Indian Wells Valley Groundwater Basin Salt and Nutrient Management Plan – Status and Loading Analysis

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Background and Status of the Indian Wells Valley Cooperative Groundwater Management Group

- Cooperative Groundwater Group formed in September 1995 consisting of 8 signatories to the Cooperative Agreement
  - Naval Air Weapons Station China Lake
  - Kern County Water Agency
  - City of Ridgecrest
  - Inyokern Community Services District (currently inactive)
  - Indian Wells Valley Water District
  - North American Chemical Company (now Searles Valley Minerals)
  - Eastern Kern County Resource Conservation District
  - Indian Wells Valley Airport District (currently inactive)

Background and Status of the Indian Wells Valley Cooperative Groundwater Management Group

Additional signatories to the Agreement since 1995

- Bureau of Land Management
- Kern County
- Quist Farms (currently inactive)
- Mojave Pistachio
- Nugent Farms
- Meadowbrook Farms

Objectives of the Cooperative Groundwater Management Agreement

- Limit additional large scale pumping in areas that may be adversely impacted.
- Distribute new groundwater extraction within the Valley in a manner that will minimize adverse effects to existing groundwater conditions (levels and quality), and maximize long-term supply within the Valley.
- Aggressively pursue the development and implementation of water conservation policy and education programs.
- Encourage the use of treated water, reclaimed water, recycled ,gray and lower quality water where appropriate and economically feasible.
- Explore the potential for other types of water management programs that are beneficial to the Valley.
- Continue cooperative efforts to develop information and data which contributes to further defining and better understanding the groundwater resource in the Indian Wells Valley.
- Develop an interagency management framework to implement and enforce the objectives of the Plan.

Background and Status of Salt & Nutrient Management Plan in Indian Wells Valley

- Salt and Nutrient Management Plan initiated by Navy contractor in 2015
- Review by RWQCB found areas to supplement in the plan including:
  - Salt & Nutrient Loading Analysis
  - Assimilative Capacity Estimate
  - Recycled water project areas including recharge
  - Antidegradation analysis

SNMP developed further in 2016

- Loading analysis completed in fall with stakeholder input
- Mixing model work to begin in December 2016 with Q1 2017 completion

