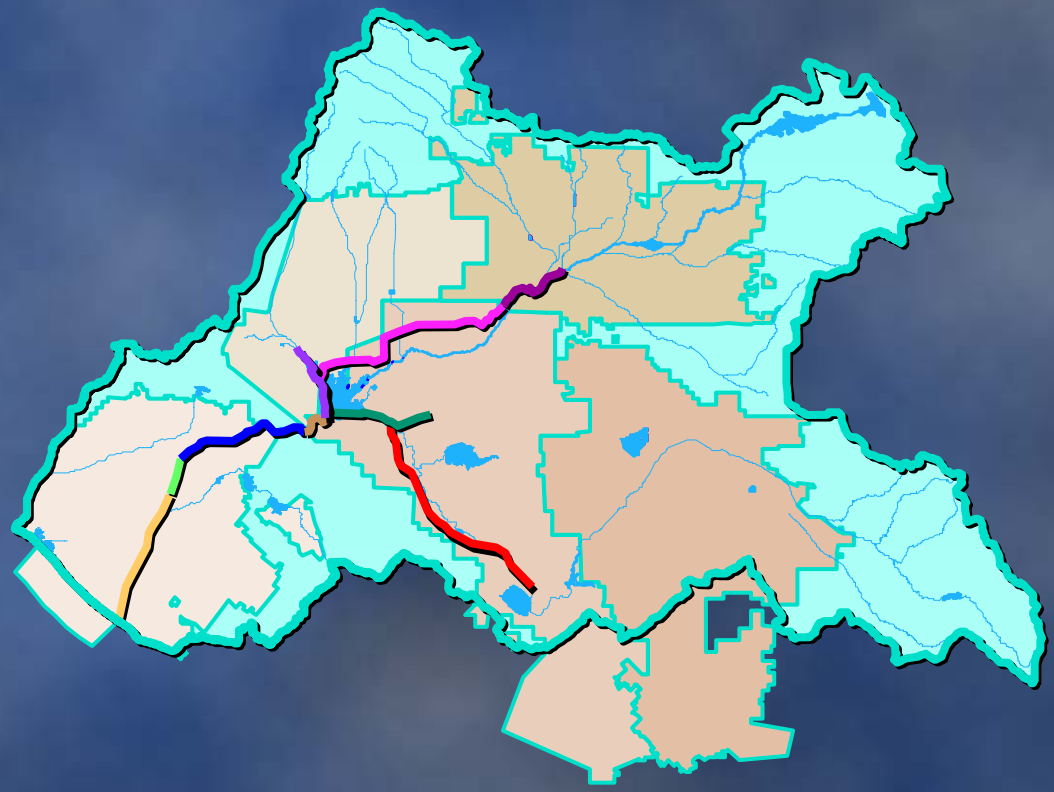
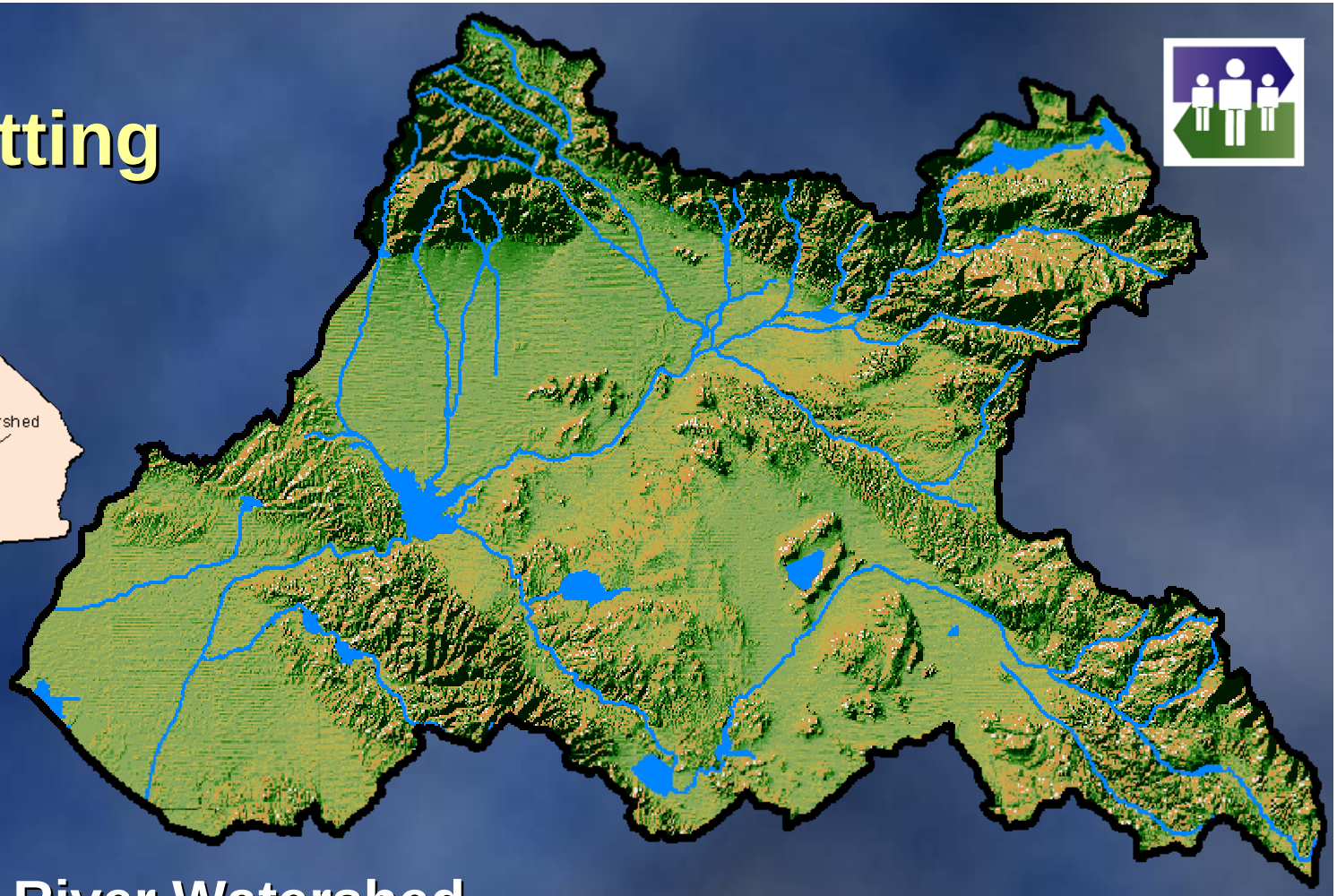
Groundwater Recharge and Salt Management in the Santa Ana Watershed

