end of the comment period. Because the more we know, the better our document can be to inform the board in making this hard decision.

MR. WHITE: I'd be happy to do that.

DR. SMITH: Mark, is -- you want to --

UNIDENTIFIED SPEAKER: Who's the No. 1 employer? Gallo?

MR. WHITE: Gallo, yeah, sure.

DR. SMITH: Yeah, Gallo, yeah.

Since we're on the economic incentive investment environment structure, is there anything you want to add? I think we're on a roll, so let's go.

MR. HENDRICKSON: I think we are on a bit of a roll, and I do appreciate Dave's comments because I think that the comments absolutely -- are absolutely reflective of what we hear in the three counties, you know, we face. You know, I think -- you know, I spoke a little bit ago, and I think as just referenced, obviously, the regulatory climate here in California is not good. I think everybody can acknowledge that. It makes doing business in this region very, very difficult. But I'm very hopeful that, you know, as you continue to advance, you know, your plan -- and, you know, we do hope that you are, you know, listening -- that you do keep in mind that we have, you know, people making very big decisions as to where they go and how they expand.

Just last evening I was at a dinner with a few hundred farmers in Merced. And what was so impressive to me as a non-farmer, these are people who wake up every single day with the intention of putting food on your table. And these are folks that work incredibly hard to ensure that not only are we all fed but, you know, most of the world.

So I'm very hopeful that as a part of this process, as you continue to, as was suggested, drill a little bit deeper into what's taking place as a part of the development of your plan and the studies that you are basing it from, that you will think about, you know, obviously those -- maybe those unintended consequences of the impacts of our farmers who -- and ranchers and growers who wake up every single day, again, with the intention of doing good for you.

You know, I would say kind of as an aside, you know, some of the other challenges that have certainly been expressed to us from an economic development standpoint are related to land value. Okay? And so certainly as we talk about obviously impacts related to having less, you know, water availability, if you will, and obviously you factor in the impacts of SGMA along -- along with it, can you maybe discuss to any extent that you studied how this will -- to what degree have you studied, you know, land value reductions?

Because clearly we've got a lot of folks out there that are concerned about, you know, what this means for them and their bottom line. So, you know, this will absolutely go into, you know, where companies will grow and expand, et cetera, et cetera. So was there any consideration given as a part of any of your economic modeling that, you know, relates to, you know, the impacts of this plan as relates to overall planned values and how that may prospectively impact, you know, business decisions here in the region?

MR. GROBER: Not specifically, not a topic that we -- no. But we looked at conversion. We had come up with some estimates of conversion of prime farmland, but not -- not changes in land value.

MR. HENDRICKSON: When you say "conversion," you mean conversion to permanent crops?

MR. GROBER: Just -- just loss of prime farmland.

MR. HENDRICKSON: Oh, loss of land. Okay. Okay.

DR. SMITH: Yeah, if I just may add, though, just wanted this point. The impacts of land value is very important because it gets back to the commissioner's things about how the real world works in terms of finance; right? If you take a 30 percent haircut on your land value, your ability to finance your existing operation sort of gets a little tenuous; right?

So I just want to be sure because sometimes economists think land value is just a wealth effect; it has no consequence. And, no, they're the financing mechanism. There is a feedback from a land value of impact to economic consequences of whatever you're studying. So I just wanted to just be sure I shared that perspective (unintelligible).

MR. O'HAIRE: Yeah, I just want to check something. I haven't read through the entire, whatever, 4,000 pages, but -- so am I correct then you're saying that there's going to be -- I think it's in the economic analysis, page 20.4 -- there's going to be between the three regions, 23,421 acres lost or fallowed, or is that converted? I can't remember exactly what it was. Versus going back -- back in, I saw numbers. And then public meetings back, I think, 2012, '13, there was some talk about 210,000 acres possibly being fallowed and why is that number different. I'm -- am I looking at -- those are two drastically different numbers.

MR. GROBER: Generally different numbers. I think, as we mentioned earlier, when we did the last round, we looked at two ways: no replacement water supply, no ground -- additional groundwater pumping or full groundwater pumping. So if you don't do any additional groundwater pumping, then it would lead to great -- even larger water supply losses and, therefore, even higher fallowing.

MR. O'HAIRE: So was that -- so was that what -- the 200-so thousand acres, was that what that was from?

MR. GROBER: That was associated with -- yeah.

MR. O'HAIRE: Okay. No backfill. Okay. Another question I have, too, is just to make sure on the data, on Appendix G-67, I'm looking at -- here it appears that you're using -- I want to make sure I'm right. Appears that you're using 2008 crop production numbers on G -- it talks about its average annual total economic output related to agricultural production in irrigation districts, and it looks -- so this is 2008 values, looks like. I just want to make sure that's -- if that is, why aren't we using more up-to-date? Because, I mean, our value is much, much larger than it was in 2008.

UNIDENTIFIED SPEAKER: (Unintelligible) 67?

UNIDENTIFIED SPEAKER: It's G -- yeah, G-67.

MR. NELSON: So that's this -- well, okay.

UNIDENTIFIED SPEAKER: It's a graph -- nice, little, colorful graph there on the page.

MR. NELSON: Yeah. So that's just in 2008 dollars. So (unintelligible) like the value of the dollar (unintelligible).

MR. WEGGE: If I could just add something to this. We attempted to keep dollars constant across the various topics, so that -- not for purposes of adding up but, rather, so you could get a sense of the relative importance of different topics if you want to look at monetary values in different sections. So, you know, this analysis was originally done in 2011. We were working with a lot of values from 2008 and 2009, and then when we redid it, we could have updated it by using an inflation factor, but we decided just leave it in 2008 dollars, and it's consistent across the various topics that are addressed in Chapter 20.

MR. O'HAIRE: Okay. Well, I would suggest that just -- I don't know about the entire document, but at some point, I think, we would love to see current numbers, even if it's some kind of summary or -- so we can see -- I mean that was, you know, eight years ago. It's almost a decade ago, so we've all moved on since that time and things have -- lot -- things have changed. We'd like to see some, you know, up-to-date real impact numbers in today's --

DR. SMITH: Yeah. And, by the way, it's (unintelligible) I -- first of all, I agree. We've got to have a constant dollar. We have to decide which -- you know, what's our base year. I agree with you. So you and I are in total 100 percent agreement. The difference, though, between 2008 and 2016 is not only the inflation but any changes in the relative value; right? And if we go back to 2008, relative to today, Commissioner --

MR. O'HAIRE: That's a recession year.

DR. SMITH: But --

MR. WEGGE: Let me clarify something here.

DR. SMITH: Okay. Good.

MR. WEGGE: Because the way you're characterizing it makes it sound like we were just -- we just used information up to 2008. That was not the case. We may have used information from 2013 or 2014 --

DR. SMITH: Oh, then brought it back.

MR. WEGGE: -- and then brought it back to keep things consistent in --

DR. SMITH: That wasn't as clear in your written document as your spoken word, but I appreciate that.

MR. WEGGE: And the other thing I'd like to point out in response to your question about the land values, we did not specifically look at land values, but we did look at the fiscal effects of the changes in agriculture. Land values wasn't specifically pulled out, and I don't recall whether it was part of a composite type of multiplier. But the fact that we looked at fiscal effects on the three counties and jurisdictions within those counties is something to note.

MR. BASS: Were the physical effects done part of the IMPLAN tied to the lost crop production revenues?

MR. WEGGE: Yes.

MR. BASS: Okay. But not to a specific -- so it didn't really flow through a valuation exercise, the land itself, tied to the production and reliable water supply?

MR. WEGGE: No, no.