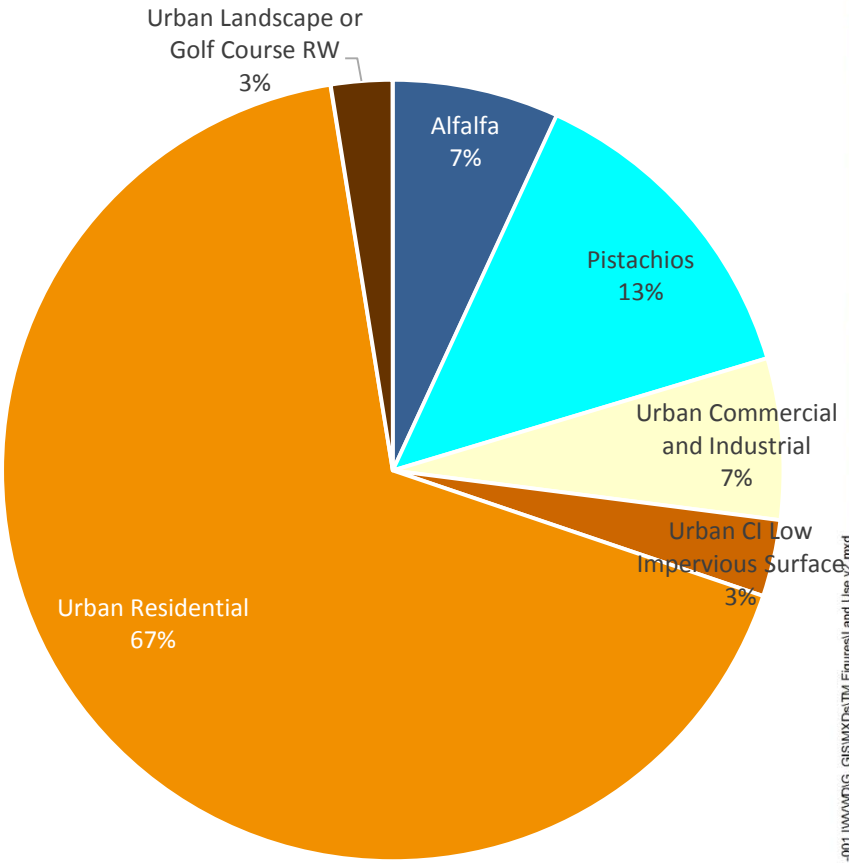
Purpose of SNMP Loading Analysis

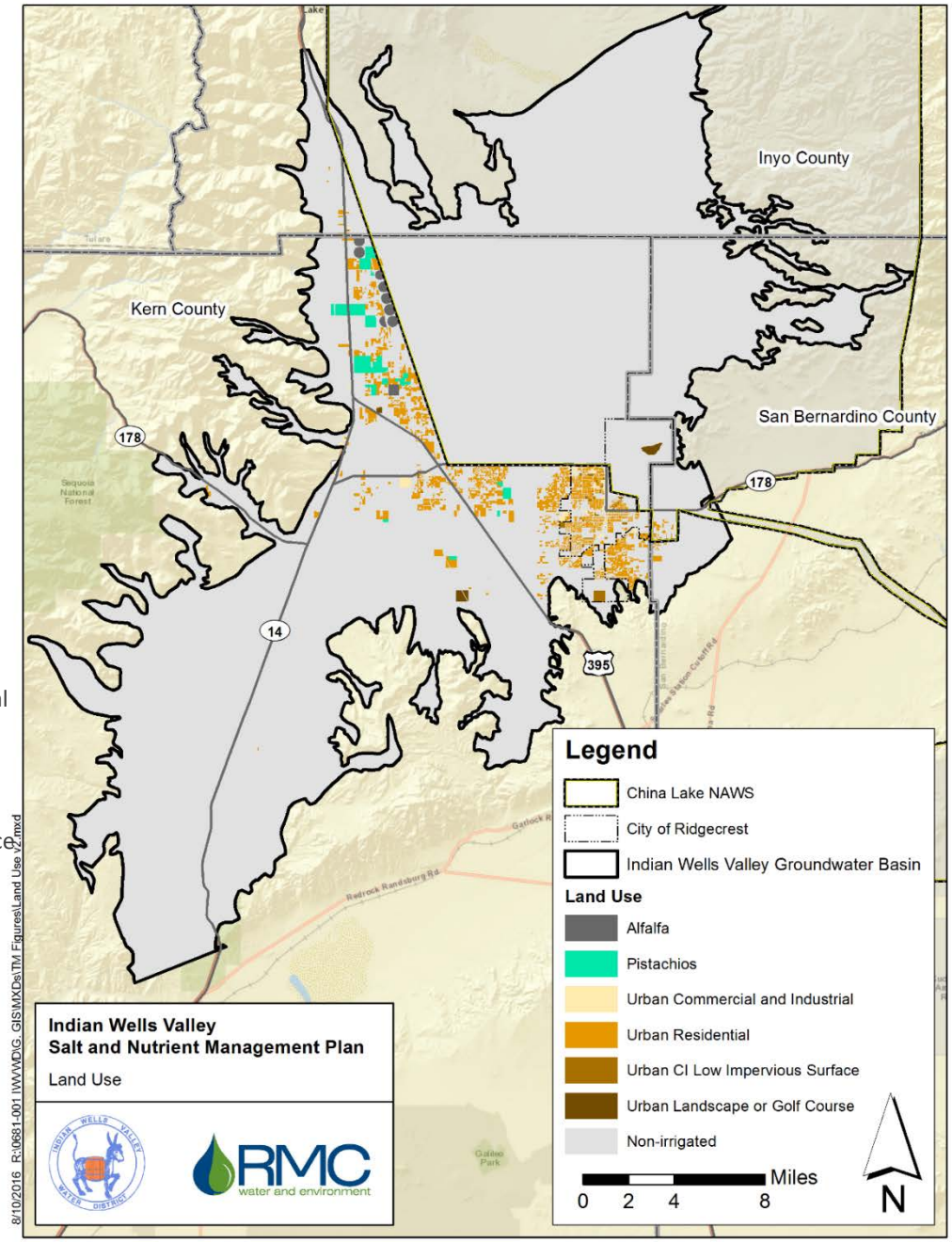
- Analysis of salt and nutrient loading occurring due to surface activities
  - Irrigation water (potable water, recycled water, and groundwater)
  - Agricultural Inputs (fertilizer, applied water)
  - Residential Inputs (septic systems, fertilizer, applied water)

