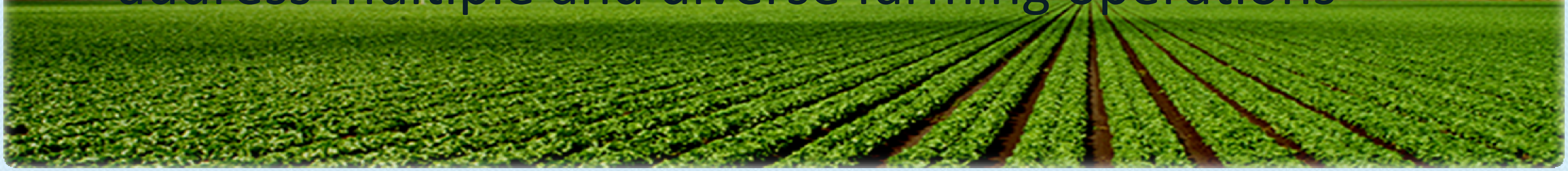
Introduction

Outcomes from May 12 Public Workshop in SLO

- Respond to the legal issues raised
- Assess staff resources to accomplish existing workload
- Justify costs
- Justify amount of information reasonably needed
- Consider at least a 10 year program
- Tackle higher priorities first
- Acknowledge complexity means solutions will take more than 10 years
- Realize the engineering approach is not effective to address multiple and diverse farming operations



Ag Proposal

- Grower Annual Report & Farm Plan
- Continuing Education
- CMP Monitoring
- Watershed focused, confidential field sampling
- Practice Implementation & Evaluation
- Better understanding of aquifer conditions