Gerard Thibeault
Executive Officer
CRWQCB, Santa Ana Region

Daniel Cozad, Principal
Former General Manager SAWPA

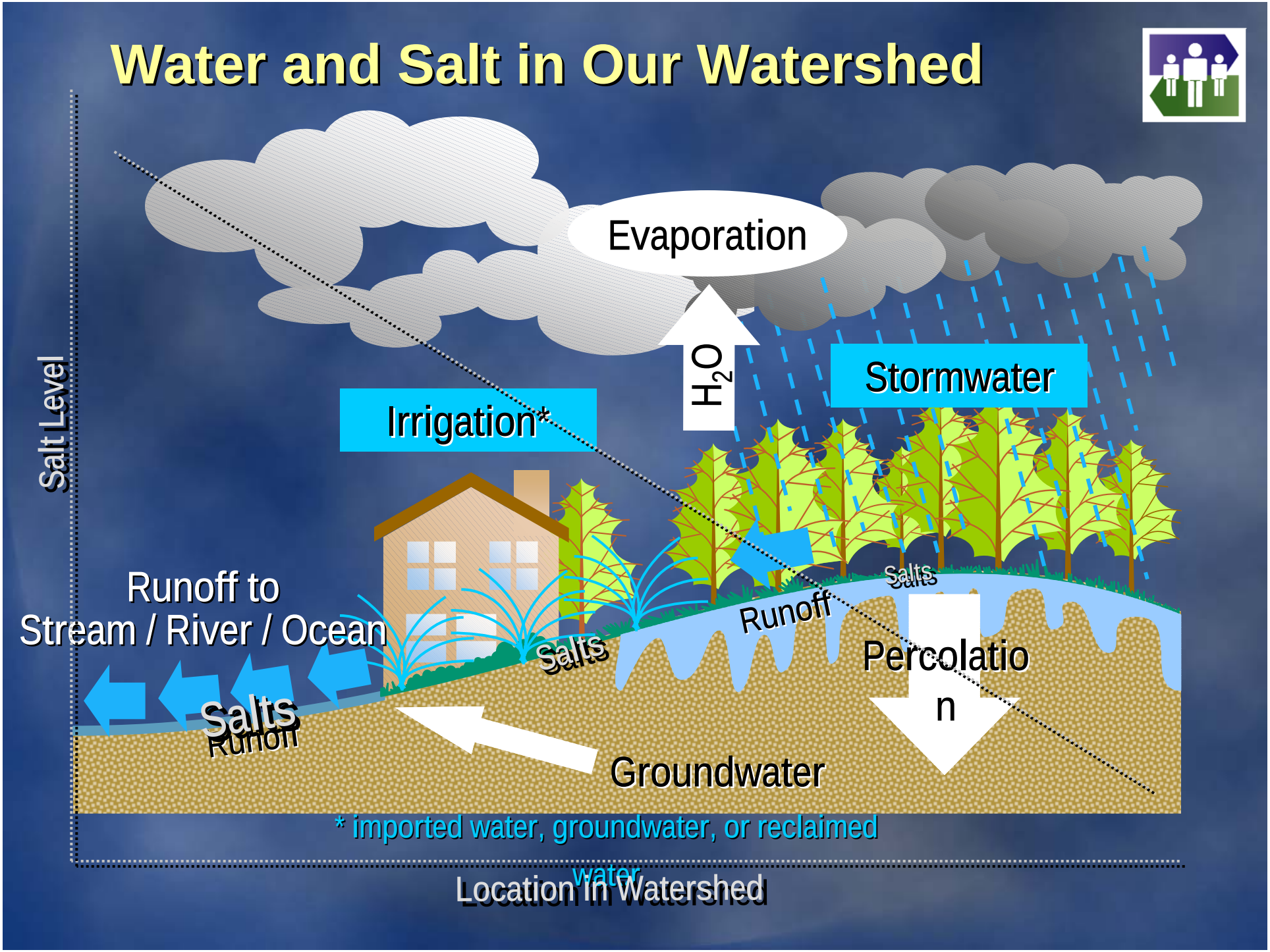


Setting

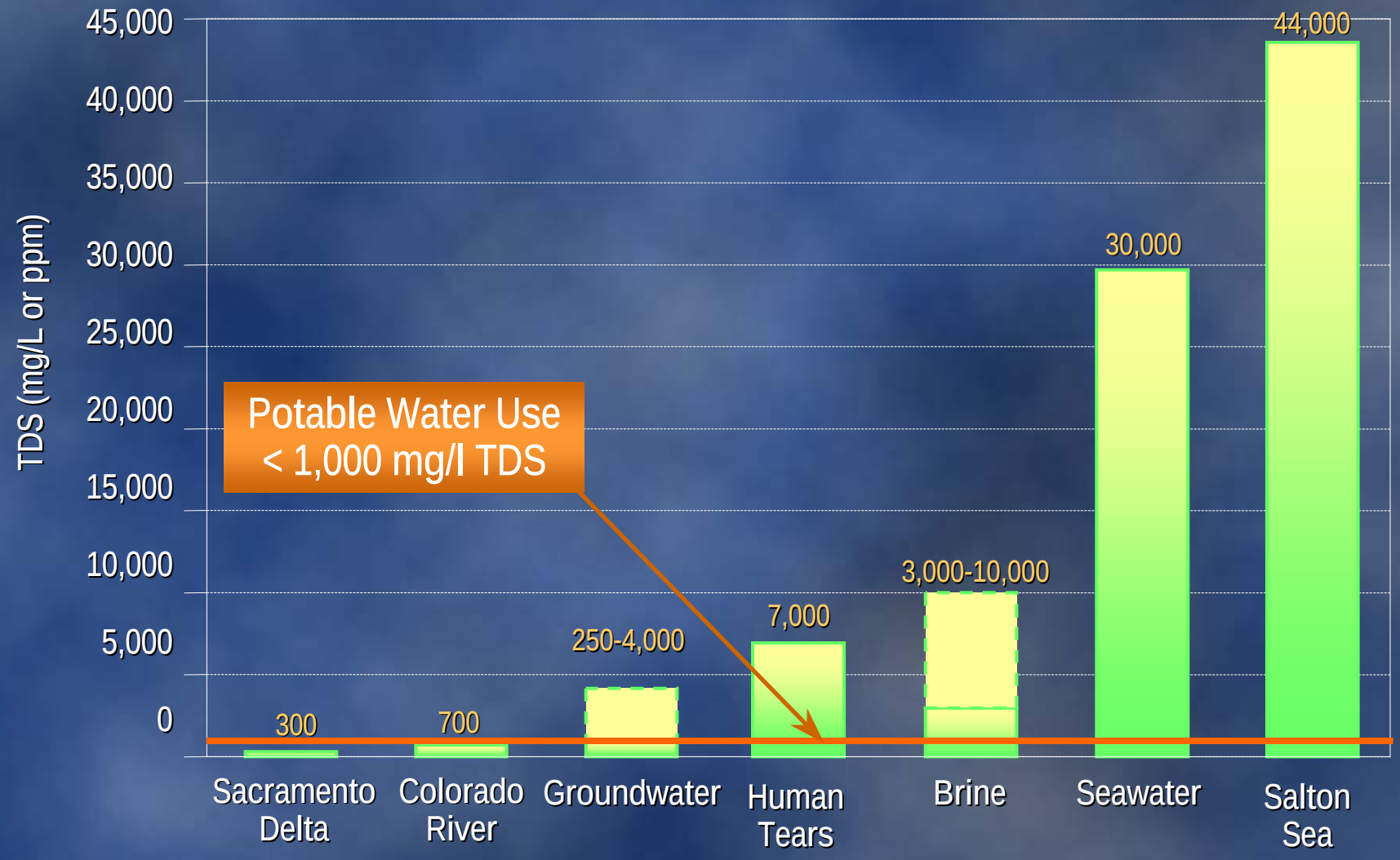


- **Santa Ana River Watershed**
  - **Largest coastal stream system in Southern California**
  - **Covers over 2650 square miles in parts of four counties**
  - **Quickly urbanizing home to over 5 million people**
  - **Population projected to increase to 7 million by 2020**
  - **Same boundary as Region 8 Water Quality Board**