Land use classification is critical to identify and quantify loading sources

- Study area divided into parcels based on county land use divisions
- Parcels categorized into land use categories
- Characteristics assigned to each land use group and vetted with stakeholders
  - Applied water
  - Percent irrigation
  - Applied Nitrogen
  - Applied TDS
  - Soil Type

Land Use with Loading Factors





RMC water and environment

Loading analysis is step-by-step process

- Estimated crop demand using crop evapotranspiration and regional effective evapotranspiration for crop type, adjusted based on stakeholder input
- Calculate applied water by adjusting for irrigation efficiency and leaching fraction to prevent excessive accumulation of salts
- Nitrogen fertilizer application rates based on crop type and stakeholder input
- Adjust for nitrate uptake efficiency and volatilization
- Apply loading value (lbs/acre-year) to land use distribution to calculate total load on basin

Land Use Related Loading Factors

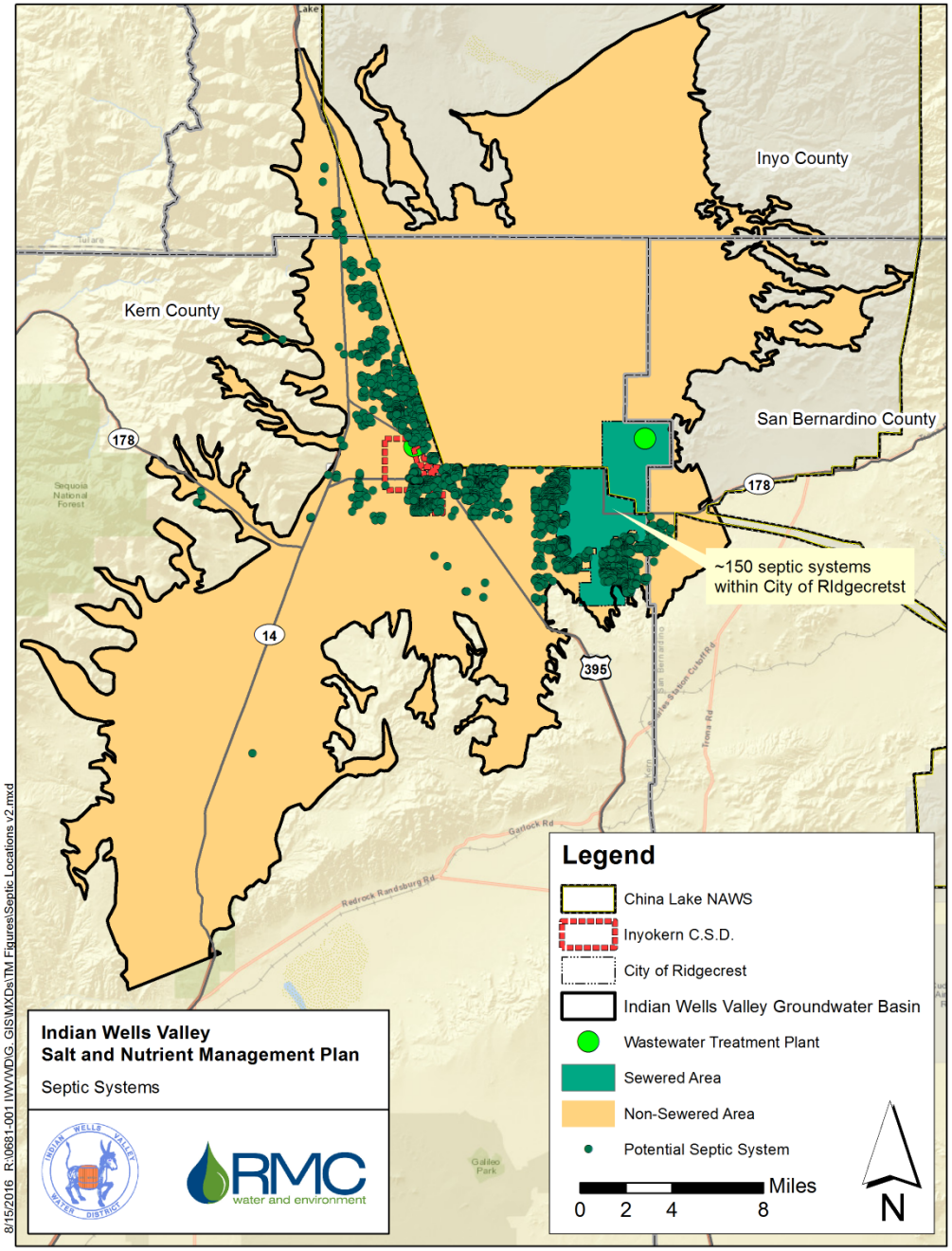
Land Use Group	Total Area (acres)	Percent Cultivated	Applied Water (in/acre-year)	Applied Nitrogen (lbs/acre-year)	Applied TDS (lbs/acre-year)
Alfalfa	1,023	100%	89.5	4.35	6,293
Pistachio	2,001	100%	58	42.1	4,078
Urban Commercial and Industrial Outside Ridgecrest	573	5%	70.2	12.5	4,934
Urban CI Low Impervious Surface Outside Ridgecrest	28	30%	70.2	12.5	4,934
Urban Residential Outside Ridgecrest	8,068	15%	70.2	12.5	4,934
Urban Landscape or Golf Course Outside Ridgecrest	200	75%	70.2	12.5	4,934
Urban Commercial and Industrial Within Ridgecrest	416	5%	70.3	12.8	5,527
Urban CI Low Impervious Surface Within Ridgecrest	442	30%	70.3	12.8	5,527
Urban Residential Within Ridgecrest	1,919	15%	70.3	12.8	5,527
Urban Landscape or Golf Course on Recycled Water	179	5%	70.9	12.5	10,763