Water Quality Improvement takes Muddy Shoes

Regulation is not actual water quality improvement

A *plan* is not actual water quality improvement

Actual improvement is muddy shoes

SMART Sampling

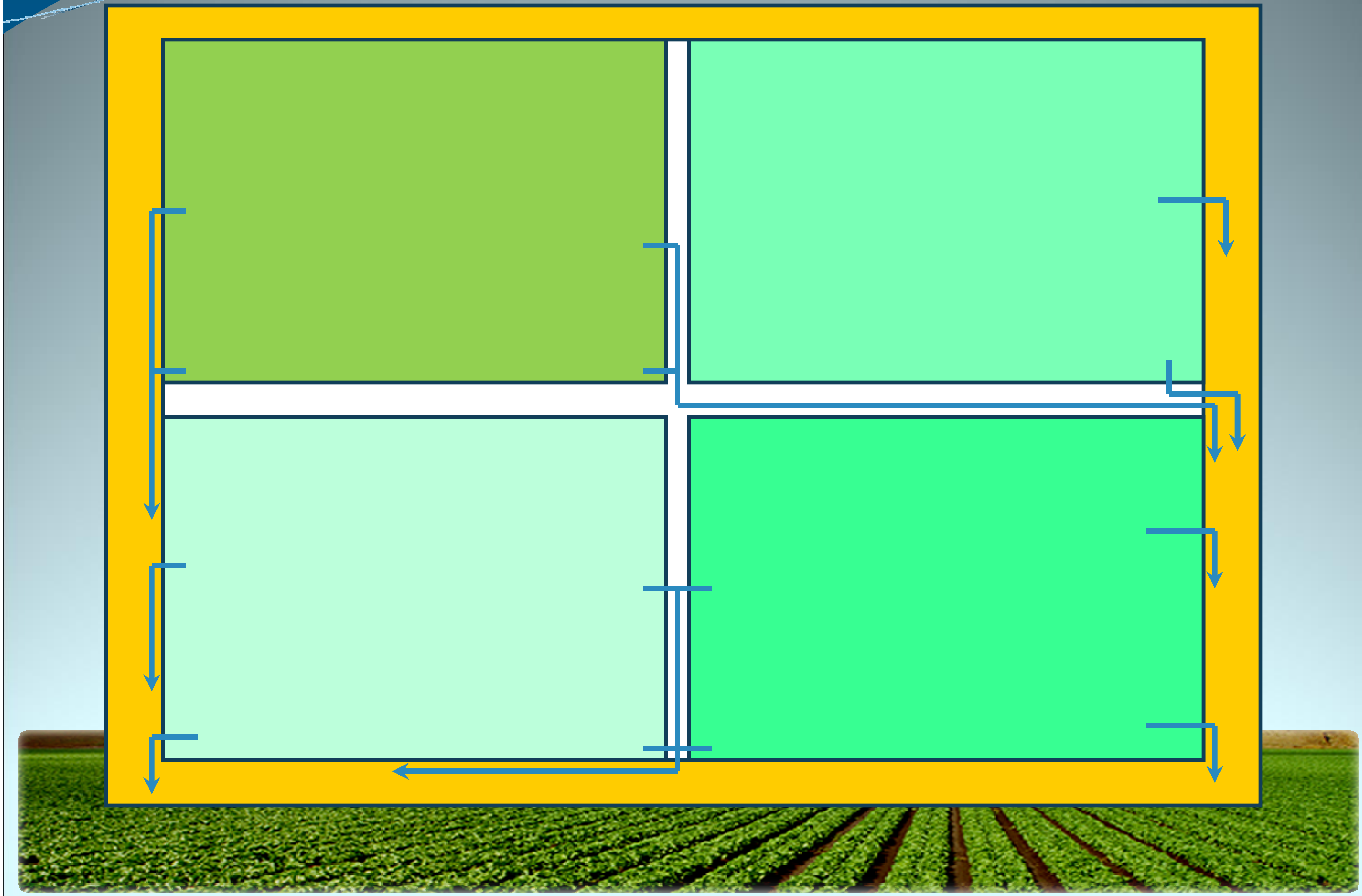
SMART way to improve water quality

SMART administration

How many farms & acres

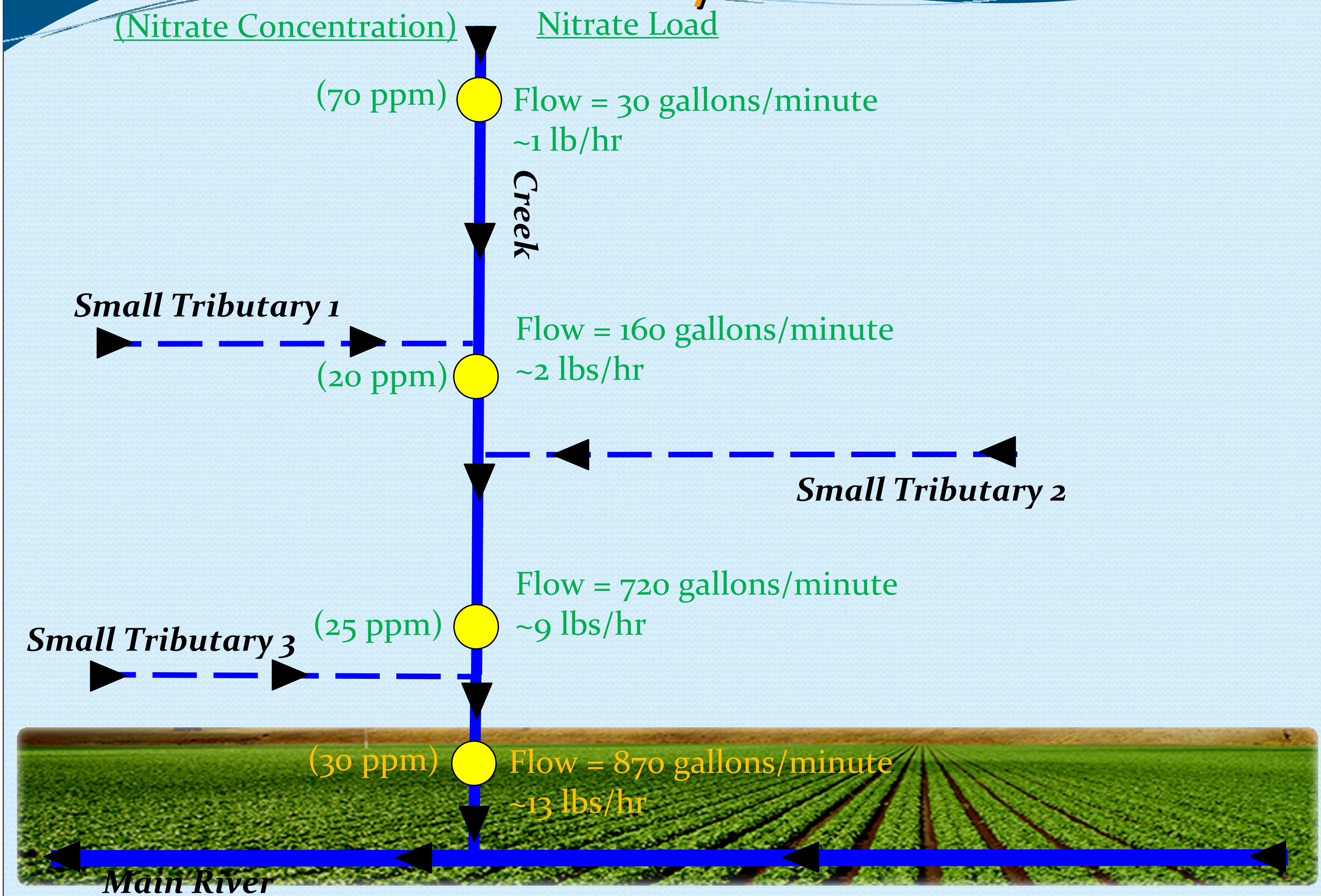
- **1,800** growers are enrolled in the Ag Waiver
- **389,000** acres are enrolled
- **318,000** acres have no tailwater, no discharge – **81%**
- **~10,000** – Number of farms (estimate)
- **8,100** - Farms with no tailwater, no discharge
- **1,900** - Estimated Farms with tailwater irrigation runoff

