Nitrogen-Loss Studies

TIN/TDS Study (2000)

- Conducted literature review of N-loss case studies

- Analyzed N-loss case studies in the Santa Ana River watershed

- Estimated N-loss coefficient for facility type

- Resulted in a default 25% N-loss coefficient in the 2004 BPA

SAR Reach 3 Study (2005)

- City of Riverside provided evidence of N-loss coefficient >25% in Reach 3

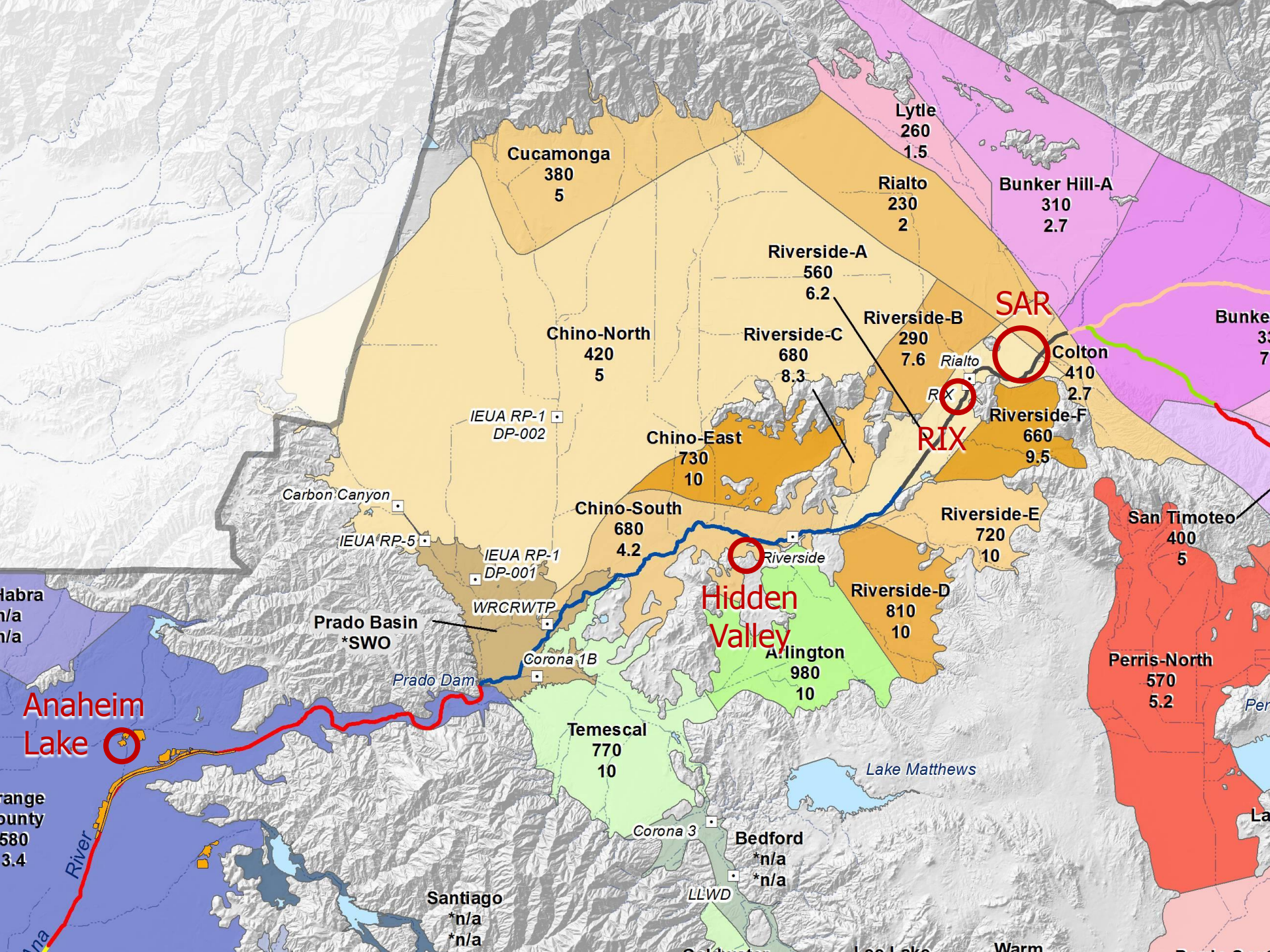- BPA established a 50% N-loss coefficient for Reach 3, with confirmatory monitoring

Literature Review of N-Loss

Nitrogen chemistry is complex

- Exists in various oxidation states (Organic-N, NH_3, NH_4, NO_2, NO_3, N_2)

- Nitrogen transformations and removal occur via biological and physical processes that are dependent on site-specific environmental factors:

  - Aqueous chemistry: nitrogen species, pH, temp, DO, TOC, others

  - Soil composition and texture

  - Microbiology

  - Infiltration rate

  - Wetting and drying cycles

- Denitrification is dependent on availability of a carbon source and anaerobic conditions

Literature Values of N-Loss

Facility Type	Reported Range of N-Loss	Expected Range of N-Loss
Ponds/Water Bodies	43 – 82%	80 – 90%
Natural Wetlands	72%	60 – 80%
Constructed Wetlands	46 – 54%	50 – 70%
Injection Wells	10 – 70%	70 – 90%
Surface Spreading	0 – 90	80 – 90%
Rapid Infiltration	30 – 95%	80 – 90%

