

Joe LeClaire, PhD  
Richard Meyerhoff, PhD  
Don Schroeder, PE

# Nitrate Implementation Measures (NIMS)

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## Draft Work Plan

**CDM**  
**Smith**

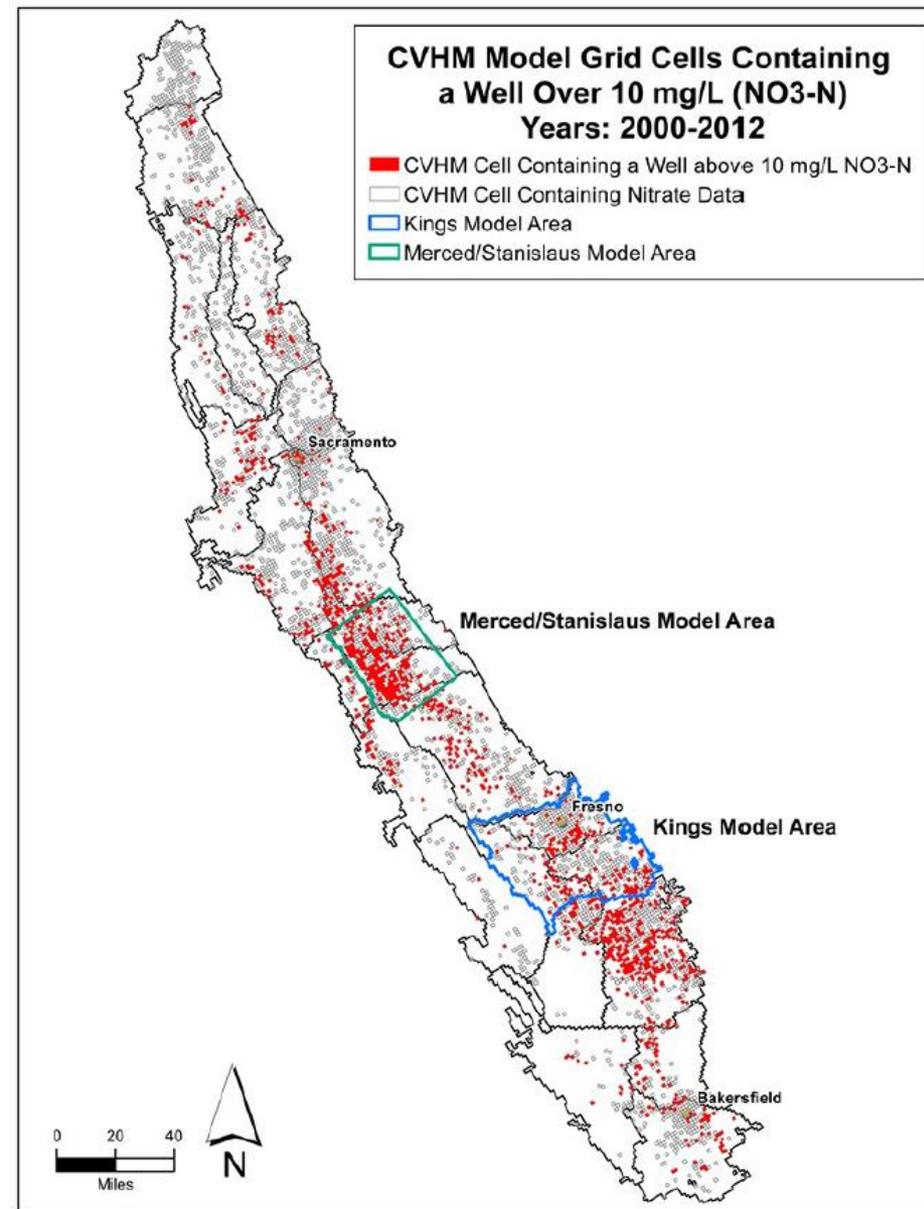
# Nitrate Implementation Measures Study (NIMS)

## Project Purpose

- Central Valley Salt and Nitrate Management Plan (SNMP) will include a section that establishes nitrate implementation measures – similar to salt implementation measures.
- Groundwater basins will be prioritized based on potential to lower risk from nitrate in groundwater.
- Nitrate implementation measures will be evaluated for a pilot study area.
- Final product will link nitrate and salt implementation measures for inclusion in the SNMP.