100 Acre Farm



- The Draft Waiver Mandatory on-farm Monitoring is based on a belief that farms are industrial point source dischargers instead of multiple or variable sources with non-consistent discharges
  - Difficult to design
  - How do you monitor for flow with multiple variable discharges into a common shared drainage ditch?
    - How do you determine average or high flows?
    - What time of day?
    - How often?
      - First Thursday after the full moon?
  - Impossible to implement consistently
  - Unknown costs
    - No draft MRP has been released
  - Unlikely to be enforced

Which tributary is a source?



- CMP upstream monitoring has shown that in several instances all growers above an impaired core CMP site contribute to the impairment.
- It is not necessary to require all growers above a core CMP site to monitor.
  - Why - to see who is contributing if all are?
  - Only then require implementation of management practices?

- **Why not skip** the monitoring, save money and enforcement time and complexity
- Implement MP above impaired CMP sites - actually address what is necessary to improve water quality
- Verification of practices by CCRWQCB
  - audits of annual reports
  - enforcement
- Farmers can apply *$* to practices instead of duplicative monitoring
- Continue to monitor for change at core CMP sites
  - Possibly add rotating upstream sites for greater definition

SMART Sampling Provides Real Results

Hydrolab instrument
(image from www.hydrolab.com)

- Water temperature
- pH
- Conductivity

- Salinity
- Turbidity
- Dissolved Solids

Colorimeter
(image from www.hach.com)

- Nutrients
  - Nitrate
  - Ammonia
  - Orthophosphates

- Organophosphate pesticides
  – Lab tests as warranted

Smart Sampling – Greater Impact

- SMART sampling will have a greater impact on improving water quality by assisting the grower to:
  - Determine scope of impairment
  - Test results of new MP implementation
    - Before and after sampling
  - On farm review of sampling results with the grower

- SMART builds on existing CMP data so it can be focused on known impairments and not waste time and effort on constituents unrelated to the specific issues on a single farm.
  - Instantaneous results for most constituents, which is cheaper
    - some methods can be repeated by the grower after training
  - Lab testing for chemical presence,
    - Only if that family of chemicals is used by grower and is causing impairment downstream.
  - In order for before and after sampling to be meaningful it will NOT be representative of typical discharge
    - It will give feedback for adaptive management and success improving water quality

Smart Sampling

case studies

Smart Sampling Basics

- 2 objectives
  1. Discover water quality issues in farm discharge (and farm-specific sources for any constituents of concern)
  2. Assess water quality outcome of any management practices or operational changes made to improve water quality
- Technically speaking… *"We're looking for nutrients, toxicants, and suspended sediment"*
- In other words… *"Fertilizers, soil amendments, crop protection materials, and eroded soils"*

From the UCCE Farm Water Quality Planning Factsheets (2004):

"A valid evaluation design is necessary if you are going to identify the changes to water quality that result from modifications to farming operations. Evaluation should answer two questions:

- *Is water quality degraded as a result of farming operations?*
- *If water quality is degraded, is water quality improved by subsequent changes in farming operations?"*

How is Smart Sampling Done?