Cucamonga
380
5

Lytle
260
1.5

Rialto
230
2

Bunker Hill-A
310
2.7

Riverside-A
560
6.2

SAR

Chino-North
420
5

Riverside-C
680
8.3

Riverside-B
290
7.6

Rialto

Colton
410
2.7

RIX

Bunker
33
7

IEUA RP-1
DP-002

Chino-East
730
10

Riverside-F
660
9.5

Carbon Canyon

Chino-South
680
4.2

Riverside-E
720
10

San Timoteo
400
5

IEUA RP-5

IEUA RP-1
DP-001

Riverside

Hidden
Valley

Riverside-D
810
10

WRCRWTP

Prado Basin
*SWO

Corona 1B

Prado Dam

Arlington
980
10

Perris-North
570
5.2

Anaheim
Lake

Habra
n/a
n/a

Temescal
770
10

Lake Matthews

Per

range
ounty
580
3.4

Corona 3

Bedford
*n/a
*n/a

La

LLWD

River

Santiago
*n/a
*n/a

Warm

Pe

N-Loss Coefficients from
Case Studies in the SAR Watershed

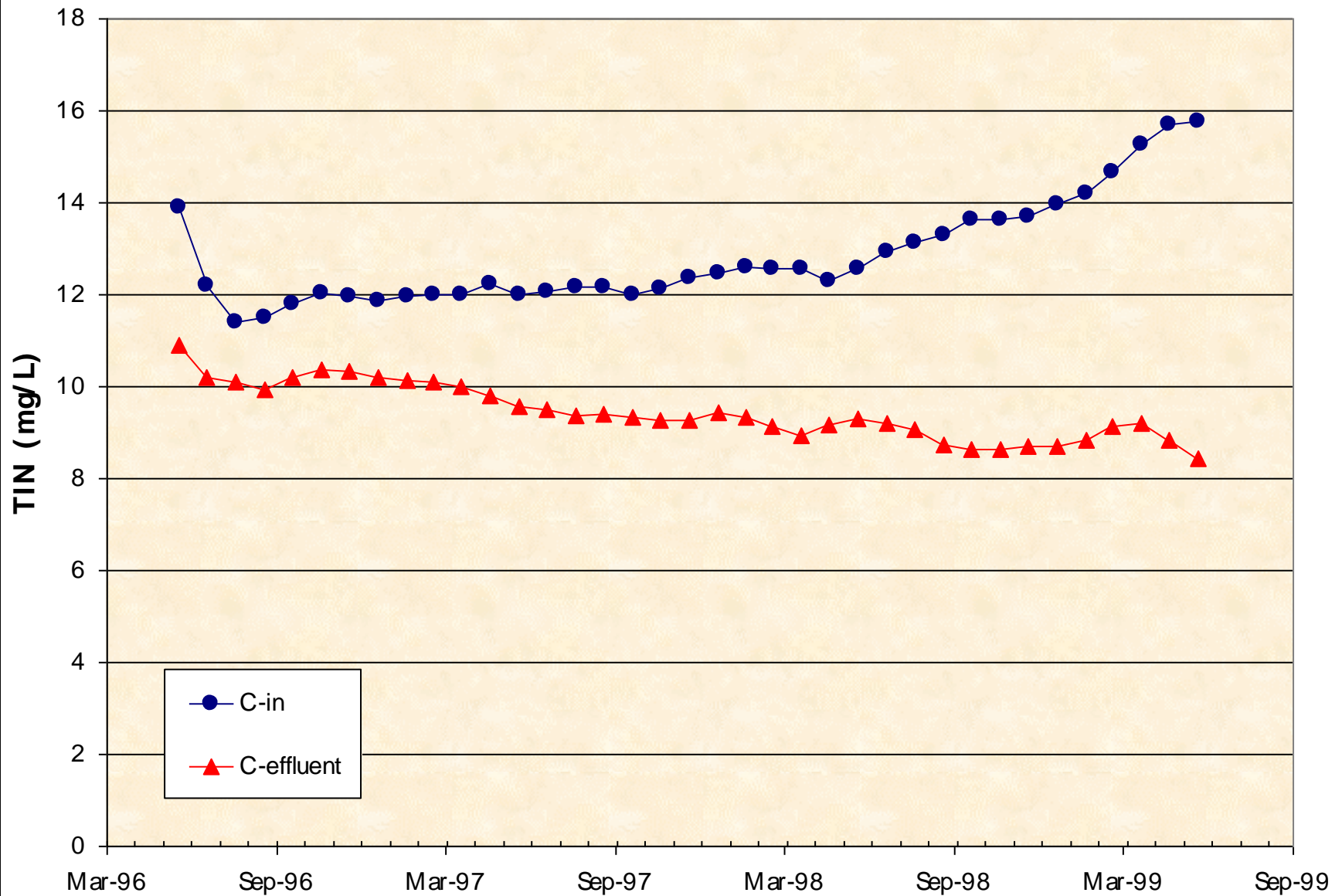| Type of Facility	Nitrogen Loss Coefficient (%)
Constructed Wetland	50 to 90
Recharge Basin	not enough data
RIX	25 to 75
SAR Discharge	25 to 75

