# Central Coast Water Quality Preservation, Inc.

P.O. Box 1049
Watsonville, CA 95077

(831) 761-8644
Fax (831) 761-8695
e-mail kschmidt@ccwqp.org


October 20, 2009

Via: FedEx Priority

STATE OF CALIFORNIA
CENTRAL COAST WATER BOARD
Received
OCT 2 1 2009
895 Aerovista Place, Ste. 101

Mr. Jeffrey Young
Chair
Central Coast Regional Water Quality Control Board
895 Aerovista Pl., Suite 101
San Luis Obispo, CA 93401

Re: Board Meeting, September 5, 2008
Item number
Executive Officer's Report
Agricultural Regulatory Program

Dear Chairman Young:

Central Coast Water Quality Preservation conducts the Cooperative Monitoring Program (CMP) for the CCRWQCB Ag Waiver. Monitoring started in 2005 and has continued monthly since. The CMP was implemented to both monitor ambient water quality in agricultural areas and to measure improvements resulting from the implementation of on farm management practices.

The Executive Officer's report (Item 21) contains a significant portion dealing with the Ag Waiver process and the renewal of the Ag Waiver. As CCWQP deals with the CMP these comments only address two portions of this report: 1) Agricultural Regulatory Data Management and 2) Monitoring and Assessment. The report is very supportive of improved data management:

> "Staff has initiated efforts to evaluate and make improvements to the way the program manages information and data necessary to adequately protect water quality from impairments due to agricultural land uses. Agricultural Regulatory Program staff has identified this activity as among the *highest priorities* because staff's ability to effectively assess and ensure compliance is dependent on staff's ability to quickly process a diverse set of information and data in an integrated fashion, including landownership, operator information, ranch information, enrollment and fee payment information, management measure reporting, inspection information, enforcement information, and water quality monitoring data. ..." (Ex Officer's Report, page 6, emphasis added)

Yet, at the same time monitoring and assessment, a key role in determining water quality improvement in agricultural areas, will have a diminished role:



Supplemental Sheet-Item No. 21
October 23, 2009 Meeting
Public Comments – Ag Regulatory Program
Attachment 5

"... While the CMP and CCAMP programs provide great benefit to the Agricultural Regulatory Program by identifying problem areas and associated water quality trends, they are not directly related to programmatic compliance and enforcement efforts. Thus, staff has determined that *the program cannot continue to support monitoring and assessment* at the same level, in the same fashion. Efforts will focus on coordinating with CMP and CCAMP to align these programs with the needs of the Agricultural Regulatory Program to the extent practical. Staff will not produce or update Water Quality Monitoring Fact Sheets and will rely on the technical reports directly produced by CMP and CCAMP. ..."(Ex Officer's Report, page 8, emphasis added)

CMP is a key element of the existing Ag Waiver. Its sole purpose is to provide a monthly analysis of water quality in agricultural areas. There is no way to determine if the efforts of growers to improve water quality through implementation of significant and expensive management practices are successful without analysis of the downstream monitoring to prove the success. It is inconsistent to say on one hand that "the program cannot continue to support monitoring and assessment" while also asserting that management of data is the "highest priority". This may lead the growers enrolled in the Ag Waiver to perceive that management practice and regulations will be mandated without any relationship to improvement of water quality.

This is unfortunate, since there have been significant improvements in some of the parameters measures by the CMP. Some CMP sites have shown a 50% reduction in summer irrigation flows since 2005. This also means that nitrate loads to receiving waters have been reduced in those sub-watersheds.

**CMP Trend Analysis:** CCWQP has consistently delivered electronically water quality monitoring results quarterly to the CCAMP database. CCWQP has submitted final reports of our monitoring for the period from January, 2005, through December, 2008. Consistent with the MRP, CCWQP has made presentations of the results to growers, CCRWQCB staff and the Ag Panel. The 2006-2008 final report was completed in June, 2009. Although it was a major undertaking, the final report was necessary to consolidate the data for CCRWQCB staff review and to show that it complied with the CMP QAPP. Now that CCWQP has completed this task we have been able to spend time analyzing the data. Our first task was to determine if there were any trends in the data for each of the 50 sites which could indicate improvement of water quality during the 2005-2008 timeframe. Sarah Greene, the CCWQP Technical Program Manager, has now completed trend analysis for flow, nitrates and turbidity. This trend analysis is attached.

