Economic and Cost Analysis Of the Proposed Ag Waiver and Ag Alternative

J. Bradley Barbeau, Ph.D.
California State University, Monterey Bay School of Business

Kay L. Mercer, M.S., PCA
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Executive Summary

The proposed Central Coast Regional Water Quality Control Board (RWQCB) Conditional Ag Waiver for Irrigated Lands (Waiver) regulates discharges from irrigated agricultural operations. Proposed regulatory requirements depend on Tier designations which, in turn, depend on a grower's perceived threat to water quality. Tier, 1, 2 and 3 are, respectively, low, medium and high threat designations.

This paper examines the economic impacts of the proposed Waiver to growing operations and the local economy. Personal interviews were conducted of twelve growers with high nitrate crops. Acreage of interviewed growers represents about 6.1% of total regional acres and the 12 operations roughly reflect acreage distribution of high-nitrate crops in the region. It is estimated the average annual per acre costs of the proposed draft order across the sample population are: tier 1 = $27.78 - $51.8, tier 2 = $67.54 - $96.20, and tier 3= $128.79 - $187.48. Averaged costs mask the economic impact on individual operations. The range of costs per acre for these surveyed operations is: tier 1 = $4.66 – $98.97, tier 2 =$ 23.75 – $231.19 and tier 3 =$73.11 – $620.55. There are several regulatory requirements which ALL growers must do that pose significant costs and so tier 1 costs were higher than anticipated. In-house or contracted labor represents the largest portion of costs across tiers. Some costs are difficult to estimate or predict, but will certainly impact a grower's bottom line. Many of the estimated costs will be offset by increased production efficiencies and input savings. There will also be indirect effects on agricultural-related industries and induced effects on general economic activity in the community.

This paper also presents a summary of annual grower and community costs as calculated by feeding survey generated data into the IMPLAN economic model. The region-wide estimated total cost to growers is between $29,495,000 and $43,181,000.The estimated total economic impact is between $60,063,000 and $87,932,000.The direct impact on the agricultural industry in the region is estimated at between $34,866,000 and $51,044,000. Indirect impacts on related industries are between $18,401,000 and $26,938,000; with induced impacts between $6,796,000 and $9,949,000. Labor income losses to the agricultural industry are estimated are $3,851,000 and $5,638,000; labor income losses to related industries are $5,592,000 – $8,188,000, and labor income losses in the general economy are $1,682,000 - $2,462,000. The largest effect is on total output. Output losses to the agricultural industry are $29,495,000 - $43,180,000. Losses to related industries are $12,153,000 - $17,791,000, and losses in the general economy are $4,789,000 - $7,011,000. These losses total to between $46,436,000 and $67,983,000 for the region. There will be an estimated total of 328 – 480 jobs lost, consisting of 164 – 241 jobs in agriculture, 130 – 191 in related industries, and 33 – 49 in the general economy.

Agriculture has proposed an alternative Waiver proposal which creates third-party groups (3PG) to provide assistance in identifying water quality risks, implementing management practices and conducting verification audits. This paper provides a comparison between Waiver approaches. Organizational startup costs of the Ag Alternative are estimated at $125,000 to $1 million. Annual organizational costs are estimated to be about $1 million and the costs to conduct audits range from $2.50 to $10.00 per acre depending on several factors. The potential number of acres which might enroll in the 3PG is 183,983. Per acre costs per year will vary with the level of growers participating in the 3PG. When evaluating the overall comparative costs of the two proposed Waiver, the Ag Alternative proposal

has the greatest probability of being the least expensive Waiver approach. However, depending on what is eventually adopted, each individual grower will need to assess which approach best suits his farm while simultaneously addressing water quality protection.

Introduction

In March 2011 the Central Coast Regional Water Quality Control Board staff produced a draft order R3-2011-0006 "Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands ("the Waiver")," plus accompanying documents including the Draft Monitoring Program ("MRP"). This report details the results of a six month study on the cost and economic impacts of implementing the Waiver and MRP, with particular focus on the costs to be born directly by growers and landowners and the associated economic impacts of those costs.

The Waiver addresses an important issue on the central coast, the threat to water quality posed by agricultural activity. Agriculture is a primary economic activity and driver in the region, with Monterey County alone accounting for $4.06 billion of agricultural output in 2010 (County Crop Report), and the six counties in the region accounting for a total of $7.03 billion. A disruption in the practice of agriculture in the region would have severe economic consequences, and the potential for serious disruption exists in both the short term and the long term, with the medium term having the least risk.

The goal of this study is to assess the cost to individual growers of implementing the proposed Waiver and, to the extent possible, extrapolate these costs to the agricultural community and to the economy of the region. The costs represented in this analysis consist of administrative costs of planning, monitoring, and reporting, costs of implementing best management practices (both those required by the Waiver and those practices implemented beyond the direct specification in the Waiver in order to achieve the mandated water quality standards), reduced revenue and income due to lower crop yields and land removed from production.

This analysis does not take into consideration the costs of implementing Best Management Practices (BMPs) unless they are mandated in the staff draft order. BMP implementation will represent additional costs. Further, there are requirements in the proposed Waiver for which the costs are very difficult to estimate, such as potential reductions in yield due to changes in management practices.

Costs of compliance with the proposed Waiver will in some cases be offset in part by increased efficiencies in irrigation and fertilization, and possibly reduced pesticide costs. Reduction in irrigation costs (less electricity for pumping, reduced labor if fewer irrigation events are used), fertilizer costs (lowered expenditure for fertilizer, reduced labor if fewer fertilization events are used), and pesticide costs (lowered expenditure for pesticides, reduced labor and professional services costs if fewer pesticide applications are used) may be offset by reductions in yields. This is discussed in more detail below.

Some of these costs (and efficiency gains) are very difficult to estimate, such as the extent of the efficiency gains in irrigation, fertilization and pest control), costs of non-mandated changes to management practices in order to achieve water quality goals, and reductions in rents to landowners

and lost property value. These costs in some cases were beyond the scope of this study to estimate, due to time and cost constraints. While difficult to estimate, these costs are certainly nonzero and may in fact be larger than the costs we were able to estimate. They are discussed further below.

Background: Economic Impacts of the Ag Waiver

The direct and immediate impact on growers will be an increase in the costs and a reduction in output of their operations. These cost increases will be due to increased costs of administration for planning, monitoring, and reporting, increased capital costs and operating costs due to required changes in management practice. Operations will also face decreased output from land taken out of production, decreased output from yield losses stemming from reductions in pest management (with likely increases in the cost of pest management) and reductions in fertilizer usage.