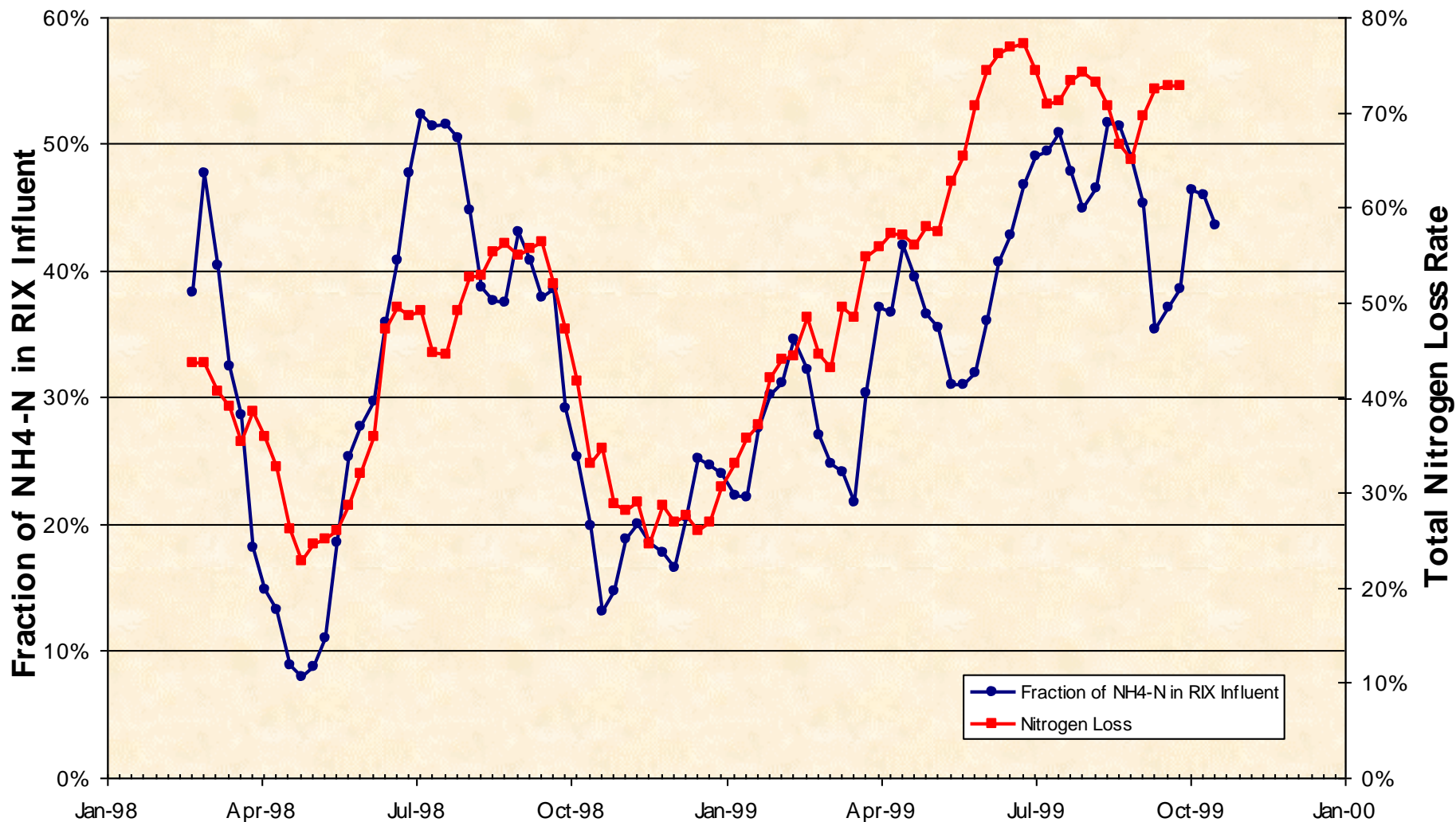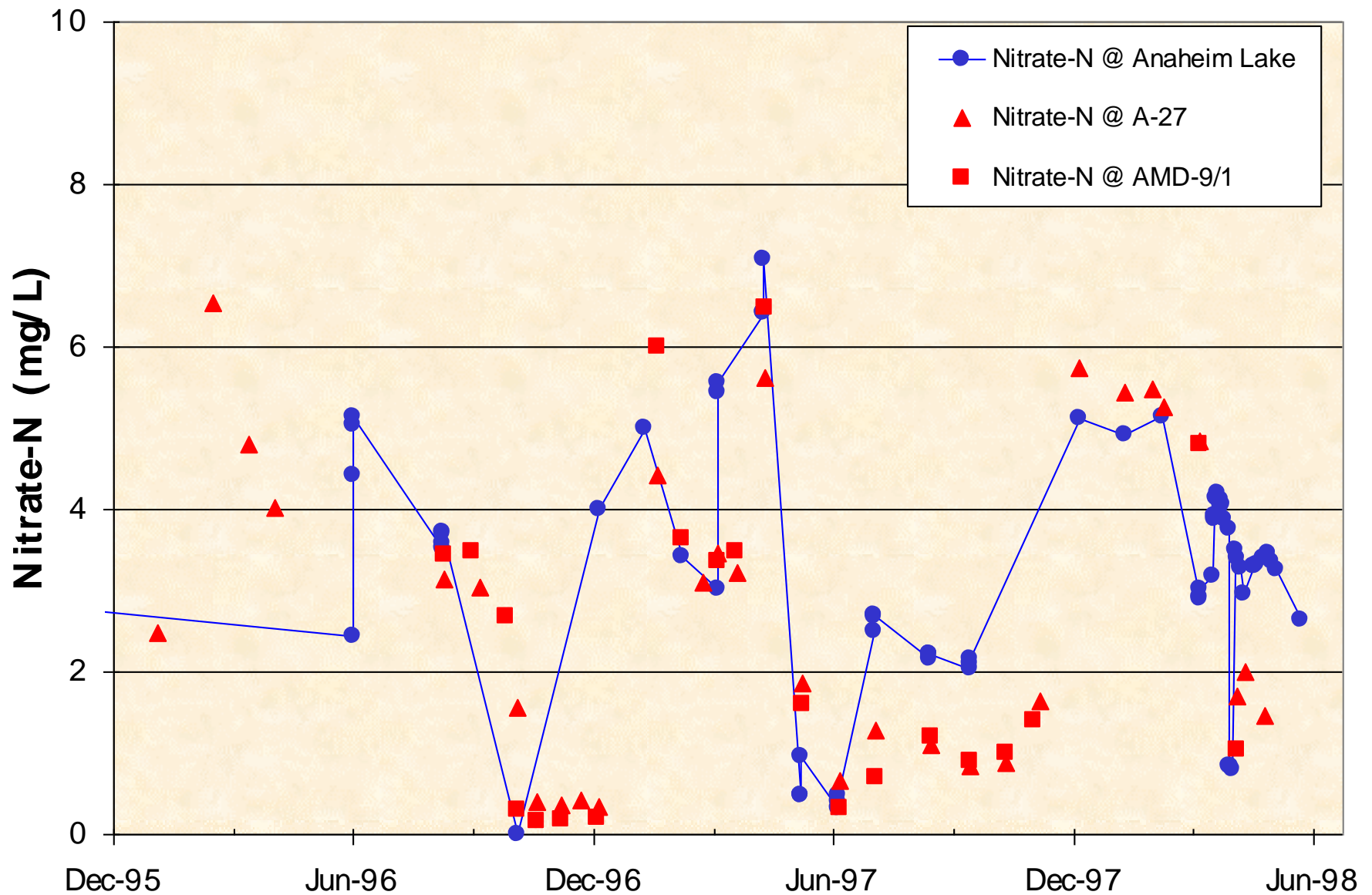# HVWEP: TIN Concentration Time Histories