The preliminary trend analysis, using a 2 season Mann-Kendall test (described in the attachment), shows:

- **Flow:** Significant downward trends in summer (April-October irrigation season) flows at 18 of 27 CMP sites in the Salinas and Santa Maria areas. Flows at most of these sites are strongly influenced by agricultural discharges, so these trends could indicate that agricultural discharges have been reduced over the past 5 years. There were also significant downward trends at two sites on the mainstem Salinas River which are more likely to be dominated by dam releases.

- **Nitrates:** A significant upward trend in summer (April-October) Nitrate concentrations at 1 of 27 CMP sites in the Salinas and Santa Maria areas (*p* values for upward trends at 2 other sites were only slightly above the alpha value of 0.05). The 2-season test also showed significant upward trends at 2 sites for the winter (November-March) period (*p* values for upward trends at 3 other sites were only slightly above the alpha value of 0.05).
- **Turbidity:** The 2-season Mann-Kendall test showed significant upward trends in summer (April-October) Turbidity at 4 of 27 CMP sites examined (all 4 of which are on the mainstem Salinas River), and a significant downward trend at 1 site (the *p* values for trends at 2 other sites, 1 up and 1 down, were only slightly above the alpha value of 0.05).

CCWQP will work to complete the trend analysis. Then there will be information which will show if there have been improvements in water quality during the term of the first Ag Waiver. Hopefully, this information will also be analyzed and considered by CCRWQCB staff in their administration of the Ag Waiver and development of the new Ag Waiver.

Should you, or your board, have any questions regarding the above, please contact me.

Thank you.

Sincerely
Central Coast Water Quality Preservation, Inc.

Kirk F. Schmidt
Executive Director

attachment: Preliminary Trend Analysis

JY-RWQCB 10-23-09 docx

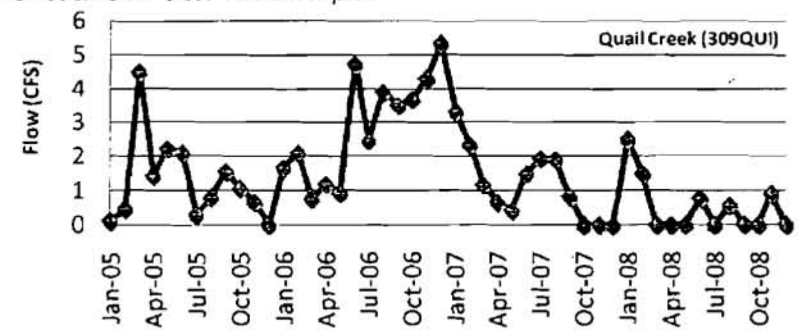
## Preliminary Trend Analysis

A major goal of the Cooperative Monitoring Program (CMP) is to show trends in water quality over time, in impaired water bodies in agricultural areas of the Central Coast. The CMP has been monitoring 25 sites monthly since January, 2005 (Phase I) and an additional 25 sites since January, 2006 (Phase II). We now have four full years of data for the Phase I sites. It would be preferable to have data from a longer period of time, but it is important to conduct preliminary trend analyses to evaluate the suitability of the current CMP dataset. The optimal dataset length for trend analysis depends on the variability of the data (the more variability, the longer the dataset needed). In a recent trend analysis of Central Coast data from the CCAMP Coastal Confluence sites (Conley et al. 2008), significant water quality trends were detected in 9% of CCAMP Coastal Confluence sites with 4 to 5 years of monthly data.

Thus far, the CMP has approached trend analysis in 3 ways. These are described below, followed by a discussion of trends identified as "significant" in a statistical analysis.