- Equipment and lab analyses needed for high QA (quality assurance) sampling are accurate, but expensive
- More economical methods can tell us much of what we need to know

From the UCCE factsheets…

"… properly designed and carefully executed self-assessment techniques can provide sound data. Their strength lies in the potential for taking large numbers of measurements inexpensively and with only semi-skilled assistance. "

Grower #3

- Tested tailwater for fertilizers, OP pesticides, and sediment
  - Grower identified source of high nutrients; is attempting to reduce/eliminate OP's from tailwater and currently re-testing to determine effectiveness

Grower #20

- Tested tailwater for fertilizers, OP pesticides, and sediment
  - Grower has plan to eliminate tailwater… Implements more each year, as fast as economically feasible

Grower #36

- Hired intern to implement operation-wide testing; Working with intern on methods and objectives for testing
  - Conducting additional water and soil monitoring to determine options for reducing tile drain nitrates; Exploring vegetative treatment methods

Grower #17

- Tested tailwater for fertilizers, OP pesticides, and sediment
  - Past efforts to reduce OP's appear to have been successful; Grower now adjusting fertilizer application methods to reduce end-of-row granule dropping

Grower #25

- Tested for nutrients, turbidity, and organophosphate pesticides, above and below a ~100 ft long ditch section, densely vegetated with watercress
  - No measurable change in nitrates, phosphates, turbidity, chlorpyrifos, or diazinon below versus above the vegetated ditch section.
  - Conducted further edge-of-field testing to evaluate organophosphates in tailwater from different irrigations throughout a crop cycle.
  - Grower experimenting with PAM (polyacrylamide) and other management practices.

Grower #35

- Has no surface runoff, so we tested leachate for nitrates
  - Grower is re-evaluating length of irrigations and quantity of fertilizer applied; will re-test following changes

Grower #30

- Evaluated vegetated ditch for nutrient removal
  - (Low flow rates and low-moderate nutrient concentrations) Found that one segment of ditch was more effectively removing nutrients than another. Grower will make improvements to the lower-performing segment.

Water Quality Considerations for Management Practices

Examples of management practice programs:

- Central Coast Vineyard Team – Sustainability in Practice (SIP) Certification, Positive Points System (PPS), and more
- Citrus Positive Points System – UC Kearney Entymology
- Runoff management by nursery growers
  - California Association of Nurseries and Garden Centers
- AWQA partners: ALBA, CAFF, NRCS, RCD's
- UCCE Management Practice Factsheets
- UC & CSU researchers: Evolving projects to develop management practices for toughest discharge issues

Ag Waiver Management Practice Tools

1. Farm Water Quality Planning Short Course
   - 15 hours; many management practice and water quality topics covered
2. The Farm Water Quality Plan
   - 48 pages, including local/regional water quality information, site assessment, and practice planning
3. BMP Checklist
   - 41 management practices

Pesticide management question P_1:

"Is an IPM (integrated pest management) program established?"

IPM does not preclude the use of materials which are toxic to aquatic organisms

What we have:

- A large collection of management and conservation practices
- A long history of successful, voluntary implementation
- A thorough framework for water quality management planning

What we may not have:

- Ready-for-action tools to address the reasons why impairment continues in some farm discharges today

In the short-term, there are some limits to technical capacity to meaningfully improve water quality in those agricultural discharges which currently cause surface water quality impairments.

Why?

More Questions…

1. *Do BMP's address the major transport mechanisms for constituents of concern in the discharges that contribute most to exceedences at CMP sites?*

2. *Are "water quality outcomes" and "BMP effectiveness" the same thing? Language barriers when communicating BMP relevance for water quality?*

3. *Issues of scale… Is management practice effectiveness calibrated for the level of pollution that needs to be mitigated?*

Are "water quality outcomes" and "BMP effectiveness" the same thing?

Example: Irrigation management practices for…

{ Water conservation

Crop production }

?
=

{ Discharge reduction }

Is there a disconnect between water quality outcomes, and the way we report BMP effectiveness?

"This BMP was not widely tested in this study. Results from this test combined with available data provided by other studies certainly suggest that this BMP has great potential for improving water quality in agricultural runoff."

"As with the wattle filter strips, the analytical results do not conclusively provide evidence of improved water quality below the grassed filter strips."

"Despite the lack of supportive data produced by this project, enough evidence has been provided through other studies to suggest that grassed filter strips have the potential to be successfully implemented in agricultural settings to improve water quality."