(moving averages)
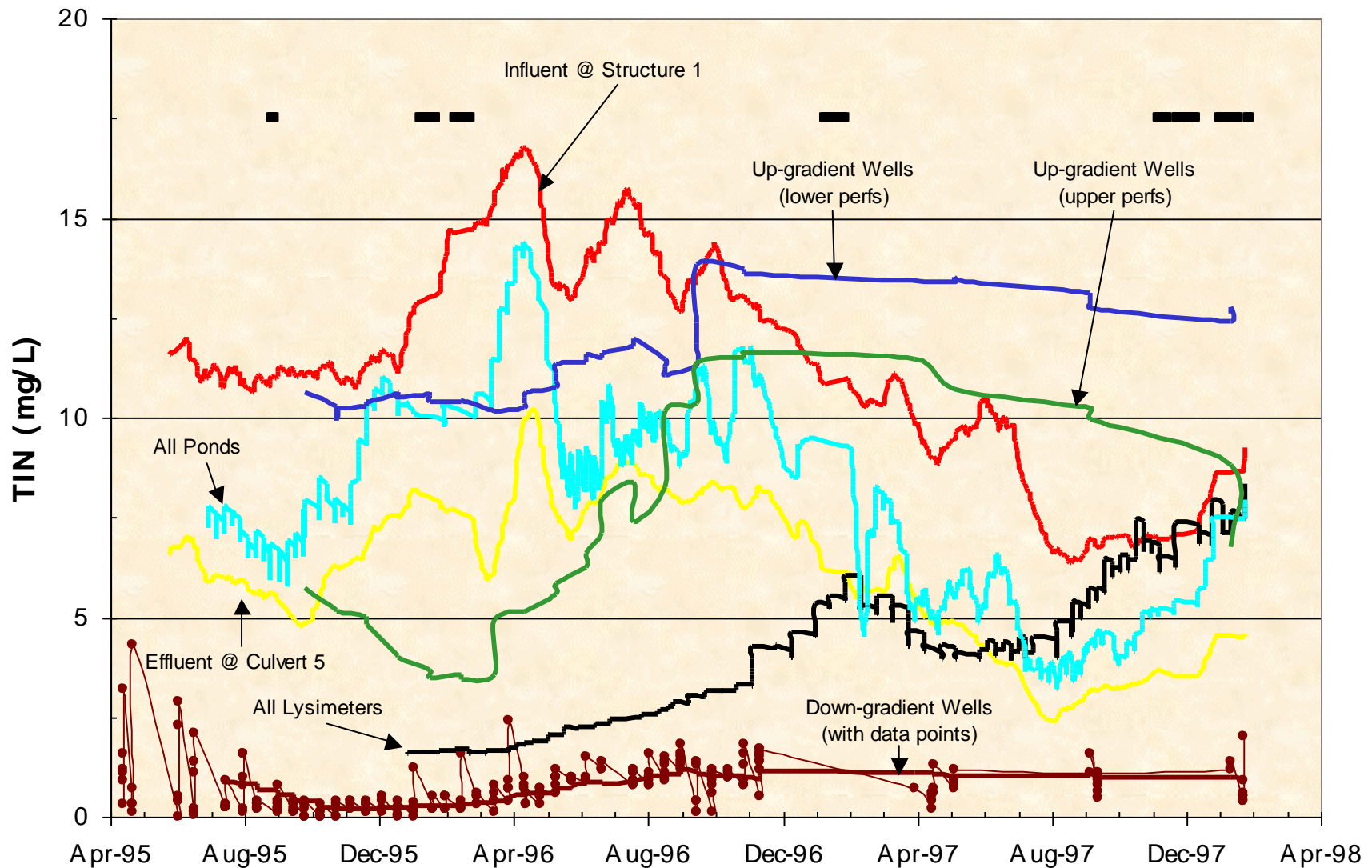
TIN Concentrations at RIX
(annual moving averages)