DR. SMITH: Well, first of all, I agree with Professor Lund; models have use and, you know, no -- none is perfect. But sometimes it's good to look at what's happening to the world sometimes as natural experiments, like just think outside of this area.

During the 1991 drought, San Diego was -- took -- being at the end of the metropolitan water system, took the hugest cutbacks in '91 I think of anyone statewide. And the semiconductor industry, right before they went to Austin, went to Susan Golding's office, who happened to be the mayor at the time, and they said: You get a reliable supply or, you know, the vans are going. It took IID and San Diego, what, 15, 17 years to put together the deal. So those guys were long gone to Austin.

So we need to think through what are some of the other types of actual experiences we've had in the state. Maybe not necessarily in these three counties, but elsewhere that have seen something of an impact already. And I'd be interested in your reaction. The one thing we know is -- and I'll try to use a (unintelligible) sense of humor here. The Central Valley Project Improvement Act gave us a natural experiment to observe.

Because as we do know, if you're familiar with the CVP allocations to south-of-Delta ag users, there's a major transformation in the data that you download from the, you know, the bureau. Pretty much until the CVPIA, they were getting 100 percent allocations, but for 1977 and thereafter, they've had a very vol -- I'm sorry I use this word, sir -- a very volatile history of what their annual allocations are from year to year.

Have you -- have you considered at looking what was the impact of that experience, for example, on groundwater pumping in Westlands or well elevations or fallowing patterns as sort of a way to look at what is happened elsewhere as a way of calibrating, you know, how your model's looking at the world? Because I didn't -- it wasn't discussed, as far as I could tell, and I guess I'm a -- I was paid to read all your stuff so I did. I don't remember any discussion of looking elsewhere of what, in fact, has happened to help inform how you look at what's being proposed.

MR. GROBER: No, but I look forward to seeing your comments and how we should be looking at that and using it.

DR. SMITH: Okay; good. After the break you'll get a few when we return to groundwater. Because I've got some great resources here, and I know I'm losing one. This one's graciously staying.

Commissioner, I don't know if you're staying for the whole --

MR. O'HAIRE: Oh, yeah. They'll be a power drain with just -- me just here. Losing all these brains. These guys know a lot more than me. I do have a --

DR. SMITH: Oh, that's not true.

MR. O'HAIRE: I do have a --

DR. SMITH: You know a lot more than what we do.

MR. O'HAIRE: I wouldn't say that, but I do have one -- I just -- question again. What was the total number that was com -- I probably missed it; it's probably in here. I just want to know. What is the total economic impact that you came up with for the total amount and sort of what was all in that? I know you --

MR. GROBER: What is the number you're saying?

MR. O'HAIRE: Yeah. You were here a couple -- or a month or so ago here at the board -- I think you said something about 65 -- 65, 64 million.

MR. GROBER: The slide is still up. It's the $64 million total sector output under the 40 percent flow.

MR. O'HAIRE: So under 40 percent -- make sure I understand this -- 40 percent, this region is only going to lose -- is it $64 million impact to the entire region? Wow.

UNIDENTIFIED SPEAKER: (Unintelligible).

MR. O'HAIRE: What's that?

UNIDENTIFIED SPEAKER: The three-county area: Stanislaus, Merced --

MR. O'HAIRE: Right. Which makes it even more dramatic because you're talking about three counties. So --

MR. GROBER: Average annual.

MR. O'HAIRE: Average. Again, I'm not an

economist. Like I said, when I was down here the other day -- but, for instance, I'm going to -- I'm a resident just like a lot of people here. I've seen what the drought has done. I go around the county, my neighborhood; I see lawns dried up, mediums lost, you know, browning lawns. It's affected just visually which I know -- I know enough about, you know, land value that that's going to drop the value of your home. So just looking at that, just no numbers -- I can't crunch any numbers for you, but Modesto has about 75,000 units. If you put -- if you say each house dropped down just $1,000 in value because of the drought, I think that's a reasonable assumption. $1,000 is, you know, not -- is not very much. This is going to make it worse, I think. $1,000 times 75 units is -- that's $75 million just on that one item. So I don't see how you can come up with only 64 million when we're talking about all these other drastic impacts. This -- so maybe I'm missing something.

MR. GROBER: Well, since you bring up the drought, I'm curious. Do you have numbers for what was the effect on the ag economy and over the drought years?

MR. O'HAIRE: Well, yeah. Well, part of it, you can look -- you can look at our crop reports. Now, we just showed the changes in the crop report from year to year. Of course, all of that is not drought related. Some of it's -- some of it's, you know, the unit -- it's supply and demand and so forth. But this last year, our crop value dropped down 500 and -- $508 million. Some of that was because of the drought. We had additional fallowing. I think like two years we fallowed something like 20,000 acres and then another 13,000. So it's -- and the $64,000 is nowhere near, in my estimate -- again, I'm no economist, but just practically looking at the numbers, it's just -- it's just not even close.

MR. GROBER: It's 64 million.

MR. O'HAIRE: I'm sorry, 64 million. Well, it's sort of like 64,000, I guess, to us. Not very much.

MR. WHITE: You have the replacement of people that have to put in new lawns or, I mean, it's just -- it's astronomic --

MR. O'HAIRE: Just in my -- just in my neighborhood, I've got three driveways that have dropped because of the -- because of the drought. So I can imagine, you know, it's just -- I mean there's a lot to consider.

DR. SMITH: I think a way of tying these things together before we -- and I know Jason's going to build on this point -- is there's life beyond models. I think Mr. -- if Professor Lund would be here, he'd probably agree with that. But we also do look at models, but there's also experience. And this is just my universal Chicago training. You always sort of look at where the evidence is relative to models. And then, you know, how you concoct it into the goulash, that's a different point. But we're not here today about concocting. We're just trying to say what are the elements you may want to consider. And Jason --

MR. BASS: And, yeah, I just wanted to add (unintelligible) because I know the drought obviously is a very important source of information. It's very instructive what's been happening in the last few years with respect to ag, with respect to municipal water use, development, et cetera. But the drought is a short-run phenomenon. We have just a couple of years, and the response is a reflection of a short-run response. In other words, people are dealing with the immediate and very difficult and challenging situation of a lack of water supply, so water -- lawns are going brown, et cetera.

But when we start talking about the SED, this is a long run, permanent, in theory, transition to a lower water supply. So I think we have to be careful not to focus too much on the short run, you know, information or demonstration of response just in the drought. It's very instructive because clearly it's created significant hardships, significant problems.

But I wanted to go into from -- we focused a lot on ag so far, and obviously it's fundamental because that's where the surface supply impacts are going to really flow through, but we haven't really talked much and saw a lot, we believe, in the documentation with respect to the community impacts. And I heard earlier discussions about how water bills have been going up very quickly in the region because well depths have been challenging, water quality issues have been challenging, et cetera, and I wanted to know to what extent you folks have really examined in particular water rates for community members, for households, household water rates.

And I've done a lot of work in this arena looking at ratios of things like the average water billed to household income. And in this region, and I'll use Merced County as an example, I think it's upward of 80 percent of the households are within areas that are designated as disadvantaged communities, economically disadvantaged, by the State of California by the Department of Water Resources. I go to the DAC, Disadvantaged Community Mapping Tool, online and it lights up in these counties because a lot of households are, again, in communities where incomes are relatively low, yet you see water rates going up and up and up.

Dr. Smith brought up the issue of groundwater depths, and we know that if increased pumping occurs, all else being equal, we're probably going to see increases in groundwater depths. Already an issue that's occurred in the drought. Lot of cost. Talking to the City of Modesto, they're investing new wells. Planada, the community, they had to put in some new wells. This is a region-wide issue already.

