REPORT TO THE CALIFORNIA STATE LEGISLATURE JOINT LEGISLATIVE BUDGET COMMITTEE

ON

REDUCTION OF AGRICULTURAL POLLUTION RUNOFF INTO THE SACRAMENTO-SAN JOAQUIN DELTA

STATE WATER RESOURCES CONTROL BOARD
AND
CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

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Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

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EXECUTIVE SUMMARY

This report has been prepared pursuant to the requirements of the Supplemental Report to the 2008 Budget Act:

> "On or before March 30, 2009, State Water Resources Control Board (State Water Board) shall submit a report to the Joint Legislative Budget Committee and to the relevant policy committees that details: (a) the precise actions the State Water Board would have to undertake to obtain a 30 percent reduction to agricultural pollution runoff in to the Sacramento-San Joaquin Delta [Delta] and its tributary watersheds by 2012, (b) the estimated costs of those actions, and (c) which of those actions can be completed administratively and which would require legislation to implement."

The Central Valley Regional Water Quality Control Board, (Central Valley Regional Water Board) staff has determined that replacing irrigation practices that produce return flow is the only method of ensuring a 30 percent reduction in agricultural pollution runoff to the Delta by 2012. The program would be focused within the Delta and San Joaquin River watershed and apply to surface return flow (tailwater). Tailwater can convey contaminants applied to or on the land surface, such as pesticides, sediment, fertilizer, and manure. Tile water (subsurface drainage pumped to surface waters) contains naturally occurring minerals found in ground water, and may contain contaminants leached into the ground water due to application on the land surface. However, tile water is not the focus of this control strategy, since it would take longer to implement the required control technologies.

Irrigation return flow is the focus of this effort, since it is more amenable to control (versus storm water runoff) and over 60 percent of the exceedances of water quality objectives we have identified occur during the irrigation season.[1] A target of converting 50 percent of the irrigated acres that produce runoff to more efficient irrigation practices that produce no runoff is recommended. A 50 percent conversion target is recommended, since there are other pathways for agricultural pollutants to reach the Delta through surface waters (e.g., pesticide drift, tile water drainage), so a larger percentage reduction in irrigation runoff would be needed to ensure that the overall 30 percent pollution reduction goal is achieved.

The estimated cost to the agricultural community to implement the required management practices is $250 million - $450 million in capital cost, assuming half of the one million acres of agricultural land requiring improved irrigation management systems would be targeted to meet the 2012 timeframe. Additional Central Valley Regional Water Board staff resources of up to 10 PY would be required to ensure the required practices are implemented.

[1] Storm water discharges are likely to have less of an impact on the Delta. Even with an alternative conveyance, a significant amount of dilution water would be coming into the Delta from the Sacramento River system during a storm event.

The State Water Board has the authority to prohibit the waste and unreasonable use of water. The State Water Board could use this authority to assess whether irrigation practices that generate surface water runoff should be replaced by more efficient practices (e.g., drip or sprinkler irrigation). However, it would likely take at least 2-3 years to conduct the necessary analysis and complete the required administrative processes before an order could be considered. The outcome of such a proceeding would be based on the evidence presented to the State Water Board and the Board's assessment of that evidence.

Alternatively, legislation could be adopted to require the necessary water conservation measures. Legislation requiring the adoption of irrigation practices that reduce or eliminate runoff would need to be enacted as urgency legislation in the 2010-11 session to meet the goal. Compliance with any such legislation would likely require State funds to be made available to provide cost share or fully fund the necessary improvements.

The unintended consequences of rapidly making such sweeping changes to the regulation of irrigation return flow are difficult to predict. Many tributaries to the San Joaquin River are seasonally dominated by agricultural return flows. The rapid reduction in return flow could dry up these streams or lead to depressed dissolved oxygen levels from reduced flows. Unless reservoir releases are increased to compensate for the reduction in flow, fisheries in the east-side tributaries of the San Joaquin River could be negatively impacted. Despite lower mass loading to the Delta, salinity concentrations in the San Joaquin River would likely increase, as poorer quality ground water accretions make up a larger percentage of the flow. In addition, there are likely to be crop production situations that are not amenable to control of surface water discharge at all times (e.g., rice fields must be drained at certain times of the year).

The Central Valley Regional Water Board already has programs in place to address water quality problems associated with agriculture. Compliance with water quality objectives is required by 2012 for chlorpyrifos and diazinon, as well as selenium in the San Joaquin River. Management plans have been approved and are being implemented by agricultural coalitions and their member growers to address water quality problems associated with pesticides and other contaminants in tributary streams. Dairies and the associated cropland are regulated to ensure dairy waste does not impact surface waters.

The Central Valley Regional Water Board has a track record of successfully working with the farming community and other stakeholders to address surface water quality problems associated with agriculture. We recommend that the current regulatory programs be maintained and sufficient resources provided to ensure agricultural discharges do not negatively impact the Delta. A focused effort on identified problems, rather than a broad approach targeting irrigation return flows, should ensure the Delta is protected, while avoiding unintended environmental impacts.

The Central Valley Regional Water Board staff recommended approach is summarized below. The State Water Board concurs with the approach recommended by the Central Valley Regional Water Board. Both the Central Valley Regional Water Board staff recommended approach and the approach required to meet the 30 percent reduction goal by 2012 are discussed in further detail in Section II of this report.

Recommended Actions to Implement the Preferred Approach for Protecting the Delta from Agricultural Discharges

To successfully implement the Central Valley Regional Water Board staff's preferred approach, the following actions are recommended:

1. Provide adequate staffing resources for the Dairy Program and Irrigated Lands Regulatory Program to ensure robust compliance and enforcement efforts;

2. Provide the Central Valley Regional Water Board with adequate contract resources to conduct monitoring and engage County Agricultural Commissioners in local water quality compliance activities.

3. Provide the Department of Pesticide Regulation with any additional resources necessary to adopt and implement regulations to prevent pesticide transport to surface waters.

4. Provide cost share funds for growers to implement improved management practices, where needed.

I. BACKGROUND

This report has been prepared pursuant to the requirements of the Supplemental Report to the 2008 Budget Act:

> "On or before March 30, 2009, State Water Board shall submit a report to the Joint Legislative Budget Committee and to the relevant policy committees that details: (a) the precise actions the State Water Board would have to undertake to obtain a 30 percent reduction to agricultural pollution runoff in to the Sacramento-San Joaquin Delta and its tributary watersheds by 2012, (b) the estimated costs of those actions, and (c) which of those actions can be completed administratively and which would require legislation to implement."

This report has been prepared by the Central Valley Regional Water Board, at the State Water Board's request, as the Central Valley Regional Water Board has primary responsibility for regulating agricultural discharges to the Delta. <u>The State Water Board concurs with this report.</u>

Clarification of Scope of Report

Central Valley Regional Water Board staff convened to decide how to best approach the report, and considered the following:

1. What pollutants and monitoring locations are associated primarily with agricultural activities so that pollution from other land uses and sources does not confuse the results?
2. Are there pollutants and monitoring locations for which we now have sufficient information to understand the extent of the problem(s), so that we have a starting point from which to measure 30 percent reductions?
3. Which management practices are most effective in reducing these pollutants so that implementing the management practices can achieve measurable reductions by 2012?
4. Where are agricultural management practices related to water quality already known so that initial conditions can be used as a starting point to assess implementation of improved practices?

Answers to these questions (summarized at end of this Section) helped the Central Valley Regional Water Board staff develop a set of actions to respond to the request, the rationale for which is described in Section II.

Geographic Scope

Based on discussions with staff from the Senate Budget and Fiscal Review Committee the scope of this analysis was narrowed to the area of the San Joaquin River and the South Delta (San Joaquin River watershed) and did not include the evaluation of the pollution sources in the Sacramento River watershed. Therefore, actions and costs estimated in this report do not include the Sacramento River and its tributaries.

Current Water Quality

Water quality within agriculturally dominated tributaries to the Delta and San Joaquin River are fairly well characterized. Beginning in 2004, the Central Valley Regional Water Board has worked with grower coalitions in the Central Valley to characterize surface water quality within agricultural regions. A complete report of the most recently compiled results of that monitoring can be found on the Central Valley Regional Water Board website at:
http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/monitoring/staff_monitoring_data_analysis/2007_monitoring_data_report/index.shtml.

Agricultural discharges include stormwater discharges, tailwater discharges, and tile water discharges. Tailwater discharge is a normal agricultural practice generally associated with surface irrigation techniques such as furrow or border strip flood irrigation. Under these methods, excess irrigation water (tail-water) is discharged from a field into a collection ditch. Tile water comes from drainage tiles installed in a field below the ground surface. These tile drains are used to lower the water table to prevent the crop root zone from becoming saturated. The ground water collected by the tile drains is conveyed to a sump, which then pumps the water to a drain or canal. Under both methods, the collected water can be recovered and returned to the same or another field, or it can be discharged back into a surface water body. Tailwater can convey contaminants applied to or on the land surface, such as pesticides, sediment, fertilizer, and manure. Tile water contains naturally occurring minerals found in ground water, and may contain contaminants leached into the ground water due to application on the land surface.

When these pollutants are discharged to surface waters, they can impair the beneficial uses of those waters. Elevated pesticide levels can impact aquatic plants or animals in the water or stream bed, as well as impair drinking water. Sediments can contain legacy pesticides that bioaccumulate in fish tissue. In addition, fine sediments can deposit in spawning beds and impair fish reproduction. Fertilizers can stimulate excess algae growth, which can cause depletion of dissolved oxygen in the water when the algae die. Pathogens found in manure can cause illnesses to swimmers and other recreational users of the water body.

We have broadly classified observed water quality problems into three groups:

- pollutants for which agricultural discharges likely cause or contribute to a water quality problem;
- pollutants for which agricultural discharges potentially cause or contribute to the exceedances; and
- pollutants for which the contribution from agriculture is still uncertain.

Table 1 provides a list of pollutants, organized by contribution group and then by number of exceedances[2] caused by that pollutant. A brief description of the nature and source of each contaminant class is provided in Attachment 2.

Table 1 also provides data about whether the exceedance occurred during the irrigation or non-irrigation season[3]. For the purpose of this report, the non-irrigation season is defined as the period beginning September 1 and extending through February 28, when the principal source of discharge into surface waters is stormwater runoff. In contrast, the irrigation season begins in March and extends through August. During this time, discharges are dominated by irrigation runoff.