Comparison of Total Nitrogen Loss Rate to NH4-Nitrogen in RIX Influent Four-Week Breakthrough

Nitrate-N at Anaheim Lake

TIN/TDS Phase 2A – Task 1
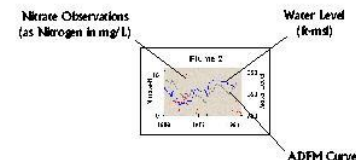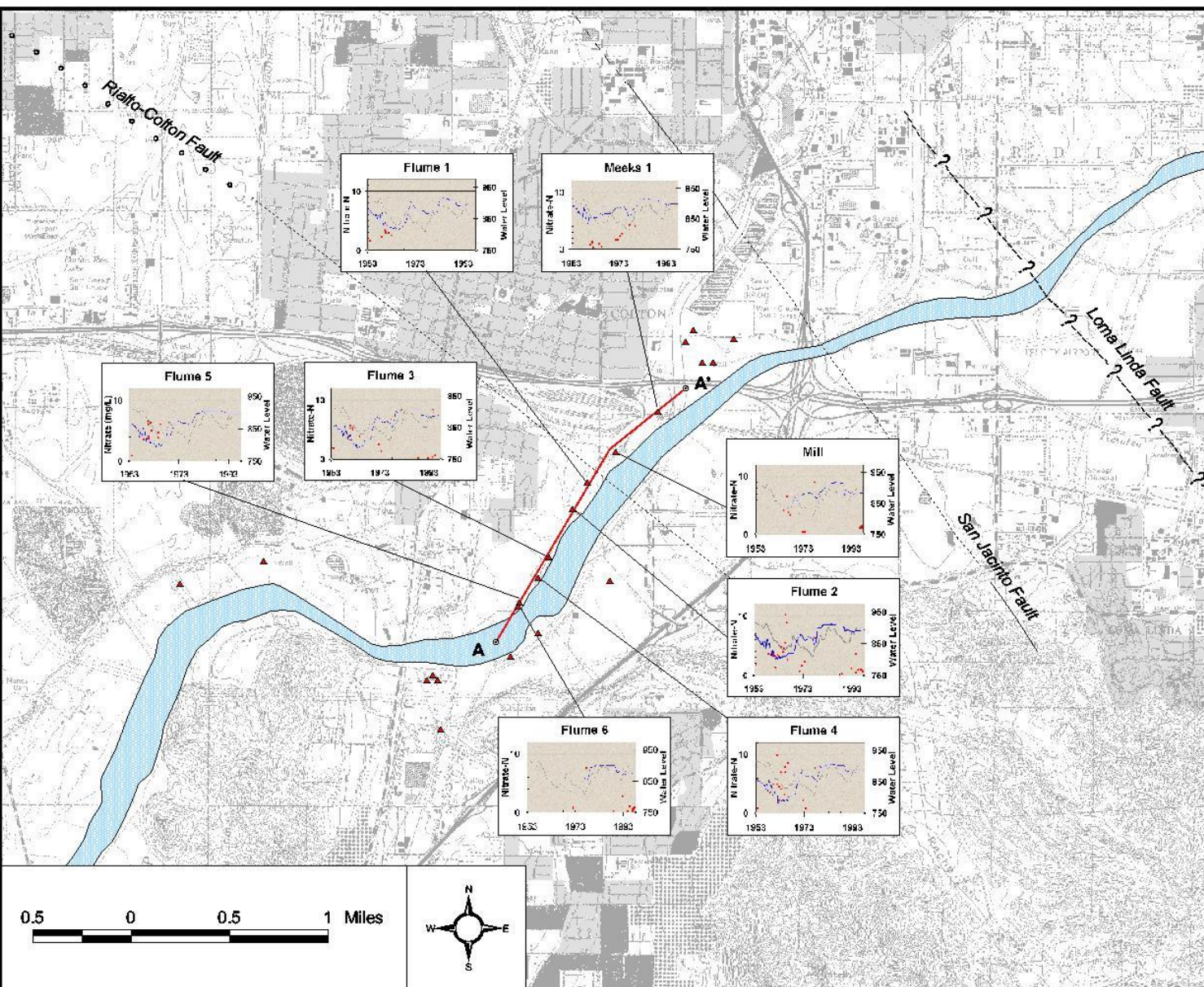Nitrogen Losses from Recycled Water Systems
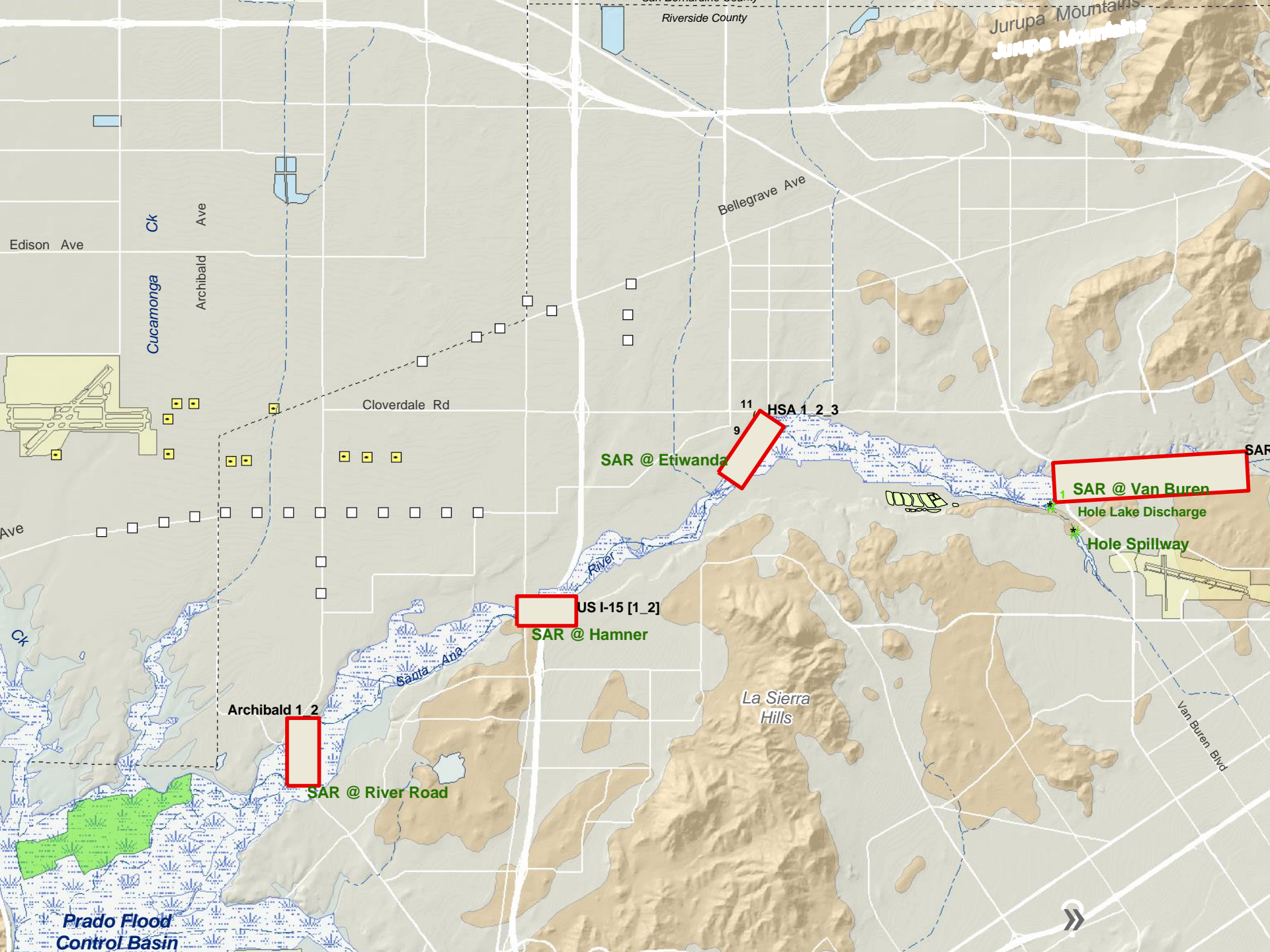
Figure 3-37