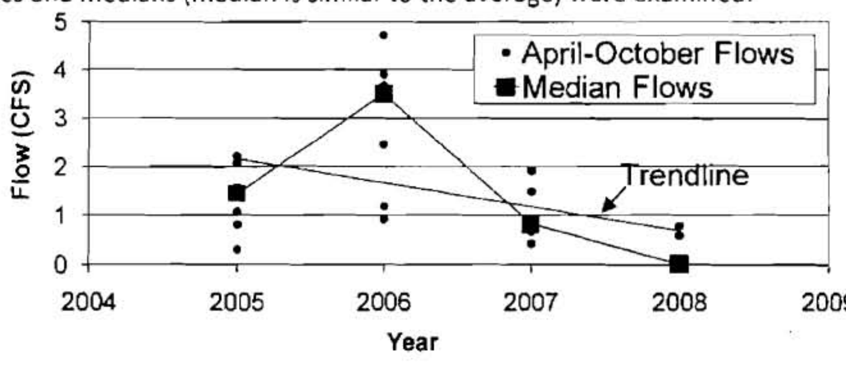
### *I.* ***Three Approaches to Data Analysis***

1) Simple scatterplot analysis: Every result for a certain water quality parameter was graphed, month-by-month, for each CMP site. For example:




The above graph shows Flows (CFS) from January 2005 through December 2008 at Quail Creek (309QUI). There's quite a bit of variability from month to month, so it's hard to say if there are any real trends, especially when you factor in winter rains. But it's a good "first look." Visual inspection suggests that perhaps Flows are going down overall, since there are fewer high values later in the dataset...

2) Annually grouped, growing season analysis: Results from November through March were removed because these have more potential to be impacted by precipitation, and ag inputs may be lower during the winter months. April through October results were grouped by year, and then the year-to-year ranges and medians (median is similar to the average) were examined:



The above graph shows Flow results for Quail Creek in April through October only, in each year from 2005 through 2008. There's quite a range throughout each year, but you can see a net downward trend from 2005 through 2008 (despite an apparent increase in 2006).

3) Seasonal Mann-Kendall statistical analysis: Results from January 2005 through December 2008 were fed into a statistical software program to test for positive or negative trends, and whether or not these are statistically significant. This test takes into account the fact that seasonal patterns might affect the variability of results, and has been used by researchers on the Central Coast for trend analysis in the past. We tried two different kinds of Mann-Kendall tests:
   a. 12 season test: Each month was designated as its own season, so we were basically comparing January of each year to January of every other year, February of each year to February of every other year, etc.
   b. 2 season test: We lumped November through March together as the "winter" season, and April through October together as "summer". Thus, the "summer" months of each year were compared to the "summer" months of every other year, and "winter" months compared to "winter" months.

Following the example of trend analysis with Flow data from Quail Creek, the downward trend in Flow for April-October was statistically significant ($p < 0.05$), there was a non-significant upward trend in November-March results, and the overall trend in the 12 season test was downward but non-significant (see Tables 1-3 on the following pages).

## *II. Results of Statistical Analysis with Seasonal Mann-Kendall Test*

We used the "SeaKen" macro in MiniTab (statistics software) to test for statistically significant trends, with an alpha of 0.05.

- Trend: A general direction (up or down) in the values of water quality monitoring results over time. If values mostly increase over time, the trend is "positive." If values mostly decrease, the trend is "negative." If values don't change at all, there is no trend (or the trend is "0"). The words "positive" and "negative" refer to *direction of trends*, and should not necessarily be interpreted as "good" and "bad." Statistical analysis must be performed to determine whether or not trends are *significant*.
- Statistically significant: Means that a positive or negative trend is strong enough that we can be very confident it is not due to random, or natural, variability. We decide beforehand how confident we want to be, by choosing an "alpha" value.
- Alpha ($\alpha$) of 0.05: This is our pre-designated confidence level for significance. Alpha of 0.05 indicates a confidence level of 95%. (With an alpha of 0.05, if we find a significant trend, we can be 95% it's a real trend, and not due to random variability in the data.) The statistical test returns a "*p* value," and the *p* value has to be smaller than our alpha in order for the trend to be considered significant. Trends with *p* values greater than our alpha might also be real, but we can't be sure.
- Insufficient data: The statistics software we used returned the result "insufficient data" if there were not enough data points to run a test. For example, if a site was frequently dry, there may not have been enough nitrate tests conducted to look for trends.

Tables summarizing the results of trend analysis for Flow, Nitrate Concentration, and Turbidity are provided on the following pages. The data is considered preliminary as outside variables have not been considered; for example precipitation during April, May and October of the Summer data set may have influenced flows.