# Estimate of Nitrate Distribution in GW – Valley Floor

- This map shows CVHM grid cells that:
  - Gray – Contain nitrate data
  - Red – Exceed the MCL
- Period is 2000 to 2012



LWA, 2013

Figure 10-4. Identifying CVHM Model Grid Cells Containing a Well Test Over 10 mg/L NO<sub>3</sub>-N from 2000-2012

# NIMS: UC Davis Report

- Second Extraordinary Session of 2008 (SBX2, Perata) requires the State Water Board “to develop pilot projects focusing on nitrate in groundwater...”
- Findings from the UC Davis Nitrate Report:
  - Nitrate from fertilizer and animal waste has infiltrated into groundwater.
  - Agricultural fertilizers and animal wastes applied to cropland are by far the largest regional sources of nitrate in groundwater.
  - Load reductions (through source control measures) are possible.
  - Pump and treat (PAT) is costly and infeasible; UC Davis recommends pump and fertilize (PAF).
  - Alternate supplies, blending, drilling deeper wells are most cost effective.
  - Small communities are impacted disproportionately.
  - Fee on nitrogen fertilizer use is a possible funding mechanism.
  - State-wide monitoring effort is needed to understand the problem/solutions.

# NIMS: Objectives

- Briefly summarize salient information from the literature – we will rely on what has been written.
- Develop an approach to phase nitrate implementation measures.
- Define a nitrate-prioritization methodology for groundwater basins.
- Develop nitrate implementation measures and provide a checklist for the selection of appropriate implementation measures.
- Establish an implementation program that considers both nitrate and salt for inclusion in the SNMP.
- Provide input to the Executive Committee regarding nitrate management policy discussions.

# NIMS: Phased Approach

Phase	Period (years)	Objectives
1	0 – 5	User Protection
2	5 – 20	Balance input/outflow of nitrate
3	> 20 to 50	Restore beneficial uses - managed aquifer restoration

- The default nitrate attainment goal in groundwater is the MCL.
- If current ambient groundwater nitrate is less than the MCL, the goal would be an antidegradation target that would be to maintain ambient nitrate concentrations, absent a maximum benefit demonstration.
- If the current ambient groundwater nitrate is greater than the MCL, the target attainment goal would be to reduce average ambient groundwater concentrations to 10 mg/L.

# NIMS: Prioritization Criteria

The 118 groundwater basins in the Central Valley will be prioritized based on a set of criteria to rank the basins so that nitrate implementation measures will provide the most risk reduction for users. Suggested criteria are:

- California Statewide Groundwater Elevation Monitoring (CASGEM) Program Basin Prioritization Process and Ranking.
- Volume-weighted average nitrate concentration in groundwater.
- Modeled nitrate loading to the upper groundwater aquifer.
- Vulnerability assessment from the Groundwater Quality Assessment Reports (GARs) developed by ILRP Coalition groups.
- The overlying population.
- The percentage of the overlying population that would be considered a part of a DAC or a DUC.