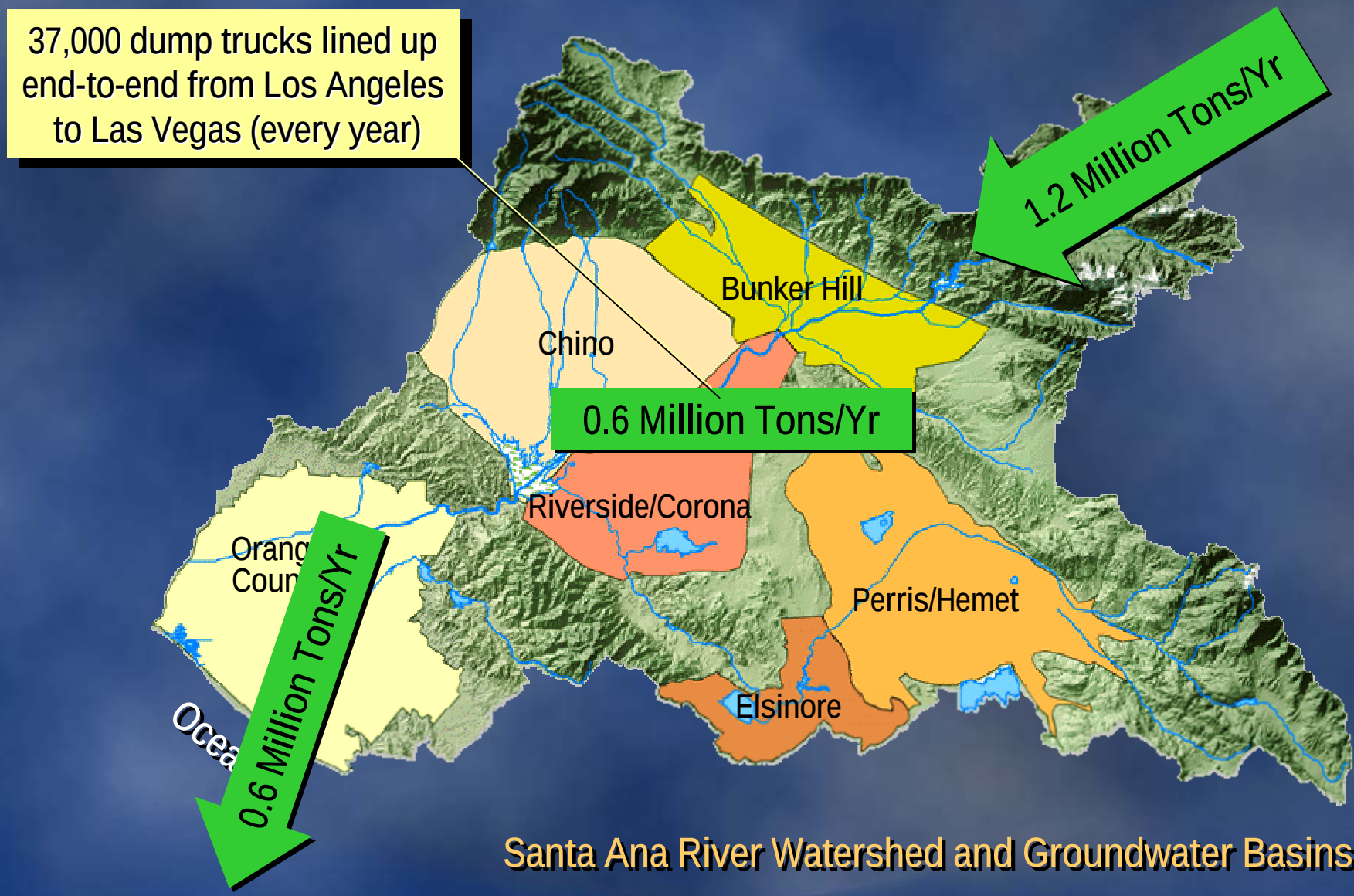
Water and Salt in Our Watershed



Salt Levels (TDS)



Watershed Salt Accumulation



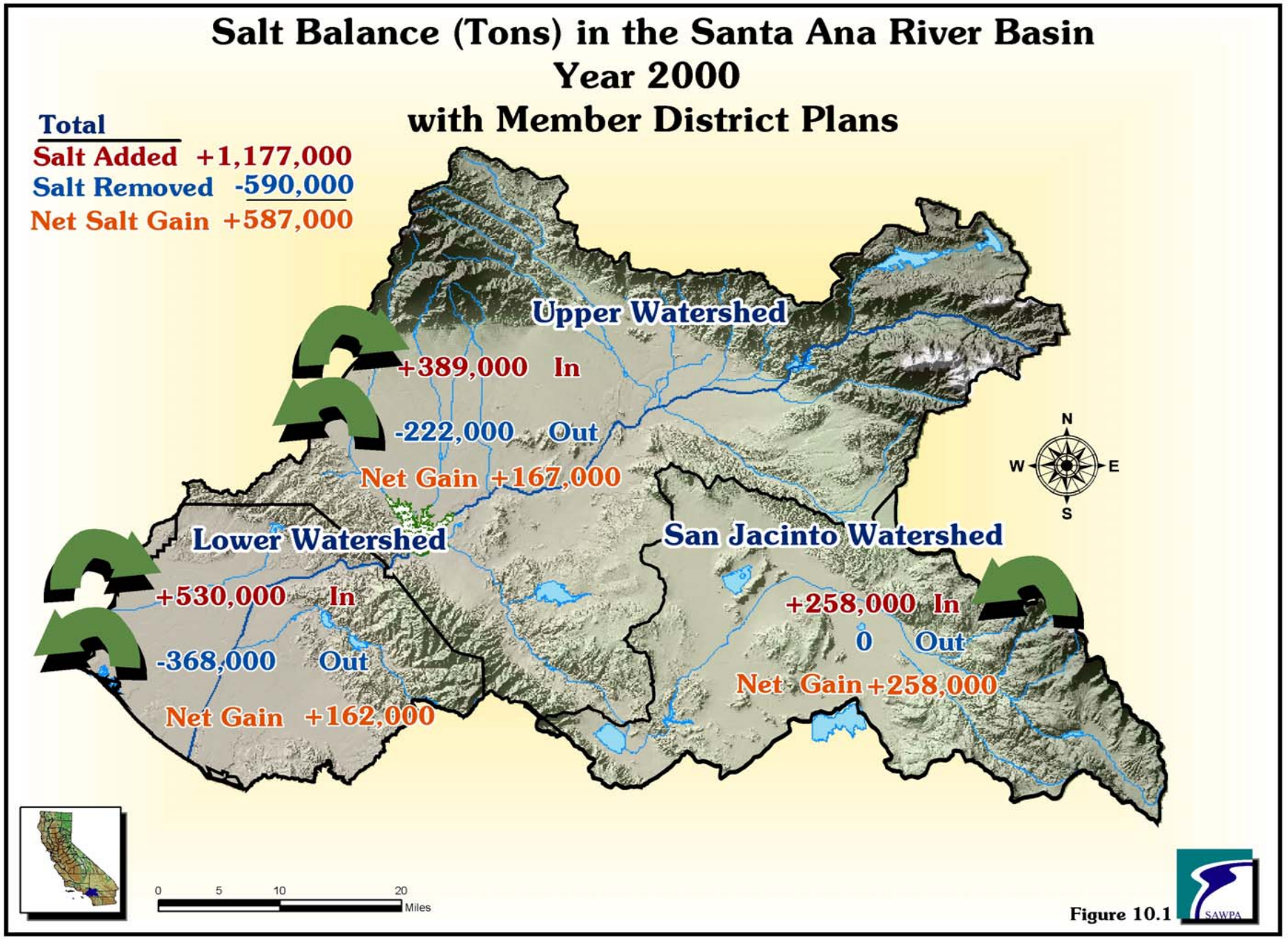


Figure 10.1

p:\projects\irp_larry\salt_balance-2000.mxd

Salt Balance (Tons) in the Santa Ana River Basin Year 2050 with Member District Plans And Additional IWRP Proposed Projects