**Table 1:** Trends in ***Flow*** identified with the seasonal Mann-Kendall test on 2005-2008 CMP results. Trends in flow can be caused by changes in the amount of agricultural or urban runoff, dam release schedules, and/or inter-annual weather patterns, with other possible factors as well. When trends are caused by changes in runoff (discharges), there is an especially strong likelihood of changes in pollutant loads. The 2-season Mann-Kendall test showed significant downward trends in SUMMER (April-October) flows at 18 of 27 CMP sites in the Salinas and Santa Maria areas. Flows at most of these sites are strongly influenced by agricultural discharges, so these trends could indicate that agricultural discharges have been reduced over the past 5 years. There were also significant downward trends at two sites on the mainstem Salinas River which are more likely to be dominated by dam releases. The 2-season Mann-Kendall test showed significant downward trends in WINTER (November-March) flows at 2 CMP sites, and the 12-season Mann-Kendall test showed overall significant downward trends at 5 sites. No significant (and very few non-significant) upward trends in Flow were identified.

**Table 2:** Trends in ***Nitrate concentration*** identified with the seasonal Mann-Kendall test on 2005-2008 CMP results. Trends in Nitrate concentration can be caused by many factors. It is important to recognize that changes in bottom-of-watershed Nitrate concentrations are not caused exclusively by changes in the Nitrate concentrations of individual inputs. Obviously, if the Nitrate concentration of each individual input increases, an upward trend will occur at the bottom of the watershed. However, changes in the volume (Flow) of individual inputs can change the way that these inputs combine to create the mixed, bottom-of-watershed Nitrate concentration. For example, if inputs with low nitrate concentrations are eliminated, but high-Nitrate inputs remain constant in volume, there will be less dilution of the high-Nitrate inputs, and a resultant increase in concentrations measured at the bottom of the watershed, even though no individual inputs increased in concentration.

The 2-season Mann-Kendall test showed a significant upward trend in SUMMER (April-October) Nitrate concentrations at 1 of 27 CMP sites in the Salinas and Santa Maria areas ($p$ values for upward trends at 2 other sites were only slightly above the alpha value of 0.05). The 2-season test also showed significant upward trends at 2 sites for the WINTER (November-March) period ($p$ values for upward trends at 3 other sites were only slightly above the alpha value of 0.05). The 12-season test showed overall significant *downward* trends at 2 sites (the $p$ value for an upward trend at 1 other site was only slightly above the alpha value of 0.05). In summary, there are 3 sites with upward trends in "summer" Nitrate concentrations that are likely to be real, and 5 sites with upward trends in "winter" that are likely to be real. On a 12 month basis, there are 2 sites with downward trends in Nitrate concentration that are likely to be real, and 1 site with a probable upward trend. The majority of trends in Nitrate concentration, significant and non-significant, were upward in direction.

**Table 3:** Trends in ***Turbidity*** identified with the seasonal Mann-Kendall test on 2005-2008 CMP results. Turbidity measures the amount of light scattered by particles suspended in water, and is used as a proxy for concentration-based parameters like "Total Suspended Solids" or "Suspended Sediment Concentration." Trends in Turbidity can be caused by many factors. It is important to recognize that changes in bottom-of-watershed Turbidity levels are not only caused by changes in the Turbidity of individual inputs. A trend in Turbidity at the bottom of the watershed could be caused by increased or decreased Turbidity in individual inputs. Or, for example, it could be caused by a decline (or rise) in low-Turbidity inputs, while higher-Turbidity inputs remain more constant in volume.

The 2-season Mann-Kendall test showed significant upward trends in SUMMER (April-October) Turbidity at 4 of 27 CMP sites examined (all 4 of which are on the mainstem Salinas River), and a significant downward trend at 1 site (the $p$ values for trends at 2 other sites, 1 up and 1 down, were only slightly above the alpha value of 0.05). No significant trends were identified during the WINTER season. On a 12 month basis, there was 1 site with a significant upward trend in Turbidity, and 1 site with a significant downward trend.