from SWRCB Grant Agreement No. 04-073-554-1

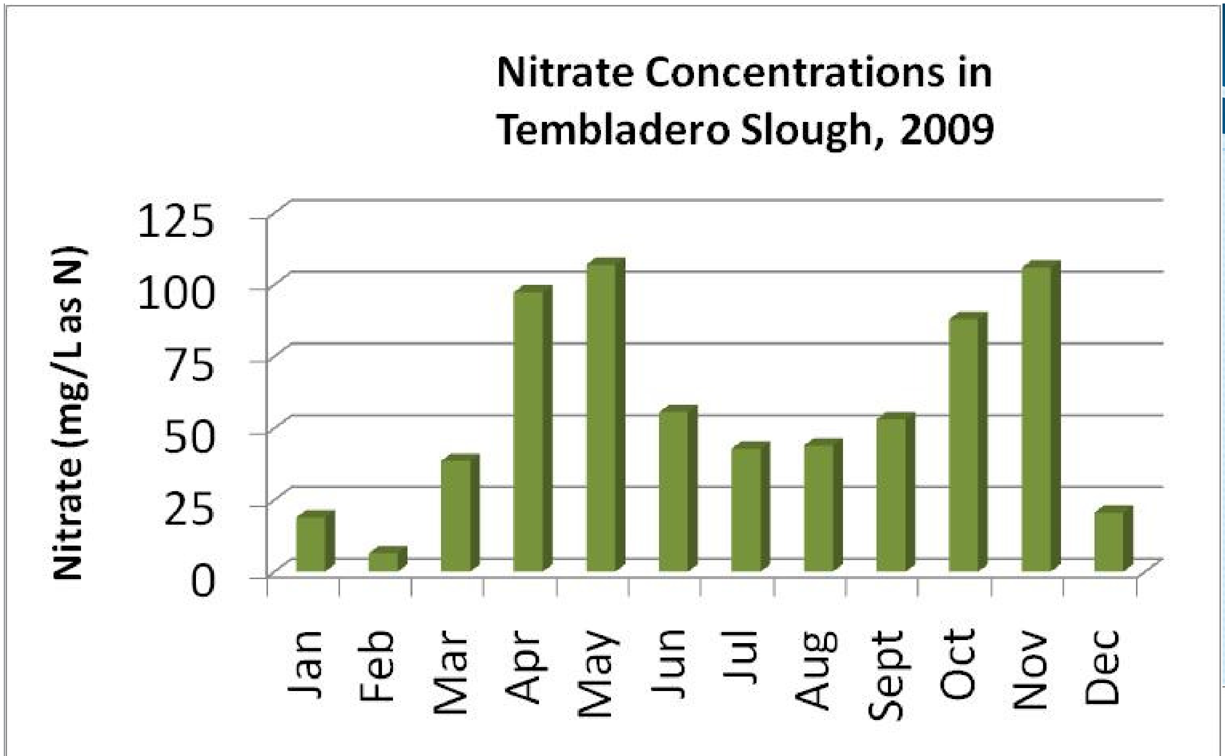
Issues of scale & calibration

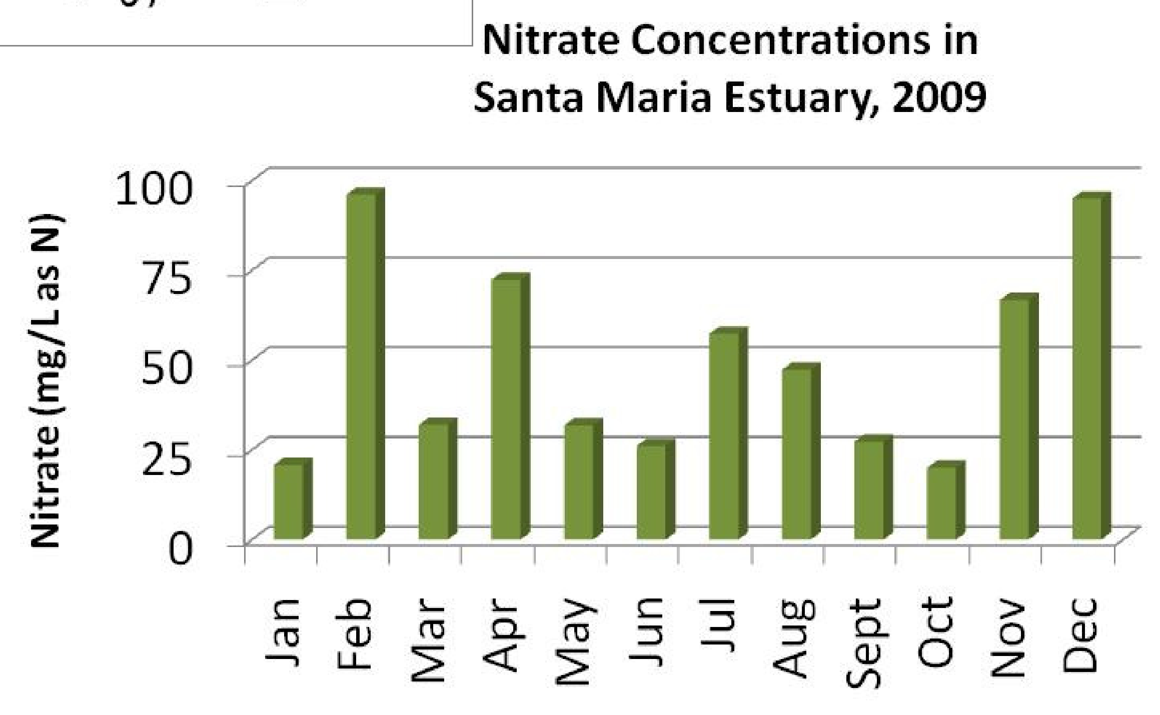
- Enzyme kinetics

- “High” nitrates for drinking water/aquatic life are “Low” nitrates for some crops

- “Highly toxic” and “Lots of pesticides in the water” vs. “Less than 0.0004 ounces of active ingredient”

Case Study 1 - Nitrogen