In the March 2011 Appendix F: Cost Considerations Concerning Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands, RWQCB staff has argued that a reduction in output may not result in a decrease in overall income. They argue that demand is inelastic for many of the crops grown and thus the reduction in output will result in an offsetting increase in consumer prices. However, prices at the field level and at the consumer level are very different and respond differently. The staff argument implies that growers' increased costs would be passed up the food chain, ultimately to consumers, increasing consumer food prices. This ignores that Individual growers are price takers in the agricultural system and have a limited ability to pass higher costs upward through price increases. There is no evidence that individual growers have the market power to be able to control price in this way, nor that there are effective means of collusion to accomplish monopoly pricing by the growers. Individual growers are price takers; their prices are determined by market conditions at the time of sale. While at a market level the prices may adjust somewhat to reflect the increased costs, individual growers do not have the power to push through those increases themselves. Only a reduction in the quantity of each commodity produced, without a corresponding reduction in demand for the commodity, can drive the field price of the commodity upward. *Prices respond to the quantity of a good that is supplied, not to the cost of producing that supply*. Individual growers who face higher costs of implementing the Waiver relative to other growers will not be able to recoup these costs by raising their prices; they will of necessity be faced with lower margins.

The costs, and therefore economic impact, on the growers are directly related to the tier to which their land becomes assigned. This may be justified on the basis that operations assigned to higher tiers may represent an increased threat to water quality, but as will be seen below the costs associated with being assigned to tier 3 appear to be about four times the costs associated with being assigned to tier 1, so it is important to ensure that the tier structure is justified by the degree of water quality impact.

Indirect and Induced Economic Impacts: In addition to the direct costs to the growers, there will be indirect effects on agricultural-related industries and induced effects on general economic activity. Increases in grower costs and resulting reductions in output will adversely effect those businesses that are suppliers to the growers, including seed, fertilizer, and pesticide suppliers, accounting and other professional service firms, and other. In addition, the increased cost will lead to an induced reduction in

economic activity. In short, these increased costs per unit of production represent a decrease in the efficiency of production; that reduced efficiency leads to an overall loss of income to the community *beyond the lost income to the grower*. This is referred to in the economic literature as a multiplier effect. Reduced business income means less spending in the community and potential job reductions. Reduced employment leads to reduced consumer spending, which in turn reduces income to community businesses selling consumer goods. This will be further addressed in the Economic Section below.

Time Frame of Impact: We believe that the economic impact of the Waiver will be different in the short, medium and "long" term, as different factors come into play in different time frames. There are three factors that will affect the costs and economic outcomes of the Waiver: the cost of compliance to the grower (and the associated indirect and induced economic impacts of these costs), competitive effects, and land use impacts.

The first factor, the cost of compliance, is likely to be highest at the initial implementation of the Waiver, and look much as they are estimated in this study. This is because growers will initially respond to the Waiver with the skills, knowledge and technology at hand. As time goes on, we would expect the real costs of compliance (separate from general inflation) to fall, as learning curves and innovation lead to more efficient solutions. This, of course, assumes no future changes in the Waiver requirements.

The second factor, competitive effects, are likely to have the opposite time pattern. In the short run, increased costs of production in the region will likely fall heavily on growers, as individual growers have little bargaining power in the agricultural supply chain. Consumer prices may rise to some degree, but this would depend on reductions in total output of a given commodity resulting from the Waiver and the price elasticity of that commodity[1]. Over time, growers faced with higher costs of production in the region will be encouraged to shift production to other regions where costs may be lower, including nondomestic regions. The likely extent of this effect is not known.

The third factor, effects on land use, will also take time to occur. To the extent that the cost of implementing the Waiver reduces the agricultural value of the land, incentives increase to put the land to alternative uses such as commercial or residential development. This change in land use, however, would take time to occur even without land use restrictions, and land use is highly regulated in each of the counties. Nevertheless, it should be considered as a part a long-term, broad-scale economic impact analysis..

[1] It is important to note the difference between the price elasticity of these commodities at the consumer level and the price elasticity faced by each grower. Although the staff in its economic analysis presented some evidence of price inelasticity at the consumer level, these are market elasticities of demand for the commodities. Growers, operating in an environment closer to economic perfect competition, face a highly elastic demand curve for their output.

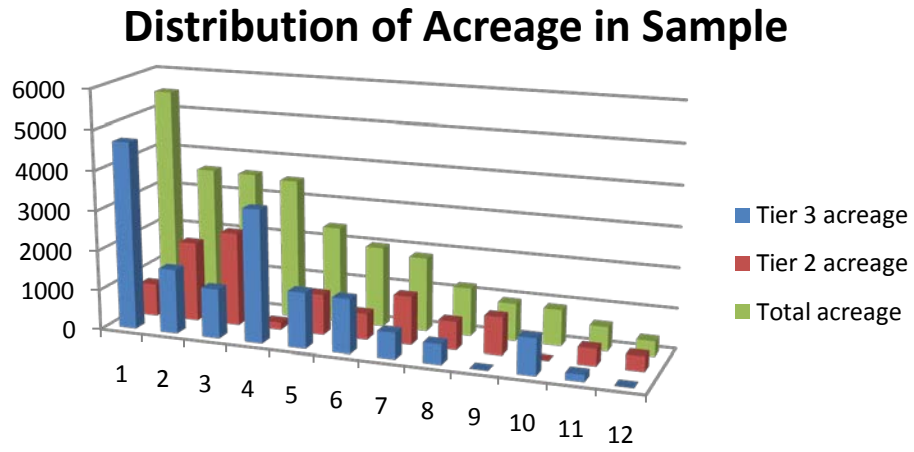
Methodology

We interviewed 12 vegetable growers with operations ranging from 378 acres to 5510 acres, with the 12 operations totaling 26,448 acres. The 26,448 acres represents about 6.1% of the 435,000 irrigated acres in the Central Coast region. We estimate that 15,824 of these acres would fall into tier 3, with the rest in tier 2. Tier 3 criteria included growers who used chlorpyrifos or diazinon, growers who primarily farmed a commodity defined by RWQCB staff as having high nitrate requirements, or a farm size of greater than 500 acres.

The respondents were chosen to be representative of growers in the region. The sample is not "random" as it was not possible to determine the population of Tier 3 growers with Waiver tiering criteria using existing data sources. Extensive phone surveys would have been required. Hence there was not a cost-efficient means of creating a true random sample of growers in tier 3.

We believe the sample to be reasonably representative of operations in the region that have tier 3 acreage. Ten of the operations had significant tier 3 acreage, with two having only tier 1 & 2 acreage. Nine of the operations had a combination of Tier 2 and Tier 3 acreage, and one grower's operation was 100% Tier 3. Two operations were initially thought to be in Tier 3, but upon examination it was determined that their operations were Tier 2. The distribution of the acreages of the respondent operations is shown in the figure below.

Distribution of the survey respondents is representative of Tier 3 acreage distribution in the region. The 12 respondents were located as follows: Eight have operations in Monterey county, 5 in Santa Maria (Santa Barbara county), and 1 in Santa Cruz county. The numbers do not add because one of the operations has acreage in all three of the counties.