Septic Loading Process

- ~150 septic systems in City of Ridgecrest, 2,668 outside city
- Assume 263 gpd effluent based on 75 gpd/person and 3.5 people/household
- 670 mg/L TDS based on City of Ridgecrest WWTP effluent
- 30 mg/L N based on typical wastewater concentrations for medium strength wastewater

Wastewater Treatment Plants & Septic Loading

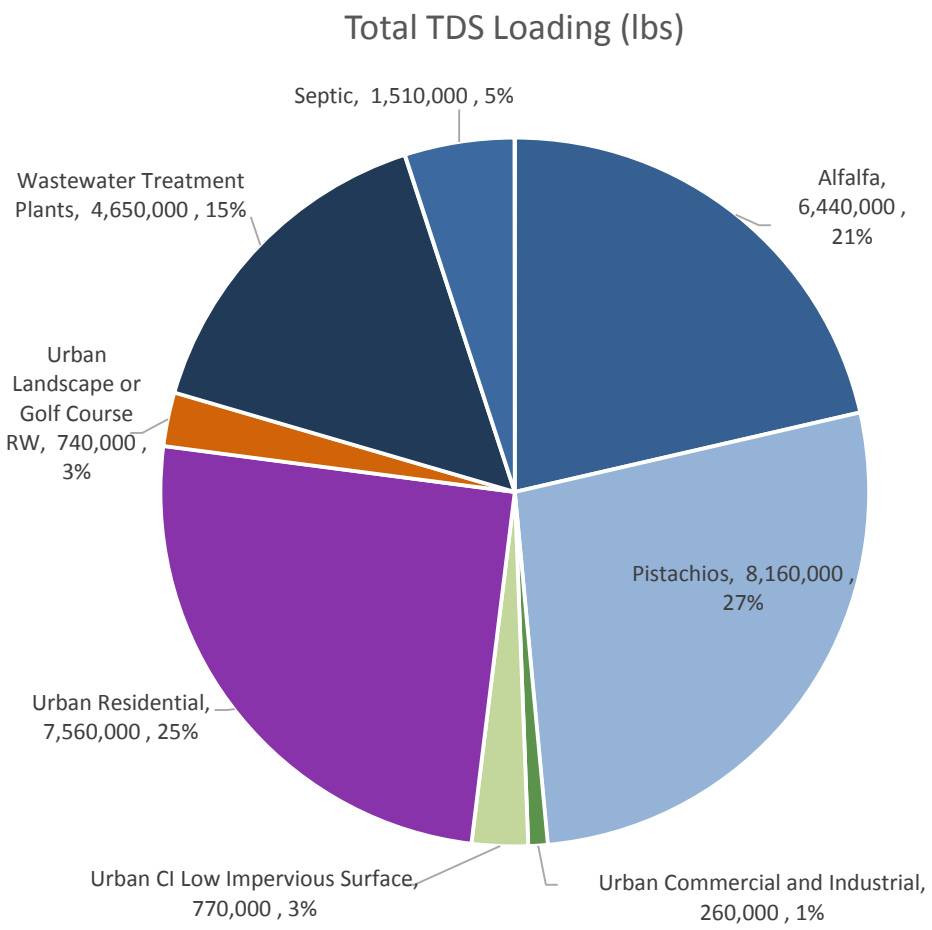
- City of Ridgecrest WWTP
  - TDS: 670 mg/L (given, 2015)
  - N: 0.76 mg/L (given, Dec 2015)
  - Q: 2.24 MGD (2014-2015 average)
- Inyokern WWTP
  - TDS: 670 mg/L (assumed)
  - N: 30 mg/L (assumed)
  - Q: 35,000 gpd (given)