Nitrate Concentrations in
Tembladero Slough, 2009
Nitrate (mg/L as N)
0
25
50
75
100
125
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec


Nitrate Concentrations in
Santa Maria Estuary, 2009
Nitrate (mg/L as N)
0
25
50
75
100
Jan
Feb
Mar
Apr
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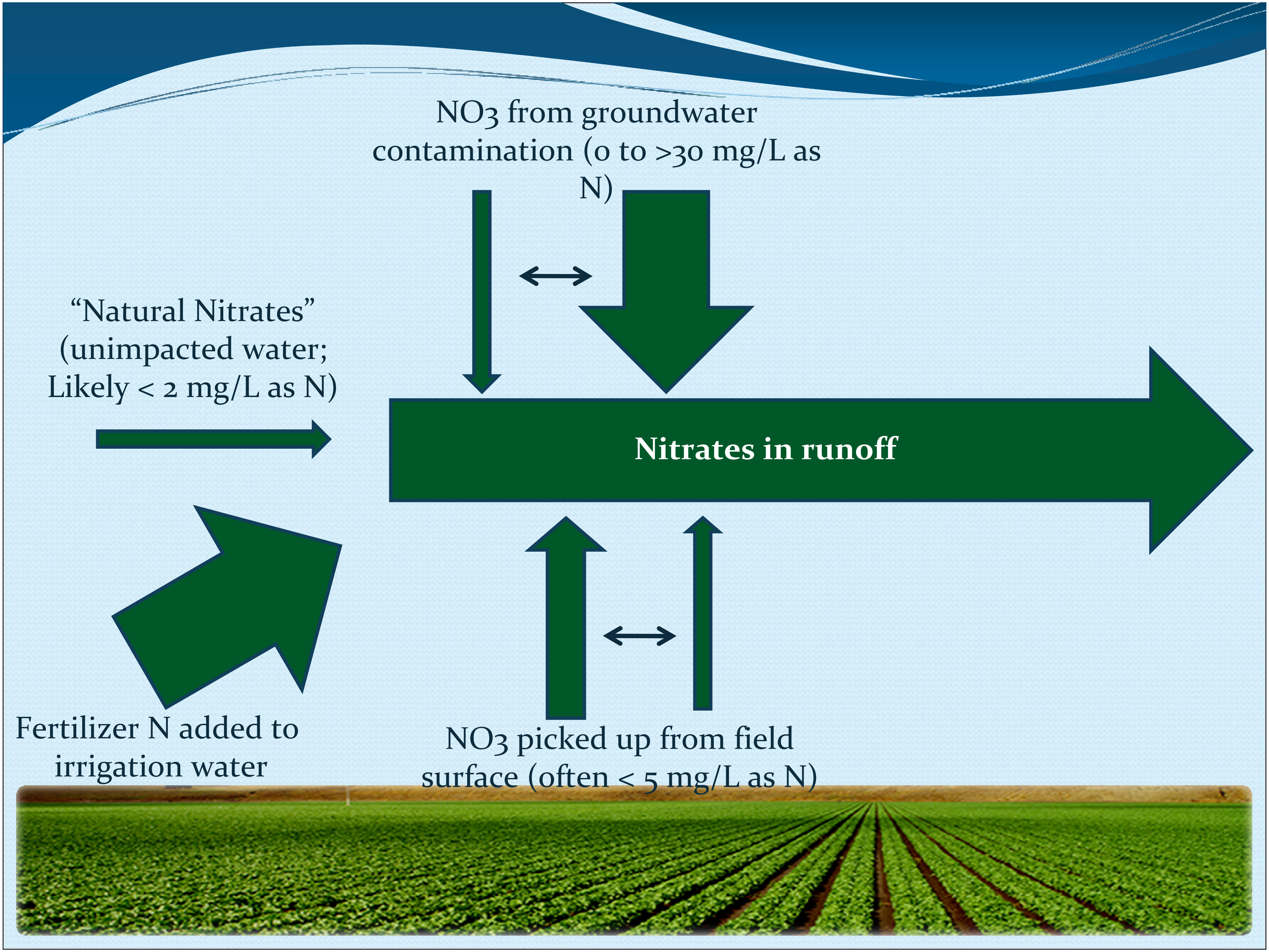
Jul
Aug
Sept
Oct
Nov
Dec