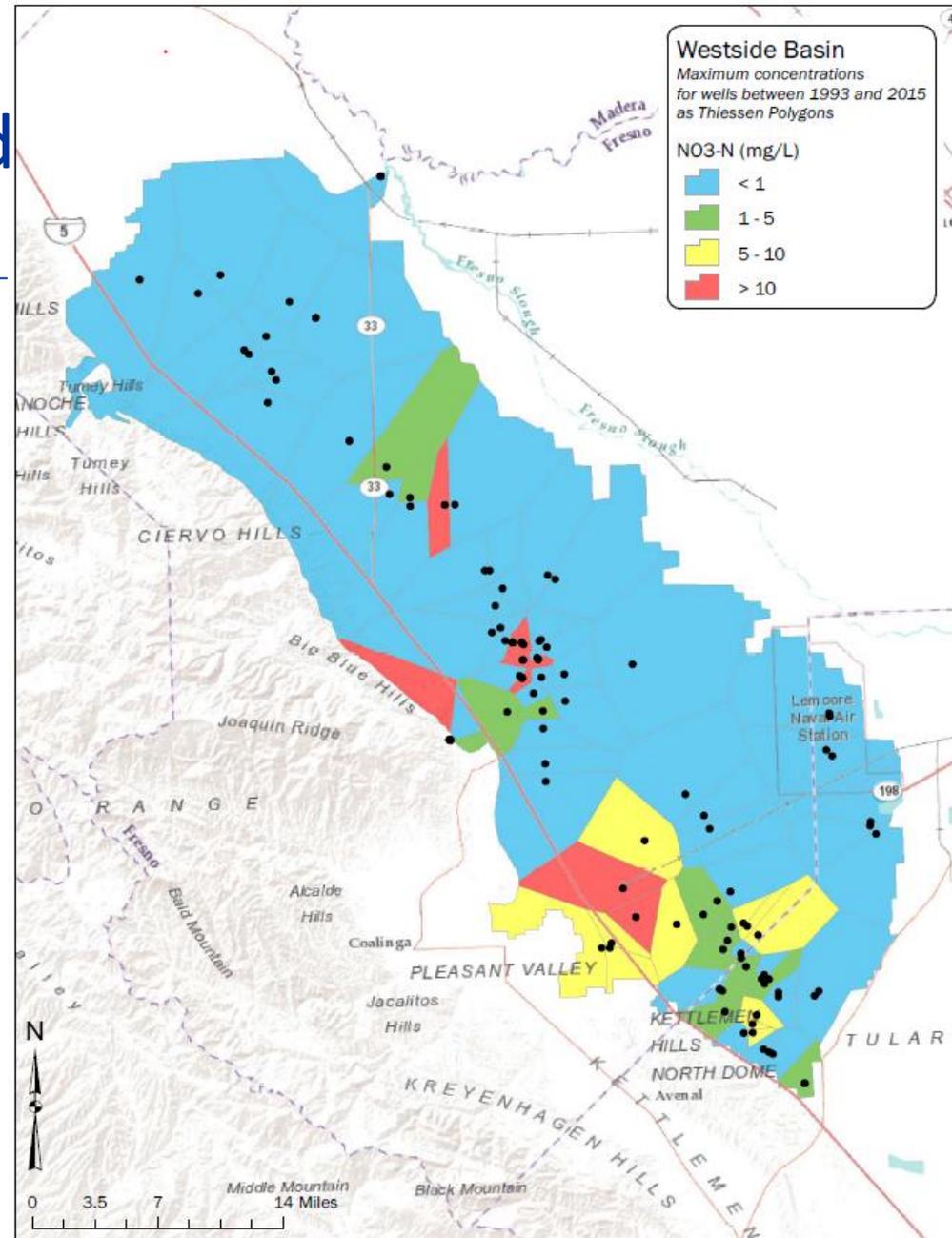
# NIMS: CASGEM Prioritization Criteria

The CASGEM Basin Prioritization Process is based on the following eight criteria:

- Overlying population;
- Projected growth of overlying population;
- Public supply wells;
- Total wells;
- Overlying irrigated acreage;
- Reliance on groundwater as the primary source of water.
- Impacts on the groundwater; including overdraft, subsidence, saline intrusion, and other water quality degradation; and
- Any other information determined to be relevant by the Department

# Thiessen Polygon Method

- This map is an example of using Thiessen polygons to analyze and visualize the distribution of nitrate in groundwater.
- Examples is the Westside Groundwater Basin.
- Map uses the 2014 version of the CV-SALTS database.
- Maximum concentrations from the period 1993 to 2015.



# DACs in California

- The population of DACs within a groundwater basin will be based on DWR's Integrated Regional Water Management (IRWM) guidelines.
- For IRWMs, DWR defines DACs to be geographic areas where the annual median household income (MHI) is less than 80 percent of the statewide annual MHI.
- MHI of \$61,094 and a calculated DAC threshold of \$48,875.



# NIMS: Develop a Nitrate Mass Balance Model

- Same methodology as SSALTS.
  - Based on the ICM nitrate loading to shallow groundwater – at the IAZ level.
  - Based on IAZ area.
  - Requisite mass of nitrate needed to be extracted to achieve attainment targets in groundwater will be based on the concentration ambient nitrate in the ICM report.
- Nitrate will be treated as a conservative constituent.
- Legacy nitrate in vadose zone needs to be accounted for.