As indicated in the table, salinity (EC/TDS) and pesticide exceedances are the most common of those contaminants for which agricultural discharges are known to contribute. Within the pesticide group, diazinon and chlorpyrifos represent nearly two-thirds of the exceedances (183 of the 287). Other contaminants with high exceedance rates include E. coli, dissolved oxygen and metals. However, the correlation to agricultural discharges of these pollutants is not as well established.

[2] The Central Valley Regional Water Board maintains a list of regulatory limits (called water quality objectives) for certain pollutants. These limits are established at levels that should be protective of all beneficial uses. Where no numeric water quality objectives have been established, staff has applied Central Valley Regional Water Board policies to the best available scientific data to interpret compliance with narrative water quality objectives. An exceedance occurs whenever monitoring results exceed the water quality objectives or threshold values. Exceedances are specific to the waterbody, pollutant and time of the sample.

[3] The reader should use caution in interpreting the results of this table. Some contaminants are tested more frequently than others. Therefore, the total number of exceedances provides only a very basic overview of the relative severity of water quality impairments. Also, the relative percentage of exceedances by season only indicates when exceedances are more likely to occur, not what proportion of samples has exceedances.

Table 1
AGRICULTURAL CONTRIBUTIONS TO WATER QUALITY EXCEEDANCES IN AGRICULTURALLY DOMINATED WATERWAYS IN THE SAN JOAQUIN RIVER WATERSHED AND SOUTH DELTA

Parameter Category	Water Body/Pollutant Exceedances Total Count	Irrigation Season	Non-Irrigation Season	Programs to Address	Goal date for Full attainment of Beneficial Uses
Agricultural Practices Likely Cause or Contribute to the Problem					
TDS/Electrical Conductivity	668	58%	42%	▪ San Joaquin Salinity and Boron TMDL ▪ CV Salts	2014 - 2026 Under Development
Pesticides	208	72%	28%	▪ San Joaquin River and Delta Diazinon and Chlorpyrifos TMDLs ▪ Irrigated Lands Regulatory Program	2010 - 2011 2011 - 2019
Legacy Pesticides	139	82%	18%	▪ Irrigated Lands Regulatory Program (addressing through sediment control) ▪ Legacy Pesticide TMDL	2011 - 2019 Under Development
Toxicity, Sediment, Scud (Hyalella)	73	62%	38%	▪ Sediment Quality Objectives	Under Development
Toxicity, Water Column, Water Flea (Ceriodaphnia dubia)	63	69%	31%	▪ Irrigated Lands Regulatory Program	2011 - 2019
Nutrient	34	69%	31%	▪ Irrigated Lands Regulatory Program ▪ Dairy Program	2011 - 2019
Selenium	2	33%	67%	▪ San Joaquin River Selenium TMDL	2010
Agricultural Practices that Potentially Cause or Contribute to the Problem					
E. Coli	611	59%	41%	▪ Irrigated Lands Regulatory Program ▪ Dairy Program	2011 - 2019
Dissolved Oxygen	530	69%	31%	▪ Irrigated Lands Regulatory Program ▪ Stockton Deep Water Ship Channel TMDL	2011 - 2019 2011
Toxicity, Water Column, Algae (Selenastrum)	95	57%	43%	▪ Irrigated Lands Regulatory Program	2011 - 2019
Uncertain Agricultural Contribution					
Metals	411	63%	37%	▪ Irrigated Lands Regulatory Program	2011 - 2019
pH	131	69%	31%	▪ Irrigated Lands Regulatory Program	2011 - 2019
Toxicity, Water Column, Fathead Minnow (Pimphales Promelas)	21	52%	48%	▪ Irrigated Lands Regulatory Program	2011 - 2019

Status of Existing Programs

The Central Valley Regional Water Board has many programs that address agricultural pollution runoff, including the Irrigated Lands Regulatory Program (ILRP), the Dairy General Order Program[4], the Total Maximum Daily Load (TMDL) Program, the Bay Delta Program, and the Grasslands Bypass Project. In addition, there are two major policy efforts underway addressing Central Valley salts and drinking water constituents in the Delta. These programs are summarized in Table 2 and discussed further in Attachment 1. In addition, Table 1 identifies the programs that address specific pollutants

The ILRP is the principal program for addressing discharges from irrigated agriculture and is the implementation vehicle for many other programs including most of the TMDLs. In addition, this program is targeted at the precise question the Legislature is asking, namely what can be done to reduce discharge of agricultural pollutants. As part of the Board's ILRP, management plans have been prepared by agricultural water quality coalitions. These plans have been approved and are being implemented by the Coalitions and their member growers to address those water quality problems clearly associated with agricultural practices (e.g., pesticides, sediment toxicity).

Because the intention is to focus on areas that are specific to agricultural use, smaller waterways have been chosen as monitoring and control points in the Coalition monitoring plans, rather than the San Joaquin River. However, staff experience has been that contaminant levels are often higher in the smaller waterways than in the major rivers. If water quality concerns are addressed in these waters, the water quality in the San Joaquin River and south Delta should improve, as well.

The Coalition management plans have been developed as an adaptive management approach focused on high priority streams first and moving forward with other areas as management practice effectiveness and water quality issues are better understood. Prioritization is based on many factors including severity and frequency of exceedance, whether the TMDLs have been established for the pollutants and whether the exceedances can be definitively correlated to environmental impacts. As such, the dates for full protection of beneficial uses vary.

Management plans include surveys of grower management practices (focused in priority watersheds). These surveys include questions regarding management of irrigation water, pest management, nutrient management, and sediment and erosion control. Management plans generally envision completing the evaluation of the first implementation iteration by 2011. However, this iteration is limited to selected high priority watersheds and pollutants (typically pesticides), and will not necessarily translate into an across the board 30 percent reduction in total agricultural pollutant discharge. The Dairy Regulatory Program focuses on the discharge of animal wastes to ground

[4] The Dairy Program regulates both dairy operations and dairy cropland through waste discharge requirements. Those requirements are structured to ensure dairy waste does not impact surface waters.

and surface waters through general waste discharge requirements (WDRs). The WDRs have been in place since 2007 and regulate discharges from approximately 250,000 acres of cropland owned or operated by dairies in the San Joaquin River watershed. Dairy owners with crop land must develop nutrient management plans and requirements in the general WDRs to prevent the discharge of dairy waste into surface waters. In addition, discharge of irrigation return flows from dairy cropland is prohibited if the water has come into contact with animal waste, and stormwater discharges are only permitted in accordance with the nutrient management plan.

The Grassland Bypass Project addresses discharges from 97,000 acres of irrigated agricultural land to the San Joaquin River. Waste discharge requirements include specific limits on selenium loading that are set to ensure compliance with downstream water quality objectives and the selenium TMDL for the San Joaquin River. The WDRs were put in place in 1998 and within three years, selenium loads were reduced by 43 percent from the previous 10 year average. Over the past 12 years, selenium loads have been reduced by over 60 percent and objectives in the San Joaquin River are currently being met.

Taken as a whole, the ILRP, together with the other programs and plans summarized in Tables 1 and 2 should achieve and surpass the Legislature's goal of 30 percent reduction in discharges of most agricultural pollutants. However, the timelines for these regulatory programs are not in synchronization with the schedule requested by the Legislature. Staff's current expectations of achievable outcomes by 2012 includes:

- Diazinon and chlorpyrifos levels will be reduced to levels that support all beneficial uses in the San Joaquin River and Delta.
- Water flea toxicity exceedances will be reduced by at least 30 percent due to reductions in diazinon and chlorpyrifos, which impact aquatic invertebrates such as the water flea. Water fleas are aquatic crustaceans that represent a secondary level of the food chain and are sensitive to certain pesticides, metals, pH, and conductivity/TDS.
- Selenium inputs to the San Joaquin River will be reduced to levels that fully support beneficial uses.

Staff's expectations regarding water quality exceedances or pollutant loads that will be reduced by 30 percent or more, later than 2012 include:

- Pesticides (including legacy pesticides) other than diazinon and chlorpyrifos
- Salt levels
- Sediment Toxicity
- E. Coli
- pH
- Algae Toxicity
- Fathead Minnow Toxicity
- Oxygen depleting substances entering the Delta

Issues Unique to the Delta
The Delta has a highly modified and exceedingly complex hydrology. This creates issues that are unique to the region and affect the applicability of management strategies. Specifically, many of the Delta islands have ground levels that are significantly below surrounding water levels. Delta islands can only be maintained for farming through active pumping of surface and groundwater back into the surrounding waterways. This land reclamation infrastructure is intimately tied to the irrigation infrastructure, and separation of functions is difficult to almost impossible. Finally, the diversions into and out of Delta islands are generally not measured, making water quality characterization problematic.

Summary of Background Information and Implications
Based on a review of our existing programs, we can address the questions raised earlier:

1. What pollutants and monitoring locations are associated primarily with agriculture activities so that pollution from other land uses and sources does not confuse the results?
2. Are these pollutants and monitoring locations for which we now have sufficient information to understand the extent of the problem(s), so that we have a starting point from which to measure 30 percent reductions?

Data collected through the Central Valley Regional Water Board's various programs provide a good picture of water quality issues in receiving waters associated with irrigated agriculture. Much of the monitoring is in areas where the effect of other potential pollutant sources is isolated from agriculture. In addition, we have four or more years of monitoring in many of these areas, which provides a solid starting point to measure improvements.

However, as shown in Table 1, not all of the parameters are clearly associated with agricultural activities. Therefore, measured changes in these pollutants may or may not be associated with changes in agricultural practices. In addition, the quantity of agricultural runoff is not being directly measured. Directly measuring a 30 percent reduction in polluted runoff is not possible in the absence of this baseline information.

3. Which management practices are most effective in reducing these pollutants so that implementing them can be required in order to achieve measurable reductions by 2012?
4. Where are agricultural management practices related to water quality already known so that initial conditions can be used as a starting point to assess implementation of improved practices?

In contrast to water quality monitoring, data on management practices are just now being collected by the Central Valley Regional Water Board and the agricultural industry. Although the practices that should protect water quality are generally known, the data on the extent of implementation of these practices and their effectiveness are limited.

The exception to this data limitation is with respect to irrigation practices. The Department of Water Resources has collected data on irrigation management within the San Joaquin River watershed. Certain irrigation practices (e.g., sprinkler or micro-irrigation) produce no or limited tailwater, eliminating a primary pathway for pollutants to move to surface waters. Current estimates are that about half of the two million irrigated acres in the geographic area under review have irrigation management practices that do not produce tailwater. The other one million acres use irrigation practices that likely produce surface water runoff.