NO3 from groundwater contamination (0 to >30 mg/L as N)
"Natural Nitrates" (unimpacted water; Likely < 2 mg/L as N)
Nitrates in runoff
Fertilizer N added to irrigation water
NO3 picked up from field surface (often < 5 mg/L as N)

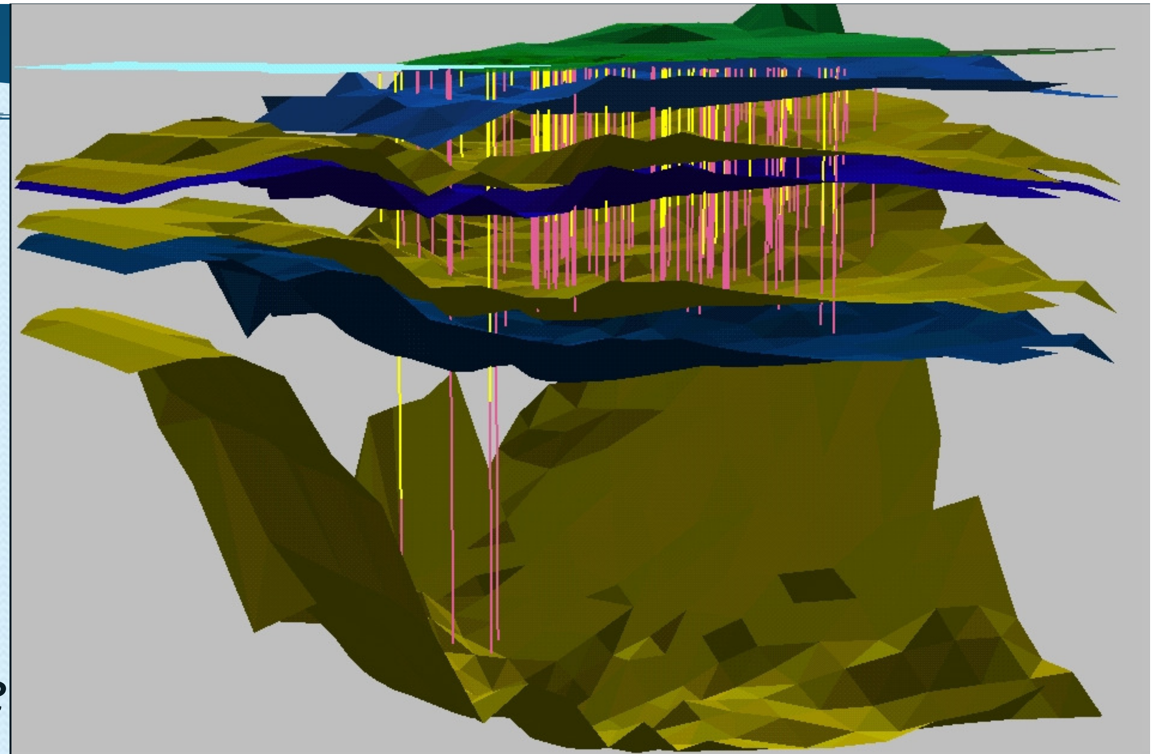
Nitrate (as N) Concentrations in 152 High Production Ag Wells (2007)