Interviews of the twelve growers were conducted between June 26 and July 12, 2011. On July 7, 2011 RWQCB staff released an update to the proposed Waiver containing multiple changes from the earlier version. . Staff recommended changes in the regulatory requirements on July 7 and provided further

clarification in subsequent email correspondence with Farmers for Water Quality on July 28, 2011. The interview process was not altered to reflect recommended changes. Rather, potential changes in the cost structure resulting from Staff's recommended changes to the order were addressed later on as a comparative impact to the overall costs.

The surveys were conducted through personal interviews. For each of the actions required by the Waiver, the survey respondent was asked to identify for their operation the resources required to comply with the requirements over a five year time period, and to estimate the cost of those resources.

It should be noted that the proposed regulatory requirements were not very specific so growers were forced to speculate on what it would take to comply. This injects some level of uncertainty into the responses and it should be emphasized that these responses are the best estimates of costs rather than definitive numbers. The interviewer explored these resource requirements and costs for the list of 53 items extracted from the Waiver; 20 are required for all growers including those in Tier 1, five additional requirements for growers in Tier 2, and 28 are additional requirements for growers in Tier 3 (see the list in Appendix A). Cost estimates were supplemented by interviews with or prices obtained from vendors, service providers and consultants.

For Tier 1 and Tier 2 costs, we arrived at the minimum cost estimates by summing the minimum costs for each item in each tier across all of the acreage represented in the sample, and dividing that total number by the total acres in the sample (26,448). Similarly, we arrived at the estimated maximum cost by summing the maximum cost reported by each respondent, adding across all respondents, and then dividing by the total acreage. Total acreage was used because the Tier 1 and Tier 2 costs applied to all acreage in the respondent operations.

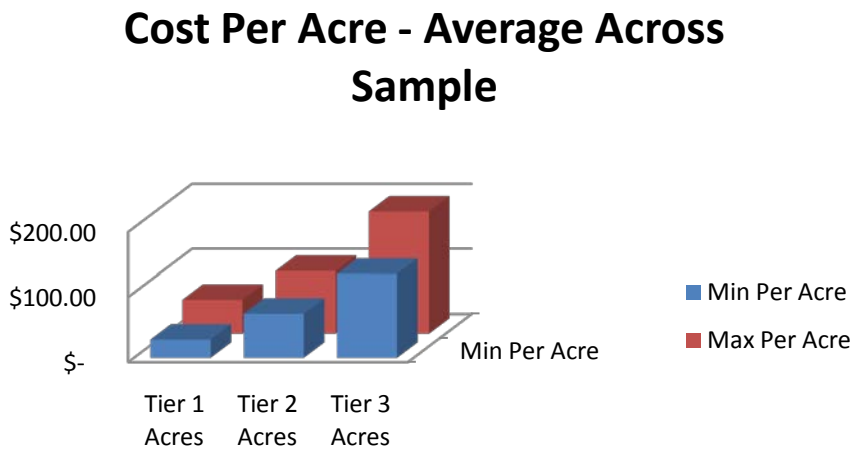
For Tier 3 costs, we summed the minimum costs reported by each respondent, across all respondents, and then divided by the number of Tier 3 acres in the sample (15,824), to arrive at the average minimum Tier 3 cost. We performed the same operation for the maximum Tier 3 costs to arrive at the average maximum Tier 3 cost.

Grower Costs of Compliance for the Proposed Waiver

Average Total Costs of Compliance

Based on the data from our survey, supplemented by cost data from vendors, we estimated the annual costs for growers on a per-acre basis for each tier. The five-year costs were divided by five to arrive at an annual "average." An annual average is easier to interpret than five-year totals, but it should be kept in mind that the expenditures for many of the requirements will not be even across the years, but may fall more heavily in certain years. Capital investments in particular are likely to be more front-loaded, depending upon the implementation schedule required by the Waiver.

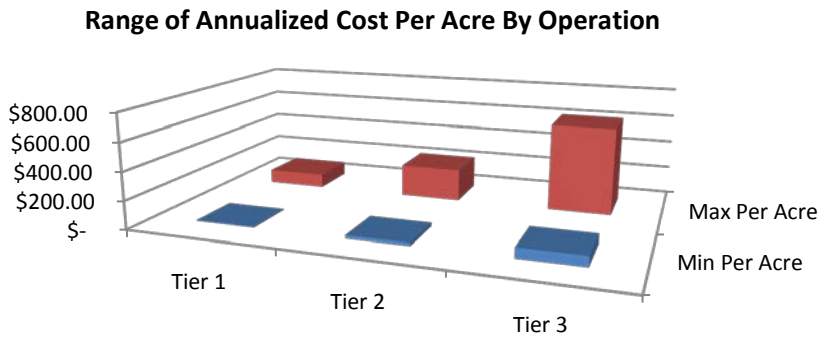
The figure "Annual Cost Per Acre" shows the pattern of minimum and maximum costs across the three tiers.



Tier 1 averaged cost estimates ranged from $27.78 per acre to $51.82 per acre, tier 2 averaged costs ranged from $67.54 per acre to $96.21 per acre, and tier 3 averaged costs ranged from $128.79 to $187.48. These numbers are represented graphically in the above figure. From this, it is expected that moving up a tier in classification approximately doubles the costs associated with compliance, with tier 3 costs per acre being nearly four times the cost of tier 1.

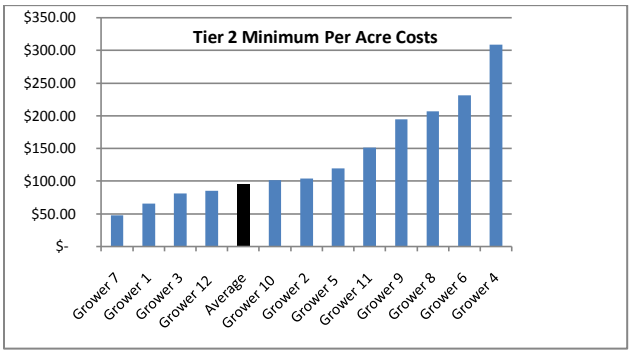
Distribution of Costs by Operation

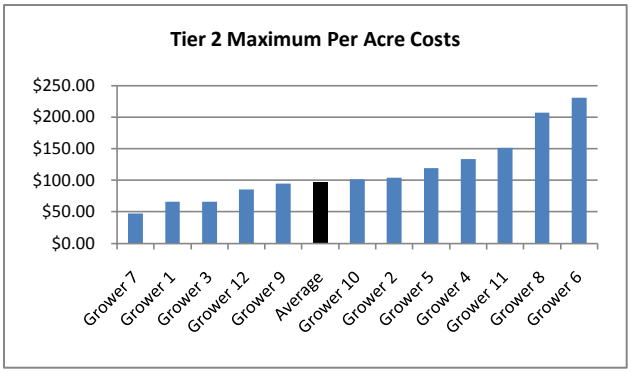
In addition to looking at averages, it is worthwhile also considering the range of costs across growers. This may give a picture of what an individual grower may face, since few operations will be "average." For individual growers in the survey, tier 1 costs ranged from a low of $4.66 per acre to a high of $98.97 per acre, the tier 2 cost range was $23.74 to $231.19, and tier 3 costs ranged from $73.11 to $620.55. This would indicate that growers will likely face widely differing costs of implementing the Order, depending upon their current management practices, the particular characteristics of their ranches, and the choices they make in how to achieve compliance. These ranges are depicted in the following figure.