The Water Boards were requested to propose a means whereby pollution from the San Joaquin River Watershed may be reduced by 30 percent by 2012. As discussed above, these reductions would target primarily salts, pesticides, sediment and water column toxicity, nutrients, and to a lesser extent dissolved oxygen and E. Coli. Control of metals and pH may be considered, but it is uncertain whether control of agricultural inputs would result in significant changes in water quality for those contaminants. These contaminants are fairly well characterized, and a review of exceedances, indicates that most water quality concerns occur during the irrigation season.

The Water Boards already have several programs in place to address many of these pollutants, and some of the programs will be fully implemented on or before 2012. However, these existing programs will not meet the goal of 30 percent reduction by 2012. To achieve the goal, additional steps will need to be taken, with the most likely focus being on reduction of irrigation season pollutant discharges. A proposal for addressing these irrigation season discharges is provided in Section II.

Table 2

SUMMARY OF EXISTING REGULATORY PROGRAMS

Program	Region	Pollutant Targeted	General Description	Implementation Completion Date	Current Status
California Water Boards Strategic Plan Update	Statewide	Pollutants causing impairment listings	Establishes the basic direction for broad program areas. Includes objective to implement strategies to fully support the beneficial uses for all 2006-listed impaired water bodies by 2030.	2030	Plan adopted – specific tasks under development
Strategic Workplan for the Bay –Delta	Legal Delta	Various	Work plan to take actions to protect beneficial uses in the Delta Estuary.	Various deadlines	Specific tasks under development
Irrigated Lands Regulatory Program	Central Valley	Agricultural Pollutants	Regulatory program to address pollutant discharges from irrigated agricultural lands. Program managed through coalitions of growers. Coalitions are responsible for monitoring and development of management plans to address water quality concerns.	2011 through 2019 to address currently identified problems.	Baseline monitoring completed management plans under development
Dairy Program	Central Valley	Pollutants from dairies	Regulatory program to address pollutant discharges from dairies and associated cropland. Requires each dairy to prepare and fully implement their waste management plan by 2011 and Nutrient management Plan by 2012.	Ongoing – Dairy Management Plans to be fully implanted by 2012	Adopted for Dairies
Central Valley Salts	Central Valley	Salts	Basin Plan Amendment to control nitrates and salts in surface and groundwater within the Central Valley.	Undetermined. Investigation phase to continue through 2012.	Under development
Salt and Boron TMDL	San Joaquin River	Salt and Boron	Basin Plan Amendment prescribing salt allocations for irrigated lands for 7 subregions.	2014 though 2026	Adopted
San Joaquin River and Delta Diazinon and Chlorpyrifos TMDLs	San Joaquin River and the Delta	Diazinon and Chlorpyrifos	Basin Plan amendment prescribing limits on Diazinon and Chlorpyrifos concentrations. Requires preparation of management plans.	2010 (San Joaquin River) 2011 (Delta)	Adopted
San Joaquin River Selenium TMDL	San Joaquin River	Selenium	Basin Plan Amendment prescribes selenium load and concentration limits.	2010	Adopted
Stockton Deep Water Ship Channel TMDL	San Joaquin River	Dissolved Oxygen	Basin Plan amendment describing means to manage Dissolved Oxygen levels. Requires development of management plans.	2011	Adopted

II. RATIONALE FOR SELECTION OF ACTIONS

As discussed in Section I., agricultural pollutants and water quality conditions in the San Joaquin River watershed and Delta are frequently evaluated by State Water Board regulatory programs. There are a variety of Regulatory Programs that are designed to address these pollutants and eventually achieve and surpass the water quality goal put forth by the Legislature. However the existing programs are not likely to accomplish the desired pollution reduction by the year 2012. Therefore additional, aggressive action would be required to meet the identified goal. Staff has considered potential options and has determined that the most feasible strategy to meet the goal of a 30 percent decrease in agricultural pollutant runoff would be to reduce or eliminate the discharge of tailwater from at least 50 percent of the irrigated land that likely discharges to surface waters.

This section discusses the steps that would be required to implement such a program and the rationale behind the actions. In addition, this section discusses some of the unintended consequences that could occur from such an approach and presents a preferred alternative approach that, while not meeting the stated goal of 30 percent reduction by 2012, is more likely to be successful over the long term.

Actions Necessary to Meet 30 percent Reduction by 2012 as Specified in the Supplemental Report Language

1) ***The Legislature should enact urgency legislation in the 2010-11 session to require irrigation practices that reduce or eliminate surface water runoff within the Delta and tributaries to the San Joaquin River.***

   Central Valley Regional Water Board staff has determined that eliminating the discharge of irrigation return flow from at least 50 percent of the irrigated land that likely discharges to surface waters is the most feasible method of ensuring a 30 percent reduction in agricultural pollution runoff to the Delta by 2012. Regardless of the pollutant types and concentrations in agriculture runoff, generally speaking, pollutant load should increase or decrease in concert with increases or decreases in volume of water being discharged from agricultural land. Therefore, selection of the approach to reduce the volume of agricultural irrigation return water to achieve pollution reduction, especially in the time frame allowed, makes the most sense. Legislation could be adopted to require growers to implement water efficiency measures, such as recirculation systems or irrigation practices that do not generate surface runoff such as drip irrigation.

   The focus of the action would be within the Delta and San Joaquin River watershed. Irrigation return flow would be the focus of this effort, since it is more amenable to control (versus storm water runoff) and over 60 percent of the exceedances of water quality objectives we have identified are during the irrigation season. Near-term tracking of implementation should be relatively easy, since data on irrigation practices has been collected by the Department of Water Resources.

To be equitable, the Legislature would likely want to require the adoption of water conservation practices by all growers within the San Joaquin River watershed and Delta. However, adoption of practices that eliminate tailwater in 50 percent of the area should be sufficient to achieve a 30 percent pollution load reduction during the irrigation season, when potential impacts to the Delta would be the greatest. The 50 percent target is established to meet the goal, since there may be other sources of agricultural pollution during the irrigation season, such as pesticide drift and tile water drainage discharge. Examples of the types of discharges that may still continue in spite of the elimination of tailwater discharges are discussed in the "Sources of Uncertainty" Section.

To meet the goal, the legislation would need to be enacted as urgency legislation during the 2009-10 session. Although the State Water Board has the authority to administratively order that more efficient irrigation practices be used (based on a waste and unreasonable use finding), such an order could not be developed to meet the 2012 timeframe. Staff estimates that it would likely take at least 2-3 years to conduct the necessary analysis; perform the environmental review; and complete the required administrative processes before an order could be considered. Such an action based on a broad finding of "waste and unreasonable use" will face many challenges and probable legal suits, which could increase the amount of time required. Finally, since the adoption of the order is a discretionary act, there is no certainty that the State Water Board would ultimately adopt the order needed to meet the 30 percent reduction goal by 2012.

2) Provide up to $450 million in grants to growers in the San Joaquin River watershed and Delta to implement improved irrigation management practices in the 2011-12 session.

The impact of a requirement to adopt better water conservation measures will be significant because it will require changes in irrigation water management, capital expenditures to install water-efficient systems; and potential loss in productive land to install re-circulation systems. Water-efficient systems may include sediment basin and tailwater return systems, drip irrigation, and other improved irrigation management measures. Additionally, the need to implement these practices by the year 2012 will require expedited action, which will increase the difficulty of implementing all the necessary changes.

The estimated cost to the agricultural community to fully implement the tailwater management practices is $500 million - $900 million capital cost and up to $60 million per year to operate and maintain them[5]. The estimate is based on approximately one million acres of agricultural land implementing improved irrigation

[5] The capital costs for tailwater return systems have been estimated at $450 to $550 per acre to install and up to $60 per acre per year for maintenance. Similarly, capital cost estimates to convert to sprinkler irrigation from flood irrigation range from $500 to $900 per acre and up to $50 per acre in annual operation and maintenance costs. More details on Management Plan costs are provided in Attachment 3.

management systems to prevent irrigation runoff[6]. The 30 percent reduction goal could likely be met by ensuring half (50 percent) of those acres have the necessary water conservation practices in place by 2012 ($250 million - $450 million capital cost).

Compliance with any such legislation will be difficult for many farmers unless State funds are available to provide cost share or fully fund the necessary improvements. Without financial assistance, it may be that some Central Valley farmers will have to choose between letting their land go fallow; making a large financial investment; or risk enforcement action by the Central Valley Regional Water Board or the State Water Board.

It should be noted that a more modest timeline would provide an opportunity to institute a cost share or low-interest loan program. Such programs would lessen the cost to the State while providing growers time to plan for the capital expenditures.

3) ***By July 1, 2011, provide the Central Valley Regional Water Board with $1.3 million and 10 PY to implement, monitor and enforce the program.***

Initial administrative work and continuing enforcement activities will be necessary to ensure implementation. This work would involve making changes in the current regulatory programs to support the new legislation and ongoing inspection work to ensure compliance. Given the tight timeframe envisioned in this report, a larger enforcement staff would be required to expedite enforcement activities and follow up on non-compliance.

Additional Central Valley Regional Water Board staff resources of up to $1.3 million and 10 PY would be required to ensure the required practices are implemented. If the Legislature wants to ensure 100 percent compliance by 2012, likely more staff would be required.

Alternatively, the work could be carried out with contract funds provided for local County Agricultural Commissioners to ensure implementation along with $260,000 and 2 PY for Central Valley Regional Water Board to manage the contract and oversee local compliance efforts. With the needed legal authority and funding, enforcement of a prohibition by the Agricultural Commissioners could be more cost effective. Agricultural Commissioners are physically located much closer to the affected areas and already have well established relationships with growers through their pesticide use activities.

Changes in the volume of discharge could be estimated by increases in management practices designed to reduce irrigation return flows. Ongoing measurements of water quality parameters through existing regulatory programs will help confirm the effectiveness of management practices. The existing regulatory

[6] The Department of Water Resources 2005 California Water Plan is the source for the estimate.

programs discussed in Section I include monitoring locations in smaller tributaries and waterways in the San Joaquin River watershed and Delta. These monitoring stations will likely remain operational through the year 2012. However, some monitoring locations directly in the South Delta and San Joaquin River should be established, so that water quality changes throughout the region can continue to be evaluated. Based on the cost of similar projects, staff estimates the additional monitoring costs would be approximately $2 million per year.

Sources of Uncertainty

The unintended consequences of rapidly making such sweeping changes to the regulation of irrigation return flows are difficult to predict. This section elaborates on some of the significant uncertainties.