When groundwater pumping goes up in response to the SED, we're going to probably need more infrastructure investment, et cetera. Costs go up. I mean someone's got to pay for it. A lot of these communities don't have a lot of financial resources. They're going to pass it through to the ratepayers who are already seeing, in many instances, double-digit growth in their water bills.

Have you addressed that impact and, also, even in the IMPLAN modeling addressed how that flows through then to the community expenditure profile where you start to see then people having less money to go out to eat because they're spending twice as much on their water bill? So that's -- I wanted to pose that question.

MR. WARD: That's -- before you and your team respond, I'll give you a chance to think about that. I think this is a good time to take a break, that this looks like a transition now from the ag econ impacts to urban and drinking water. So why don't we take a ten-minute break. Everybody back here around 2:30; we'll wrap it up.

MR. GROBER: Great. Thank you.

(Recess.)

MR. WARD: All right. We're going to get started again, if you'll all sit down.

DR. SMITH: I don't have any kind of questions for you. I want you to talk on the issues that we're talking about that you can say something to talk about.

MR. BASS: Okay. If I can think of a smart question, I'll ask it.

DR. SMITH: Yeah, yeah.

MR. WARD: Okay. We're into the final session of the afternoon, and looks like we've lost Milt and Mark; right? Okay. So Dr. Smith, it's yours.

DR. SMITH: Okay. I think in fairness to our good friends from Sacramento, Jason, why don't you just state the question again.

MR. BASS: Yeah, I will. I know we were talking and focusing on agriculture and irrigation, but we want to shift over now to urban water, to the communities in the region that rely on -- mostly on groundwater. Well, a large portion on groundwater. They're obviously communities as well, typically the City of Modesto, that rely on surface supplies.

But an important question really gets to the characteristics of the household in the region. We have a region where, as has been discussed, we have high unemployment. We have high rates of poverty. We have -- relative to the State of California. And we also have a lot of communities, proportionately much larger amount of communities as compared to the state, that are designated as economically disadvantaged. And what we've seen in a lot of these communities over the years, particularly most recently with the drought, has been a need for a lot of investment in new water infrastructure, rising costs of water, a deteriorating water quality, particularly groundwater quality and, therefore, associated costs and water bills that have been rising very quickly as relative to incomes.

And so the question really is, is to what extent have you addressed this issue and how the SED implementation, say at the 40 percent level, how that would flow through to additional costs and ultimately affect water bills and whether that's even tenable in the long run is my question.

MR. GROBER: I'm not sure what you mean which part is "tenable," but we -- I mean one of the things for cities, cities of course can, you know, afford -- I hear in terms of the disadvantaged communities, but maybe I'll pose it back to your question with a question. Because we look at, you know, the ability to purchase water, you know, and I think we look at figures of $1,000 an acre-foot or $2,000 an acre-foot. So with those costs, what -- what -- how much additional cost would that impart to the cities, if there are any?

So there basically is no shortage to cities because cities -- you know, it's high value. It's the disadvantaged communities.

MR. BASS: Sure.

MR. GROBER: So is -- that's -- I think that's part of the perspective that we had is that the -- for the relatively smaller quantities of water for cities, that there would be some purchase possibilities.

MR. BASS: Sure. No, there's certainly -- I mean we're not as focused, per se, on water supply issues. Obviously there will be water supply challenges for some of the communities relying particularly on surface water because of the SED, but with groundwater, we're talking about increased depths to groundwater, influences of increased pumping by irrigators affecting groundwater depths. Water quality often gets influenced by greater depths to groundwater.

But really the issue just is the issue of cost. We know that if we're out purchasing water as opposed to producing it locally and supply/demand dynamics, that we're probably going to see escalation of cost of water. You're taking away a big chunk of the region's water supply. It would be expected that there would be a cost effect as a result, whether it's because of higher cost to purchase water, whether it's higher cost to pump water because it's deeper, et cetera. Those costs have to be borne by someone, and you have a region, again, that has a significant amount of economic challenges, high rates of unemployment, poverty, and a lot of communities that are designated disadvantaged.

You're going to have job losses associated with this, so you're putting additional strain on the economy, some of the bigger picture issues we talked about in terms of in generating new investment regionally in terms of the impacts on existing investment because of the loss of reliable water supplies. So you have a myriad of things that are putting a lot of pressure on the regional economy, and then you're saying, and in addition, now these communities, some of them very small -- we heard from some members of those communities who face -- don't even have any of the financial resources they need to respond to increased costs of water, yet now they're going to be faced with additional costs on top of everything else.

How do we expect them to support those additional costs when they're -- the households are already paying water bills that are at percentages of their income that are higher than EPA standards, that are higher than a lot of the -- sort of the standard thresholds that are used to evaluate water supply availability? How do you -- how do you address that? Are you going to address that? And also the implications of increased water bills on regional economic impacts and flow thrust.

MR. GROBER: So I'm curious because you went -- now you phrased it in terms of addressing that. We disclose a lot of information, and to make this a productive, you know, panel discussion, technical discussion, again, I think I would like to pose it again as a question, but only after making very clear a point that has to do with both the total quantity of water and then the effects as well.

I'm seeing a tendency to look at, well, there's this bad effect and then there's this bad effect and this bad effect, and they're all kind of added up and that they're happening everywhere. We've disclosed a limited quantity of water that would be unavailable for public interest use, if you will, so combined agricultural and water supply, and it's shifting of that quantity of water to public trust use for reasonable protection of fish and wildlife.

So that's a -- that's a -- if there's one thing that's certain in the modeling, though we didn't discuss today the Water Supply Effects Model and how that all works, but let's just assume for a moment that that's the correct number. It's a -- that's a defined quantity of water, and it can only have so many effects either here or there because -- so the reason I bring this up here in the context of the cities, it's not going to be both in effect here and then the full effect on ag. It's that limited quantity of water. And that's both a fact in terms of the limited quantity of water, so it can't be both in effect to the cities and effect to ag except barring -- I'm hearing what you've said about, you know, how the connectedness of the economy and all of these other things.

And, again, I look forward -- we look forward to hearing your comments and your analyses on that because -- I digress a bit, but I hear it both disparaged and yet it's useful. We have 3200 pages -- I always forget the number of pages. We have a lot of pages of document there because we've done, I think, a very good job at doing a programmatic analysis for a very big topic. That being said, the reason we're here and the reason the board wants us to be here is that there's a lot more information that could be added to it, which will add great value.

But getting back to that limited quantity of water, you can't have all of the effect. It's either going to effect the water supply of the cities or ag or a little bit of both, but it's not the total amount. And there's --

UNIDENTIFIED SPEAKER: And I'm not --

MR. GROBER: -- (unintelligible) --

DR. SMITH: You try to put the --

MR. GROBER: I'm almost done, so just let me --

DR. SMITH: Yeah, we don't double count, yeah.

MR. GROBER: Okay. Okay. But I just want to make sure --

DR. SMITH: Right. We don't double count.

MR. GROBER: -- because when you're talking for ag -- because if there's a water supply effect to the cities because -- and then here's part of where -- and you as economists would know part of the magic is that it's very easy to show impacts. It's very easy to show that this is going to lead to all sorts of negative effects, but the reality is markets respond to new conditions. And one of the responses here, while money will change hands in terms of water will get to the cities that will provide money for infrastructure to ag that is then maybe taken the hit, but that can improve infrastructure. That infrastructure can lead to greater efficiencies. That infrastructure can lead to increased groundwater recharge taking advantage of wet years.