Nitrate-N Concentrations, Water Levels, ADFM
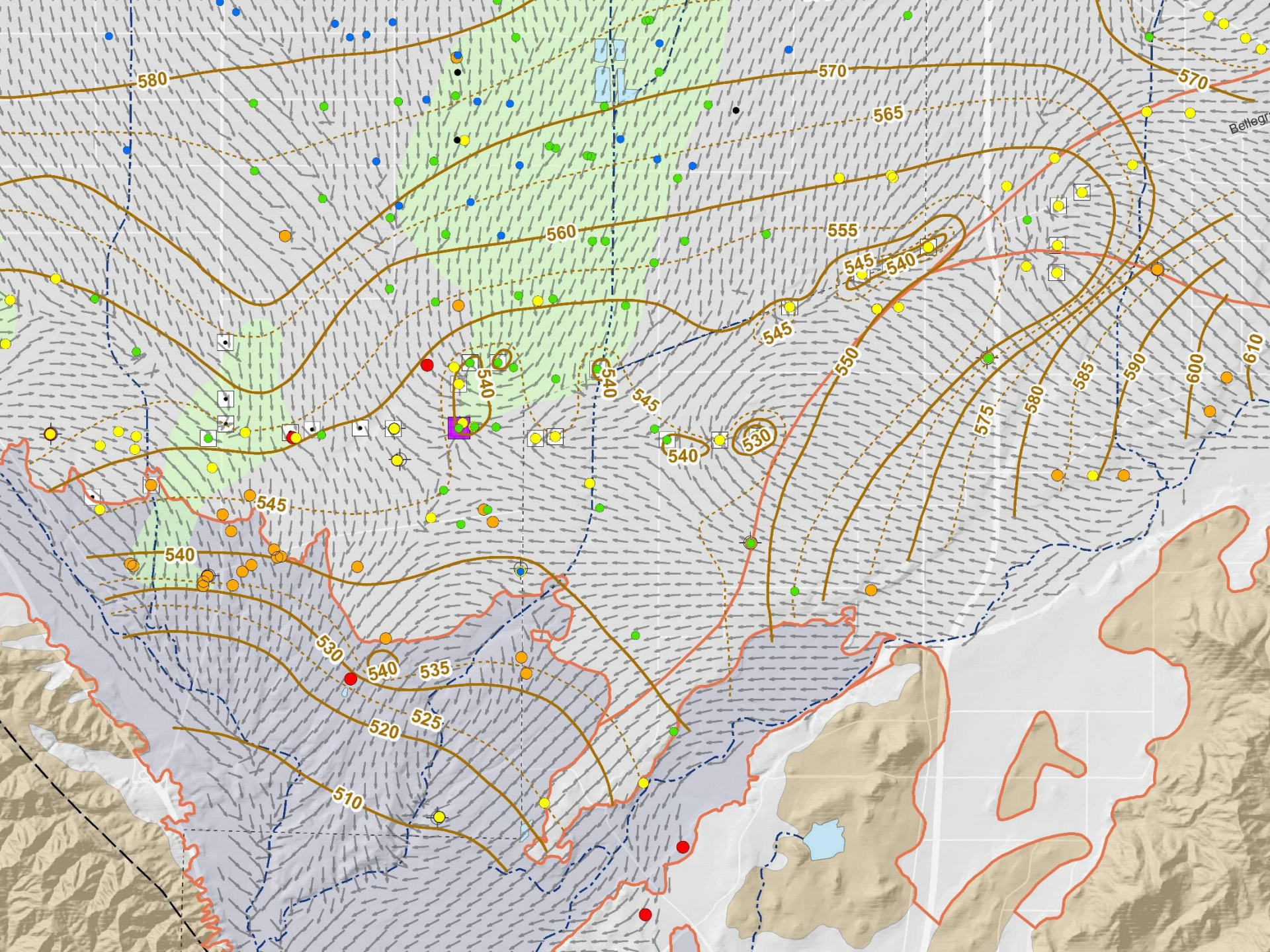for Selected Wells near the Santa Ana River