**Table 1.** Trends in Flow identified with the seasonal Mann-Kendall test on 2005-2008 CMP results.

| | 12 season; α=0.05 | | 2 season; winter; α = 0.05 | | 2 season; summer; α=0.05 | |
|---|---|---|---|---|---|---|
| **Site** | **Trend** | **Significant?** | **Trend** | **Significant?** | **Trend** | **Significant?** |
| 306MOR | insufficient data | | insufficient data | | insufficient data | |
| 309ALG | ↓ | YES | ↓ | NO | ↓ | YES |
| 309ASB | ↓ | NO | ↓ | NO | ↑ | NO |
| 39BLA | ↓ | NO* | ↓ | NO | ↓ | YES |
| 309CRR | insufficient data | | ↓ | NO | ↓ | NO |
| 309ESP | ↓ | YES | ↓ | NO | ↓ | YES |
| 309GAB | insufficient data | | ↓ | YES | ↓ | YES |
| 309GRN | insufficient data | | ↑ | NO | ↓ | YES |
| 309JON | ↓ | NO* | ↓ | NO | ↓ | YES |
| 309MER | ↓ | NO | ↓ | NO | ↓ | NO |
| 309NAD | insufficient data | | ↓ | YES! | ↓ | NO |
| 309OLD | insufficient data | | ↑ | NO | ↓ | NO |
| 309QUI | ↓ | NO* | ↑ | NO | ↓ | YES |
| 309SAC | insufficient data | | ↓ | NO | ↓ | YES |
| 309SAG | insufficient data | | ↓ | NO | ↓ | YES |
| 309SSP | insufficient data | | ↓ | NO | ↓ | YES |
| 309TEH | ↓ | YES | ↓ | NO | ↓ | YES |
| 312BCC | insufficient data | | insufficient data | | insufficient data | |
| 312BCJ | ↓ | NO | ↓ | NO* | ↓ | NO |
| 312GVS | ↓ | YES | ↓ | NO* | ↓ | YES |
| 312MSD | insufficient data | | ↑ | NO | ↓ | YES |
| 312OFC | ↓ | NO | ↓ | NO | ↓ | YES |
| 312OFN | ↓ | NO | ↑ | NO | ↓ | YES |
| 312ORC | ↓ | YES | ↓ | NO | ↓ | YES |
| 312ORI | ↓ | NO | ↓ | NO | ↓ | NO |
| 312SMA | ↓ | NO* | ↑ | NO | ↓ | YES |
| 312SMI | insufficient data | | ↓ | NO | ↓ | YES |

* Trend not significant at alpha = 0.05, but p value very low (less than 0.1)

| Sites with: | 12 Season Overall | 2 Season Winter | 2 Season Summer |
|---|---|---|---|
| Signif. ↓ trends: | 5 | 2 | 18 |
| Signif. ↑ trends: | 0 | 0 | 0 |
| No signif. trends: | 10 | 23 | 7 |
| Insufficient data: | 12 | 2 | 2 |

**Table 2.** Trends in Nitrate Concentration identified with the seasonal Mann-Kendall test on 2005-2008 CMP results.

| | 12 season; $\alpha$=0.05 | | 2 season; winter; $\alpha$ = 0.05 | | 2 season; summer; $\alpha$=0.05 | |
|---|---|---|---|---|---|---|
| Site | Trend | Significant? | Trend | Significant? | Trend | Significant? |
| 306MOR | ↑ | NO | ↑ | NO | ↑ | NO |
| 309ALG | ↑ | NO | ↑ | NO* | ↑ | NO |
| 309ASB | ↑ | NO | ↑ | NO | ↑ | NO |
| 39BLA | ↑ | NO* | ↑ | NO* | ↑ | NO |
| 309CRR | insufficient data | | ↓ | NO | ↓ | NO |
| 309ESP | ↑ | NO | ↓ | NO | ↑ | NO |
| 309GAB | insufficient data | | insufficient data | | insufficient data | |
| 309GRN | insufficient data | | ↑ | NO | ↓ | NO |
| 309JON | ↓ | NO | ↑ | NO | ↑ | NO |
| 309MER | ↑ | NO | ↑ | NO | ↑ | NO |
| 309NAD | insufficient data | | ↑ | YES | ↑ | YES |
| 309OLD | insufficient data | | insufficient data | | insufficient data | |
| 309QUI | insufficient data | | ↓ | NO | ↑ | NO* |
| 309SAC | ↓ | NO | ↑ | YES | ↑ | NO* |
| 309SAG | insufficient data | | ↓ | NO | ↓ | NO |
| 309SSP | insufficient data | | ↑ | NO* | ↓ | NO |
| 309TEH | ↑ | NO | ↑ | NO | ↑ | NO |
| 312BCC | insufficient data | | insufficient data | | insufficient data | |
| 312BCJ | ↓ | NO | ↑ | NO | ↓ | NO |
| 312GVS | ↓ | YES | ↓ | NO | ↓ | NO |
| 312MSD | insufficient data | | ↑ | NO | ↑ | NO |
| 312OFC | ↓ | NO | ↓ | NO | ↓ | NO |
| 312OFN | ↓ | YES | ↓ | NO | ↓ | NO |
| 312ORC | ↑ | NO | ↑ | NO | ↓ | NO |
| 312ORI | ↑ | NO | ↑ | NO | ↑ | NO |
| 312SMA | ↑ | NO | ↑ | NO | ↑ | NO |
| 312SMI | insufficient data | | ↑ | NO | ↓ | NO |