So there's an exhaustive analysis which we also did not do which is how you can actually achieve many, ultimately, benefits from the entire system because this gets at the crux of what I hear. I always hear it in my head, Felicia Marcus, the chair of the Water Board. How do you maximize the beneficial use of water? And there are tremendous opportunities here. And I understand what you're asking, what you're doing is that there's also a cost. There's also all these things that we should be looking at and we acknowledge we need to look at, but let's not lose sight of how much better we can use the quantities of water we already have.

MR. BASS: Let me make two points related to that. First of all, I'm not talking about water supply. I'm not trying to double count. I'm not talking about a reduction in water supply to communities. I'm talking about the added cost to communities of mining the groundwater they need, of dealing with decreased water quality from the groundwater as a result of the pumping response that you've modeled with the irrigation districts. So I'm not saying that they're going to get hit by the water supply situation the same as the districts are and double counting. So that's one -- seems like you misinterpreted that.

The second thing is just the issue of the overall economic consequences of this. I think we don't want to lose sight of the fact that this is a regional economy that has a lot of these inner ties. And I think we don't want to separate too much irrigation from the communities. They have their own water supply situations, their own water supply needs. But at the end of the day, the jobs that are being generated by the ag economy are the jobs that are supporting these communities, and these communities are reliant on those jobs. And so you're taking away jobs as a result of these impacts potentially, some -- 2 and a half percent by your estimates on an average, but on certain years, significant job losses by our estimation.

And then on the other side of the equation, you're saying we're also going to do things as a result of the farmer response, which we expect -- again, we can't just put it back on the farmers to deal with it, but ultimately the result of a reduction in their surface water supplies, how that flows through then to the cost to the cities of pumping. And Rod can talk more about that pumping tradeoff, that groundwater depth tradeoff.

DR. SMITH: Yeah, I'm not sure they answered your question, so let's move on.

MR. BASS: Yeah, okay.

DR. SMITH: And, first of all, I -- let me reassure you again, we are not a -- not in favor of double counting, so -- deal? Okay. So we're there.

What is interesting, though, is that if we get -- I think what Jason was getting at in part was that as you pump more groundwater, well elevations, you know, change. And as well elevations change, especially as you heard from the panels this morning, on even the large but especially the small systems, intensifies their problems. You heard today that their -- some of these communities are on a trajectory towards hitting their max -- you know, their MCLs.

So further changes -- the question would be -- and a research question. Okay? A research question would be given the trajectory currently of the communities' trajectories towards reaching their MCLs, how much more groundwater pumping and their impacts on elevations, what happens to that trajectory? Just because you hadn't hit the limit yet doesn't mean you're not going to hit the limit in the future.

It's getting back to some of these fundamental things we did at the first session where you can't look at this as an independent year-by-year thing. You have to look at more in the context of the trends and the resource. And we just didn't see any analysis -- to be fair to you, it was news to us today about this data about, you know, moving to the MCLs. We hadn't heard about that one yet. So I think that's a way of putting in that increased pumping will further lower elevations.

Now, as far as I can tell reading your material a few times -- I didn't have glasses before this engagement -- is that you didn't have any information available to you on how to tackle it, what could be the possible impact of increased pumping on well elevations. Is that correct?

MR. GROBER: I think what we're saying is we don't have detailed information to do this in a very detailed fashion throughout the project area, which is why, again, we did the programmatic assessment. I'm hearing -- I think we heard this morning that there could be hot spots or something there was suggested where there might be some variations. And, again, if there's information that can be provided, then do please provide it.

DR. SMITH: Yeah. Again, a natural experiment that's been occurring actually in San Joaquin County -- and the only reason why I know this, I represent Central San Joaquin Water Conservation District as an expert in the federal litigation against the breach of contract on the New Melones, so I learned a little bit about that area. And from just a study point of view, the bureau did a great job of creating volatility in availability of surface water. And the San Joaquin Flood Control District puts out annual reports on continuous data of well elevations of certain key wells they have, and four of those wells happen to be in the -- happen to be in the Central San Joaquin Water Conservation District. So that would be an -- that could be some evidence you may want to look to.

Because we've looked at it and, indeed, well elevations were on secular decline for only 40 or 50 years. Once Central San Joaquin got access to surface water, that trend slowed. And then when the bureau started seesawing available surface water deliveries, the well elevations were just sort of there doing a tango. And from that case study or that natural experiment, you can identify what's the impact of a change in surface water on well elevations.

So, again, there is information out there. We are -- we, we, us, are in an adventure of being detectives. We have certain information but not as much as we'd like to have. So what we've got to do is piece together -- right? -- based on the information we do have and take advantage of some of these experiences, you know, of actual circumstances. And so the two that Jason and I have turned to thus far, I've told you. One is the Westlands experience, and the other is -- I'm just identifying the Central San Joaquin because it does provide some insight to what is the impact of the changes in surface water availability.

And, by the way, there is a diversity and then a sense of wells that you can't study, you know. Some wells have a greater impact than others. And if you knew more about the subbasins and talked to your hydrologist, you can understand all that. So there is information out on well elevations. Similarly, the districts have at least provided us information, what, on their trends; right? In elevations?

MR. BASS: Elevation trends and pumping and how pumping affects the elevations.

DR. SMITH: Right. So we're trying to solve a mystery here -- right? -- with pieces of information. We're trying to be Sherlock Holmes; right? Try to divine from pieces. But there's information out there, and everything that we've run into, these impacts are material. And so I would invite you to take a look when -- as we finish our work, we'll certainly share -- I think we're retained to share work with you, I suspect, but you have to talk to Keith about that. But -- so there is things we can do better, okay, on that. And I'd just like you to keep an open mind and start thinking about revisiting what can you say about well elevations. Our -- sure. Go ahead.

MS. HUBER: Consideration of well elevations in Chapter 13. I was just trying to find the table.

DR. SMITH: The quantification of impact though?

MS. HUBER: It's more an evaluation of current well elevations relative to groundwater depth. There is more concern for those wells that are close to the top of the aquifer, and we point out a few small districts where there would be potentially the need to make new wells. And impact SP1 talks about impacts associated with drilling new wells or deepening existing wells.

DR. SMITH: Yeah, I'm familiar with that table, and that's a snapshot of what -- what the current well depths are. I instead was talking about what was the trend of and actual data we have on well elevation and how has it evolved over time and, indeed, how that evolving trend is impacted by the availability of surface water. So I (unintelligible). When I read that table, that was sort of what's your view of the head room was, of how much could well elevations change without someone having to deepen a well, your well depth table.

MS. HUBER: Right. So clearly well --

groundwater elevations vary up and down through time, and if the groundwater deficit increases, then there would be more of a trend downwards and there's more concern for wells being adequately deep, which is why we considered the impact of making new wells within Chapter 13. And I think there's also a financial consideration in Chapter 20, but I agree that it's not -- you know, we cannot say how many wells will need to be deepened.

DR. SMITH: Yeah, but actually I -- thank you for that comment because it gives me an opportunity to make something of (unintelligible). A lot of these questions are difficult; right? We can agree on that. A lot of these questions we don't have as much information as we'd like, if we're doing a Ph.D. thesis, to try to get our Ph.D. signed off by our advisor. But because it's hard doesn't mean there's no impact.

MS. HUBER: Yeah, I think --

DR. SMITH: I'm sorry. Just because it's hard to do, doesn't mean it's zero impact. I think the proper thing is to say it's an unknown impact until we start trying to improve our understanding.

MS. HUBER: Yeah, well, we agree. And for like impact SP1, we say there is potential significant impact associated with construction of new wells, for example, but there are a lot of other things that potentially could be required work as well.