- Many tributaries to the San Joaquin River are seasonally dominated by agricultural return flows. The rapid reduction in return flows could dry up these streams or lead to depressed dissolved oxygen levels from reduced flows. Unless reservoir releases are increased to compensate for the reduction in flow, fisheries in the east-side tributaries of the San Joaquin River could be negatively impacted. Salinity levels in the San Joaquin River would likely increase, as poorer quality ground water accretions make up a larger percentage of the flow.
- Installation of efficient irrigation practices will require large quantities of manufactured goods (pipes, pumps, valves, etc.). Some of the construction activities can likely be performed by the growers themselves, but others will need to be purchased or contracted out. It is unknown whether the production and construction capacity currently exists to complete installation of efficient irrigation practices on 500,000 acres within a two year period.
- Elimination of tailwater runoff is significant, but there are other potential pathways for pollution to reach surface waters during the irrigation season. It is not possible at this time to estimate how much agricultural pollution mass load comes from tile water discharges or aerial drift. In addition, control of tile water and aerial drift is much more challenging than controlling tailwater return flows.
- Delta Islands generally must pump and discharge water that infiltrates the levees to avoid flooding. Because many of these islands have agriculture land uses, the water that is pumped and discharged has the potential to carry agricultural contaminants. For this reason, elimination of irrigation return flows on some Delta islands is likely infeasible. Staff assumes that reductions of pollutants entering via the San Joaquin River watershed will compensate for any continued discharges within the Delta proper. However, because the Delta water management infrastructure is so complex and intertwined with the land reclamation infrastructure, there is a lack of comprehensive flow information.

Preferred Alternative Approach

The Central Valley Regional Water Board staff believes that eliminating the discharge of irrigation return flow from at least 50 percent of the irrigated land that likely discharges to surface waters is the most feasible method of ensuring a 30 percent reduction in agricultural pollution runoff to the Delta by 2012. However, the Water Boards do not support the premise of the Supplemental Report Language that it would be desirable to reduce the agricultural runoff to the Delta by at 30 percent by 2012, and do not recommend that this approach be pursued at this time because: (1) the unintended consequences are not clear; (2) the timeline for getting the required practices in place is likely unachievable; and (3) the Central Valley Regional Water Board already has programs in place to identify and address water quality problems associated with agriculture.

Instead, staff recommends an alternative that builds on existing programs and focuses on known water quality problems originating from agricultural lands. To further reduce the impact of agricultural discharges on the Delta, we recommend that the Legislature:

1) Provide adequate staffing resources for the Central Valley Regional Water Board's Dairy Program and Irrigated Lands Regulatory Program to ensure robust compliance and enforcement efforts;
2) Provide the Central Valley Regional Water Board adequate contract resources to conduct monitoring and engage County Agricultural Commissioners in water quality compliance activities;
3) Provide the Department of Pesticide Regulation any additional resources necessary to adopt and implement regulations to prevent pesticide transport to surface waters;
4) Provide cost share funds for growers to implement improved management practices, where needed; and

This plan is similar to the recommended action except that it envisions a compliance deadline that is five to ten years out instead of two years. A later compliance date would allow the Central Valley Regional Water Board the time to implement a more targeted approach that addresses the pollutants of principal concern, rather than focusing on one single potential pollution pathway (tailwater discharges). A more targeted approach would allow more flexibility to the agricultural community, which would likely reduce implementation costs. In addition, a later compliance deadline would provide the Central Valley Regional Water Board more time to ensure compliance, which would reduce the amount of staff resources required. Most importantly, more effective management practices could be identified and implemented, rather than focusing solely on irrigation return flows.

Other Options Considered to Meet the 30 percent Reduction Goal by 2012

Note that the only methods to meet a 30 percent reduction in agricultural pollution discharges by 2012 would also require rather draconian actions. Central Valley Regional Water Board staff considered other options besides the elimination of tailwater return flows. All of these options are highly undesirable from an economic standpoint; have potentially significant unintended environmental consequences; or may result in significant disruptions to the supply of food and fiber. Our assessment is that the options below would have more significant deleterious consequences than the proposed program to eliminate tailwater return flows through better water conservation practices.

A. Requiring Implementation of a Broad Range of Management Practices

The Legislature could require growers discharging to the Delta to implement a wide array of irrigation, pesticide, nutrient, and erosion management practices based on recommendations of the Natural Resources Conservation Service and University of California Cooperative Extension. Such legislation would address more of the potential pathways of pollutants from agricultural land to surface waters. However, such a prescriptive approach would likely have a significant negative impact on agricultural production, since site-specific and crop specific conditions require management practices to be adaptive rather than strictly prescribed.

B. Curtail Surface Water Imports to the San Joaquin River Watershed

The west-side of the San Joaquin Valley relies heavily on imported water to maintain crop production. During the drought of the late 1980's and early 1990's, imports were significantly reduced and pollutant loads (salts and selenium) were significantly reduced, although salt concentrations increased. Mass loading may be reduced by 30 percent if surface water imports to the San Joaquin River watershed were curtailed. However, the economic impact to the communities in the area would be devastating, since agriculture would likely not be viable in large areas without surface water imports.

C. Prohibit Use of Pesticides Causing or Contributing to Water Quality Impairments

A significant number of exceedances are due to or potentially associated with use of certain pesticides. The Legislature could prohibit the use of those pesticides in watersheds that drain to the San Joaquin River or south Delta. This action would not address other potential contaminants, such as nutrients and sediment. Such a ban would lead to use of other pesticides, which may be less desirable from a worker protection or ground water protection perspective. If no viable alternatives are available, significant crop damage and associated economic loss could occur.

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ATTACHMENTS

Attachment 1: Existing Regulatory Framework to Address Impacts from Agriculture Pollution Runoff

Attachment 2: Discussion of Existing Water Quality in the Southern Delta and San Joaquin River Watershed
Table 2-1 and Table 2-2 – Summary Statistics

Attachment 3: Cost Estimates for Water Efficient Irrigation Systems

Attachment 4: Potential Impacts of a Discharge Prohibition on Water Rights

ATTACHMENT 1
EXISTING REGULATORY FRAMEWORK TO ADDRESS IMPACTS FROM AGRICULTURE POLLUTION RUNOFF

The programs that are briefly summarized in this Section provide background on the activities that are taking place to protect water quality from agriculture-related discharges in the San Joaquin River system and Delta. The described programs and plans are a combination of planning efforts, incentive-based projects (such as grant-funded projects) and regulatory programs:

PLANS – Water Quality Control Boards

- California Water Boards Strategic Plan (Update 2008-2012)
- Bay-Delta Strategic Workplan
- Sediment Quality Objectives

PROGRAMS - Water Quality Control Boards

- Irrigated Lands Regulatory Program
- Confined Animal Facility Program
- Agriculture Water Quality Grant Funded Projects
- Total Maximum Daily Load (TMDL) Programs
  (pesticides, selenium, salt, dissolved oxygen, nutrients)

MULTI-AGENCY PROJECTS

- Central Valley Salinity Alternatives for Long-Term Sustainability

All of these efforts, in whole or in part, address discharges from agriculture and share a goal of meeting water quality objectives. However, the programs and plans described in this section have been designed to answer different questions than what the Legislature is requesting. Specifically, these programs and plans were developed with a focus on addressing specific water quality issues with the ultimate goal of protecting beneficial uses.

The timetables that have been established for the activities in each program or plan are determined based on the scope and focus of the effort. None of these programs or plans have been designed to meet the particular completion timetable that the Legislature is requesting; 30 percent reduction of agricultural pollution to the Delta by the year 2012. However, taken together, they do provide a structure through which additional protective measures could be implemented should sufficient resources be provided.

California Water Boards Strategic Plan - Update 2008-2012
The Strategic Plan has designated objectives to achieve environmental priorities in groundwater and surface water protection. Priority 1 of the Strategic Plan that was developed by the Water Boards is to 'Protect and Restore Surface Water Quality' with a primary objective to "<u>implement strategies to fully support the beneficial uses for all</u>

2006-listed water bodies by 2030". This objective and various actions that are listed in the Strategic Plan emphasize the importance of water quality protection throughout California with the Bay-Delta being recognized as a priority. However, the 2030 date, which is the goal for implementing actions to fully support beneficial uses, does not conform to the 2012 goal. The Strategic Plan can be found at the following link: http://www.waterboards.ca.gov/water_issues/hot_topics/strategic_plan/2007update.shtml

Strategic Workplan for the Bay-Delta

The State Water Board and the Central Valley and San Francisco Bay Regional Water Boards have committed through Board Resolution No. 2008-0056 to take various actions to protect beneficial uses in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta). These actions are described in a document entitled, *Strategic Workplan for Activities in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary*, July 2008, many of which are directed toward agricultural pollutants. Workplan activities are scheduled for the next five year period - through 2013.

Those actions in the Workplan which address agricultural pollutants from the San Joaquin River Basin and the Delta include the following:

- Total Maximum Daily Loads (TMDLs)
- Drinking Water Policy
- Develop Sediment Quality Objectives for Enclosed Bays and Estuaries
- Monitor and Control Factors that Lead to Blue Green Algae Growth
- Characterize and Control Discharges from the Delta Islands
- Conduct a Selenium Screen Study for the Delta
- Coordination with the Department of Pesticide Regulation and Delta County Agricultural Commissioners on In-Delta Pesticide Use to Eliminate Pesticide Toxicity in Delta Waters
- Actions to Address Water Use Efficiency for Agricultural Water Users

Some of the Bay-Delta actions are newly defined efforts that are being developed to address the pelagic organism decline and issues that may be causal to the collapse of the Delta. Others such as TMDLs, Sediment Quality Objectives and the Drinking Water Policy are programs with the State Water Resources Control Board and California Regional Water Quality Control Boards that are currently taking place.

The Bay-Delta activities are updated regularly and posted on the State Water Board website at the following link: http://www.waterrights.ca.gov/baydelta/default.htm

Sediment Quality Objectives

Sediments in enclosed bays and estuaries are often contaminated with a variety of pollutants stemming from sources including industrial and agricultural discharges, municipal wastewater treatment plants and storm water. Enclosed bays include the San Francisco Bay where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Estuaries are waters at the mouths of streams that serve as mixing zones for fresh and ocean waters during a major portion of the year, including the Sacramento-San Joaquin Delta

Exposure to contaminated sediments can have a significant effect on the health, diversity and abundance of invertebrates such as clams and worms. Foraging fish and birds may also be exposed by ingesting contaminated invertebrates or sediments. In turn, those organisms consuming contaminated fish may be exposed to toxic pollutants. These effects underscore the need for sediment quality objectives that protect aquatic ecosystems and human health. In September 2008, the State Water Board began drafting sediment quality objectives (SQOs) for the Delta. This project expects to have SQOs ready for approval by 2012.