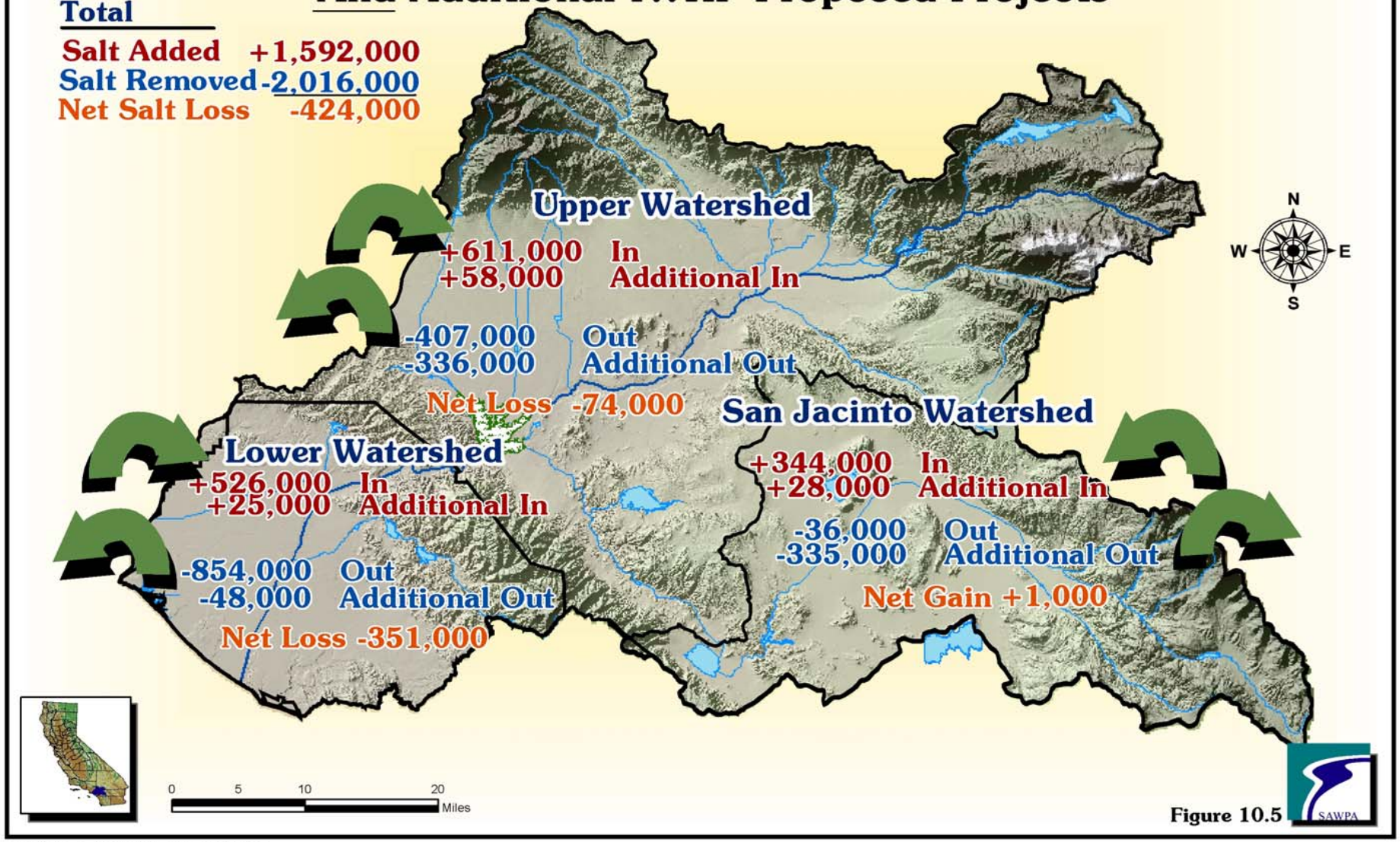


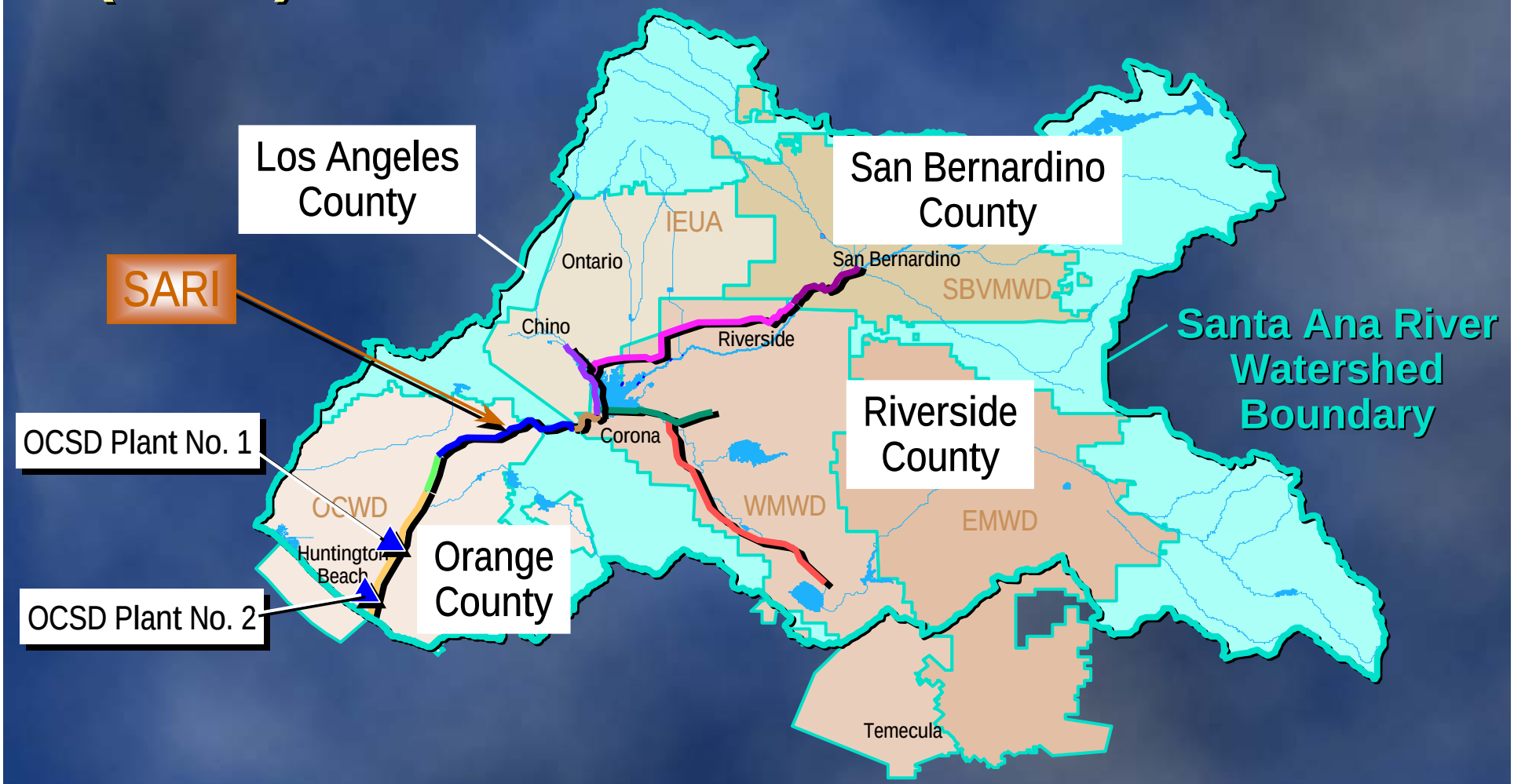
Figure 10.5

p:\projects\irp_larry\salt_balance-2050b.mxd

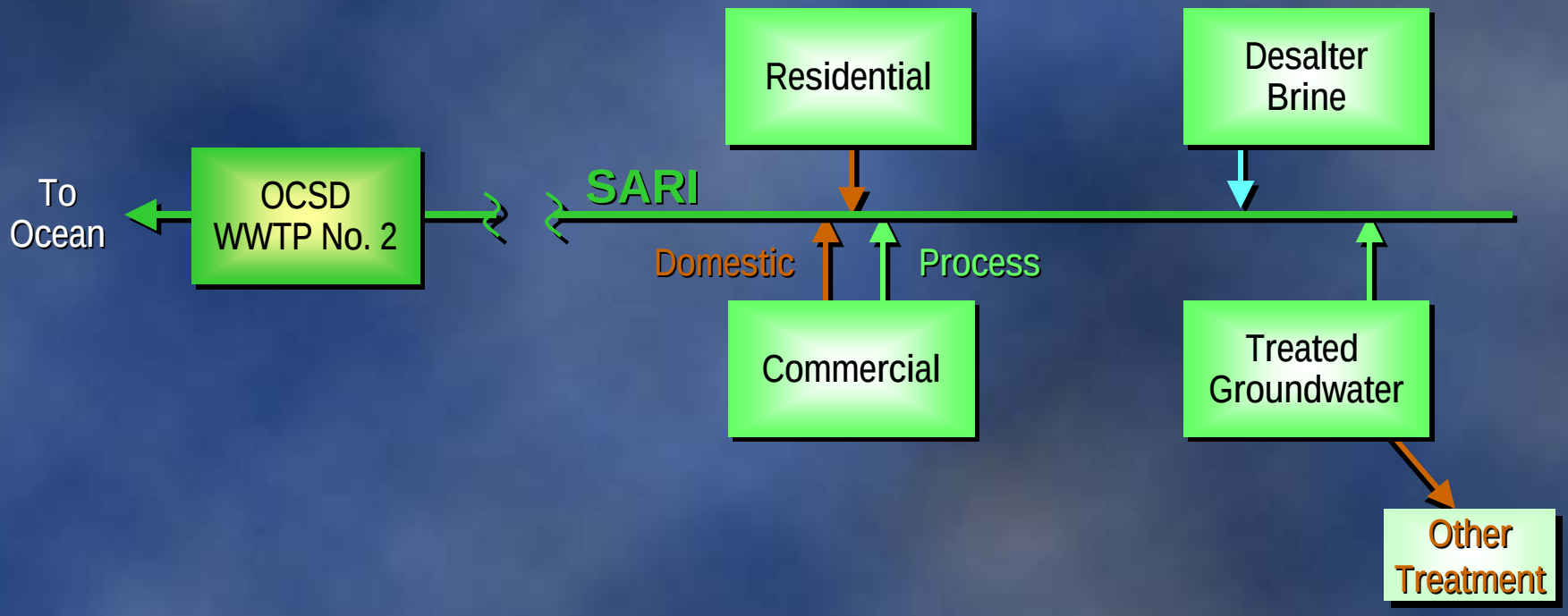
History of SARI/SAWPA

- Studies over 1930's to 1970's documented increasing salt concentrations in groundwater
- SAWPA Formed as a Planning Agency
- First Basin Plan created for Watershed by SAWPA with SAR Board
- Late 1960's initial leg of brine disposal pipeline constructed in Orange County
- 1973 SAWPA was formed as a PROJECT Authority
- SAWPA's first project - Construct the Santa Ana Regional Interceptor (SARI) to transport highly saline water from the upper watershed and bypass lower groundwater subbasins.
- 1995 final leg of SARI completed
- 2002 Temescal Valley Regional Interceptor (TVRI) connection to SARI completed

Existing Santa Ana Regional Interceptor (SARI)



What goes into the SARI Line?



SARI Description

- Length - 93 miles
- Pipeline size: 16 inch – 84 inch
- Pipeline Capacity: 30 – 36 mgd
- Direct Connections
  - 24 Connections
    - 15 Industrial
    - 4 Desalters
    - 5 Domestic Waste

Recharge Order

- General permit for recharge of imported water from State Water Project, Colorado River or inter-basin transfers of groundwater
- Proposed that 5-year running average salt levels of recharge water meet basin plan water quality objectives
- Monitoring required

Need for Order?

- Santa Ana Basin Plan – completely revised Salt Management Plan
  - Very high adverse salt balance
  - New GW objectives throughout Region
    - Rigorous scientific process
    - Stakeholder-driven and funded effort

Compliance with Objectives?

- Why regulate and monitor recharge quality and resultant water quality affects?
- State Water Board Rancho Caballero decision?
- True water quality need, or technical compliance with California Water Code?

Develop procedures to calculate groundwater quality objectives

- Completed volume-weighted management zone analyses of TDS and nitrate concentrations for entire Santa Ana Watershed
- Rigorous scientific analysis
- Near real-time groundwater monitoring
- Re-calculate ambient quality every three years

Develop procedures to calculate groundwater quality objectives

- **WHY?**
  - Basin Plan Objectives:
    - TDS: About 200 wells; Two years of data
    - Nitrate objectives not scientifically calculated
  - TIN/TDS Study:
    - TDS/Nitrate: About 1,800 wells; 20 years of data
    - Nitrate and TDS objectives rigorously calculated