DR. SMITH: Did I cut you off? I'm sorry.

MR. WEGGE: Well, again, I guess I'd just like to return to a couple of issues, one of Jason's and one of yours just to follow up on what Les said. You know, as far as Jason was mentioning ratepayer effects and, you know, did we look at that. Yes, we did look at that, and we concluded that there would be effects on ratepayers because it's likely that costs would get passed on to those ratepayers. But without knowing the extent of the costs and without knowing specifically how the individual districts would be impacted and given that it was a programmatic analysis, we tried to lay out what we knew. And what we didn't know, we acknowledged that.

So in answer to your question where I think you were going about ratepayer effects, we did analyze that, and it's in Chapter 20.

MR. BASS: Okay.

MR. WEGGE: And just to follow up on the issue of --

MR. BASS: Could I actually just respond a little --

MR. WEGGE: Sure.

MR. BASS: -- just to interject one thing before you get -- go back to something Rod said. One of the things that was just raised a minute ago was that there's an expectation or a vision that there will be investment in infrastructure and activities to improve efficiencies; that it's not all bad, that there are ways to mitigate effectively is what I heard, whether it's groundwater recharge in wet years as one example. Well, again, that takes a lot of money, and so I wanted to ask -- and that's the crux of my question before.

And I know, Tom, you met -- you responded somewhat is who pays for that cost? And if that cost ultimately flows through the businesses and the farming interests and households in this region, their cost of water went up, they're in the same situation they were before but their cost of water is higher. And when you have an economy that is often struggling -- we've heard about, you know, unemployment rates. We've heard about poverty. We've heard about a lot of things, the challenges in this region for continued economic growth where population continues to go up more rapidly than the state. How do you support the water supply (unintelligible) that population and also support the level of cost necessary to meet those water supply obligations?

DR. SMITH: Yeah. It's really a cost (unintelligible) analysis; right?

MR. GROBER: And this is what becomes very interesting about these questions. And I really appreciate the questions, and I'm sure the audience does as well, but it's very hard when you look at any single piece of this proposal without considering other pieces. And here I want to harken back to, you know, again, how many times have I said this is hard and you're living proof. No, this is hard to do this, and there's many different ways of looking at it. There's many different pieces, parts to this puzzle, but the -- my introductory remarks about it being hard, we also encourage settlement, which is important. Parts of settlement can involve also money changing hands, you know. It's not the subject here today. It will be the subject in the future in terms of the City and County of San Francisco and potential shortages depending on how contracts, water rights are interpreted, things like that. Those are opportunities for money to change hands to build infrastructure.

And, again, without speaking in the same thing as you -- I'm sure you're all aware, currently there are water transfers that occur from districts in the area for sales, and that brings in money. You know, water I think we would all agree is -- it's a very valuable substance. It isn't as even highly valued as it should be in many cases. This is going to create some new stressors and opportunities, but through those, that can help to build that infrastructure in this area.

I'd also like to link this -- and there is a connection here because here we're kind of looking at what are the effects on, you know, drinking water, water levels, hearing about economic concerns. It's important to note that when we went out with this proposal in 2012, one of the top criticisms -- in fact, I just -- I just turned to it. And, you know, for those of you -- I'm sure you've all looked at it -- it's a 3,000-page document, but we have about a 100-page executive summary.

One of the things that was pointed out was concern that we needed to explain and improve our reservoir operation assumptions and surface groundwater supply and quality effects. That's because in the first round, as we've already discussed a bit here today, we made the assumption of either no reliance on groundwater or full reliance on groundwater. We also didn't do -- we didn't look at reoperating the reservoirs. We basically said, well, let's just keep it the same. Criticism we heard is it wouldn't be the same. If we had less water, we're going to hit those reservoirs harder. That's basically what created that, as you refer to it, that volatility.

So there's -- there's different perspectives, different interests, different stressors, and many different ways to look at it. We've looked at one way that presents, we think, a full picture, but I can't emphasize enough how important it is to provide these different perspectives. And then in the end just to manage everyone's expectations, then you'll have to -- everyone will have to look at that once again in the context of the overall picture, which I'm hearing that is of great interest to all of you as well.

DR. SMITH: Yeah. Okay. I appreciate the sentiment. Let me just pick up on one thing because this is a question. Stratecon is probably in -- one of the things we do is we actually do water transactions, so we've closed some deals over the years. And from that perspective, I didn't see where you looked at what was the market value of the surface water lost in this area relative to the market value of the water the exporters will receive.

And now what I'm -- because I remember way deep in one of your tables, your estimate on average I think was 77,000 acre-feet a year was going to go to the exporters. So the dealmaker (unintelligible) sort of looks at it this way. Again, you want a different way to look at the world? Here it comes, my friend. You're asking these people to say, well, you know, you divert water here or here or there. You can't -- you got to send some of the water downstream.

Now we got water down at this diversion point. What's now available for consumptive use? One thing you can do is assign that water to them and say you got some of your water here; take your restrictions. Water that's available down, you know, at another point, you know. Why isn't it their water or not? So I asked myself a question. There's a market value there. So did you do any market valuation of what -- of the water lost versus the water gained? I didn't see it. But, again, with 3,000 pages, you know, you miss something.

MR. GROBER: The short answer is no.

DR. SMITH: Okay.

MR. GROBER: But it's good that you mention it because that really is something that helps inform some of the settlement discussions to talk about clarification just to make it important. And, again, it's hard when we do this in a disjointed fashion because we haven't talked about, you know, many elements of the analysis and the fish benefits and what we're doing in this phase as opposed to the next phase.

But an important point to make is that we're looking in this phase just what would happen with the increased San Joaquin River flows, and then you mentioned that additional amount of pumping that would occur. That's based on current rules, the current regulations in terms of export limits, inflow export ratios, things like that. All of that is going to be addressed in Phase 2 because the intent of this proposal is to protect migrating salmon on the San Joaquin River tributaries. Part of that migration includes through the Delta. So there will be new regulations as part of the Phase 2 update.

DR. SMITH: Okay. Okay. Let's go to groundwater and SGMA just because -- well, we've got 20 minutes. Certainly Jason and I have no clue what is going to be the explanation to SGMA here. So up front, disclosure, okay, whatever it is, would you agree that probably there will be less groundwater pumping allowed than today? We don't know what that difference may be, but whenever SGMA gets implemented, you can't pump as much as you can today. Would you agree with that as just a general premise?

MR. GROBER: Sorry to disappoint you, but this is why this gets into the realm of all being rather speculative because it's about sustainability. It's as much about how much water you're getting in the ground as how much you're taking out. So it depends on in response to this what the local area does in terms of additional recharge, active recharge as opposed to the passive recharge that's generally occurring.

DR. SMITH: I would agree with that answer, but let me pick off the pieces. The reason why I would agree with the answer is before those recharge programs come in, I would believe that pumping under SGMA will be less than today. I agree with what you then added is that because -- they could pump 100 acre-feet histor -- or they pumped 100 acre-feet historically. SGMA, before they do anything of a recharge project, they only do 50. Now they can do a recharge project. Maybe they do a great recharge project. Now they can do 150. Well, as Jason has already pointed out, that didn't come for me. So there's a cost to move, you know, in my example from the 50 to 150.

So let me fine-tune my question a little better, is prior to any of those adjustments, it's got -- the amount of pumping that will be allowed prior to any other investment will have to be less than today. Would you agree with that?

MR. GROBER: You're saying with the qualification that you might do some additional recharge?

DR. SMITH: Yeah, yeah. In other words, before you do additional recharge.