* Trend not significant at alpha = 0.05, but *p* value very low (less than 0.1)

| Sites with: | 12 Season Overall | 2 Season Winter | 2 Season Summer |
|---|---|---|---|
| Signif. ↓ trends: | 2 | 0 | 0 |
| Signif. ↑ trends: | 0 | 2 | 1 |
| No signif. trends: | 14 | 23 | 23 |
| Insufficient data: | 11 | 4 | 3 |

**Table 3.** Trends in Turbidity identified with the seasonal Mann-Kendall test on 2005-2008 CMP results.

| Site | 12 season; α=0.05 Trend | Significant? | 2 season; winter; α = 0.05 Trend | Significant? | 2 season; summer; α=0.05 Trend | Significant? |
|---|---|---|---|---|---|---|
| 306MOR | ↓ | NO | ↓ | NO | ↑ | NO |
| 309ALG | ↑ | NO | ↑ | NO | ↑ | NO |
| 309ASB | ↓ | NO | ↑ | NO | ↓ | NO |
| 39BLA | ↑ | NO | ↑ | NO | ↑ | NO |
| 309CRR | insufficient data | | ↑ | NO | insufficient data | |
| 309ESP | ↓ | NO | ↓ | NO | ↓ | NO |
| 309GAB | insufficient data | | ↓ | NO | ↑ | NO |
| 309GRN | ↑ | YES | ↑ | NO | ↑ | YES |
| 309JON | ↓ | NO | insufficient data | | insufficient data | |
| 309MER | ↑ | NO | ↑ | NO | ↓ | NO |
| 309NAD | insufficient data | | ↓ | NO | ↓ | NO |
| 309OLD | insufficient data | | ↑ | NO | ↓ | NO |
| 309QUI | insufficient data | | ↑ | NO | ↑ | NO |
| 309SAC | ↑ | NO | ↓ | NO | ↑ | YES |
| 309SAG | insufficient data | | ↑ | NO | ↑ | YES |
| 309SSP | insufficient data | | ↑ | NO | ↑ | YES |
| 309TEH | ↑ | NO | ↓ | NO | ↑ | NO* |
| 312BCC | insufficient data | | insufficient data | | insufficient data | |
| 312BCJ | ↓ | YES | ↓ | NO | ↓ | NO* |
| 312GVS | ↓ | NO | ↓ | NO | ↓ | NO |
| 312MSD | insufficient data | | ↑ | NO | ↓ | YES |
| 312OFC | ↑ | NO | ↑ | NO | ↑ | NO |
| 312OFN | ↓ | NO | ↑ | NO | ↓ | NO |
| 312ORC | ↓ | NO | ↑ | NO | ↓ | NO |
| 312ORI | ↓ | NO | ↓ | NO | ↓ | NO |
| 312SMA | ↑ | NO | ↑ | NO | ↑ | NO |
| 312SMI | insufficient data | | ↑ | NO | ↑ | NO |

* Trend not significant at alpha = 0.05, but *p* value very low (less than 0.1)

| Sites with: | 12 Season Overall | 2 Season Winter | 2 Season Summer |
|---|---|---|---|
| Signif. ↓ trends: | 1 | 0 | 1 |
| Signif. ↑ trends: | 1 | 0 | 4 |
| No signif. trends: | 15 | 25 | 19 |
| Insufficient data: | 10 | 2 | 3 |