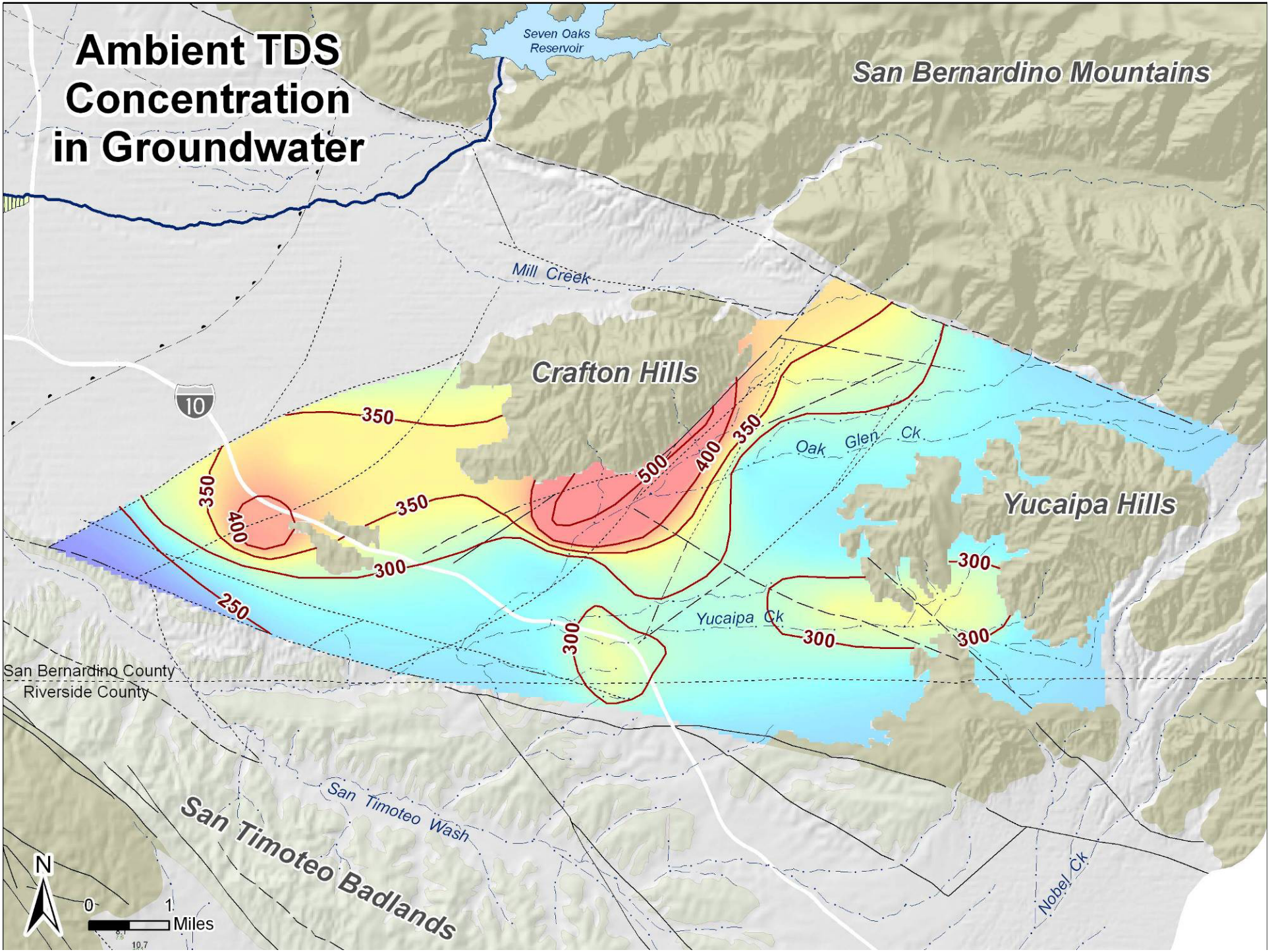
Water Boards

Develop procedures to calculate groundwater quality objectives

- Develop *volume-weighted* management zone estimates of TDS and nitrate concentrations
  - $Concentration_{MZ} = {}^{MassMZ} / {}_{GW\ Volume_{MZ}}$
  - historical ambient conditions (1954 – 1973)
    - Objective setting period
  - current ambient conditions (1978 – 1997)
    - Measure of compliance

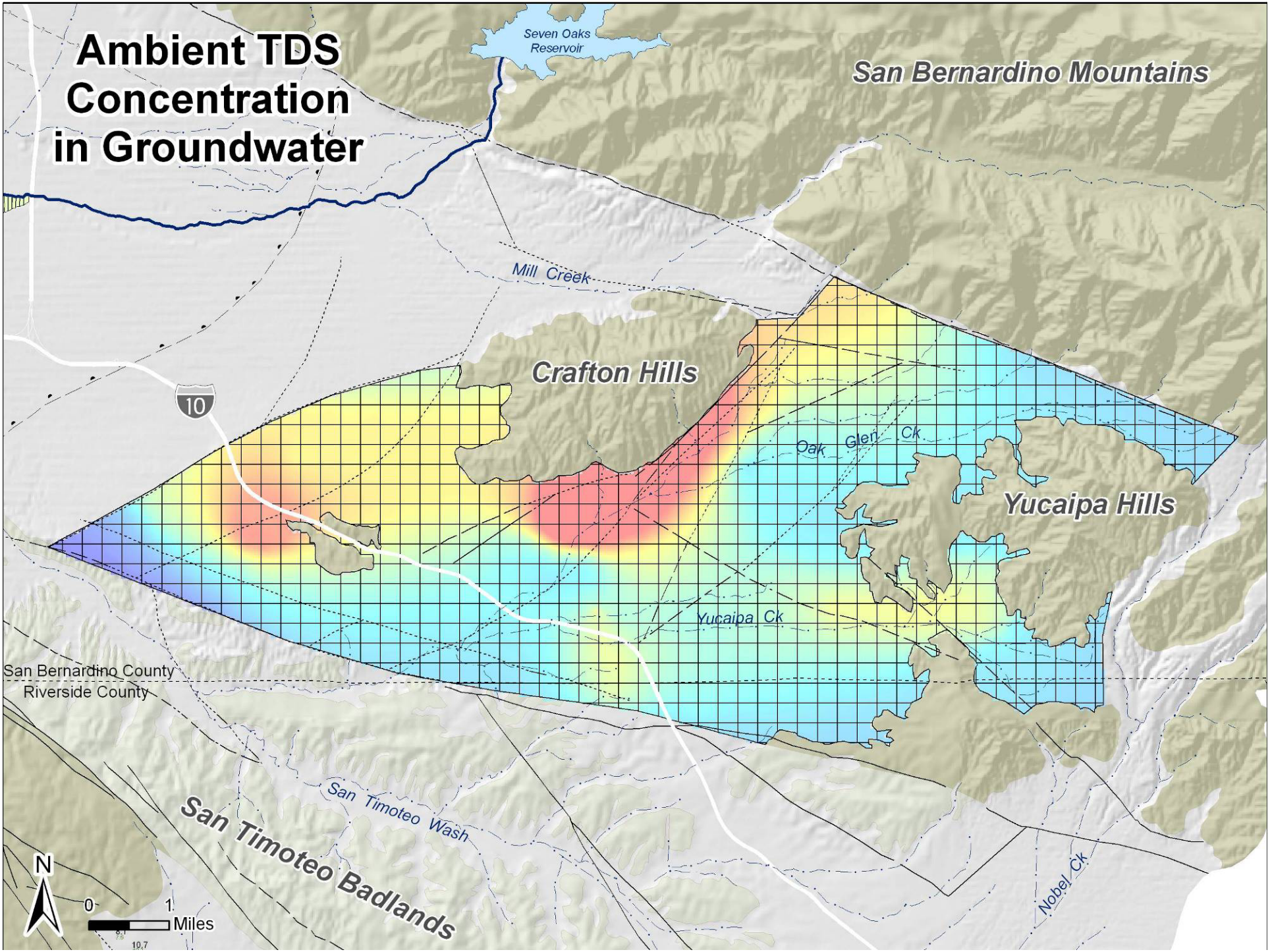
Compute Ambient Water Quality for Management Zones