MR. GROBER: Some hypothetical in the future, and --

DR. SMITH: No, no, no. Not in the future. You implement SGMA tomorrow.

MR. GROBER: Well, there's the rub. These are, and we discussed this morning, separate processes. This area, as we've disclosed in this, already has areas that are -- appear to be in overdraft. So that would be suggestive of having to go in the other direction, reducing overdraft. And this project imposed on it, we've done the analysis that there would be at least initially and for some time additional groundwater pumping.

DR. SMITH: Right.

MR. GROBER: The question is how long will it take for things to happen.

DR. SMITH: Right.

MR. GROBER: How will all this come together? How much additional groundwater recharge will there be?

DR. SMITH: Right.

MR. GROBER: A lot of changing conditions, changing circumstance. So we've presented one -- one thing that could be occurring. And likely, based on the most recent drought when SGMA's already in place and groundwater increased, a scenario that will unfold. Will it unfold exactly like that? That's back to all models and assumptions are wrong. It will be something else.

And it's important for you to provide that something else in that broad context, both of what and when and how they would be different. And you referred to volatility and reliability. If there's an alternate model that you suggest that should be assessed, then please provide.

DR. SMITH: Okay. This is right now our current thinking. Certainly before SGMA is implemented, there will be what we'll call for -- picking up on your formulation for unknown period of time, there will be some -- in response to less surface water supply, increase in groundwater pumping. The way I characterize your approach is you assume 100 percent offset. What I mean by an offset, for each acre-foot of surface water that's looked -- no longer available, you're going to increase groundwater pumping by an acre-foot. Continue that 100 percent offset until you hit a maximum. Maximum defined either by the 2009 or 2014 threshold. That's your model; correct?

MR. GROBER: I didn't know that was a question. We didn't come up with any date certain of --

DR. SMITH: No, no, no, no. I said until. Whenever it was, you have a full offset, one-for-one offset, of the increased pumping until total pumping hits a capacity constraint. That's what's creating the --

MR. GROBER: Oh, you mean in the moment --

DR. SMITH: Yeah, in the moment.

MR. GROBER: -- (unintelligible) maximum pumping?

MR. BASS: Up until SGMA comes into place.

DR. SMITH: Yeah, yeah.

MR. Bass: Basically said we're doing analysis (unintelligible) SGMA.

MR. GROBER: Well, I think you're saying two different things.

DR. SMITH: Okay. That's fine.

MR. GROBER: The maximum pumping that we --

DR. SMITH: Oh, no. What I mean is you can't pump indefinitely up to offset everything, the peak reduction. The -- you're going to hit a maximum, groundwater pumping maximum.

MR. GROBER: Well, I -- maybe we're using different terms.

DR. SMITH: Yeah.

MR. GROBER: The maximum pumping is -- we just used a level, a maximum pumping based on 2009 information.

DR. SMITH: Yeah, no. That's what I'm saying. You defined a maximum.

MR. GROBER: The way we've -- we viewed it is that we didn't change that maximum pumping rate. That's just what --

DR. SMITH: No, I understand. That's what I mean. It's a maximum. So you have 100 percent offset until you hit a capacity constraint as defined. Okay?

What's interesting about the Westlands study is that if you look at the data -- and once we finish ours, I guess we'll be able to share it to you -- you get a 50 percent offset. That's been the experience based on about, what, 22 years. And what's interesting from a scientist or an economic researcher's point of view is we know Westlands had great variability in available surface water year to year, so it's not like we're trying to extract from small variations. It's really remarkable. It's like a 50 percent offset. And some of the discussions we've done -- because we do believe in getting -- not only looking at data but talking to real people.

When we talked to the Westlands people about that offset, they hadn't looked at the data in that way, and so they were sort of interested in it. But, you know, there's a lot of good reasons why you don't have that full one-to-one offset. And that probably gets us into too much of ag economics, so let me just say that's not unreasonable.

So what's interesting is if you use that approach, that's 50 percent offset until you hit your maximum pumping, what that's going to do, it's going to reduce a bit your stressor, to use your concept. I agree about increased groundwater pumping is going to be a stressor in this area. It reduces the pressure there, but it's really going to increase the land fallowing by a lot.

So in terms of your point, you know, there's two models, let's say. It's 100 percent offset until maximums hit. A 50-50 offset, 50 percent offset until the same maximums hit. One's going to have a little less stressor than the other, but one's going to have a lot more impact on the local economy. And so what we're doing, again, is trying to look at experiences anywhere we can find them and how to see what happened, to help us inform. And, you know, as you can imagine, that's -- those differences are going to have -- you know, where does reality fit within those is going to, you know, be really -- those are different futures.

MR. GROBER: So you've been -- I guess it's never seems to be a friendly phrase, but you were putting not words in my mouth, but you were saying things that I was saying. Let me say something back.

DR. SMITH: Good. No, no, no. I was letting you know how I characterize your approach; that's all. That's all. Just being honest.

MR. GROBER: So an analysis that, say, looked at no additional groundwater pumping, your suggestive that would be a better reflection --

DR. SMITH: No.

MR. GROBER: No?

DR. SMITH: Before SGMA's --

MR. GROBER: Or it would be -- it would be a glide slope down to --

DR. SMITH: Yeah.

MR. GROBER: -- to (unintelligible).

DR. SMITH: Another one, okay, real simple. A hypothetical. And you say math is good. I agree with you. Math is good. As a former math major, math is great.

I got a situation where I had 100 acre-feet of surface water. I lose 50. I had a 25 -- 100 -- 25 foot -- 25 acre-feet of groundwater pumping for a loss.

Rather than, you know, increasing to 75, it only increased, you know, by half of the loss. And as you got more lost groundwater, you could increase your pumping until you hit that maximum. Because what you guys do is you have the full offset until the maximum's reached.

MR. GROBER: And you're saying there should be some glide slope?

DR. SMITH: Yeah, glide slope. And I guess the -- our argument's based on looking at over 20 years of experience of what's happening in Westlands, as opposed to just, oh, isn't this a cool assumption, you know. And that will have very different impacts. It would be less stress on the groundwater base, but there's still a lot of stress relative to today.

MR. GROBER: Yeah, but you're saying it would adjust over time.

DR. SMITH: It should adjust over time. Now, when we get to SGMA, I don't see -- until you start adding recharge projects or something else, until SGMA, you cannot increase your groundwater pumping. I would not blame the reduction in groundwater pumping fully on the, you know -- you know, the flow restriction. You have an implementation of SGMA, whenever it's going to occur, 10 years, 15 years, whenever that shift point's going to be. But once we get into that SGMA world, the idea that we can increase ground pumping -- groundwater pumping at all to offset the loss of surface water is just problematic. It's just an opinion.

MR. GROBER: No, no. I -- that's -- this is what's great about panel discussions.

DR. SMITH: Right.

MR. GROBER: So I look forward to seeing what assumptions you would be --

DR. SMITH: Right.

MR. GROBER: -- suggesting and then also how you would suggest dealing with what I characterize as uncertainty because there's the recharge part of the equation. Because there's a lot of big unknowns, and I think all of this useful discussion --

DR. SMITH: Yeah.

MR. GROBER: -- shows what a big case somebody already thinks. It's not what (unintelligible) is.

DR. SMITH: (Unintelligible) follow up. Okay? So, therefore, I think we, in our opinion, we think the baseline of analysis -- again, we don't -- we think the short-term, just looking, averaging with the short-term model is not the right -- you got to look at it more of a, you know, a longer-term perspective. Within that longer-term perspective, we're going to hit out of the box increased groundwater pumping either by your 100 percent offset model or 50 percent offset model, whatever it is, until you get to SGMA.