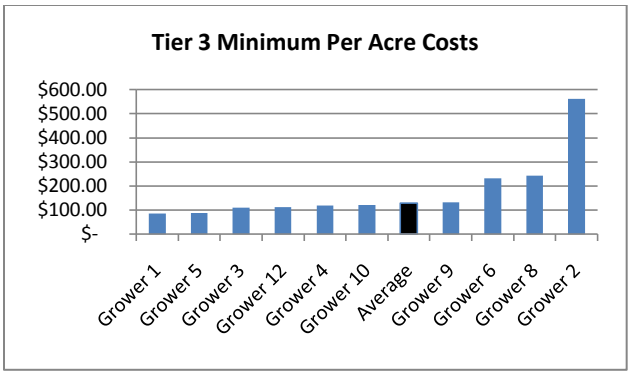


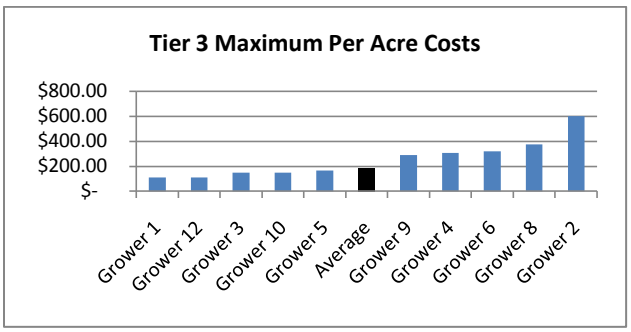
	Tier 1	Tier 2	Tier 3
Min Per Acre	$4.66	$23.74	$73.11
Max Per Acre	$98.97	$231.19	$620.55

The following four graphs show the distribution of costs across the operations, compared to the per-acre average across all respondents. From these we can see that there is a wide dispersion of costs that operations face.

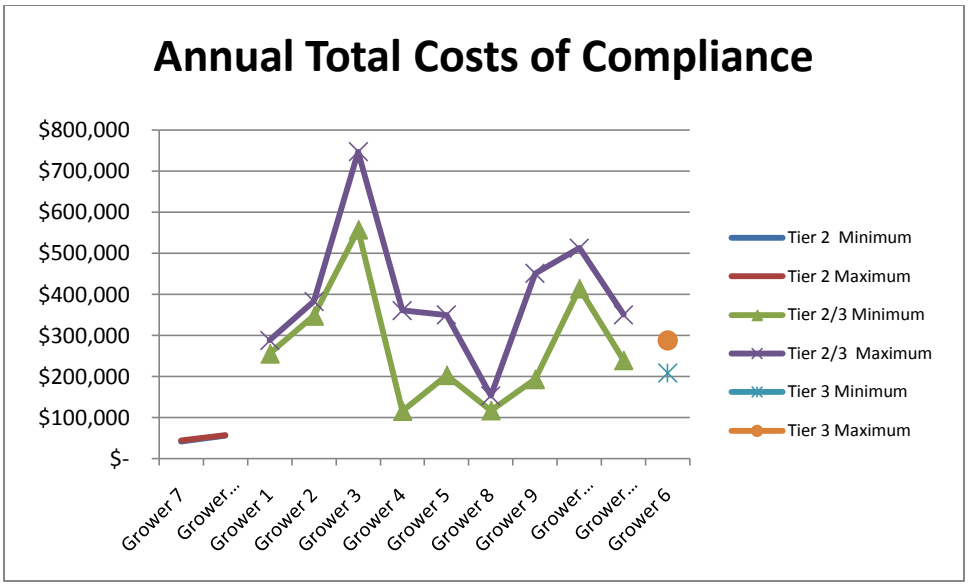


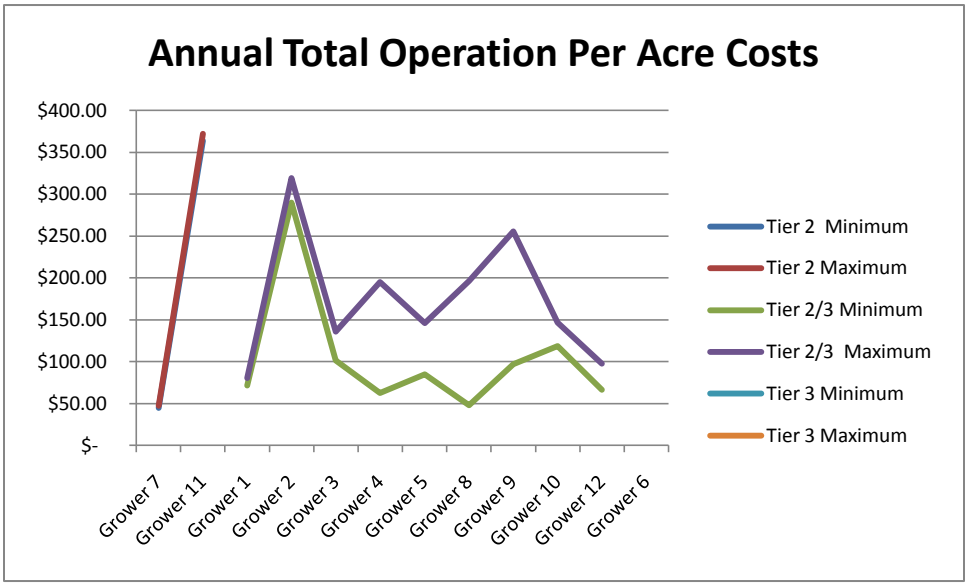






Similarly, the total impact on an operation, which will depend on its mix of Tier 1, 2 and 3 acreage, its location, growing characteristics, etc., has a wide dispersion and will be quite large for some operations. The distribution of these total costs per year is shown in the following two graphs. The first graph shows the total annual operational costs of compliance with the Waiver for the twelve growers. Growers 7 and 11 had Tier 2 acreage only, grower 6 had Tier 3 acreage only, and the other growers had a mix of Tier 2 and 3 acreage. One respondent operation (grower 3) had estimated total costs of as high as $755,000 per year, nearly 7-1/2 times the annual compliance costs of growers 4 and 8. The second graph shows the annual compliance costs on a per-acre basis, which also shows a wide variation among growers, with grower 2 having nearly six times the per-acre compliance costs of growers 4 and 8.





One effect of this dispersion is that the Waiver may create uneven competitive factors within the region. For some growers, differences in size, location of a farm or arrangement and characteristics of their land, may put some operations at a competitive disadvantage to growers who do not have these factors but, in essence, farm in essentially the same manner.