Draft narrative objectives for aquatic life beneficial use state that pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries. Draft narrative objectives for human health state that pollutants shall not be present in sediment at levels that will bioaccumulate in aquatic life to levels that are harmful to human health.

More information about SQOs can be found at the following link:
http://www.waterboards.ca.gov/water_issues/programs/bptcp/sediment.shtml

Irrigated Lands Regulatory Program (ILRP)
Irrigated lands are farm lands, on which water is applied to produce crops. This includes lands that are irrigated to allow grazing of livestock, as well as nurseries and managed wetlands. The ILRP gives a waiver from waste discharge requirements to farmers, providing they meet the specific conditions of the waiver. The Central Valley Regional Water Board has developed a conditional waiver program entitled the Irrigated Lands Regulatory Program (ILRP), designed to address surface water pollution caused by waste discharges from irrigated agricultural lands. Conditions include developing a monitoring and reporting program to determine if agricultural waste discharges contribute to exceedances of water quality standards, and development of management plans to address any exceedances. The types of waste that are a primary concern for irrigated agriculture include pesticides, salt, nutrients, and sediment.

The ILRP began in 2003, and was renewed with modifications in 2006. Requirements for monitoring and for fixing water quality problems have also been modified, with the Regional Water Board adoption of Board Order R5-2008-005 in January 2008. The requirements that Coalition groups must follow when addressing water quality exceedances must be described in a management plan, the components for which include the following:

1. Identification of irrigated agriculture sources of pollution.
2. Identification of management practices to be implemented to address the exceedances.
3. Management practice implementation schedule.
4. Management practice performance goals with a schedule.
5. Waste-specific monitoring schedule.
6. A process and schedule for evaluating management practice effectiveness.
7. Identification of the participants and Coalition Group(s) that will implement the management plan.

8. An identified routine schedule of reporting to the Regional Water Board.

Currently there are management plan activities taking place throughout the San Joaquin River system and Delta. In total, 523 water body/parameter combinations are incorporated into management plans by the three Agriculture Coalitions and Irrigation Districts in the San Joaquin River basin and Delta.

The implementation of the management plans to address these multiple water quality problems are prioritized by the Coalitions so that they can maximize resources on a smaller number of locations at any given time, and thereby more effectively solve problems. Under the existing authorities of the ILRP, achieving successful completion of the activities and goals described in these management plans should occur for high priority pollutants (pesticides, toxicity) in approximately eight watersheds by 2012. The other identified water quality problems will be addressed in the next seven to ten years.

More information about the Irrigated Lands Regulatory Program requirements, monitoring information, and management plans is provided at the following link: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/index.shtml

Central Valley Salinity Alternatives for Long-Term Sustainability (CV-Salts)

Elevated salinity in surface water and groundwater is an increasing problem affecting much of California's Central Valley, other western states, and arid regions throughout the world. As surface and groundwater supplies become scarcer, and as wastewater streams become more concentrated, salinity impairments are occurring with greater frequency and magnitude. The Central Valley Regional Water Board and State Water Board have initiated a comprehensive effort to address salinity problems in California's Central Valley and adopt long-term solutions that will lead to enhanced water quality and economic sustainability. Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is an effort to develop and implement a comprehensive salinity management program. The goal of CV-SALTS is to maintain a healthy environment and a good quality of life for all Californians by protecting our most essential and vulnerable resource: water. Participants include State, federal and local agencies, as well as industry and environmental organizations that have formed working committees. Sources of salt will be investigated by the Economic and Social Impact Committee of the CV-SALTS participants. The sources of salinity, and the solutions to reduce salt loads to the San Joaquin River are extremely complex, and actions to be defined by the CV-SALTS are not expected to be completely identified, much less completed by 2012. http://www.waterboards.ca.gov/centralvalley/water_issues/salinity/

Total Maximum Daily Load (TMDL) Program

The TMDL Program is a Federal Clean Water Act program which leads the development of a "pollution budget" for dischargers to surface waters, including agriculture. The TMDL process is designed to restore the health of a specific polluted body of water for specific pollutants. The TMDL process identifies water quality problems, the contributors to the pollution, and the actions needed to restore and protect the individual water body from that particular pollutant. The Central Valley Region has several TMDLs for which agriculture is an identified source of the pollution, including parameters for salt and boron, selenium, dissolved oxygen, organophosphate pesticides and nutrients. These TMDLs are described below.

SALT AND BORON TMDL. In 2004, the Central Valley Regional Water Board adopted the San Joaquin River at Vernalis Salt and Boron TMDL Basin Plan Amendment to help address the salt loads from all sources, including agriculture. The Basin Plan Amendment prescribes salt load allocations for irrigated lands by dividing the San Joaquin River watershed into seven sub-areas, with the earliest sub-area compliance date of July 2014 and the latest compliance date of July 2026 depending on the priority of the specific areas and the wetness or dryness of the years.

Agricultural Coalitions in the San Joaquin River basin have committed to meeting the salt load allocation requirements and are describing their activities in water quality management plans submitted to the Regional Water Board. More information regarding the Salt and Boron TMDL can be found at the following link:
http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/vernalis_salt_boron/index.shtml

DIAZINON AND CHLORPYRIFOS PESTICIDES TMDL. The Sacramento-San Joaquin Delta Diazinon and Chlorpyrifos TMDL and the San Joaquin River Diazinon and Chlorpyrifos TMDL were developed to address the impacts from organophosphate pesticides. Organophosphate pesticides are used in dormant sprays for orchards and on crops such as alfalfa and corn, throughout the Central Valley. The Basin Plan amendments associated with these TMDLs include policies and requirements to achieve the diazinon and chlorpyrifos objectives by 2010 in the San Joaquin River and 2011 in the Delta. The updated Basin Plan, which includes this Amendment, can be downloaded from the following link:

- http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_op_pesticide/index.shtml
- http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/san_joaquin_op_pesticide/index.shtml

Agricultural Coalitions in the San Joaquin River basin have committed to controlling discharge of these pesticides and are describing their activities in water quality management plans submitted to the Regional Water Board.

SAN JOAQUIN RIVER SELENIUM TMDL. A TMDL for selenium in the San Joaquin River was completed by the Central Valley Regional Water Board and approved by USEPA in March 2002. The TMDL is implemented through: 1) prohibitions of discharge of agricultural subsurface drainage water adopted in a Basin Plan Amendment for the Control of Subsurface Drainage Discharges (Central Valley Regional Water Board Resolution 96-147), with an effective date of 10 January 1997; and 2) load allocations in waste discharge requirements. The deadline for compliance with Selenium objectives in the San Joaquin River is 2010.

DISSOLVED OXYGEN IMPAIRMENT IN THE STOCKTON DEEP WATER SHIP CHANNEL TMDL. The San Joaquin River experiences regular periods of low dissolved oxygen (DO) concentrations in the first few miles of the Stockton Deep Water Ship Channel which is downstream from the City of Stockton. The TMDL identifies three

contributing factors: loads of oxygen demanding substances from upstream sources, the geometry of the Deep Water Ship Channel (DWSC) and reduced flow through the DWSC. Though the TMDL does not specify the relative responsibility among these three factors, it does provide the relative responsibilities of the parties that contribute the sources of the oxygen demanding substances. Thirty percent of the load that results in low DO is attributed to the City of Stockton Regional Wastewater Control Facility and 60 percent is attributed to nonpoint sources, which are specified in the TMDL as discharges from irrigated lands. Substances that can contribute to depletion of DO include nitrogen and phosphorous, which are nutrients often applied to agricultural fields as fertilizers. Agriculture Coalitions in the San Joaquin River basin have committed to conducting studies and other activities to address the DO TMDL requirements, as described in water quality management plans submitted to the Regional Water Board. The deadline for compliance with the dissolved oxygen objectives is 2011. More information on the DO TMDL can be found at the following link:
http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/san_joaquin_oxygen/final_staff_report/do_tmdl_final_draft.pdf

Confined Animal Facility Program

The Central Valley Regional Water Board regulates several types of confined animal facilities, including dairies, feedlots, poultry facilities, and horse facilities. The Confined Animal Facility Program (CAFOs) primarily focuses on dairies, which are the majority of confined animal facilities in the region. Over 1,500 dairies are located in the Central Valley. On May 3, 2007, the Central Valley Regional Water Board adopted Waste Discharge Requirements General Order for Existing Milk Cow Dairies (General Order). The General Order includes requirements for both the dairy production area and land application area and requires each dairy to fully implement their waste management plan by 2011 and nutrient management plan by 2012.

Pollutants that are specific to confined animal facilities include ammonia, nitrates, phosphorus, pathogens, and salts. Generally, the CAFOs Program addresses groundwater quality control and the discharge of animal waste to surface water is prohibited. For dairies, the General Order prohibits the direct or indirect discharge of waste and/or storm water from the production area to surface waters. In addition, discharge of irrigation return flows from dairy cropland is prohibited if the water has come into contact with animal waste and stormwater discharges are only permitted in accordance with a nutrient management plan. The nutrient management plan requires monitoring for electrical conductivity, total ammonia-nitrogen, un-ionized ammonia-nitrogen, nitrate-nitrogen, phosphorus, turbidity, and total and fecal coliform. Dairy Industry representatives are working with representatives of the Irrigated Lands Regulatory Program Coalitions to evaluate the potential of pesticide discharges from croplands associated with dairies. The General Order does not allow any discharges to result in violations of water quality objectives for receiving waters.

Croplands associated with dairies are used to grow alfalfa and corn for their dairy cows, as well as areas for dairy waste application. These lands are regulated for the waste application so as to ensure compliance with applicable state and federal regulations.

These regulations limit the amount of nutrients (from manure, fertilizer and other sources) that can be applied.

Other types of confined animal facilities, such as feedlots and poultry facilities, are not regulated under the General Order. A few of these other types of facilities are regulated under individual waste discharge requirements. Those not regulated under waste discharge requirements must still comply with the Water Code.