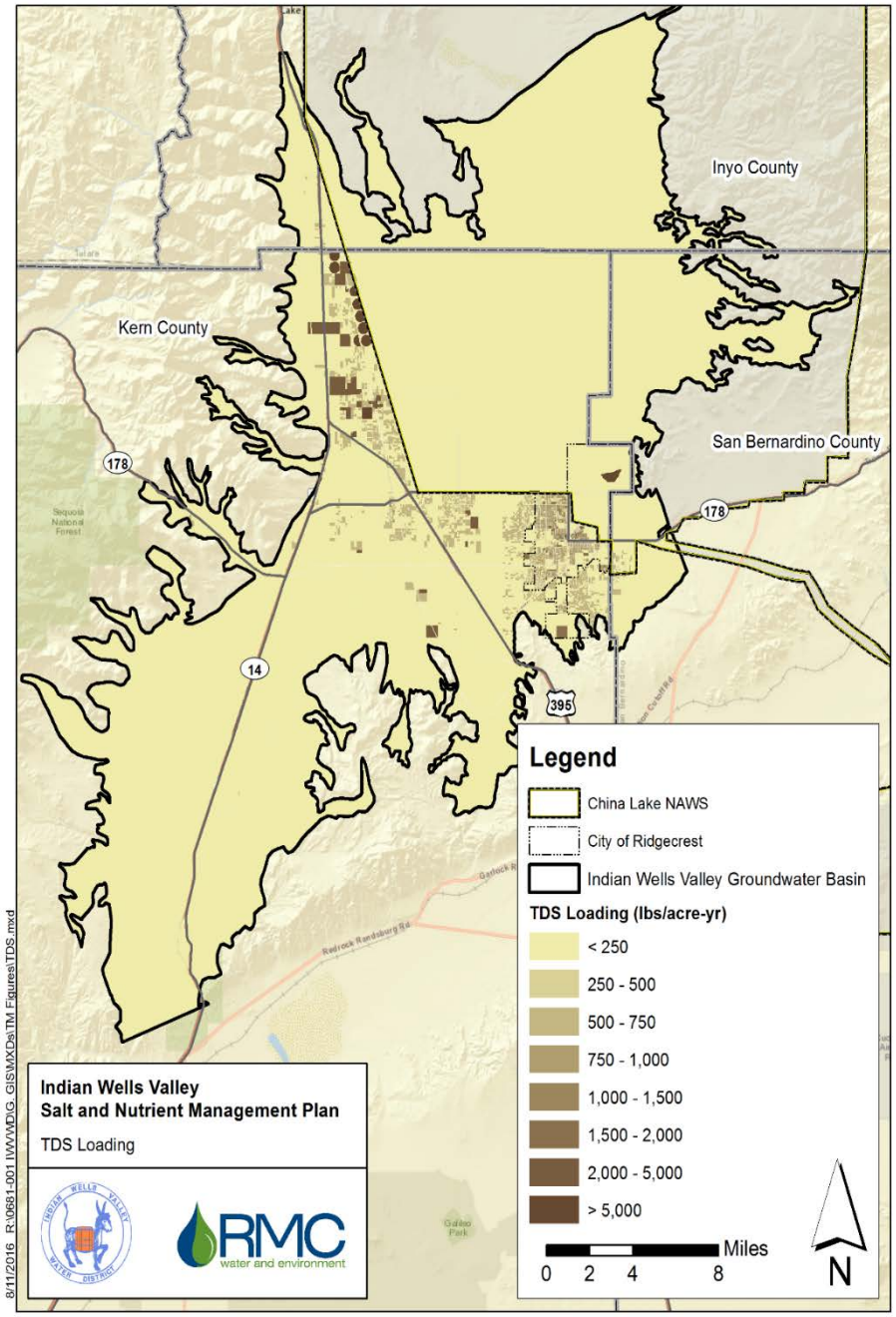


Loading Results – vetted and updated through stakeholder process

Land Use Group	Total Area (acres)	Percent of Total Area	Total TDS Load (lbs)	Percentage of Total TDS Loading	Total N Load (lbs)	Percentage of Nitrogen Loading
Alfalfa	1,023	7%	6,440,000	21%	2,000	2%
Pistachios	2,001	13%	8,160,000	27%	41,000	45%
Urban Commercial and Industrial	989	7%	260,000	1%	300	0%
Urban CI Low Impervious Surface	470	3%	770,000	3%	900	1%
Urban Residential	9,987	67%	7,560,000	25%	9,300	10%
Urban Landscape or Golf Course	379	3%	740,000	2%	900	1%
Wastewater Treatment Plants	2 Treatment Plants	N/A	4,650,000	15%	4,000	4%
Septic	2,818 Septic Systems	N/A	1,510,000	5%	33,000	36%