And once you get into SGMA, you're going to transition to a new world where there's no offset of groundwater pumping in response to the flow objectives -- and here's where we get some common ground, I hope --

until we do new investment. Would you agree with that sort of definition of a baseline?

MR. GROBER: When you say, "new investment," meaning --

MR. BASS: Recharge.

DR. SMITH: Recharge.

MR. GROBER: Oh, yeah. Uh-huh.

MR. BASS: Or other actions, right.

DR. SMITH: Or other actions.

MR. GROBER: Yes. I think it's important to note -- again, I'm -- you know, of course I'm both defending and disclosing our analysis, but some of this discussion really gets at the crux of, say, why we didn't use the 2014 levels of groundwater pumping. Because rather than that glide slope approach, which you're referring to, it's rather looking at, well, how about a lower level that is, perhaps, underestimating what the current capacity is just because that's, as we characterize it, more sustainable than 2014 levels.

DR. SMITH: Right.

MR. GROBER: I don't think we're disagreeing about, you know, big concepts.

DR. SMITH: Yeah. Well, that's -- that's why it's good to start the first discussion. We see how we've looked at the world, same or differently. Yeah, because I agree with you too. To think you could put the (unintelligible) indefinitely from 2014 would be irresponsible analysis, because if we think of the Supreme

Court's decisions in groundwater adjudications, a concept of safe yield is really sort of average recharge plus the concept of temporary surplus. And the concept of temporary surpluses in light of the fact you don't always pump, you know, the average annual recharge, your demands are low or (unintelligible) or whatever. So you have, like, something in storage so you can peak above safe yield for a few years. And then all the groundwater adjudications in California, that's what watermasters are, you know, always trying to keep track of.

And so I do agree that to look at peak stressing in response to a drought and have a model that thinks, well, we can just go up there indefinitely is just -- that's bad resource economics anyway. I --

MR. WARD: While we're all enjoying this two-way conversation immensely, believe me, we've got about 15 minutes left.

DR. SMITH: Yeah.

MR. WARD: So, Dave, did you have -- I sense you --

MR. WHITE: I do. And I still don't understand this regional -- and maybe it's just me. I'm a little dense. But this regional economic impacts, you did not take into consideration the processors?

DR. SMITH: Yes, they did not.

MR. WHITE: That you did not? It was just agricultural output; correct?

MR. WEGGE: The processors were evaluated but not as part of the regional economic analysis using IMPLAN.

MR. WHITE: Okay. Well, to me, that's a very significant flaw in your study because here, at least in our county, we have a lot of very significant processors. And I can tell you anecdotally that when fields go fallow and tomatoes are not grown, the processors react to that. They lay people off. They don't produce as much.

UNIDENTIFIED SPEAKER: They move.

MR. WHITE: Or they leave because they can't expand. So to me, that's a major flaw in your analysis.

MR. WEGGE: Let me -- let me clarify something. All I was saying was that we didn't use this particular model to look at the effects on processors. We looked at the effects on processors, but we did not feel that IMPLAN was the right tool to look at those effects.

MR. WARD: Where was that in your --

DR. SMITH: Which tool did you use then?

MR. WEGGE: We didn't use a tool. We --

DR. SMITH: That's right. So, therefore, it wasn't -- see, when you say you didn't use a tool, like his presentation, we can go back to the slides, it was all down. You didn't go forward and then you say this is the IMPLAN results.

MR. WEGGE: Right.

DR. SMITH: It didn't look forward. So these results are without looking at the processors, and now I hear you say: But we did something else.

MR. WEGGE: Yes.

DR. SMITH: And as Walt said, where is that in the document?

MR. WEGGE: Well, we talked about this earlier. It's in Chapter 20, Chapter 11, and Appendix G.

MR. WHITE: Well, I guess what I would like to see --

MR. GROBER: I just wanted to -- we'll have more information on this on December 5th or 12th. I don't know when we're discussing the economics, but our economic expert is not here today. And I think in conversations we've had with him, and I can't refer you to where in the document it is, but some of the variability or the ranges that were considered in terms of how the processors would be considered, that would be absorbed by the pros -- crops from out of area and shipping and things like that. But I will -- we'll have more of the details of that on the 5th or the 12th.

MR. WHITE: I can tell you anecdotally that many of our processors have local supply, and it is because many of them are farm fresh, want to be quick to market. And, for example, one tomato processor here, their whole mantra is that they can get their tomatoes in the can in six hours. So it does have an effect. And I would like to see a chart -- this regional economic impacts chart, I would see -- I would like to see the processors included in that, because I think it's going to be significant.

MR. GROBER: Well, we -- we recognize, I think, that it is important. We just felt that the tool that we used to do the analysis of crop production was not the right analytical tool to evaluate the effects on processors and dairies.

DR. SMITH: So, Walt, is what I'm hearing -- let me see if I can -- because I know my client will ask me: What the heck does all this mean? I think when Tim did the presentation, it was step by step. It was good. It was appreciated as the IMPLAN results. These are the IMPLAN results. So, therefore, the answer to your question is this does not include the processor (unintelligible) issue.

Now, you're saying it was addressed elsewhere, and we'll reiterate again, because we missed it the first time, but it's -- you know, you read stuff; you miss it. But then I'm puzzled. If you had that elsewhere, why wasn't that included in your full -- we get IMPLAN plus the other work to get to the full result?

MR. WEGGE: Well, because, one, we did not estimate -- we described what we thought the effects would be in terms of whether processors -- as you pointed out, some of them get a large share of their product locally; some of them don't. Those are issues that from a modeling standpoint you need to be able to figure out. And the IMPLAN model doesn't allow for that, so it's beyond the capability of the IMPLAN model to accurately capture that. So --

MR. WHITE: I get that. But, again, if you're going to be presenting to the public an argument of this is what the impact is going to -- and at least this is what's being presented to you. And I -- maybe my assumption's wrong, but if this is the same chart that you're intending to show the Water Board of what the impacts are going to be and you're not articulating strongly enough what the impacts are going to be to the whole economy, not just to ag but to processors, to the community, and et cetera, then I don't think they're going to get the whole picture. Despite the fact that it might be buried somewhere in the report, it needs to be shown very clearly.

MR. GROBER: And your point is well taken which is why, I believe -- and we'll be -- we'll have to talk to the other expert that was involved in this. And my thought is that it's covered implicitly, but your point is well taken; show us where is it. So hold that thought.

DR. SMITH: (Unintelligible) the math.

MR. WEGGE: And the other point I'd like to make about the other person who couldn't be here today who is at UC Davis, works at UC Davis, he would have been the one to make contact with the processors, contact with the growers. We collectively don't know exactly all the contacts he made. So I know that he did, but I can't sit here and tell you what they are. But --

DR. SMITH: Yeah.

MR. WEGGE: -- so he would be the best person to explain that. I know he didn't just, you know, sit in his office at UC Davis and run the model and say, okay, here are the results. It was --

DR. SMITH: Well, that's fair.

MR. WARD: Who is that specifically?

DR. SMITH: I think Lund, Lund. Lund, isn't it?

MR. WEGGE: Josué --

UNIDENTIFIED SPEAKER: (Unintelligible).

MR. WEGGE: Azuara.

UNIDENTIFIED SPEAKER: I'm getting (unintelligible).

DR. SMITH: It's someone. It's someone, yeah.

MR. GROBER: Josué Medellín-Azuara.

DR. SMITH: Oh, okay.

