Nitrate Implementation Measures (NIMS)

Draft Work Plan
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
• 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

<table>
<thead>
<tr>
<th>Phase</th>
<th>Period (years)</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 – 5</td>
<td>User Protection</td>
</tr>
<tr>
<td>2</td>
<td>5 – 20</td>
<td>Balance input/outflow of nitrate</td>
</tr>
<tr>
<td>3</td>
<td>&gt; 20 to 50</td>
<td>Restore beneficial uses - managed aquifer restoration</td>
</tr>
</tbody>
</table>

- 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:

- 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.
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.
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

<table>
<thead>
<tr>
<th>Source Type</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Lagoons</td>
<td>0.1%</td>
</tr>
<tr>
<td>Corrals</td>
<td>0.2%</td>
</tr>
<tr>
<td>Urban</td>
<td>0.4%</td>
</tr>
<tr>
<td>Septic</td>
<td>1.1%</td>
</tr>
<tr>
<td>WWTP/Food Processors</td>
<td>1.5%</td>
</tr>
<tr>
<td>Croplands</td>
<td>96.5%</td>
</tr>
</tbody>
</table>

![Pie chart showing source control measures](image)

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

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Aug-15</th>
<th>Sep-15</th>
<th>Oct-15</th>
<th>Nov-15</th>
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<tbody>
<tr>
<td>1</td>
<td>Project Set-up &amp; Management</td>
<td></td>
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<tr>
<td>2</td>
<td>Develop Phased Approach and Nitrate Attainment Goal</td>
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<tr>
<td>3</td>
<td>Define a Groundwater Prioritization Methodology</td>
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<td>4</td>
<td>...Nitrate Implementation Measures</td>
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<tr>
<td>5</td>
<td>Select Nitrate Implementation Measures</td>
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<td>6</td>
<td>Joint Nitrate and Salt Implementation Measures</td>
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<tr>
<td>7</td>
<td>Prepare Draft &amp; Final NIMS Technical Memoranda</td>
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Notice to proceed is anticipated to be in late July/early August 2015.
Questions?