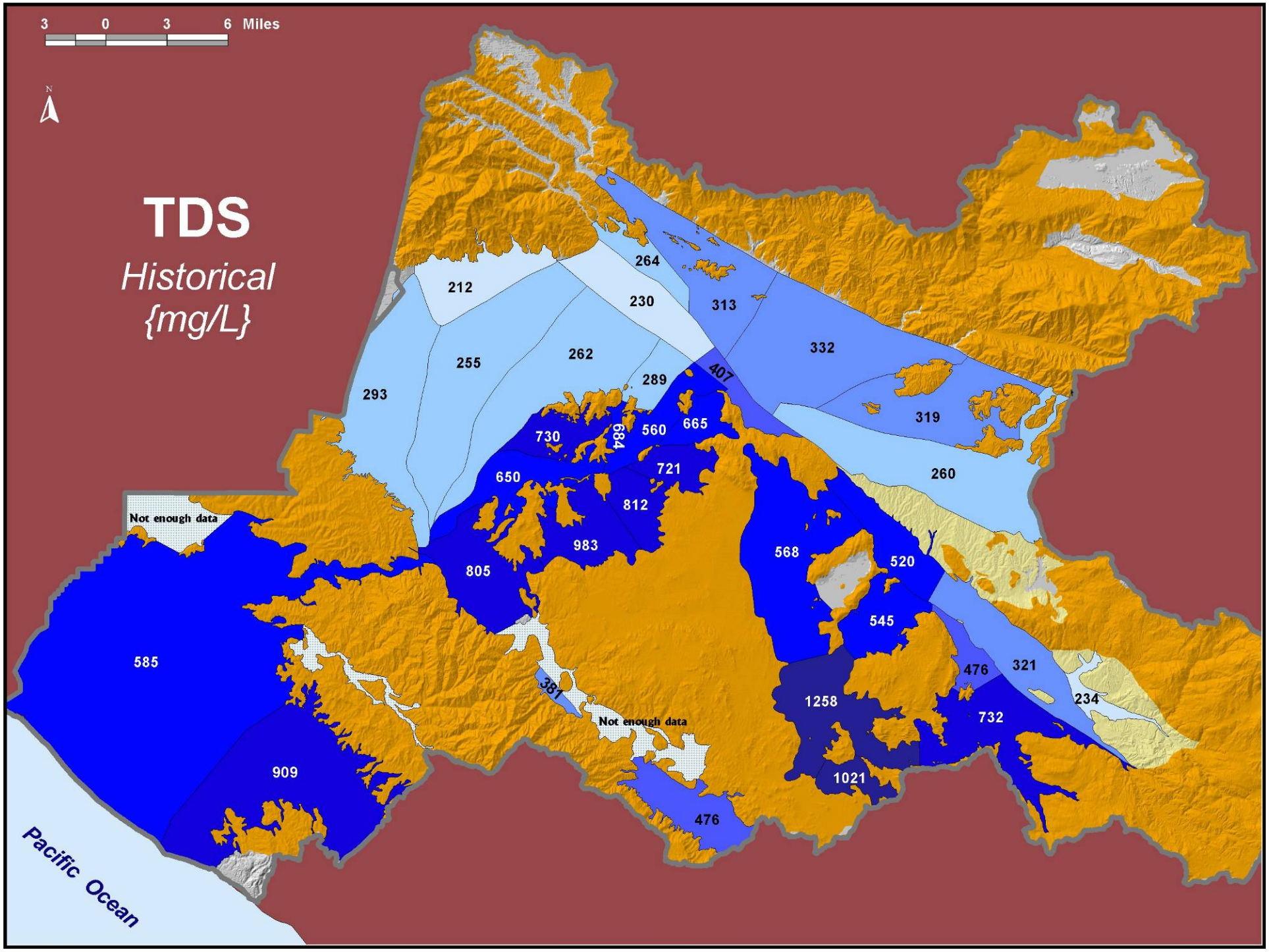
- Create 3-D GIS layers of:
  - Water quality (TDS and Nitrate)
  - Groundwater elevations
  - Specific yield
  - Bottom of the aquifer
  - Aquifer geometry (layering) where appropriate
- 3rd dimension is value of layer

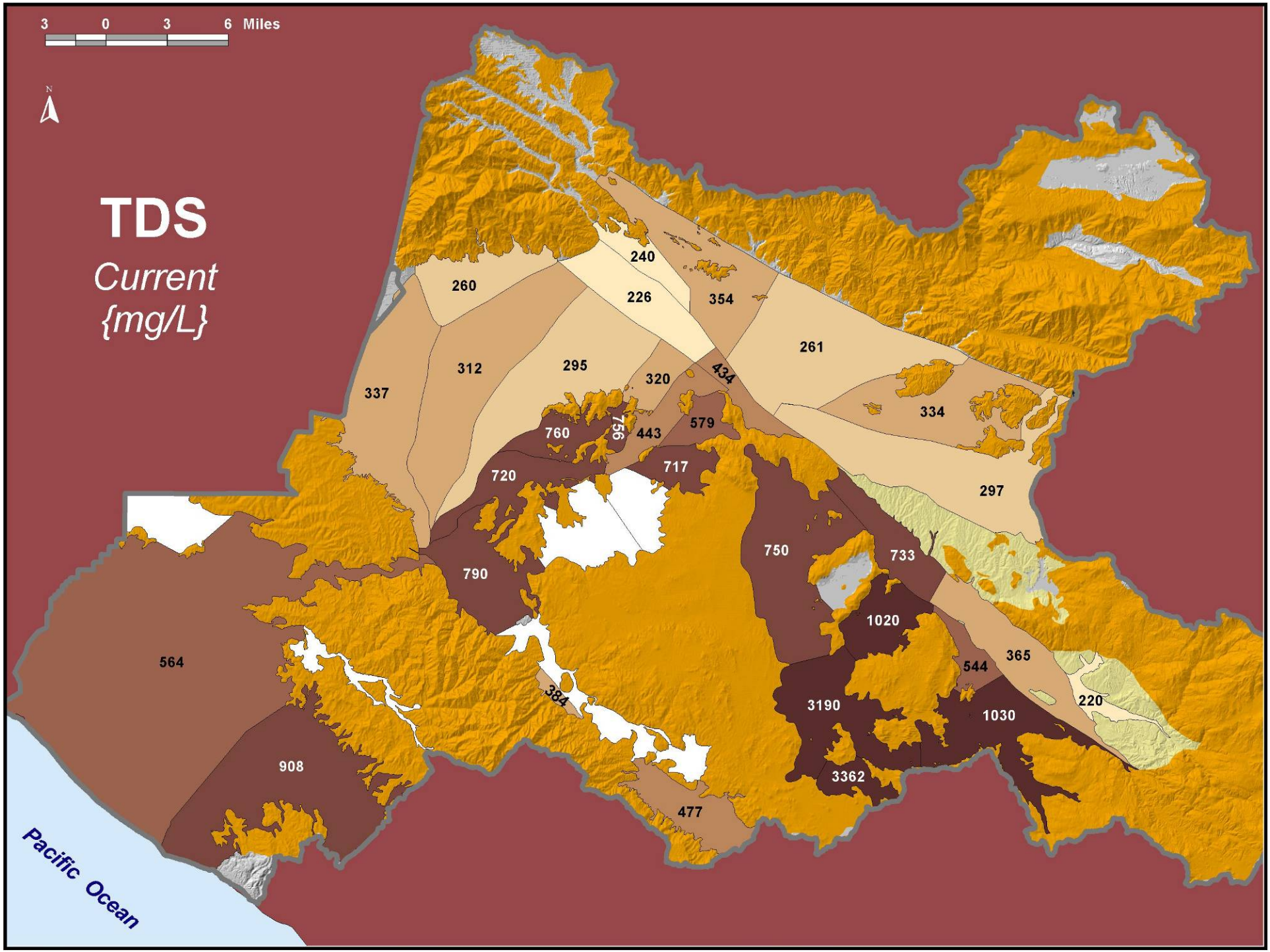

Ambient TDS Concentration in Groundwater
Seven Oaks Reservoir
San Bernardino Mountains
Mill Creek
Crafton Hills
10
350
350
350
400
500
400
350
Oak Glen Ck
Yucaipa Hills
300
300
250
300
Yucaipa Ck
300
300
San Bernardino County
Riverside County
San Timoteo Wash
San Timoteo Badlands
Nobel Ck
N
0
1
Miles