More information regarding the Regional Water Boards General Order for Dairy Cows can be found at: http://www.waterboards.ca.gov/centralvalley/water_issues/dairies/index.shtml

State Water Board Grant Funded Projects

The State Water Board administers bond funds from Prop 13, Prop 40, Prop 50, Prop 84, and federal appropriations that have provided funding for a variety of agriculture water quality grant projects. Additionally, since 1999 there have been several bond funded grant programs, such as the CalFED Nonpoint Source Grant projects that focused specifically on agricultural water quality issues. Generally these bond funds have provided funding for projects that improve agricultural water quality through monitoring, demonstration projects, research, construction of agricultural drainage improvements, and to reduce pollutants in agricultural drainage water through reuse, integrated management, or treatment. Some examples of existing projects that provide management practice or pollutant transport information are:

1. Western United Dairymen Resource Development Water Quality Improvement Projects for the Central Valley (dairy improvement projects)

2. BMPs for Reducing Sediment and pesticides in Runoff form Colusa County

3. Westside Regional Drainage Plan Distribution Facilities Improvements

4. Reducing Unexplained Toxicity to Protect Sediment Quality Associated With Irrigated Agriculture

5. Transport processes of Pyrethroid Insecticides in Streams and Rivers of the San Joaquin Basin

6. Implementing IPM/BMP to Reduce OP and Pyrethroid Runoff in Agricultural Land

7. Management Practices for Mitigating Off-Site Transport of Soil-Adsorbed Pesticides

8. Source Identification, Optimized Monitoring and Local Outreach for Reducing Agricultural Pathogens into the Sacramento-San Joaquin Delta Estuary.

9. Water quality characteristics of riparian-zone groundwater of the lower San Joaquin River, California.

10. Quantifying loads and assessing management strategies for reducing drinking water constituents of concern in watersheds.

Additional information about State Water Board and Central Valley Regional Water Board Grants can be found at the following links:
- http://www.waterboards.ca.gov/water_issues/programs/grants_loans/
- http://www.waterboards.ca.gov/centralvalley/water_issues/grants/index.shtml#prop84rfq

ATTACHMENT 2
DISCUSSION OF EXISTING WATER QUALITY IN THE SOUTHERN DELTA AND SAN JOAQUIN RIVER WATERSHED

This attachment provides additional data about the current water quality in the Southern Delta and San Joaquin River watershed. This data comes from the Irrigated Lands Regulatory Program (ILRP) 2007 Zone Reports with additional data collected after completion of that report. The Zone Reports provide a general understanding of the baseline water quality conditions for agriculturally dominated areas within the Central Valley. Additional information about that program can be found online at: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/monitoring/staff_monitoring_data_analysis/2007_monitoring_data_report/index.shtml

Discussion of Current Water Quality

Water quality monitoring data has been collected within the San Joaquin River basin and Delta region under the ILRP since its inception. Sources for data within the program include: Coalition Groups; Individual Dischargers; State Water Board contracts (Phases I and II) with the University of California; and staff monitoring. Data used includes monitoring efforts from May 2004 to October 2007.

Because of the focus of the ILRP, effort was made by the Regional Water Board and cooperating coalitions to focus monitoring efforts on waterbodies that were located in predominantly agricultural areas. As a result, most of the monitoring comes from smaller tributaries and agricultural drains and not from the larger rivers. This was done deliberately to avoid interference from urban and industrial discharges. Staff experience has been that contaminant levels are often higher in the smaller waterways than the major rivers. If water quality concerns are addressed in these smaller waterbodies, the water quality in the San Joaquin River and the south Delta should improve, as well.

The Central Valley Regional Water Board maintains a list of regulatory limits (called water quality objectives) for certain pollutants. These limits are established at levels that should be protective of all beneficial uses. Where no numeric water quality objectives have been established, staff has applied Central Valley Regional Water Board policies to the best available scientific data to interpret compliance with narrative water quality objectives. An exceedance occurs whenever monitoring results exceed the water quality objectives or threshold values. Exceedances are specific to the waterbody, pollutant and time of the sample.

Tables 2-1 and 2-2 within this attachment provide summary statistics on that monitoring data. Specifically, the tables provide a total count of exceedances by pollutant category. Table 2-1 provides a summary of the whole San Joaquin River Watershed and Delta. Table 2-2 provides information broken out by subwatershed.

Table 2-1

SUMMARY OF EXCEEDANCES IN AGRICULTURALLY DOMINATED AREAS OF THE SAN JOAQUIN RIVER WATERSHED

Pollutant Category	Water Body/Pollutant Exceedances		
	Total Count	**Irrigation Season**	**Non-Irrigation Season**
Agricultural Practices that Likely Cause or Contribute to the Problem			
TDS/Electrical Conductivity	668	58%	42%
Pesticide	208	72%	28%
Legacy Pesticide	139	82%	18%
Toxicity, Sediment, Scud (Hyalella)	73	62%	38%
Toxicity, Water Column, Water Flea (Ceriodaphnia dubia)	63	69%	31%
Nutrient	34	69%	31%
Selenium	2	33%	67%
Agricultural Practices that Potentially Cause or Contribute to the Problem			
E. Coli	611	59%	41%
Dissolved Oxygen	530	69%	31%
Uncertain Agricultural Contribution			
Metals	411	63%	37%
Toxicity, Water Column, Algae (Selenastrum)	95	57%	43%
pH	131	69%	31%
Toxicity, Water Column, Fathead Minnow (Pimphales Promelas)	21	52%	57%

Table 2-2
SUMMARY OF EXCEEDANCES IN THE SAN JOAQUIN RIVER WATERSHED (BY REGION)

		Water Body/Pollutant Exceedances		
Sub Watershed	**Pollutant Category**	**Total Count**	**Irrigation Season**	**Non-Irrigation Season**
East San Joaquin	Electrical Conductivity/Total Dissolved Solids	94	75%	25%
	Pesticide	46	71%	29%
	Nutrient	28	78%	22%
	Toxicity, Water Column, Ceriodaphnia	25	74%	26%
	Toxicity, Sediment, Hyalella	14	61%	39%
	Legacy Pesticide	6	67%	33%
	E. Coli	123	73%	27%
	Dissolved Oxygen	95	80%	20%
	Metals	109	67%	33%
	pH	30	88%	12%
	Toxicity, Water Column, Selenastrum	18	72%	28%
	Toxicity, Water Column, Pimphales Promelas	4	100%	0%
San Joaquin & Delta	Electrical Conductivity/Total Dissolved Solids	162	63%	37%
	Pesticide	39	54%	46%
	Toxicity, Sediment, Hyalella	32	82%	18%
	Legacy Pesticide	23	79%	21%
	Toxicity, Water Column, Ceriodaphnia	17	63%	37%
	Nutrient	3	50%	50%
	Dissolved Oxygen	139	77%	23%
	E. Coli	88	62%	38%
	Metals	76	65%	35%
	Toxicity, Water Column, Selenastrum	17	61%	39%
	pH	19	79%	21%
	Toxicity, Water Column, Pimphales Promelas	2	22%	78%
Westside	Electrical Conductivity/Total Dissolved Solids	412	53%	47%
	Pesticide	123	82%	18%
	Legacy Pesticide	110	83%	17%
	Toxicity, Sediment, Hyalella	27	48%	52%
	Toxicity, Water Column, Ceriodaphnia	21	70%	30%
	Nutrient	3	43%	57%
	Selenium	2	33%	67%
	E. Coli	152	51%	49%
	Dissolved Oxygen	134	58%	42%
	Metals	73	55%	45%
	pH	42	58%	42%
	Toxicity, Water Column, Selenastrum	19	45%	55%
	Toxicity, Water Column, Pimphales Promelas	5	63%	38%

The reader should use caution in interpreting the results of these tables. Testing for some contaminants is more frequent than others. Therefore, the total number of exceedances provides only a very basic overview of the relative severity of water quality impairments.

Tables 2-1 and 2-2 also provide information on the relative frequency of occurrence the non-irrigation season is defined as the period beginning September 1 and extending through February 28, when the principal source of discharge into surface waters is storm water runoff. In contrast, the irrigation season begins in March and extends through August. During this time, discharges are dominated by irrigation runoff. Individual irrigation and storm events may have varied however, most fall within the above definitions and permit data analysis for each time period.

We have broadly classified observed water quality problems into three groups: 1) pollutants for which agricultural discharges likely cause or contribute to a water quality problem; 2) pollutants for which agricultural discharges potentially cause or contribute to the exceedances; and 3) pollutants for which the contribution from agriculture is still uncertain. For example, chlorpyrifos, which comprises 183 of the 287 pesticide exceedances, is a registered pesticide. In 2004, the US EPA banned most non agricultural uses of chlorpyrifos. In addition, the half life of chlorpyrifos is fairly short (less 90 days under most conditions). That means that any exceedances of chlorpyrifos are nearly certain to be from current year agricultural use. In contrast, other water quality issues, such as pH excursions cannot be conclusively tied to agricultural discharges, even within agriculturally dominated land uses.

An analysis of the monitoring data revealed that exceedances generally occurred in greater numbers within the irrigation season versus the non-irrigation season. As with the total number of exceedances, the relative percentage of exceedances by season is only intended to indicate when exceedances are more likely to occur, not what the overall level of impairment is.

Contaminant Description

Electrical Conductivity &Total Dissolved Solids (TDS)

Dissolved solids in water are made up of both inorganic and organic substances. They can be measured in two ways: total dissolved solids by gravimetry and electrical conductivity. Both measurements are affected by temperature and pH and are often referred to as a measure of salinity. Total dissolved solids within water are primarily inorganic salts; bicarbonate, carbonate, chloride, sulfate, calcium, magnesium, sodium and potassium. The measurement of these salts is important because aquatic organisms require a relatively stable concentration of these salts. Fluctuating levels may limit survival, growth or reproduction. In addition, high salinity levels can limit the use of water for drinking water and agricultural purposes. Influences of salinity within a water body include discharges of naturally saline groundwater, surface runoff from urban and agricultural land and point source discharges from industrial and wastewater treatment facilities.

Pesticides & Legacy Pesticides

Insecticides, herbicides, and fungicides are used to control pests in urban, industrial and agricultural settings. The presence of these chemicals within a water body can adversely affect the growth, development, survival and reproduction of aquatic life. Additionally, some pesticides can accumulate in fish tissue and serve as a potential pubic health concern. These chemicals can enter a water body through atmospheric deposition, direct application, and discharge from surface or groundwater sources.

Legacy pesticides are those that were used historically and banned later due to the discovery of their toxic effects and persistence in the environment. Examples of legacy pesticides include DDTs and its breakdown products: DDE and DDD, as well as chlordanes and dieldrin. These chemicals remain a concern due to their persistence in the environment and tendency for bioaccumulation in higher organisms. These chemicals enter water bodies through surface discharge, erosion of contaminated soils and dredging activities.