# NIMS: Assess Nitrate Implementation Measures

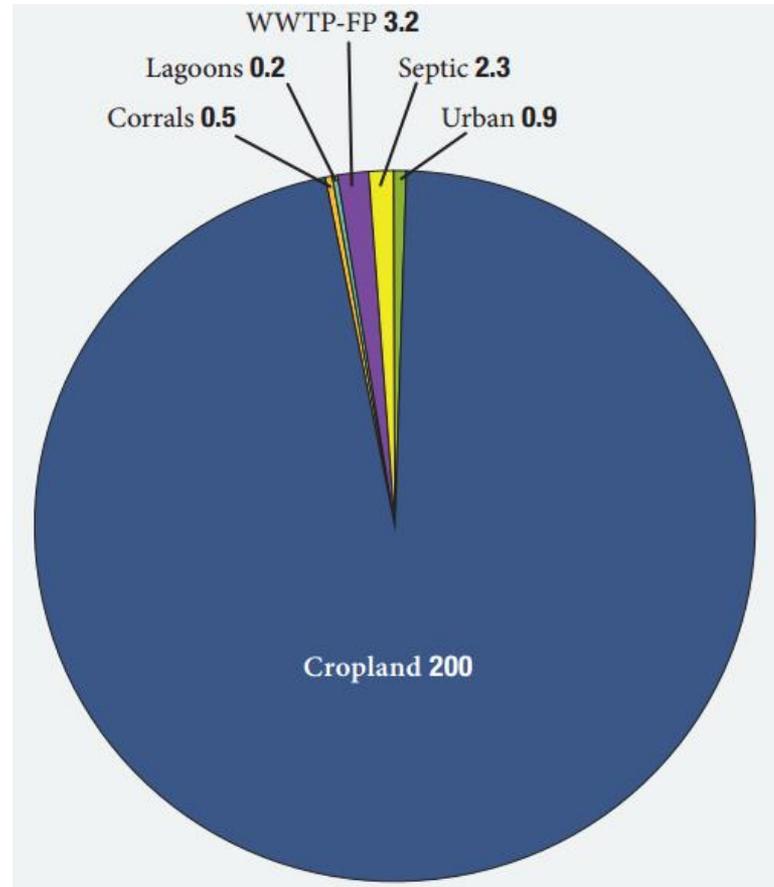
Nitrate implementation measures fall into three general categories:

- Source control measures
- Groundwater remediation
- Alternate water supplies

The following four slides will discuss implementation measures that fall within these categories.

# NIMS: Source Control Measures

Lagoons	0.1%
Corrals	0.2%
Urban	0.4%
Septic	1.1%
WWTP/Food Processors	1.5%
Croplands	96.5%



Harter *et al.*, 2012

# NIMS: Source Control Measures

- Source Control Measures Information
  - Management practices evaluation program
  - UC Cooperative Extension
- Practices
  - Design and operations & maintenance of irrigation systems to reduce deep percolation
  - Optimize crop and field management (crop rotations, tillage) to reduce nitrate leaching.
  - Manage nitrogen fertilizer and manure to increase crop nitrogen use efficiency and decrease deep percolation

# NIMS: Groundwater Remediation

- Pump and Fertilize
- Pump with Aboveground Treatment
  - Pump high priority groundwater basins to achieve two attainment targets
    - balance of nitrate inflows and outflows
    - restoration of beneficial uses
  - For a pilot groundwater basin, PAT only the portions of the groundwater basin that currently exceed the attainment target
- In Situ Treatment

# NIMS: Alternate Drinking Water Supplies

- Emphasis on DACs, DUCs, and individual families who do not have direct access to safe drinking water
- Blending
- Deeper wells
- Packing off screen intervals with higher levels of contamination
- Trucking in water
- Providing bottle water
- Connecting to an existing community water system
- Constructing a new community system
- Providing well-head treatment

# NIMS: Select Nitrate Implementation Measures

For a pilot study area, this task will methodically complete a checklist of implementation measures and evaluation factors.

- Governance structure.
- Nitrate sources.
- Source control measures (SCMs) for croplands .
- Other SCMs.
- Point-sources of nitrate.
- PAF
- Stormwater capture and recharge
- Compare pump, treat, and serve with PAT.