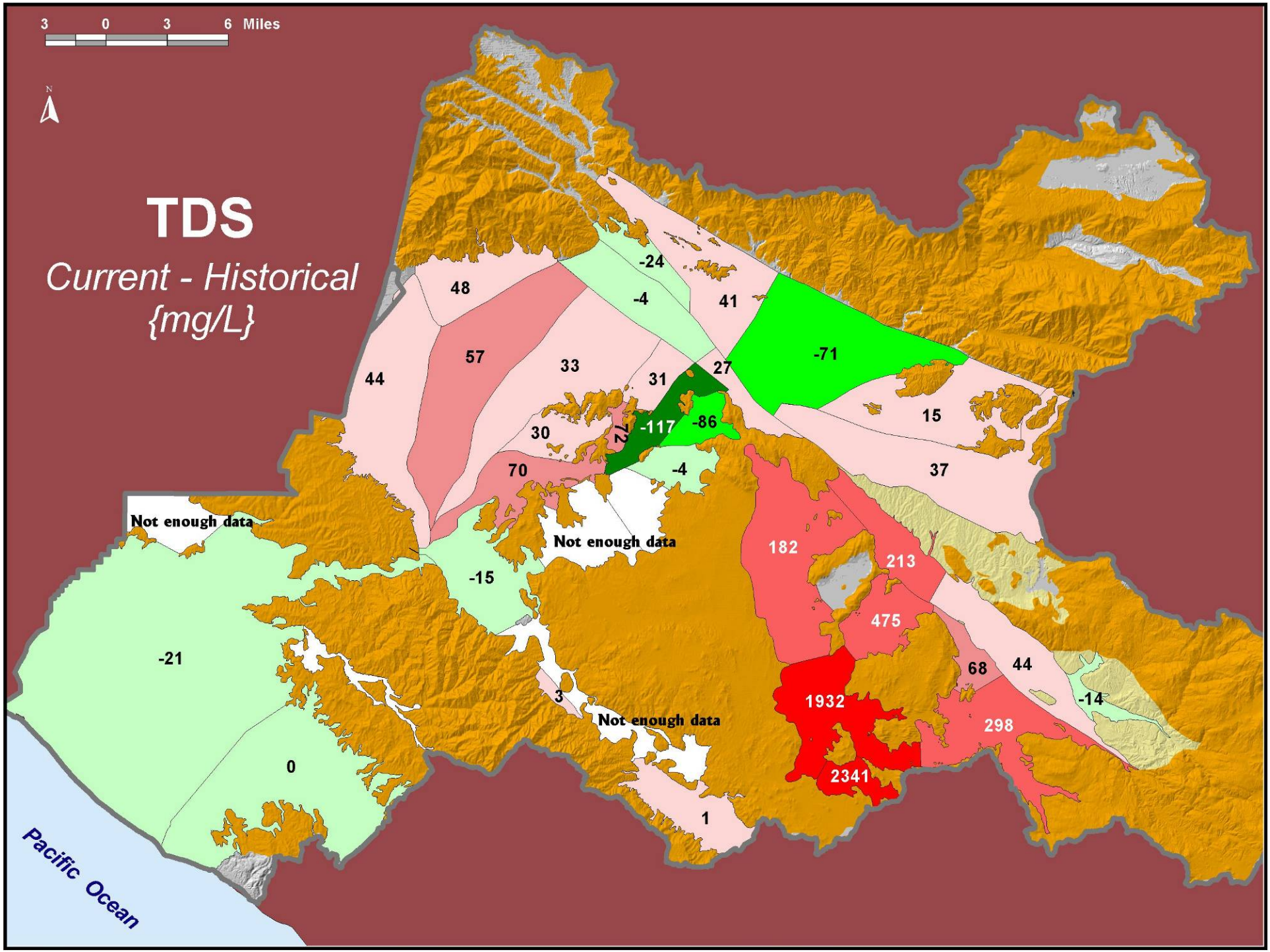
Compute Ambient Water Quality for Management Zones

- Create 400x400m grid across all MZs
- Populate each grid cell with:
  - Water quality (TDS and Nitrate)
  - Groundwater elevations
  - Specific yield
  - Bottom of the aquifer
  - Aquifer geometry (layering) where appropriate


Ambient TDS Concentration in Groundwater
Seven Oaks Reservoir
San Bernardino Mountains
Mill Creek
Crafton Hills
10
Oak Glen Ck
Yucaipa Hills
Yucaipa Ck
San Bernardino County
Riverside County
San Timoteo Wash
San Timoteo Badlands
Nobel Ck
N
0
1
Miles


3 0 3 6 Miles
N
TDS
Historical
{mg/L}
264
212
230
313
332
255
262
289
407
293
319
730
684
560
665
650
721
260
812
Not enough data
983
805
568
520
585
545
476
321
387
1258
234
Not enough data
732
909
1021
476
Pacific Ocean


3 0 3 6 Miles
N
TDS
Current
{mg/L}
240
260
226
354
261
312
295
320
434
337
334
760
756
443
579
720
717
297
750
733
790
1020
564
365
544
384
3190
1030
220
908
3362
477
Pacific Ocean


3 0 3 6 Miles
N
TDS
Current - Historical
{mg/L}
-24
48
-4
41
57
33
44
31
27
-71
-117
-86
30
72
15
70
-4
37
Not enough data
Not enough data
182
213
-15
475
-21
68
44
3
1932
-14
Not enough data
298
2341
0
1
Pacific Ocean

Proposed Recharge Order

- General order
  - Proposed to cover imported water and interbasin transfer of GW
  - Similar to 2005 WDRs for Inland Empire and Chino Basin Watermaster
  - 5-year running average salt levels of recharge water must meet management zone groundwater quality objectives
- Would require implementation of salt management plan, as developed thru consensus stakeholder process

Response to the Order and Alternative Approach

- Stakeholder community and State Water Project Contractors reacted swiftly and negatively
- Alternative approach feasible
  - Development of regional compact between water agencies
  - Basin plan prohibition against violating objectives – reporting requirement
  - Water Code 13225 order to report on any technical factors involved in water quality control
- SAWPA volunteered to facilitate
- Effort progressing with umbrella agreement and further work to come next year.

Water Boards

Implications for the Central Valley

- Central Valley is much larger and more diverse than the Santa Ana
- Likely a SAWPA like role with stakeholders and regulated community needed
- Single solution, brine line will be difficult but lessons learned in the Santa Ana can help
- A pallet of salt management alternatives can be used short term or long term
- Regulatory and market approaches suggested
- Infrastructure and interim measures