WE WILDERMUTH
ENVIRONMENTAL, INC.

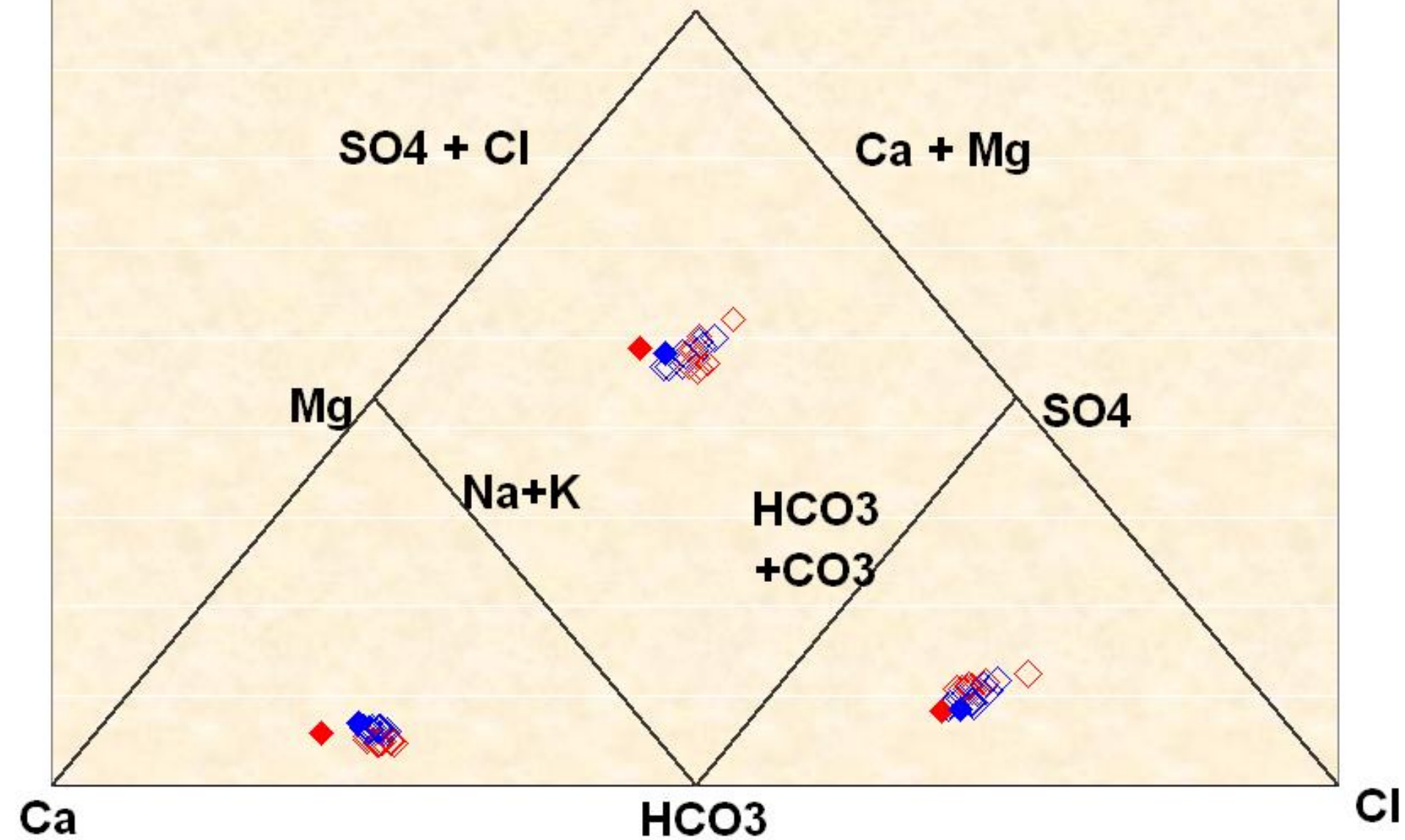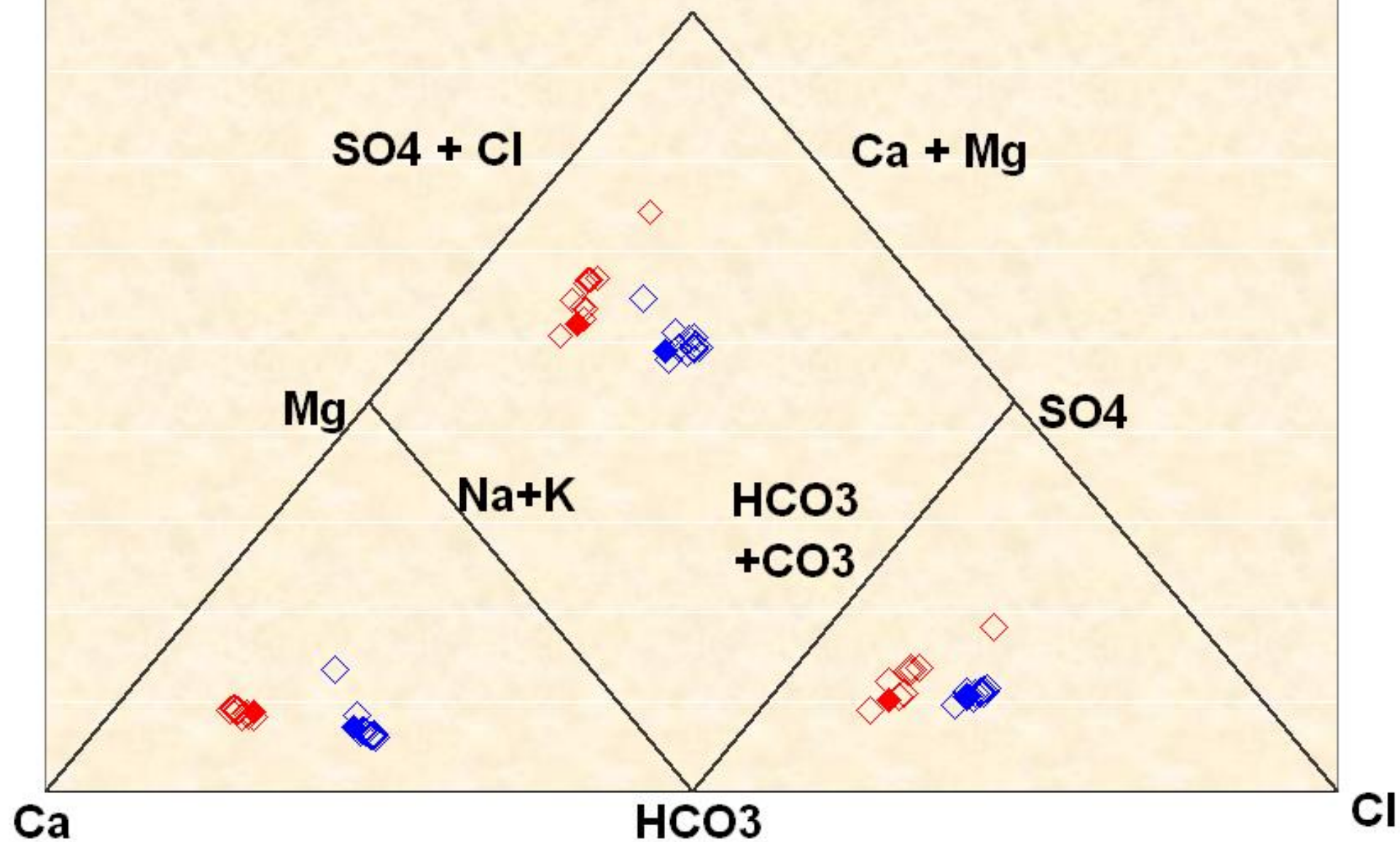Prepared by: AEM   Date: November 24, 1998