TDS Loading





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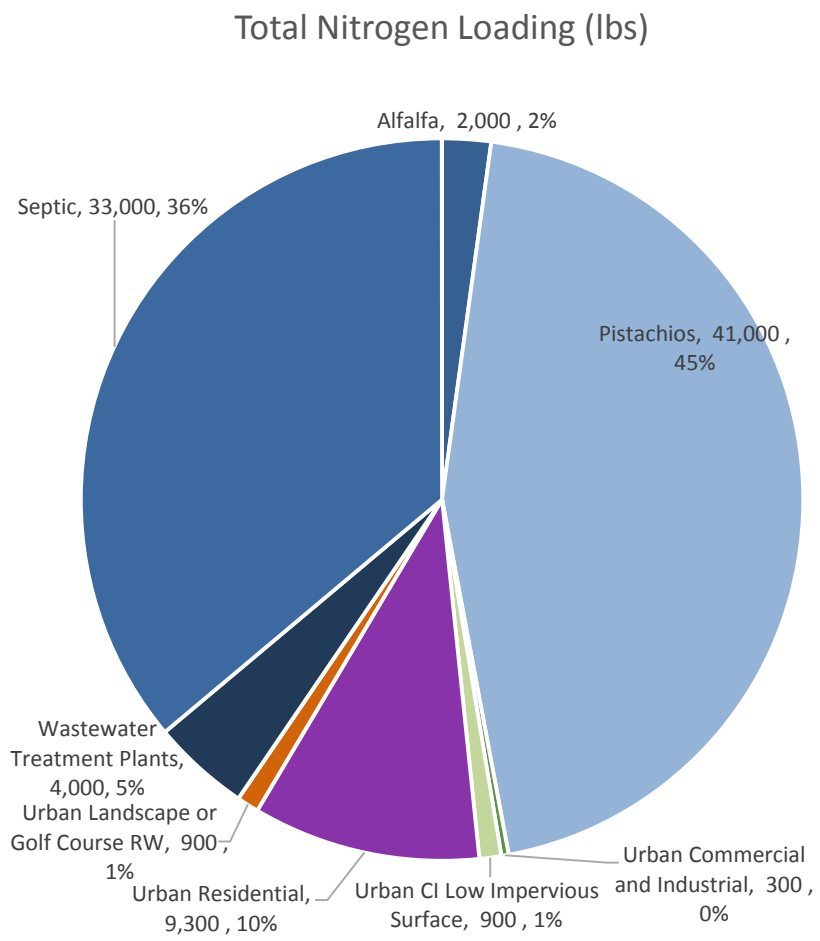
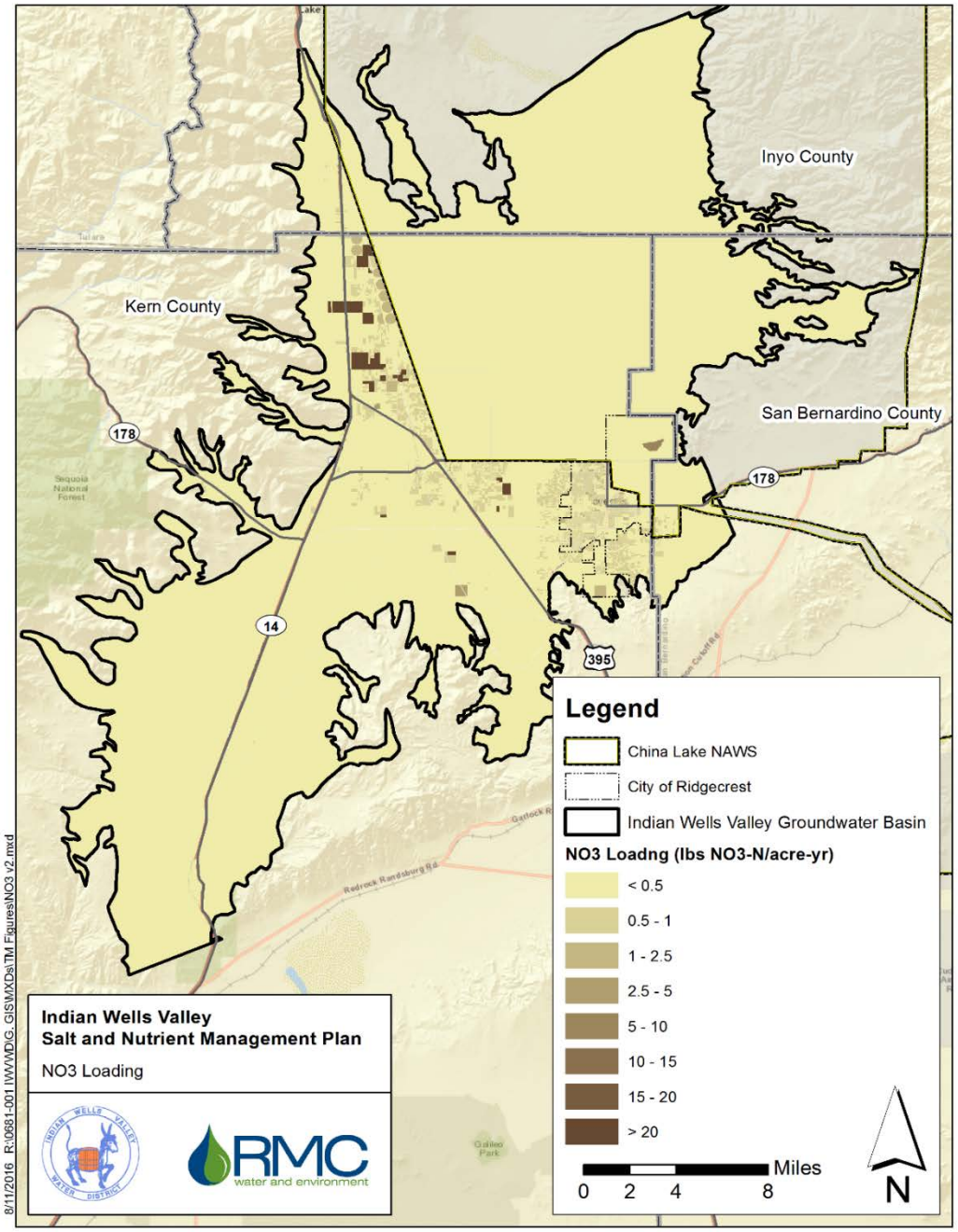
Nitrate Loading





Next Steps

- Develop mixing model to associate loading with assimilative capacity and determine trends (Dec 2016-Jan 2017)
- Use results from loading analysis and mixing model to complete an antidegradation analysis and collaboratively develop best management practices with stakeholders if warranted (Spring 2017)