Sediment Toxicity, Scud (Hyalella azteca)

Hyalella are shrimp-like crustaceans that burrow in freshwater sediments that accumulate at the bottom of surface waters. They are used as an indicator for sediment toxicity and are particularly sensitive to soil bound pesticides, as well as pH and metals. Analysis of toxicity within sediment allows for the determination of the cumulative toxic effects of pollutants present in sediments.

Studies of sediment toxicity within the San Joaquin River watershed are relatively new. Preliminary investigation (Weston et al., 2008) suggest that agricultural pesticides (pyrethroids, legacy pesticides and some organophosphates) may be a significant contributor to contaminated sediments within the San Joaquin River watershed.

Water Column Toxicity

Analysis of toxicity within a water column provides a screening level assessment of the cumulative toxic effects of all pollutants present. Three species are used within water column toxicity analysis to represent different levels of the aquatic food chain. When combined, results from the three toxicity studies can be used to provide an indication of what type of contamination is causing a water quality impairment.

- ***Algae (Selenastrum capricornutum)***

  Selenastrum are single celled algae and represent a primary level of the aquatic food chain. Algae are sensitive to pollutants such as herbicides, metals, pH, conductivity, and nutrients.

- ***Water Flea (Ceriodaphnia dubia)***

  Ceriodaphnia are aquatic crustaceans that represent a secondary level of the food chain. They are sensitive to certain pesticides, metals, pH, and conductivity/TDS.

- ***Fathead Minnow (Pimephales promelas)***

  Pimephales are immature fish and represent a tertiary level of the food chain. They are sensitive to some pesticides, metals and ammonia.

Nutrients

Nutrients, such as nitrogen and phosphorous are required by all plants for growth and are often limited in aquatic environments providing balance to the aquatic ecosystem. Inputs of higher concentrations from discharges can lead to the overgrowth of the aquatic plants and algae which can adversely affect the water body. An overgrowth of algae and plants reduces the overall availability of dissolved oxygen for other aquatic organisms, which can lead to fish kills. Nutrients may also be associated with unpleasant tastes and odors, turbidity, and interference with recreational uses. High levels of nitrogen (as nitrates) within drinking water can also be harmful to infants. Within agriculturally dominated areas, the source of nutrients is generally fertilizer runoff. However, sources for nutrients also include urban, industrial and wastewater treatment facilities.

Escherichia coli (E. coli)

E. coli serve as indicator bacteria for the presence of fecal pollution in a surface water body. *E. coli* are shed in feces of warm blooded animals including wildlife, pets, humans, and agricultural animals. While most strains are non-pathogenic, the general identification of *E. coli* within a water body can indicate the potential presence of fecal borne pathogens such as, *Cryptosporidium parvum*, *Giardia* sp, and *Escherichia coli* 0157:H7. Fecal pollution can enter a water body through the discharge of urban and agricultural surface runoff, contaminated ground water, or point source discharges or spills.

Dissolved Oxygen

Oxygen is an essential component to all living things and reduced levels of dissolved oxygen within a water body can have a detrimental effect on aquatic life including mass fish kills. The presence of dissolved oxygen in water can be attributed to diffusion, aeration and as a byproduct of metabolic pathways of aquatic plants. Factors that impact the levels of dissolved oxygen within a water body include reduced flows, temperature, and presence of pollutants that affect the growth of oxygen demanding organisms such as nutrients and organic matter.

Metals (Including Selenium)

Metals occur naturally in the environment. Examples of metals that can be found in water include calcium, magnesium, iron, aluminum, lead, manganese, sodium, and zinc. While some metals are considered non-toxic and absorbed readily by aquatic organisms, others can be become toxic at elevated concentrations as well as accumulate in the tissues of organisms. Human activities can greatly influence the concentration of metals over the natural background levels. Because metal solubility in water is dependant on pH and hardness, influences over metal concentrations can include changes to these chemical conditions as well as the discharge of excess metals to a water body. Examples of activities that influence metal concentrations in water include disruption of soil leading to erosion, discharges from wastewater treatment and industrial facilities, as well as chemical applications for land management purposes. Copper is commonly used as an herbicide, as well as occurring naturally. Of the metals, only selenium has been definitively associated with agricultural discharges as a primary source.

pH

pH is a measurement of relative acidity of the water. Acidity plays a major role in the solubility and biological availability of nutrients and metals within water. Aquatic organisms require a certain range of pH to be able to thrive and reproduce. A pH outside of that range can lead to toxicity due to the lack of or overabundance of certain nutrients and metals. Factors that influence pH include the water body type, natural geology, as well as the affects of urban, industrial and agricultural runoff. A change in pH within a water body is often attributed to a cumulative effect of pollutants versus one single pollutant.

ATTACHMENT 3
COST ESTIMATES FOR
WATER EFFICIENT IRRIGATION SYSTEMS

To meet the Legislature's defined goal for this report of a 30 percent reduction in agricultural runoff it would be necessary to eliminate most tailwater return flows. Tailwater discharge is a normal agricultural practice generally associated with surface irrigation techniques such as furrow or border strip flood irrigation. For these systems, surface irrigation can be performed without discharge, but in some cases only at the expense of risking crop damage or inefficient irrigation. Therefore, to eliminate tailwater discharges from at least 50 percent of the irrigated lands many growers will need to modify their irrigation infrastructure. There are two basic approaches that growers would likely use to eliminate tailwater discharges. The first is to collect and reuse any tailwater discharged from the field before it enters a surface water. The second is to invest in irrigation equipment (i.e. sprinkler systems, micro spray, drip or subsurface irrigation systems) that minimize or eliminate tailwater runoff. Typical capital and operation and maintenance (O&M) costs are summarized in Table A below and discussed in detail following the table.

Table A
Estimate of Per Acre and Watershed Wide Costs for Alternative Irrigation Approaches

Per Acre Costs				
	Capital Cost		**Annual O&M**	
Approach	**Low**	**High**	**Low**	**High**
Tailwater Return	$450	$550	$12	$60
Alternative Irrigation Practice	$500	$900	[a]	50

Costs for San Joaquin River Watershed [b]				
	Capital Cost		**Annual O&M**	
Approach	**Low**	**High**	**Low**	**High**
Tailwater Return	$270 Million	$550 Million	$7.2 Million	$60 Million
Alternative Irrigation Practice	$300 Million	$900 Million	[b]	$50 Million

[a] The lowest bound operation and maintenance cost was included in the overall capital cost.
[b] Watershed Cost = Cost per acre * 2 Million irrigated Acres * Required Conversion Rate (see assumptions section for additional explanation).

I. Tail Water Return Systems

Tailwater return systems involve collecting tailwater from a field and transporting it back to the same field or a neighboring field. A typical system will include a collection ditch, some amount of tailwater storage (typically a pond) and pumps and pipes required to transport the water. Some of the variables that affect the cost of a tailwater recovery system include the following:

- The surface area to be covered, which will change storage requirements

- The location where recovered water will be used, which affects the amount of piping required and the size of the pump.
- Crop type and soil characteristics
- Rate and duration of irrigation

Representative costs reported ranged from $450 to $550 per acre treated.
The reported cost range for maintenance of these systems is from $12 to $60 per acre per year.

II. Reduced Runoff Irrigation Systems
Sprinkler systems and micro-irrigation systems -- surface drip, subsurface drip, and micro sprinklers -- are a means of delivering water uniformly, with excellent control of the amount and timing of irrigation. These systems generally can be run with high irrigation efficiency while reducing or eliminating tailwater. The higher irrigation efficiency would also reduce the amount of water going past the crop root zone, which would reduce the production of tile water in areas with high ground water tables.

Operational costs may vary significantly based on the system design, as well as unforeseen factors such as pest damage to the equipment. Some of the predictable variables that affect the cost of these irrigation systems include the following:

- Crop type and planting conditions (space between plants, row separation, etc.)
- Duration of irrigation season
- Type of system
- Pump size
- Water source: groundwater or surface water

The cost range for installation of these systems is reported from $500 to $900 per acre. The cost range for maintenance varies with how well a system is maintained and the quality of the irrigation water. Reported maintenance costs are up to $50 per acre per year.

III. Tile Water Drainage Management

Tile water comes from drainage tiles installed in a field below the ground surface. These tile drains are used to lower the water table to prevent the crop root zone from becoming saturated. The ground water collected by the tile drains is conveyed to a sump, which then pumps the water to a drain or canal.

The discharge of tile water can be reduced using methods similar to those used to control tailwater discharge. More efficient irrigation techniques can reduce the volume of water that goes past the crop root zone, which reduces the amount of tile water generated due to water tables rising. Any tile water generated could also be re-circulated into the irrigation supply system, although there are limits based on the salinity of the tile drainage. The Draft EIR/EIS for the Grassland Bypass Project addresses the management of tile drainage from approximately 100,000 acres on the west-side of the San Joaquin River watershed. In addition to other management actions, treatment of the remaining tile drainage is estimated to cost $35 million. An estimate of the number of tile drained acres requiring additional management measures is not available. However, there is some information available for the Grasslands area that can be used to give an order of magnitude cost estimate. Based on the Grasslands Bypass Project analysis, reduction of discharge from tile drained land to meet the Legislature's target is likely to cost in the hundreds of millions of dollars.

IV. Assumptions and Uncertainties

Cost estimates are always subject to some uncertainty. To better communicate this uncertainty, the summary estimates are provided as low and high estimates. However even these bounding estimates are subject to several assumptions that are outlined below:

- An estimate of 2 million irrigated acres comes from the DWR 2005 Water Plan.
- The required conversion rate is the estimate of how many growers used surface irrigation practices in 2001 as determined by DWR's Survey of Irrigation Practices. This survey, which is performed every 10 years, showed a long term trend away from surface irrigation practices that generate tailwater. The current (2001) number of farms still using surface irrigation is likely significantly lower than the 50 percent reported in 2001 and used for the high cost estimate. If the trend observed in the 2001 survey has continued, it could be as low as 30 percent (used for the low cost estimate). In other words, between 600,000 and 1,000,000 acres of irrigated lands potentially generate tailwater return flows.
- All of the per-acre costs are from 2005 or newer sources, and have not been adjusted for inflation.
- This cost estimate only considers direct capital, and operation and maintenance costs. Indirect costs are not considered. Two significant examples of indirect costs include: (1) potential water cost savings resulting from increased irrigation efficiency; and (2) decreased yields due to taking land out of production to provide space for tailwater recovery systems.
- Some groups of growers may be able to reduce costs by developing communal or regional tailwater systems. Such potential cost savings are not quantified.
- Other benefits are not quantified, such as increased yields due to more effective irrigation and potential reduction in weed control and fertilizer use.

