

SWRCB Staff's Background Information Nitrate Discharges to Groundwater

1. Nitrate is one of the most common groundwater pollutants found in the Central Valley.
 - The basin-wide average concentration of nitrate exceeds its regulatory level in approximately 25% of the groundwater basins within the Central Valley.¹
 - Many small communities rely on groundwater for drinking water. Some communities and private well owners are unable to safely use groundwater for drinking water as nitrate levels present a potential for human health impacts.
2. Recent studies completed by UC Davis concluded that agricultural lands are the largest contributor of nitrate to groundwater in the Central Valley.
 - Urban and domestic contributions to potential groundwater nitrogen loading are less than 10% of the total.^{2,3}
 - Synthetic fertilizer contributes nearly 60% of all nitrogen fluxes to cropland. The second largest contributor is dairy manure at nearly 20%.²
 - Manure nitrogen accounts for approximately one-third of the total nitrogen applied to agricultural lands in the San Joaquin Valley and Tulare Lake Basin.²
3. Of all dairy operations, the majority of nitrate loading to groundwater results from land application of manure (approximately 94%). Leakage from lagoons and corrals account for the remaining loading from dairy operations, at approximately 4% and 2%, respectively.²
4. Excessive application of dairy manure has resulted in concentrations of nitrate in groundwater beneath dairy operations well in excess of its maximum contaminant level for drinking water (10 mg/L). Results of recent monitoring of dairies in the Central Valley indicate that the average concentration of nitrate in shallow groundwater beneath dairy operations was 48 mg/L, with a median of 35 mg/L. Nitrate also was detected in groundwater offsite with respect to the dairy at a median concentration of 15 mg/L.⁴
5. The total estimated nitrogen excretion amount from dairy cattle in the Central Valley has risen exponentially from 1945 to 2005.²

- Higher annual nitrogen excretion is driven by the growth in the Central Valley dairy herd size and the growth in per cow milk production.
 - Total nitrogen excretion from the Central Valley dairy herd has increased by about 1,200% from less than 40,700 tons N/yr in the 1940s to 520,000 tons N/yr in 2005.
6. A recent study by UC Davis has indicated that the highest potential loading rates for nitrogen to groundwater are associated with the crops most intensively fertilized and particularly with those crops typically receiving dairy manure (corn, sorghum, sudangrass, cotton, miscellaneous other field crops, and grain and hay).
- The amount of manure nitrogen land applied on cropland considered to be dairy cropland yields a Central Valley average application rate of manure N on dairy cropland of 890 lbs N/ac/yr.² This estimated application rate exceeds currently recommended application rates for the crops being cultivated as part of the dairy operation by approximately 4:1 or more.
 - The corn-sorghum-sudangrass crop group has an estimated loading rate for nitrogen to groundwater of 282 lbs/ac/yr. The loading rate far exceeds a protective benchmark loading rate of approximately 32 lbs/ac/yr.^{2,3}
 - Nitrate loading to groundwater associated with dairy forage crops appear to account for a sizable fraction of the total loading of nitrate to groundwater in the Central Valley.²

References:

1. Central Valley Region Salt and Nitrate Management Plan, Final Document for Central Valley Board Consideration (Dec. 2016).
2. Harter, T., K. Dzurella, G. Kourakos, A. Hollander, A. Bell, N. Santos, Q. Hart, A. King, J. Quinn, G. Lampinen, D. Liptzin, T. Rosenstock, M. Zhang, G.S. Pettygrove, and T. Tomich (2017). Nitrogen Fertilizer Loading to Groundwater in the Central Valley. Final Report to the Fertilizer Research Education Program, Projects 11-0301 and 15-0454, California Department of Food and Agriculture and University of California Davis, 333p., <http://groundwaternitrate.ucdavis.edu>.
3. Harter, T., J. R. Lund, J. Darby, G. E. Fogg, R. Howitt, K. K. Jessoe, G. S. Pettygrove, J. F. Quinn, J. H. Viers, D. B. Boyle, H. E. Canada, N. DeLaMora, K. N. Dzurella, A. Fryjoff-Hung, A. D. Hollander, K. L. Honeycutt, M. W. Jenkins, V. B. Jensen, A. M. King, G. Kourakos, D. Liptzin, E. M. Lopez, M. M. Mayzelle, A. McNally, J. Medellin-Azuara, and T. S. Rosenstock. 2012. Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater. Report for the State Water Resources Control Board Report to the Legislature (Jan. 2012). Center for Watershed Sciences, University of California, Davis, 78 p. <http://groundwaternitrate.ucdavis.edu>.
4. Central Valley Dairy Representative Monitoring Program (2019). Summary Representative Monitoring Report (April 19, 2019).