Individual Items Representing Major Costs

Tier 1 requirements: Although tier 1 operations face the lowest costs of compliance per acre, there are several items in the proposed Waiver used for the survey which ALL growers must do and that pose significant costs. These include constructing and maintaining containment structures to avoid percolation of waste to groundwater to prevent percolation into groundwater, minimizing bare soil vulnerable to erosion and soil runoff to surface waters, erosion control, and eliminating discharge of chemicals used to control wildlife (such as bait traps or poison) into surface waters.

Lining water containment ponds presents a significant expense to some growers. The cost of lining an average pond 100' x 200' x 8' deep is about $15,000. One large grower with 5500 acres has 16 of these ponds, for a total expense of $240,000. Other growers who do not use containment ponds avoid this expense, but we would expect the use of these ponds to increase under the Order. Subsequent clarification by RWQCB staff has indicated that lining water containment ponds is not a stand-alone requirement; other alternatives such as denitrification of pondwater would also be acceptable if possible. However, this information was received too late to be included in this analysis.

The cost of minimizing bare soil vulnerable to erosion depends greatly on the interpretation of this requirement. This cost could be significantly lower, depending on the interpretation of the term "minimize" and the method used to achieve compliance. If all non-cropped bare soil were vegetated through the planting of annual grasses, the cost could be as high as $22.31 per acre annually. Costs of planting perennial grasses might lower overall costs of compliance, but, since the vegetation would be permanent, it would increase the likelihood of conflict with food safety requirements.

Eliminating discharge of chemicals used to control wildlife into surface waters: Up to $575,000 for one operation. However, this cost for this grower was an outlier; the grower assumed that he would need to discontinue all use of chemicals to control wildlife and that this would in turn lead to increased labor, increased buffers which would take land out of production, increased food safety requirements and corrective actions and the cost of trapping and additional fencing. For other growers, this was a small expense, and for several no cost was listed for this item.

Tier 2 requirements: Tier 2 operations face all of the requirements of tier 1, plus a set of additional requirements.

The most expensive of these, as reported in our survey, is the submission of an annual compliance form. Estimates ranges from an annual cost of $30.32 per acre to $34.88 per acre. As a total cost to an operation, the highest reported estimate was $997,500 for the 5 years or about $200,000 per year.

Large growers (regardless of whether they are in tier 2 or 3) believe that they will have to hire a full time technical person (e.g. an agronomist or soil scientist) to manage the data collection and reporting for the annual compliance form. These estimated compliance costs ranged from $7.79 to $7.85 annually per acre. One operation reported an estimate of $150,000 per year.

Tier 3 requirements: Tier 3 operations face a considerable number of requirements in addition to the tier 1 and 2 requirements. High cost items include creating riparian buffers, soil sampling for nitrogen, individual surface water quality sampling, and additions to the annual compliance form.

Costs of riparian buffers will vary widely depending upon the location of a particular farm relative to impaired waterbodies. Costs for respondent operations ranged from $36,000 to $1.4 million.

Costs of soil sampling prior to planting ranged as high as $75,000 per year, due to the large number of sampling events required.

Adding Staff: A large source of costs associated with the Waiver is the need to add staff to manage and undertake the various planning, monitoring and reporting requirements. Based on survey responses, smaller operations are likely to need to add part-time staff or rely on outside consultants, while growers with multiple Tier 3 farms and Tier 2 acreage will need to add employees with fertility and irrigation management experience. These staff will probably need to have an advanced degree. Further, depending on the number of acres in Tier 3, the grower may need to add a part- to full-time staff person to take field samples and a part- to full-time staff person to do data entry in order to comply with tracking and reporting requirements. A skilled full-time staff person, with benefits and adding a pickup truck for transportation, is estimated to cost upwards of $150,000 per year.

Costs difficult to estimate

Many of the costs associated with compliance with the Waiver proved difficult to estimate. In some cases this is because the Waiver provides insufficient specificity in the actions required of growers, in others it is because there are too many interacting factors affecting costs.

Yield losses: Changes to management practices with the intention of reducing the threat to water quality may result in reduced yields or reduced quality of the yield (or both), lowering the value of the output. Reduction in the use of fertilizer (nitrogen) below a certain level may reduce or slow plant growth. Defining what the minimum level is, or what the yield loss would be for a given reduction in fertilization, is beyond the scope of this study. While much is known about nitrogen uptake by different crops, that uptake is affected by factors beyond the plant itself, such as soil characteristics and weather factors. It may be the case that the level of nitrogen that can be added to the soil without leaching to groundwater may be below the level needed for optimum plant growth under a variety of conditions which fluctuate seasonally.

Similarly, reduction or discontinuance of the use of pesticides (chlorpyrifos and diazinon, potentially others depending on future regulations) may leave fields vulnerable to pest and disease infestations which are currently controlled. Strict pesticide registration and use laws and regulations and prioritization of pesticide registrations for commodity crops sometimes combine so that alternative pesticides may or may not be available for specialty crops such as fresh fruits and vegetables.

The potential buildup of salts when less irrigation is used (e.g., in the conversion from sprinklers to drip irrigation), combined with other factors such as an increase in pests or crop disease due to increased vegetation near the fields, has the potential of exponentially reducing yields and/or quality. These yield reductions could be from increases in pest damage, decreased plant growth from reduced nitrogen availability, or lost buyers due to increased food safety concerns. However, these yield reductions are very difficult to estimate, and range from a percentage reduction in the harvested yield from a field to the complete loss of yield if size, quality and food safety parameters are not met.

Further complicating the calculation of costs from yield losses are discontinuities and interacting factors. Reductions in yields of 10% or 20% are one thing; reductions in quality, as measured both in shelf life and aesthetic appearance, may lead to unfitness for sale for an entire field. Simple reductions in the size of a head of lettuce, for instance, may lead to severe decreases in the market price of the lettuce and

potential unsaleability; this makes for "all or nothing" (discontinuity) in some cases. Further, there can be interactions among factors, such as reduced fertilization along with cold weather leading to a larger reduction in yield than the effect of each factor independently.

Tile Drains: The RWQCB has recently recommended a requirement: "The focus of this Order is non-tile drain discharges, although Tier 3 tile drain discharges on individual farms/ranchers must be monitored. Dischargers with tile drains must also describe management practices used or proposed to be used to attain water quality standards or minimize exceedances in receiving waters while making progress to attain water quality standards. The Executive Officer will evaluate any proposed longer timeframes to address tile drain-discharges." Costs related to this requirement have not been estimated but could be substantial for individual operations.

Efficiency Gains

There is some evidence that both water and nitrogen usage can be decreased considerably without loss of yield.[2] The extent of these efficiencies will vary widely across operations, depending upon existing patterns of irrigation methods and fertilizer usage, weather conditions (temperature and moisture), soil type, and other factors. Many operations have already instituted drip irrigation and have tightened fertilizer usage, minimizing expected future gains.

Below are potential Savings from increased fertilizer and irrigation efficiencies realized as a result of Conditional Ag Waiver regulatory compliance. These numbers are derived from University of California Cooperative Extension Sample Productions Costs.