The net affect of the above assumptions is that the upper bound cost estimate is likely overestimated, but to what extent cannot be quantified without studies beyond the scope of this report.

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ATTACHMENT 4
POTENTIAL IMPACTS ON WATER RIGHTS FROM ELIMINATING TAILWATER

Surface agricultural discharges seasonally provide a significant portion of the instream flow in agricultural-dominated water bodies such as the San Joaquin River (SJR). Reductions in the quantity of surface agricultural discharges could therefore have a large impact on instream flows. One would reasonably expect that a reduction in surface agricultural return flows will in all cases reduce, by an equal amount, instream flow downstream of the discharge point. The magnitude of the effect, however, depends upon the physical source and basis of right of the applied water because less "new" water will need to be applied to any given acre of land to achieve a reduction in surface agricultural return flows. New water is defined as water not obtained through recycling or reuse on the farm. The disposition of any water saved further depends upon what happens to any reduced use of "new" water. The effect that eliminating tailwater may have on instream flows will depend, in part, on the type of water rights involved. A primer on water rights is needed to understand the possible and likely effects that eliminating surface agricultural discharges could have on instream flows.

There is no requirement, under water rights in general, to return any component of water diverted under a consumptive water right, such as for irrigation, to a stream. This is in contrast to a water right granted for a non-consumptive use such as hydropower, for which the full amount of any appropriated water must be returned to a natural channel after the use. For water reclaimed from a wastewater treatment plant, a change petition must be filed with the State Water Board to change the place of use and purpose of use before reclaimed water can be used for another purpose if the change will result in a reduction in flows downstream of the discharge.

There are two basic types of water rights, applicable principally to surface water diversions: riparian, and appropriative. Most groundwater pumping does not fall into either of these categories, and is not subject to State Water Board jurisdiction. Only groundwater pumped from "subterranean streams flowing through a known and definite channel" is subject to an appropriative water right. Percolating groundwater is not subject to an appropriative water right.

Riparian water must be used within the same watershed as the point of diversion (POD) and on a parcel of land adjacent to the surface stream. Riparian water rights holders may use any natural flow on riparian lands. Water cannot be stored for later use and riparian water right holders may not divert water that has been previously stored. Agricultural discharges that have returned to a natural channel from lands irrigated by previously stored appropriative water may also not be used under a riparian water right. There are no seasonal constraints on riparian diversions so long as the diverted water is reasonably and beneficially used. Any shortages of water must be shared equally between riparians.

Appropriative water may be diverted and used directly by a water right holder or it may be sold by the water right holder so long as the water is still used within the conditions of the water right permit-- within the permitted place of use and for the permitted purpose of use, e.g. irrigation. The provenance of appropriated water may be proximal to the supply water source and point of diversion or it may be distal or far removed from both the source and POD. There is water applied on the west side of the SJR based upon proximal water rights, where an appropriative diversion from the SJR is used on lands proximal to the POD, generally directly adjacent or just upstream or downstream of the POD. There is also water applied on the west side of the SJR based upon a distal appropriative water right, where the POD is Delta water delivered via the Delta Mendota Canal. In this latter example, the water right holder is the United States Bureau of Reclamation and the water is sold under contract to the end user, likely also first passing through the conveyance facilities of a local water district, and then to the farmer. Appropriative water rights must be further defined based on the date of initiation of the water right: pre and post-1914. This distinction is particularly important as it affects how water may be transferred. Appropriative rights can rely upon direct diversion of water from a waterbody or from releases of stored water. In both cases water must be used within seasons of use specified in the water right. The water right priority system provides the basis for determining when water is available for any appropriator, particularly in times of low flow. When water is scarce, junior appropriators, those with a water right date later than a senior water right holder may not divert water unless the needs of senior water right holders are met.

The effect that eliminating tailwater returns will have on instream flows depends on the quantity of water under the water right relative to the quantity of water than can be reasonably and beneficially used in the place of use under the water right, and the method used to eliminate the tailwater. There are two principal methods that can be used to reduce surface agricultural discharges: 1) apply less water to each acre irrigated so that only enough water is applied to meet crop water use and leaching requirements; and 2) capture and recycle excess applied water through a surface water, or “tail water” recovery system at the downslope end of the irrigated field. In the first example, less water will be applied to each acre of land. In the second example, less “new” water can be applied to a given acre of land because it must be blended with the recovered tail water, unless extensive lands are used to simply store and evaporate the recovered tail water. Assuming a reasonably good quality of water, any such storage and evaporation of recovered tail water would not likely qualify as a reasonable use of water. Both methods will result in the need to apply less “new” water to each irrigated acre, resulting in a savings of applied water. How this saved water affects instream flows, however, further depends upon whether there is sufficient water to fully support the existing use under the water right’s place of use.

If there has not been sufficient water to support the existing use then, in general, any water saved through methods applied to reduce surface agricultural discharges, could be used to expand use of the limited supply. This is not likely to be the case for a riparian water right holder because a riparian is likely to have limited the quantity of applied water only in years of scarcity. Any required reduction in surface agricultural water discharges would therefore likely translate into reduced diversion of water from the same affected waterbody. A requirement to eliminate tailwater dischargers, applied to a riparian water right holder, is likely to have little or no effect on instream flows. Any effect would likely be positive since if less water is diverted upstream and there is an equivalent reduction in return flow downstream there would still be more water in the channel between the POD and the discharge location, assuming the POD is upstream of the discharge.

Eliminating tailwater could, however, result in reduction of instream flows if there has been a limited water supply for lands irrigated with appropriated water. A 640 acre farm, for example, might have an appropriative water right that allows diversion and use of 1,920 acre-feet of water each irrigation season, and the farmer has been growing a crop on only half of the 640 acres, applying six acre-feet per acre per year. Subsequent to eliminating tailwater, and development of additional infrastructure such as drip irrigation and tail water recovery, the farmer may be able to use the full quantity of water on more acreage, resulting in no change in applied water to the gross 640 acres, and elimination of all surface agricultural return flows. In this case there would be a reduction in instream flows equal to the reduction in surface water discharges. If, however, the underlying water right for the 640 acres were 3,840 acre-feet per season rather than only 1,920 acre-feet, less new water would likely need to be applied to support a crop in order to comply. In this latter case, the effect on instream flows depends upon the source of water. If the source is proximal to the place of use, that is, the same stream to which surface agricultural return flows are discharged, then less water would be diverted, in an amount similar to the reduction in surface agricultural return flows. If the source were distal, that is, from a source other than the stream to which surface agricultural return flows are discharged, then a reduction of surface agricultural return flows will reduce flows in the receiving water tributary by that amount.

Additionally, farmers may use both groundwater and surface water as sources of irrigation water. Assume the 640-acre farm used as an example above has a 1,920 acre-foot surface water right to irrigate about half the farm's acreage, and uses groundwater to irrigate the other half of the farm's acreage. If this farmer reduces surface water drainage through improvements in infrastructure (as mentioned above) the resulting reduced surface water demand may result in either less surface water diversions or less groundwater pumping. Depending on what the individual farmer chooses, impacts to streamflow in nearby waterways may vary greatly. The degree to which the farmer reduces groundwater pumping may result in a reduction in nearby streamflow. The degree to which the farmer reduces surface water diversions may result in an increase or no change in the amount of nearby surface water flow.

Further complicating assessment of the effects of reduced water use, appropriative water right holders (or parties they have contracted with) may transfer any water that is not used due to measures employed to reduce use. Water right holders with appropriative water rights initiated after 1914 (post-1914 appropriators) are required to petition the State Water Board to change the purpose of use, place of use, or points of diversion to allow for the transfer of water. Prior to approving the petition, the State Water Board must find that the change will not injure other legal users of water (Water Code sections 1702, 1725, and 1736). In determining injury for changes where the transferor makes water available for transfer through fallowing or tailwater control, the State Water Board must find that the proposed change will not injure downstream parties by reducing the amount of water available for their diversion. The amount of water available for transfer is typically only that which would have been consumptively used absent the proposed transfer. The percentage of applied water which results in tailwater or groundwater percolation to a usable groundwater basin is not considered to be 'transferable water'. In order to avoid injury to other legal users of water, post-1914 appropriators who choose to reduce their agricultural surface water discharges by fallowing land (or changing to crop with lower water demand) may only transfer the difference in the amount of water which would have been consumptively used absent the transfer. Thus, these transfers should not impact the amount of water remaining in the applicable source stream.

Pre-1914 appropriative water right holders (pre-1914 appropriators) can change the purpose of use, place of use, or points of diversion provided such changes do not "cause injury to others" (Water Code section 1706). State Water Board approval is not required for a change in pre-1914 water rights. Therefore, complying with section 1706 is the responsibility of the water right holder and, if challenged, the courts. This means that pre-1914 appropriators can transfer the saved water without State Water Board approval. For example, a pre-1914 appropriative water right holder may reduce its agricultural drainage by fallowing land within its service area and sell the water to a downstream user without notifying the State Water Board. It would be the responsibility of nearby water right holders to take legal action against the pre-1914 water right holder if any of these parties determined the transfer would injure their water rights. Transfers such as these may occur at any time and their impact to nearby streamflow would not be known to the State Water Board. Since parties which enter into these transfers take on risk of litigation, the parties may voluntarily choose to only transfer that amount of water they would have consumptively used in the absence of the transfer (as described above). Thus, while the State Water Board may not have a record of (or jurisdiction over) these transfers, they may have little or no impact on local streamflow.

Finally, a landowner irrigating in a watershed such as the SJR with water supplied by a major water right holder, such as the USBR under a water supply contract, may choose to reduce surface water discharges by reducing contract water use and arrange to transfer this water. If the transferee, the recipient of the transferred water, is another USBR contractor, then the underlying water right (held by USBR) typically allows water to be delivered to the entire service area. Thus, no changes in USBR's water right are required to accomplish this transfer, and the State Water Board would not be notified (similar to the pre-1914 transfers described above). There would be different impacts to streamflow depending on where the transferor was located within the USBR service area. If the transferor was located within close proximity to the transferee, then little to no change in nearby natural streamflow could result. It is more likely, however, that the transferee would be located some distance from the landowner. In this case there would be a reduction in streamflow near the transferor and an increase in streamflow downstream of the transferee.