MR. WHITE: May I ask another question? And actually, Jason and I were talking about this. Okay. For example, let's suppose the water -- you know, the water flows are increased to the Delta, farmers lose a certain percentage of water, and we talk about fields going fallow. Now, some fields, the loss -- there's not a huge impact pertaining to the investment they made in those fields because they could be row crops. But what about the loss of investment if a farmer has to -- if a farmer has to destroy his acreage of almonds or something that really required a huge investment? Is that figured -- is that -- have you determined that at all in this model?

MR. GROBER: That's available in our appendices that show that with -- well, that's what the SWAP model does is that it does not hit the permanent crops. Does not hit the high value crops. It's just having an effect on the lower value crops.

MR. WEGGE: What he means by "hit," I mean it's considered in the model, but the extent to which the reduction in water affects different crop types, it works sort of from the bottom, lower value, net value crops, and it works its way up. So if you're just eliminating or reducing a small amount of water, it's going to only affect the lower value crops.

DR. SMITH: Under the model.

MR. GROBER: So it's -- yeah, so it's in the model, but it doesn't -- the effect on almonds doesn't get triggered because there's not the level of reduction of water in order to have that effect.

DR. SMITH: Commissioner?

MR. O'HAIRE: Well, yeah, I was going to say in reality probably -- I don't know how accurate that is. You go up and down the Valley and you see orchards being pulled out, ripped out. So I'd say it will affect some of the permanent crops eventually, sure.

I did have a question, sort of -- a couple actually, real quick. I was just wondering -- really a big-picture question for me. I know we've got a lot of detail here. We're talking about all these impacts, numbers, and so forth. But, you know, when you're putting budgets together, when it's your household or your company and -- you know, I always, as a manager, I want to see the worst-case scenario.

And, you know, we're talking -- I had mentioned earlier about this. We talked about the 210,000 acres fallowed, and we've talked about all these different downstream effects. And to me, that's what I would -- I mean, I'm just speaking for myself personally. That's what I would want to see. I would want to see, okay, what's the worst-case scenario here? What are we looking at? You know, give me all -- everything that's tied to this. I want the big number. That may not be what happens, but I want to see it. And I think the public should see it, because it could actually happen. And I think we need to be aware of that.

And what I've found out in life is, you know, especially with government, a lot of times they underestimate, you know. I'm not saying anything particular about you. Just in general, federal government, whatever. They say, oh, it's going to cost $3 billion, and by the time it's done, it's, you know, $9 billion. It's three times that.

So I'm not saying that's the situation here, but I think we need to see the big number. That's what I want to see. I want to see the full -- give me the -- you know, I want to see the whole nine yards as to what the potential impact to this -- to this area could be. And it should be down to the detail where we can see it.

MR. GROBER: And --

MR. WHITE: And we can understand it.

MR. GROBER: And we appreciate that sentiment, but it's -- the problem is that cuts both ways, especially when you're doing like a CEQA analysis, CEQA document. Because we don't want to just overstate every impact and then just sort of, well, everything's bad and everything's expensive and then it doesn't really provide resolution on what -- really what we're trying to do here. Which is why the comments are good. We're trying to present what we think are the real effects and also the real costs. Everything we're hearing here, if you think there's something different we should have, then we will need --

MR. O'HAIRE: But in reality, it's a range. I mean life's -- we're never going to hit it -- we know that. You can't hit it exact.

MR. GROBER: Sure.

MR. O'HAIRE: You're not God.

MR. GROBER: And there's some --

MR. O'HAIRE: It's nice to have that range and say we -- gee, this is at -- where at one end we think we can be and here's the other end, and it's probably going to be somewhere in between there, you know.

The other thing I just quickly would say -- maybe it's still on our topic here -- it's back -- it's sort of back to the residential areas. Did you work with -- I'm just -- because I get down in (unintelligible). Maybe it's small stuff, but did you -- did you talk with the -- or did you work with the water districts to see what type of impact this would mean to the residents as far as like watering? Like I -- again, I'm going back to my own situation. I live in town. We're down to the wintertime one watering a week, summertime two waterings a week. And I'm sitting here thinking, gee, are we going to be down to one watering a week during the summertime? I don't know. I don't know if that is going to mean that's going to happen.

They're already cutting out a lot of trees in Modesto because of the drought and because of the lack of watering. There's a -- there's other impacts, as we mentioned a little bit earlier, but, you know, there's other impacts besides -- you know, there's property value. There's -- trees are going to be going. There's -- rotting and dying and infestation, beetle infestations.

There's a whole lot of other things, I think, that would happen. That's very important to the residents to know that, you know, possibly your yard trees could be dying, your yard is going to be going brown and -- you know, and what's the impact of that? I don't -- you know, I don't -- was that studied? Is that included in here anywhere?

MR. GROBER: Not at that granular level that you're describing.

MR. O'HAIRE: Okay.

DR. SMITH: Well, I promised you one thing is that I -- we'd take you up on your great plea that you started with this morning. What from our perspective could you consider doing differently or better? Okay. In no particular order, and just to just show you, no particular order, lot of scribbling, I'm going to try to capture the essence of these two panels.

I think you need to define your time horizon. And where does the interface with SGMA implementation happen within that time horizon? I know everything's going to be tough, so I don't -- I won't go each into these, how tough. But at least consider doing that.

I think you've also heard that averages are good, but you've got to realize that economically they can be misleading, so open your mind up to think about volatility.

Similarly, consider reliability. I think we have to be sure how we think about how we're addressing sustainability. I think to ground truth models and assumptions to the extent you can is a real good idea. I mean, I share with you we're looking at a couple things of what's happened in Westlands and Central San Joaquin. There may be other things, so be mindful.

In terms of the issue about orchards coming out, Commissioner, I do know that if you take the 5 to the 46 to the 101, you can see how that The Wonderful Company, aka, Paramount, have ripped off -- have taken down hundreds of acres. So ground truth your models.

I think in terms of other things and challenges, know the structure of the local economy. I think you heard today that there's significant issues related to impacts downstream from ag as it relates to processing, dairies, feed lots. Sorry Frito-Lay, you know, my stepdaughter. You know, you have to think about that because what we're hearing from the economic development officials of the states -- from the counties who have been on this panel today, that is a material issue.

And I think what my other punch list would include, that -- and I think this gets your point, Commissioner. We have to think in terms of risk analysis; right? What is our risk? These are hard things to do. I mean, we do it. You know, it's hard but, you know, to not do risk analysis at all is, you know, is troubling, at least to some of us.

And then I think the last thing is to say let's keep the discussion going. Thank you.

MR. GROBER: Thank you.

MR. WARD: And that's it. We ended it right on time.

MR. GROBER: You're a great timekeeper.

MR. WARD: You'll be seeing -- you'll be seeing more of us, hearing more from us. We're not going away. And --

MR. GROBER: We -- even if we might not always look like it, we appreciate the opportunity. Hopefully we do look like it.

MR. WARD: All right. We do. Thank you all very much, and everybody who stayed all day long.

As Keith Boggs said, we'll have this out on our website. So whatever that's worth to the people, that's where you'll be able to go back and review it. Thank you.

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STATE OF CALIFORNIA,)
)
COUNTY OF STANISLAUS.)

I, LISA S. COELHO, a Certified Shorthand Reporter in and for the County of Stanislaus, State of California, do hereby certify:

That in December 2016 and January 2017 thereof, I transcribed the text/electronic/audiotaped recording of the proceedings; that the foregoing transcript constitutes a full, true, and correct transcription of all proceedings had and given.

IN WITNESS HEREOF, I have hereunto set my hand and affixed my Official Seal on January 9, 2017.

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LISA S. COELHO, CSR #9487

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