Source Data: USGS, SAWPA, DWR, City of Riverside, DOHS.

N-Loss Results for Reach 3

Table 5-2. Calculated Nitrogen Loss Coefficients for the Santa Ana River

Year	Month	Concentration of Total Nitrogen (mg/L)			Percent Nitrogen
		Near River Wells[a]	Santa Ana River	Loss	Lost
2004	March	2.9	7.4	4.5	60.9%
	April (early)	3.1	8.1	5.0	62.3%
	April (late)	2.9	8.5	5.5	65.3%
	May	3.1	8.3	5.2	62.8%
	June	3.0	6.8	3.8	55.7%
	July	2.5	7.1	4.7	65.7%
	August	3.3	8.3	5.0	60.5%
	September	3.5	7.8	4.3	55.4%
	October	2.3	8.8	6.5	73.4%
	November	2.9	10.5	7.6	72.5%
	December	2.6	9.5	6.9	72.3%
2005	January	3.2	9.3	6.1	65.4%
	March (early)	2.6	7.4	4.8	65.0%
	March (late)	4.1	3.3	-0.8	-24.0%
	April	3.1	4.7	1.6	34.7%
	May	2.6	4.7	2.1	44.0%
	June	2.44	5.86	3.42	58.3%
Average March-04 through June-05		2.9	7.4	4.49	55.9%

[a] Mar-Sept: RRXing, HSA and SARWC wells; Oct: HSA; Nov-Jan: HSA and SARWC wells; Mar on: SARWC wells

N-Loss Study in Reach 3

Summary and Conclusions

- Period of study: 16 months (Mar-2004 to Jun-2005)

- The Study used near-river wells with water chemistry similar to the SAR

- Estimated N-loss coefficient averaged about 56%

- N-loss coefficient decreased significantly during storm events

- The study supports the 50% N-loss coefficient for Reach 3 in the 2004 BPA

Questions?