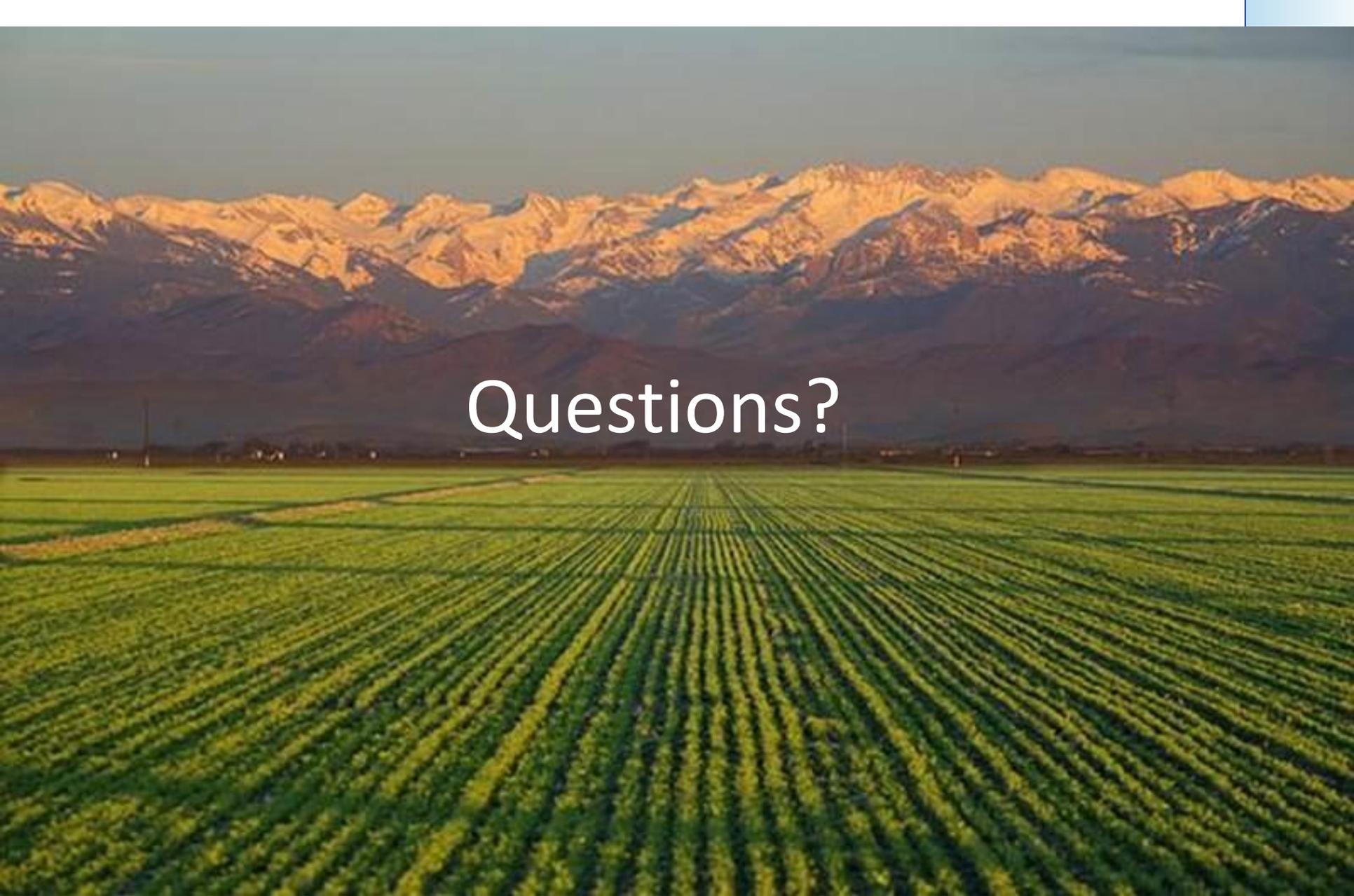
# NIMS: Joint Nitrate and Salt Implementation Measures

- The treatment technologies reviewed in SSALTS will remove nitrate together with all salts.
- There are lower cost technologies that focus only on nitrate that may be more appropriate if there are areas with elevated nitrates but acceptable levels of TDS.
- Opportunities for joint implementation measures exist where TDS and nitrate are above target attainment goals in a subregional area (*i.e.*, a management zone).
- A map, or series of maps, will be produced that show areas (using Thiessen polygons) where TDS exceeds 1000 mg/L, where nitrate exceeds 10 mg/L, and where both TDS and nitrate exceed their respective attainment targets. These would be areas where joint implementation measures would be cost effective.

# NIMS Schedule

Task	Description	Aug-15	Sep-15	Oct-15	Nov-15
1	Project Set-up & Management				
2	Develop Phased Approach and Nitrate Attainment Goal				
3	Define a Groundwater Prioritization Methodology				
4	...Nitrate Implementation Measures				
5	Select Nitrate Implementation Measures				
6	Joint Nitrate and Salt Implementation Measures				
7	Prepare Draft & Final NIMS Technical Memoranda				

*Notice to proceed is anticipated to be in late July/early August 2015.*



# Questions?