According to the University of California Cooperative Extension, the costs of sprinkler irrigation on head lettuce can vary from $285 -$477.00 per acre. For lettuce fields which have converted to drip tape from sprinkler or furrow irrigation, direct advantages are primarily generated by reduced water usage. This might or might not translate into direct cost savings, depending on whether the grower is purchasing his irrigation water or using groundwater for irrigation. However, there are numerous indirect savings. One is that more uniform irrigation water application can translate into more uniform yields and quality. The other is that less nitrate fertilizer may be required as the fertilizer is not being leached out of the soil profile. Drip irrigation reduces water contact with the crop leaves which could promote infection by some crop diseases such as downy mildew. Using drip irrigation could potentially reduce the number of fungicide applications needed. Also, most common weeds have very shallow seed germination. The fact that the soil surface remains drier reduces weed seed germination. Depending on the soil type where the crop is grown, drip irrigation may improve the soil condition by reducing soil "crusting". Compaction may be less of an issue as less cultivation is needed to break the soil crust.

The direct and indirect advantages of drip irrigation may ultimately be off-set by increased production costs associated with the price of drip irrigation equipment which can vary from $500-$1200 more acre. The labor of moving sprinkler irrigation pipe or managing irrigation furrows may simply be displaced with the cost of maintaining drip irrigation tubing to avoid leakage. Comparison of labor costs

[2]Cf. Tanji, Kenneth K., Gloria Helfand and Douglas M. Larson (1994), "BMP Assessment Model for Agricultural NPS Pollution." Land, Air and Water Resources Hydrologic Science Paper.

associated with types of irrigation was not readily available. Additionally, there are costs associated with extra cleanup costs and disposal/recycling of irrigation tape after harvest.

Additional costs savings may be realized with reduced fertilizer use. Depending on soil nitrate residual levels, fertilizer can be substantially reduced, which is especially true later in the year. Using pre-sidedress soil nitrate testing or PSNT, University of California Cooperative Extension demonstrated as much as 45% fertilizer savings when adequate soil residual nitrogen is present to negate the need for additional nutrient inputs. This would be the equivalent of a 22.5% fertilizer savings for the year with 2 crops per season. This could range from $50-$200.00 per acre.

Landowner Impacts

Agricultural land in the region has two potential sources of value. The first is the value from agricultural use of the land, and that value is directly related to the profitability (not the revenue) of farming it. The second is the value of alternative uses of the land, such as for residential or commercial development. The rent that a landowner can charge to a farmer for the land is dependent upon the value of the agricultural production on the land; if alternative uses of the land (development) have a higher value, the landowner would be financially better off to convert the land, either through developing it him or herself or by selling to a developer.

To the extent that implementation of the Order reduces the profitability of the land through higher costs of farming, lower yields, or land taken out of production, the landowner's incentive to convert the land to alternative uses increases. These alternative uses would likely have their own environmental challenges, and should be considered as a potential unintended impact of the Order.

Economic Impacts[3]

In addition to considering the direct cost impact on growers, we must also consider the larger economic impact on the industry, related businesses, and the community. For this part of the study, we used the annual minimum and maximum costs to growers as input to IMPLAN, a set of computer-based modeling tools used to estimate economic impacts.

IMPLAN is used by government agencies, colleges and universities, non-profit organizations, corporations, and business development and community planning organizations. IMPLAN provides information about a local area's economy and can be used to project the broader economic impacts stemming from a change in the economy.

For the purposes of this study, data for the six counties of Monterey, San Benito, Santa Barbara, Santa Cruz, San Luis Obispo, and Santa Clara were used. These IMPLAN data sets are updated annually.

Total costs to growers were inputted to the IMPLAN model and the model was run to estimate impacts on industry output, employment, indirect business taxes, and labor income.

[3] Analysis for this section was done by Sanjay Varshney, Ph.D., Dean of the College of Business Administration at California State University, Sacramento.

Total costs were based on the average minimum and maximum costs to growers for each of the three tiers, as calculated above. Acreage estimates for each tier were calculated as follows: For the high-nitrate crops, which total 205,000 acres (data drawn from county crop reports), we assumed that 10% would fall in Tier 1, 70% in Tier 2, and 20% in Tier 3. For the other crops, totaling 230,000 acres, we assumed 25% in Tier 1, 70% in Tier 2, and 5% in Tier 3. This gives a total of 78,000 acres in Tier 1, 304,500 acres in Tier 2, and 52,500 acres in Tier 3.

This assumed distribution of tier acreage results in an estimated total cost to growers of between $29,495,000 and $43,181,000 annually. Applying the multipliers derived from the IMPLAN model, the estimated total economic impact is between $60,063,000 and $87,932,000 annually. The direct impact on the agricultural industry in the region is estimated at between $34,866,000 and $51,044,000; indirect impacts on related industries of between $18,401,000 and $26,938,000; and induced impacts of between $6,796,000 and $9,949,000 annually.

Employment impacts are estimated at a total of 328 – 480 jobs lost, consisting of 164 – 241 in the industry, 130 – 191 in related industries, and 33 – 49 in the general economy.

While employment impacts measure the expected number of jobs lost, the effect on labor income measures that total expected lost income to labor. Labor income losses to the agricultural industry are estimated at between $3,851,000 and $5,638,000, labor income losses to related industries at $5,592,000 – $8,188,000, and labor income losses in the general economy at $1,682,000 - $2,462,000.

The largest effect is on total output. Output losses to the agricultural industry are estimated at $29,495,000 - $43,180,000, losses to related industries at $12,153,000 - $17,791,000, and losses in the general economy at $4,789,000 - $7,011,000. These losses total to between $46,436,000 and 67,983,000.

Costs of the Third Party Plan

As an alternative to monitoring and reporting by individual growers, a proposal has been put forward for the creation of third-party groups (3PG) to work directly with growers throughout the Central Coast to provide assistance in identifying and implementing appropriate management practices to improve water quality and comply with water quality standards, while providing accountability to the Regional Board and the public in general by ensuring that third party group grower members and their agricultural operations are subject to technically-sound, scientific and objective verification audits. It is worthwhile comparing the estimated costs of utilizing 3PGs as opposed to the growers doing their monitoring and reporting individually, to the extent that this comparison is possible.

For the purposes of this assessment, we will assume that a single 3PG is created for the region. It is possible that multiple 3PGs will be created, but a single group would be administratively most efficient.

Costs associated with the 3PG include organization costs of the TPG itself, initial startup and planning costs, auditing costs, and program review costs. Based on the work of Mercer (Mercer 7/16/11) and of

Marc Los Huertos (Los Huertos 7/29/11) we estimate the startup costs for the 3PG at $110,000 and the annual costs for the TPG at $1.085 million per year, plus audit costs.