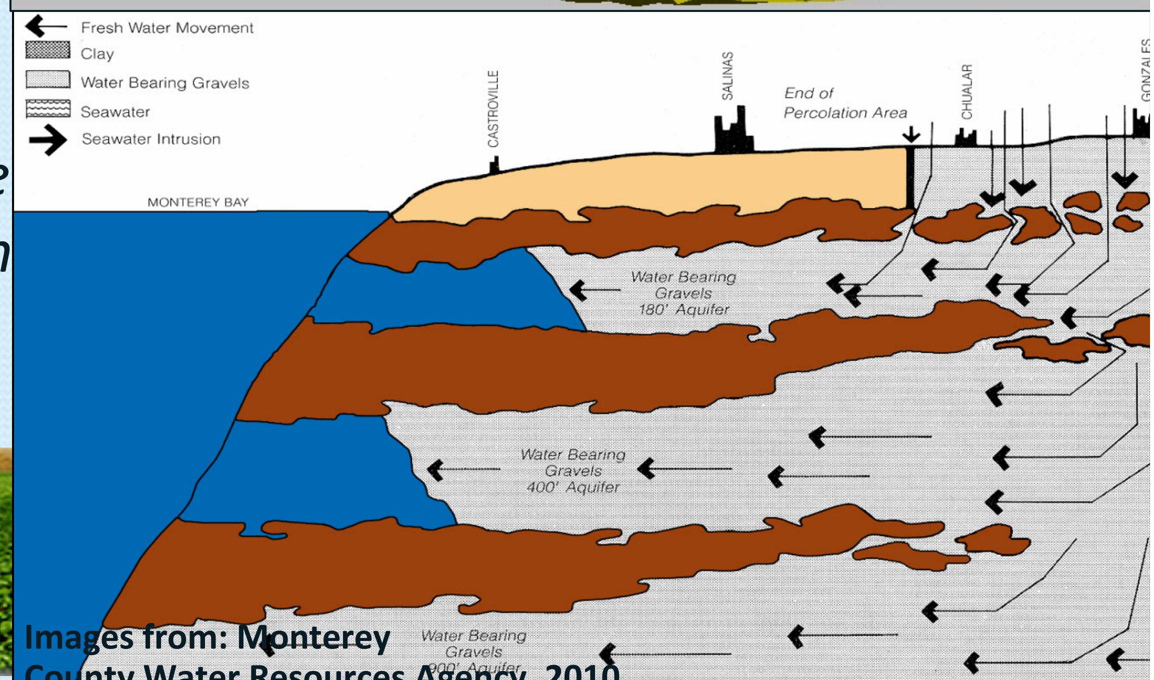
Nitrate Concentration as N (mg/L)	Percent of Wells	Number of Wells
Less than 10	63%	96
10 – 20	14%	21
20-30	10%	15
Greater than 30	13%	20

Data Source: Monterey County Water Resources Agency, 6/10/2009

Movement of water (and nitrates) to ag production wells in the Salinas Valley

A grower's ability to influence nitrate concentration in his/her own well water (and thus in surface runoff) may be limited in the short term, even with perfect nutrient management.





Images from: Monterey County Water Resources Agency, 2010

The ability of a grower to reduce surface runoff nitrates via <u>input management</u>, appears to be limited.

Why can't the grower just factor all that nitrogen into their fertilizer budget, and have the crops take it out?

What about output mitigation (i.e. removing the nitrates from the water before it leaves the farm)?

With proper budgeting, why can't crops take out all the excess nitrogen?

"In the typical field situation, runoff water contact from a sprinkler irrigation is mostly limited to the soil surface (not the profile), and runoff often occurs within minutes of the water leaving a sprinkler head. This limited soil contact, and limited time in the field, make it unlikely that nitrate in the portion of the well water that runs off will be retained on the field. Therefore, the nitrate concentration in irrigation runoff is unlikely to be substantially lower than the initial nitrate concentration of the well water."

- T. Hartz, pers. comm.

Why can't we remove the nitrates with vegetation or denitrification?

"A group of conservation practices have been promoted as being helpful in reducing pollutants in farm runoff. While these practices undoubtedly reduce the level of some pollutants under some field conditions, local experience in highly impaired watersheds has shown that they have little consistent effect on the concentration of soluble nutrients in farm runoff. As currently deployed, these practices typically slow farm runoff only on a scale of minutes to hours. In most cases this is simply insufficient time for biological processes to significantly influence soluble nutrient concentrations before runoff exits the farm. "

- T. Hartz, pers. comm.

Case Study 1 - Nitrogen

Case Study 2 - Sediment

Case Study 3 – Aquatic Toxicity

Case Study 4 – Discharge Volume

The good news:

- Most farms don't have tailwater
- Of farms that *do* have tailwater, some have low volumes and low or moderate nitrate concentrations… There are existing BMP's that can help in these cases

The technical challenges:

- As currently implemented, the existing "menu" of BMP's doesn't provide many effective options for improving nitrate concentrations in highly impaired discharges
- High-nitrate remediation technologies already exist, but not adapted for ag
- Though it will not reduce nitrate *concentrations* in discharge-dominated streams, major reductions in nitrate *loading* are achievable with tailwater reduction/elimination