Water Quality audit cost projections are based largely on a survey which was undertaken recently to assess the costs to growers and handlers of the national Leafy Green Marketing Agreement (LGMA)[4]. An important part of the LGMA is auditing of growers' food safety practices and outcomes by independent auditors. Costs of these audits are reported in the survey (citation). A typical audit costs $92.00/hour plus expenses. For small growers (200 acres), the reported total audit costs are $2000 or $10 per acre. The survey postulated that costs for a 200 acre grower are roughly representative of costs for operations possessing between 10-500 acres. For large growers (10,000 acres), the reported audit costs range from $2.50 to $5.00 per acre.

We would expect the water quality audits to be substantially similar to the food safety audits. Further, it we anticipate that operations audited by the Third Party Group would range from less than 100 acres to as much as 10,000 acres. Farm demographics vary highly by county. According to the National Agricultural Statistics Service, average farm size was 70, 261, 492, 455 and 1,108 acres for all farms in Santa Cruz, Santa Clara, SLO, Santa Barbara and Monterey Counties, respectively. In SLO and Santa Barbara, the average size of irrigated farms is 365 acres. The bulk of operations participating in the Coalition are expected to be between 300 and 3,500 acres based upon county demographics provided by the National Agricultural Statistics Service and Conditional Ag Waiver Tier 2 and 3 designation criteria. Hence, an estimated mid-range of audit costs of $5.00 per acre can safely be applied to the majority of growers participating in the Third Party Group.

As demonstrated above, these costs will vary depending on efficiencies of scale or the location of the farm. Additionally, the cost to individual growers would depend on the level of participation and the fee structure. As the costs above have been reported primarily on a per-acre basis, we will consider the TPG costs on the same basis.

Participation by growers in the TPG, which is required to be voluntary by the proposed Waiver, will depend in large part on the tier into which a grower falls. It is likely that only operations growing high-nitrate crops will participate, although many of these operations also grow other crops. So as a starting point, we will assume that the potential participants will represent the approximately 205,000 acres of high-nitrate crops grown in the five counties (drawn from county crop reports; see Appendix B). For strawberries, information from the Strawberry Commission indicated that 40% of the total strawberry acreage would fall into tier 1, leaving 14,491 acres of strawberries in tiers 2 and 3. For other high nitrate crops, we estimate that 90% of the ranches in Santa Clara, Santa Cruz, SLO, Santa Barbara, and San Benito counties are larger than 50 acres, yielding 43,028 acres above the 50 acre limit, and 95% in Monterey exceed the 50 acre size, yielding 126,464 acres, for a total of 183,983 acres that would potentially enroll in the TPG program.

[4] Wetherington, Diane, Testimony at the National Leafy Green Marketing Agreement Hearings, Exhibit 34A , September 22, 2009, Monterey, CA.

We do not know what percentage of this 184,000 acres will actually enroll. If 50% of the acres enroll, then the cost per year for the 3PG would be approximately $11.79 per acre, plus audit costs. Seventy-five percent participation would lower the costs to $7.86 per acre plus auditing cost, and 85% participation would lower the cost to $6.94 per acre plus audit costs.

Conclusions, Implications and Recommendations

This report has had as its objective the estimation of costs to growers of complying with the proposed Ag Waiver. This estimation has been accomplished using multiple data sources, with the central source being twelve in-depth interviews of region growers. In addition, economic impacts on the industry, related businesses, and the general economy of the region have been estimated.

The research shows that there are significant costs of compliance for all three tiers that a grower might be assigned to. The level of these costs and their impact will vary considerably across the growers. Costs of as much as $755,000 per year have been identified for a large grower (5500 acres), and costs per acre of as high as $372 per acre have been identified.

On the plus side, there will likely be some efficiency gains from changes in practices that lead to lowered expenditures for water, fertilizer, and pesticides along with reductions in labor costs associated with applying these inputs. Quantifying these efficiency gains has been beyond the scope of what has been possible to accomplish during the time frame of this study.

There are also additional costs of compliance which we have not been able to estimate within the scope and timeframe of this study. Potential yield losses from reductions in irrigation, fertilization, and pesticide use, in particular, are controversial and difficult to assess. There may also be a loss of land value, to the extent that compliance with the Waiver results in reduced income from the land. We have not attempted to include these potential costs in our estimates.

Total costs to growers in the region have been estimated at between $29,495,000 and $43,181,000 annually. These estimate are very dependent upon the distribution of acreage among the tiers; we have attempted to use the most reasonable estimates of that distribution that we could, given the limitations of data sets for identifying tier assignments of acreage within the region.

Broader economic impacts of these costs have been identified, with a total negative impact of $60 million - $88 million per year. While these numbers are not large for a region whose economy is measured in billions, it is nevertheless a significant negative impact in the region.

The study has also considered the costs of a Third Party Group providing oversight of farmers' compliance and progress in improving water quality. Compared with the costs of compliance with the Waiver, the 3PG appears to be very cost efficient and may provide other benefits in achieving cooperation from growers in attaining water quality goals.

Consider cost efficiency: The goal from a cost and economic standpoint should be to achieve the desired water quality at the lowest cost possible and minimizing any negative economic impact. This

requires consideration of cost efficiency in selecting required actions by growers. Several Items that add significantly to the cost of compliance have been identified, and should be examined for their likely contribution to water quality.

Reduce the number of plans and reports: One aspect of minimizing costs is to minimize "bureaucracy" costs and ensure that as much of the money spent as possible should be going to directly impacting water quality. While oversight and reporting are necessary elements of a regulatory process, streamlining the reporting process can provide gains to everyone involved in it. The Waiver currently contains a confusing array of plans and reports that could be significantly reduced, possibly to a single Farm Plan.

Appendix A: Actions Required by the Proposed Waiver

	TIER 1 GROWER REQUIREMENTS
1	Dischargers that apply fertilizers, pesticides, fumigants or other chemicals through an irrigation system must have functional and properly maintained back flow prevention devices installed at the well or pump to prevent pollution of groundwater or surface water consistent with any applicable DPR requirements or local ordinances.
2	Dischargers must properly destroy (i.e. plug) abandoned wells, exploration holes or test holes.
3	Dischargers must implement proper handling, storage, disposal, and management of pesticides, fertilizer, and other chemicals to prevent or control the discharge of waste.
4	Discharges who utilize containment structures (such as retention ponds or reservoirs) to achieve treatment or control of the discharge of wastes much construct and maintain such containment structures to avoid percolation of waster to groundwater that causes or contributes to exceedances of water quality standards and to avoid surface water overflows that have the potential to impair water quality.
5	Dischargers must implement source control or treatment management practices to prevent erosion, reduce stormwater run-off quantity and velocity and hold fine particles in place. Practices must infiltrate, control or treat stormwater run-off for the first half inch of rain during each storm and further reduce the run-off of the next one inch of rain during each storm.
6	Discharges must comply with DPR Surface Water Regulations.
7	Must comply with any applicable stormwater permit
8	Must 1) maintain existing, naturally occurring, riparian vegetative cover (such as trees, shrubs, and grasses) in aquatic habitat areas as necessary to minimize the discharge of waster; and b) maintain riparian areas for effective streambank stabilization and erosion control, stream shading and temperature control, sediment and chemical filtration, aquatic life support, and wildlife support to minimize the discharge of waste.
9	Dischargers must Update or develop a new Farm WQ Plan and implement it to achieve compliance
10	Must obtain appropriate farm WQ education and technical assistance necessary to achieve compliance with the Order

11	**Must pay State Water Resources Control Board fees and relevant monitoring fees.**
12	**Must sample GW wells twice during the first year and again in four years and report results for analysis of 11 constituents (as per MRP) to RWQCB**
13	**Must file an NOI with information, as specified in the Order**
14	**The discharges of agricultural rubbish, refuse, irrigation tubing or tape, or other solid wastes into surface waters, or at any place where they may contact or may eventually be discharged to surface waters, is prohibited.**
15	**The discharge of chemical used to control wildlife (such as bait traps or poison) into surface waters, or at any place where the chemicals may contact or may eventually be discharged to surface waters, is prohibited.**
16	**Comply with any Stormwater permit.**
17	**The EO may require Dischargers to locate (inventory) and conduct sampling of private domestic wells in or near agricultural areas with high nitrate in groundwater and submit technical reports evaluating the sampling results. In addition, Dischargers bay be required to provide alternative water supplies or replacement water se4vice, including wellhead treatment, to affected public water suppliers or private domestic well owners.**
18	**Discharges must submit any technical reports that the Executive Officer may require.**
19	**How much will it cost to negotiate Tier designations? *(Need ranch map, flow map, description of pollutant load, description of any WQ sampling info)***
20	**How much will it cost to change Tier designations every time a grower changes a lease? *(Need ranch map, flow map, description of pollutant load, description of any WQ sampling info)***

Appendix A, Continued

	TIER 2 AND TIER 3 GROWER REQUIREMENTS
1	Discharger must submit an annual compliance form
2	Photo-monitor riparian and wetland habitat every 4 years
3	Tier 2 growers with High NO3 Loading Risk must record and report the total N applied per acre to each farm/ranch or NO3 loading risk unit including organic and inorganic fertilizers, slow release products, compost, compost teas, manure, extracts, N present in the soil and NO3 in irrigation water or propose an individual GW monitoring reporting program.
4	Determine GW NO3 loading risk factor for each ranch/farm or "NO3 loading risk units"
5	Calculate the NO3 loading risk level as "low, medium or high".

Appendix A, Continued

	TIER 3 GROWER REQUIREMENTS
1	Must do individual surface WQ monitoring
2	Must submit an individual surface water discharge Sampling and Analysis Plan which includes
3	Individual Sampling and Assessment Plan and QAPP are subject to approval by Executive Officer.
4	Must select monitoring points to characterize at least 80% of the estimated irrigation runoff discharge volume from each farm-ranch at the point in time the sample is taken, including tailwater discharges and discharges from tile drains.
5	Tailwater ponds must be sampled twice during the dry season and 4 times during the wet season
6	Monitoring Parameters for tailwater ponds and other surface containment features are volume of pond and NO3 +Nitrite (as N).
7	Must include at least one monitoring point from each farm/ranch which drains areas where chlorpyrifos or diazinon are applied and monitoring of runoff or tailwater must be conducted within one week of chemical application.
8	Annually submit individual surface water discharge monitoring data and reports.
9	Must use a state registered professional engineer, registered geologist or certified laboratory to submit lab data.
10	Must develop a WQ Buffer Plan or submit evidence that discharge is adequately treated.
11	WQ Buffer Plan must include a minimum of a 30 foot buffer
12	Must maintain a filter strip of appropriate width between disturbed land and "surface water features". If doing any "construction" must maintain a 30' buffer strip.
13	Must include a WQ Buffer Plan or alternative in the Annual Compliance Plan.
14	Must add the following to the Annual Compliance Form
15	Must take an N soil sample prior to planting or seeding a field.
16	Must take a leaf sample prior to applying more N.
17	Must determine typical crop N uptake for each crop type and report the basis for determination
18	Must develop a certified Irrigation and Nutrient Management Plan using a professional soil scientist, professional agronomist or crop advisor.
19	Must meet N Balance Ratio targets of no more than 100% of crop needs for annual crop rotation and 120% for

	strawberries and raspberries.
20	**Must evaluate effectiveness of INMP.**
21	**Must submit an INMP Effectiveness Report prepared by a state registered professional engineer, professional geologist or similarly qualified professional. Dischargers may choose to comply by GW basin or subbasin.**
22	**Beyond 3 years, must demonstrate improved irrigation and nutrient management efficiency, N balance ratios, and reduced NO3 loading to GW**
23	**After 3 years, the N balance ratio must compare the total amount of N applied to the crop against total N removed rather than total N uptake.**
24	**By 2015, Tier 3 growers with nigh-NO3 loading risk levels must verify the overall effectiveness of INMP.**
25	**Within one year of adoption, must sample all domestic drinking water wells and Ag wells to evaluate GW conditions in Ag areas, identify areas of greatest risk for N loading and exceedances of drinking water standards and identify priority areas for followup actions.**
26	**Sample at least one GW well for each farm/ranch or NO3 loading unit in their operation. Initially conduct 2 rounds of sampling - one in spring and one in fall and annually thereafter during the quarter when NO3 concentration is highest.**
27	**GW samples must be collected by a state registered professional engineer, professional geologist, or other similarly qualified professional.**
28	**Lab analysis must be conducted by a state certified lab.**

Appendix B: IMPLAN Definitions

- ***Direct costs*** **consist of economic activity contained exclusively within the designated sector(s). This includes all expenditures made and all people employed.**

- ***Indirect costs*** **define the creation of additional economic activity that results from linked businesses, suppliers of goods and services, and provision of operating inputs.**

- ***Induced costs*** **measure the consumption expenditures of direct and indirect sector employees. Examples of induced costs include employees' expenditures on items such as retail purchases, housing, banking, medical services, and insurance.**

The total direct, indirect, and induced costs arising due to the multiplier effect are presented in four ways:

- ***Output*** **accounts for total revenues lost including all sources of income for a given time period for an industry in dollars. This is the best overall measure of business and economic activity because it is the measure most firms use to determine current activity levels.**

- ***Employment*** **demonstrates the number of jobs not generated and is calculated in a full-time equivalent employment value on an annual basis.**

- ***Indirect Business Taxes*** **consist of property taxes, excise taxes, fees, licenses, and sales taxes that would have been paid by businesses but now lost. While all taxes during the normal operation of businesses are included, taxes on profits or income are not included.**

- ***Labor Income*** **includes all forms of employee compensation that would have been paid by employers bbut now lost (e.g., total payroll costs including benefits, wages and salaries of workers, health and life insurance, retirement payments, non-cash compensation), and proprietary income (e.g., self employment income, income received by private business owners including doctors, lawyers).**